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FOSTERING NEIGHBOURHOOD ADVANTAGE FOR HEALTH
IMPLICATIONS AND GUIDELINES FOR URBAN REGENERATION

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FOSTERING NEIGHBOURHOOD ADVANTAGE FOR HEALTH
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List of Acronyms

BMI: Body-mass Index.
CDC: Centre of Disease Control and Prevention.
GHQ-12: General Health Questionnaire.
HIA: Health Impact Assessment.
ISTAT: Istituto Nazionale di Statistiche.
LCBEH: Life Course Built Environment and Health.
LTW: Leisure-time Walking.
MOS: Medical Outcomes Study.
NAH: Neighbourhood Advantage for Health.
NCD: Non-communicable Diseases.
NEWS: Neighbourhoods Environment Walkability Scale.
OECD: Organisation for Economic Co-operation and Development.
SDG: Sustainable Development Goals.
SEP: Socioeconomic Positions.
SES: Socio-economic Status.
SF-12: Short Form-12.
SFO: Systematic Field Observations.
SPHW: State of Perceived Health and Wellbeing.
TRB: Transportation Research Board of Washington.
UN: United Nations.
WEMWBS: Warwick-Edinburgh Mental Well-Being Scale.
WHO: World Health Organization.

List of Symbols

⇒ Variable; Research question.
→ Sub-variable; Research Sub-question; Implication.
○ Null Hypothesis.
• Alternative or Directional Hypothesis.
ᔕ Analysis; Interpretation of Data.
Δ Concept; Principle.
Φ Criterion.
> Intervention.

FOSTERING NEIGHBOURHOOD ADVANTAGE FOR HEALTH
IMPLICATIONS AND GUIDELINES FOR URBAN REGENERATION

Abstract
Residential location is a fundamental determinant of health and wellbeing for urban communities, especially in deprived neighbourhoods where compositional and contextual disadvantages have been linked to cardiovascular and respiratory diseases, depression and diabetes. Neighbourhood disadvantages are triggered by a wide range of factors which can be grouped into compositional factors (e.g., residents' genetic and behavioural traits, socioeconomic) and contextual factors (e.g., urban forms and design, land-use patterns, transportation arrangements, and pollution levels). Recently, the relationship between neighbourhood and health has become a major concern in urban studies, where an emerging strand of research is shedding light on how regeneration programs can *directly* intervene on urban determinants of health in order to *indirectly* influence community's health and wellbeing. Yet, little is known about how regeneration can affect individuals and community health at the neighbourhood level. Meanwhile, the existing literature is silent in regard to a neighbourhood-based regeneration scheme aiming to indirectly enhance public health and wellbeing of the community through specific regeneration interventions. For this reason, the objective of this research is to introduce the concept of Neighbourhood Advantage for Health (NAH) which relies on specific neighbourhood-based compositional and contextual factors that are more relevant for community health and wellbeing.
The final objective of this study is to provide guidelines for urban regeneration to foster NAH within residential areas in order to indirectly affect community's health and wellbeing. To this end, this research explores and describes the extent to which NAH associates with the State of Perceived Health and Wellbeing (SPHW) of 11 communities living in 11 neighbourhoods featuring different socioeconomic and spatial characteristics. Specifically, this study investigates the associations between individuals' perception of their health and wellbeing and their neighborhood. For doing this, the author carried out a cross-sectional survey study, augmented with objective and on-field observations, to 11 communities based in Pellaro (Reggio Calabria, Italy), using primary data from 400 participants (25yo to 69yo) collected via self-reported surveys for assessing perceived health and wellbeing and for investigating built and natural environment features within the neighbourhood. This study relies on a quantitative strategy of inquiry led by two research questions: To which extent Neighbourhood Advantage for Health (NAH) associates with State of Perceived Health and Wellbeing (SPHW)? Which specific factors of Neighborhood Advantage for Health (NAH) are more relevant for State of Perceived Health and Wellbeing (SPHW) of the community, and thus to consider for urban regeneration interventions at the neighborhood level? To tackle the research questions, the author carried out an iterating analysis, namely a systematic, repetitive, and recursive process for analysing quantitative primary and secondary data collected for this study.
Findings suggest that NAH does positively associate to the SPHW within the community as neighbourhoods where higher performances of NAH were registered boast greater score in SPHW. Such associations are related to specific compositional and contextual factors within the neighbourhood. Specifically, compositional factors include (1) individuals' awareness about the determinants of and risk factors for health, (2) individuals' socioeconomic position (SEP), (3) propensity for practicing physical activities; (4) safety within the neighbourhood; (5) social support within the community; and (6) accessibility to the economic domain of the local community. Instead, contextual factors encompass (1) architectural and aesthetic features of the visual and functional dimensions of the man-made environment; (2) land-use distribution; (3) presence of and accessibility to recreational spaces for leisure time, resting, and practicing physical activities; (4) housing quality and overall performances of the disposable residential units. Finally, considering the implications of the results of this study in the urban regeneration field, the author provides guidelines for fostering NAH through neighbourhood-based socioeconomic and spatial interventions. The guidelines developed in this work for fostering NAH could serve as an interpretative grid for practitioners and

local decision-makers to deliver effective neighbourhood-based regeneration interventions to enhance indirectly community health and wellbeing.

Keywords: *urban regeneration; health; wellbeing; neighbourhood; urban planning; urban policy.*

FAVORIRE IL VANTAGGIO URBANO PER LA SALUTE
IMPLICAZIONI E LINEE GUIDA PER LA RIGENERAZIONE URBANA

Abstract

Il quartiere di residenza è un determinante cruciale per la salute e il benessere delle comunità urbane, specialmente in quartieri maggiormente svantaggiati che sono stati associati ad una forte incidenza di malattie cardiovascolari, problemi respiratori, depressione e diabete. Gli svantaggi che influenzano la salute all'interno del quartiere sono innescati da un'ampia gamma di fattori, socioeconomici e spaziali, che possono essere classificati in spiegazioni compositive e contestuali. Recentemente, l'argomento è diventato una questione di interesse primario negli studi urbani, in cui un emergente filone di ricerca sta indagando su come i programmi di rigenerazione urbana possano intervenire *direttamente* sui determinanti urbani della salute al fine di influenzare *indirettamente* la salute e il benessere della comunità urbana. Tuttavia, la letteratura in rigenerazione urbana per la salute è ancora molto limitata rispetto alle possibilità di espansione. Per questi motivi, questa tesi introduce il concetto di "Vantaggio Urbano per la Salute" (NAH[1]), ovvero un costrutto basato sui fattori compositivi e contestuali del quartiere che sono più significativi per la salute e il benessere della comunità di residenti.

L'obiettivo finale di questo studio è fornire delle linee guida e interventi per la rigenerazione urbana al fine di favorire il Vantaggio Urbano per la Salute (NAH) nel quartiere e quindi influenzare positivamente e *indirettamente* la salute e il benessere della comunità di residenti. Per farlo, questo studio esplora e descrive come il Vantaggio Urbano per la Salute (NAH) è associabile allo Stato di Salute e Benessere Percepito (SPHW[2]) di 11 comunità residenti in 11 quartieri con caratteristiche socioeconomiche e spaziali diverse, indagando le relazioni esistenti tra lo stato di salute e benessere percepito dalla comunità e le caratteristiche socioeconomiche e spaziali del quartiere di residenza. I dati primari analizzati sono stati raccolti tramite osservazioni dirette e questionari auto-somministrati a 400 individui di età compresa tra 25 e 69 anni e residenti a Pellaro (Reggio Calabria, Italia), mentre i dati secondari sono stati acquisiti dal database ISTAT. Questo studio è guidato da due domande di ricerca: (1) In che misura il Vantaggio Urbano per la Salute (NAH) nel quartiere si associa allo Stato di Salute e Benessere Percepito (SPHW) dalla comunità residente? (2) Quali fattori del Vantaggio Urbano per la Salute (NAH) sono più rilevanti per lo Stato di Salute e Benessere Percepito (SPHW) dalla comunità, e quindi da considerare per gli interventi di rigenerazione urbana a livello di quartiere? Per rispondere alle domande di ricerca, l'autore ha effettuato un'analisi iterativa basata su un processo sistematico e ripetitivo per l'analisi quantitativa dei dati.

Dai risultati delle analisi emergono delle correlazioni positive e significative tra il Vantaggio Urbano per la Salute (NAH) e lo Stato di Salute e Benessere Percepito (SPHW), in quanto quartieri con maggiore presenza di NAH vantano un punteggio più alto di SPHW. Tali correlazioni sono attribuibili a specifici fattori compositivi e contestuali del quartiere. Specificatamente, i fattori compositivi includono: (1) consapevolezza dei residenti sui determinanti di salute e comportamenti individuali che influenzano la salute e il benessere; (2) posizione socioeconomica dei residenti; (3) propensione dei residenti per l'attività fisica; (4) sicurezza, (5) supporto sociale e (6) accessibilità economica all'interno del quartiere. Invece, i fattori contestuali comprendono: (1) caratteristiche architettoniche ed estetiche dell'ambiente costruito; (2) destinazione d'uso degli spazi e degli edifici del quartiere; (3) accessibilità agli spazi ricreativi, per il riposo, attività fisica e tempo libero; e (4) qualità costruttiva, esposizione ai fattori ambientali e comfort interno degli insediamenti residenziali. In conclusione, considerando i risultati ottenuti, l'autore suggerisce linee guida per favorire il Vantaggio Urbano per la Salute (NAH) all'interno del quartiere attraverso interventi educativi, socioeconomici e di trasformazione dell'ambiente costruito. Le linee guida per favorire il Vantaggio Urbano per la Salute (NAH) potrebbero servire da griglie interpretative per i professionisti e i decisori locali al fine

[1] NAH si riferisce a "Neighbourhood Advantage for Health," oppure in lingua italiana a "Vantaggio Urbano per la Salute."
[2] SPHW si riferisce a "State of Perceived Health and Wellbeing" oppure in lingua italiana a "Stato di Salute e Benessere Percepito."

di sviluppare e implementare interventi di rigenerazione urbana per migliorare indirettamente la salute e il benessere della comunità urbane.

Parole chiave: *rigenerazione urbana; salute; benessere; quartiere; pianificazione urbana; politiche urbane.*

Chapter 1

1. INTRODUCTION

Residential location is a fundamental determinant of health, especially in deprived neighbourhoods where compositional and contextual disadvantages have been linked to cardiovascular and respiratory diseases, depression and diabetes. Neighbourhood disadvantages are triggered by a wide range of factors which can be grouped into compositional and contextual explanations. Compositional factors refer to genetic, behavioural, and socioeconomic traits of the residents, and social and community environment. Contextual factors, instead, encompass physical and natural features of the neighbourhood, such as urban forms and land-use patterns, urban design and aesthetics, transportation arrangements, and the quality of the natural environment including air, water and soil pollution levels. The distribution of such factors within the neighbourhood is a key determinant of health and wellbeing. Consequently, it has recently become a major concern in urban studies, where an emerging strand of research is shedding light on how regeneration programs can *directly* intervene on such determinants of health in order to affect *indirectly* health and wellbeing. Nonetheless, little is known about how regeneration can affect health at the neighbourhood level. Thus, the topic deserves to be further explored, especially at a neighbourhood level where there is a lack of empirical studies linking urban regeneration and health. In particular, the current literature in urban regeneration is silent in regard to a comprehensive urban regeneration scheme aiming to enhance indirectly community health at the neighbourhood level as a primary objective. In the light of this issue, this research is aimed at investigating how urban regeneration can provide a solid interpretative grid for identifying and intervening on compositional and contextual factors within the neighbourhood that are relevant for health and wellbeing.

This research introduces the concept of Neighbourhood Advantage for Health (NAH) with the intention of providing guidelines encompassing a set of *direct* interventions for urban regeneration to *indirectly* shape health and wellbeing at the neighbourhood level. The construct of NAH relies on specific compositional and contextual factors within the neighbourhood that are more relevant for health and wellbeing. To tackle the research questions developed in this study, the researcher carried out an iterating analysis process, namely a systematic, repetitive, and recursive process in quantitative data analysis. Such an iterative approach involved a sequence of tasks carried out in exactly the same manner each time and executed multiple time through regression and correlation analyses for exploring the degree to which Neighbourhood Advantage for Health (independent variable - X) for the neighbourhood associate to Status of Perceived Health and Wellbeing (dependent variable - Y) of the resident community, and for identify which dimensions of NAH are more relevant for SPHW. Interpretations of the findings in this study represent the foundation to provide the neighbourhood-based guidelines and *direct* interventions for fostering NAH and thus *indirectly* affect public health and wellbeing at the neighbourhood level.

Health and Residential Location in the Urban Regeneration Field

Health is about residential location (Duncan and Kawachi, 2018; Kivimäki et al., 2018), and residential location can be embedded in the concept of neighbourhood (Kennett & Forrest, 2003; Blockland, 2003). Residential location represents one of the main contexts in which people spend a major part of their lives (Duncan and Kawachi, 2018). The World Health Organization (2008) affirm that public health is affected by socioeconomic and spatial conditions in which people are born, grow, learn, work and age. Individuals' residential location determines the quality of schools they attend, access to services they use, retail stores where they buy food and other commodities, jobs, transport modes available, exposure to crime, pollution, noise, and other environmental characteristics (Duncan and Kawachi, 2018). Residential location affects individual and collective health and wellbeing, as place and location determine the quality of the services, retail stores, schools, jobs, transport, and

other factors such as noise, crime air quality, social interaction and all other dimensions that are crucial for human being (Duncan and Kawachi, 2018). Macintyre et al. (2002) sustain that there are five dimensions of the neighbourhood that affect health of the community, i.e. physical features (air and water quality, climate); healthy residential, working and play environments (quality of housing, non-hazardous employment, safe areas for playing); services availability (education, transport modes, clean street, policing, welfare); socio-cultural features (political, economic, ethnic, and religious traditions of the community within the neighbourhoods); and the reputation of an area (degree of attractiveness for investors and people that want to move in, or out, the area).

Residential location is a fundamental determinant for health, especially in deprived neighbourhoods where compositional and contextual disadvantages have been linked to cardiovascular and respiratory diseases, depression and diabetes (Diez Roux, 2003; Kivimäki et al., 2018). Such disadvantages are triggered by a wide range of factors within the neighbourhood that can be grouped into compositional and contextual explanations (Macintyre et al., 2002; Graham & Kelly, 2004; Jokela, 2014; Von Szombathely et al., 2017; Duncan and Kawachi, 2018). Compositional factors refer to genetic, behavioural, and socioeconomic traits of the residents, and social and community environment (Marmot & Wilkinson, 1999; Mackenbach, 2005; Bernard et al., 2007; Irwin & Scali, 2010). Contextual factors encompass physical and natural features of the neighbourhood, such as urban forms and land-use patterns, urban design and aesthetics, transportation arrangements, and the quality of the natural environment including air, water and soil pollution levels (Frumking, Lawrence and Jackson, 2004; Grant & Braubach, 2010; Costa et al., 2014; Hero et al., 2014; Von Szombathely et al., 2017).

The distribution of compositional and contextual factors within the neighbourhood is a key determinant for health and wellbeing (Macintyre et al., 2002; Graham & Kelly, 2004; Bernard et al., 2007; Diez Roux, 2007; O'Campo et al., 2014; Duncan and Kawachi, 2018). Consequently, it recently became a main concern in urban studies (D'Onofrio and Trusiani, 2017; Pineo, 2018), where an emerging strand of research is shedding light on how regeneration programs can *directly* intervene on such determinants of health in order to affect *indirectly* health and wellbeing (Diez Roux, 2003, 2007; Kramer et al., 2017; Krefis et al., 2018). Nonetheless, little is known about how regeneration activities can affect health (McCartey et al., 2017). Thus, the topic deserves to be further explored, especially at a neighbourhood level where there is a lack of empirical studies (Graham & Kelly, 2004). In the light of this issue, the focus of this research is on investigating how urban regeneration can provide a solid interpretative grid for identifying compositional and contextual factors within the neighbourhood that are relevant for health and wellbeing. Finally, the outcome of this research is to identify a set of place-based interventions and guidelines that could indirectly affect public health and wellbeing at a local level.

"Urban regeneration" entered the British language in the 1970s (Tallon, 2013), and since then its practices have been adopted worldwide with different scopes (Porter and Shaw, 2009). Roberts, Roberts, and Sykes (2000) define the concept of urban regeneration as the process of reversing social, economic, and physical decay in distressed and deprived urban areas. Since its inception, research and practices in the urban regeneration field has firmly established it as a branch of urban studies that investigate how to improve the conditions of deprived pockets within urban areas (Porter and Shaw, 2009). Urban regeneration can enhance the socioeconomic and physical conditions of contemporary cities through appropriate programs, or interventions (Tallon, 2013). Recently, urban regeneration researchers are shading light on how urban program or interventions in urban areas affect the social determinants of health improving health levels and health equity for the communities targeted by urban regeneration interventions (McCartey et al., 2017). Through a structured literature review on 1,382 citations, McCartey et al. (2017) identified 46 studies showing evidence about the impact of urban regeneration on health, health inequalities and their determinants. From the analysis of these

studies, it shows that most of the existing urban regeneration approaches have low participant response rates and lack longitudinal follow up, both of which impact the quality of the generated data. Also, up to date, it seems that most of the urban regeneration interventions for health focused on housing refurbishment for improving health, lacking the complexity needed to enhance health. In addition, Porter and Shaw (2009) highlight that often these housing-oriented urban regeneration interventions can trigger undesirable phenomenon of social stratification (e.g., gentrification), unbalancing the socioeconomic structure of the community being affected by the regeneration interventions.

Recently, health has increasingly become a major concern in urban studies (D'Onofrio and Trusiani, 2017; Pineo, 2018). As a matter of fact, in the last decade there has been an increase in research focused on the relationship between residential location and health (Frumking, Lawrence and Jackson, 2004; Grant & Braubach; 2010; Pineo, 2018), also in non-health sectors such as urban planning, urban regeneration, and urban policy (Diaz Roux, 2003, 2007; Parry and Judge, 2005; Berrigan and McKinno, 2008; Beck et al, 2010; Capolongo, 2014; Wizemann, 2014; D'Alessandro et al., 2015; McCartey et al., 2017; Kramer at al., 2017; D'Onofrio and Trusiani, 2017; Krefis et al., 2018). Specifically, a growing body of research in urban regeneration is investigating the impact of regeneration programs on the determinants of health and well-being (Parry and Judge, 2005; Beck et al, 2010; Egan et al., 2010; White et al., 2014; McCartey et al., 2017) and an emerging strand of research is shedding light on how regeneration programs can *directly* intervene on such determinants of health in order to affect *indirectly* health and wellbeing (Diaz Roux, 2003, 2007; Kramer et al., 2017; Krefis et al., 2018).

A considerable part of the relevant literature is investigating how regeneration can enhance individuals' level of moderate and intense physical activities, as these are strongly associated to physical and mental health (Mackenbach, 2018). Kramer et al. (2017) point out that urban regeneration programs can stimulate leisure-time walking which is comparable to a form of moderate physical activity; this could be done with urban regeneration interventions such as improving sidewalks, trails, parks, lighting, presence of trees and green spaces, etcetera. Furthermore, Diaz Roux (2003; 2007) asserts that there exists multiple mechanisms through which regeneration programs can affect community health, among which: enhancing accessibility to recreational spaces for increasing opportunities for the community to practice moderate and intense physical activities, providing economic support for low-income individuals to buy healthy food, improving the design features of the built environment to make it safer and cleaner, incentivize active modes of transportation to decrease car traffic and pollution. Moreover, it is emerging that the built environment plays a crucial role for physical activities (Ewing, 2005; Frank et al., 2005; Transportation Research Board of Washington, 2005; Florida 2016) as urban factors such as land use density, accessibility in term of proximity from destination or facilities, design features, aesthetics and transportation patterns facilitate or constraint population likelihood to practice physical activities (Lavin et al., 2006).

Deficiencies in the Health-related Urban Regeneration Literature

Urban regeneration programs have a strong potential to positively impact public health. Yet, McCartney et al. (2017) affirm that little is known about how urban regeneration can affect health as the urban regeneration literature on the topic is still limited. Krefis et al. (2018) highlight that there is a lack of interdisciplinary approaches to intervene on the complexity of urban structures and dynamics and their possible influence on urban health and wellbeing. Likewise, von Szombathely et al. (2017) sustain that researchers need better conceptions capable of capturing and addressing the complexity of urban structures for health. Furthermore, there is a lack of agreement on what is the most effective method to foster health within the neighbourhood (Srinivasan at al., 2003; Gullon & Lovasi, 2018), especially in the urban studies field (Krefis et al., 2018), including urban regeneration (McCartney et al., 2017). In addition, both in public health and urban studies field there is an open

debate between who prioritize the socioeconomic determinants of health to the spatial ones (Wilkinson, 1997; Kawachi et al., 1999; Leal and Chaix, 2011; Jokela, 2014; Murtin et al., 2017; Kivimäki et al., 2018), while other research perspectives look at the determinants of health in a systemic way in order to embody the complex dynamics behind the relationship between neighbourhood and health (Hancock, 1985; Whitehead and Dahlgren, 1991, 2006; Macintyre et al., 2002; Northridge et al., 2003; Barton and Grant, 2006; Sallis et al., 2008; Grant and Braubach, 2010; Von Szombathely et al., 2017). In synthesis, the relevant urban studies and urban regeneration literature seem to suffer from interpretative and methodological issues when referring to a comprehensive distinction of the compositional and contextual determinants of health within the neighbourhood. This is due to the late emergence of health as a priority for the fields. Thus, the topic deserves to be further explored, especially at a neighbourhood level where there is a lack of empirical studies (Graham & Kelly, 2004; McCartney et al., 2017). In particular, the current literature in urban regeneration is silent in regard to a comprehensive urban regeneration scheme aimed to enhance public health and wellbeing at the neighbourhood level as a primary objective.

Research Methodology

This study observes the geographical variations of the factors responsible for Neighbourhood Advantage for Health across 11 different neighbourhoods located within the same urban area. The variables explored in this study are the following:

⇒ Neighbourhood Advantage for Health
(NAH - independent variable X - measured for neighbourhood);

⇒ State of Perceived Health and Wellbeing
(SPHW - dependent variable Y - measured for the community within neighbourhood);

This research work emphasizes how NAH can be positively associated with the differences in State of Perceived Health and Wellbeing (SPHW) of the 11 communities living in the neighbourhoods under study. To observe geographical variations in SPHW and the degree of associations between NAH and SPHW, the author conducted a survey study on 400 individuals grouped by their neighbourhood of residence, for a total amount of 11 neighbourhoods and 11 communities (Tab. 3 in Appendix 2). The research methodology adopted for this study relies on a quantitative strategy of inquire led by two research questions: To which extent Neighborhood Advantage for Health (NAH) associates with State of Perceived Health and Wellbeing (SPHW)? Which specific factors of Neighborhood Advantage for Health (NAH) are more relevant for State of Perceived Health and Wellbeing (SPHW) of the community, and thus to consider for urban regeneration interventions at the neighborhood level?

Firstly, to define interpretative grids for capturing the Neighbourhood Advantage for Health (NAH), this study investigated the relevant literature[3] in public health and urban studies to identify concepts and an overarching methodology that could provide a solid analytic distinction between the

[3] The topics considered in this research work were explored tackling the following questions: What is neighbourhood advantage for health? What is the relationship between urbanization and health? What is health? What are the determinants of health? What are the non-communicable diseases and why they are important in the urban context? What the best metrics for assessing physical and mental health in relation to the urban environment? What is well-being? What are health inequalities? Which are the social, economic and spatial determinants of health inequalities? What policies exist for tackling health inequalities? What is the effect of the built environment on health, well-being, and health inequalities? What are the relevant methods to measure the neighbourhood health effect? What are the relevant neighbourhood components that affect health and wellbeing? What are the relevant health-related studies in the urban regeneration field? How urban regeneration can indirectly shape health and wellbeing? What are the urban health indicators developed to date? Why the neighbourhood could be considered as an ecosystem for health? What the conceptual modelling approach able to fit the concept of neighbourhood advantage for health?

compositional and contextual factors within the neighbourhood that associate directly and indirectly with public health and wellbeing. Then, such an analytic distinction of NAH was adopted to frame and introduce the concept of NAH. To observe how NAH affect State of Perceived Health and Wellbeing (SPHW) across 11 neighbourhoods, this research explores and describes the extent to which NAH associates with the State of Perceived Health and Wellbeing (SPHW) of 11 communities living in 11 neighbourhoods featuring different socio-economic and spatial characteristics, specifically, the study investigates the associations between individuals' perceptions of their health and wellbeing and their neighborhood. To doing this, the author carried out a cross-sectional and self-reported survey, augmented with objective and on-field observations, to 11 communities based in Pellaro (Reggio Calabria, Italy), the author conducted a population-based cross-sectional study in Pellaro using primary data from 400 participants[4] aged 25-69 via self-reported surveys, complemented with objective measures gathered from ISTAT database regarding demography and socioeconomic features and built environment indicators, as well as web-based, GIS databases and subjective on-field observations. To tackle the research questions developed in this study, the researcher carried out an iterating analysis process, namely a systematic, repetitive, and recursive process in quantitative data analysis. An iterative approach involves a sequence of tasks carried out in exactly the same manner each time and executed multiple time through regression and correlation analyses for exploring the degree to which Neighbourhood Advantage for Health (X) for the neighbourhood associate to Status of Perceived Health and Wellbeing (Y) of the resident community, and for identify which dimensions of NAH are more relevant for SPHW. Using linear regression and descriptive correlation analysis, the iterative analysis conducted for this study investigate the association between NAH and the 'State of Perceived Health and Wellbeing' (SPHW), finally, examining differences in cumulative NAH across the eleven neighbourhoods under study.

Location and Spatial Boundaries of this Study

This study was conducted on a sample of 400 individuals (25yo to 69 yo) living within the sub-municipal area of Pellaro, a coastal location inside the municipality of Reggio Calabria (Calabria, Italy). The survey was submitted in Italian language. Participants to this study have been engaged on the study field and the survey was self-reported. An amount 550 surveys were taken and 418 have been submitted and analysed for the purpose of this study. The area being studied matches the administrative boundary of the Italian "circoscrizione" that is a sub-unit of the Italian municipalities, a sub-municipal area. For the scope of this research in terms of urban policy the unit of analysis in this study will reflect an administrative boundary[5] and perceived boundaries (using the survey as a participatory mapping tool). This choice is due to the administrative boundaries are also policy-relevant boundaries, therefore, administrative boundaries are the metrics for funding public health interventions and policy. Primary[6] and secondary[7] data in this study were aggregated for ISTAT census and perceived neighbourhood boundaries[8] with the aim to fit a significative operational unit of neighbourhood. To doing so, to respondents was asked their place of residence and address (no number), this in order to obtain information about their location on ISTAT census-tracks (sezioni di censimento) within the sub-municipal area of Pellaro. All individuals who live in the same ISTAT census tract were assigned the same exposure measure. This step was crucial as the geo-location of the respondents allowed the author of this study to generalize these individuals' exposure measures to the whole community living within the specific neighbourhood being studied, therefore, assessing which neighbourhood performs better for SPHW.

[4] Grouped by age cohorts: 25 to 29; 30 to 34; 35 to 39; 40 to 44; 45 to 49; 50 to 54; 55 to 59; 60 to 64; 65 to 69.
[5] Administrative boundaries for the entire sub-municipal area being studied, and vvariations in health were registered according to a spatial aggregation relaying on perceived neighbourhood boundaries indicated by respondents.
[6] Data from Respondent Profile, Survey A, Survey B and C.
[7] Secondary data were gathered from ISTAT census track database, multiple GIS databases, and Google Maps.
[8] Perceived boundaries aggregation was adopted in manifold studies (Duncan and Kawachi, 2018). Further informations in the literature review in Chap. 2 of this work at paragraph 2.6.2. Operational definitions of neighborhood as a unit of study.

Added Value, Objective and Research Questions

This research introduces the concept of Neighbourhood Advantage for Health (NAH) with the intention of providing guidelines encompassing a set of *direct* interventions for urban regeneration to *indirectly* shape health and wellbeing at the neighbourhood level. The construct of NAH relies on specific compositional and contextual factors within the neighbourhood that are more relevant for health and wellbeing. The outcome of this research is to provide a set of neighbourhood-based interventions and guidelines that could *indirectly* affect public health and wellbeing at the neighbourhood level. To identify which factors of NAH are more relevant to SPHW, the author tackled the following Research Questions (RQ):

RQ 1: To which extent Neighbourhood Advantage for Health (NAH) associates with State of Perceived Health and Wellbeing (SPHW)?

RQ 2: Which specific factors of Neighbourhood Advantage for Health (NAH) are more relevant for State of Perceived Health and Wellbeing (SPHW), and thus to consider for urban regeneration interventions at the neighbourhood level?

In order to expand the current urban regeneration literature focused on the compositional and contextual determinants of health at the neighbourhood level, the objective of this research is to investigate how urban regeneration can intervene on compositional and contextual factors within the neighbourhood that are relevant to State of Perceived Health and Wellbeing (SPHW) of the resident community. Accordingly, the outcome of this research is to provide a set of neighbourhood-based regeneration guidelines that could directly intervene on the compositional and contextual determinants of health in order to indirectly affect public health and wellbeing at a local level. To doing so, this research work introduces the concept of Neighbourhood Advantage for Health (NAH) as a main analytic distinction to classify determinants of health and wellbeing within the neighbourhood into two broad categories defined for compositional or contextual determinants. Compositional determinants refer to *a-spatial* factors related to the individual characteristics of the residents (e.g., genetic predispositions, exposure to risk factors such as alcohol and tobacco consumption, food habits and lifestyle) and socio-economic features of the community (e.g., support and social cohesion, institutional presence, economic accessibility to food and primary resources within the neighbourhood). Contextual determinants of health, instead, refer the spatial factors such as the features of the built environment (e.g., urban form, transportation pattern, land-use, distribution of economic activities, residential and productive settlements, presence of recreational and *restorative* spaces for resting and practicing physical activities), and the characteristics of the natural environment (e.g., land morphology, hydrography, landscape, naturalistic value, pollution levels).

Findings

To tackle the research questions, the author carried out an iterating analysis, namely a systematic, repetitive, and recursive process for analysing quantitative primary and secondary data collected for this study. Positive associations between NAH and SPHW was observed in all the 11 neighbourhoods under study. As emerged from the analyses, the value of SPHW for each community tracks in magnitude and direction the value of NAH for their relative neighbourhood. Neighbourhoods where greater level of NAH were registered boast higher score in SPHW related to the following compositional and contextual NAH factors:

→ Individual factors: Individuals' awareness of the determinants of health, parent's education, education attainment, household income, nutrition, lifestyle, and individuals' level of physical activities;

→ Community factors: Social supportive environment, social cohesion, trust, safety, economic accessibility, institutional presence;

→ Man-made environment factors: Proximity to food store, pleasant aesthetics, sidewalks quality, streets quality, spaces for physical activities, pleasant walking, home quality and comfort.

Implications and Guidelines for Urban Regeneration

Living in neighbourhoods with higher level of NAH can be associated to the State of Perceived Health and Wellbeing within the community. Findings and implications of this study suggest that in order to foster NAH within the neighbourhood, urban regeneration should directly intervene on specific neighbourhood-based compositional and contextual factors. For connecting urban regeneration and health, direct regeneration interventions should target the compositional and contextual factors defined in this research. Urban regeneration interventions and their indirect effect on health and wellbeing are full described in detail in the last chapter (section 7.1) providing principle and criteria for neighbourhood-based urban regeneration aiming to community's health and wellbeing. In synthesis, interventions for fostering NAH are the following:

> Educational interventions to increase individual's awareness of the determinants of health such as nutrition habits, propensity for physical activities, exposure to health-related risk factors and sedentary behaviours;

> Socioeconomic interventions for improving the community environment as well as provide social and economic support for fostering social cohesion and trust within the community, including institutional support, neighbourhood safety, economic accessibility to primary goods such as healthy foods for disadvantaged households and individuals;

> Spatial and urban planning interventions for fostering mixed-use land use and to create vibrant urban spaces, increasing the amount of *walkable* destinations within the neighborhood, reducing the walking distance between residents' homes and commercial activities and public spaces, improving the visual and restorative built environment, increasing the presence and quality of sidewalks and recreational spaces for resting and to practice physical activities. Finally, interventions are recommended to improve residents' home quality and comfort, and to support individuals within the community through economic incentives to improve the qualitative performances of their homes.

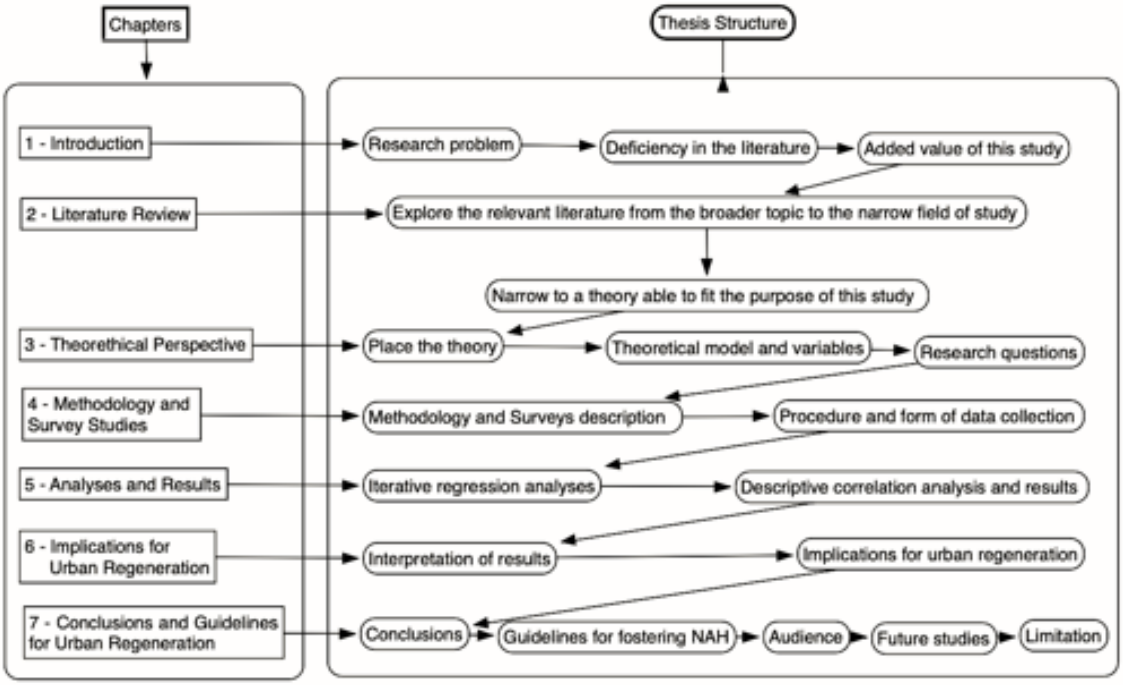
1.1. Research Structure

This research work which encompasses the following 7 sections (Fig.1): (1) Introduction, (2) Literature Review, (3) Theoretical Perspective, (4) Methodology and Survey Studies, (5) Analyses and Results, (6) Implications for Urban Regeneration, and (7) Conclusions and Guidelines for Urban Regeneration.

- Chapter 1 – INTRODUCTION
  To begin with, the author highlights the need for this study, starting from the research problem to the deficiency in the urban regeneration literature. Then, he describes the research methodology and findings in this study, focusing on the added value that this research will bring to the urban regeneration field.

- Chapter 2 - LITERATURE REVIEW
  The literature review aims to achieve the following objectives: (1) Provide a summary of the major studies focusing on the relationships between urbanization and health and exploring urban determinants of health from a macro scale to a neighbourhood level; (2) Inform the research design of this work in all its steps such as collect, analyse, and interpret quantitative data; (3) Limit the number of theories emerged in the relevant literature in order to identify one overarching theory able to fit the purpose of this study and the central research question; (4) Limit the scope to a needed area of inquiry, contextualizing the theoretical design presented in this research, suggesting why it is a useful perspective to adopt and expand in the urban regeneration field.

Fig. 1: Research Structure



Source: Author's elaboration.

- Chapter 3 - THEORETICAL PERSPECTIVE - This chapter aims to formulate a theoretical perspective for introducing the concept of Neighbourhood Advantage for Health (NHA) which is the main variable investigated in this work. To this end, the following steps were conducted: (1) Investigate the public health and urban studies literature which specific compositional and contextual factors of the neighbourhood are more relevant to health and wellbeing; (2) Adopt an overarching theory able to embody the concept of Neighbourhood Advantage for Health and provide an analytic distinction of the dimensions and factors of such a construct; (3) Script out and visualise the theoretical model on which this study relies; (4) Generate a research question that bridges the independent and dependent variables being studied in order to observe the extent to which the independent variables influence the dependent variable.

- Chapter 4 - RESEARCH METHODOLOGY AND SURVEY STUDIES
  This chapter presents the survey on which this study relies. This work relies on a non-experimental form of investigation informed by a survey instrument followed by a correlational design upon which the author describes and measures the degree or association between the variables mentioned in the theoretical model presented in Chapter 3. The survey encompasses three parts aiming at different objectives as follows: Respondents Profile for

collecting demographic, socioeconomic and behavioural data; Survey A to estimate Status of Perceived Health and Wellbeing (SPHW); Surveys B and C to quantify Neighbourhood Advantage for Health (NAH). The three parts of the survey were appositively developed for the purpose of this study, imitating well-known medical and urban audit tools used in the US and Europe for assessing perceived health and wellbeing and for collecting neighbourhood features through the self-reported data.

- Chapter 5 - ANALYSES
  This chapter provides a spatial analysis of the study site and a descriptive analysis of the variations in State of Perceived Health and Wellbeing (SPHW) in the 11 neighbourhoods under study. Then, the author tested the theoretical model of Neighbourhood Advantage for Health (NAH) presented in Chapter 3, exploring the association between the score of SPHW and NAH in the 11 neighbourhoods being studied. Furthermore, the author carried out a descriptive correlation analysis in order to identify specific factors of NAH that are more significative to SPHW and therefore to consider for regeneration.

- Chapter 6 - RESULTS AND IMPLICATIONS FOR URBAN REGENERATION
  Interpreting the results of the analyses, complemented with secondary data (ISTAT, GIS, and web-based), the author provides urban regeneration interventions aiming to enhance health and wellbeing at the neighbourhood level.

- Chapter 7 - CONCLUSIONS AND GUIDELINES FOR URBAN REGENERATION
  The final chapter aims to synthetize findings and, based on implications in Chap. 6, provide transferable guidelines for fostering Neighbourhood Advantage for Health at the neighbourhood level. Eventually, the author suggests future studies on the topic and limitations of this research work.

Chapter 2

2. LITERATURE REVIEW

2.1. Purpose of and Methodology for Reviewing the Literature

This literature review was developed according to the guidelines provided by Creswell (2013) in his book *Research Design, Qualitative, Quantitative, and Mixed Methods Approach* (4th Edition), and the style of citation applied to this thesis is the American Psychological Association Style 6th Edition. As most of the evidence showing the effect of urbanization on health come from the public health field, this research work was developed organizing concept[9] s and empirical finding from different research fields. In synthesis, this literature review aims to the following objectives:

- Provide a summary[10] of the major studies focusing on the relationships between urbanization and health, exploring urban determinants of health from a macro scale to a neighbourhood level;
- Inform the research design of this work in all its steps such as collect, analyse, and interpret quantitative data;
- Limit the number of theories emerged in the relevant literature in order to identify one overarching theory able to fit the purpose of this study and the central research question;
- Limit the scope to a needed area of inquiry, contextualizing[11] the theoretical design presented in the next chapter (Chap. 3) of this study, suggesting why it is a useful perspective to adopt and expand in the urban regeneration field.

2.2. Urbanization, Residential Location and Health

Urbanisation represents the process that shape form and function of the urban environment. Urban[12] factors relevant for health encompass land-use, housing, and transportation pattern, air pollution, and noise (Kickbusch & Gleicher, 2013); these factors shape health and wellbeing of individuals living in urban areas. Urbanization contributes to the recent increase in the burden of Non-communicable Diseases, also known as NCDs[13] (Barton et al., 2006; WHO, 2012; Wang et al. 2015). NCDs are

[9] To organize this literature review, the researcher identified keywords related to the study topic, searching for related studies in journals and books. Then, after an intermediate skimming phase, he summarized, structured and assembled the literature review in a thematic manner, organizing it from the broader topic to the narrower issue that leads into the methods of the study.

[10] For selecting the relevant sources, this literature review prioritizes as follows: broad syntheses in journals or abstract series; article published in major journals; books related to the topics; recent conference paper (in order to align the literature at the current state of knowledge on the topic); dissertation abstracts; web pages, blog, and other internet sources.

[11] The topics considered in this research work were explored tackling the following questions: What is neighbourhood advantage for health? What is the relationship between urbanization and health? What is health? What are the determinants of health? What are the non-communicable diseases and why they are important in the urban context? What the best metrics for assessing physical and mental health in relation to the urban environment? What is well-being? What are health inequalities? Which are the social, economic and spatial determinants of health inequalities? What policies exist for tackling health inequalities? What is the effect of the built environment on health, well-being, and health inequalities? What are the relevant methods to measure the neighbourhood health effect? What are the relevant neighbourhood components that affect health and wellbeing? …and the health-related studies in the urban regeneration field? What are the urban health indicators developed to date? Why the neighbourhood could be considered as an ecosystem for health?

[12] The definition of the term "urban" varies from country to country (Duncan & Kawachi, 2018). However, there is a common agreement on the fact that urbanized areas are characterized by high density, diversity of populations and activities, as well as complex flows of skills, energies, information, goods and, in a prominent way, from migratory flows (Talukder et al., 2015). Urban areas could be defined by high concentration of residential dwellings, working places, services, and activities. Also, sometimes urban areas refer to human settlements adjacent to the cities (Caiaffa, 2008).

[13] Non-communicable diseases (NCDs), also known as chronic diseases, tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behaviors factors. The main types of NCDs are cardiovascular diseases (like heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructive pulmonary disease and asthma) and diabetes.

driven by forces that include rapid unplanned urbanization, globalization of unhealthy lifestyles and population ageing. NCDs kill 41 million people each year, equivalent to 71% of all deaths globally. Each year, 15 million[14] people die from an NCD between the ages of 30 and 69 years; over 85% of these "premature" deaths occur in low- and middle-income countries. Urbanization exerts a significant impact on public health as factors such as urban governance, population size and characteristics, quality of the natural and built environment, degree of social and economic development, quality of services and health-care, and food security have a crucial impact on the health of human beings (World Health Organization, 2018b). Urbanization exerts a primary role on the distribution of the determinants of health (Harpham & Stephens, 1991; Graham & Kelly, 2004; Graham, 2009; Kickbusch & Gleicher, 2013; Bravemann & Gottlieb, 2014; De Leeuw & Simos, 2017; National Academies of Sciences, Engineering and Medicine, 2017; WHO, 2018b) as it shapes the environment in which people which is a key determinant of health (Barton & Grant, 2006). According to WHO (2016), transport and mobility, land use planning and landscape design, food system, energy, housing, clean water and waste management, workplace and workers' health, slum upgrading, greening strategies are factors on which to focus for achieving a healthy environment for the world population, providing the conditions for urban residents to lead healthier, safer and more fulfilling lives.

2.2.1. Place and health: historical background

The effect of place and location on health is not a new concept. Back in the 400 BC, "On Air, Water, and Places" was the earlier Hippocrates description of geographic health disparities in term of topographical factors such as differences in altitude, population density or proximity to a river. Hippocrates highlighted the negative impacts on health of swamps that are described as unhealthy place, while he emphasized the benefits for health associated to sunny and breezy places. Also, he associated unhealthy place to a state of "miasma" -Greek word for pollution- thus laying down the foundation for understanding of the relationship between places, health, and disease. The "miasma" theory dominated until the early 19th century, during which epidemiologists investigated for the socioeconomic and spatial causes of the spread of diseases (Julia and Valleron, 2011).

In 1854, the British physician John Snow, the founder of modern epidemiology, observed the connection between spatial features of the neighbourhood and public health by means of mapping cases and death for cholera in Soho (London). Observing the proximity of cholera cases (mapped through dots), he attributed the source of transmission of the disease to a water pump in Broad Street which was contaminated by the neighbourhood sewage system, before his breakthrough the cholera epidemy was believed to be a matter of air pollution (miasma). Similarly, but in New York, Gillespie (1810) ascribed the spread of the yellow fever to a foreign ship, rather than attributing the cause of the fever to the "filthy" conditions (or miasma) of the populous neighbourhood of Brooklyn. A crucial contribute in epidemiologic studies is due to Louis-Renè Villermé, a scientific pioneer in the field of social epidemiology as he challenged traditional medical hypotheses, shifting the focus of epidemiology to revolutionary understanding of the social, economic and spatial determinants of health. Specifically, Villermè investigated the mortality-rate variations across the 12 districts (or arrondissements) of Paris analysing death rates by district from 1817 to 1826, population density and income indicators (Julia and Valleron, 2011). Likewise, Chadwick (1842) argued about the role of place of residence, and social and occupational class as determinants of individuals' life expectancy, the more quality of the place and higher social and occupational class, the longer is individual's life expectancy. Early in 1877, Bayles (1877) highlights that variations of public health in different

[14] Cardiovascular diseases account for most NCD deaths, or 17.9 million people annually, followed by cancers (9.0 million), respiratory diseases (3.9million), and diabetes (1.6 million). These 4 groups of diseases account for over 80% of all premature NCDs deaths. Tobacco use, physical inactivity, the harmful use of alcohol and unhealthy diets all increase the risk of dying from an NCDs. Detection, screening and treatment of NCDs, as well as palliative care, are key components of the response to NCDs.

neighbourhood are due to the differences in the local sanitation infrastructure, also, he argued about how social class influence public health differences between and within neighbourhoods.

Urbanization and public health are related as the modern way to plan cities originated in the 19th Century to address health issue related to overcrowded and unhealthy conditions that characterized the early industrial cities at that time (Barton & Grant, 2006). Grant and Braubach (2010) highlight that, in 1875, the Public Health Act was the first recognized public effort to address the growing demand for healthier and more hygienic neighbourhood. More recently, epidemiological researches shifted their focus from sanitation to other factors of health such as the socio-economic and spatial determinants of health (Macintyre et al., 2002). Contemporary scientists are investigating how residential location affect health, and these analyses are being conducted across and within nations, states, regions, and neighbourhood (Duncan and Kawachi, 2018). Nowadays, it seems that the focus of urban planning is shifting on the promotion of community initiatives that could improve the quality of urban contexts in European cities (Capolongo, 2014), starting from the assumption that urban design and land-use are determinants of public health and wellbeing (Duncan and Kawachi, 2018).

McKeown (1991) affirm that an important step forward in curbing human diseases can be attributed to progresses of urbanism. The primary aim of urbanism was to address the scarce hygienic conditions of industrial cities (Schilling, 2005) by providing the population with proper residential services and addressing overcrowding and poor hygiene conditions occurred at the time due to fast population growth. Even today, but with a different perspective, the built environment plays a fundamental role in health (Gullon & Lovasi, 2018, Jackson, 2003). Duncan and Kawachi (2018) sustain that factors of the built environment interact with each other in a complex way, influencing people's behaviours and habits and thus indirectly their physical and mental health. James at al. (2013) describe the built environment as man-mad system that affects both man' and women's health. They outline that the built environment includes buildings, transportation system, and urban form (arrangements, function and aesthetic qualities of the design of buildings and street) (p. 753). Contemporary research on the neighbourhood-built environment focuses on measures of density, mixed land-use, and proximity to destinations around one's residence (James et al., 2013: 753). The built environment dictates travel patterns, which in term determine exposure to air pollutants, levels of physical activity, diet, and degree of social interaction (James et al, 2013).

Regulation intersecting urban planning and health are well rooted in the Italian[15] and European legal framework for cities planning and development in the XIX and XX centuries. In 1884, the city of Naples was affected by a cholera epidemic due to the overcrowding and poor sanitary conditions of the residential settlements. The "Naples" law n. 2392 delivered sanitary regulations concerning the water and sewage networks, and the city renovation plan included large areas where buildings were demolished and reconstruct using eminent domain due to public utility. It was the first time that the property right was questioned for a social purpose in order to meet hygienic and sanitary needs. In 1933, the Athens Charter affected cities development in Europe and worldwide, providing guidelines for the separation of living and working areas through the practice zoning, however zoning was later criticized for its negative impacts on the natural environment as well as on public health and wellbeing of the community living in monofunctional residential areas.

[15] Since 1968, the Italian regulation framework for urban planning and zoning mainly relies on the concept of "urban standards" which are outlined in the law DM 1444/68. "Urban standard" works as a quantitative tool for distributing land-use and thus urban functions within the city. Recently, the Istituto Nazionale Urbanistica (INU) highlights that urban standards, as developed in 1968, can be considered anachronistic due to societal changes and thus they should be revised integrating a qualitative dimension to foster socioeconomic forces shaping contemporary life (e.g., technological innovation and smart cities). Likewise, Iaione (2013) affirms that updating the "urban standards" should overcome a quantitative approach for capturing the relationship between urban space, public health and wellbeing.

2.2.2. Urbanization, urban growth and opportunities for public health

The role of urbanization for health is increasing as urban areas are becoming extremely dense as a major share of world population lives in urban environment (WHO, 2018b). The World Health Organization (WHO, 2018b) points out that by the 2050 over 70% of the world population will be urban, and urban growth is expanding at a faster rate especially in small cities, and dense urban areas in less-developed countries. In 2014, the World Health Organization[16] (WHO) affirm that the urban population reached the 54% of the world population, mostly this share of population is concentrated in less developed areas of the world where overcrowding, unhygienic and undesirable living conditions represent an imminent public health challenge to address (WHO, 2018a). As the world is becoming urban (Caiaffa, 2008; WHO, 2008), the relationship between the urban environment and public health gained an increased focus in non-health sectors such as urban planning (Wizemann, 2014). Also, the WHO[17] affirms that the economic consequences of poor health in dense urban areas will be significant both at micro and macroeconomic level (e.g.; local healthcare cost; costs for households and firms; and negative impacts for national gross domestic product -GDP-), contributing to fuel socioeconomic health inequalities across and within worldwide countries.

Urbanization is related to the co-location of many people in a specific urban area. This density of people in urban areas offers an opportunity to develop and implement health-related strategies that can potentially impacts the health levels of a major share of the world population (Gullon and Lovasi, 2018). Understanding how urban policies can enhance health is an urgent need and an opportunity for policy-maker, especially in metropolitan areas. Indeed, metropolitan contexts offer multiple opportunities for access to services, communication and integration, but also high risks of exposure to physical, chemical, mental and social stress agents, with negative effects on the health of the inhabitants (WHO, 2018b). Nowadays, metropolitan environments are comparable to dynamic organisms in constant change (West, 2017) whereas people share resources through different norms (McLaren and Agyeman, 2015).

Urbanization shape the man-made environment through urban planning, especially at a very local level, where urban planning choices affect directly individuals' lifestyle and health related behaviours. Grant and Braubach (2010) affirms that the mandate of urban planning is on local scale, especially when planning is oriented to foster health. They also sustain that local budgets are constraint for an integrating public health and urban planning strategy, thus, more intersectoral work among private, public and NGO is needed to better develop and undertake potential interventions. Grant & Braubach (2010) advocate for more efforts to produce healthier urban environments, especially at the local level, where interventions are more likely to produce effective outcome. In line with EU directive, Grant & Braubach (2010) affirm that in order to measure the impact produced by cities on public health, we should look at the following urban parameters:

- *Noise[18]:* noise level to which people are exposed affect individuals' health and wellbeing, thus, suitable noise indicators should consider noise levels, but also quietness and tranquillity levels, and noise annoyance;
- *Transportation[19]*: active transportation increase individuals' physical activity levels affecting individual's health and wellbeing. Also, alternative means of transportation rather than car seem to be conducive for people health.

[16] The objective of the World Health Organization is the attainment by all peoples of the highest possible level of health.

[17] Retrieved at https://www.who.int/choice/publications/d_economic_impact_guide.pdf?ua=1

[18] Suitable indicators for the noise dimension are the following: traffic flow/intensity and composition, share of people exposed to noise levels ranging from above 55 dB A, share of people living in quiet areas, share of people exposed to noise sources, road, and industry. The European Commission Directive 2002-49-EC provide guidelines on environmental noise.

[19] Suitable indicators for the transportation dimension are the following: accessibility to alternative means of transportation and transport networks across different population subgroups, efficiency of the transportation services, presence of incentives for public

- *Waste & waste management*[20]: the manner in which local authorities, and citizens, manage wastes is important for public health.
- *Water and water treatment*[21]: water is a crucial dimension for health as it can be a powerful mean to spread disease, or, in a nature calamity perspective, to destroy entire human settlements, also, people's water intake and the quality of the organoleptic characteristics of water affect individuals' diet, and thus their health.
- *Recreational & green space dimension*[22]: these kinds of space allow people to practice more physical activities, and to socialize with other residents, both conditions are conducive for mental and physical health and wellbeing. However, public spaces, if not well maintained or too isolated, can be hotspot for crime and labelled as zone of fear.

2.2.3. Focus on cities, neighbourhoods, communities, society and public health

When referring to cities Mumford (1937) defines urban settlements as not just a physical fact, but as a shelter embedding economic, institutional, and social dimensions; these drive human activities. Smith (1977) sustain that cities "exists for concentrating services for a large population in a relatively small area, and one of the most important of these services is providing people with a place to live" (p. 368). The neighbourhood is a crucial part of the city, it is planning construct to define a residential area, it is a product of the modern city planning (Platt, 2014). Mumford (1937) describes the neighbourhood as a "fact of nature" to indicate people's necessity to gather together for a common objective, forming communities. In Europe, the role of the neighbourhood has changed in the last century due to the increasing diversity fuelled by migration (Kennett & Forrest, 2003) which changed the social relationships and ties within European communities (Blockland, 2003).

The modern concept of "neighbourhood unit" was put forward by the American architect Clarence Perry (1929) whom described the neighbourhood unit as which is part of the cellular city but also as a distinct entity with specific socioeconomic and cultural characteristics. Perry (1929) underlines that an important element of the neighbourhood is the primary education system that attracts parents to choose a certain neighbourhood instead of another. Moreover, Perry (1929) describes the neighbourhood unit as the sum of the following six dimensions: (1) size (according to population density, but not more than one quarter mile radius); (2) boundaries (bounded on all sides by streets); (3) open spaces (presence of recreational spaces for stimulate interactions); (4) institutions sites (mostly schools and other institutions placed in the centre of the neighbourhood); (5) local shops (placed at the edge of the neighbourhood); (6) internal street system. More recently, Duncan and Kawachi (2018: 1) affirm that the neighbourhood is a "geographical places that can have social and cultural meaning to residents and non-residents alike and are subdivisions of large places," while Blokland (2003) sustain that a neighbourhood is a "geographically circumscribed, built environment that people use practically and symbolically" (p. 213). As evident, geographically circumscribed, bounded limits, socioeconomically homogeneity, and access to services still remain solid components of the contemporary concept of neighbourhood which is a crucial building block for harnessing social

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and physical active transportation, access to cycling networks and public transportation. The European Commission provide guidelines on sustainable transportation plan and specifically, the Directive 2004-345-EC provide guidelines on road safety.

[20] Suitable indicators for the noise dimension are the following: type of local recycling system, local waste management and treatment technologies, public plan for green waste collection and treatment for composting, public plans for transforming waste into energy such as biogas, incineration, and others. The European Commission provide guidelines on waste management, these are the following: EC Directive 91-271-EEC on urban waste water, EC Directive 2006-12-EC on waste water, EC Directive 2000-76-EC on the incineration of waste.

[21] Suitable indicators for the water dimension are the following: presence of local flood rick management, presence of house with rainwater harvesting systems, tap water quality, quality of potable water supply system, capacity of the local water treatment system, presence of water supply emergency plans, household use of bottle water. European Commission Directives on the water dimensions are EC Directive 91-271 EEC on urban waste water, and EC Directive 2006-12-EC on waste water.

[22] Suitable indicators for the recreational and green space dimension are the following: share of green and recreational space in sqm and in % of city surface, accessibility to green and recreational spaces, share (sqm and %) of green and recreational spaces at neighborhood level, safety of green areas by crime, type of green spaces (Pvt/public green spaces), local incentives for green space quality.

cohesion and solidarity (Kennet & Forrest, 2003). According to Kennett & Forrest (2003). The institutional variations within the European neighbourhoods are due different planning perspectives. In Europe, the role of the family varies with the country whereas "some societies exhibit a more public, sociable, culture in which sociable culture in which family life spills over into the public spaces of the neighbourhood compared with more privatized, home-cantered societies" (Kennett & Forrest, 2003: 715).

The concept of neighbourhood follows the evolution of the concept of community to society. The existence of society was firstly described in the early nineteenth century, when the rising of a new form of social integration -*society*- challenged worldwide communities, especially in urban areas (Storper, 2005). In 1887, Tonnie sustained that community and society are *antinomy*. In his perspective *community* -*Gemeinashaft*- is characterized by familiarity, traditions, informal relationships, emotions, affinities, similarities, and a rural-oriented organizational form, while *society* -*Gesellshaft*- refers to collectivises bounded through anonymous, formal, more transparent, thus, society is more conducive for social mobility which is accessed by formal and pre-established relationships, still anonymously and transparently. Adler and Heckscher (2006) affirm that *community*[23] relies on loyalty, collectivism, particularism, as well as a mechanical division of labour informed by common norms and vertical dependence. Storper (2005) highlight that, in the late 19th to the mid 20th century, community was intended as an obstacle for modernization and economic development due to its closed structure, while from then to date, preeminent sociologists point out the fact that *too much* society could be an issue for individual and social development, thus, highlighting the renovated role of the community as a driver of growth for the contemporary world.

Mumford (1961) points out that cities changed through times as an expression of their temporal society[24]. In 1997, Manuel Castells (1997) describes the rise of a modern network society, one in which the variety of social processes are closely inter-related in function and meaning. Thus, this new form of social pattern affects individual's social relationships and the meaning they apply to the man-made environment. The intense urbanization processes happening worldwide are fuelled by many powerful socio-cultural and market forces that shape the urban context, thus, challenging communities' exposure to health-related risk factors, thus, affecting cities vulnerability (Von Szombathely et al., 2017). Often, neighbourhoods are the outcome of the metropolitan urban planning processes, indeed -as an administrative and physical concept- they are a smaller part of bigger entities such as cities, regions, states, and nations. Therefore, the quality of the neighbourhood is strongly affected by the broader context in which it is nested as well as the macro socioeconomic forces playing in such a broader context (Duncan and Kawachi, 2018). The urban design of cities and neighbourhoods affect physical and mental health (Frumkin, Lawrence and Jackson, 2004; Melis et al., 2015; Duncan & Kawachi, 2018) as well as individuals' wellbeing (Gehl, 2010).

2.2.4. A re-emerging focus on health

The phenomenon of fast-growing population attracted the attentions of prominent institutions as the United Nations[25] (UN) and the WHO on developing policies to enhance public health at urban level. The 2030 Agenda for Sustainable Development recognizes NCDs as a major challenge for

[23] Muniz and O'Guinn (2001) highlight that scholars widely agree on three dimensions to define a community: (1) Consciousness of kind" (Gusfiel (1978) refers to the sense of belonging and to the similarity that members of the same community experience with each other, and the differences they perceive towards outsiders); (2) Ritual and traditions" the sharing of particular meanings, and the sharing of similar behaviours and values among members; (3) Sense of moral responsibility; (Durkheim (1915) and Marshall (1994) refer to the respect that the members of the community perceive for the community as a whole, and inspires collective action against threats to the community itself.

[24] For instance, from the ancient European settlements, based on a tribal division of the space, to the Greek -democratic- Ippodameo regular grid, from the fortressed cities during the spread fear during the middle-age to the new perspectives of the Renaissance, from the baroque boulevards to the modern cities of the XX century until today.

[25] United Nations (UN) is an international organization operating since 1945. Since its inception, the UN fosters dialogue between and among governments in order to find appropriate solutions for emergency and raising issues all around the world.

sustainable development. By 2030, as part of the Agenda, Heads of State and Government are committed to reduce by one-third premature mortality from NCDs through prevention and treatment (SDG target 3.4). This target comes from the High-level Meetings of the UN General Assembly on NCDs in 2011 and 2014, which confirmed WHO's leadership and coordination role in promoting and monitoring global action against NCDs. The UN General To support countries in their national efforts, WHO developed a Global action plan for the prevention and control of NCDs 2013-2020, which includes nine global targets that have the greatest impact on global NCD mortality. These targets address prevention and management of NCDs.

NCDs threaten progress towards the 2030 Agenda for Sustainable Development, which includes a target of reducing premature deaths from NCDs by one-third by 2030. A strong focus on health is the primary concern of the 2030 Agenda for Sustainable Development [26] as urban poverty is closely linked with NCDs. The rapid rise in NCDs is predicted to impede poverty reduction initiatives in low-income countries, particularly by increasing household costs associated with health care. Vulnerable and socially disadvantaged people get sicker and die sooner than people of higher social positions, especially because they are at greater risk of being exposed to harmful products, such as tobacco, or unhealthy dietary practices, and have limited access to health services. Among the most influent organizations participating in the implementation of the 2030 Agenda, the World Health Organization (WHO) exerts a primary role, proposing to place health as a driver, or "pulse" of an inclusive and sustainable urban development (WHO, 2016). In the perspective of the Sustainable Development Goals, the aim of the WHO is to bring an "health-lens" in all the 17 sustainable development goals and the means to achieve them. On April 7th, 2018 the WHO[27] promoted the world health day, an initiative focused on the "Universal Health Coverage (UHC): everyone, everywhere."

NCDs disproportionately affect people in low- and middle-income countries where more than three quarters of global NCD deaths – 32million – occur. People of all age groups, regions and countries are affected by NCDs. These conditions are often associated with older age groups, but evidence shows that 15 million of all deaths attributed to NCDs occur between the ages of 30 and 69 years. Of these "premature" deaths, over 85% are estimated to occur in low- and middle-income countries. Children, adults and the elderly are all vulnerable to the risk factors contributing to NCDs, whether from unhealthy diets, physical inactivity, exposure to tobacco smoke or the harmful use of alcohol. In low-resource settings, health-care costs for NCDs quickly drain household resources. NCD management interventions are essential for achieving the global target of a 25% relative reduction in the risk of premature mortality from NCDs by 2025, and the SDG target of a one-third reduction in premature deaths from NCDs by 2030.

According to a considerable amount of studies, the quality of the urban built environment[28] is a crucial topic as it will influence the health of billions of people living in the future cities, thus, upgrading our neighbourhoods for enhancing public health and wellbeing is a valuable perspective to undertake in urban studies. Dannenberg et al. (2011) point out that the manner in which we design and build our communities, where we spend virtually our entire lives, has profound impacts on our physical, mental, social, environmental, and economic well-being as community design -in a comprehensive way- impacts physical activities levels, air quality, water quality, and social capital; these are main determinants of health. Structure and form of the built environment is the product of the broad political, social, and economic context of a specific place (Borrell et al. 2017). These

[26] On September 2015, the Division for Sustainable Development Goals (a body within the UN) promoted the United Nations' 2030 Agenda (United Nations, 2018), an approach focused on 17 Sustainable Development Goals (SDG) with 169 associated target which are integrated and indivisible. The 17 SDG are shared by all the countries of UN, and national and international organizations devoted to pursuing global prosperity, health, and socioeconomic development.

[27] Retrieved at http://www.who.int/en/news-room/fact-sheets/detail/universal-health-coverage-(uhc).

[28] According to English Oxford Living Dictionary (2018), the concept of "built environment" refers to the "man-made structures, features, and facilities viewed collectively as an environment in which people live and work."

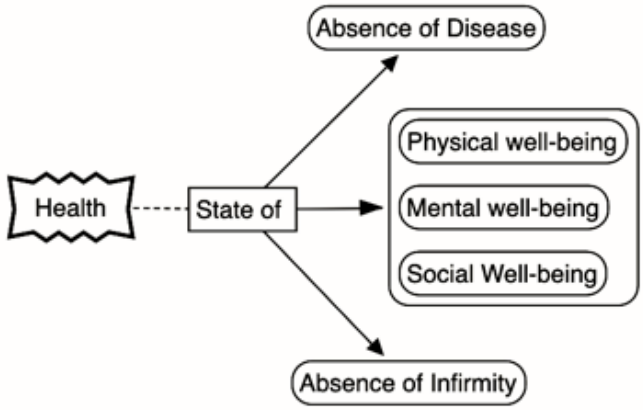
contextual elements interact with the range of socioeconomic characteristics of the individuals living within that place. These interactions make difficult to objectively link built environment features to health outcome (Gullong and Lovasi, 2018).

Health can be the focus of the future for urban planning and urban regeneration aiming to health as the main outcome, thus, offering significant opportunities for enhancing communities' health and wellbeing and at the same time economic productivity (WHO, 2016). Recently, in the field of urban studies, the term urban health has been used to define a strategic orientation that integrates the actions of protection and promotion of health in territorial planning (Capolongo et al., 2011). Urban Health Indicators are employed to benchmark public health from a local to a national level, set objectives for improvement, capture the urban environment effect on people's health, prioritise allocation of fund in a specific health-related field, and identify strength and weaknesses of a specific community (Pineo, 2018). Urban health indicators as tools able to capture the effect of the built environment on health as well identifying health inequalities within and across different areas, thus, guiding policy-maker to undertake better decision when delivering interventions. Through a review of the literature on 145 urban health indicator tools developed to date, Pineo et al. (2018) classify urban health indicators in five categories: topic, spatial scale, format, scope and purpose, further highlighting that the impacts associated to interventions on the built environment features are often indirect and there exist a lack of empirical evidence on their effectiveness.

2.2.5. Concept and determinants of health

Health is more than an absence of illness as it encompasses other dimensions such as quality of life and all the components of individuals' well-being (Kickbush, 2007). As stated in the Constitution[29] of the World Health Organization, entered into force on 7 April 1948, health is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." Fig. 2 provide the five dimensions of health according to the WHO, this definition will be used in the theoretical perspective on which this study relies

Fig. 2: Definition of "Health" according to the WHO.



Source: Author's elaboration.

The WHO emphasizes the equity dimension in health. The WHO (1948) affirms that the "unequal development in different countries in the promotion of health and control of disease, especially communicable disease, is a common danger," and also "the extension to all peoples of the benefits of medical, psychological and related knowledge is essential to the fullest attainment of health." Furthermore, the WHO (1948) highlight the crucial role of governments for the health of their peoples which can be fulfilled only through a equitable provision of health and social services. As stated in the Ottawa Charter for Health Promotion held in 1986, the prerequisites for health are peace, shelter, education, food, income, a stable eco-system, sustainable resources, social justice and

[29] Retrieved at http://apps.who.int/gb/bd/PDF/bd47/EN/constitution-en.pdf?ua=1

equity. The social determinants of health are mostly responsible for health inequities, namely, the avoidable differences in health status seen within and between countries (Murtin et al., 2017). The World Health Organization (2018b) sustains that the social determinants of health are the circumstances in which people are born, grow up, live, work and age, and the systems put in place to deal with illness. These circumstances are in turn shaped by a wider set of forces: economics, social policies, and politics, and the distribution of money, power and resources at global, national and local levels.

The WHO sustains that health is a fundamental right for each human being without distinction of gender, race, religion, political belief, economic or social condition. These two key principles, on which the WHO's Constitution relies, emphasize the meaning of health and the equity of health for all. Still, today, health inequalities[30] are a common and growing issue worldwide (Marmot & Wilkinson, 1999; Wilkinson & Marmot, 2003) and their causes depend on various determinants such as individuals' socioeconomic status and the spatial dimension the urban settings where individuals live, work and socialize (Kawachi et al. 1997; 2002). Marmot & Wilkinson (1999) sustain that human health is affected by the contextual social, economic, and environmental factors existing in the place where people lives. Also, they affirm that the way governments intervene on these factors can affect (positively or negatively) individuals' health and wellbeing.

According to the WHO (2017) highlight that the determinants of health include the social and economic environment, physical environment, and the person's individual characteristics and behaviours. As a consequence, we can say that the place where people live determine their health. Also, it is self-evident that individuals are unlikely to directly control many determinants of health. When referring to health, we intend not only on the absence of disease but to the broad determinants of health such as individuals' living and working condition, contextual societal and economic factors, and the quality of the built and natural environment of health.

Among the main determinants of health, the WHO[31] emphasize the influence on health of factors such as: (1) gender (man and woman can be affected from different diseases at different ages); (2) income and social status (higher income and better social status are associated to better health); (3) education (low education levels associate to poor health and more stress); (4) physical environment (water and air quality, quality of housing, working place); (5) transportation pattern used, social and recreational spaces); (6) social environment (family, friends, and community support associate to better health, also, the cultural context in which individual's live affect their health); (7) genetics (inherited genetic traits determine lifespan, health and the likelihood to be affected by certain diseases); (8) personal behaviours and coping skills (healthy food eating, physical activities, smoking, drinking, and attitude towards daily life stress affect health);(9) health care services (accessibility and use for treating disease). Bonnefoy et al (2007) sustain that in order to tackle the social determinants of health, it is crucial to investigate and describe the social structure of societies, giving a sociological, economical, and geographical dimension. Also, they[32] affirm (2007: 17) that variables in such social structure encompass key axes such as "social class status, education, occupation, income/asset, gender, ethnicity, race, caste, tribes, religion, national origins, age, and residence."

[30] According to Kawachi et al. (2002: 647), health inequality is "the generic term used to designate differences, variations, and disparities in the health achievements of individuals and groups."
[31] http://www.who.int/hia/evidence/doh/en/
[32] All these variables affect each other affecting individuals' health. Furthermore, Bonnefoy et al. (2007) argue that the context in which these key axes exists influences their intensity. For instance, generalization of the social determinants should take in consideration the *external validity* (whether that which has been observed under controlled circumstances still applies without strict scientific control in ordinary setting), *replicability* (the extent to which the findings from one setting would be replicated if carried out in a different context), and *epistemological framework* (the degree to which the cultural context has generated the conceptual structure of the original studies and their subsequent interpretation).

Early in the 80s, the WHO (1986) highlighted that health is a resource for socioeconomic development and individual's quality of life. Population size and growth represents the drivers, as causes and effect, of humans' economic and social development (OECD, 2013). The WHO (2012) affirms that population health level is a powerful indicator of how development is advancing in the three main pillars of sustainability: social, environmental, and economic sustainability. Specifically, the WHO affirms that indicators to benchmark the sustainability of urban policy should reflect progresses on urban social equity, environment and development in fields such as housing, air quality and pollution, transport, crime and violence, urban services, health care services, green spaces, water, food, and energy and waste management. The WHO affirms that the key for the urban success lies in the urban governance which is the mechanism through which, bringing together private, public, and civil society sectors and their efforts, the city of the future can be healthier. The WHO aims to bring health considerations into national, regional, and local public policies.

The WHO (2017) suggests that factors such as education, employment status, income level, gender, and ethnicity affect individuals' health. The National Academies of Sciences, Engineering and Medicine (2017: 100) affirms that the social determinants of health are "the conditions in the environments in which people live, learn, work, play, worship, and age…" Similarly, the WHO affirms that the social determinants of health varies with the circumstances in which people are born, grow up, live, work and age, and the system to put in place to deal with illness. Thus, apart from socioeconomic status (which include individual's childhood circumstances, education, income, etc..), people's health depends on the quality of the place where they live. These circumstances are shaped by the broad spectrum of social, economic and spatial policies undertaken from the specific government system. Also, as emerged in the literature, factors such as culture (Costa et al., 2014), gender and ethnicity (World Health Organization, 2017) seem to play a crucial role for the magnitude of the issue.

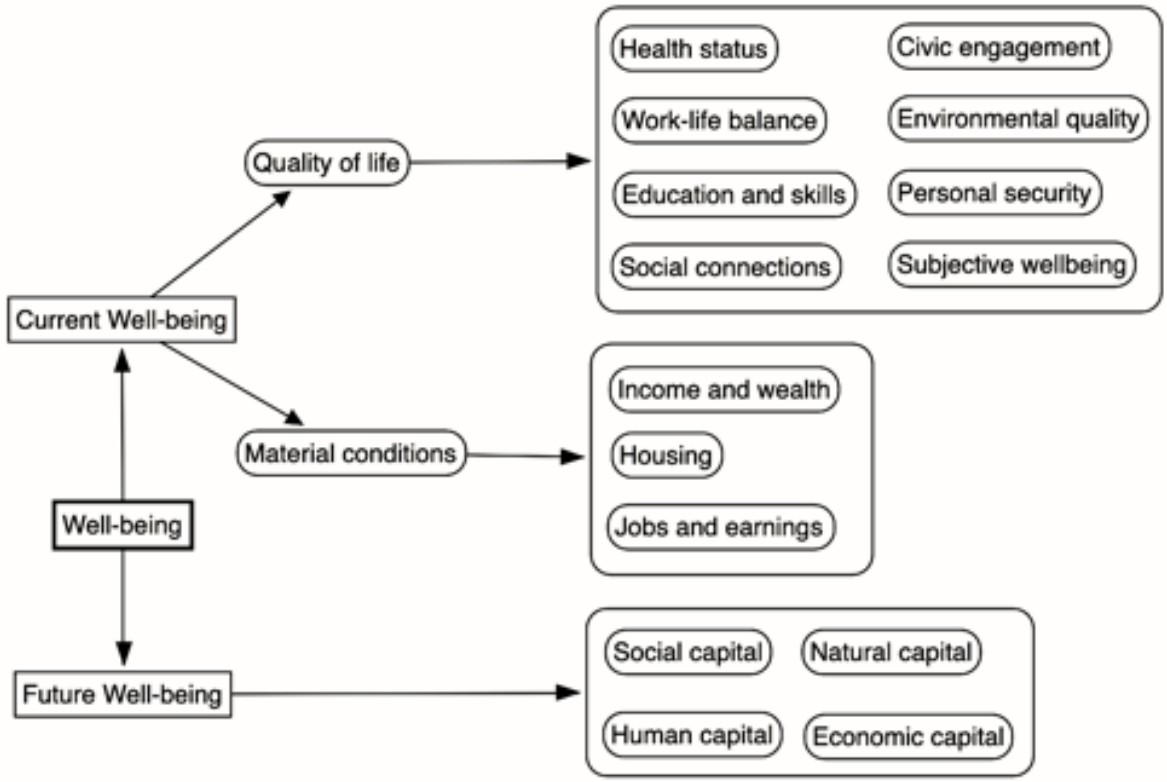
Dahlgren & Whitehead (2006) sustains that determinants of health are factors that affect, positively or negatively, health and wellbeing. They also highlight the differences between social, economic, cultural, and environmental determinants (that are in turn influenced by the political and commercial contexts, and individual's decision) and age, sex, and genetics factors which are specific (and non-modifiable) individuals' features. Furthermore, Dahlgren & Whitehead (2006) make a crucial difference between the determinants of health and the determinants of social inequalities in health. Indeed, they sustain that the determinants of social inequalities in health are due to specific imbalances within the population, among these: different levels of power and resources, different levels of exposure to health harming factors, the morbidity of different segments within population to health harming factors, individuals' life-course perspectives, and the individuals' variations of social and economic effects of being sick. Finally, Dahlgren & Whitehead (2006) affirm that such social inequalities in health are due to the broad/macro socioeconomic, cultural and environmental conditions of the place in which individuals live. For instance, the extent of poverty, magnitude of economic growth and income inequalities existing in a specific context are triggering factors of the social inequalities in health. In conclusion, disadvantaged individuals and groups are more exposed to be affected by health inequalities because they have limited resources.

2.2.6. Concept and determinants of wellbeing

Well-being is intended as a positive -therefore desirable- outcome for individuals, communities and more in general society (CDC, 2018). According to the Centre for Disease Control and Prevention (CDC, 2018) well-being levels are influenced by determinants such as genes and personality, age and gender, income and work, and relationship. The World Health Organisation (2014) affirms that a state of well-being is connected to a good mental health, and that a desirable state of well-being allows individuals to realize their own potentials, thus, affecting communities in which individuals live. The term well-being encompasses factors such as mental and physical health

(Dunn, 1973) and individuals' achievement of life expectations (Diener, 2009). Interestingly, despite it has been associated with genetic traits (Barry, 2007; Lykken & Tellegen, 1996), society' and individuals' well-being is shaped by the environmental conditions in which people live, work and socialize (Frey, 2002; Diener et al., 2009). Researchers associated wellbeing with a higher self-perceived health, longevity, healthy behaviours, less mental and physical illness, social connectedness, productivity, and more in general with good physical and social environment contextual conditions (Diener, 2004; Lyubomirsky et al., 2005). Higher levels of well-being deliver positive outcome for individuals such as health-, job-, family-, and economically-related benefits (Lyubomirsky et al., 2005).

Fig. 3: Framework for Wellbeing according to the OECD.



Source: Author's elaboration.

The Organisation for Economic Co-operation and Development (OECD, 2018) proposes a framework for measuring *current well-being* (Fig. 3) and provide a list of resources to stimulate for future *well-being*. The current well-being framework encompasses two dimension such as quality of life (health status, work-life balance, education and skills, social connections, civic engagement and governance, environmental quality, personal security, subjective wellbeing) and material conditions (income and wealth, job and earning, housing). Also, the OECD affirms that the resources for sustaining well-being through time are natural capital, human capital, economic capital, and social capital; these being stimulated can enhance society levels of well-being.

The National Research Council (US) (2001) sustains that there exist various approaches to measure well-being. For instance, Kahneman et al. (1999) put forward a multidimensional concept for defining wellbeing, descending from a molar to a molecular scale. Starting from molar, this multidimensional concept includes: "external conditions" of the environment to which people are exposed including factors such as income, housing, work, social relationship; "subjective well-being" intended as individual's life satisfaction; "persistent mood level" (optimistic vs pessimistic); "immediate pleasures/pains, transient emotional states" (from joy to anger); and, eventually at a

molecular scale “biochemical” intending the neural bases of individuals’ behaviour. Furthermore, the National Research Council (US) (2001) sustains that surveys on well-being aim to measure three dimensions such as life satisfaction (Campbell et al., 1976), health and ability/disability, and composite indexes of positive functioning.

2.2.7. Healthy cities network and urban planning for health in Europe and Italy

D'Onofrio and Trusiani (2017) highlights urban partenrships and tools developed at European level for new urban planning processes aiming to health and wellbeing. The healthy cities project is based on the principles outlined in the Ottawa Charter 1986 (WHO,1988) which emphasizes the transformations of the urban environments as a strong determinant for health as well as the quality of the natural environment. The Healthy Cities projects relies on health and life quality as an outcome for the urban community rather than individuals. Indeed, Healthy Cities initiatives promote a new method to shape the form and distribute the functions of the urban built environment, including the relationship among the natural environment, built environment and landscape. While in some European countries the integration between health issues and city planning has been achieved by introducing national health-related laws and regulations, other countries carried out experimental local initiatives involving private actors, public sectors and civil society in the development of urban development projects aiming to public health and wellbeing. Among the Healthy Cities best practice descripted by D'Onofrio and Trusiani (2017), we find north European cities such as Belfast (North Ireland), Bristol (UK), Hamburg (De), and moreover the Green health Project (Scotland) and the Network Città Sane (Italy).

Healthy Cities

The Healthy Cities European Network includes 1400 European cities. The inspiring principles of the network relies on the investigation of the determinants of public health and their link with urban planning according to the health map for the local habitat put forward by Barton and Grant (2006). The map was built on the theory of urban ecosystems and the model of health determinants of Whitehead and Dahlgren (1991), and it place the individual at the center of a global ecosystem encompassing dimensions such as the natural and built environment, work activities, local economy, learning and entertainment, community, and lifestyles. Health-Urbanism aim to intervene on these dimensions for promoting health and wellbeing of urban communities, not only improving healthcare but also for the creation of environments conducive to improving quality of life and wellbeing.

Belfast (North Ireland)

Belfast has been a member of the WHO European Healthy Cities Network since 1988. The city developed the program Healthy Urban Environment led by Regeneration and Healthy Urban Environment Group[33]. Starting in 2000, Northern Ireland introduced the HIA (Health Impact Assessment) tool as a tool to assess the health impacts of urban projects, programs and policies. The use of the HIA is supported at national level because it is considered a useful tool to reduce health inequalities through the awareness of the political decision-makers on the different provision of health-related services among the citizens. Specifically, Belfast City Council has endowed the city of Belfast City Masterplan in 2004 with the aim of starting a process of urban regeneration; the master plan was updated in 2011, according to the principle of improving the life and well-being of all citizens. Planning ACT 2011 is the main regulatory reference for planning in Northern Ireland. This

[33] The RHUE Thematic Group guides works on the Regeneration and Healthy Urban Environments (RHUE) theme focuses on how planning, transport and regeneration affect Belfast people's lives and health, and how this forms disadvantage and inequalities. The work program focuses on capacity building and innovative demonstration projects. Each project aims to show how people are able to effectively contribute to health and equity, while supporting the environment and the economy. The group is coordinated and facilitated by the Belfast Healthy Cities, who have responsibility for leading work on this theme, delivering of the Healthy Urban Environments program on behalf of Belfast as a World Health Organization (WHO) Healthy City, reporting to WHO Europe through the Belfast Healthy Cities' Board of Directors.

has given new responsibilities and greater powers to local administrations, including taking on the role of key decision makers in terms of city planning and development with the preparation of the Local Development Plan. The significant change in terms of governance has prompted the public administration to equip itself and organize itself to assume the new role of greater responsibility in terms of development of the city, shared with the citizens. The Planning act contains actions to be taken to promote sustainable development and the improvement of health and well-being of citizens, explicitly seeking to establish a relationship between urban planning and health. The Strategic Planning Policy Statement (SPPS) for Northern Ireland) pursues sustainable development according to the principles of improvement of health and wellbeing preserving and enhancing the built and natural environment through good design and places suitable for the citizen. The key principle is the improvement of health according to the determinants of health outlined by the WHO, the objectives are: to safeguard and facilitate the quality of open space for sport and recreational activities, to provide safe and protected age-friendly environments, to facilitate connections between communities through safe walking paths, integration between land use planning and transport, supporting the distribution of housing to meet housing needs, contributing to the balance of communities, encouraging the supply of jobs, services and economic growth, supporting government policies aimed at tackling obesity and the impacts of pollution on health and well-being. The involvement of the population in the planning processes takes place through the regulated permanent consultation in the Statement of Community Involvement and on the basis of Community Planning paths that apply to all the planning and planning tools of the city. Indeed, the municipal administration is operating on the territory through actions shared with the community by preparing new tools such as Local Development Plan, which defines the vision until 2030 and among the actions includes the preparation of the Belfast Agenda and the establishment of the Community Planning, a system of permanent consultation of the community to define the Belfast Agenda. The Community Planning process requires the Belfast Council to listen to the community's point of view about the strengthening of public transport infrastructure, greater support for the economy and employment, reduction of social and health inequalities, improvement of the relationship between the city and the surrounding environment, greater individual fulfillment and emancipation. Belfast activated participatory leadership and governance processes, capacity building, training and direct access to WHO experiences, research and publications, innovative projects (pilot projects), influence policies. In terms of actions, all this translates into promoting the concept of health equity in all policies, resilient communities and healthy urban environments, places suitable for children and the elderly, health literacy and capacity building for public health. Citizens' accountability is a fundamental aspect and is pursued through civic actions and constant commitment / dialogue with the community in order to make citizens aware of the choices related to their health. As an example of community-based program is the Connswater Community Greenway (2005, east Belfast) which purpose was to improve the health and well-being of citizens, the cohesion of the community and the urban environment. It is a linear park with services, cycle paths and recreational activities that connects open and green spaces along the Connswater River which represents a catalyst for the physical-economic development of the city. At the basis of the project actions there is a strategy of sharing ideas with the community that flows into the pursuit of the following objectives: to make the community healthier and more active; guarantee security; offer a better quality of life; regenerate through investments for employment and tourism; improve the urban environment.

Bristol (UK)

The UK National Planning Policy Framework (NPPF) promoted the improvement of health and wellbeing in local planning strategies able to meet the needs of the community. The transfer of more responsibilities to the municipalities has been supported by the central government with Localism Act. The national legislation aims to encourage the direct participation of citizens in planning processes, and it introduces the concept of district planning, or Neighborhood Development Plan with a focus on health and wellbeing through local policies intervening on urban design quality, green

infrastructure, transport and accessibility, sustainable housing, and pollution. Furthermore, the Bristol City Council has entered into a protocol of collaboration with National Health Service for the inclusion of health principles in city planning tools, since prevention is as important as healthcare. The partnership aims to the following objectives: architectural quality of housing, public space livability, accessibility and density, green areas. HIA plays a fundamental role for urban project aiming to health and wellbeing in UK as it mandatory for significant urban transformation, , and it is required for residential interventions of 100 or more units and for residential projects of 10,000 square meters. As for the Belfast case, the community participation is regulated through the Statement of Community Involvement, which guarantees the minimum standard of community involvement in design choices, in particular at the neighborhood level is supported by a network called Neighborhood Planning Network, namely, a network of community volunteers who want to be involved in the city planning system for increasing the effectiveness of community groups to engage in the planning system for sharing skills, know-how and experiences. In 2008, the Bristol parks and green space strategy was adopted outlining investments for green spaces within the city to be implemented over 20 years following quantitative and qualitative standards.

Hamburg (Germany)

Hamburg through the regeneration of the HafenCity district has been pursued the aim of uniformly green areas, decentralizing the functions and distributing them through a network of different paths that offers a varied choice of activities and interactions with the aim of creating an environment in able to increase the state of mental and physical well-being of people.

Green Health Project (Scotland)

The James Hutton Institute[34] (2014) outlines the findings from the Scottish Government's Green Health project, which explores the relationship between urban green space and health using different investigation methods at different scales (individual, community and population). Findings show that urban green and open spaces contribute widely to public health and wellbeing by promoting physical activity and reducing health inequalities while also promoting mental and social health. In synthesis, the Green Health project aimed to:

- Investigate the associations between people's perceptions of their health and wellbeing and their surroundings, using different spatial measures, and other indicators of access to green space within these surroundings;
- Investigate for quantitative factors associated with people's local environment and their health and wellbeing;
- Describe how research findings could relate to urban policies on planning and managing the environment to promote health and wellbeing.

The Green Health Project was guided by the following research questions: (1) Are the optimal policies and policy priorities in place to ensure that investment in the environment enhances people's health and wellbeing? (2) Can investments in the environment be targeted better to enhance public health and wellbeing? Key findings from the Green Health project suggest that there is evidence that access to, and use of, green space is favorably associated with risk of mortality and risk of poor mental health for some people. Also, evidence was found of a link between green space quantity and both perceived stress and mental wellbeing. In addition, evidence was found that more urban green space is favorably associated with lower levels of self-reported stress and reduced physiological stress, as indicated by diurnal salivary cortisol patterns in a sample of middle-aged men and women not in work. Furthermore, findings show that green spaces have different meanings for different people.

[34] The James Hutton Institute combines strengths in crops, soils and land use and environmental research, and makes a major contribution to the understanding of key global issues, such as food, energy and environmental security, and developing and promoting effective technological and management solutions to these.

Hence, there is not a simple cause-effect relationship between green space engagement and wellbeing. Moreover, findings show the importance of the multiple services provided by green spaces, such as places for relaxation and escape, and desires to improve the quality and range of benefits. Finally, findings illustrate the potential geographic significance of the inclusion of measures of visibility of green spaces together with the distance to green spaces from residential properties. The protective relationship between regular use of green space and risk of poor mental health is an important finding. Although this kind of study cannot prove that green space per se protects mental health, it does echo findings from small scale laboratory and field experiments, providing more confidence in our results. The Green Health project has potential implications for those involved in green space management and planning, thus, policy makers, planners and green space managers should ensure that communities have access to a range of different kinds of green space, to allow all to use it to enhance their wellbeing.

Network Città Sane (Italy)

The Healthy Cities Network encompasses the "Città Sane Network" which was established in 1995 as a movement of Italian municipalities, and in 2001 it turned to be a non-profit association including more than 70 Italian cities such as Bologna, Torino, Milano, Udine, etcetera. The objectives of Città Sane Network are the following: promotion of public health awareness; development of local health policies; development of health prevention programs aimed at individuals and community's health. The network aims to improve quality of life and public health. In July 2006, the "Manifesto per la Salute nelle Città" was presented in Rome by the Health City Think Tank, a group of experts belonging to different institutions aiming to support local authorities guidelines for a better understanding of the urban determinants of health and wellbeing and the development of urban strategies to improve public health of urban communities through the development of local policies for environmental sustainable urban transit and the promotion of healthy habits; promote an healthy lifestyles in the workplace; improve accessibility to sports practices by all citizens; monitoring the determinants of health at an urban level promoting partnership among local municipalities, universities, research centers, hospitals, and professionals. The activities promoted within the Città Sane Network are developed and implemented in partnership with healthcare companies, public administrations, universities, schools, trade associations and the third sector, the productive and economic realities interested in the theme of health promotion. This cross-sectorial network is conducive for bonding stakeholders in different sectors of the public administration that usually do not dialogue. Networking means promoting the transfer of design know-how through education, learning, innovation in health promotion and replicable and transferable best-practices. Some successful experiences of the Network Città Sane Network are the following:

- Udine: the project "Age-Friendly Cities" relies on a cognitive survey on the needs of elderly citizens within the population regarding the livability and accessibility of urban spaces in order to outline interventions to make the city more livable for the disadvantaged groups within the population;
- Torino: in order to pursuing the WHO objectives, the city developed and implemented projects for improving urban public spaces, sustainable mobility and social inclusion. Among these projects, we find "Piazza Risorgimento" as the first smart square in Italy and also the "biciplan project" for enhancing cycle paths;
- Bologna developed a community-led city planning framework aiming to public health and relying on partnerships between the public sector, private sector and civil society. Among the project implemented in Bologna, we find the Sustainable Energy Action Plan, the Local Adaptation Plan, the Blue-App European project, these are urban planning tools that deal with urban quality for enhancing community health, moreover, it is important to highlight the Bologna Urban Innovation Plan where the role assigned to the neighborhood-based tool for local stakeholders to co-planning and co-managing public spaces.

2.2.8. Neighbourhood as a determinant of health and wellbeing

Health is about residential location (Duncan and Kawachi, 2018; Kivimäki et al., 2018), and residential location can be embedded in the concept of neighbourhood (Kennett & Forrest, 2003; Blockland, 2003), specifically in countries where modern urban planning shaped urban forms (Platt, 2014). The WHO (WHO, 2008) affirm that public health is affected by socioeconomic and spatial conditions in which people are born, grow, learn, work and age.

Residential location affects individual's and community's health and wellbeing as place and location determine the quality of the services, retail stores, schools, jobs, transport, and other factors such as noise, crime air quality, social interaction and all other dimensions that are crucial for human being (Duncan and Kawachi, 2018). Residential location, namely neighbourhood, represents one of the main contexts in which people spend a major part of their lives (Duncan and Kawachi, 2018). Individuals' residential location determine the quality of schools they attend, access to services they use, retail store where they buy food and other commodities, jobs, transport modes available, exposure to crime, pollution, noise, and other environmental characteristics (Duncan and Kawachi, 2018). Macintyre at al. (2002) sustain that there exist five neighbourhood features that affect health including physical features (air and water quality, climate, etc…); healthy residential, working and play environments (quality of housing, non-hazardous employment, safe areas for playing, etc…); services availability (education, transport modes, clean street, policing, welfare, etc…); socio-cultural features (political, economic, ethnic, and religious traditions of the community within the neighbourhoods); finally, the reputation of an area (degree of attractiveness for investors and people that want to move in, or out, the area). Thus, it is clear that individual's residential location influences their health, leading to variations between people who lives in thriving neighbourhoods and who live in poor and deprived ones. Specifically, in Italy, the Istituto Nazionale di Urbanistica (INU) is emphasizing the importance of urbanization for health looking at urban determinants of health and health inequalities such spatial and functional organization of the urban settlement, design features of the built environment, presence of public and green spaces, and the quality of the natural environment around and within cities.

2.3. Urbanization and Health Inequalities

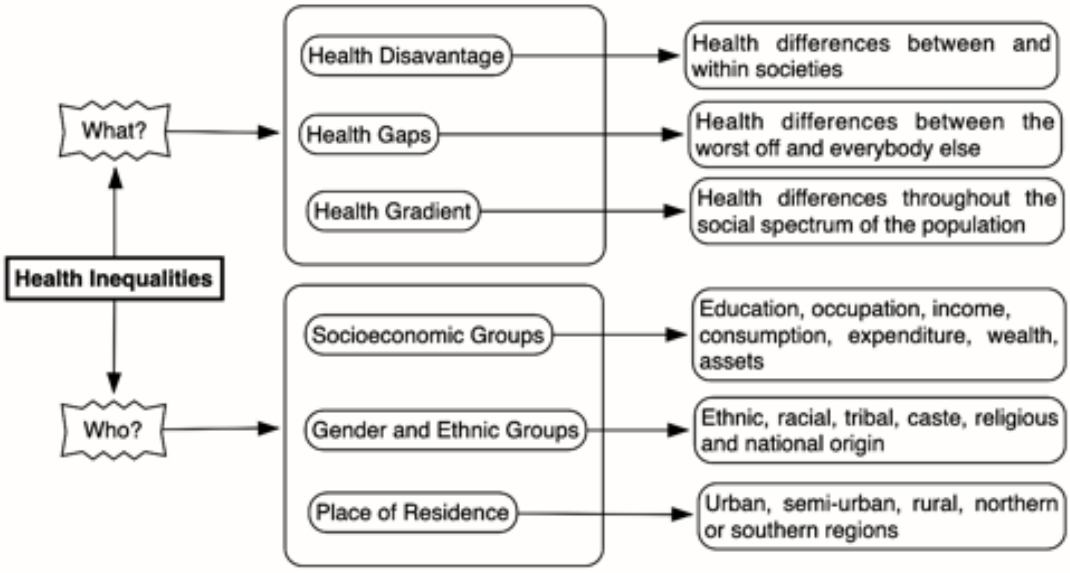
Since the beginning of the 21st Century a worrying phenomenon of health inequalities have been growing worldwide affecting health status of communities within countries from a national to a local level (Wilkinson, 1997; Marmot & Wilkinson, 1999; Kawachi et al., 1999, 2002; Whitehead, Dalgren, and Gilson, 2001; Graham, 2004a, 2004b, 2005; 2009; Mackenbach, 2005; Irwin & Scali, 2010; Costa et al., 2014; Marmot, 2016; WHO, 2018; OECD, 2017; Duncan and Kawachi, 2018). Such disparities in health refer to the avoidable variations in attainable health between individuals or socioeconomic groups (Wilkinson & Marmot, 2003; Kawachi et al., 2002; Bonnefoy et al., 2007; Murtin et al., 2017; WHO, 2018a, 2018d), and they are due to the unequal distribution of the social, economic and spatial determinants of health across the population (Mohan, 1987; Frumkin, Lawrence and Jackson, 2004; Mahoney et al., 2004; Dahlgren & Whitehead, 2006; Bonnefoy et al., 2007; CDC, 2011; Costa et al., 2014; WHO, 2017).

Urbanization exerts a primary role on the distribution of the determinants of health (Harpham & Stephens, 1991; Graham & Kelly, 2004; Graham, 2009; Kickbusch & Gleicher, 2013; Bravemann & Gottlieb, 2014; De Leeuw & Simos; 2017; National Academies of Sciences, Engineering and Medicine, 2017; WHO, 2018b). The relationship between urbanizations and health inequalities seems to apply from a macro scale to a local level such as at the neighbourhood scale (Smith, 1974, 1975, 1977; Macintyre et al., 2002; Graham & Kelly, 2004; Bernard et al., 2007; O'Campo et al., 2014; Duncan and Kawachi, 2018; Kivimäki et al., 2018), namely, in residential areas where people spend most of their lives (National Research Council, 1981; Dannenberg et al., 2011).

2.3.1. Concept and dynamics of a growing phenomenon

According to Kawachi et al. (2002: 647), health inequality is "the generic term used to designate differences, variations, and disparities in the health achievements of individuals and groups." Mahoney et al. (2004) define equity in health as "equal access to services for equal need, equal utilization for equal need and equal quality of care for all, with a focus on health outcomes" (p. 3). Hamer et al. (2006) argue that equity in health encompasses the following dimensions: geography, sex, age, ethnicity. Graham (2009) highlight that health inequalities are due to the differences in the distribution of the social determinants of health such as individual's income and education level, employment, and the quality of housing and the environment where people lives. Specifically, health inequalities strongly associate with variations in health achievement of individuals and groups with different income and educational levels (Kawachi et al, 1999).

Fig. 4: Health inequalities according to Graham (2004a; 2004b, 2005) and Bonnefoy et al. (2007).



Source: Author's elaboration.

Fig. 4 above provides the main dimensions of health inequalities. Graham (2004a; 2004b, 2005) and Graham & Kelly (2004) classified health inequalities into the following three groups: (1) health disadvantage (health differences between and within societies); (2) health gaps (health differences between the worst off and everybody else); (3) health gradient (focusing on the health differences all the throughout the social spectrum of the population). Furthermore, health inequalities are related to health disadvantages intended as the differences between distinct subgroups of the population, or between societies. Bonnefoy et al. (2007) describes these differences, between and within societies, as health equity strata that can be grouped in the following four main types: (1) socioeconomic groups (sub-grouped in education, occupation, income, consumption, expenditure, wealth, assets), (2) gender groups, ethnic groups (sub-grouped in ethnic, racial, tribal, caste, religious and national origin groups, (3) place of residence (sub-grouped in urban, semi-urban, rural, northern or southern regions).

The WHO (2017) highlights that health inequalities are growing worldwide affecting people with lower socioeconomic positions within society. Wilkinson & Marmot (2003, p. 10) affirm that "Life expectancy is shorter [compared to the past] and most diseases are common further down the social ladder in each society." Also, Marmot (2006; 2016) argues the existence of a social gradient in health which affects individuals' life expectancy. Although early descriptions of the issue occurred in the 19th century thanks to the scientific progress in epidemiologic studies (Mackenback, 2015), it was only from the 1990s to date that scientists began developing a better understanding of the social

and economic determinants of the phenomenon (Irwin & Scali, 2010). As emerged in the research of Wilkinson and Marmot (2003), apart from the mere biophysical dimensions, inequalities in health are an outcome of both social and physical determinants, thus, factors as individuals' socioeconomic position and the quality of the place where they live exert a powerful effect on their health.

As a primary concern, the WHO highlights that at least half of the world's population still do not have full coverage of essential health services, while about 100 million people are still being pushed into "extreme poverty" (living on 1.90 USD (1) or less a day) because they have to pay for health care. In addition, over 800 million people (12% of the world's population) spent at least 10% of their household budgets to pay for health care. As a direct response to these issues, all UN Member States have agreed to try to achieve universal health coverage (UHC) by 2030, as part of the Sustainable Development Goals. It is worth notice that health inequalities are growing worldwide, especially in high- income countries. Whitehead, Dalgren, and Gilson (2001) point out that social inequalities in health are spreading worldwide, from North to South, affecting populations across the countries. They sustain that those inequalities are triggered by the changing macroeconomic conditions, which produce an uneven distribution of wealth across the world population, and socioeconomic crises. They support the thesis that health inequities represent the major challenge for public health. According to Hero et al. (20174), the US are characterized by large health inequalities strictly related to individuals' income level. Also, their findings reveal that individuals with different income self-assess differently their health status, namely, individuals with high-income percept a higher level of health status, and vice versa. The European scenario is characterized by health inequalities as well. Indeed, according to OECD (2016), it seems that a substantial share of the low-income European population reports unmet needs for dental and medical care. Moreover, Mackenbach (2005) affirms that health inequalities exist between and within all European countries. Also, he points out that such disparities were found "...between people with higher and lower educational level, occupational class and income level..." (Mackenbach, 2005, p. 4). Still, Costa et al. (2014) outline the existence of a social gradient of health in Europe. Also, they affirm that East Europe is more affected by health inequalities than North and West Europe. Additionally, Costa et al. (2014) affirm that the magnitude of health inequalities through time is affected by the specific *cultural features* of the community. That is, health inequalities influence communities differently according to their cultural background.

Health inequalities exist within and across multiscale geographic locations, from the national to the local level. Mackenback (2005) sustains that health inequalities exist between and within all European countries, pointing out that such disparities were found between "people with higher and low educational, occupational class and income level…" (p. 4). Similarly, the United States is also characterized by large health inequalities related to individual's income level (Hero et al., 2017). Likewise, Costa et al. (2014) outline the existence of a social gradient of health in Europe. They also affirm that East Europe is more affected by health inequalities than North and West Europe. Moreover, the Organisation for Economic Co-operation and Development (OECD, 2016) highlights that a substantial share of the low-income European population reports unmet needs for dental and medical examination for financial reasons.

The Organization for Economic Cooperation and Development (OECD, 2017) sustains that health inequalities exist across population groups and within the 35 OECD countries affecting individuals' life expectancy. Health inequalities associate to differences in exposure to health risk factors and in access to health care. Specifically, the OECD developed a set of five indicators able to capture the health care system performance in the OECD countries, the dimensions being studied are the following: (1) health status; (2) risk factors for health; (3) access to care; (4) quality and outcome of care; (5) health care resources. According to the OECD (2017), health these five dimensions drove the health status within the OECD countries along with factors such as the national demographic,

social and economic context within the specific country. As a major policy objective, policy makers in OECD countries are focusing on the reduction of health inequalities by understanding how well their health systems perform in the above-mentioned dimensions.

Italy as well as other high-income countries seems to be affected by health inequalities, especially at interregional level (Costa et al., 2014). In addition, the OECD (2016) reports that a substantial share of people in Italy reports unmet medical and dentist needs for economic reasons. However, ISTAT (2015: 69) affirms that the country "life expectancy is one of the highest in Europe (EU 28) and longevity continues to increase." Still, according to ISTAT (2015) the quality of life in Italy did not improve, but returned to 2011 levels. Costa et al. (2014) claim that the magnitude of health inequalities through time is affected by the specific cultural features of the community. In this regard, Costa (2014, author's translation, p.14) affirms: "…inequalities in subjective health indicators are evident in favour of the most favoured social categories in all European countries, but their intensity and variation over time are also influenced by cultural factors, and they are therefore less useful in guiding contrary actions." Therefore, in the general equation of health disparities fundamental importance must be attributed to the cultural background of the communities, namely, a specific place-based dimension to consider for designing effective strategies to mitigate health inequalities at the local level.

2.3.2. Socioeconomic determinants of health inequalities

Health inequalities are related to income and social disparities (Marmot & Wilkinson, 1999; Kawachi et al., 1999, 2002). The WHO[35] affirms that "the poorest of the poor, around the world, have the worst health." Wilkinson and Marmot (2003: 10) assert that "Life expectancy is shorter and most diseases are common further down the social ladder in each society." Marmot (2006) describes the existence of a social gradient in health that affects individuals' life expectancy. According to Marmot (2016), there are severe health differences gap between and within countries all around the world, he describes the phenomenon as the health gradient. Bonnefoy et al. (2007) argue about the differences between linking social determinants to health outcomes, and explaining how the social determinants' causal pathway works affecting individuals' biological sphere. In other words, the richest and better educated individuals presents higher level of health compared to whom lies down on the socioeconomic scale, in addition, the higher individuals are in the social hierarchy the better their health and the longer they will live.

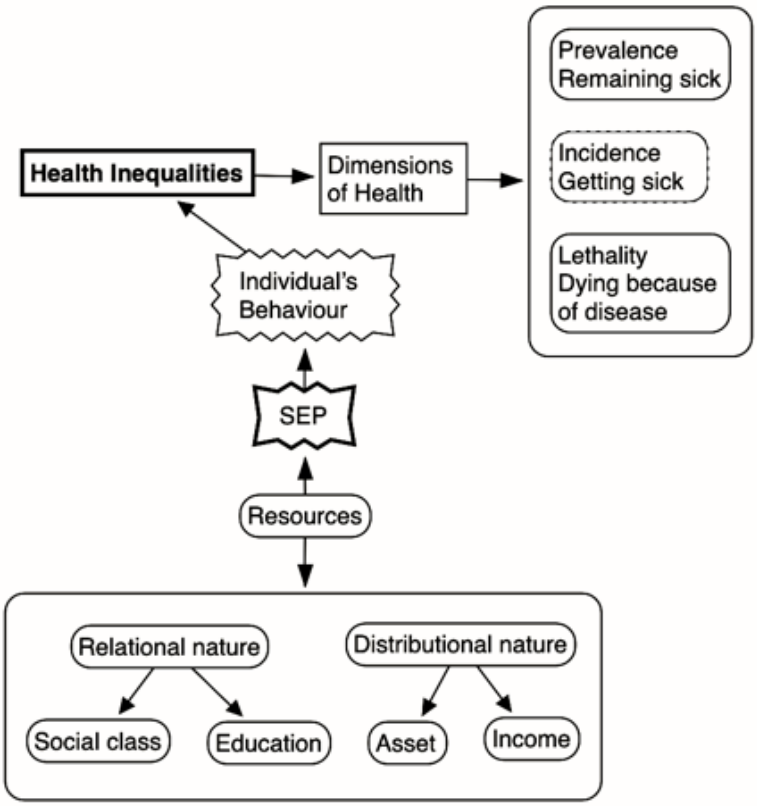
The World Health Organization (2018d) describes health inequities as "avoidable inequalities in health between groups of people within countries and between countries" (2018: 1). The WHO sustains that such inequities arise from socioeconomic inequalities within and between society, these inequalities affect individuals' lives and their exposure to rick of illness. For instance, the WHO points out that infant mortality rate is 2 per 1000 in Iceland, and over 120 per 1000 in Mozambique, or the prevalence of long-term disabilities among European men aged 80+ is 58.8% among the lower educated, while 40.2% among the more educated. Furthermore, the WHO affirms that, in low, middle, and high-income countries, there is a "social gradient in health that runs from top to bottom of the socioeconomic spectrum" (2018: 1).

Bonnefoy et al. (2007) affirm that to understand health inequalities we need to focus on the social determinants of health. Costa et al. (2014) affirm that the socioeconomic determinants of health are mostly due to the individual SEO which contribute to intensify, or decrease, the prevalence of remaining sick, the incidence of getting sick, and the lethality of the disease, namely, dying because of the disease. Costa et al. (2014) that individual's SEP is about availability of resources (Fig. 5) both of *relational* and a *distributional* nature; the extent of these two components affects individuals' behaviours contributing to intensify, or decrease, the prevalence of remaining sick, the incidence of

[35] http://www.who.int/social_determinants/final_report/key_concepts_en.pdf?ua=1

getting sick, and the lethality of the disease, namely, dying because of the disease. Marshall et al. (2015) affirms that the latest findings on the relation between socioeconomic status and health point out that low-income and middle-income countries are more likely to be affected by stroke, the same happens also in socioeconomically deprived populations within high-income countries like Danmark (Andersen et al., 2014). Thus, from low- to high-income societies, the effect of socioeconomic status for health is a crucial factor to investigate. Bonnefoy et al. (2007) outline that individuals' specific conditions and circumstances, and the social real in which they are rooted in which they live affect the individuals' biological sphere. Some of the social determinants of health are the following: poverty, hunger, occupation, socioeconomic effect of aging, gender, ethnicity, housing, self-efficacy through their disposable income (or as Costa et al. (2014) define "relational asset"), diet, food, physical activity, social mobility, education, marital and socioeconomic status. Also, it is worth notice that the determinants of good health are not necessarily the same determinants of health inequalities. Bonnefay et al. (2007) stress this fundamental concept providing an example of this differences, arguing that a general health improvement, if not equally distributed, does not address the issue of the social disadvantage, thus, an improvement for all means that health inequalities remain.

Fig. 5. The effect of SEP on health according to Costa et al. (2014).



Source: Author's elaboration.

Individual's socioeconomic position, or SEP, affects individuals' physical and mental health. The SEP refers to the social and economic factors that affect individuals position in society, or within a community (Krieger at al., 1997). It is a complex construct that is the product of individuals' livelihood circumstances such as childhood, young adulthood, active professional life, and retirement (Galobardes et al., 2006). Individuals vary in health as they do in every other characteristic such as education, occupation, and income; three indicators of SEP. In the last decades, the relationship between SEP[36] and health had been emphasized (Mackenbach, 2015; Nordahl, 2014) due to the self-evident role played from SEP in the contemporary capitalistic society.

[36] In the XX Century, the concept of SEP come to existence thanks to the theories of Marx (Bartley, 2004); specifically, Marx (1867) depict SEP as a matter of social class where individuals belong to different groups -or classes- of a stratified society, these groups are

2.3.3. Spatial determinants of health inequalities

Health differences are triggered by the specific social, economic, and physical contextual conditions where individuals live (WHO, 2018b). An emerging body of research is evaluating the connection between the built environment and health. The built environment is linked with air pollution, diet, social interactions, social capital, and health disparities (James et al., 2013). The built environment often dictates travel patterns, which in turn determine exposure to air pollutants, levels of physical activity, diet, and degree of social interaction (James et al, 2013). The health effects of the built environment are often disproportionately distributed, as planning and zoning decisions often segregate communities according to socioeconomic status, and establish uneven disease burdens across populations (James et al, 2013). Understanding what and how these conditions affect health is a first step in order to address health equity. Indeed, other than socioeconomic, Frumking et al. (2004: 2) affirm that health inequalities encompass a spatial component as "land use and transportation interact to affect many aspects of human activities, their well-being and health." In the past, spatial health inequality was investigated as a lack of equitable distributed provision of health-care services. Early concerns about the connection existing between the public health and the built environment occurred during the industrial revolution when unhygienic and overcrowded conditions were conducive to the spread of disease (Perdue et al., 2003). Today, De Leeuw & Simos (2017) point out that the built environment still play a crucial role for triggering health inequalities. Jackson (2003) highlights that specific characteristics of the built environment such as transportation pattern and land-use affect individual's health. According to Centre of Disease Control and Prevention (CDC, 2011), the built environment encompasses all the physical components of the places where we live, work and socialize, and it effects both the individuals' physical and mental health. Finally, it is noteworthy that land-use and local legislation interact with each other, shaping the built environment (Platt, 2014). Early in 1987, Mohan (1987) argue about the threat of spatial inequality in health-care in England in term of service provision. Specifically, inequality in the geographical distribution of health care resources. Also, already at that time, to tackle such inequalities, Mohan (1987) advocates for more integration in the policy analysis of all the individual elements of the health care system, namely, acute and primary, and public and private health-care.

The built environment represents a strong spatial determinant of health, it is a multiscale concept, meaning that it can be described at different geographical level, from a national to local level, or neighbourhood (Lovasi et al., 2012). Gullon and Lovasi (2018) point out that in the U.S. the concept of neighbourhood reflects the census track, namely, a specific area often bounded by arterial streets and characterized by a certain number of individuals living within the area. Additionally, they sustain that the most relevant scale for measuring the built environment depends on the surrounding context and on the possibility for people to reach these surroundings by car or foot. Furthermore, they underline that concept of neighbourhood is dynamic, in the sense that often the neighbourhood can expand in a certain direction offering new services and opportunity for the local community.

Bonnefoy et al. (2007) affirm that, to address the social disadvantages in health, it is crucial to define the social, economic and geographical dimension of the specific society. They outline that the key axes for identifying social differences in a specific population are "social class, education, occupation, income, assets, gender, race, caste, tribes, religion, national origins, age, and residence" (p 17). However, although their link to health is widely accepted, since their entrenched nature due the manifold interaction among (thus, the difficulties in measuring them), age, gender, religion, race, ethnicity, and place of residence seems to be the less empirically studied variable for health inequalities (Graham & Kelly, 2004).

related each other's with the final aim of the development of human capital and capitalistic production. Building on Marxist theories, expands this definition arguing that those groups (classes) aim to a common market position leading to their "life chance." Therefore, it is clear that SEP is about differences and variations between groups within society.

The Centre of Disease Control and Prevention (2011) highlights that the built environment affects mental and physical health. In Italy, the effect of the built environment on health was studied by Melis et al. (2015) whom emphasize the correlation between the characteristics of the urban structure and the consumption of antidepressants, their finding *accessibility* to public transport and dense urban structure could contribute to reduced risk of depression -especially for women and elderly- by increasing opportunities to move around and have an active social life. Similarly, Gelormino et al. (2015) propose a framework to relate key features of the built environment (density, functional mix, public spaces and services) to individuals' health. These key features affect the natural and social environment within the neighbourhood, thus, affecting people health-related behaviours that are associated to diabetes, coronary vascular disease, and asthma (Perdue et al., 2003). Furthermore, they sustain that the intensity of such built environment effect is unequally distributed across the socioeconomic position of individuals.

The built environment is part of the public health equation, and, often, it debated its effect for public health as if enhanced it can be a driver for public health to thrive. The built environment is the product (output) of the urban planning processes which shape its form, function and structure (Platt, 2014), producing a modifiable setting where human being lives, work and socialize. Through the selection of specific land use, transport pattern, and design features, urban planning processes shape the built environment, thus, the man-made landscape (Platt, 2014). Also, the presentation of deleterious genetic traits can be triggered by the social and built environments (Bravemann and Gottlieb, 2014). Thus, for a comprehensive understanding of the dimensions of the phenomenon, besides social and economic determinants, it is fundamental to cast light on the spatial determinant of health inequalities.

Lavin et al. (2006) provide a review on the relationship between built environment and health. Their findings point out that the effect of the built environment on health is huge, both at a macro than a local level. At macro level, they sustain that spatial planning, mixed land-use and transportation infrastructures play a crucial role for individuals health. While at the local level, the affirm that the specific urban design, maintenance and availability (in term of accessibility) of the built environment affect mental, physical and social health. In particular, they point out that the street network design, accessibility (and availability) of public and green spaces, the safety level of a certain area, coupled with individuals' mental traits, affect individual's health. Lavin et al. (2006) emphasize that individuals living in poor quality-built environments (as a deprived neighbourhood) have lower level of mental and physical health. Conversely, people living in vibrant and well-maintained built environment, with availability of public and green space, have higher health levels. These evidences support the existence of a spatial determinant of health inequalities.

2.3.4. Policies for tackling health inequalities

Whitehead, Dalgren, and Gilson (2001) sustain that the process of building proper policies to tackle health inequalities encompasses several steps such as establishing values on which the policy interventions rely (in this case health as a core value of the policy, even if it is a social, economic or environmental policy), identify, describe and analyze the causes of health inequalities (meaning that the health gap, or divide, between different group of the population should be understood through the analysis of the related causal pathways), addressing the root of such inequalities (meaning that the policymakers should identify the key points leading the potential actions to undertake), and, finally, acting on the root of inequalities reducing the negative health outcome for vulnerable segments of the population (this final point aim to build equitable health care systems, bringing down financial, geographical, and cultural barrier to access health care system). In an attempt to shade light on the relationship between health and the built environment, Berrigan and McKinno (2008) advocate for interdisciplinary collaboration among the fields of public health, economic, planning and policy sectors and for the development of an experimental tradition in this literature.

The WHO (2018d) advocate for health equity in all policies, affirming that policy coherence among many fields of actions (housing, education, employment, transport, food system, health-care, finance, et…) should be a priority issue. Dahlgren & Whitehead (2006) affirm that, to tackle social inequalities in health, more multisectoral policies are needed in field such as education, working environment (unemployment and working conditions), social, economic and physical access to healthcare, and social and community inclusion policies. Beside these field-oriented policies, they sustain that there is a general need for policymaker to tackle tobacco and alcohol consumption, and raise population awareness towards the potential positive benefits of physical activity for health. Furthermore, Dahlgren & Whitehead (2006) affirm that "there is a significant gap between policy statements to reduce social inequalities in health and the actions needed to reach this objective" (p. 102). This gap is due to many causes such as lack of political will, health-related knowledge, financial resources, coordination and management capacity, and lack of policy audit and evaluations. Furthermore, they sustain that, at a national level, the aim of health policies should be that to level up the health of worst off in society, rather than level down the health levels of whom is better off.

The Prevention Institute of Oakland (2003) developed the THRIVE framework, namely, a Tool for Health & Resilience in Vulnerable Environments. This tool was developed with the aim to enhance community health and safety levels, promoting health equity. THRIVE encompasses three interrelated clusters (or environments) such as people (social-cultural environment), place (physical environment), and equitable opportunities (Economic and educational environment). Each cluster includes crucial factors that affect community health. For instance, the people cluster (1) include social networks and trust, participation and willingness to act for the community good, norm and culture; the place cluster (2) includes what's sold in the community (store and services) and how it is promoted, aesthetics and safety, parks and open spaces, getting around, housing, air, water, and soil, arts and cultural expression; finally, the equitable opportunity cluster (3) encompasses education, living wages and local wealth. All these factors are intended as structural drivers for community health, and the quantity and quality of each one contribute to measure illness, injury, and inequity at community level.

Boneffey et al. (2007) point out that policy aiming to tackle health inequalities need to be developed under the guide of eight principle that provide a framework for the decision-maker to be more effective. These principles are the following: (1) a commitment to the value of equity, (2) evidence-based approach (here the challenge of the social lens in studying health is crucial), (3) methodological diversity (tailor-based approach for the specific targeted population), (4) gradients and gaps (health disadvantage, health gaps, and health gradients), (5) determinants and outcome (identify the causal pathway to link and explain how the social determinants affect health), (6 and 7) social structure and social dynamics (meaning find the social theory that fits more with the population being studied, in this way, the researcher, or policy-maker, can establish how the social determinants of health operate in a specific social context), finally, (8) explicating bias (as social theories are socially constructed, they can be subjected to bias, thus, the role of the policy-maker is to identify if (and then how) there are any political construct that influence the developed policy).

Grant & Braubach (2010) sustain that an integrated approach between urban planning and health outcome can bring significant economic savings for health care services. They also affirm that more collaboration among public health planner, environmentalists, and architectural planners is needed to be more preventive than reactive to urban health issues. Indeed, the actual public health model is focused on reactive actions, rather than prevention. A shift from reaction measures to prevention measures would mean a significant decrease in the long-term human and economic cost due to the reduction of the burden of disease to tackle in the future.

Grant & Braubach (2010) provide a list of recommendations for the European Commission and the WHO. Specifically for the European Commission, they ask for more communication and collaboration of public authorities from an European to local level, integration of health aspects in urban planning education, further development and integration Environmental and Health Impact Assessment in urban planning, develop a model to consider the urban environment as a setting rather than the sum of many single elements, more economic support (grant and funds) for local authorities to develop and implement health-related urban planning interventions. Instead, for the World Health Organization, Grant & Braubach (2010) ask for more involvement of non-health sector professionals (architects, urban planners) for planning more effective interventions, provide a sound list of health impacts produced by specific urban features, thus, allowing urban planners to effectively planning for health.

Millew at al. (2011) point out that individuals' and communities' exposure to the physical, social, and economic environments, in which they live, affect their health, contributing to trigger health disparities among and within communities. Millew et al (2011) emphasize that policies aiming to reduce health inequalities should be the outcome of intersectoral strategies between private entities, not-for-profit organizations, and public agencies (housing, transportation, recreation, community development, planning agencies). Berrigan & McKinno (2008) emphasize that public health research should undertake a more holistic approach. They point out that more interdisciplinary collaboration (among health, economy, urban planning, and policy sector) is needed for the advancements of the knowledges about the relationship between health and built environment.

2.3.5. Neighbourhood as a determinant of health inequalities

The concept that neighbourhood features affect public health and wellbeing is a well know conception (Duncan and Kawachi, 2018; Kivimäki et al., 2018). Among the multiplicity of levels and contexts that affect health, many researches point out that the neighbourhood, or the "place[37]" where individuals live, is the very first example of context affecting individuals' levels of health (Duncan and Kawachi, 2018). The neighbourhood is a recurrent unit of analysis of most contemporary studies focus on health as it represents the location where human beings spend most of their lives (National Research Council, 2001; Dannenberg et al., 2011).

Nowadays, many research designs have been applied to cast light on the neighbourhood effects on health and health inequalities across population. Among these, upstream and multilevel causation studies are the most relevant, and experimental and quasi-experimental studies are fuelling a growing body of literature in the public health field (Duncan and Kawachi, 2018), often these studies rely on very sophisticated theoretical and methodological framework in order to capture the complex health-related dynamics occurring in the neighbourhood. Also, it is at the neighbourhood level that we can observe large socioeconomic inequalities due to the compositional structure of the residents within (Smith, 1974, 1975, 1977; Macintyre et al., 2002; Graham & Kelly, 2004; Bernard et al., 2007; O'Campo et al., 2014; Duncan and Kawachi, 2018). Specifically, as emerged in unique longitudinal study, it seems that neighbourhood socioeconomic disadvantage is associated with increased cardiometabolic risk factor and increased incidence of diabetes (Kivimäki et al., 2018).

2.4. A Modelling Approach for Investigating Neighbourhood Effect on Health

Frameworks and indexes conceptualizing how the neighbourhood affects health and wellbeing vary across scale and scope (Pineo, 2018), and they have different emphases according to the specific theoretical lens with which research look at this phenomenon. Mostly, these frameworks vary because

[37] According to English Oxford Living Dictionary, "place" is defined as a particular position, point, or area in space; a location. Retrieved at https://en.oxforddictionaries.com/definition/place, accessed on 26 June 2018.

of the internal elements composing the framework and, mostly, for the specific mechanism (or pathways) being studied from the researcher (Gullon & Lovasi, 2018).

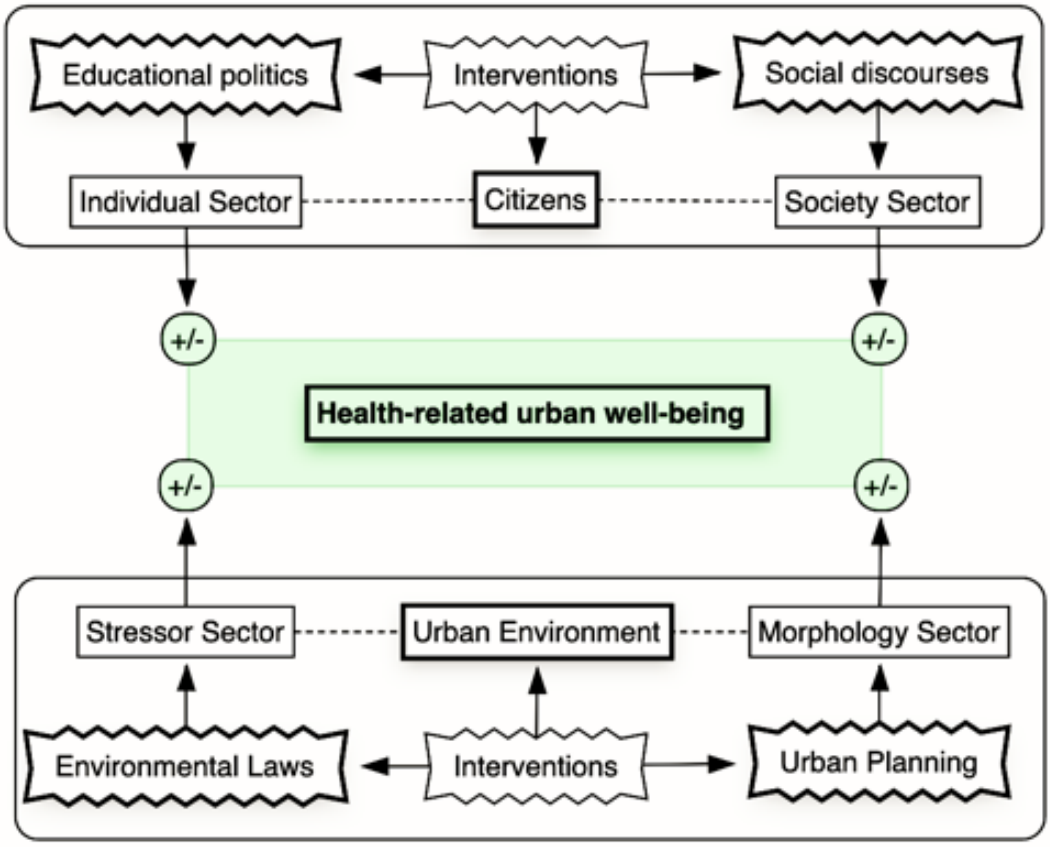
Hancock (1985) put forward the Mandala of Health, namely, a bio-psycho-socio-environmental model of health that lies at the intersection of natural and social sciences, the individual, the family, the community and society in a holistic ecosystem. The Mandala of Health is intended to provide a broad perspective to shift the emphasis of health on the characteristic of the community, and place, rather than on the illness or disease. To begin with, the individual plays a central role in the ecosystem. Here, we can talk about human biology referring to the specific individual's characteristics such as genetic traits, predisposition to diseases, the physiological and anatomical state of the individual and his/her family. Secondly, there are the individuals' personal behaviours such as dietary habits, smoking, drinking, driving habits, risk taking and preventive behaviours. Thirdly, we find the psycho-social environment that refers to the individual', and his/her family, socioeconomic status, the contextual factors of the community where he lives, and his exposure to the society pressure and norms. Finally, as the fourth major factors, we find the physical environment, namely, the conditions of the built environment where individuals live; this category encompasses factors such as housing, workplace, neighbourhood, etc. These four dimensions, all together, affects individual's lifestyle that here is intended differently from a mere personal behaviour. Indeed, individual's lifestyle is the result of the influence of the four-dimension descripted above. Another dimension of the model is the medical care system accessed by the individual, it can be good or bad accordingly to the place where he lives. These dimensions exist in the community that can be, therefore, described as the sum of such factors (dimensions). As a corollary to the community we find the human-made or human modified environment including urban setting, energy consumption, transportation, agriculture and other man-made systems that affect individual's health. Furthermore, when talking about community, it is important to understand the cultural setting in which the specific community is entrenched, and shaped, for instance, western, technologic, science based, Judei-Christian or Islamic culture, and so on. These different cultural landscapes, affect both individuals' health and the way the individuals perceived their health. Thus, cultural values, attitudes and beliefs are factors that shape public health. Hancock (1985) proposes the Mandala of Health as a powerful tool to identify and tackle public health issue. For instance, taking the community as a health determinant, it emerges the importance to identify community characteristics (as descripted above) to guide public health interventions able to change (hopefully in a positive way), individuals' health level.

Whitehead & Dahlgren (1991) developed the rainbow model of the determinants of health inequalities, this is a powerful and effective illustration linking socioeconomic, cultural, and environmental factors to individuals' health levels. Specifically, the Dahlgren-Whitehead rainbow model encompasses several spheres that maps the connections between the individuals and the environment, intended as a broad social, economic, cultural, and environmental context) in which they live. To begin with, the rainbow model places as its core sphere individuals' characteristics such as age, sex, and genetic factors. Then, at the second sphere, we find individuals lifestyles factors (habits and health-related behaviours). Thirdly, we find social and community networks. Furthermore, the fourth sphere represents individuals living and working conditions, including food habits, educational level, occupation, quality of the work environment, water and sanitation, quality of housing and health-care services. Finally, the fifth sphere represent the macro conditions of the socio-economic, cultural, and environmental context in which individuals live. The Dahlgreen-Whitehead rainbow model is a solid framework on which researchers can built hypotheses to investigate the relationships among the different determinants of health.

Barton & Grant (2006) developed the health map as a result of their research studies as spatial planners' advice the WHO healthy Cities movement (Barton, Grant, and Guise, 2003; Barton, 2005).

Building on the theories of Whitehead & Dahlgren (1991) (that capture the relationship between health and social, economic, and physical environment), and the principles of sustainable development and eco-system, Barton & Grant (2006) provide a theoretical framework for investigating the relationships among the many determinants that affect health. The framework is based on a holistic view of health encompassing different science fields such as urban planning, public health, engineering, environmentalism, community and economic development, etc… As the Dahlgren-Whitehead rainbow model (which is descripted above), the Barton & Grant (2006) health map consists in many spheres, interrelated with each other; the model place at its core center individuals' unmodifiable characteristics such as age, sex and genetic factors.

Fig. 6: Modelling approach and interventions according to Von Szombathely et al. (2017).



Source: Author's elaboration of Krefis et al. (2018)

According to Von Szombathely et al. (2017, abstract), globalizations, demographic, environmental and climate changes affect the worldwide communities' wellbeing, bringing new forms of social organizations and lifestyles. These changes affect community's lifestyle which in turn affect community's vulnerability to health-related risk factors. Von Szombathely et al. (2017) sustain that urban social well-being is shaped by forces such as globalization, demographic and climate change, new forms of social organization, and the fragmentation of lifestyle, and consequentially, health-related behaviours. Von Szombathely et al. (2017), building on the theories of Hancock (1999), put forward a conceptual model to identify variables that affect urban health and wellbeing (Fig. 6), these are defined as a unified concept such as Urban-Wellth. Their theoretical model provides a powerful scheme to capture the relevant variables affecting health. Building on the concept of UrbanWellth developed by Von Szombathely et al. (2017), Krefis at al. (2018) summarize major studies linking urban environment to health and wellbeing outcome exploring how the four sectors affect health-related urban-wellbeing. Also, they propose a set of macro area of interventions such as interventions by educational politics, social discourses, urban planning, and environmental law.

Fig. 6 above provide a synthesis about the structure and organization of Von Szombathely et al. (2017) model. Specifically, the scheme aims to represent the compositional and contextual dimension of the neighbourhood as a relational system. The modelling approach according to Von Szombathely et al. (2017) -for capturing health-related urban well-being- relies on the following dimensions:

- Individual sector provides a list of the relevant variables from a medical perspective and their effect on public health. These variables are the following: education, income, age, gender, smoking/alcohol, nutrition, clothing mental and physical constitution, habituation, medical disposition. Interventions for the individual sector are related to educational politics.

- Society sector provides a list of the relevant variables from a sociological perspective and their effect on public health. These variables are the following: security, social network, household, supply, work, leisure, mobility lifestyle, modes of transport. Interventions for the society sector are related to social discourse.

- Morphology sector provides a list of the relevant variables from an urban planning perspective and their effect on public health. Variables for the morphology sector are public places, transportation infrastructure green and blue spaces, buildings and built structure, public and health infrastructure, emitters (including means of transport). Interventions for the society sector are related to urban planning.

- Stressor sector, or natural environment provides a list of the relevant variables from an environmental perspective and their effect on public health. Variables for the stressor sector (natural environment) are noise, thermal environment, UV radiation, air pollutants, temperature, humidity, wind, precipitation. Interventions for the society sector are related to environmental laws.

2.5. Factors Influencing Neighbourhood Effect on Health

Macintyre et al. (2002) sustain that there exist three explanations for describing geographical variations in health, namely, contextual, compositional and collective differences. “Compositional” variations refer to predictors of health such as the social and economic features of the individuals living within the neighbourhood, “contextual” variations refer to differences in neighbourhood’s health predictors such as access to services, food stores, jobs, transportation patterns, level of noise, pollution, crime, and other environmental factors, finally, “collective” variations refer to the to the socio-cultural and historical differences of the features of communities.

Recent studies point out that contextual, compositional and collective components of the neighbourhood should be analysed as a whole as they are related categories (Duncan and Kawachi, 2018). Following this logic, contemporary approaches in social and spatial epidemiology are developing complex systems capable to merge contextual, compositional and collective components of the neighbourhood, building conceptual frameworks to better understanding the causal relationships between neighbourhood and health (Duncan and Kawachi, 2018). These conceptual frameworks should consider housing, working, and recreational conditions of the neighbourhood as a whole.

The link between public health and human settlement is complex and often indirect (Barton & Grant, 2006). As all human settlements, the urban environment is a complex and open system shaped by macro social, economic and political forces, meaning that it changes when such forces change magnitude or direction. Structure and form of the neighbourhood-built environment is the product of the broad political, social, and economic context of a specific place (Borrell et al. 2017).

These contextual elements interact with the range of socioeconomic characteristics of the individuals living within that place. These interactions make difficult to objectively link built environment features to health outcome (Gullong and Lovasi, 2018).

The multiple dimensions of the place where individuals live (e.g., the residential neighbourhood) matters as in epidemiologic studies, the triad of "persons, place and time" interact with each other affecting individuals' health (Gullong and Lovasi, 2018). As emphasized in social science researches, the dimensions, and qualities, of the place affects humans' behaviour and thus the social processes within society; examples are child development, educational outcomes, reproductive behaviours, criminality. Duncan and Kawachi (2018) affirm that neighbourhood physical settings, that can be seen as the specific census measures, could affect individuals' levels of health. Neighbourhood composition can be seen as the sum of the physical and social settings occurring in a specific place, or location, where individuals live. The neighbourhood physical settings are an outcome of the transformations occurred in the neighbourhood-built environment[38], While the social settings refer to the social stratification, and the relationships among these strata, within the neighbourhood. Duncan and Kawachi (2018) affirms that greater specificity is needed to understand the complexity of the causal relationship between neighbourhood dimensions and health. Thus, assessing precisely what and how neighbourhood factors affect specific health-related processes and outcomes become crucial for enhancing neighbourhood performances for health.

Neighbourhood transportation mode plays a fundamental role for health. Residential locations with higher level of bike lane are associated with higher levels of walking and bicycling (Titze et al., 2008). Also, the presence of public transportation is associated with walking (Villanueva et al., 2008), thus, encouraging public transport can increase individuals' levels of physical activities. Furthermore, the role of walking or bicycling infrastructures is even more important, if we think that the only presence of parks, or open public spaces, seems to be not (little) correlated with higher levels of physical activities (Witten et al., 2008). Thus, it means that the mere presence of parks, or public spaces, in the built environment is not enough for encouraging people to practice physical activities, if there is absence of public transportation, and good pedestrian and bike connectivity.

2.5.1. Compositional influences on health

Compositional factors influencing health refer to genetic, behavioural, and socioeconomic traits of the residents, and social and community environment. Kivimäki et al. (2018) sustain that living in disadvantaged neighbourhood shape health in childhood and adulthood. According to their study, individuals exposed consistently to high neighbourhood socioeconomic disadvantage from childhood to adulthood had a worse cardiometabolic profile (obesity, hypertension, and fatty liver) and an increased risk of developing diabetes. Through qualitative interviews, self-reported questionnaires about socioeconomic and psychosocial factors, and health, Harding et al. (2015) sustain that ethnic minority adolescents reported better mental health than white British but had higher blood pressure compared to white British. Also, they affirm that high neighbourhood socioeconomic disadvantage was characterised by an unhealthier diet at baseline, lower physical activity, and greater prevalence of daily smoking from adolescence onwards, and adverse changes in glucose metabolism. Ross and Mirowsky (2001) sustain that that residents of disadvantaged neighbourhoods have worse health than residents of more advantaged neighbourhoods. Clark et al. (2013) affirm that after adjustment for health behaviours and SES, neighbourhood socioeconomic disadvantage was associated with the metabolic syndrome in women, also, they sustain that neighbourhood socioeconomic disadvantage and perceived safety should be considered as targets for intervention to reduce cardiometabolic risks. Jokela (2014) highlight that people who live in disadvantaged

[38] According to English Oxford Living Dictionary, the concept of "built environment" refers to the "man-made structures, features, and facilities viewed collectively as an environment in which people live and work." Retrieved at https://en.oxforddictionaries.com/definition/built_environment, accessed on 26 June 2018.

neighbourhoods tend to have poor physical and mental health as neighbourhood disadvantage was associated with poorer self-rated health, mental health, and physical functioning, higher probability of smoking, and less frequent physical activity. Finch et al. (2010) highlight that neighborhood advantage is stronger for those with more education. They sustain that *uneducated neighbourhoods are universally deleterious* as individuals with more education benefit from living in highly educated neighbourhoods to a greater degree than individuals with lower levels of education.

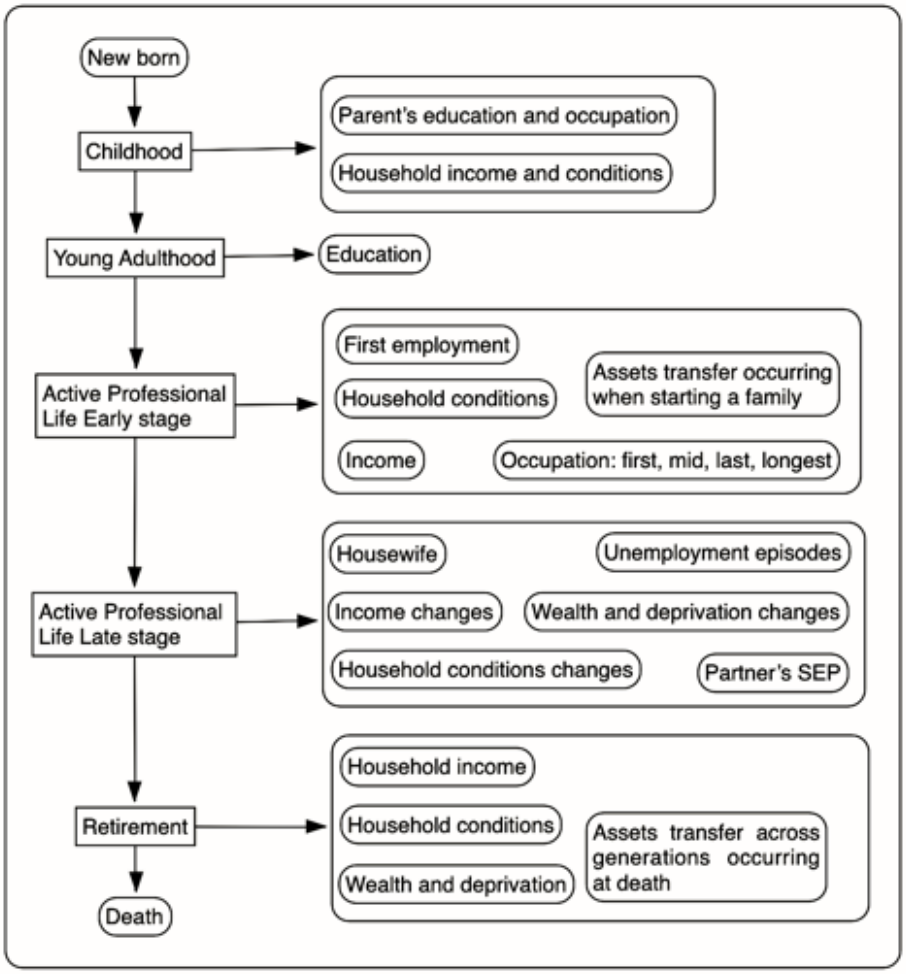
Age, educational level, income, eating habits and daily consumption of water and lifestyle, are crucial determinants of health (WHO, 2018; Duncan and Kawachi, 2018). Individuals who are more aware of the influence of such factors on their health can modify their health-related choices and behaviours in order to positively influence their health and wellbeing. The WHO affirms that unhealthy diets and a lack of physical activity may show up in people as raised blood pressure, increased blood glucose, elevated blood lipids and obesity. Behaviour Risk factors[39] for NCDs include modifiable behaviours[40], such as tobacco use, physical inactivity, unhealthy diet and the harmful use of alcohol. Metabolic risk factors contribute to four key metabolic changes that increase the risk of NCDs: raised blood pressure, overweight/obesity, hyperglycemia (high blood glucose levels) and hyperlipidaemia (high levels of fat in the blood). These are called metabolic risk factors that can lead to cardiovascular disease, the leading NCD in terms of premature deaths. Noncommunicable diseases (NCDs), also known as chronic diseases, tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behaviours factors. Evan (2003) affirms that personal control, social support and restoration affect indirectly mental health.

Individuals' socioeconomic position, or SEP, is a crucial determinant for health (Marmot and Wilkinson, 1999; Kawachi et al., 2002; Evans & Kantrowitz; 2002), certainly it is the most investigated in the medical and social sciences. According to Costa (2014), the SEP depends on the quantity of distributive and relational resources available for the individual; these resources affect individuals' behaviours and habits therefore increasing, or decreasing if SEP is higher, their exposure to health risk factors. Galobardes et al. (2006) affirms that factors of SEP are childhood circumstances in which individuals were born, parents' education, income, education and kind of occupation. Kawachi et al. (2002) and Evans & Kantrowitz (2002) affirm that SEP is a crucial determinant of health as it allows individuals to gain access to health-related resources. Individuals' income influences their health as well as poverty affect life expectancy (Wilkinson, 1997). Galobardes et al. (2006) sustain that, in epidemiology, to measure individuals' SEP the researchers look at the specific individual's life path from childhood to retirement. Accordingly, Fig.7 depicts life circumstances and their factors which are relevant for health. Firstly, childhood circumstances refers to parent's education and occupation as well as household income and conditions; secondly, in young adulthood, we find individual's education a crucial factor; thirdly, during the first phase of active professional life, we find first employment, earned income, household conditions, and assets transfer occurring when starting a family; then, during the second stage of active professional life, we find occupation, housewife, unemployment episodes, income changes, wealth and deprivation changes, household conditions changes, and partner socioeconomic position; finally, during the retirement stage, we find household income, wealth and deprivation, household conditions, assets transfer across generations occurring at individual's death. All these life-circumstances are determinants of socioeconomic position. Therefore, we can say that factors such as individuals' education attainment, parent's education, occupation stability, and household income should be observed for assessing the impact of SEP on health.

[39] Tobacco accounts for over 7.2 million deaths every year, 4.1 million annual deaths have been attributed to excess salt/sodium intake, more than half of the 3.3 million annual deaths attributable to alcohol use are from NCDs, including cancer, 1.6 million deaths annually can be attributed to insufficient physical activity.

[40] In terms of attributable deaths, the leading metabolic risk factor globally is elevated blood pressure (to which 19% of global deaths are attributed), (1) followed by overweight and obesity and raised blood glucose.

Fig. 7. Socioeconomic status and life path according to Galobardes et al. (2006).



Source: Author's elaboration.

Mental and general health advantage in young individuals are associated with higher levels of positive perception of neighbourhood safety, aesthetics, walkability, and services (Smith et al., 2015). Cross-sectional self-reported questionnaire for wellbeing (Warwick-Edinburgh Mental Wellbeing Scale) and for neighbourhood perception. Clark et al. (2013) examined associations between neighborhood socioeconomic disadvantage, perceived neighborhood safety and cardiometabolic risk factors, adjusting for health behaviors and socioeconomic status (SES) among African Americans. They affirm that the association is mediated entirely by perceived neighbourhood disorder and the resulting fear. It is not mediated by limitation of outdoor physical activity. The daily stress associated with living in a neighborhood where danger, trouble, crime and incivility are common apparently damages health.

The social and community environment within the neighbourhood affect individuals' health and wellbeing. Putnam (2001) argues that higher levels of social capital (defined as quantity and quality of social interactions within the community) are positively associated to higher educational performance and childhood well-being, less TV-watching, lower levels of crime, less tax-evasion, greater tolerance and economic and civic equality, and higher levels of health. In the opposite direction, social exclusion and a low *sense of belonging to the community* are predictors of psychological stress (Ward-Thompson et al., 2016). In addition, factors such as institutional support and economic accessibility within the neighbourhood have been associated with community health and wellbeing (Bernard et al., 2014; Duncan and Kawachi, 2018). Also, when referring to the community environment, we should also consider the degree of perceived safety from crime within

the neighbourhood. In fact, as emerged from recent studies, the fear of being victims of crimes and violence, while walking within the neighbourhood, limits social interactions (Clark et al., 2013). This has an effect for both mental health (as it springs in fear for the external environment) and for physical health (social limitations increase the levels of physical *inactivity* and therefore sedentary behaviours that negatively influence health). Social support, including emotional support, seems to be a major factor for stimulate walking, mechanisms such as motivation, stimulation, and enjoyment are outcome of higher level of social support; furthermore, more social support stimulate the creation of social capital and related benefits. Social support affects mental health through environmental characteristics such as proximity to spaces for social interactions (Fleming et al., 1985; Moos, 1976; Mccoy, 2002; Sundstrom, 1976). Lack of social spaces within the neighbourhood associate to negative effect for health such as delirium, depression, and increased need for antidepressants (Ulrich, 1991; Jackson, 2003; Melis et al., 2015). In addition, social issues such as social exclusion and segregation act as a catalyser of poverty within the neighbourhood provoking a stigma effect for that specific area. Social isolation, place belonging, amount and degree of accessibility to green space are significant predictor for community stress (Ward-Thompson et al., 2016). Cross-sectional self-reported surveys conducted in Scotland for self- reported stress (Perceived Stress Scale), wellbeing (SWEMWBS) usage of green spaces, physical activities, and social wellbeing. Putnam (1995; 2000; 2001) affirm that the quantity and quality of the local network of relationships and the associated norm of reciprocity within a community can be defined as the social capital. Capturing and measuring the concept of social capital in an appropriate index (Social Capital Index), Putnam (2001) sustains that high levels of social capital are correlated to greater educational performances, child welfare, less tv watching, less crime, less tax evasion, higher tolerance, higher economic and civic equality, and interestingly for the purpose of this study, higher individuals' general health levels. Hence, the concept of social capital for health is a crucial dimension to consider. Qualitative and quantitative evidence suggests that more egalitarian societies are more cohesive. In their study of Italian regions, Putnam et al. (1993) report a strong correlation (0.81) between income equality and their index of the strength of local community life. They say, "Equality is an essential feature of the civic community." Kawachi et al. (1999) have shown that measures of "social trust" provide a statistical link between income distribution and mortality in the United States. Likewise, Berkman (1995) argue about the role of social relations in health promotion. Lack of trust within the neighbourhood is associated with social isolation, social capital within the neighbourhood is associated with higher wellbeing for residents (Hayward et al., 2015).

Bernard et al. (2014) sustain that the neighbourhood encompasses five domains such as physical, economic, institutional, local sociability, and community organisations domains. According to their rationale, these domains could be accessed through different set of rules such as proximity for physical domain, price for the economic domain, rights for the institutional domain, and, finally, informal reciprocity for accessing the community sociability domains. Bernard et al. (2014) suggest that the degree to which residents acquire resources from these domains affect their life course trajectory in health and social functioning, thus, triggering health issues and health inequalities.

2.5.2. Contextual influences on health

Contextual factors influencing community health encompass physical and natural features of the neighbourhood, among these: built environment features including urban forms and land-use patterns, urban design and aesthetics, transportation arrangements, and the quality of the natural environment including air, water and soil pollution levels.

D'Onofrio and Trusiani (2017) sustain that urban form, built environment design features, transport pattern, technological network, land-use mixite and distribution, accessibility to green and public spaces, natural environment safety and resilience. The shape and functions of the built environment shape public health (Jackson, 2003; Duncan and Kawachi, 2018). According to Gullon & Lovasi (2018), the built environment can be depicted as a human-made physical system including

"access to" and "attractiveness of" walkable destinations (public spaces, parks, retail stores, and other public and private services) and community design characteristics such as streets, roads, sidewalk, trails, bicycle path. The built environment, as defined by the US Centers for Disease Control and Prevention (CDC), encompasses all human-formed, developed, or structured areas. Ewing (2005) defines the built environment as man-made structures in contrast with the natural environment. The concept of built environment can be applied in urban, semi-urban, and rural areas; the importance of rural areas for the urban ones is even stronger in context where urban and rural boundaries are not defined in a sharply manner. The built environment of a specifically geographical location should be considered as a continuum -from the most urban to the most rural part- whereas the built environment changes in characteristics. Many definitions of the built environment, grouped for scope and nature, can be found in the scientific literature. Gelormino et al. (2015) describe the built environment as the physical setting where human activities take place. Handy et al. (2002) sustain that the built environment encompasses metropolitan land-use patterns, transportation system, all kinds of buildings (residential, commercial, industrial, and institutional) and the spaces around them. Lovasi (2012) conceptualizes the built environment considering all its stable elements such as building, transportation system, architectural and design features, landscape elements, and cultivated green space. Gullon & Lovasi (2018) sustain that the physical setting of the built environment affects individuals' exposure to natural environment stressors (e.g., air and water quality, pollution, winter and summer climate), and also the social environment, namely, the way how people interact with each other and the local level of social capital. Manuell Castell (1977) defined the built environment as a physical *shell,* in which human activities occur. Jackson (2003), Lovasi (2012) and James et al. (2013) define the built environment considering its recurrent elements, that is, buildings of any kind, transportation system, and architectural and aesthetic characteristics. All these factors indirectly influence both mental health (Evans, 2003, Brown et al., 2008; Ochodo, 2014) and physical health (Lavin et al., 2006; James, 2013).

Gullon & Lovasi (2018) argue about the differences among built environment, land-use, and urban design. They sustain that "urban design" refers to the specific design characteristics of the physical elements of the city, specifically, urban design concern about the arrangement and the appearance of such physical elements, directly influencing the aesthetics and the attractiveness of the city. Furthermore, "land-use" refers to the spatial distribution of the activities across the city, including the proximity among, and the density of such activities across the city (activities such as residential, commercial, industrial, institutional, etc…); land-use is subjected to the local zoning regulation. Finally, Gullon & Lovasi (2018) define the built environment as a dynamic human-made structure which is affected by changes in urban design, land-use, and transportation system; these changes can be implemented by public and private agencies, companies, community organizations, and, at the very local level, by individuals within the community. Thus, the responsibility for the changes in the built environment are due to all the actors playing within the city. Gullong and Lovasi (2018) sustain that there exist three possible mechanisms for the built environment to affect health. To begin with, environmental toxins within the built environment are usually present, thus, people living in close proximity to sources of toxins (traffic, waste management, brownfield, industrial site, contaminated water or ground, etcetera) are more exposed to environmental risks. Secondly, the individuals' behavioural mechanism through which people choose to undertake a choice (such as usage of public transport, walking on well-maintained sidewalks) on another (such as car transportation); the built environment quantitative and qualitative features are responsible for individuals' choices which can be positive or negative for health. Finally, there exists the psychosocial mechanism through which people react to chronic stressor within the built environment (streetscape with limited buffer between sidewalks and the street can be a stressor for walkers, lack of green spaces, lack of social destinations for social interaction).

The built environment affects health in many ways, both directly and indirectly. For instance, the neighbourhood-built environment (therefore at a micro scale) can influence individuals' level of physical activity and their diet. This indirect effect exists because the physical setting of the built environment can influence individuals' behaviour as the quality of, and the proximity among, the elements of the built environment can encourage, or discourage, people to walk or to access services such as trail, walking and cycling path, and healthy food store (Berrigan & McKinno, 2008). When people are discouraged to walk, they conduct more sedentary lifestyle, thus, decreasing the daily-energy they spend during the day, thus, increasing weight and likelihood of cardiovascular disease. Thus, we can say that transportation system plays a crucial role for health as it can affects individuals' behaviour, decreasing the exposure to health-related risk factors.

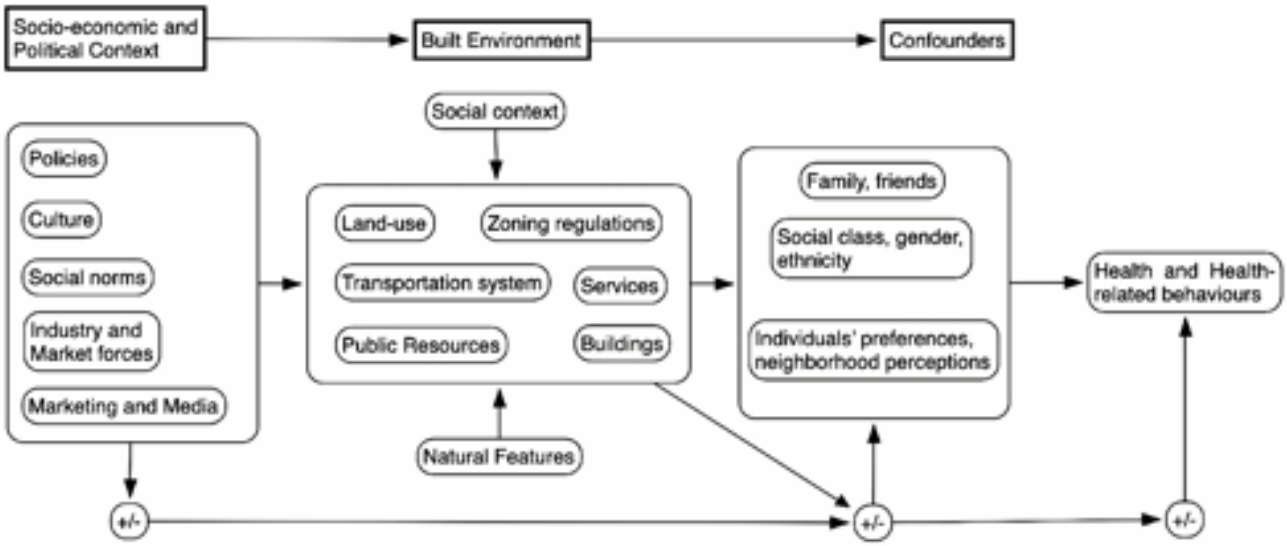
The relationship between the built environment and health is complex and indirect (Duncan and Kawachi). Indeed, the built environment could be linked to health outcomes mainly in two manners such as "stress coping" and "restoration" (Ochodo, 2014). Building on the conceptual framework of Northridge et al. (2003), Gullon and Lovasi (2018) provide a list of useful levers able to capture the effects that changes in the built environment produces on health. These levers are the following: (1) Land use (single or mixed use, residential, commercial, industrial, institutional, etc…); (2) Transportation systems (street network design, public transportation infrastructure, active transportation infrastructure); (3) Services (facilities, shopping areas for food and commodities, post-office, gyms, etc…); (4) Public resources (green, recreational, cultural, and public spaces, and amenities); (5) Zoning regulations (restrictions on the kind of land-use allowed in a certain area, for instance, just residential, commercial, industrial, or institutional); (6) Buildings (quality and quantity of housing, schools, universities, commercial and shopping centres, office buildings, etc…).

Some characteristics of the built environment are more relevant for health and wellbeing according to *where* the built environment is located. For instance, the presence of trails in rural areas is strongly associated with physical activities, and therefore, health (Park et al, 2017; Messing et al., 2015), while in urban areas it seems that mixed land-use plays a crucial role for individuals' levels of walking, but not in rural areas where the perception of slow traffic was positively associated with recreational walking (Stewart et al., 2016). Built environment features that facilitate visual and social contacts associate with elder's physical functioning through social support and psychological distress (Brown et al., 2008). Self-reported survey conducted in Miami (Florida, US) to assess built environment metrics, social support, self-reported anxiety and depressive symptom.

The scheme in Fig. 8 depict how the built environment is shaped by the socio-economic, natural and political context existing in a specific place, these elements all together affect individuals' health cofounding to intensify the magnitude and direction of the effect of the built environment for health. Researchers developed varies framework that build the pathway through which the built environment affects health, these frameworks are informed by different theoretical lens. Evans (2003) sustain that the built environment associate to mental health in two ways: directly through environmental factors such as housing, crowding, noise, indoor air quality, and light; indirectly through altering psychosocial processes which lead to mental health consequences. Through a cross-sectional survey to measure quality of life, Hogan et al. (2016) highlight that health and happiness in young individuals are related to accessibility to cultural, shopping and sport amenities, and city attractiveness; while, for older individuals is associated with distribution and quality of health-care and governmental services. In addition, with an observational and interventional intent, Sallis et al. (2008) proposed an ecological model to better understand individuals' behavioural influences at multiple level, observing how individuals, environments, and health behaviours interacts with each other. This is a sociological perspective informing the framework. In a similar fashion, but with a different perspective, Northridge at al. (2003) propose a conceptual framework for investigating, through the observation of the urban morphology, the multiple pathways of how the built environment affect health and wellbeing. Differently from Sallis et al. (2008), they look at how the changes in the

built environment (land-use, transportation, urban design features) due to the post-WWII urban planning and policies often translated in poor environments for the population, thus, affecting communities' health.

Fig. 8: Effect of the built environment for health according to Gullon and Lovasi (2018).



Source: Author's elaboration.

Jane Jacobs (1961) was one of the first urban planner who sustained that the structure of the neighbourhood-built environment influences people lifestyles and behaviours. In her research studies on different neighbourhood, she points out that mixed land-use and density are crucial components of the built environment as they foster diversity of people using the neighbourhood. Also, she noticed that such diversity and density have an indirect effect on safety as more people in the street provide informal surveillance (eyes-on-the street). Furthermore, mixed land-use attract visitors with different interests, thus, the neighbourhood seems to live day and night with the same intensity. At that time, Jacobs (1961) provided example of successful neighbourhoods such as Boston's North End, Philadelphia's Rittenhouse Square and Manhattan's Lower East Side. These places are still characterized by human scale size, vibrant public spaces, and attractive amenities. All these features are crucial spatial determinants of health.

Lavin et al. (2006) provide a review on the relationship between built environment and health. Their findings point out that the effect of the built environment on health is huge, both at a macro than a local level. At macro level, they sustain that spatial planning, mixed land-use and transportation infrastructures play a crucial role for individuals health. While at the local level, the affirm that the specific urban design, maintenance and availability (in term of accessibility) of the built environment affect mental, physical and social health. In particular, they point out that the street network design, accessibility (and availability) of public and green spaces, the safety level of a certain area, coupled with individuals' mental traits, affect individual's health. Lavin et al. (2006) emphasize that individuals living in poor quality-built environments (as a deprived neighbourhood) have lower level of mental and physical health. Conversely, people living in vibrant and well-maintained built environment, with availability of public and green space, have higher health levels. These evidences support the existence of a spatial determinant of health inequalities.

According to Leal and Chaix (2011), diseases as obesity or hypertension are associated with poor neighbourhood socio-economic and physical characteristics general low socioeconomic position, low urbanization degree, low street intersection, service availability and residential density, high noise pollution, low accessibility to supermarkets and high density of convenience stores, and

low social cohesion. The effect of the built environment for health is a well-known phenomenon, however, only in the last decades there seems to be a renovated research interest in developing metrics to measures the place-based characteristics that could affect health (Prasad et al., 2016), mostly, these metrics focus on the health impacts of the social and built environment. Also, new technologies able to capture micro-data through GPS measurement (Vine et al., 1997), the development of multilevel modelling (Diez Roux, 2000) and new metrics for assessing walkability (Leal and Chaix, 2011; Kerr et al., 2007; Frank et al., 2005) at neighbourhood level seems to be the next research standard for measuring the relationship between built environment and health. A growing body of research is investigating the role of the built, or physical, environment for human health.

Aesthetic Features

Aesthetics pleasant neighbourhood are conducive for public health and wellbeing. According to Ochodo et al. (2014) sustain that poor external built environment triggers psychological stress and mental disorders. walling materials used on buildings, density of dwelling units, state of street lighting, types of doors, state of roofs, and states of windows represent external built environment factors affecting mental health in adults. Furthermore, they sustain that urban areas characterized by poor aesthetic features expose the population to daily stressors and inconveniences that increase the likelihood of developing mental health disorders. Ochodo (2014) associate key aesthetic characteristics of the built environment (poor state of roofs, insecure doors and windows, narrow access pathways, lack of street lights, inadequate garbage disposal, sewer disposal and water provision facilities, crowded housing, lack of green spaces and shopping facilities (independent variables) to psychological stress (intervening variable) and thus to mental health disorders, thus, encouraging specific interventions to foster public mental health in urban areas. The aesthetic and functional features of built environment is a strong determinant of health inequalities.

Functional and Visual Features of the Built Environment

The concept of visual built-environment was put forward from Smith (1975). He described the distinction between the kind of given information for defining the built environment: spatially bounded information (e.g., the view from the kitchen windows) and a-spatially bounded (e.g., the security of the neighbourhood). Smith (1974; 1975) tested the hypothesis that the visual and functional characteristics of the residential neighbourhood influence the well-being of its residents. Identifying multiple dimensions of the residential neighbourhood as independent variables to predict three outcomes of well-being in former mental patients, Smith (1977) found out that neighbourhood type seems to affect patient's rehabilitation. Back in 1970s, Sommer (1974) put forward the concept that there exist two kind of physical space, an "hard" (unresponsive to human needs) and a soft (welcome and reflect the presence of human being). The hard dimension is the built environment, while the soft is the social environment. The functional built environment refers to the distributions of activities within the neighbourhood which influences residents' and visitor's health-related behaviours. For instance, the high concentration of convenience stores within the neighbourhood is associated with higher individuals' level of cigarettes smoking (Chuang et al., 2005) and electronic cigarettes use (Giovenco et al., 2016). Also, the structure and form of the built environment, especially for the transportation system component as it can trace the pathway to obesity (Zick et al., 2009) and it can be responsible for depression in youngs (Duncan et al., 2013), elderlies (Berke et al., 2007), and low-income African-American and white people (James et al., 2017). Additionally, Cervero & Kockelman (1997) sustain that the built environment influence travel demand trough three dimensions (3Ds) such as density, diversity and design. According to their study relying on travel diary data, land-use data, regional inventories, and field surveys, they sustain that density, diverse land-use (mixed), and pedestrian-oriented urban design predict a reduction in car-driving rates and an increase in non-car travel. Likewise, Handy et al. (2002) sustain that the structure of the built environment affects individuals' travel behaviors, they sustain that the overall setting of urban design,

land use, and transportation systems can stimulate walking and bicycling within a community, therefore, indirectly creating active and healthier communities.

Sidewalks, Pedestrian Paths, and Transportation

Hallal et al. (2010) found out that a lack of sidewalks and low access to recreational facilities were correlated with lower levels of leisure-time for physical activities. Specifically, they used three outcome variables such as leisure-time physical activities, transport-related physical activity, and walking for leisure; while for measuring individuals' perceptions of the built environment attributes, they used the Neighbourhoods Environment Walkability Scale (NEWS). Their finding suggests that policies aiming to enhance specific built environment features can increase community's levels of physical activities. Florida (2016) associates the number of people who practice physical activities with the commuting patterns of public transportation. Conversely, he argues that there is an inverse relationship between the number of people who practice fitness and the number of people who drive to work alone. Thus, the role of the public transportation as a facilitator for health is crucial. Neighbourhood design features are significantly associated with moderate levels of physical activity (Frank et al., 2005). The structure of the built environment affects individuals' behaviors and choices, producing an indirect effect on people's lifestyles and their health (Lovasi, 2012). For instance, built environments where the presence of pedestrian path and other active transportation infrastructure, rather than car-oriented transportation, have a crucial effect on individuals' levels of physical activity (Perdue, 2003). They sustain that the development of new urban policy that should Amorim et al. (2010) explored the association between the physical and social environment and their effect on individuals' levels of physical activities considering leisure-time and transport-related physical activities. Through their cross-sectional survey of 972 individual in Pelotas (Brazil), they point out that individuals living in safer and greener areas presented higher levels of physical activities. Thus, they advocate for policy interventions aiming to provide more enjoyable and safer public spaces in urban areas.

Walkability

Neighbourhood walkability is a crucial factor for health. Indeed, walkable places implies that individuals are more likely to walk within the neighbourhood, thus, practicing higher levels of moderate physical activity that is beneficial for health. Kerr et al. (2007), Moudon et al. (2006), and Frank et al. (2005) sustain that neighbourhood walkability associates with higher levels of physical activities both for young and adult individuals within the community. Ewing et al. (2006) developed operational definitions and metrics for assessing urban design qualities affecting neighbourhood walkability. Among these, they found out that five urban design qualities exert stronger influence of walkability. These are the following: imageability (aesthetics and attractiveness of urban design elements), visual enclosure, human scale, transparency, and complexity of the active transportation infrastructure. In particular, crucial features of a walkable neighbourhood include land-use mix, high residential density, small street-blocks, short distance to food and retail stores from home (about 263 to 440 meters) (Moudon et al., 2006). Furthermore, other built environment features that influence neighbourhood levels walkability are specific urban design features such as sidewalks width (Cervero and Kockelman, 1997) and quality (Boehmer et al., 2007), presence of trees and other environmental characteristics (Larsen et al., 2009), and the size of architectural characteristics of the streetscape (Ewing et al., 2006). In addition, it seems that a constraint for walkability is the lack of perceived safety within the neighbourhood, specifically, this is due to the presence of littering (Shenassa et al., 2006) and physical disorder (Molnar et al., 2004; Kawachi and Berkman, 2003). Higher neighbourhood walkability is associated with decreased prevalence of overweight and obesity, and lower incidence of diabetes (Creatore et al., 2016). Also, the presence of public transport seems to associate with neighbourhood walkability as individuals walk (rather than drive) for reaching transportation (Owen et al., 2007). Despite individual's socio-economic status (SES) is a strong determinant of health (Marmot, 2016; Bonnefoy et al., 2007), it seems that SES is not a significant

moderator of walkability (Van Dyck et al., 2010). Thus, interventions aiming to increase walkability in low-income neighbourhood could be an appropriate solution to stimulate individuals' levels of physical activities in such socioeconomically disadvantaged areas. Bohemer et al. (2007) associated high levels of obesity in neighbourhoods with absence of non-residential destinations, absence and poor quality of sidewalks, unpleasant community, lack of interesting areas within the neighbourhoods, physical disorder, presence of garbage. Among these factors, they point out that land-use and neighbourhood aesthetics strongly correlated with obesity levels.

Urban or suburban transportation mode plays a fundamental role for health. Free public transport for older individuals associate to more social interaction, health, wellbeing, and reduced loneliness (Green et al., 2014). Neighbourhoods, and more in general built environments, with higher level of bike lane are associated with higher levels of walking and bicycling (Titze et al., 2008). Also, the presence of public transportation is associated with walking (Villanueva et al., 2008), thus, encouraging public transport can increase individuals' levels of physical activities. Also, the role of walking or bicycling infrastructures is even more important, if we think that the only presence of parks, or open public spaces, seems to be not (little) correlated with higher levels of physical activities (Witten et al., 2008). Thus, it means that the mere presence of parks, or public spaces, in the built environment is not enough for encouraging people to practice physical activities, if there is absence of public transportation, and good pedestrian and bike connectivity. Also, more convenience to reach social and recreational spaces is a major factor for walking as proximity to recreational areas and the features of the infrastructures existing (cycle-walking) to reach them seems to be crucial for walking and physical activity. More social interaction is another fundamental factor that stimulate people to walk, this refers to the opportunity that walkers have to meet other people along their way.

Physical Activities

The built environment plays a crucial role for individuals' level of physical activities (Ewing, 2005). The Transportation Research Board of Washington (TRB, 2005) highlights that the spatial features of the built environment influence the level of individuals' physical activity. McCormack and Shiell (2011) highlight that there exists a reduction in physical inactivity, thus, urban environments that promote active transport have positive repercussions on the health of the population and receive strong attention from the public administrations and maker policies that govern contemporary metropolises (D'Alessandro et al., 2015). In addition, Lavin at al. (2006) described the factors that facilitate or constraint population likelihood to practice physical activities. Among these, we find:

- land use density and mix, accessibility in term of proximity from destination or facilities;
- design features including aesthetics of the built environment;
- transportation patterns including sidewalks and trails;
- people's attitudes and motivations depending on specific individual and relational factors.

Housing

Housing characteristics are crucial determinants for health and wellbeing. Capolongo et al., (2013a) highlights that given the huge amount of time that we spend in our home, housing quality and comfort is a crucial determinant for health. In metropolitan context, especially in the US, high rise housing producing elevated psychological distress among low-income individuals (Freeman, 1984; Evans et al., 2003). Residential floor level producing psychological distress in adults living on higher floors (Fanning, 1967; Evans et al., 2003). Housing quality (poor maintenance, climatic problems, heat humidity) produce greater psychological distress in housing of poorer quality (Freeman, 1984; Halpern, 1995; Evans et al., 2003); neighbourhood quality producing greater psychological distress and poorer cognitive development in children (Johnson et al., 2002; Dalgard & Tambs, 1997; Wandersman & Nation, 1998; Leventhal & Brooks-Gunn, 2000; Weich et al., 2002).

Interior design including furniture placement increase social interactions and decrease isolated behaviours (Holahan, 1972; Holahan & Saegert, 1972; Osmond, 1957; Sommer, 1969); privacy (Zimring et al., 1982; Ittelson et al., 1970); residential density inside the house (people/room) produces greater psychological disorder (Baum and Paulus, 1987; Evans, 2001; Lepore et al., 1991); indoor air quality (Evans, 1994; Rotton and Cohn, 2002; Edelstein, 2002). Poor urban planning and housing could trigger undesirable health effect such as anxiety, depression, attention deficit hyperactivity disorder, substance abuse, and aggressive behaviours (Raffestine and Lawrence, 1990; Fullilove & Fullilove, 2000). In residential buildings, of the spaces (bedroom, toilets and bathrooms) of the residential units should be characterised privacy and confidentiality (Ochodo et al., 2014). House type, floor level, housing quality, neighbourhood quality associate to mental health through specific pathway (Evans, 2003). Large windows, pleasant outdoor views, balconies, and courtyard spaces were associated to higher level of mental health (Douglas & Douglas, 2003). Fullilove and Fullilove (2000) sustain that poor housing relate to mental and physical health disorders, while Rauh et al. (2002) highlight that deteriorating housing contribute to high level of allergies. Residential buildings that have been delapidated leaking pipes, peeling paint, cracks, and holes in walls or ceilings are stressors affecting mental health (Rauh, 2002; Lehman et al., 2008). Furthermore, home light and brightness affect depression level (Rosenthal et al., 1984; Beauchemin, 1996; Kuller and Lindsten, 1992).

Green Spaces, Natural Environment and Health

Green areas to public health and wellbeing, as green areas stimulate individuals' physical activity levels in the urban context D'Alessandro et al. (2015). Green space usage is associated with quality of life in children (McCracken et al., 2016). Urban green spaces associate with better self-esteem, general health, and less depression and fatigue and more vigour (Wood et al., 2016). People living in urban areas with more green spaces show higher level of mental health and wellbeing compared to those living in urban areas with few green spaces (White et al., 2013). Greater amount of vacant land associate to less community wellbeing, higher level of crime, lower physical health because of more injuries, less mental health through anxiety and stigma (Garvin et al., 2013). For instance, green and public spaces and natural amenities seem to have a positive effect on individuals' mental health (Bowler et al., 2010) and levels of physical activities (Handy et al., 2002; Almanza et al. 2012), but these elements can be also a threat for safety as these spaces can be hotspot for crime (Weiss et al. 2011) and they can produce health issues such as pollen allergy and asthma in some individuals (Jariwala et al., 2011).

The built environment contours pieces of the natural environment such as trees, public and private gardens, parks, rivers, and other natural elements that coexist with the human-made structures within the city. Restoration and recovery from cognitive fatigue and stress depends upon environmental characteristics such as natural environment features such as trees (Kaplan & Kaplan, 1984, Larsen et al., 1998; Kuo et al., 1998) and architectural elements (Kaplan & Kaplan, 1984; Kaplan et al., 1998; Frumkin, 2001; Wachs & Gruen, 1982). The presence of green spaces within the neighbourhood associate with positive outcome for mental health as these spaces are conducive for social interactions, and opportunity for practice physical activities. Ulrich (2002) associate green spaces such as gardens to more relaxing environments. Calogiuri and Chroni (2014) explored the relationship about how the natural environment influence individuals' level of physical activities, providing a conceptual model on which such a relationship lies. In synthesis, they found out that attractive views of nature and the natural environment within the individuals' living environment influence positively individuals' feeling and beliefs, stimulating individual's likelihood to practice physical activities, and working as a stress-relieve mechanism that positively influence people's attitude toward active living. Air pollution caused by car traffic associate to respiratory mortality in Italy (Faustini et al (2011). Electric car usage is associate to health benefits, reduction of private car use (thus less carbon dioxane) to positive health impacts, housing energy efficiency to a reduction of

carbon dioxin and positive impacts for physical health and wellbeing deriving from better air quality, biomass heating systems for houses to reduction in carbon dioxane emission (Sabel et al., 2016). Poor health levels associate to blocks with higher level of noise, air pollution, and lack of green spaces (Honold et al., 2012). Individuals living within a deprived area near an urban motorway experience lower level of wellbeing compared to those living further away (Foley et al., 2017). Noise associates to psychiatric disorder and elevated psychological distress in children (Stansfeld, 1993; Haines et al., 2001). Grant & Braubach (2010) sustains that noise level to which people are exposed affect individuals' health and wellbeing, thus, suitable noise indicators should consider noise levels, but also quietness and tranquillity levels, and noise annoyance. Suitable indicators for the noise dimension are the following: traffic flow/intensity and composition, share of people exposed to noise levels ranging from above 55 dB A, share of people living in quiet areas, share of people exposed to noise sources, road, and industry.

2.6. Methods to Measure the Neighbourhood Effect on Health

Duncan et al. (2018) affirm that neighbourhood characteristics are primary predictors in spatial epidemiology researchers, in particular, how the measure of this characteristics in relation to public health, providing for estimations both in magnitude and direction. According to Duncan and Kawachi (2018), in order to better understand the many ways of how neighbourhood dimensions affect individuals' health, there is the necessity to integrate multiple sources of evidence and thus combined gathered data through observational studies, experiments, and system simulation approaches. These steps are complementary as observations shape experiments which generate questions that need to be answered by other observations. Also, observations and experiments build to modelling simulation which drives to new observations and experiments. Once the system simulation is built, it can be used to develop actions in order to trigger actions, and thus changes, that will be evaluated to better understand the consistency of the built system simulation.

There exist different methods to measure neighbourhood characteristics, but the choice depends on the kind of topic being studied by the researcher (Duncan et al., 2018). With a general research perspective, Creswell (2013) classifies research methods in quantitative, qualitative and mixed method strategy of inquiry. Likewise, in neighbourhood and health research, we find the same classification, but with a specific perspective for this particular field. With a specific focus in neighbourhood and public health research, Duncan et al. (2018) divide quantitative methods into the following three broad categories: (1) traditional; (2) current; and (3) emerging methods of inquire. In synthesis, traditional methods encompass self-reported surveys and systematic field observation. Current methods include the use of Geographic Information Systems and Web-based geospatial data. Finally, emerging methods are those relying on new technologies such as wearable geospatial monitors, crowd-sourced data, and social media and internet-sourced data.

- Traditional methods

  Self-reported surveys are questionnaire where the respondent chose among multiple given answers; this method is used to measure neighbourhood characteristics through the perceptions of the residents about topics such as aesthetics, quality of amenities, accessibility to food and commodities, safety, social support, violence, etc. The answers are reported on a preestablish scale, usually from 1 to 5, or range of options such as 1 to 5 minutes, 6 to 10 minutes, and so on. The scale reflects the researcher necessities. An example of a very well know, and fully validated, self-reported survey, to assess the effect of the components of the built environment for walkability and physical activities, is the Neighborhood Environment Walkability Scale (NEWS) (Saelens et al. 2003; Cerin et al., 2006; Cerin et al., 2009; Cerin et al., 2013; Oyeyemi et al., 2016; Oyeyemi et al., 2017). Self-reported surveys can be used to assess perceived access to the built environment, but also for investigate the social

environment and range of health-related behavior within a community. Examples of self-reported questionnaires were used in manifold research studies, for instance, to assess perceived neighborhood safety (Duncan et al., 2017), to assess sidewalks quality and access to recreational facilities (Hallal et al., 2010), to associate the effect of the physical and social environment on individuals' levels of physical activities (Amorim et al., 2010), to associate trails use and obesity (Hughey et al., 2016), to assess neighborhood safety in relation to informal social control, social cohesion and trust within the community (Sampson et al., 1997), and much more. Self-reported surveys collect self-reported information on paper and digital support, via telephone, e-mail, social networks, Web-based surveys, etc… (Duncan et al., 2017; Duncan et al., 2018). Self-reported surveys aim to capture individuals' perception of the neighborhood built environment, however, comprehensive (and reliable) analysis can be performed through the spatial aggregation of such data. According to Duncan et al. (2018), the spatial aggregation of many survey responses improves the reliability and validity of the survey. Also, if the survey aims to capture individuals' self-reported health, the aggregation of survey responses minimizes same-source bias (Diez Roux, 2007), namely, to avoid associations between "self-reported neighborhood conditions and self-reported health outcomes, due to correlated measurement error" (Duncan et al., 2018: 62). Another example of aggregation of self-reported surveys for assessing neighborhood built environment was used by Mujahid et al. (2007) to gather information about six neighborhood dimensions such as aesthetic quality, walking environment, availability of healthy food, safety, violence, social cohesion, and activities with neighbors. Furthermore, Roux (2007) argues about the complementary nature of observational, experimental and quasi-experimental evidence; he also sustains that to capture the neighbourhood effects for health, it is important to develop multidisciplinary research studies that can relate evidence with different science field in a system manner. In addition, as the validity of the survey relies on the interpretation of the questions by the surveyed population (Stone and Shiffman, 2002), it is worth notice that surveys should be developed according to the specifically geographical context where it is conducted (Duncan et al., 2018), so the researchers have to consider the social, cultural and political features of a population.

Systematic Field Observations (SFO), or human observations, are also known as methods for environmental auditing, and they are an objective -traditional- method to assess neighborhood characteristics (Duncan et al., 2018). There exists two kind of SFO. Firstly, SFO can be conducted by neighborhood raters that (after they have been trained by workshops) provide a checklist of neighborhood characteristics such as sidewalks quality, aesthetics, quality and quantity of buildings, littering, physical disorder, etc… (Duncan and Kawachi, 2018); neighborhood raters can use paper support, imaging, or video to record neighborhood information. Secondly, thanks to the new technological opportunities, SFO can be conducted through vehicle-mounted camera such as Google Street View, this approach allows the researcher to cut time and expenses for travelling through the neighbourhood being studied (Duncan et al., 2018); to date, many are the research studies that have been used, and validated, the Google Street View approach (Rzotkiewicz et al., 2018). In particular, this "virtual" observation approach was used to assess the association between urban greenness and walking behaviour (Lu, 2018; Lu et al., 2018), neighbourhood disorder and obesity in Chicago (Mayne et al., 2018), recreational facilities and leisure time physical activities (Mackenbach et al., 2018), to identify the share of shade for sun protection in recreational spaces (Gage et al., 2018), to associate traffic related air pollution and incidence of cardiovascular disease in Oakland (Alexeeff et al., 2018), to quantify neighborhood physical disorder (Marco et al., 2017), to identify city-level travel patterns in Britan (Goel et al., 2018), neighborhood environments auditing (Rundle et al., 2011), to measure environmental supportiveness for physical activity (Griew at al., 2013), to assess environmental features of

cycling routes to school (Vanwolleghem et al., 2014) and environmental contributions to pedestrian injury (Mooney et al., 2016), and many others. The reliability and validity of SFO is based on the training of the rater observing the neighborhood-built environment. These methods are very useful to measure actual (physical and social) neighborhood conditions, however, they are time consuming and expensive due to the travel time and the physical barriers that the researcher can find during the observation/exploration.

Current methods

Recently, approaches to measure neighbourhood dimensions relies on the use of Geographic Information Systems (GIS). This method allows the researcher to store and to geocode health and neighbourhood related information that are divided in different layers. GIS metrics include both distance and density measures (Duncan et al., 2018). For instance, the distance from the people's home to desirable destinations, or the density of park, or social and recreational spaces, within a specific area or region. GIS measures, such as proximity to recreational areas, residential and traffic density, were used in Massachusetts to associate built environment features to childhood body mass index (Duncan et al., 2014); this study reveals that closer proximity to recreational spaces is associated with lower BMI, meaning that proximity to those spaces stimulate walking behaviors and, thus, physical activities levels. A similar GIS-based study conducted in Massachusetts was used to measure access to food-store (healthy and not-healthy food) considering driving distance of these from people's home (Block et al., 2011). GIS-based methods are useful to gather data about the neighbourhood social environment such as population diversity in terms of gender (LGBT) and hate crime incidents (Duncan & Hatzenbuehler, 2014a). GIS methods simplify the process of neighbourhood investigation as they offer manifold objective perspective in real time. Despite this, GIS data availability might not be accessed for the area investigated by the researcher.

Current methods include also Web-based Geospatial Data that are able to measure neighbourhood characteristics such as urban walkability, transit, biking, general state of the place, etc… These dimensions are assessed by calculating the distance, amount, or density of the observed dimensions for zip code, or even better, census track (Duncan et al., 2018). However, such methods are really useful at a neighbourhood scale, but they might not be appropriate for smaller unit of analysis. Also, considering the walk score, it is worth notice that often the walk score metrics (linear distances of the potential pedestrian lane) does not match the routes that people prefer, thus, the measurement can be altered.

Emerging methods

These methods aim to gather real time data through the usage of wearable geospatial tools, crowdsourcing geospatial data, and internet-based social network (Duncan et al., 2018). Wearable geospatial devices, like sensors and wearable cameras, produce real-time data that the research can use to monitor the interaction of the participants with the neighbourhood-built environment (Oliver et al., 2013); this method can be a proxy for systematic field observation as the researcher has a first-person point of view during the investigation. Crowdsourcing means to gather neighbourhood data (presence of food store and recreational spaces, noise level, etc…) from online communities. Likewise, social media such as Twitter, or Instagram can be useful for the researcher to assess residents' perceptions of their neighbourhood, looking at the kind of topic or recurrent geotagged post or pictures that emerge within a group located in a specific area (Duncan et al., 2018).

Choosing among traditional, current, or emerging methods should be a major concern of the researcher. Each of these approaches has strength and limitations, and the researcher has the task to read the social and economic context of the area being studied in order to

choose a proper approach (Sampson, 2012). Furthermore, other than quantitative or qualitative, methods and tools to audit, and measure, the components of the built environment can be divided into "subjective" and "objective." To begin with, subjective methods encompasses investigation tools such as questionnaires and interview, while, objective methods relies on direct observations with checklist or official dataset gathered trough primary or secondary sources (Dunkan and Kawachi, 2018).

Objective observations can be conducted in several manners, accordingly to the scale of the built environment we want to investigate. For instance, GIS data are very useful and precise at a large scale and they are free of errors, however, GIS data are limited if the researcher want to explore a causal pathway, or mechanism (Gullon and Lovasi, 2018). Also, direct observations encompass audit tools to measure a specific or a set of features of the built environment such as sidewalks, density, aesthetics, physical disorder, traffic, littering, etc… An example of audit tool at a street-scale is provided by Browson et al. (2003), they developed this tool to understand the relationship between physical environment and physical activities, measuring factors such as types of recreational and non-recreational destinations, sidewalk quality, littering, presence of natural elements, and public transit. Additionally, new virtual tools are emerging for measuring the built environment, these include wearable geospatial technologies, crowdsourcing geospatial data from virtual community, social media (google earth and view, facebook, twitter, instagram) and other internet sources (Duncan and Kawachi, 2018). These virtual instruments seem to be a fast, cheap, reliable and promising way for evaluating objective dimensions of the built environment (Charreire et al., 2014).

Subjective observations include surveys and interviews to the population being studied. Subjective observations are even more useful when coupled with objectives ones (Gullon et al., 2014) to get rid of source bias. Survey and interviews for assessing people perceptions of the components of the built environment (e.g., access to destinations or retail/food stores, distance to public transportation, safety, aesthetics) are really useful when the research wants to narrow the investigation to a specific topic, also, these subjective observations allow the researcher to better understand psychosocial and behavioral patterns within the community being studied (Kerr et al 2016; Blacksher & Lovasi, 2012).

2.6.1. Metrics for assessing perceived health and well-being within the neighbourhood

Kunst et al. (2001) provide a list of useful sources of health information for capture and analysing health features of a specific population as a community living inside a neighbourhood. Among these sources: birth and deaths registries (for mortality and life expectation), cause-of-death registries, wellbeing/health/quality of life surveys, health interview surveys, health examination survey, health care registries (incidence, prevalence and fatality of a certain disease), disease registries, health surveillance systems, and social security registries (to understand work disabilities).

Self-reported surveys for assessing physical and mental health varies in scope and number of items, and they are often used in public health and more recently in urban studies as well as Body Mass Index[41]. Through a structured literature review, Krefis et al. (2018) point out that the studies

[41] According to the Center for Disease Control and Prevention (CDC, 2017a), the Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters. BMI is a reliable indicator for health and an easy method to screen individuals by their weight. Although using the same formula, BMI is interpreted differently for children, teens, and adults. For the purpose of this study, we are going to measures BMI for adult individuals. Specifically, for adults, the BMI measures range from below 18.5 (underweight), 18.5 to 24.9 (normal or healthy weight), 25 to 29.9 (overweight), and 30 or above (obese). BMI is not directly correlated with body fat; however, it is moderately correlated with measures of body fat obtained from skinfold thickness measurements, bioelectrical impedance, densitometry, etc…BMI is strongly correlated with various metabolic and disease outcome. The CDC (2018) points out that obese subjects (BMI= 30 or above) are more exposed to all-causes of death, high blood pressure (Hypertension), high LDL cholesterol, low HDL cholesterol, high level or triglycerides, type 2 diabetes, coronary heart disease, stroke, Gallbladder disease, osteoarthritis, sleep apnea and breathing problems, chronic inflammation and increased oxidative stress, some cancers, low quality of life, mental illness such as clinical depression, anxiety, body pain and difficulty with physical functioning.

about the relationship between urbanization and health assessed the level of perceived individual's health and wellbeing through two questionnaires: (2) health was mostly assessed by the General Health Questionnaire (GHQ-12), (2) well-being was mostly assessed by using the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS).

The SF-12[42], it is a 12-items short-form survey (abbreviated from the 36-item short-form) for surveying health status in the Medical Outcomes Study. The SF-12 is useful for clinical practice and research, health policy evaluation and general population survey. The survey SF-12 to assess Quality of Life and physical and mental health is highly reliable and already validate through the years. According to Ware and Sherbourne (1992) the scoring standardized responses to standardized questions is an efficient way to measure health status, including the Italian[43] version of the SF-36 that was validated by Apolone and Mosconi (2000). In addition, the Warwick-Edinburgh Mental Well-Being Scale[44] (WEMWBS) was developed in 2006 by the Universities of Warwick and Edinburgh in order to monitoring, and assess, the wellbeing in the general population and the evaluation of projects, programmes and policies aiming to enhance mental wellbeing. The survey encompasses 14 items each one respectively scored from 1 to 5 (the lower score the worst wellbeing), the total score is the sum of the partial score for each question, thus the WEMWBS range from 14 (poor) to 70 (high). Various studies outline that the WEMWBS features robust psychometric properties, it is able to capture the concept of wellbeing both in feeling and functioning, and it is sensitive to changes that occur in wellbeing promotion projects. Also, according to major studies the WEMWBS is normally distributer in the general population. In Italy, the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) was validated by Gremigni and Stewart-Brown (2011). Their results show that the Italian WEMWBS features high correlation with other mental health and well-being scales ($p < 0.01$), good reliability, internal consistency and stability, as well as good psychometric qualities. Thus, we can say that the Italian WEMWBS showed to be an appropriate instrument for assessing mental well-being at population level.

Perceived health is a powerful indicator of the quality of the urban environment. A strength of self-reported surveys relies on their capacity to provides a comprehensive picture of the *lived realities* of the respondents (Duncan et al., 2018), indeed, psychologists showed that people's behaviour is more influenced by their perceptions of the built environment than the objective reality. Through a quantitative self-reported survey[45] to assess air quality in an industrial neighbourhood, Elliott et al. (1999) described how powerful is the community perception of health risk, and how it is reliable. Also, the opportunity to aggregate many respondent's perception on a specific area (neighbourhood) is a useful method to make inference on the relationship of built environment factors and health. However, weakness of self-reported surveys lies in their validity, especially if the investigation tool used for the research is new, and the properties of the items have not been evaluated; besides, self-reported surveys are often characterized by self-reported bias (Duncan et al., 2018). Self-reported surveys were used in the he Life Course Built Environment and Health (LCBEH) project

[42] The SF-12 aims to assess the following eight different health concepts: physical functioning, role limitations due to physical health problems, bodily pain, general health perceptions, energy/fatigue and vitality, social functioning, role limitations due to personal or emotional problems, emotional wellbeing.

[43] Findings from a wide array of studies and diseases indicate that the performance of the questionnaire improved as the Italian translation was successfully revised meeting the standard suggested by the literature in terms of feasibility, psychometric tests, and interpretability. Thus, we can say that the Italian survey is as valid and reliable as the original instrument and applicable and valid across age, gender, and variety of disease.

[44] The original English form of the WEMWBS can be accessed at the following link: https://warwick.ac.uk/fac/med/research/platform/wemwbs/wemwbs_14_item.pdf. An Italian form of the WEMWBS can be downloaded by the following link: https://warwick.ac.uk/fac/med/research/platform/wemwbs/researchers/languages/wemwbs-italiana.pdf.

[45] The survey developed by Elliott et al. (1999) was designed to document the health risk perceptions of the members of a community in Hamilton (Ontario, Canada) about air quality in their neighbourhood. The results of the survey confirm that community's concerns about air quality were legitimate.

which explores the impact of the built environment on self-reported and objectively measured health outcomes in a random sample of people across the life course Villanueva et al. (2013).

2.6.2. Operational definitions of neighbourhood as a unit of study

The operational definition of neighbourhood is a challenging topic in public health research. How to operationalize the neighbourhood is the starting point for investigating neighbourhood health effect; however, up to date, there is a lack of agreement on the operational definition of neighbourhood in public health research (Duncan, Regan, and Chaix, 2018). The operational definition of neighbourhood should be selected considering the specific research question and the health outcome being studied (Duncan, Regan, and Chaix, 2018). However, even back in the early XX Century, McKenzie (1923) highlighted that the definition of neighbourhood is a volatile concept in social science research. The way the researchers define neighbourhood can lead to a "spatial misclassification" problem or as Duncan, Regan, and Chaix (2018) sustain: a "incorrect characterization of a neighbourhood-level exposure based on the neighbourhood definition used" (p. 20). Specifically, the spatial misclassification problem can compromise the validity of the study if the researchers don't consider the specific socio-political and economic context being studied, neighbourhood size, and specific spatial polygamy (Duncan, Regan, and Chaix, 2018). In particular, spatial polygamy refers to the concept that individuals are exposed to many neighbourhoods, not just their residential one. For instance, people can choose to live in a specific neighbourhood, but work and play, or visit in another one. Consequently, people are exposed to many neighbourhood environments that exert multiple effect on health.

Operationalizing the neighbourhood is challenging, and it is crucial to define neighbourhood as a unit of study through its potential boundaries. Duncan, Regan, and Chaix (2018) describes four methods to define neighbourhood boundaries:

- Perceived boundaries (surveys and participatory mapping tool);
- Administrative boundaries (all individuals who live in the same census tract are assigned the same exposure measure);
- GIS-Based Buffer neighbourhood definitions (neighbourhood as a radius of the particular location being studied);
- Activity space neighbourhood definitions (set of spatial locations visited by an individual corresponding to his/her exhaustive spatial footprint).

For the scope of this research in terms of urban policy the unit of analysis in this study will reflect an administrative[46] definition. This choice is due to the administrative boundaries are also policy-relevant boundaries, therefore, administrative boundaries are the metrics for funding public health interventions and policy. Identifying neighbourhood's boundaries as a target area of action is the key for achieving public health in the urban regeneration field.

2.7. Health-related Studies in the Urban Regeneration Field

"Urban regeneration" entered the British lexicon in 1970 (Tallon, 2013), and since then urban regeneration practices have been adopted worldwide with different scopes (Porter and Shaw, 2009). Roberts, Roberts, and Sykes (2000) define the concept of urban regeneration as the process of reversing social, economic, and physical decay in distressed and deprived urban areas. Urban regeneration as well as urban planning can enhance the social, economic and built environment through appropriate programs, or interventions (Tallon, 2013). Since its inception, research and practices in the urban regeneration field has firmly established it as a branch of urban studies that

[46] Administrative boundaries for the entire sub-municipal area being studied, and vvariations in health were registered according to a spatial aggregation relaying on perceived neighbourhood boundaries indicated by respondents.

investigate how to improve the conditions of deprived pockets within urban areas (Porter and Shaw, 2009).

Recently, urban regeneration researchers are shading light on how urban program or interventions in urban areas affect the social determinants of health improving health levels and health equity for the communities targeted by urban regeneration interventions (McCartey et al., 2017). Through a structured literature review on 1382 citations, McCartey et al. (2017) identified 46 studies showing evidence about the impact of urban regeneration on health, health inequalities and their determinants. From the analysis of these studies, it come out that most of the existing urban regeneration approaches have low participant response rates and lack longitudinal follow up, both of which impact the quality of the generated data. Also, up to date, it seems that most of the urban regeneration interventions for health focused on housing refurbishment for improving health, lacking the complexity needed to enhance health. In addition, Porter and Shaw (2009) highlight that often these housing-oriented urban regeneration interventions can trigger undesirable phenomenon of social stratification (e.g., gentrification), unbalancing the socioeconomic structure of the community being affected by the regeneration interventions.

A considerable part of the relevant literature is investigating how regeneration can enhance individuals' level of moderate and intense physical activities, as these are strongly associated to physical and mental health (Mackenbach, 2018). Kramer et al. (2017) point out that urban regeneration programs can stimulate leisure-time walking which is comparable to a form of moderate physical activity; this could be done with urban regeneration interventions such as improving sidewalks, trails, parks, lighting, presence of trees and green spaces, etcetera. Furthermore, Diaz Roux (2003; 2007) asserts that there exists multiple mechanisms through which regeneration programs can affect community health, among these: enhancing accessibility to recreational spaces for increasing opportunities for the community to practice moderate and intense physical activities, providing economic support for low-income individuals to buy healthy food, improving the design features of the built environment to make it safer and cleaner, incentivize active modes of transportation to decrease car traffic and pollution. Moreover, it is emerging that the built environment plays a crucial role for physical activities (Ewing, 2005; Frank et al., 2005; Transportation Research Board of Washington, 2005; Florida 2016) as urban factors such as land use density, accessibility in term of proximity from destination or facilities, design features, aesthetics and transportation patterns facilitate or constraint population likelihood to practice physical activities (Lavin et al., 2006).

Health and health equity seem to be the next focus in urban studies, specifically, in the urban regeneration field. Indeed, a growing body of research in urban regeneration is investigating the impact of regeneration programs on the determinants of health, health inequalities and well-being (Parry and Judge, 2005; Beck et al., 2010; Egan et al., 2010; White et al., 2014; McCartey et al., 2017). As a matter of fact, in the last decade there has been an increase in researches focused on the relationship between residential location and health (Frumking, Lawrence and Jackson, 2004; Grant & Braubach; 2010; Pineo, 2018), also in non-health sectors such as urban planning, urban regeneration, and urban policy (Diaz Roux, 2003, 2007; Parry and Judge, 2005; Berrigan and McKinno, 2008; Beck et al, 2010; Capolongo, 2014; Wizemann, 2014; D'Alessandro et al., 2015; McCartey et al., 2017; Kramer at al., 2017; D'Onofrio and Trusiani, 2017; Krefis et al., 2018)

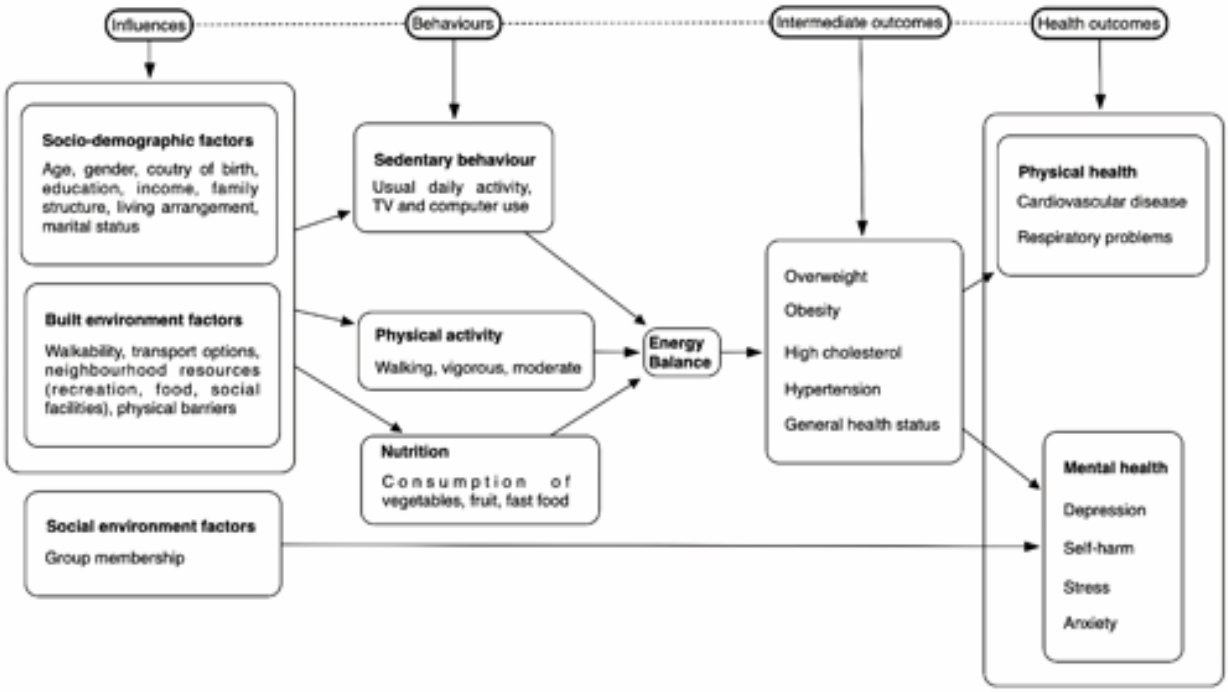
Lately, to measure the health impact of an urban regeneration program, researchers and practitioners adopt Health Impact Assessment, or HIA, a relatively new kind of evaluation, or decision-support tool, aiming to capture the potential changes in a specific population health due to the implementation of policies or projects. HIA is a multidisciplinary approach aiming to protect population health through the analysis and evaluation of the impacts of programs, practices, and

projects. According to the WHO[47], the HIA tool can be used in different fields such as agriculture, air, culture, economic and social development, energy, housing, integrated impact assessment, mining, noise, social welfare, tourism, transport and communications, waste, water, and other subjects. Specifically, in the urban regeneration field, Serrano et al (2014) used the Health-Impact-Assessment (HIA) on local residents to explore the health benefits of two urban regeneration programs in the Pasaya Bay (Gipuzkoa, Spain). The first program refers to the development of a new fish market, and it was used as a positive case study, while the second program was the regeneration of a port area North/West Herrerain the same region, which was affected by delays. To assess the health impacts of the two projects, Serrano et al. (2014) identified four different thematic areas such as urban quality, connectivity, social cohesion, and employment. Furthermore, they considered the specific socio-political context were the projects happened. Their findings suggest that the two regeneration programs produced different health impacts, positive for the first, while negative for the second. Indeed, if the new fish market brought new public spaces, improving urban quality and social cohesion, the stagnation of the regeneration of the port area brought ulterior deprivation, with the negative consequences for safety, poor health and negative social outcomes.

2.8. Connecting Urban Regeneration and Health

Villanueva et al. (2013) sustain that the built environment is increasingly recognized as being associated with health outcomes. Relationships between the built environment and health differ among age groups, especially between children and adults, but also between younger, mid-age and older adults. Yet few address differences across life stage groups within a single population study. Moreover, existing research mostly focuses on physical activity behaviors, with few studying objective clinical and mental health outcomes.

Fig. 9: The Life Course Built Environment and Health (LCBEH) project.



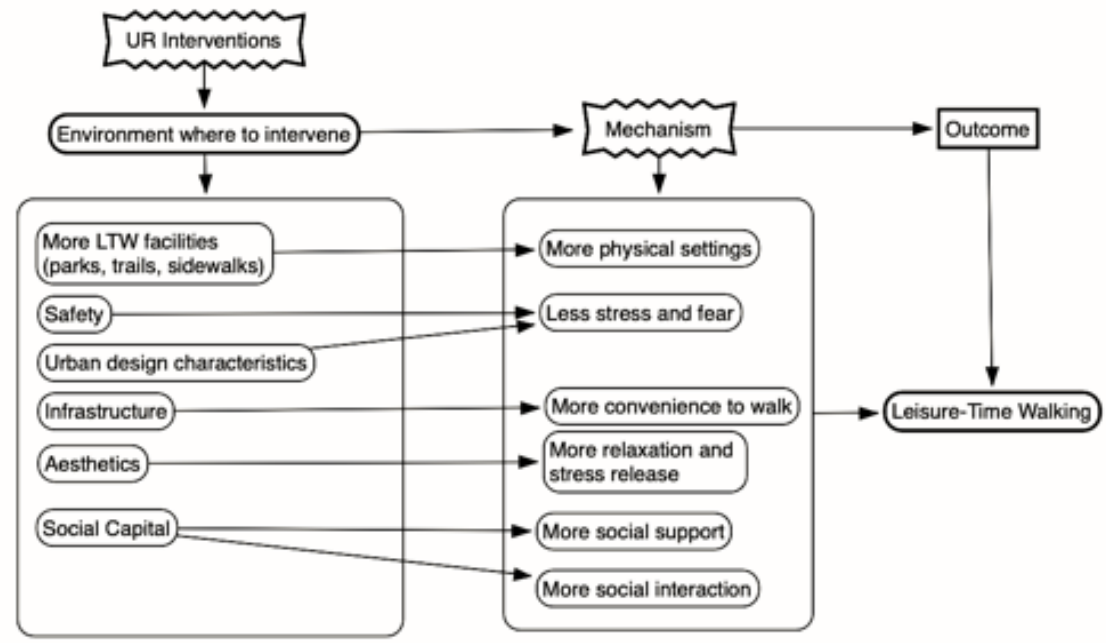
Source: Author's elaboration.

The Life Course Built Environment and Health (LCBEH - Fig. 9) project explores the impact of the built environment on self-reported and objectively measured health outcomes in a random sample of people across the life course. This study was conceptualised using the theoretical

[47] http://www.who.int/hia/examples/en/

framework outlined in figure 1. Specifically, the goal was to assemble data that would permit the examination of associations between the built environment and: (1) behavioural and protective behaviours (e.g., physical activity, nutrition, sedentary behaviour); (2) self-reported health status (e.g., weight status, physical health, injuries, chronic conditions, mental health) and (3) objectively measured health outcomes (e.g., cardiovascular events, respiratory problems, anxiety, depression, mental health) for children, young adults, adults and older adults.

Fig. 10: Pathways to Leisure Time Walking according to Kramer et al. (2017).



Source: Author's elaboration.

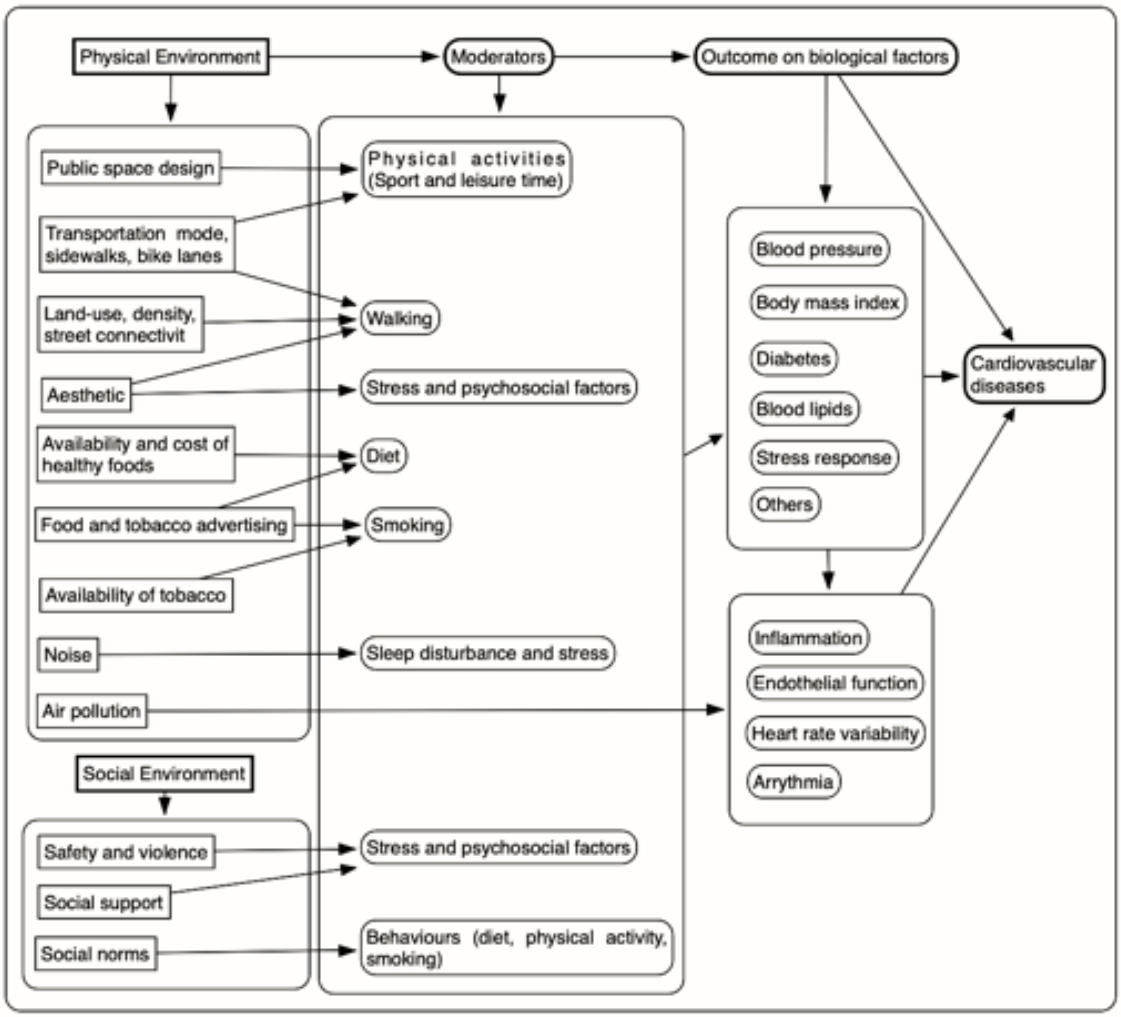
Kramer et al. (2017) point out that urban regeneration programs can stimulate Leisure-time Walking (LTW) which is compared to a form of moderate physical activity. Kramer at al. (2017) to outline evidence-based pathways through which urban regeneration can provoke increasing levels of Leisure Time Walking (LTW) in communities within deprived areas. These pathways are the following: (1) urban regeneration aiming to increase neighbourhood safety and improve the quality of the built environment reduce people's fear to walk, thus, stimulating LTW; (2) urban regeneration aiming to improve neighbourhood's connective infrastructures produces a more convenient environment where to walk, thus, stimulating LTW; (3) urban regeneration aiming to increase the quantity and quality parks, trails, sidewalks, public spaces could enhance neighbourhood quality, stimulating LTW; (4) urban regeneration aiming to fuel social capital provides to increase the level of social support for walking, and social interaction while walking, thus, stimulating LTW.

Through a realist review (a new method of systematic review designed for complex policy interventions), Kramer et al. (2017) found out that neighbourhood factors such as safety problems, poor aesthetics, poor infrastructure, and lack of sidewalks, trails, local parks, and public spaces are constraints for neighbourhood walkability (Fig. 10). However, only very few of these studies focus on how urban regeneration programs affect LTW. Kramer et al. (2017) outline the following set of interventions trough which urban regeneration can influence individuals' level of Leisure Time Walking: (1) increase the presence and quality of the infrastructure and spaces for walking such as sidewalks, trails, and local parks; (2) decrease the fear for walking due to antisocial behaviours within the neighbourhood such as burglary, vandalism, assault, drug dealing, drunken people, and youth gangs; (3) increase lighting in the street to reduce fear of walking in the neighbourhood; (4) reorganize area dense of trees and isolated which can cause fear; (5) decrease car traffic; (6) decrease the number

of stray dogs' people are nervous and afraid about they can be attacked in some walking route), also these levels of fear seem to be higher for women and for people that walk alone instead of walking in group or with others.

Diaz Roux (2003) sustain that there exist multiple mechanisms through which neighbourhood physical and social features of the residential environments affect cardiovascular health. Summarizing existing research related to residential environments to cardiovascular outcomes and risk factors, Diaz Roux (2003; 2007) highlights the association between neighbourhood socioeconomic characteristics and cardiovascular disease, the effects of residential environments on physical activity, and the effects of residential environments on diet. Also, she outlines challenges in investigating the relationship between residential environments and health, including the conceptualization and measurement of relevant features of the built environment and the definition of a proper geographic scale for investigating the effect of the built environment on health.

Fig. 11: Pathways to health according to Diaz Roux (2003; 2007).



Source: Author's elaboration.

Neighbourhood environment and individual's psychosocial factors interact affecting leisure-time walking. In their cross-sectional study, Beenackers et al. (2014) explore how urban form features can affect individuals' level of Leisure-Time Walking. Based on survey data from adults (25-74), and systematic field observations, they relate urban form characteristics (accessibility, safety, comfort, and pleasurably) and individual psychosocial factors (attitude, self-efficacy, social influence, and intention) to Leisure-Time Walking (sufficient Leisure-Time Walking and and Any Leisure-Time Walking). Their findings suggest that urban form and individuals' psychosocial factor are somehow

correlated, and this interaction seems to increase LTW in residents with less attitude to practice physical activities.

2.9. Lacuna in the Urban Regeneration Literature

Urban regeneration programs have a strong potential to positively impact public health. Yet, McCartney et al. (2017) affirm that little is known about how urban regeneration can affect health as the urban regeneration literature on the topic is still limited. Krefis et al. (2018) highlight that there is a lack of interdisciplinary approaches the complexity of urban structures and dynamics and their possible influence on urban health and well-being. Likewise, Von Szombathely et al. (2017) sustain that researchers need better conceptions capable of capturing and addressing the complexity of urban structures for health. Furthermore, there is a lack of agreement on what is the most effective method to foster health within the neighbourhood (Srinivasan at al., 2003; Gullon & Lovasi, 2018), especially in the urban studies field (Krefis et al., 2018), including urban regeneration (McCartney et al., 2017). In addition, both in public health and urban studies field there is an open debate between who prioritize the socioeconomic determinants of health to the spatial ones (Wilkinson, 1997; Kawachi et al., 1999; Leal and Chaix, 2011; Jokela, 2014; Murtin et al., 2017; Kivimäki et al., 2018), while other research perspectives look at the determinants of health in a systemic way in order to embodies the complex dynamics behind the relationship between neighbourhood and health (Hancock, 1985; Whitehead and Dahlgren, 1991, 2006; Macintyre et al., 2002; Northridge et al., 2003; Barton and Grant, 2006; Sallis et al., 2008; Grant and Braubach, 2010; Von Szombathely et al., 2017). In summary, the relevant urban studies and urban regeneration literature seems to suffer from interpretative and methodological issues when referring to a comprehensive compositional and contextual distinction of the determinants of health, this is due to the late emergence of health as a priority for the fields. Thus, the topic deserves to be further explored, especially at a neighbourhood level where there is a lack of empirical studies (Graham & Kelly, 2004; McCartney et al., 2017). In particular, the current literature in urban regeneration is silent in regard to a comprehensive urban regeneration scheme aiming to enhance public health at the neighbourhood level as a primary objective.

2.10. Adopting a Theoretical Perspective for the Purpose of this Study

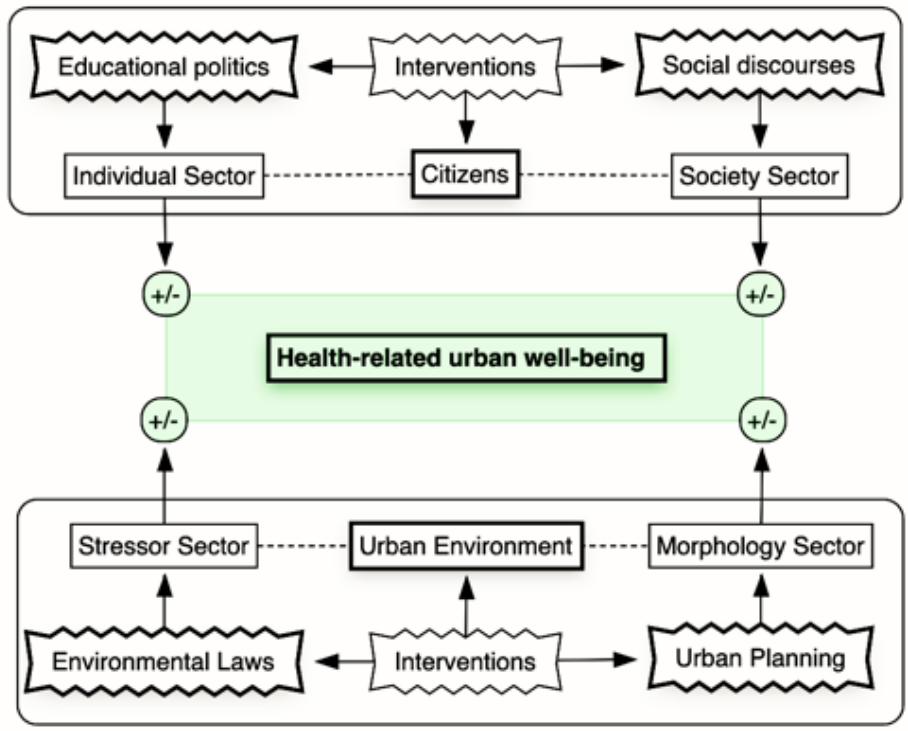
The relationship between neighbourhood and health seems to apply from a macro scale to a local level such as at the neighbourhood scale (Smith, 1974, 1975, 1977; Macintyre et al., 2002; Graham & Kelly, 2004; Bernard et al., 2007; O'Campo et al., 2014; Duncan and Kawachi, 2018; Kivimäki et al., 2018), namely, in residential areas where people spend most of their lives (National Research Council, 1981; Dannenberg et al., 2011). It is emerging in the relevant literature that neighbourhood's compositional and contextual factors such as urban form, design features, spatial and functional organization, transportation modes, and socioeconomic composition influence the degree of health and wellbeing of individuals and communities living within the neighbourhood (CDC, 2011; Lovasi, 2012; Costa et al., 2014; Hero et al., 2014; Duncan and Kawachi, 2018; Kivimäki et al., 2018). The focus of this research is on investigating how urban regeneration can provide a solid interpretative grid for identifying compositional and contextual factors within the neighbourhood that are relevant for health and wellbeing. The final outcome of this research is to identify a set of place-based interventions and guidelines that could indirectly affect public health and wellbeing at a local level.

To narrow this study to the specific factors responsible for such compositional and contextual explanations, the author adopted the conceptual model[48] (see Fig. 4 above in Chap.2.4) of Von

[48] Specifically, in Chapter 2 at 2.4. Recent conceptual approaches for investigating neighborhood and health.

Szombathely et al. (2017) as an overarching theory[49] for proposing a solid analytic distinction of the dimensions of Neighbourhood Advantage for Health. Since the unit of this study in this work is the neighbourhood, the author adopted the compositional and contextual explanations of geographical variation in health to explain variances in health achievement for communities living in different neighbourhoods. The model developed by Von Szombathely et al. (2017) provide a significant definition[50] of a generical urban environment as it could be the neighbourhood further proposing macro area for interventions for each dimensions of such hypothetical urban environment. Indeed, knowing what and how urban factors affect health is the key to understand causal inferences and their implications for policy interventions. However, differently from Von Szombathely et al. (2017) who proposed the model for multiple[51] urban scales, my conceptualisation of NAH focuses on appropriate neighbourhood-scale variables on which urban regeneration could intervene with tailor-based interventions.

Fig. 12: Modelling approach and interventions according to Von Szombathely et al. (2017).



Source: Author's elaboration of Krefis et al. (2018)

The analytic distinction (Fig. 12) proposed by Von Szombathely et al. (2017) was used as an underpinning foundation to fit a neighbourhood scale according to the methodological suggestions for measuring the neighbourhood health effect described by Duncan and Kawachi (2018) and the follow-up work of Krefis at al. (2018), but differs from other similar approaches mainly in the analytical distinctions it suggests. In addition, Von Szombathely et al. (2017) highlight that those compositional and contextual influences can be classified into four broad groups: "individuals'

[49] Specifically, the theory that I will use as a baseline for developing the theoretical perspective in this study is the conceptual modelling approach to health-related urban well-being developed by Von Szombathely et al. (2017). Specifically, this theory indicates that urban areas can be defined as a system encompassing two main dimensions, namely, "citizens" and "urban environment." The extent of these two dimensions can affect positively, or negatively, the health-related urban well-being of the community living within the urban area. The rationale behind this construct was to tackle the *duality* of composition and context which is a challenging topic in public health and urban planning research[49] (Duncan and Kawachi, 2018).

[50] Von Szombathely et al. (2017) provide explanations for the internal dynamics occurring in the model further introducing a "vulnerability" filter that applies to the effect of each sector.

[51] Despite the conceptual model developed by Von Szombathely et al. (2017) introduces a robust definition of urban variables affecting health-related urban well-being, this conceptualization lacks a specific scale as the intention of the researchers was to provide a base for following studies to test empirically the significance of the model itself.

sector" and "community sector" for compositional influences while "built environment sector" and "natural environment sector" for the contextual ones. Interestingly, Von Szombathely et al. (2017) outline how interventions on a specific sector (Fig. 12) could influence public health where these occurred.

- Individual sector provides a list of the relevant variables from a medical perspective and their effect on public health. These variables are the following: education, income, age, gender, smoking/alcohol, nutrition, clothing mental and physical constitution, habituation, medical disposition. Interventions for the individual sector are related to educational politics.

- Society sector provides a list of the relevant variables from a sociological perspective and their effect on public health. These variables are the following: security, social network, household, supply, work, leisure, mobility lifestyle, modes of transport. Interventions for the society sector are related to social discourse.

- Morphology sector provides a list of the relevant variables from an urban planning perspective and their effect on public health. Variables for the morphology sector are public places, transportation infrastructure green and blue spaces, buildings and built structure, public and health infrastructure, emitters (including means of transport). Interventions for the society sector are related to urban planning.

- Stressor sector, or natural environment sector, provides a list of the relevant variables from an environmental perspective and their effect on public health. Variables for the stressor sector (natural environment) are noise, thermal environment, UV radiation, air pollutants, temperature, humidity, wind, precipitation. Interventions for the society sector are related to environmental laws.

Holding this sectorial perspective (Fig. 12) and looking at the potential outcome for urban regeneration, the author of study proposes to adopt the same analytic distinction for defining the Neighbourhood Advantage for Health (NAH) that is the main variable introduced in the next chapter of this study. Adopting the same perspective, the author assumes that whereas NAH occur it exert a positive or negative influence on public health and wellbeing. Kramer et al. (2017) and Diaz Roux (2003; 2007) developed very similar framework for describing how urban regeneration affect health. However, the model used to define NAH is based on the basic subdivision of the health determinants described by Macintyre et al. (2002) which relies on compositional and contextual explanations for geographical variations in terms of health between different urban areas. For the purposes of urban regeneration, the NAH model considers compositional and contextual factors grouping them according to the directions suggested by Barton & Grant (2006), Kramer et al. (2017) and Diaz Roux (2003; 2007) which define and describe the direct and indirect relationships through which compositional and contextual factors act on the health and wellbeing of the communities. To these I added all the urban elements relevant for health at the neighbourhood level. A comprehensive description of the NAH model, including all its variables and internal relations, is provided in chapter 3 (section 3.4.).

Chapter 3

3. THEORETICAL PERSPECTIVE

3.1. Aims and Objectives

This chapter aims to the formulation of a theoretical[52] perspective, namely, a framework for defining the concept of Neighbourhood Advantage for Health (NHA) which is the main variable investigated in this work. This research work relies on a *postpositivist*[53] perspective, the author used the literature review in a deductively manner as a basis for advancing main research question and hypotheses tackled in this work, and to provide appropriate interpretative grids for the construct of NAH. This theoretical perspective embraces prior studies about the dynamics between neighbourhood and health, attempting to achieve a balanced synthesis of public health and social epidemiology with the principles of urban planning. To doing so, the following steps were conducted:

- Investigate in the public health and urban studies literature which specific compositional and contextual factors of the neighbourhood are more relevant for health and wellbeing (chapter 2 - section 2.5.);
- Adopt an overarching theory able to embody the concept of Neighbourhood Advantage for Health (NAH) and provide an analytic distinction of the dimensions and factors of such as construct;
- Script out and visualise the theoretical model and the variables on which this study relies;
- Generate a research question that bridges the independent and dependent variables being studied in order to observe the extent to which the independent variables influence the dependent variable.

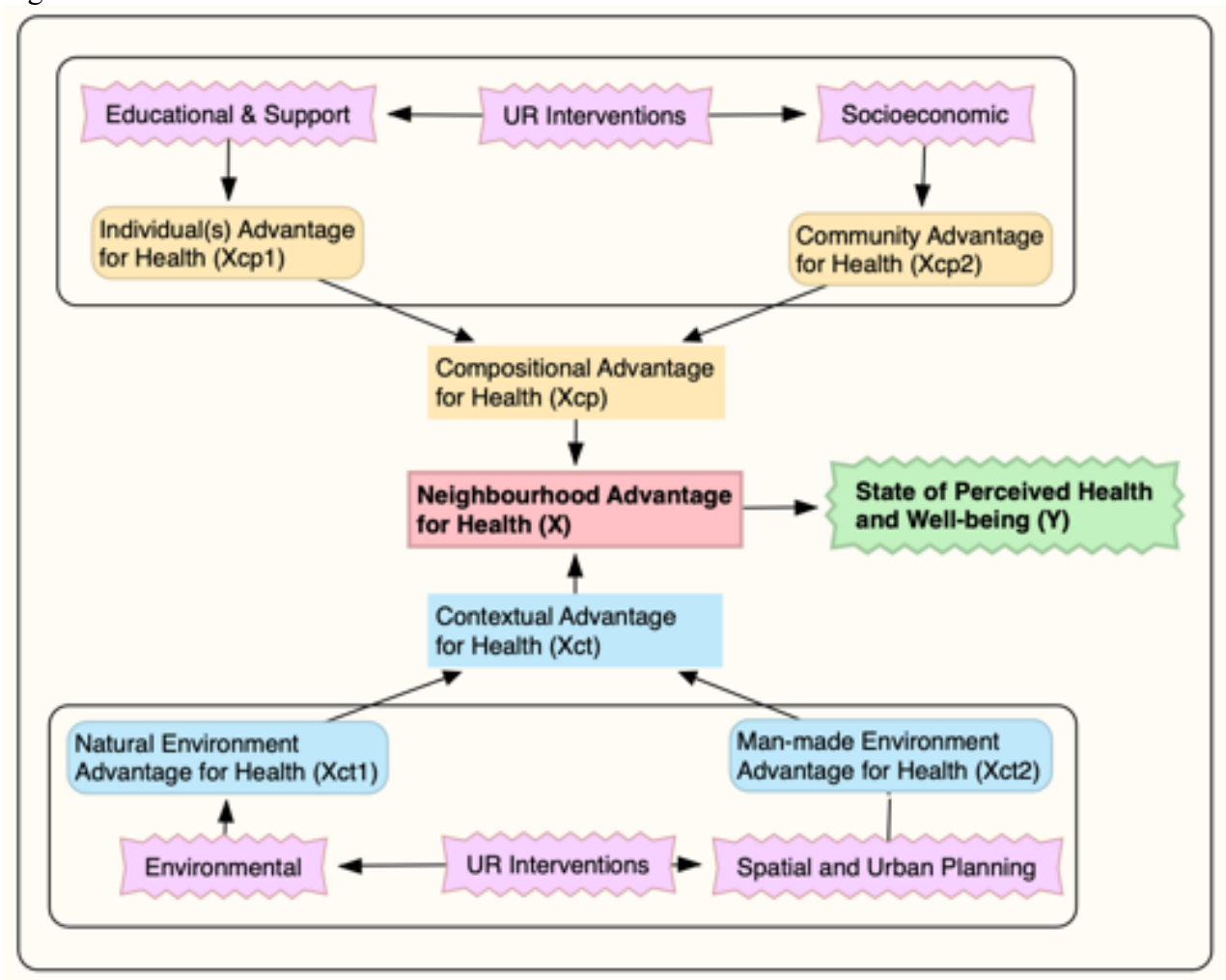
3.2. Introducing Neighbourhood Advantage for Health (NAH)

The relevant literature suggests that community health and wellbeing is influenced by residential location as there exist individuals, socioeconomic, built and natural environment factors within the neighbourhood that are conducive or harmful for community health and wellbeing. Accordingly, we can say the extent of such factors could exert a positive or negative influence on public health and wellbeing within the neighbourhood. Thus, it is self-evident that when these compositional and contextual factors are properly present and distributed within the neighbourhood then there exists an edge, or an advantage, for the neighbourhood in term of health and wellbeing for the resident community. Holding this perspective, this research introduces the concept of Neighbourhood Advantage for Health (NAH) with the intension of providing an interpretative grid to define NAH and guidelines for fostering NAH through a set of *direct* interventions for urban regeneration to shape *indirectly* health and wellbeing at the neighbourhood level. The construct of NAH relies on specific compositional and contextual factors within the neighbourhood that are more relevant for health and wellbeing. The theoretical model in Fig. 13 approaches the explanation of neighbourhood effect for health in terms of Neighbourhood Advantage for Health, which is the outcome of compositional and contextual explanations. Compositional explanations refer to Compositional Advantage for Health (Xcp), namely, a-spatial dimension which indicate characteristics of the individuals and community

[52] A theory intended as "a set of interrelated constructs, variables, definitions, and propositions that presents a systematic view of phenomena by specifying relations among variables, with the purpose of explaining natural phenomena" (Kerlinger, 1979, p. 64).
[53] According to Creswell (2013), post positivism "hold a deterministic philosophy in which causes (probably) determine effects or outcomes. Thus, the problems studied by postpositivist reflect the need to identify and assess the causes that influence outcomes" (p. 38).

living within the sub-neighbourhood; conversely, contextual explanations refer to Contextual Advantage for Health (Xct), a spatial dimension of the neighbourhood which refers to the man-made and natural environment existing within the neighbourhood. These *advantages for health* within the neighbourhood are the dimensions which are responsible for Neighbourhood Advantage (X) for Health and they have been described in the figure below (Fig. 13). The author of this study assumed that if there exist asymmetries in health between communities of different neighbourhoods, then it is possible to explain such asymmetries by the extent of the variations in *compositional and contextual advantages for health* between neighbourhoods. Compositional Advantage for Health (Xcp) and Contextual Advantage for Health (Xct) can be further categorized into four broad groups: Individual(s) Advantage for Health (Xcp1) and Community Advantage for Health (Xcp2) as compositional advantages; while, Man-made environment Advantage for Health (Xct1) and Natural environment Advantage for Health (Xct2) as contextual advantages. As applied to this study, this theoretical perspective holds that there exist variations in health among different communities that are due to extent of the quantitative variations of compositional and contextual factors of NAH within the respective neighbourhoods in which these communities live.

Fig. 13: Theoretical model of NAH.

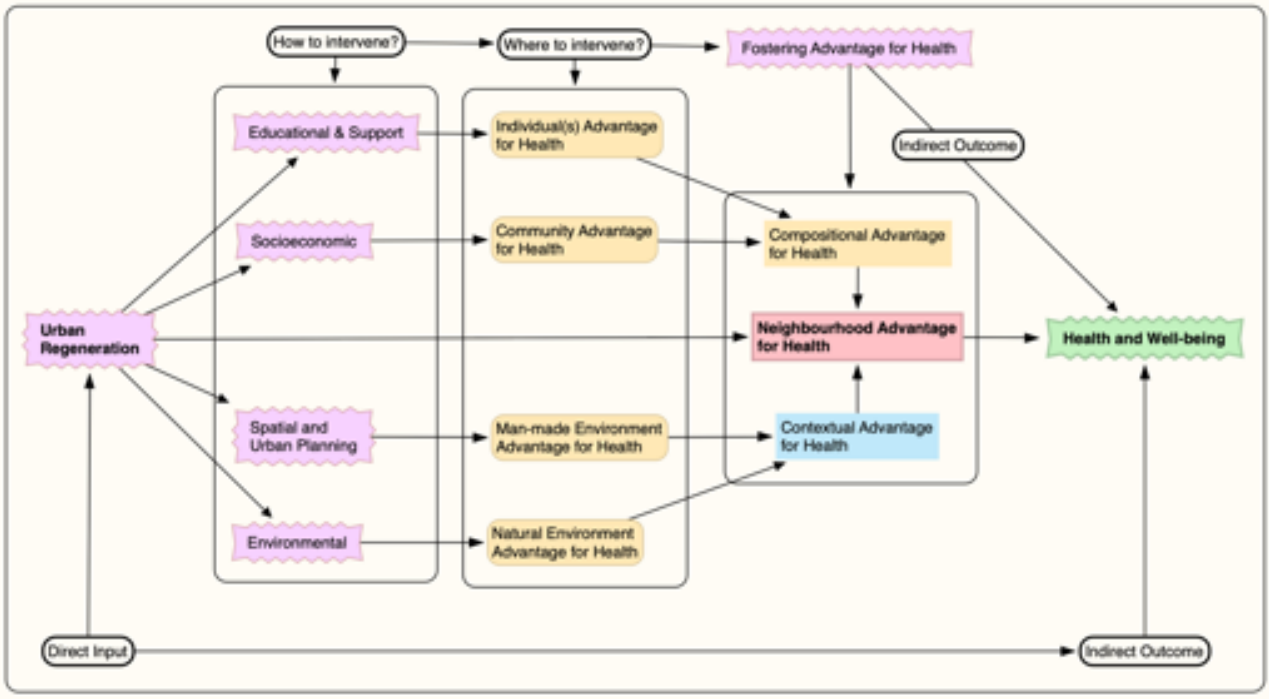


Source: Author's elaboration.

The theoretical model in Fig. 13 above systematize the relevant dimensions of NAH in order to offer proper interpretative grids for introducing and observing the NAH as a specific entity defined by measurable dimensions. Such a theoretical model relies on the methodological perspective of Macintyre et al. (2002) and Duncan and Kawachi (2018) and the conceptual framework of Von Szombathely et al. (2017) enhanced with the insights of Krefis at al. (2018). To begin with, this study

adopted the methodological perspective of Macintyre et al. (2002) and Duncan and Kawachi (2018) who sustain that there exist contextual and compositional explanation for variations in health between groups by place of residence[54]. Specifically, the author assumed that if it is true that there exist compositional and contextual explanations for geographical variations in health, then we can define such variations as an *advantage*. In this theoretical perspective, an "advantage" is defined as something that puts an entity A in a better position than entity B[55], thus, when referring to an advantage the author intends to a positive distance. As applied to the theoretical perspective proposed in this study, such a positive distance is the gap that define the geographical variations in health across communities living in different neighbourhoods within in a generic urban area. Also, differently from other studies focused on neighbourhood disadvantage as a negative socioeconomic and physical condition, the author intends the NAH as a positive condition for the neighbourhood.

Fig. 14: Theoretical model of NAH and interventions.



Source: Author's elaboration.

Advantage or disadvantage are recurrent terms in social science to identify asymmetries and variations between two or more entities. In this particular case, the entity being observed is the *neighbourhood* as a unit of study, while the dynamics being studied refers to the variations of these factors responsible for the NAH across different neighbourhood. This is the main assumption on which relies the concept of Neighbourhood Advantage for Health. In addition, differently the model of Von Szombathely et al. (2017) that do not establish a specific urban scale for application, the theoretical model of NHA proposed in this research study (Fig. 13) focuses on a neighbourhood scale using the methodological suggestions of Duncan and Kawachi (2018) to operationalize the neighbourhood as a unit of study. Furthermore, for adapting the model to the final purposes of urban regeneration, the theoretical model of NAH considers compositional and contextual factors according

[54] Bonnefoy et al. (2007) describes these differences, between and within societies, as health equity strata that can be grouped in the following four main types: (1) socioeconomic groups (sub-grouped in education, occupation, income, consumption, expenditure, wealth, assets), (2) gender groups, ethnic groups (sub-grouped in ethnic, racial, tribal, caste, religious and national origin groups, (3) place of residence (sub-grouped in urban, semi-urban, rural, northern or southern regions). Graham (2004a; 2004b, 2005) and Graham & Kelly (2004) classified health inequalities into the following three groups: (1) health disadvantage (health differences between and within societies); (2) health gaps (health differences between the worst off and everybody else); (3) health gradient (focusing on the health differences all the throughout the social spectrum of the population).

[55] Retrieved at https://www.collinsdictionary.com/it/dizionario/inglese/advantage

to the suggestions by Kramer et al. (2017) and Diaz Roux (2003; 2007) who define and describe the *indirect*[56] relationships through which compositional and contextual factors influence health and wellbeing within a generic urban area. Finally, the theoretical model of NAH encompasses all the urban factors that emerged in the literature review as relevant to health and wellbeing at the neighbourhood level (section 2.5.1 - 2.5.2).

Fig. 14 above relies on the theoretical model of Fig. 13, outlining a scheme for fostering NAH at the neighbourhood level. This scheme proposes direct interventions for each dimension of NAH that can indirectly affect health and wellbeing within the neighbourhood. The scheme in Fig. 14 can be a useful paradigm to expand in the urban regeneration field as it encompasses the main urban dimensions tackled by urban regeneration[57] such as the social, economic, and physical dimension of a generic urban settlement (Roberts, Roberts, and Sykes, 2000; Tallon, 2013). In particular, this scheme is useful for the purpose of this study since the current literature in urban regeneration is silent in regard to a comprehensive urban regeneration framework aiming to enhance public health at the neighbourhood level as a primary objective. Thus, the model of NAH can fill in the gap in the literature and, at the same time, it can provide policy-makers with a solid framework to deliver place-based interventions and guidelines that could indirectly affect public health and wellbeing at a local level.

3.3. Theoretical Model of NAH and Variables

The headline argument in this study was the following: "greater the Neighbourhood Advantage for Health (predictor X), higher the State of Perceived Health and Wellbeing (predicted Y) of the community living within that neighbourhood." Following this rationale, the two main variables considered in this study are defined as follows: "Neighbourhood Advantage for Health" (NAH within the neighbourhood - independent variable X) and State of Perceived Health and Wellbeing (SPHW of the community - dependent variable Y).

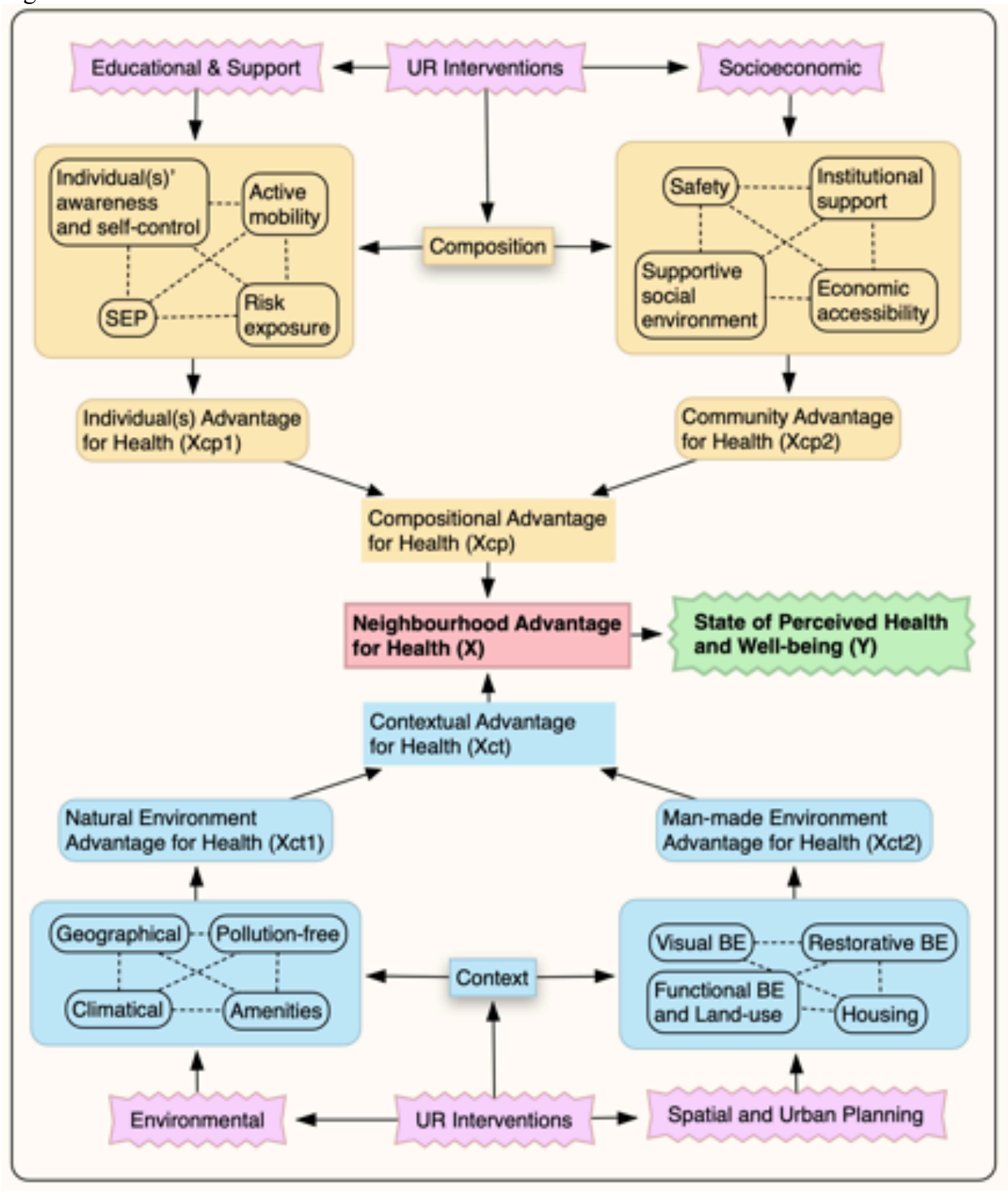
To observe *if* and *how* NAH associate to SPHW, this study examined the relevant literature in urban studies and public health field searching for neighbourhood factors[58] relevant for community health and wellbeing which could be grouped in compositional and contextual categories[59]. In particular, factors within the compositional category refer to *predictors of health* such to genetic, behavioural, and socioeconomic traits of the residents, and social and community environment; while contextual factors encompass physical and natural features of the neighbourhood referring to *predictors of health* such as urban forms and land-use patterns, urban design and aesthetics, transportation arrangements, and the quality of the natural environment including air, water and soil pollution levels. Then, I put the identified factors in form of variables. These variables have been selected according to their pre-established *indirect* relationship with health and wellbeing according to the suggestions[60] (section 2.8) by Kramer et al. (2017) and Diaz Roux (2003; 2007).

Fig. 15 depicts compositional and contextual variables of NAH, but grouped for macro areas of interventions (educational and support; socioeconomic; spatial and urban planning; environmental)

[56] See the indirect relationship in literature review Chap. 2.8.
[57] "Urban regeneration" entered the British lexicon in 1970 (Tallon, 2013), and since then urban regeneration practices have been adopted worldwide with different scopes (Porter and Shaw, 2009). Since its inception, research and practices in the urban regeneration field has firmly established it as a branch of urban studies that investigate how to improve the conditions of deprived pockets within urban areas (Porter and Shaw, 2009). Roberts, Roberts, and Sykes (2000) define the concept of urban regeneration as the process of reversing social, economic, and physical decay in distressed and deprived urban areas. Urban regeneration as well as urban planning can enhance the social, economic and built environment through appropriate programs, or interventions (Tallon, 2013).
[58] Factors were grouped by their compositional and contextual nature in chapter 2 - section 2.5.
[59] See compositional and contextual factors in section 2.2.5.
[60] Kramer et al. (2017) and Diaz Roux (2003; 2007) define and describe the *indirect*[60] relationships through which compositional and contextual factors influence health and wellbeing within a generic urban area. These explanations can be found in Chap.2.

in an urban regeneration perspective. As emerged in the literature review, all variables are related to each other but this condition will not be considered in this study as the final aim of this work is to provide associations for developing specific urban regeneration interventions rather than causal explanations among the variables. However, differently from these two, the theoretical model of NAH is more comprehensive at a neighbourhood level as it was augmented with multiple perspectives and findings about the neighbourhood effect on health that were collected in the literature review. On following, a list of the variables considered in this study grouped for macro areas according to their nature. All variables were considered significant to being investigated at a neighbourhood level according to the finding in the literature review (chapter 2 - section 2.5.).

Fig. 15: Variables and macro-areas within the theoretical model of NAH.



Source: Author's elaboration.

⇒ Neighbourhood Advantage for Health (NAH - X)
It was intended as the average value of 64 variables included within Compositional Advantage for Health (Xcp - 32 variables) and Contextual Advantage for Health (Xct - 32 variables).

→ Compositional Advantages for Health (Xcp)
It encompasses all the relevant compositional factors within the neighbourhood, reflecting the average values of 32 variables. These variables can be grouped into the following two categories: Individual(s) Advantage for health (Xcp1) and Community Advantage for Health (Xcp2). Specifically, variables included in Xcp1 and Xcp2 are the following:

- Individual Advantage for Health (Xcp1)
  It provides a list of 16 relevant variables from a medical perspective and their effect on individuals' health and wellbeing. Such compositional factors were classified into four macro areas as follows: Individuals' awareness of the determinants of health (Q. 1 to Q. 7 in Survey B in Appendix 1 and Tab. 6 in Appendix 2); Socio-economic position -SEP- (Q. 8 to Q. 12 in Survey B in Appendix 1 and Tab. 6 in Appendix 2); Propensity to physical activity (Q.13 to Q.14 in Survey B in Appendix 1 and Tab. 6 in Appendix 2); Exposure to risk-factors for health (Q. 15 to Q. 16 in Survey B in Appendix 1 and Tab. 6 in Appendix 2).
- Community Advantage for Health (Xcp2)
  It provides a list of 16 relevant variables from a sociological perspective and their effect on community health and wellbeing. This category of NAH contains variables that from a sociological perspective can influence the level of health and well-being of the individuals and the community. Such compositional factors were classified into four macro areas as follows: Safety (Q. 17 to Q. 18 in Survey B in Appendix 1 and Tab. 6 in Appendix 2); Social support within the community (Q. 19 to Q. 27 - Survey B in Appendix 2 and Tab. 6 in Appendix 2); Institutional support (Q. 28 to Q. 30 in Survey B in Appendix 2 and Tab. 6 in Appendix 2); Economic accessibility (Q. 31 to Q. 32 in Survey B in Appendix 1 and Tab. 6 in Appendix 2).

→ Contextual Advantage for Health (Xct)
It encompasses all the relevant *contextual factors* within the neighbourhood, reflecting the average values of 32 variables. These variables can be grouped into the following two categories: Man-made Advantage for health (Xct1) and Natural Environment Advantage for Health (Xct2). Specifically, variables included in Xct1 and Xct2 are the following:

- Man-made Advantage for Health (Xct1)
  It provides a list of 16 relevant variables from an urban planning perspective and their effect on public health and wellbeing. I classified such contextual factors into four macro areas as follows: Visual man-made environment, or architectural and aesthetic features of the man-made environment (Q. 1 to Q. 4 in Survey C in Appendix 1 and Tab. 7 in Appendix 2); Functional man-made environment (Q. 5 to Q. 11 in Survey C in Appendix 1 and Tab. 7 in Appendix 2); Restorative man-made environment (social spaces for *resting* and for leisure time) (Q. 12 to Q. 14 in Survey C in Appendix 1 and Tab. 7 in Appendix 2); Housing (Q. 15 to Q. 16 in Survey C in Appendix 1 and Tab. 7 in Appendix 2);

- Natural Environment Advantage for Health (Xct2)
  It provides a list of 16 relevant variables from an environmental perspective and their effect on public health and wellbeing. I classified such contextual factors into four macro areas

as follows: Geographical (Q. 17 to Q. 19 in Survey C in Appendix 1 and Tab. 7 in Appendix 2); Climate (Q. 20 to Q. 24 in Survey C in Appendix 1 and Tab. 7 in Appendix 2); Pollution-free (Q. 25 to Q. 28 in Survey C in Appendix 1 and Tab. 7 in Appendix 2); Natural amenities (Q. 29 to Q. 32 in Survey C in Appendix 1 and Tab. 7 in Appendix 2).

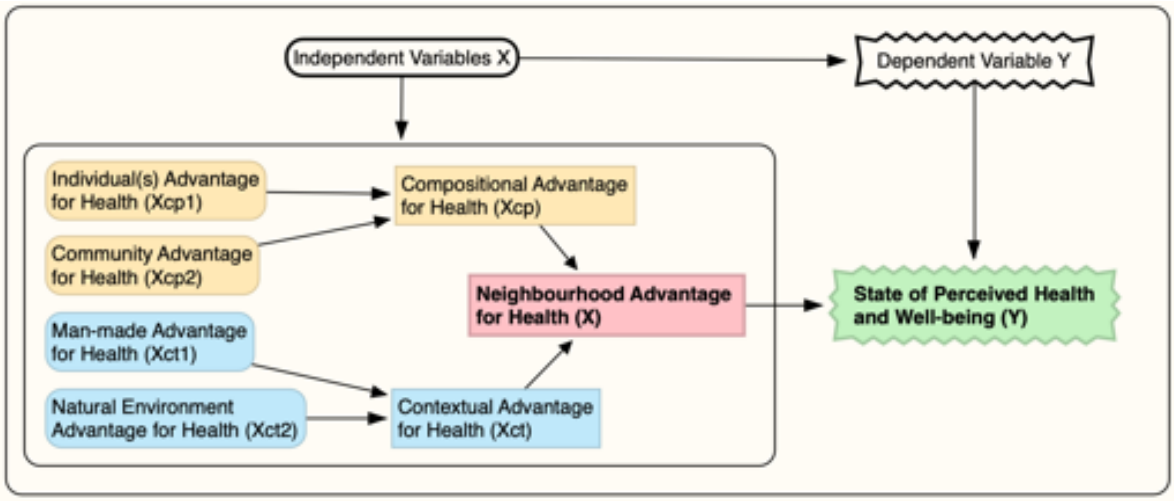
⇒ State of Perceived Health and Wellbeing (SPHW - Y)

It is a proxy for estimating health and wellbeing of the community living within the neighbourhood being studied. To estimate SPHW, I investigated the state of perceived health and wellbeing of a sample (5%) of individuals living within the same neighbourhood in order to build a value able to capture the SPHW of the whole resident community. SPHW was *estimated* according to 5 dimensions of health (Q. 1 to 5 - Survey A - Appendix 2) suggested by the WHO[61] (section 2.2.5.), these variables are the following: Absence of disease (Q. 1 - Survey A), Absence of infirmity (Q. 2 - Survey A), Physical wellbeing (Q.3 - Survey A), Social wellbeing (Q. 4 - Survey A) and Mental well-being (Q. 5 - Survey A). More information about SPHW are provided in the next chapter (Chap.4).

3.4. Research Questions and Hypotheses

The visual theoretical model in Fig. 16 above introduces the conceptual basis on which to build research questions and provide an explanation for the expected relationships among the variables investigated in this study, thus, laying down the foundation for the evidence-based urban regeneration scheme for fostering the Neighbourhood Advantage for Health (NAH), that is the final objective of this research work. Fig. 16 below depict the theoretical construct adopted for this study as well as the direction of the existing relationships existing within it, these relationships are visualised as an arrow line as it occurred in similar researches (see Ochoda, 2014).

Fig. 16: Visual theoretical model.



Source: Author's elaboration.

The author of this work seeks to develop true statements to explain the conditions that describe the relationships outlined in the theoretical model in Fig. 4 above. To doing so, I advanced the relationship among variables identified in the literature review, posing such variables in terms of questions or hypotheses that are provided below. To give a value for each variable, I collected objective and subjective data through a survey-based instruments and ISTAT and web-based database

[61] As stated in the Constitution of the World Health Organization, entered into force on 7 April 1948, health is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."

and direct observations. The research question and related hypotheses narrow the purpose statement to predictions about what will be learned and the questions to be answered in the study. In this research work, the author tested hypotheses[62] to draws inferences about the population from a study sample of the 5% of the population for each neighbourhood. Data and rational considerations in this study reflect a post-positivist perspective in which knowledge is conjectural, meaning that absolute truth can never be found and the research is always imperfect and fallible (Phillips and Burbules, 2000). Consequently, the author of study does not prove a hypothesis, but he rejects the main hypothesis (Ho), exploring for alternative (Ha1) and directional hypotheses (Ha2). While the null hypothesis (Ho) represents the prediction that in the general population no relationship exists between groups on a variable, the alternative (or directional) hypotheses (Ha1 and Ha2) represent a prediction about the expected outcome, basing this prediction on prior studies on the topic that suggest a potential outcome. In this case, the author of this study assumed that the neighbourhood Pellaro Centro (which is the core urban area for the whole area being study), will perform better than other neighbourhoods both in NAH and SPHW. According to the variables described above and for the purpose of this study, the research question and hypotheses tackled were the following:

⇒ RQ1: To which extent Neighbourhood Advantage for Health (X) associate to State of Perceived Health and Well-being (Y)?

- Ho: Neighbourhood Advantage for Health (X) do not associate to State of Perceived Health and Well-being (Y).
- Ha1: Neighbourhood Advantage for Health (X) associate to State of Perceived Health and Well-being (Y).
- Ha2: The neighbourhood Pellaro Centro will have higher score in Neighbourhood Advantage for Health (X) and greater score of State of Perceived Health and Wellbeing (Y) than other neighbourhoods;

→ RQ1a: To which extent Compositional Advantage for Health (Xcp) associate to State of Perceived Health and Well-being (Y)?

- Ho: Compositional Advantage for Health (Xcp) do not associate to State of Perceived Health and Well-being (Y).
- Ha1: Compositional Advantage for Health (Xcp) associate to State of Perceived Health and Well-being (Y).
- Ha2: The neighbourhood Pellaro Centro will have higher score in Compositional Advantage for Health (Xcp) and greater score of State of Perceived Health and Wellbeing (Y) than other neighbourhoods;

→ RQ1b: To which extent Contextual Advantage for Health (Xct) associates to State of Perceived Health and Well-being (Y)?

- Ho: Contextual Advantage for Health (Xct) do not associate to State of Perceived Health and Well-being (Y).
- Ha1: Contextual Advantage for Health (Xct) associate to State of Perceived Health and Well-being (Y).
- Ha2: The neighbourhood Pellaro Centro will have higher score in Contextual Advantage for Health (Xct) and greater score of State of Perceived Health and Wellbeing (Y) than other neighbourhoods;

[62] Hypotheses builds on research questions. They are predictions the researcher makes about the expected outcomes of relationships among variables and numeric estimates of population values based on data collected from samples.

→ RQ1c: To which extent Individual's Advantage for Health (Xcp1) associates to State of Perceived Health and Well-being (Y)?

- Ho: Individual's Advantage for Health (Xcp1) do not associate to State of Perceived Health and Well-being (Y).
- Ha1: Individual's Advantage for Health (Xcp1) associate to State of Perceived Health and Well-being (Y).

→ RQ1d: To which extent Community's Advantage for Health (Xcp2) associate to State of Perceived Health and Well-being (Y)?

- Ho: Community's Advantage for Health (Xcp2) do not associate to State of Perceived Health and Well-being (Y).
- Ha1: Community's Advantage for Health (Xcp2) associate to State of Perceived Health and Well-being (Y).

→ RQ1e: To which extent Man-made Environment Advantage for Health (Xct1) associate to State of Perceived Health and Well-being (Y)?

- Ho: Man-made Environment Advantage for Health (Xct1) do not associate to State of Perceived Health and Well-being (Y).
- Ha1: Man-made Environment Advantage for Health (Xct1) associate to State of Perceived Health and Well-being (Y).

→ RQ1f: To which extent Natural Environment Advantage for Health (Xct2) associate to State of Perceived Health and Well-being (Y)?

- Ho: Natural Environment Advantage for Health (Xct2) do not associate to State of Perceived Health and Well-being (Y).
- Ha1: Natural Environment Advantage for Health (Xct2) associate to State of Perceived Health and Well-being (Y).

⇒ RQ 2: Which specific factors of NAH are more relevant for health and wellbeing, and thus for urban regeneration at the neighbourhood level?

→ RQ 2a. Which specific factors of Individual(s) Advantage for Health (Xcp1) are more relevant for SPHW, and thus to consider for urban regeneration at the neighbourhood level?

→ RQ 2b. Which specific factors of Community Advantage for Health (Xcp2) are more relevant for SPHW, and thus to consider for urban regeneration at the neighbourhood level?

→ RQ 2c. Which specific factors of Man-made Advantage for Health (Xct1) are more relevant for SPHW, and thus to consider for urban regeneration at the neighbourhood level?

→ RQ 2d. Which specific factors of Natural Environment Advantage for Health (Xct2) are more relevant for SPHW, and thus to consider for urban regeneration at the neighbourhood level?

The next chapter provide a description of the research approach and methodology to answer RQ 1 and RQ 2 and related sub-questions through a survey-based instrument augmented with subjective on-field observations and objective measures from the ISTAT database and web-based observations.

Chapter 4

4. METHODOLOGY AND SURVEY STUDIES

4.1. Research Approach and Procedures

This research work relies on a *postpositivist*[63] perspective, and it is informed by a *quantitative strategy of inquire* to provide numeric descriptions of trends, attitudes, and opinions registered on a sample of the population being studied. The author used the literature review in a deductively manner as a basis for advancing main research question and hypotheses tackled in this work. The quantitative database being built during this work was informed by a cross-sectional survey research design, direct on-field observations, GIS and web-based observations, and objective measures retrieved by ISTAT databases. The variables explored in this study are the following:

⇒ Neighbourhood Advantage for Health
(NAH - independent variable X - e.g., measured for neighbourhood A);

⇒ State of Perceived Health and Wellbeing
(SPHW - dependent variable Y - e.g., measured for the community within neighbourhood A);

This study observes the geographical variations of the factors responsible for Neighbourhood Advantage for Health across 11 different neighbourhoods located within the same urban area. This research work emphasizes how NAH can be positively associated with the differences in State of Perceived Health and Wellbeing (SPHW). This research explores and describes the extent to which NAH associates with the State of Perceived Health and Wellbeing (SPHW) of 11 communities living in 11 neighbourhoods featuring different socio-economic and spatial characteristics, specifically, the study investigates the associations between individuals' perceptions of their health and wellbeing and their neighborhood. To doing this, the author carried out a cross-sectional and self-reported survey, augmented with objective and on-field observations, to 11 communities based in Pellaro (Reggio Calabria, Italy) using primary data from 400 participants (25yo to 69yo) collected via self-reported surveys for assessing perceived health and wellbeing and for investigating built and natural environment features within the neighbourhood. This study relies on a quantitative strategy of inquire led by two research questions: To which extent Neighborhood Advantage for Health (NAH) associates with State of Perceived Health and Wellbeing (SPHW)? Which specific factors of Neighborhood Advantage for Health (NAH) are more relevant for State of Perceived Health and Wellbeing (SPHW) of the community, and thus to consider for urban regeneration interventions at the neighborhood level?

Procedures for Literature Review, Data Collection and Analysis

To begin with, this study investigated the relevant literature[64] in public health and urban studies to identify concepts and an overarching methodology that could provide a solid analytic

[63] According to Creswell (2013), post positivism "hold a deterministic philosophy in which causes (probably) determine effects or outcomes. Thus, the problems studied by postpositivist reflect the need to identify and assess the causes that influence outcomes" (p. 38).

[64] The topics considered in this research work were explored tackling the following questions: What is neighbourhood advantage for health? What is the relationship between urbanization and health? What is health? What are the determinants of health? What are the non-communicable diseases and why they are important in the urban context? What the best metrics for assessing physical and mental health in relation to the urban environment? What is well-being? What are health inequalities? Which are the social, economic and spatial determinants of health inequalities? What policies exist for tackling health inequalities? What is the effect of the built environment on health, well-being, and health

distinction between the compositional and contextual factors within the neighbourhood that associate directly and indirectly with public health and wellbeing. Then, such an analytic distinction was adopted to frame and introduce the concept of NAH. To observe how NAH affect SPHW across 11 different neighbouhoods, this study relies on a population-based cross-sectional study in Pellaro (Reggio Calabria, Italy) using primary data from 400 participants aged 25-69 and objective measures gathered from ISTAT, web-based, and GIS databases and subjective direct on-field observations. simento) within the sub-municipal area of Pellaro. Then, to tackle the Research Questions[65] leading this study, the researcher carried out an iterating analysis process, namely a systematic, repetitive, and recursive process in quantitative data analysis. Such an iterative approach involves a sequence of tasks carried out in exactly the same manner each time and executed multiple time through regression and correlation analyses for exploring the degree to which Neighbourhood Advantage for Health (X) for the neighbourhood associate to Status of Perceived Health and Wellbeing (Y) of the community living within the neighbourhood, and for identify which dimensions of NAH are more relevant for SPHW. The scale for scores of NAH and SPHW range from 1 (negative) to 5 (positive), reflecting the mean value among all individuals living in the same neighbourhood. Finally, this study investigates the associations between NAH and the 'State of Perceived Health and Wellbeing' (SPHW) examining differences in cumulative NAH across the 11 neighbourhoods under study. To analyse geographical variations in cumulative NAH, the author identified neighbourhoods where significative values of NAH occurred (mean, median, minimum, and maximum values) providing potential explanations for variations of NAH and SPHW across the 11 neighbourhoods and communities being studied.

Fig. 17: Neighbourhood aggregated for ISTAT census tracks.

Source: Author's elaboration of GIS and Google Earth.

Geographic Location and Spatial Boundaries of this Study

This study was conducted on a sample of 400 individuals (25yo to 69 yo) living within the sub-municipal area of Pellaro (Fig. 17), a coastal location within the municipality of Reggio Calabria (Calabria, Italy). The survey was submitted in Italian language. Participants to this study have been engaged on the study field and the surveys were self-reported. An amount 550 surveys were taken and 400 have been submitted and analysed for the purpose of this study. The sub-municipal area of Pellaro accounts for a total amount of 182 ISTAT census tracks, of which 150 have been considered

inequalities? What are the relevant methods to measure the neighbourhood health effect? What are the relevant neighbourhood components that affect health and wellbeing? What are the relevant health-related studies in the urban regeneration field? How urban regeneration can indirectly shape health and wellbeing? What are the urban health indicators developed to date? Why the neighbourhood could be considered as an ecosystem for health? What the conceptual modelling approach able to fit the concept of neighbourhood advantage for health?

[65] RQ 1: To which extent NAH associate to Perceived Health and Wellbeing? RQ 2: Which specific factors of NAH are more relevant for health and wellbeing, and thus for urban regeneration at the neighborhood level?

in this study (Tab. 2-3 in Appendix 2) according to individuals' perceived neighbourhood boundaries using the survey as a mapping tool for define the 11 communities. aggregation of such ISTAT census tracks, an amount of 11 neighbourhoods have been identified (Fig.17) using the survey as a mapping tool. Primary[66] and secondary[67] data in this study were aggregated for ISTAT census and perceived neighbourhood boundaries[68] with the aim to fit a significative operational unit of neighbourhood. Respondents were asked their place of residence and address (no number), this in order to obtain information about their location on ISTAT census-tracks (sezioni di censimento) within the sub-municipal area of Pellaro. All individuals who live in the same ISTAT census tract were assigned the same exposure measure. This step was crucial as the geo-location of the respondents allowed the author of this study to generalize these individuals' exposure measures to the whole community living within the specific neighbourhood being studied, therefore, assessing which neighbourhood performs better for SPHW.

4.2. Survey Studies

This study was conducted on a sample of 400 individuals (25yo to 69 yo) living within the sub-municipal area of Pellaro. This survey aims to gather data for testing the theoretical model (Fig. 4) presented in chapter 3 (section 3.4.). The survey was submitted in Italian language. Participants to this study have been engaged on the study field and the survey was self-reported. An amount of 400 surveys have been submitted and analysed for the purpose of this study. Survey studies encompass three parts with different aims as follows:

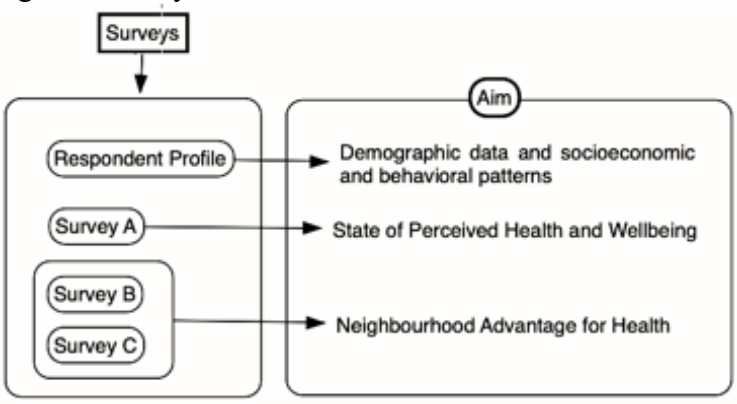
- Survey A to estimate Status of Perceived Health and Wellbeing (SPHW) of the community under study;
- Respondents Profile for collecting demographic, socioeconomic and behavioural data of the individuals living within the community under study;
- Survey B and C to quantify Neighbourhood Advantage for Health (NAH) for the neighbourhood under study.

The three part of the survey were appositively developed for the purpose of this study, imitating well-known medical and urban audit tools used in US and Europe for assessing perceived health and well-being and for collecting neighbourhood features through the self-reported data (see chapter 2 - section 2.6.). Survey A provide data on the Status of Perceived Health & Wellbeing (Y) for each neighbourhood being studied, while Survey B and C investigate the presence of significative factors that fuel Neighbourhood Advantage for Health (X). The dependent variable Y and the independent variable X have been measured through a multiple survey instrument so that numbered data can be analysed using statistical descriptive and inferential procedures. Self-reported survey as the one used for this work were adopted in manifold similar researches (Duncan & Kawachi, 2018) such as the Life Course Built Environment and Health[69], a longitudinal study to explore the impact of the built environment on health by both self-reported and objective measures. This work relies on the same rationale as it follows the same perspective[70] for collecting self-reported data to merge with objective measures and direct observations.

[66] Data from Respondent Profile, Survey A, Survey B and C.
[67] Secondary data were gathered from ISTAT census track database, multiple GIS databases, and Google Maps.
[68] Perceived boundaries aggregation was adopted in manifold studies (Duncan and Kawachi, 2018). Further informations in the literature review in Chap. 2 of this work at paragraph 2.6.2. Operational definitions of neighborhood as a unit of study.
[69] Villanueva et al. (2013) highlight that the data linkage of built environment measures to both self-reported health behaviour data and objectively measured health outcome data is a strength of LCBEH study to build a stronger case for changes to the built environment that are conducive to healthy living.
[70] This survey was developed according to the suggestions identified in the literature review in Chapter 2. Specifically, within the following paragraphs: 2.6. Methods to measure the neighborhood advantage for health, 2.6.1. Metrics for assessing perceived health and well-being within the neighborhood, and 2.6.2. Operational definitions of neighborhood as a unit of study.

Survey A was a self-reported survey for perceived health and wellbeing used to estimate the score of SPHW for each community living within the 11 neighbourhoods under study. Survey A (detailed form in Appendix 1 and Tab. 5 in Appendix 2) was used Survey A relies on five items investigating the five dimensions of health as suggested by the World Health Organization (WHO), these are the following: absence of disease and infirmity, and physical, mental and social wellbeing. Instead, Survey B and C aimed to quantify the presence of compositional and contextual factors within the neighbourhoods under study. Survey B and C investigate neighbourhood-based factors relevant for health and wellbeing (Fig. 18) and grouped following the analytic distinction adopted as a theoretical perspective for define the concept of NAH (X) described in chapter 3 - section 3.4.

Fig. 18: Surveys and aims



Source: Author's elaboration.

Survey B and Survey C encompass 32 items each one, for an amount of 64 items. These surveys were structured following the rationale of well-known urban-audit tools such as the Neighbourhood Environment Walkability Scale (Oyeyemi et al., 2017) and Life Course Built Environment and Health study (chapter 2 - section 2.6.1). Surveys B and C can be found in Appendix 1 and Tab. 6 and 7 in Appendix 2 at the end of this study. In addition, to each one of the 418 participants was given a profiling survey (Respondent Profile in Appendix 1 and Tab. 4 in Appendix 2) to identify individual's lifestyle and health-related behaviours, nutrition habituations, exposure to health-related risk factors and sedentary behaviours, and propensity for physical activities. Then, the scores for Respondent Profile, Survey B and C were aggregated grouping respondents by their neighbourhood of residence (Tab. 11, 12, 13, 14 - Appendix 2), this in order to generalize from the study sample (5% of population) to the community living within the neighbourhood under study. The detailed scores of NAH and SPHW for each neighbourhood are provided in Tab. 15 in Appendix 2, where minimum, mean and maximum values of NAH have been identified, grouped for macro areas, and organised by degree of correlation with SPHW. Successively, these data were transferred in GIS maps (Appendix 4) and interpreted as a whole complementing analysis results with secondary data form the ISTAT database (Tab. 10 in Appendix 2), and direct on-field and web-based observations (Appendix 5). Finally, findings and recurrent patterns in the analyses were interpreted and the significant factors of NAH classified in macro-areas of intervention for the purpose of delivering guidelines for urban regeneration aiming at health and wellbeing at a neighbourhood level.

4.2.1. Survey A - SPHW

Survey A for State of Perceived Health and Wellbeing (SPHW) encompasses 5 items, and it was developed to estimate the state of perceived health and well-being of individuals living within the neighbourhood being studied. This survey investigates the state of perceived health and wellbeing of individuals according to the five dimensions of health suggested by the WHO[71], these are the

[71] As stated in the Constitution of the World Health Organization, entered into force on 7 April 1948, health is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."

following: *absence of disease, absence of infirmity, and physical, social, and mental well-being*. To doing so, Survey A was developed to fit such definition of health upon the base of the items contained in two well-known surveys for estimate perceived state of mental and physical health within a population, such surveys are the Short Form-12[72] (SF-12) and Warwick-Edinburgh Mental Well-Being Scale[73] (WEMWBS). These surveys are useful for clinical practice and research, health policy evaluation and general population survey to assess quality of life and physical and mental health in a highly reliable manner.

Tab. 1: Description of variables and scale for Survey A.

SURVEY									
Aim	Estimate State of Perceived Health and Well-being (SPHW) within the								
Items	5 items								
Proxy for	State of Perceived Health and Well-being			Scale for Survey A					
Direction	1 (-)(-); 2 (-); 3 (0); 4 (+); 5 (+)(+);			Direction	(-)(-)	(-)	0	(+)	(+) (+)
Score	1 (Very Low); 2 (Low); 3 (Normal); 4 (High); 5 (Very High);			Magnitude	Very Low	Low	Normal	High	Very High
Adv	No.	Variable	Question	Score	1	2	3	4	5
SPHW (Y)	1	Absence of Disease	In general, would you say your health is…;	Excellent (5) - Poor (1)	Poor	Fair	Good	Very Good	Excellent
	2	Absence of Infirmity	During the past 4 weeks, pain interferred with your working and household activities;	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all
	3	Physical Well-being	During the past 4 weeks, I've had energy to spare;	None of the time (5) - All of the time (1)	None of the time	Rarely	Some of the time	Often	All of the time
	4	Mental Well-being	During the past 4 weeks, I've been feeling calm and relaxed;	None of the time (5) - All of the time (1)	None of the time	Rarely	Some of the time	Often	All of the time
	5	Social well-being	During the past 4 weeks, physical health or emotional problems interfered with your social activities with friends and relative;	None of the time (5) - All of the time (1)	All of the time	Most of the time	Some of the time	A little of the time	None of the time

Source: Author's elaboration of Survey A dataset.

Tab. 1 above depicts variables, questions and score for Survey A that is intended to estimate SPHW for each of the 11 communities living in the 11 neighbourhood under study. To investigate the above-mentioned five dimensions of health as defined by the WHO, significative questions have been extracted from the Short Form-12 survey (Q.1, Q. 8, and Q. 12)[74] and WEMWBS survey (Q. 3 and 5), these items have been adopted according to their original scope as well as their scale which range from 1 to 5. The scale of the Survey A ranges from 1 to 5 according to the magnitude of the score of perceived health and wellbeing (Tab. 4). Survey A was used for collecting data referring to the last 4 weeks[75], this range of time comes from the methodological approach of the SF-12 and WEMWBS. Furthermore, Survey A is intended to estimate the State of Perceived Health and

[72] SF-12 is a 12-items short-form survey for surveying health status in the Medical Outcomes Study. It was used in previous study for assessing perceived health and well-being (Krefis at al., 2018). The SF-12 aims to assess the following eight different health concepts: physical functioning, role limitations due to physical health problems, bodily pain, general health perceptions, energy/fatigue and vitality, social functioning, role limitations due to personal or emotional problems, emotional wellbeing. The survey SF-12 to assess Quality of Life and physical and mental health is highly reliable and already validate through the years. According to Ware and Sherbourne (1992) the scoring standardized responses to standardized questions is an efficient way to measure health status, including the Italian version of the SF-36 that was validated by Apolone and Mosconi (1998). The Italian version of the SF-12 can be retrieved at http://crc.marionegri.it/qdv/downloads/SF12_Questionario.pdf.

[73] Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) was developed in 2006 by the Universities of Warwick and Edinburgh in order to monitoring, and assess, the wellbeing in the general population and the evaluation of projects, programmes and policies aiming to enhance mental wellbeing. The survey encompasses 14 items each one respectively scored from 1 to 5 (the lower score the worst wellbeing), the total score is the sum of the partial score for each question, thus the WEMWBS range from 14 (poor) to 70 (high). Various studies outline that the WEMWBS features robust psychometric properties, it is able to capture the concept of wellbeing both in feeling and functioning, and it is sensitive to changes that occur in wellbeing promotion projects. Also, according to major studies the WEMWBS is normally distributer in the general population. In Italy, the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) was validated by Gremigni and Stewart-Brown (2011). Their results show that the Italian WEMWBS features high correlation with other mental health and well-being scales ($p < 0.01$), good reliability, internal consistency and stability, as well as good psychometric qualities. An Italian and English form form of the WEMWBS can be downloaded by the following link: https://warwick.ac.uk/fac/med/research/platform/wemwbs/researchers/languages/wemwbs-italiana.pdf, while the original version can be retrieved at https://warwick.ac.uk/fac/med/research/platform/wemwbs/wemwbs_14_item.pdf

[75] Q.1: During the last four weeks, would you say your health was…?

Wellbeing (SPHW) at a community level, thus, the value of SPHW for each neighbourhood reflect the mean value across all respondents (5% population) living in the same area. For further information, a detailed version of Survey A is provided in Appendix 1, while information about the scale and score of the survey can be found in Tab. 5 in Appendix 2.

Tab. 2: Description of Respondent Profile survey (see also larger Tab. 4 in Appendix 2).

Survey	**Respondent Profile**				
Aim	Collect participant's data such as demographic, socioeconomic and health-related data;				
Items	44 items				
No.	**Observation**	**Units and scales for category**	**No.**	**Observation**	**Units and scales for category**
1	Day and time	Central European Time (CET+1)	23	Hosehold income	Less than 5,000; 5,000 to 10,000; 10,000 to 15,000; 15,000 to 20,000; 20,000 to 25,000; 25,000 to 30,000; 30,000 to 40,000; 40,000 to 50,000; 50,000 to 60,000; 60,000 to 70,000; 70,000 to 90,000; over 90,000;
2	Gender	Male; Female; Other;	24	Insurance	No; Yes, life; Yes, health; Yes, other;
3	Age	Years;	25	Diseases	High blood pressure; Diabetes; Heart diseases; Cancer; Asthma; Depression; None;
4	Weight	Kg;	26	Medicine for diseases	High blood pressure; Diabetes; Heart diseases; Cancer; Asthma; Depression; None;
5	Height	cm;	27	Angina/Heart attack	Yes; No;
6	BMI	Kg/cm;	28	Transient Ischemic Attack (TIA)	Yes; No;
7	Race	Caucasican; Black; Asian; Other;	29	Cancer	Yes; No;
8	Marital Status	Celibate or Nubile; Married; Divorced; Widowed;	30	Smoker	Yes; No;
9	Household size	No. of people;	31	Time smoking	Years;
10	Neighborhood	Name of the neighborhood;	32	Cigarettes per day	No. Cigarettes/day;
11	Kind of area	Coastal; Hilly	33	Time quit smoking	Years;
12	Address	Just street name (NO number for privacy);	34	Alcohol intake	Yes; No;
13	Proximity to a well-known point	Station; Church; Square; Bar; Shop; Bakery; Bus stop; Club; Pub; Pizzeria; Restaurant;	35	Alcohol units intake	No. Alcoholic units/week;
14	Proximity from the center of the neighborhood	Far; Medium distance; Close by	36	Computer or laptop usage	1 to 10 hours/day;
15	Commute to work	Name of the neighborhood where commuting	37	TV watching	2 to 10 hours/day;
16	Transportation mode to commute	Car; Train or Bus; Bike; By walk; Other;	38	Smartphone usage	3 to 10 hours/day;
17	Time to go to work	Minutes	39	Not-for-profit	Yes; No;
18	Occupation	Housewife; Student; Retired; Unemployed; Industry worker; Service worker; Office employee; Freelance professional; Commerce; Craftsman; Entrepreneur; Manager; Army or Law Enforcement;	40	Not-for-profit attituded	Not involved; Less than 2 h/day; 2 to 4 /day; 4 to 6 h/day; 8 to 12 h/days; Over 12 h/day;
19	Occupation stability	Permanent employed; Fixed term employed; Retired; I work when I want; Not working and not looking for a job; Unemployed looking for a job; Disabled and not looking for a job; Disabled and looking for a job;	41	Physical activities	Low; Moderate; Intense;
20	Education	None; Primary; 12th grade or less; High-school graduate; Bachelor Degree; Master Degree; Specialisation/Master/PhD;	42	Low physical activities	1 to 10 hours/day;
21	Father's education	None; Primary; 12th grade or less; High-school graduate; Bachelor Degree; Master Degree; Specialisation/Master/PhD;	43	Moderate physical activities	1 to 10 hours/day;
22	Mother's education	None; Primary; 12th grade or less; High-school graduate; Bachelor Degree; Master Degree; Specialisation/Master/PhD;	44	Intense physical activities	1 to 10 hours/day;

Source: Author's elaboration of survey Respondents Profile results.

4.2.2. Respondent Profile

Tab. 2 above depicts variables for Respondent profile survey which encompasses 44 items investigating a broad range of demographic and socioeconomic individuals' traits and health-related behaviours. Respondent Profile survey provide to collect the following information: gender; age; weight; height; body-mass index[76] (BMI); race; marital status; household size; neighbourhood of

[76] According to the Center for Disease Control and Prevention (CDC, 2017a), the Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters. BMI is a reliable indicator for health and an easy method to screen individuals by their weight. Although using the same formula, BMI is interpreted differently for children, teens, and adults. For the purpose of this

residence within the suburban area of Pellaro; address; proximity to a well-known point within the neighbourhood of residence; proximity from the centre within neighbourhood of residence; neighbourhood for working; time to commute to work; occupation kind; occupation stability; parent's education; education; income; occupation; occupation stability; private health or life insurance; presence of Non-communicable diseases (NCD) such as high blood pressure, diabetes, stroke, bronchitis chronical, asthma, depression; health-related risk factors such as smoking (cigarettes per day), drinking (alcoholic units per week); sedentary activities (usage of for computer, TV, smartphone, iPad hours per day); physical activities per day (low, moderate, and intense in hours per day); and individual social propension (member of not-for-profit organization and how many hours per week). An English version of Respondent Profile is provided in Appendix 1, while a detailed descriptive table of the items and scales for Respondent Profile survey can be found in Tab. 4 in Appendix 2.

4.2.3. Survey B and C - NAH

Surveys B and C for (Tab. 4 and 5) assessing people perceptions of the components of the built environment (e.g., access to destinations or retail/food stores, distance to public transportation, safety, aesthetics) are useful when the research wants to narrow the investigation to a specific topic, also, these subjective observations allow the researcher to better understand psychosocial and behavioural patterns within the community being studied (Kerr et al 2016; Blacksher & Lovasi, 2012). Survey B and C encompass 64 items, 32 items each, aiming to quantify Neighbourhood Advantage for Health (NAH) within each one of the eleven neighbourhoods of the sub-municipal area of Pellaro. To investigate the score of NAH, significative questions have been developed according to the theoretical model presented in Fig. 14 (chapter 3 - section 3.4.) and findings in the literature review (chapter 2 - section 2.3.). For further information on Survey B and Survey C (items, variables, and scale) a detailed version of the surveys is provided in Tab. 6, 7, 8 in Appendix 2 at the end of this work.

Tab. 3: Synthesis of Survey B and C

Survey	**SURVEY B**				
Aim	Quantify Neighborhood Compositional Advantage for Health				
Items	32 items				
Proxy for	Compositional Advantage for Health				
	Scale for Survey B				
Direction	*(-)(-)*	*(-)*	*0*	*(+)*	*(+) (+)*
Magnitude	*Very Low*	*Low*	*Normal*	*High*	*Very High*
Score	*1*	*2*	*3*	*4*	*5*

Survey	**SURVEY C**				
Aim	Quantify Neighborhood Contextual Advantage for Health				
Items	32 items				
Proxy for	Contextual Advantage for Health (spatially bounded)				
	Scale for Survey C				
Direction	*(-)(-)*	*(-)*	*0*	*(+)*	*(+) (+)*
Magnitude	*Very Low*	*Low*	*Normal*	*High*	*Very High*
Score	*1*	*2*	*3*	*4*	*5*

Source: Author's elaboration.

Survey B (Tab. 4) encompasses 32 items investigating Compositional Advantage for Health (Xcp) for each neighbourhood, the variable Xcp encompasses two sub-variables such as Individuals' Advantage for Health (Xcp1 - 16 items) and Community Advantage for Health (Xcp2 - 16 items). The 16 items for Xcp1 refer to factors of the individuals living within the neighbourhood such as individuals' awareness and self-control, socioeconomic position (SEP), active mobility and exposure to risk factors for health. Instead, the remaining 16 items which build variable Xcp2 refer to

study, we are going to measures BMI for adult individuals. Specifically, for adults, the BMI measures range from below 18.5 (underweight), 18.5 to 24.9 (normal or healthy weight), 25 to 29.9 (overweight), and 30 or above (obese). BMI is not directly correlated with body fat; however, it is moderately correlated with measures of body fat obtained from skinfold thickness measurements, bioelectrical impedance, densitometry, etc…BMI is strongly correlated with various metabolic and disease outcome. The CDC (2018) points out that obese subjects (BMI= 30 or above) are more exposed to all-causes of death, high blood pressure (Hypertension), high LDL cholesterol, low HDL cholesterol, high level or triglycerides, type 2 diabetes, coronary heart disease, stroke, Gallbladder disease, osteoarthritis, sleep apnea and breathing problems, chronic inflammation and increased oxidative stress, some cancers, low quality of life, mental illness such as clinical depression, anxiety, body pain and difficulty with physical functioning.

community's factors such as safety, supportiveness of the social environment, institutional support, and economic accessibility.

Tab. 4: Description of variables and scale for Survey B (see also larger Tab. 6 in Appendix 2).

SURVEY B										
Aim			Quantify Neighborhood Compositional Advantage for Health							
Items			32 items							
Proxy for			Compositional Advantage for Health (a-spatially bounded)			Scale for Survey B				
Direction			1 (-)(-); 2 (-); 3 (0); 4 (+); 5 (+)(+);		Direction	(-)(-)	(-)	0	(+)	(+) (+)
Score			1 (Very Low); 2 (Low); 3 (Normal); 4 (High); 5 (Very High);		Magnitude	Very Low	Low	Normal	High	Very High
Advantage		No.	Variable	To which extent do...?	Score	1	2	3	4	5
Invidual(s) Advantage for Health (Xcp1)	Individual's awareness and self-control	1	Age (awarness)	You think that your age negatively affects your health?	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all
		2	Education (awareness)	You think that your education positively affects your health?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		3	Income (awareness)	You think that your income negatively affects your lifestyle?	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all
		4	Nutrition (awareness)	You think that your food habits are healthy (e.g., vegetables, few carbs and proteins)?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		5	Water intake (awareness)	You drink water properly during day?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		6	Health and urban environment (awareness)	Your health directly depends from the quality of the urban environment in which you live?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		7	Lifestyle (awareness)	You think that your lifestyle is healthy?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
	Socio-economic position (SEP)	8	Education attainment	Objective measure: What is your educational level?	None (1) to PhD (5)	None	Primary or 12th grade or	High-school/Bachelor	Master degree	Specialisation/Master/Phd
		9	Father's education	Objective measure:What is your educational level?	None (1) to PhD (5)	None	Primary or 12th grade or	High-school/Bachelor	Master degree	Specialisation/Master/Phd
		10	Mother's education	Objective measure: What is your educational level?	None (1) to PhD (5)	None	Primary or 12th grade or	High-school/Bachelor	Master degree	Specialisation/Master/Phd
		11	Occupational stability	Objective measure: Which of these statements best describes your current occupational status?	Unemployed (1) to Full-time Employed (5)	Unemployed looking for a job;	Fixed-term employed	I work when I want;	Not working and not looking	Permanent employed or Retired;
		12	Household income	Objective measure: What is your household income in the last 12 months?	Less than 5,000 Euro (1) to over 90,000 (5)	Less than 5,000 to 10,000	10,000 to 25,000	25,000 to 50,000	50,000 to 90,000	Over 90,000
	Active mobility	13	Physical activities	Objective measure: What kind of physical activities do you perform during the day?	Low (1) to Intensive (5)	Low	Low	Moderate	Intense	Intense
		14	Active transportation	Objective measure: How do you move for your activities?	Car (1) to By walk and Bike (5)	Car	Train or Bus	By walk	Bike	Walk + Bike
	Risk factors	15	Anti-alcohol attitude	Objective measure: How many Alcoholic Units (AU) do you drink per week?	More than 4 AU/week (1) to None or less	4 AU or over	more than 2 AU	2 AU	less than 2 AU	less than 1 AU or none
		16	Anti-smoking attitude	Objective measure: Do you smoke or are you a former-smoker?	Yes (1) to No (5)	Yes	Ex-smoker	Ex-smoker	Ex-smoker	No
Commmunity Advantage for Health (Xcp2)	Safety	17	Safety	You think that your neighbourhood is safe? (e.g.: walking in the neighbourhood in the evening	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		18	See other people walking	You see other people walking in your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
	Supportive social environment	19	Family support	You perceive your family support?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		20	Social cohesion	You think that your neighbours are likely to help you if needed?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		21	Trust	You think that you can trust your neighbours?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		22	Sharing values	You think that the members of your community share the same values?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		23	Conviviality	You think that your community is convivial (eat and joke together)?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		24	Diversity	You think that your neighbourhood ethnically and culturally diverse?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		25	Stigma free	You think that your community is the best among those in Pellaro?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		26	Cultural events	You think that your neighbourhood is interesting for cultural events?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		27	Sense of belonging	You think that there is sense of community in your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
	Institutional support	28	Institutional presence	Perceive the presence of the institutions in your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		29	Decision involvement	You feel involved in public decisions regarding your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		30	Not-for-profit presence	You perceive the presence of not-for-profit organizations in your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
	Economic accessibility	31	Price of healthy food	You think that the healthy food you buy in your neighbourhood is cheap?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		32	Economic accessibility	You think that prices for food, rent, and commodities are cheap?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely

Source: Author's elaboration of Survey B dataset

Tab. 5: Description of variables and scale for Survey C (see also larger Tab. 7 in Appendix 2).

SURVEY C											
Aim			Quantify Neighborhood Contextual Advantage for Health								
Items			32 items								
Proxy for			Contextual Advantage for Health (spatially bounded)			Scale for Survey C					
Direction			1 (-)(-); 2 (-); 3 (0); 4 (+); 5 (+)(+);		Direction	(-)(-)	(-)	0	(+)	(+) (+)	
Score			1 (Very Low); 2 (Low); 3 (Normal); 4 (High); 5 (Very High);		Magnitude	Very Low	Low	Normal	High	Very High	
Advantag		No.	Variable	To which extent do...?	Score	1	2	3	4	5	
Man-made environment Advantage for Health (Xct1)	Visual built environment	1	Aesthetic pleasant	You think that your neighbourhood is aesthetically pleasant? (e.g.: pleasant buildings and houses)	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		2	Cleanliness	You think that your neighbourhood is clean? (e.g.: garbage, dirty streets, etc…)	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		3	Street quality	You think that the streets in your neighbourhood are of high quality?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		4	Sidewalks quality	You think that the sidewalks in your neighbourhood are of high quality?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
	Functional built environment and land-use	5	Presence of healthy-food stores	You find healthy food in your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		6	Walk to food store	Your reach by walking food-stores in your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		7	Presence of food store	You think that your neighbourhood is provided with food stores?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		8	Presence of commercial activities	You think that your neighbourhood is provided with shops and other commercial activities?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		9	Presence of public spaces	You think that your neighbourhood is provided with public spaces?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		10	Proximity to healthcare facilities	You reach health-facilities by walking from your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		11	Opportunity for physical activity	You think that your neighbourhood offers opportunities for practice physical activities? (walk, run and bike lanes, gym or spaces for physical activities)	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
	Restorative built environment	12	Shadowed public spaces with benches where to rest	You think that your neighbourhood is provided with public spaces with shadows and benches for resting?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		13	Pleasant walking	You think that your neighbourhood is pleasant for walking?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		14	Traffic free	You think that there is traffic in your neighbourhood?	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all	
	Housing	15	Home quality	You think that your home is conducive for your wellbeing?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		16	Home comfort	You think that your neighbourhood is comfortable?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
Natural environment Advantage for Health (Xct2)	Geographical location	17	Natural environment	You evaluate the quality of the natural environment of your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		18	Potable water availability	You think that water in your neighbourhood is potable?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		19	Home exposure to the South	You think that your home is exposed to the South?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
	Climatical	20	Temperature too warm in the summer	You think that your neighbourhood is warm in the summer?	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all	
		21	Temperature too cold in the winter	You think that your neighbourhood is cold in the winter?	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all	
		22	Sunny	You think that your neighbourhood is sunny (exposed to the sun…)?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		23	Wind intensity	You think that your neighbourhood is exposed to wind or windy?	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all	
		24	Precipitation intensity	You think that your neighbourhood is exposed to the rain? (e.g.: intensity and streets flooding, etc…)	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all	
	Pollution free	25	Noise-pollution free	You think that your neighbourhood is noisy? (e.g.: car traffic, construction, factories, etc…)	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all	
		26	Air-pollution free	You think that the air in your neighbourhood is polluted?	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all	
		27	Water-pollution free	You think that the water in your neighbourhood is polluted?	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all	
		28	Soil-pollution free	You think that the soil in your neighbourhood is polluted?	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all	
	Natural amenities	29	Landscape	You think that your neighbourhood boasts high-quality landscape features?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		30	Presence of green spaces	You think that your neighbourhood is provided of green spaces?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		31	Presence of public fountains	To which extent do you think that your neighbourhood is provided with public fountains?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	
		32	Presence of walkable paths provided with trees	You think that the presence of walkable paths with trees is appropriate in your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely	

Source: Author's elaboration of Survey C dataset.

Survey C (Tab. 5) encompasses 32 items investigating Contextual Advantage for Health (Xct) for each neighbourhood (spatially bounded data), the variable Xct encompasses two sub-variables

such as Man-made Advantage for Health (Xct1 - 16 items) and natural Environment Advantage for Health (Xct2 - 16 items). The 16 items for Xct1 refer to factors such as the visual and functional built environment and land-use, restorative built environment, and housing. Instead, the remaining 16 items which build variable Xct2 refer to natural environment factors such as geographical location, climatic conditions, pollution, and natural amenities. The scales of Survey B and C for quantifying Neighbourhood Advantage for Health (NAH) ranges from 1 to 5 according to the intensity and direction of the degree of advantage for each of the 64 variables being studied. Table 2 and depict the detailed scale where to each degree of intensity represent a number that interpret a very negative (very low), negative (low), normal (0), positive (high), and very positive (very high). Also, scores for items from 8 to 16 in Survey B have been measured through data collected in respective Respondent Profile survey and answers for such questions were standardized to fit a score from 1 to 5 similarly to other questions in this study (Table 8 - Appendix 2).

4.3. Data Collection and Procedures for Data Quality Assessment

The purpose of this paragraph is to provide a scheme of the procedure for data collection and data quality assessment. The database built during this research work relies on primary data from 400 individuals living within Pellaro, and secondary data such as objective measures provided by ISTAT. Specifically, the following dimensions for data quality assessment[77] were considered:

- Completeness of the sample size: the proportion of available data was 5% against the potential of 100% complete. Limitations of this study include standard errors in the set of self-reported data, missing data and underrepresentation of people with severe disabilities;

- Uniqueness of the data: this work aims to identify a specific entity that in this case is the individual in order to group individuals living in the same neighbourhood. No entity was recorded more than once thus data are unique.

- Temporal accuracy: data represent a current phenomenon within a suburban residential area. From January 2018 to July 2018, a cross sectional survey was conducted to 418 individuals living within the sub-municipal area of Pellaro;

- Validity: data conforms to the syntax of the theoretical model proposed in chapter 3 (section 3.4.) and the definitions of the variables of NAH described in the theoretical perspective (section 3.4.) for tackling the research questions leading this study (section 3.5.). Accordingly, the collected data covers two main research themes: Neighbourhood Advantage for Health (X) and Status of Perceived Health and Wellbeing (Y). The data from the survey are anonymous and they were aggregated for obtaining representative groups (5%) of a sample of individuals living within the same neighbourhood. Following guidelines and similar studies investigating neighbourhood and health, the sample size was a 5% of the population for each community living within the 11 neighbourhood under study. Data have been checked and plotted to assess any outliers due to basic data errors and spatial delimitation;

- Spatial and thematic accuracy refers to the degree to which data correctly describes the "real world" object being described. Operationalizing the neighbourhood is challenging, and it is crucial to define neighbourhood as a unit of study through its potential boundaries. Duncan, Regan, and Chaix (2018) describes four methods to define neighbourhood boundaries: Perceived boundaries (surveys and participatory mapping tool); Administrative

[77] The surveys were developed according to the methodological suggestions from the Creswell (2014) work and the guideline provided by DAMA UK and the Data Quality Dimensions Working group (2013).

boundaries (all individuals who live in the same census tract are assigned the same exposure measure); GIS-based Buffer neighbourhood definitions (neighbourhood as a radius of the particular location being studied); Activity space neighbourhood definitions (set of spatial locations visited by an individual corresponding to his/her exhaustive spatial footprint). For the scope of this research in terms of urban policy the unit of analysis in this study will reflect an administrative boundary[78] and perceived boundaries (using the survey as a participatory mapping tool). This choice is due to the administrative boundaries are also policy-relevant boundaries, therefore, administrative boundaries are the metrics for funding public health interventions and policy. Identifying neighbourhood's boundaries as a target area of action is the key for achieving public health in the urban regeneration field. The area being studied matches the administrative boundary of the Italian "circoscrizione" that is a sub-unit of the Italian municipalities, a sub-municipal area. This choice reflects the strong emphasis of my work on local urban policy. The sub-municipal area of Pellaro accounts for a total amount of 182 ISTAT census tracks, of which 150 have been considered in this study (Tab. 2 in Appendix 2) according to individuals' perceived neighbourhood boundaries. From the aggregation of such ISTAT census tracks, an amount of 11 neighbourhoods have been identified (Fig.18). Primary[79] and secondary[80] data in this study were aggregated for ISTAT census and perceived neighbourhood boundaries[81] with the aim to fit a significative operational unit of neighbourhood. To doing so, to respondents was asked their place of residence and address (no number), this in order to obtain information about their location on ISTAT census-tracks (sezioni di censimento) within the sub-municipal area of Pellaro. All individuals who live in the same ISTAT census tract were assigned the same exposure measure. This step was crucial as the geo-location of the respondents allowed the author of this study to generalize these individuals' exposure measures to the whole community living within the specific neighbourhood being studied, therefore, assessing which neighbourhood performs better for SPHW. Also, to classify neighbourhoods three dimensions were observed: density, proximity from Pellaro Centro, and kind of area (urban; semi-urban; rural).

- Data modification and harmonization: data have been modified for a need of aggregation and standardization and for the necessity to merge and combine different datasets. Spatial and socioeconomic data from ISTAT database were aggregated for the purpose of this research;

- Data classification: data for the survey have been classified for transforming them from a nominal to ordinal scale. Data for survey A, B, C were ranked as follows: 1 (very negative); 2 (negative); 3 (normal); 4 (positive); 5 (very positive). This choice reflects the intensity of the factor being studied for each question;

- Procedure for regression and descriptive analysis: To tackle the research questions posed in this study, the researcher of this study carried out an iterating analysis process, namely a systematic, repetitive, and recursive process in quantitative data analysis. The iterative approach involves a sequence of tasks carried out in exactly the same manner each time and executed multiple time through regression and correlation analyses for exploring the degree to which Neighbourhood Advantage for Health (X) associate to Status of Perceived Health and Wellbeing (Y) and for identify which dimensions of NAH are more relevant for SPHW. The analysis relies on an associational perspective rather than causational. Continuous

[78] Administrative boundaries for the entire sub-municipal area being studied, and vvariations in health were registered according to a spatial aggregation relaying on perceived neighbourhood boundaries indicated by respondents.
[79] Data from Respondent Profile, Survey A, Survey B and C.
[80] Secondary data were gathered from ISTAT census track database, multiple GIS databases, and Google Maps.
[81] Perceived boundaries aggregation was adopted in manifold studies (Duncan and Kawachi, 2018). Further informations in the literature review in Chap. 2 of this work at paragraph 2.6.2. Operational definitions of neighborhood as a unit of study.

data (Pearson) were used and the software adopted to run the regression analysis was RegressIt. The purpose of the regression analyses used in this study is explorative as well as confirmatory as the researcher want to test the following hypothesis: greater the NAH score, higher the score of SPHW. The parameters considered for the interpretation of this regression analysis are the following: R-quared[82]; P-value (2 tails - 95%)[83], unstandardized regression coefficient also known as "b" [84], standardised regression coefficient or "Beta value"[85], and regression equation[86]. The procedures for carried out the three analysis above (chapter 5 - section 5.3.) relies on a simple format. To begin with, regression and correlation values are given and the significance of these was assessed. Secondly, for each variable object of specific analysis, the author identified the neighbourhoods where sensitive values occurs, these values include mean, median, minimum, and maximum Eventually, the authors provide potential explanations of the observed associations (chapter 6 - section 6.1.).

[82] R-squared tell us how much all those included variables jointly are able to explain the variation (from 0.00 to 1.00) in the dependent variable, R^2 that tell us what part of the variation in the dependent variable can be explained by variation in the independent variable;
[83] P-value denotes the statistical significance of the estimated regression coefficient. If this value is smaller than 0.05 then the coefficient is significant (i.e. different from zero) with at least 95% confidence. 0.05 is the confidence level for exercises in this study;
[84] Unstandardized regression coefficient "b" indicates how much the dependent variable on average would change if that particular independent variable would change. An unstandardized coefficient of 0.166 could be interpreted as follows: each one unit increase in the independent variable is expected to produce a 0.166 unit increase in the dependent variable.
[85] Beta Value differs from "b" as the scales of measurement for each variable have transformed into a joint scale (standard deviations).
[86] Statistical equation indicate which variables are interlinked, this includes both the constant and the slope of the line of best fit.

5. ANALYSES

This chapter provide to tackle the research questions and test hypotheses developed earlier in chapter 3 (section 3.5). To begin with, regression and correlation values are given and the significance of these was assessed. Secondly, for each variable object of specific analysis, the author identified the neighbourhoods where sensitive values occurs, these values include mean, median, minimum, and maximum. Then, the authors provide potential explanations of the observed associations. Finally, implications for urban regeneration are provided interpreting results of the survey studies (Surveys A, B, C and Respondent Profile) augmented with objective and direct on-field observations and findings in the literature review. To tackle the Research Questions[87] leading this study, the researcher carried out an iterating analysis process, namely a systematic, repetitive, and recursive process in quantitative data analysis. Such an iterative approach involves a sequence of tasks carried out in exactly the same manner each time and executed multiple time through regression and correlation analyses for exploring the degree to which Neighbourhood Advantage for Health (X) for the neighbourhood associate to Status of Perceived Health and Wellbeing (Y) of the community living within the neighbourhood, and for identify which dimensions of NAH are more relevant for SPHW. The scale for scores of NAH (for the neighbourhood) and SPHW (for the resident community) range from 1 (negative) to 5 (positive), reflecting the mean value among all individuals living in the same neighbourhood. In synthesis, this chapter aims to the following objectives:

- Provide a socioeconomic and spatial analysis of the study site;
- Describe variations in State of Perceived Health and Wellbeing (SPHW - Y) across the 11 neighbourhoods being studied;
- Test the significance of the theoretical model of Neighbourhood Advantage for Health (NAH) for SPHW (Y), exploring the association between SPHW and the dimensions of NAH across the 11 neighbourhoods, including a description of the specific compositional and contextual factors of NAH emerged as significative for being targeted by neighbourhood-based urban regeneration direct interventions for enhancing indirectly resident community health and wellbeing.

Fig. 19: Geographical location of this study

Source: Author's elaboration of GIS and Google Maps.

5.1. Socioeconomic and Spatial Analysis of the Study Site

This study was conducted in Pellaro (Fig. 19) a suburban area within the southern part of the municipal City of Reggio Calabria[88] (Map 1 in Appendix 3), which is the core centre for the whole

[87] RQ 1: To which extent NAH associate to Perceived Health and Wellbeing? RQ 2: Which specific factors of NAH are more relevant for health and wellbeing, and thus for urban regeneration at the neighborhood level?
[88] The municipality of Reggio Calabria (RC) which counts 180.817 people on a whole area of 239 sqKm (ISTAT, 2011).

Metropolitan area[89]. From a regional perspective, the area is located on the south-west coast of the Calabria[90] region. Pellaro is an *ex-circoscrizione*[91] namely, a traditional Italian administrative area that refers to a sub-unit of the entire municipality. The area being studied matches the administrative boundary of the Italian "circoscrizione" that is a sub-unit of the Italian municipalities, a sub-municipal area. This choice reflects the strong emphasis of my work on local urban policy. Primary[92]) and secondary[93] data (Tab. 10, 11, 12, 13, 14 in Appendix 2) in this study were aggregated for ISTAT census and perceived neighbourhood boundaries[94] (Map 2 in Appendix 3) with the aim to fit a significative operational unit of neighbourhood. To doing so, to respondents was asked their place of residence and address (no number), this in order to obtain information about their location on ISTAT census-tracks (sezioni di censimento) within the sub-municipal area of Pellaro. All individuals who live in the same ISTAT census tract were assigned the same exposure measure. This step was crucial as the geo-location of the respondents allowed the author of this study to generalize these individuals' exposure measures to the whole community living within the specific neighbourhood being studied, therefore, assessing which neighbourhood performs better for SPHW.

Fig. 20: Neighbourhood aggregated for ISTAT census tracks

Source: Author's elaboration of GIS and Google Earth.

In 2011, the sub-municipality of Pellaro[95] accounted for 13.020 people (7,2% of the population of RC) on a whole area of 25 sqKm (10,4% of the total area of RC) and a density of 520

[89] ISTAT (2011) points out that the metropolitan population is aging, educational levels are below the national average, participation to the labour market is below the national average, and unemployment rate reached 22.4%. Furthermore, ISTAT (2011) highlights that, in 2011, the value of the *material* and *social vulnerability* index of the Metropolitan City of Reggio Calabria was 100.3, one point above the national value at 99.3. Undeniably, all these factors are relevant indicators of the socioeconomic issues that the Metropolitan City of RC is experiencing. Such issues are the same emerged in this study as the triggering causes of health inequalities, among these, low income and educational levels, and unemployment.

[90] In 2015, the health care system in the Calabria region lagged behind northern ones such as Tuscany (Graph. 1), the leading region in terms of health care performance in Italy. As evidence, according to a LEA (Livelli Essenziali di Assistenza, or Basic Assistance Levels) indicator developed by the Italian Ministry of Health in 2015, the gap in health care performance between Calabria (147) and Tuscany (212) reached 65 points. According to ISTAT (2011) the median income in the Calabria region () is below the Italian median income (?). Comparing to Italian high-performance regions, since 2003 the median income of the Calabria region is severely lower than Tuscany. Also, while the median income value in Tuscany has been increasing since 2003, in Calabria the value has declined from 2011, reaching 23,600 Euro per capita in 2015, versus 34,255 Euro per capita in Tuscany in the same year. Certainly, such enormous income disparities represent an indicator of the potential exposition of Calabria region to health inequalities. Costa et al. (2014) sustains that there exist health inequalities within and between Italian regions, especially from northern to southern regions emphasizes that socioeconomic disparities in Italy are even more evident at the inter-regional level, where differences are increasing between the regions of the North, the Center and the South (ISTAT, 2015).

[91] Retrieved at http://www.reggiocal.it/on-line/Home/Amministrazione/Circoscrizioni/XV-Pellaro/scheda101511.html

[92] Data from Respondent Profile, Survey A, Survey B and C.

[93] Secondary data were gathered from ISTAT census track database, multiple GIS databases, and Google Maps.

[94] Perceived boundaries aggregation was adopted in manifold studies (Duncan and Kawachi, 2018). Further informations in the literature review in Chap. 2 of this work at paragraph 2.6.2. Operational definitions of neighborhood as a unit of study.

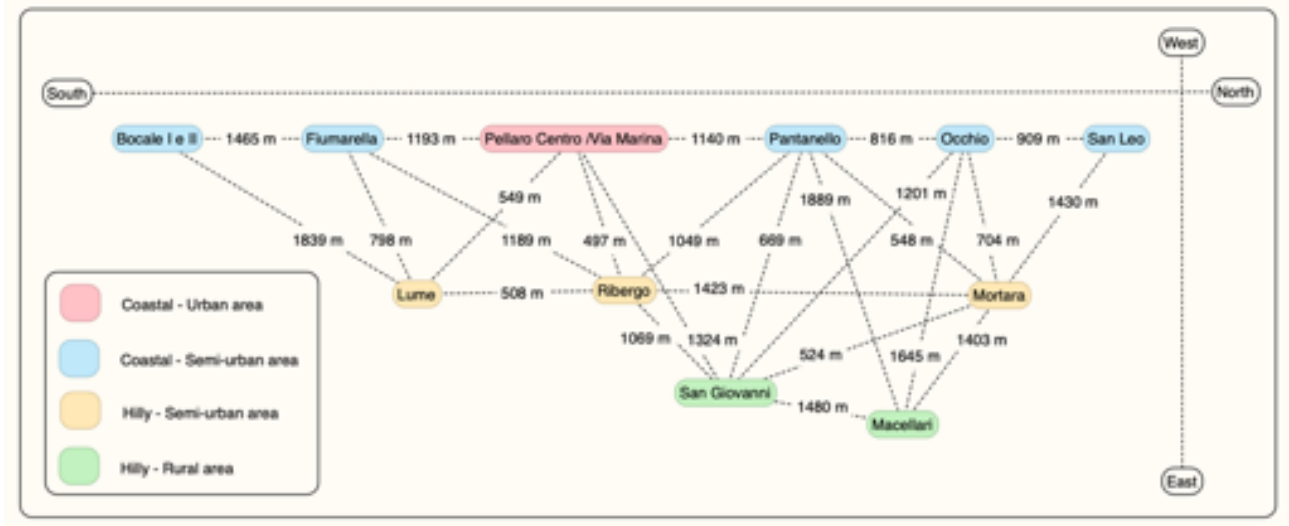
[95] The foreign population in Pellaro is 559 people, accounting for 6% of the total foreign population in the whole municipality of RC. The percentage ratio between the resident population aged 65 and over and the population aged from 0 to 14 class is 120, this value is below 152 which is the mean for the whole city of RC. ISTAT (2011) point out that social and material vulnerability in Pellaro is 93, below the mean value (103) for the whole area, employment rate is 37% (just above the mean at 36%), the index of conservation of

P/sqKm (ISTAT, 2011). The sub-municipal area of Pellaro accounts for a total amount of 182 ISTAT census tracks, of which 150 have been considered in this study (Tab. 6) according to individuals' perceived neighbourhood boundaries. Analysing secondary ISTAT data, the core urban centre of Pellaro is the neighbourhood "Pellaro Centro" (Fig. 21) representing the downtown within the whole sub-municipal area. From the aggregation of such ISTAT census tracks, an amount of 11 neighbourhoods have been identified (Fig. 20). The neighbourhoods being identified and their relative amount of ISTAT census tracks (Map 2 in Appendix 4) are the following: Pellaro Centro (29 census); San Leo (6 census); Ribergo (25 census); Lume (8 census); Mortara (8 census); Fiumarella (6 census); Bocale (30 census); San Giovanni (14 census); Pantanello (7 census); Occhio (10 census); and Macellari (7 census). These neighbourhoods differ from each other mainly in their land-use, transportation patterns and design features, not mentioning basic demographic and socioeconomic variations across their communities. Specifically, some neighbourhoods are characterised by orthogonal grids (see Neighbourhood 11 in Appendix 5), while others by leapfrog patterns of development, commercial strips, low density, automobile dominance, and a minimum of public open space.[96] Detailed information about neighbourhood boundaries, and population are provided in Tab. 2, 3 in Appendix 2 and Map 5 in Appendix 3, while aerial photos, viability and land-use schemes are provided in Appendix 5.

Fig. 21: Pellaro Centro (downtown).

Source: Author's elaboration of GIS and Google Earth data.

Fig. 22: Spatial analysis by proximity and kind of area.



Source: Author's elaboration.

Pellaro Centro is the core area as it is the one with higher density of people, economic activities and number of residential buildings, also Pellaro Centro is where population boasts higher

residential buildings is 31 (below the mean of RC at 40), and price of housing per sqm is 780 Euro/sqm (below the mean value of RC at 867 Euro/sqm).

[96] These characteristics refers to the definition of sprawl (Gillham, 2002, p. 8). The meaning of the term sprawl refers to the act of spreading out, or distributing, in a struggling manner (Word Reference, 2017). Generally, in the field of urban studies, scholars refer to sprawl as a particular form of urban or suburban development fueled by different causes.

level of educational attainment and income (Tab. 2 in Appendix 2). Fig. 22 is intended to depict the spatial setting and proximities between neighbourhoods being studied. To classify neighbourhoods three dimensions were observed: density, proximity from Pellaro Centro, and kind of area. According to these parameters, Pellaro Centro (Fig. 21) can be defined as the *downtown* area with a resident community of 2.331 people and a high density (3.565 people per sqKm) and the presence of 1.500 residential units, the maximum values across all neighbourhoods. As emerged in the analysis in the next paragraph (section 5.2.), among all the eleven neighbourhoods being studied, Pellaro Centro is the leading one for score of State of Perceived Health and Wellbeing (Y) of the resident community.

Tab 6: Population, sample size, kind of area for each neighborhood.

			NEIGHBOURHOODS UNDER STUDY											
	Data	Unit	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro	TOTAL
	No. Census Tracks	No.	7	10	7	14	30	6	8	8	25	6	29	150
	Kind of area	/	Hilly	Coastal	Coastal	Hilly	Coastal	Coastal	Hilly	Hilly	Hilly	Coastal	Coastal	/
	Area	sqKm	0,24	0,27	0,12	0,84	1,56	0,36	0,48	0,30	0,58	0,60	0,65	6,01
	Density	P/sqkm	1582,86	2444,23	2837,87	1993,27	1076,04	1732,23	1745,06	2368,94	1878,35	1270,31	3565,96	/
Population	Total Population	No.	380	655	350	1665	1683	618	838	716	1093	767	2331	11096
Sample (5%) 25y to 69y	Population 25-29yo	No.	220	405	202	1020	1031	373	521	441	644	462	1428	6747
	Sample 5%	No.	11	20,25	10,1	51	51,55	18,65	26,05	22,05	32,2	23,1	71,4	337,35
	Respondents	No.	17	24	16	57	59	25	30	27	39	29	77	400

Source: Author's elaboration of ISTAT data (https://www.istat.it/it/archivio/104317).

Fig. 23: From the left: Macellari, Ribergo (brown area) and Lume (pink area), and Pellaro Centro.

Source: Author's elaboration of GIS and Google Earth data.

Fig. 23 above and 24 below depict visual evidence of the urban morphology, land-use and transportation pattern observed within the 11 neighbourhoods considered in this study (see Appendix 3 and 5 for neighbourhood maps and schemes). Pellaro Centro (blue -urban) is the urban area (Fig. 21) characterised by a regular grid () where a human-size built environment favoured the flourishing of commercial activities and a dense network of sidewalks. Then, we find the neighbourhoods such as Lume and Ribergo (Fig. 21) that lie just next to the inner boarder of Pellaro Centro. Despite being separated by high-speed primary road (Map. 4 in Appendix 3), these two neighbourhoods are properly connected to Pellaro Centro (downtown) by pedestrian paths that cross the highway infrastructure. Furthermore, in the closest surrounding of Pellaro Centro, we can find the semi-urban coastal neighbourhoods of Bocale I e II (Fig. 21), Fiumarella, Pantanello, Occhio, and San Leo (Fig. 21),

these settlements are characterised by a similar pattern of *linear* development, opposite to the grid-based found in Pellaro Centro. Finally, we find the neighbourhoods of Macellari (Fig. 21 - rural area) and San Giovanni (Fig. 21 - semi-urban area). These two are characterised by linear pattern of sparse and *leapfrogging* development and sometimes. Aerial pictures and scheme for each neighbourhood under study are provided in the Appendix 5.

Fig. 24: From the left: Bocale (yellow area) and San Giovanni (light green), and San Leo (violet).

Source: Author's elaboration of GIS and Google Earth data.

5.2. Analysis of State of Perceived Health and Wellbeing (SPHW)

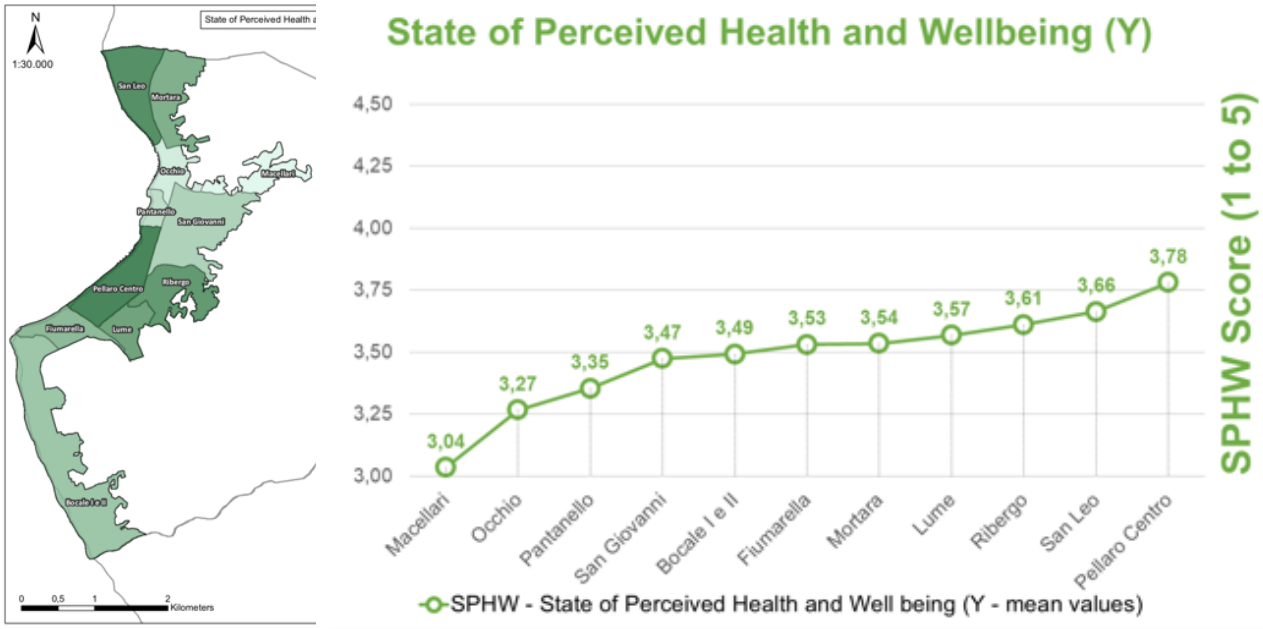
There exist inequalities[97] in the State of Perceived Health and Wellbeing (SPHW) (Graph 1 and Tab. 12 in Appendix 2) and in the burden of NCDs (Graph 3) across the 11 neighbourhood being studied. From results plotted in Graph 1 below, it comes out that just 6 out of 11 (69%) neighbourhoods boast higher score of SPHW than its mean value of 3,48. The minimum value of SPHW (3,03) was observed in Macellari, while the maximum value (3,78) was registered in Pellaro Centro. Overall, on a scale ranging from 1 to 5, the mean value of 3,48 suggests that, overall within the sub-municipality of Pellaro, there is a positive normal-to-high State of Perceived Health and Wellbeing. In addition, it seems that there exists a substantial health gap between Macellari (3,04), and Pellaro Centro (3,78).

By the analysis of the distribution throughout all the SPHW spectrum (Graph1 and Tab. 7), it emerges that there exists a health gradient among all neighbourhoods, ranging from rural areas (which perform below the mean value of NAH) such as Macellari (3,04) and San Giovanni (3,47) to semi-urban areas such as Occhio (3,27) and Pantanello (3,35). Furthermore, above the mean, we can find semi-urban areas such as Bocale I-II (3,49) and Fiumarella (3,53) which are characterised by a linear transportation pattern. Also, above the mean we can find semi-urban areas such as San Leo (3,66)

[97] According to Kawachi et al. (2002: 647), health inequality is "the generic term used to designate differences, variations, and disparities in the health achievements of individuals and groups."

and Mortara (3,54) which recently have been characterised by fast urban and economic growth (as emerged from direct observations). Finally, higher values of SPHW have been found in densely populated urban areas such as Pellaro Centro (3,78), Ribergo (3,61), and Lume (3,57); these areas lie next to each other, composing the core centre of the whole sub-municipality of Pellaro, the downtown. As emerged from secondary data from ISTAT (2011), these three neighbourhoods are characterized by high density, mixed land-use, and they are provided with a considerable amount of services and economic activities (Tab. 3 - Appendix).

Graph 1: SPHW score for each neighbourhood.



Source: Author's elaboration of Survey A data.

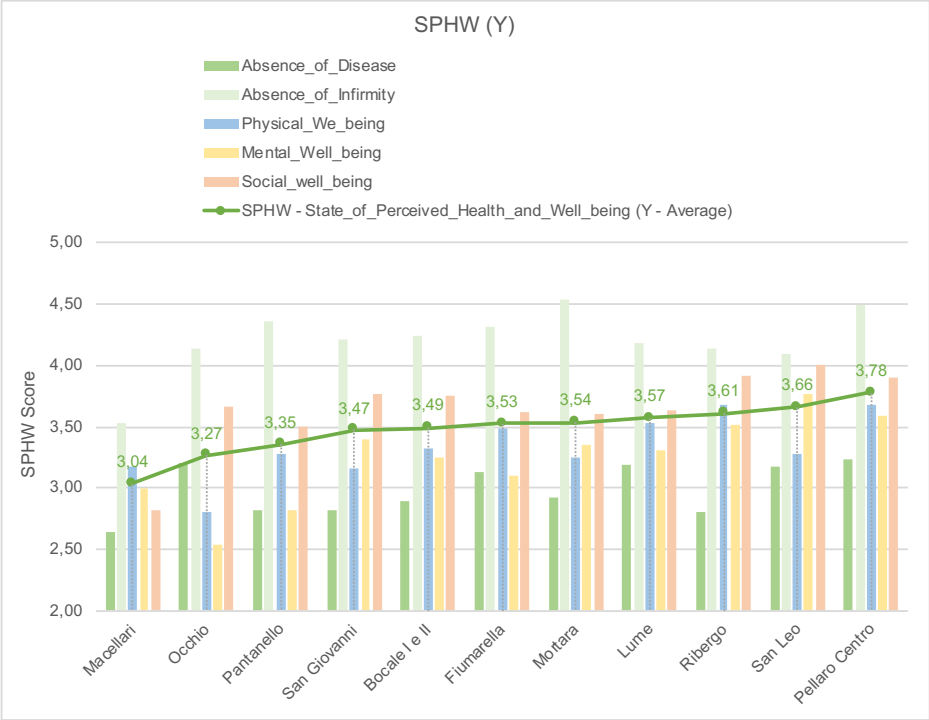
Tab. 7: All dimensions of SPHW.

	Variable		Mean	Med	Min	Max	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Survey A	Absence of Disease	Q.1	2,99	2,93	2,65	3,24	2,65	3,20	2,82	2,82	2,89	3,14	2,93	3,18	2,80	3,18	3,24
	Absence of Infirmity	Q.2	4,20	4,21	3,53	4,54	3,53	4,13	4,36	4,21	4,25	4,31	4,54	4,18	4,14	4,09	4,49
	Physical Wellbeing	Q.3	3,33	3,27	2,80	3,69	3,18	2,80	3,27	3,16	3,32	3,48	3,25	3,53	3,69	3,27	3,67
	Mental Wellbeing	Q.4	3,24	3,32	2,53	3,77	3,00	2,53	2,82	3,40	3,25	3,10	3,36	3,32	3,51	3,77	3,59
	Social Wellbeing	Q.5	3,65	3,67	2,82	4,00	2,82	3,67	3,50	3,77	3,75	3,62	3,61	3,63	3,91	4,00	3,90
	SPHW	Y	3,48	3,53	3,04	3,78	3,04	3,27	3,35	3,47	3,49	3,53	3,54	3,57	3,61	3,66	3,78

Source: Author's elaboration of Survey A.

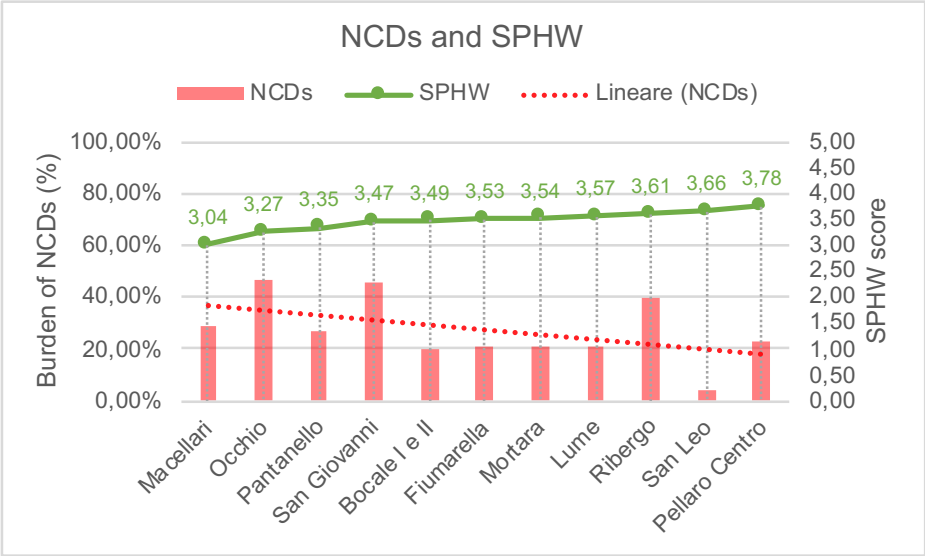
Tab. 7 and Graph. 2 provide a breakdown of SPHW (Y) for each neighbourhood, showing how similar patterns of SPHW occurs in all the five dimensions of perceived health throughout all the the neighbourhood. The score of SPHW (X) refers to the average value for all five dimensions of health and wellbeing considered in this study: absence of disease (Y1); absence of infirmity (Y2); physical wellbeing (Y3); mental wellbeing (Y4); social wellbeing (Y5). As an evidence, there exists gap and differences in all dimensions of perceived health between neighbourhoods such as Pellaro Centro and Macellari. Once again, the variations between urban, semi-urban and rural areas still exists. Interestingly, social wellbeing seems to follow the SPHW average value in all neighbourhoods being studied. Also, findings suggest that SPHW is substantially lowert in rural and semi-urban areas characterised by leapfrog pattern of physical development and a linear transportation system relying on car more than public transport.

Graph 2: All dimensions of SPHW score for each neighbourhood.



Source: Author's elaboration of Survey A.

Graph 3: NCDs and SPHW.



Source: Author's elaboration.

To conclude this first analysis on the State of Perceived Health and Wellbeing across the eleven neighbourhoods, it is useful to analyse if perceived health matches real health in terms of burden of NCDs within the population being studied. For each respondent of the survey was asked to indicate if he had been affected by one of the common NCDs[98] and other diseases (Q. 25 - Respondent Profile - Appendix). This comparison is full of potential biases, still it is a useful insight. Graph 3 above plot the percentage of respondents by neighbourhood that affirmed to be affected at least by one NCDs or other diseases. The comparison between the burden of NCDs and the value of SPHW partially reflect the main trends seen for SPHW in Graph 1, however caution is needed as factors such

[98] Such as High blood pressure; Diabetes; Heart Diseases; Cancer; Chronic bronchitis; Asthma; Depression; or I am not affected by any of these diseases.

as respondents' age and genetic factors play a crucial role for NCDs thus results should be interpreted with a broad view. Furthermore, when referring to the value of NCDs, we intend all diseases, therefore, Asthma accounts as cancer or depression and vice versa. Holding this perspective, and starting from the better and worst off to the other neighbourhoods, Pellaro Centro account for 22% in the burden of respondents with at least one NCDs, while its SPHW score reach 3, 78. On the opposite side of the spectrum we still find the rural area of Macellari where the burden of NCDs accounts for almost 30% and where SPHW score is 3,04, the worst among all neighbourhoods. Thus, there seems to be an inverse relationship between SPHW and burden of NCDs (divergence in Graph 4), this makes sense as higher the value of perceived health and few should be the burden of NCDs. Also, in San Leo where SPHW scores second just behind Pellaro Centro (3,78), the burden of NCDs is just 4%. In general, we can say that for neighbourhoods whose SPHW score lied below the mean SPHW value (3,48) the burden of NCDs is higher. Conversely, an inverse trend appears to neighbourhoods scoring above the mean SPHW value such as Fiumarella, Mortara, and Lume. However, there are discrepancy in in Ribergo where SPHW reach a positive value of 3,61, still the burden of NCDs reach almost 40%. Among all neighbourhoods, the San Leo SPHW score very high seems to match the lower burden of NCDs across all the neighbourhoods. In conclusion, there exist variations in the burden of NCDs across all 11 neighbourhoods, as between burden of NCDs and SPHW reinforce the potential validity of Survey A for investigating SPHW.

5.3. Analysis of the Model for Neighbourhood Advantage for Health (NAH)

To tackle the first research question[99] (RQ 1) in this study, and test the theoretical model of NAH, the author developed an iterative analysis process encompassing the following set of linear regression analyses[100]:

- Analysis 1 (section 5.3.1)
  Linear regression between the independent variable NAH (X) and dependent variable SPHW (Y) in order to identify the extent to which X associate to Y.

- Analysis 2 (section 5.3.2)
  Linear regression between the independent variables Compositional Advantage for Health (Xcp) and Contextual Advantage for Health (Xct) to identify the extent to which Xcp and Xct associate to Y. Then, linear regression between the independent variables Individual(s) Advantage for Health (Xcp1), Community Advantage for Health (Xcp2), Man-made Environment Advantage for Health (Xct1), Natural Environment Advantage for Health (Xct2) to identify the extent to which they associate to Y.

  → To tackle the second research question[101] (RQ 2), the author carried out the following descriptive correlation analysis:

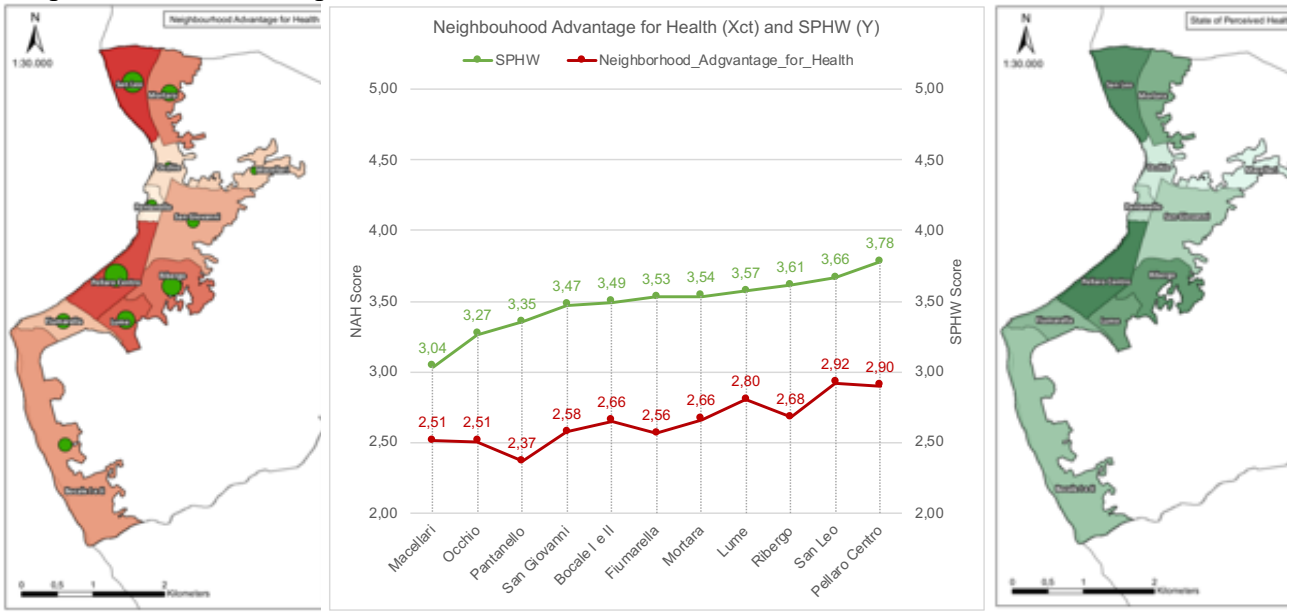
- Analysis 3 (section 5.3.3)
  It aims to describe the correlation between all factors of NAH and the dependent variable SPHW (Y) this in order to identify narrow the focus of this study on specific factors relevant for urban regeneration.

[99] RQ 1: To which extent NAH associate to Perceived Health and Wellbeing? RQ 2: Which specific factors of NAH are more relevant for health and wellbeing, and thus for urban regeneration at the neighborhood level?
[100] Regression and correlation values are given and the significance of these was assessed. Secondly, for each variable object of specific analysis, the author identified the neighbourhoods where sensitive values occurs, these values include mean, median, minimum, and maximum. Eventually, the authors provide potential explanations of the observed associations.
[101] RQ 2: Which specific factors of NAH are more relevant for health and wellbeing, and thus for urban regeneration at the neighborhood level?

5.3.1. Analysis 1 - SPHW to NAH

RQ 1: To which extent Neighbourhood Advantage for Health (X) associate to State of Perceived Health and Wellbeing(Y)? For tackling the main Research Question (RQ1) and testing the null hypothesis (Ho) and the directional hypotheses (Ha1, 2) the researcher performed a linear regression analysis between the two variables considered in this study (X and Y). Specifically, the parameters considered for the interpretation of this regression analysis are the following: R-squared; adjusted R-square; P-value (95% - 2 tails); unstandardized regression coefficient beta value; regression constant; and the regression equation. The detailed results for this analysis are provided in Regr. 1- Appendix 4 at the end of this work.

Graph 4: The relationship between NAH and SPHW.



Source: Author's elaboration.

This first regression analysis considers the following variables: score of the Neighbourhood Advantage for Health, or NAH (X - independent variable), and score of State of Perceived health and Wellbeing, or SPHW (Y - dependent variable). The detailed dataset for this statistical analysis is provided in Regr.1 in Appendix 4. The purpose of Analysis 1 was to explore the relationship between X and Y, to doing so, the following hypotheses were tested:

⇒ RQ1: To which extent Neighbourhood Advantage for Health (X) associate to State of Perceived Health and Well-being (Y)?

- *Ho: Neighbourhood Advantage for Health (X) do not associate to State of Perceived Health and Well-being (Y).*
- *Ha1: Neighbourhood Advantage for Health (X) associate to State of Perceived Health and Well-being (Y).*
- *Ha2: The neighbourhood Pellaro Centro will have higher score in Neighbourhood Advantage for Health (X) and greater score of State of Perceived Health and Wellbeing (Y) than other neighbourhoods;*

For the 11 neighbourhoods being observed, the results of the regression analysis indicate that NAH (X) do positively associates to SPHW (Y), accounting for a R-squared value=0,585 (58% of significance) an adjusted R-squared=0,539 (53% of significance) and a P-value=0,006 (more than 95% of confidence). The results indicate an unstandardized

regression coefficient beta value of 0,911, while a regression constant of 1,069. Moreover, the regression equation is the following Y=0,911*X+1,069, thus, according to the beta value each one unit increase in X (NAH) is expected to produce a 0,911 unit increase in the Y (SPHW). In the light of this, we can say that the null hypothesis (Ho) is rejected in favour of the alternative hypothesis (Ha1) that indicate that Neighbourhood Advantage for Health (X) do associate in magnitude and direction with State of Perceived Health and Wellbeing (Y). Therefore, the main Research Question (RQ) can be answered as follow: the theoretical model proposed in this study is significant with a confidence of over 95%, therefore we can say that Neighbourhood Advantage for Health do associate to Status of Perceived Health and Wellbeing.

- As suggested from the Graph 4 above, similar patterns for the two variables support the alternative hypothesis Ha2 (*Pellaro Centro will have higher score in Neighbourhood Advantage for Health (X) and greater score of State of Perceived Health and Wellbeing (Y) than other neighbourhoods*). Indeed, for each neighbourhood it comes out that value of NAH tracks the value of SPHW. As evidence, values of NAH (3,78) and SPHW (2,90) in the urban area of Pellaro Centro are substantially higher than in rural neighbourhoods such as Macellari (NAH = 2,51; SPHW = 3,04) and San Giovanni (NAH=2,58; SPHW=3,47), and also higher than semi-urban neighbourhoods such as Fiumarella (NAH = 2,51; SPHW= 3,04), Lume (NAH = 2,80; SPHW = 3,57), and Ribergo (NAH = 2,92; SPHW = 3,61), however, San Leo performed 2,92 for NHA and 3,66 for SPHW. Therefore, we can say that the alternative hypothesis Ha2 is partially confirmed. However, a more in-depth analysis is needed to estimate the extent of these variations across all neighbourhood being studied. Indeed, although the regression analysis suggest that the theoretical model is significant, caution is suggested in the interpretation of the results of the theoretical model as it encompasses many sub-variables as well as is exposed to many biases. However, the intent of this study is to provide descriptions of associations rather than causal explanation.

5.3.2. Analysis 2 - SPHW to Compositional and Contextual Advantages for Health

To shed light on which compositional and contextual factors of NAH (Xcp, Xct, Xcp1, Xcp2, Xct1, Xct2) affect more SPHW (Y), the model on NAH was collapsed according to the dimensions of the theoretical model presented in Chap. 3. Then, for each dimension multiple linear regression analyses and correlation analysis were carried out, the results of those are provided below.

→ Compositional Advantage for Health (Xcp) and SPHW (Y).
The detailed dataset for this statistical analysis is provided in Regr. 2 in the Appendix 4.

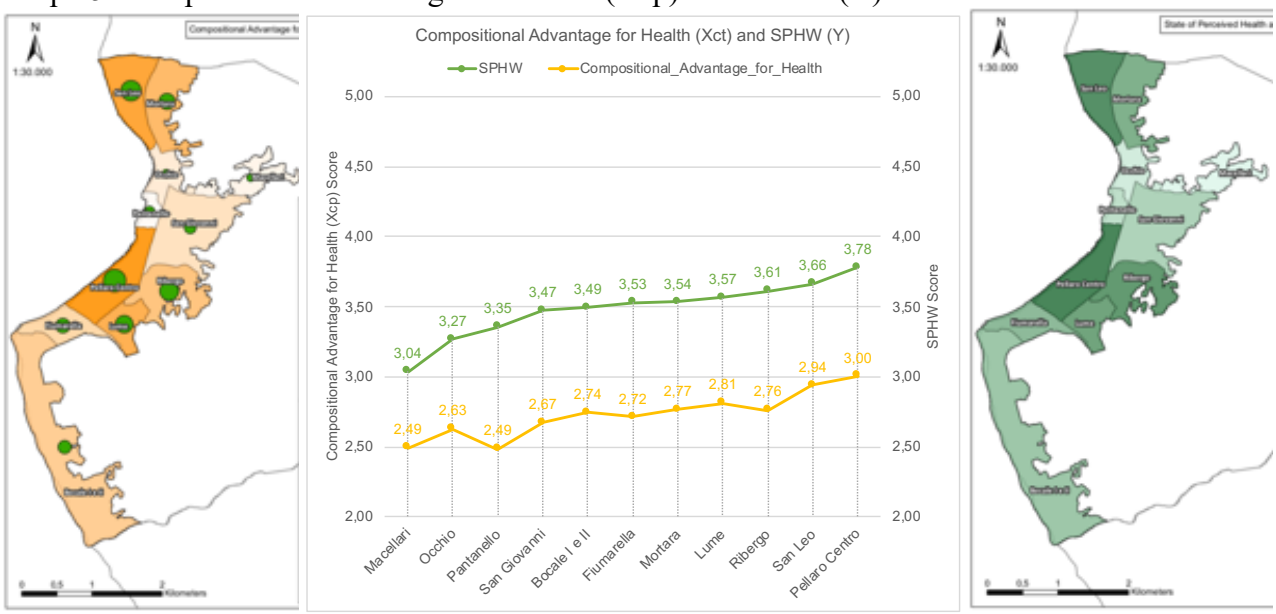
RQ1a: To which extent Compositional Advantage for Health (Xcp) associate to State of Perceived Health and Well-being (Y)?

- *Ho: Compositional Advantage for Health (Xcp) do not associate to State of Perceived Health and Well-being (Y).*
- *Ha1: Compositional Advantage for Health (Xcp) associate to State of Perceived Health and Well-being (Y).*
- *Ha2: The neighbourhood Pellaro Centro will have higher score in Compositional Advantage for Health (Xcp) and greater score of State of Perceived Health and Wellbeing (Y) than other neighbourhoods;*

- Compositional Advantage for Health (Xcp) do positively associates to SPHW (Y), accounting for a R-squared value=0,797 (79,7% of significance), an adjusted R-squared=0,775 (77,5% of significance) and a P-value=0,00 (more than 95% of confidence). The results indicate an unstandardized regression coefficient beta value of 1,129, while a regression constant of

0,403. The regression equation is Y=1,29*Xcp+0,403, thus, according to the beta value each one unit increase in Xcp is expected to produce a 1,129 unit increase in the Y (SPHW). In the light of this, we can say that the null hypothesis (Ho) is rejected in favour of the alternative hypothesis (Ha1) that indicate that Compositional Advantage for Health (Xcp) do associate in magnitude and direction with State of Perceived Health and Wellbeing (Y). The mean value of Xcp is 2,72, while the maximum value of 3,00 have been found in Pellaro (Tab. 21, 24 - Appendix). On the opposite, the lower value of 2,48 was found in the rural area of Macellari. Above the mean, in order of rank, we find San Leo, Ribergo, Lume, Mortara, and Fiumarella. Therefore, we can say that the alternative hypothesis Ha2 is confirmed. Interestingly, below the mean value (3,48) of Xcp, we find the same neighbourhoods performing low SHPW scores such as San Giovanni, Pantanello, Occhio and Macellari (Graph 5).

Graph 5: Compositional Advantage for Health (Xcp) and SPHW (Y)



Source: Author's elaboration.

→ Contextual Advantage for Health (Xct) and SPHW (Y).
The detailed dataset for this statistical analysis is provided in Regr.5 - Appendix 4.

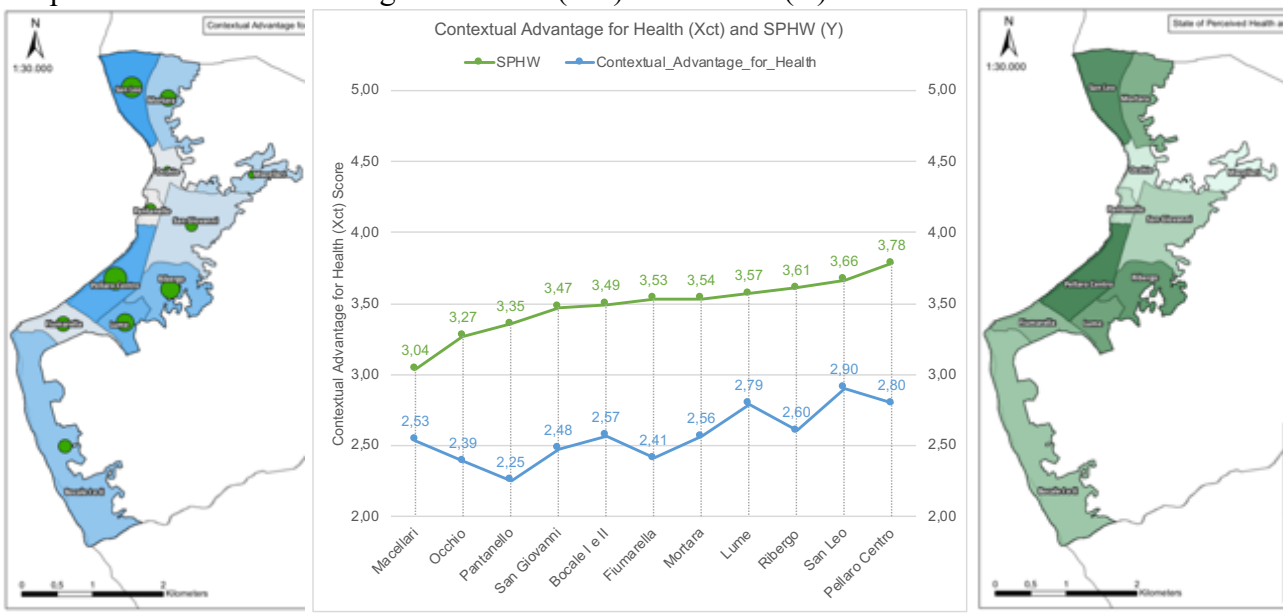
RQ1b: To which extent Contextual Advantage for Health (Xct) associates to State of Perceived Health and Well-being (Y)?

- *Ho: Contextual Advantage for Health (Xct) do not associate to State of Perceived Health and Well-being (Y).*
- *Ha1: Contextual Advantage for Health (Xct) associate to State of Perceived Health and Well-being (Y).*
- *Ha2: The neighbourhood Pellaro Centro will have higher score in Contextual Advantage for Health (Xct) and greater score of State of Perceived Health and Wellbeing (Y) than other neighbourhoods;*

Contextual Advantage for Health (Xct) do positively associates to SPHW (Y), accounting for a R-squared value=0,363 (36% of significance), an adjusted R-squared=0,292 (29% of significance) and a P-value=0,05 (95% of confidence). The results indicate an unstandardized regression coefficient beta value of 0,628, while a regression constant of 1,868. The regression equation is Y=0,628*Xct+1,868, thus, according to the beta value each one unit increase in Xct is expected to produce a 0,628 unit increase in the Y (SPHW). In the light of this, we can say that the null hypothesis (Ho) is rejected in favour of the alternative hypothesis (Ha1) that

indicate that Contextual Advantage for Health (Xct) do associate in magnitude and direction with State of Perceived Health and Wellbeing (Y). The mean value for Xct was 2,57, while the maximum value registered was 2,90 and it was found in the neighbourhood of San Leo where SPHW scores very high at 3,66, just behind Pellaro Centro the leading neighbourhood for SPHW performances (Graph. 6). Same patterns as above seems to characterised Xct as neighbourhoods performing better in SPHW do the same for Xct, and vice versa. Therefore, we can say that the alternative hypothesis Ha2 is partially confirmed. Although the correlation coefficients of Xcp (77%) and Xct (29%) are significative and suggest positive relationship of Xcp and Xcp to SPHW across all the 11 neighbourhoods, it is interesting to explore further the relationship among the specific factors on which relies the Compositional (Xcp) and Contextual Advantage for Health (Xct) to better understand which specific factors within these two are the more relevant for SPHW, and thus for urban regeneration.

Graph 6: Contextual Advantage for Health (Xct) and SPHW (Y).



Source: Author's elaboration.

→ Individual's Advantage for Health (Xcp1) and SPHW (Y).
The detailed dataset for this statistical analysis is provided in Regr.3 - Appendix 4.

RQ1c: To which extent Individual's Advantage for Health (Xcp1) associates to State of Perceived Health and Well-being (Y)?

- *Ho: Individual's Advantage for Health (Xcp1) do not associate to State of Perceived Health and Well-being (Y).*
- *Ha1: Individual's Advantage for Health (Xcp1) associate to State of Perceived Health and Well-being (Y).*

↜ Individual(s) Advantage for Health (Xcp1) do positively associates to SPHW (Y), accounting for a R-squared value=0,727 (72% of significance), an adjusted R-squared=0,696 (69% of significance) and a P-value=0,001 (more than 95% of confidence). The results indicate an unstandardized regression coefficient beta value of 1,25 while a regression constant of 0,017. The regression equation is Y=1,215*Xct+0,017, thus, according to the beta value each one unit increase in Xct is expected to produce a 1,215 unit increase in the Y (SPHW). In the light of this, we can say that the null hypothesis (Ho) is rejected in favour of the alternative hypothesis (Ha1) that indicate that *Individual's Advantage for Health (Xcp1)* do associate in magnitude and direction with State of Perceived Health and Wellbeing (Y). The mean value

of Xcp1 was 2,53, the minimum value of 2,27 was registered in Macellari (Graph. 7), while the maximum value of 2,85 was performed in the neighbourhood of Pellaro Centro, the leading area for SPHW (3,78).

→ Community's Advantage for Health (Xcp2) and SPHW (Y).
The detailed dataset for this statistical analysis is provided in Regr.4 - Appendix 4.

RQ1d: To which extent Community's Advantage for Health (Xcp2) associate to State of Perceived Health and Well-being (Y)?

- *Ho: Community's Advantage for Health (Xcp2) do not associate to State of Perceived Health and Well-being (Y).*
- *Ha1: Community's Advantage for Health (Xcp2) associate to State of Perceived Health and Well-being (Y).*

↷ Community Advantage for Health (Xcp2) do positively associates to SPHW (Y), accounting for a R-squared value=0,514 (51% of significance), an adjusted R-squared=0,460 (46% of significance) and a P-value=0,013 (more than 95% of confidence). The results indicate an unstandardized regression coefficient beta value of 0,63 while a regression constant of 1,841. The regression equation is Y=0,630*Xct+01,184, thus, according to the beta value each one unit increase in Xct is expected to produce a 0,630 unit increase in the Y (SPHW). In the light of this, we can say that the null hypothesis (Ho) is rejected in favour of the alternative hypothesis (Ha1) that indicate that Community Advantage for Health (Xcp2) *do* associate in magnitude and direction with State of Perceived Health and Wellbeing (Y). The mean value of Xcp2 was 2,59, while the maximum value of 3 was registered in San Leo where SPHW was 3,66. The minimum value of 2,23 was found in Pantanello, semi-urban area scoring 3,35, below the SPHW mean of 3,48.

→ Man-made Environment Advantage for Health (Xct1) and SPHW (Y).
The detailed dataset for this statistical analysis is provided in Regr. 6 - Appendix 4.

RQ1e: To which extent Man-made Environment Advantage for Health (Xct1) associate to State of Perceived Health and Well-being (Y)?

- *Ho: Man-made Environment Advantage for Health (Xct1) do not associate to State of Perceived Health and Well-being (Y).*
- *Ha1: Man-made Environment Advantage for Health (Xct1) associate to State of Perceived Health and Well-being (Y).*

↷ Man-made environment Advantage for Health (Xct1) do positively associates to SPHW (Y), accounting for a R-squared value=0,513 (51,3% of significance), an adjusted R-squared=0,459 (45,9% of significance) and a P-value=0,013 (more than 95% of confidence). The results indicate an unstandardized regression coefficient beta value of 0,537 while a regression constant of 2,226. The regression equation is Y=0,537*Xct+2,226, thus, according to the beta value each one unit increase in Xct1 is expected to produce a 0,537 unit increase in the Y (SPHW). In the light of this, we can say that the null hypothesis (Ho) is rejected in favour of the alternative hypothesis (Ha1) that indicate that Man-made environment Advantage for Health (Xct1) *do* associate in magnitude and direction with State of Perceived Health and Wellbeing (Y). The mean value for Xct1 was 2,45, while the maximum value was registered in San Leo (2,83), a semi-urban residential area where residential and economic development is occurring as the area is very well connected with main transportation system. As expected, the score of Xct1for Pellaro Centro (2,80) ranks just a step behind San Leo, while the minimum value of Xct1 was found in Pantanello (2,13).

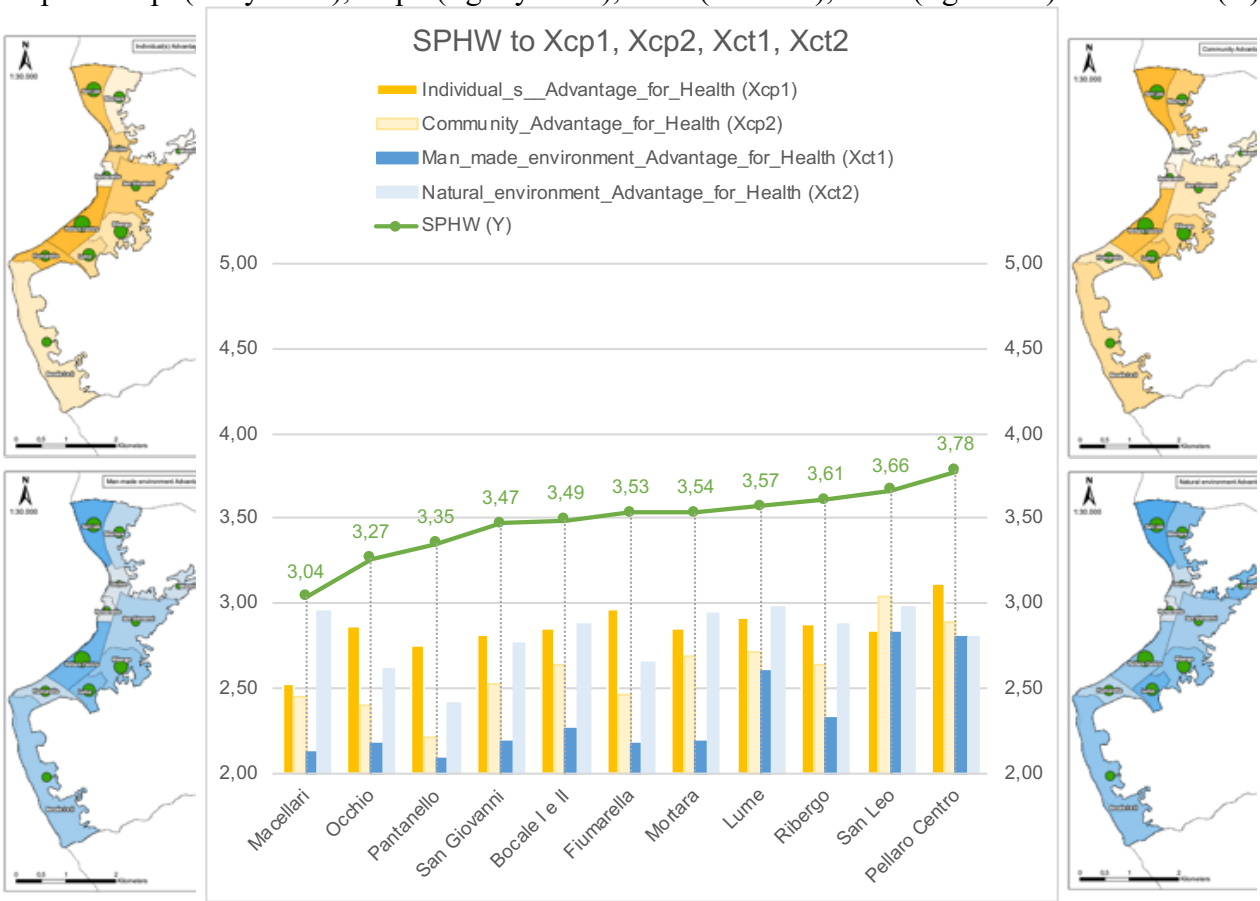
→ Natural Environment Advantage for Health (Xct2) and SPHW (Y).
The detailed dataset for this statistical analysis is provided in Regr.7 - Appendix 5.

RQ1f: To which extent Natural Environment Advantage for Health (Xct2) associate to State of Perceived Health and Well-being (Y)?

- *Ho: Natural Environment Advantage for Health (Xct2) do not associate to State of Perceived Health and Well-being (Y).*
- *Ha1: Natural Environment Advantage for Health (Xct2) associate to State of Perceived Health and Well-being (Y).*

Natural Environment Advantage for Health (Xct2) do not associate to SPHW (Y), accounting for a R-squared value=0,051 (5,1% of significance), an adjusted R-squared= -0,504 and a P-value=0,504. The results indicate an unstandardized regression coefficient beta value of 0,256 while a regression constant of 2,765. The regression equation is Y=0,256 *Xct+2,765. In the light of this, we can say that the null hypothesis (Ho) is true, thus, Environment Advantage for Health (Xct2) *do not* associate with State of Perceived Health and Wellbeing (Y). However, the mean value of Xct2 was 2,78, while the maximum value was registered in San Leo (2,98), here it is worth notice to say that the neighbourhood enjoys the influence of his positive geographical position. The minimum value of 2,39 was found in Pantanello following the same trend as described in Xcp2, Xct1 and Xct2. Interestingly, a high Xtc2 score of 2,92 was found in Macellari which makes sense as it is a rural area.

Graph 7: Xcp1(left yellow), Xcp2 (right yellow), Xct1 (left blue), Xct2 (right blue) and SPHW (Y).



Source: Author's elaboration.

Tab. 8 depict a synthesis of the results for Analysis 1 and 2. Overall, there exist positive associations between neighbourhood advantages for health and SPHW, apart from Xct2 and SPHW

that challenge the theoretical model on the observability of the Natural Environment Advantage for Health. In the light of this, we can say that Individual(s) Advantage for Health (Xcp1), Community Advantage for Health (Xcp2), and Man-made Environment Advantage for Health (Xcti1) still hold as significative association with SPHW to explore further, instead the influence of the Natural Environment can be discarded. One explanation for the weakness of the correlation between Xcp2 and SPHW could lie in the fact that questions asked to respondents lacked their initial investigation purposes, or, even more, the effect of the natural environment on health is not detectable as the studied area is too small (6 sqKm), thus, climatically and geographical variations between neighbourhoods may not be observable.

Tab. 8: Correlation of all dimensions of NAH (X) to SPHW (Y).

Survey	Items	Variable	Name of the variable	R2	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Survey A	5 items	**Y**	SPHW	1,000	3,04	3,27	3,35	3,47	3,49	3,53	3,54	3,57	3,61	3,66	3,78
Survey A + B	64 items	**X**	NAH	0,585	2,51	2,51	2,37	2,58	2,66	2,56	2,66	2,80	2,68	2,92	2,90
Survey B	32 items	**X cp**	Compositional Advantage For Health	0,797	2,49	2,63	2,49	2,67	2,74	2,72	2,77	2,81	2,76	2,94	3,00
Survey B	16 items	**Xcp1**	Individuals' Advantage for Health	0,727	2,53	2,86	2,76	2,82	2,85	2,97	2,85	2,91	2,88	2,84	3,12
Survey B	16 items	**Xcp2**	Community's Advantage for Health	0,514	2,46	2,40	2,21	2,53	2,63	2,46	2,69	2,71	2,64	3,04	2,89
Survey C	32 items	**X ct**	Contextual Advantage for Health	0,363	2,53	2,39	2,25	2,48	2,57	2,41	2,56	2,79	2,60	2,90	2,80
Survey C	16 items	**Xct1**	Man-made environment Adv for Health	0,513	2,12	2,17	2,09	2,19	2,26	2,17	2,19	2,61	2,32	2,83	2,80
Survey C	16 items	**Xct2**	Natural environment Adv for Health	0,051	2,95	2,61	2,42	2,77	2,88	2,65	2,94	2,98	2,88	2,98	2,80

Source: Author's elaboration.

5.3.3. Analysis 3 - SPHW to all factors of NAH

The following paragraph aims to answer the second research question (RQ2) tackled in this study. Results of the analysis 1 (section 5.3.1.) and analysis 2 (section 5.3.2.) suggest that the dimensions of NAH (Compositional Advantage for Health, Xcp - Contextual Advantage for Health, Xct) do associate to a certain extent to Perceived State of Health and Wellbeing (Y). However, in Analysis 2, when Xcp and Xct were tested to SPHW, these did associate to SPHW, but with different degree of intensity (see results in Tab. 5). As the purpose of this study is to narrow the investigation to investigate which specific factors of NAH are more relevant to foster in urban regeneration schemes, and therefore answer the RQ2[102], Analysis 3 provided in the next paragraph (section 5.3.3.) investigates further and expand the analyses 1 and 2, exploring which factors within Xcp and Xct are the more significative for SPHW. To doing so, the author carried out a correlation analysis between SPHW (Y) and all sub-factors composing NAH (Xcp; Xcp1; Xcp2; Xct; Xct1; Xct2) to find out which of these sub-factors correlate to minimum value of minimum 0,40 (40% of correlation to SPHW). The overarching intent of Analysis 3 is to identify which specific factors of NAH are more significative for SPHW. To doing so, factors of NHA were considered significative only if they correlated above 40% to SPHW. The detailed dataset for this descriptive correlation[103] analysis is provided in Regr.10 in the Appendix 5 and in Tab. 15 in Appendix 2.

⇒ RQ 2: Which specific factors of NAH are more relevant for health and wellbeing, and thus for urban regeneration at the neighbourhood level? [104] Among all the 32 factors[105] composing Compositional Advantage for Health (Xcp), a total amount of 17 factors seems to be significant for SPHW (Y) as these factors do correlate to SPHW within

[102] RQ 2: Which specific factors of NAH are more relevant for health and wellbeing, and thus for urban regeneration at the neighborhood level?

[103] Differently from Analyses 1 and 2 that considered the adjusted R-squared, Analysis 3 considers just the correlation value between SPHW and the specific factor being studied. The intent is to narrow this research to relevant factors for urban regeneration.

[104] The procedures for carried out the three analysis above relies on a simple format. To begin with, regression and correlation values are given and the significance of these was assessed. Factors with a correlation value of 40% and more were defined as significative. For each significative factor, the author identified the neighbourhoods where sensitive values occurred, these values include mean, median, minimum, and maximum.

[105] For more information on the factors see Table 6 - Appendix 2

values ranging from 0,40 (40%) to 0,90 (83%). Specifically, 8 factors are related to Individual(s) Advantage for Health (Xcp1), while 9 factors are related to Community Advantage for Health (Xcp2). Among all the 32 factors[106] composing Contextual Advantage for Health (Xcp), a total amount of 11 factors seems to be significant for SPHW (Y) as these factors do correlate to SPHW within values ranging from 0,40 (0,50) to 0,90 (90%). In particular, 9 significant factors are related to Man-made Environment Advantage for Health (Xct1), while 2 factors are related to the Natural Environment Advantage for Health (Xct2).

Fig. 25: Individual(s) Advantage for Health (Xcp1)

Source: Author's elaboration.

→ RQ 2a. Which specific factors of Individual(s) Advantage for Health (Xcp1) are more relevant for SPHW, and thus for urban regeneration at the neighbourhood level? In order of ranking by degree of correlation with SPHW, factors which are related to Individual(s) sector (Fig. 25) are the following: household income (0,83); mother's education (0,83); father's education (0,77); individuals' awareness of the determinants of health such as income (0,66), nutrition (0,64), lifestyle (0,61), age (0,56), and education (0,54). In addition, it is worth notice to highlight Individual(s) sector-related factors that correlate to SPHW below 0,50 (50%) such as individual's propension to physical activities (0,51), water intake per day (0,47), hours of not-for-profit per individual (0,42), anti-alcohol attitude (0,41) and anti-smoking attitude (0,41), hours of intense physical activities per day (0,40), and BMI (-0,34, inverse relationship).

Fig. 26: Community Advantage for Health (Xcp2)

Source: Author's elaboration.

→ RQ 2b. Which specific factors of Community Advantage for Health (Xcp2) are more relevant for SPHW, and thus for urban regeneration at the neighbourhood level? In order of ranking by degree of correlation with SPHW, factors which are related to Community sector (Fig. 26) are the following: trust (0,90); stigma-free

[106] For more information on the factors see Table 7 - Appendix 2

neighbourhood (0,84); sense of belonging to the community (0,73); social cohesion (0,73); economic accessibility (0,69); see other people walking in the neighbourhood (0,66); safety (0,60); sharing values (0,54); and price of healthy food (0,50). In addition, it is worth notice to highlight Community sector-related factors that correlate to SPHW below 0,50 (50%) such as community perception of not-for-profit institutions (0,47), and institutional support (0,47).

Fig. 27: Man-made Environment Advantage for Health (Xct1)

Source: Author's elaboration.

→ RQ 2c. Which specific factors of Man-made Advantage for Health (Xct1) are more relevant for SPHW, and thus for urban regeneration at the neighbourhood level? In order of ranking by degree of correlation with SPHW, factors which are related to Man-made Environment sector (Fig. 27) are the following: proximity by walk to food store (0,86); aesthetics pleasant (0,76); sidewalk quality (0,76); streets quality (0,69); opportunity for physical activities (0,67); home comfort (0,63); presence of healthy food stores (0,62); pleasant walking (0,51); home quality (0,50). In addition, it is worth notice to highlight Man-made Environment sector-related factors that correlate to SPHW below 0,50 (50%) such as presence of commercial activities (0,49), and proximity to health care facilities (0,46).

Fig. 28: Natural Environment Advantage for Health (Xct2)

Source: Author's elaboration.

→ RQ 2d. Which specific factors of Natural Environment Advantage for Health (Xct2) are more relevant for SPHW, and thus for urban regeneration at the neighbourhood level? Although Xct2 was registered as not significative for SPHW, it is interesting to describe which factor within Xct2 correlate the most with SPHW (Fig. 28). In order of ranking by degree of correlation with SPHW, factors which are related to Natural Environment sector are the following: air-pollution free (0,62), and quality of the natural environment (0,60). In addition, it is worth notice to highlight Natural Environment sector-

related factors that correlate to SPHW below 0,50 (50%) such as home exposure to South (0,47), and soil-pollution free (0,41).

6. RESULTS AND IMPLICATIONS FOR URBAN REGENERATION

This paragraph aims to provide interpretation for the results obtained in Analysis 1, 2, and 3 (chapter 5 - section 5.2., 5.3.) proving implications of the results of this study (Tab. 9 and 10 below) for urban regeneration aiming to foster health and wellbeing at the neighbourhood level. Implications of this study provided in this section are the foundation to build guidelines (chapter 7 - section 7.1.) for urban regeneration interventions for better community health and wellbeing.

Tab. 9: Synthesis of the results for NAH by correlation to SPHW and mean values.

	Name of the variable	R2	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Y	**SPHW**	**1,000**	**3,04**	**3,27**	**3,35**	**3,47**	**3,49**	**3,53**	**3,54**	**3,57**	**3,61**	**3,66**	**3,78**
X	**NAH**	**0,585**	**2,51**	**2,51**	**2,37**	**2,58**	**2,66**	**2,56**	**2,66**	**2,80**	**2,68**	**2,92**	**2,90**
X cp	**Compositive Adv for Health**	**0,797**	**2,49**	**2,63**	**2,49**	**2,67**	**2,74**	**2,72**	**2,77**	**2,81**	**2,76**	**2,94**	**3,00**
Xcp1	Individual(s) Adv for Health	**0,727**	2,53	2,86	2,76	2,82	2,85	2,97	2,85	2,91	2,88	2,84	3,12
Xcp2	Community Adv for Health	**0,514**	2,46	2,40	2,21	2,53	2,63	2,46	2,69	2,71	2,64	3,04	2,89
X ct	**Contextual Adv for Health**	**0,363**	2,53	2,39	2,25	2,48	2,57	2,41	2,56	2,79	2,60	2,90	2,80
Xct1	Man-made Env Adv for Health	**0,513**	2,12	2,17	2,09	2,19	2,26	2,17	2,19	2,61	2,32	2,83	2,80
Xct2	Natural Env Adv for health	**0,051**	2,95	2,61	2,42	2,77	2,88	2,65	2,94	2,98	2,88	2,98	2,80

Source: Author's elaboration.

Tab. 10: All dimensions of State of Perceived Health and Wellbeing (SPHW - Y).

	Variable		Mean	Med	Min	Max	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Survey A	Absence of Disease	Q.1	2,99	2,93	2,65	3,24	2,65	3,20	2,82	2,82	2,89	3,14	2,93	3,18	2,80	3,18	3,24
	Absence of Infirmity	Q.2	4,20	4,21	3,53	4,54	3,53	4,13	4,36	4,21	4,25	4,31	4,54	4,18	4,14	4,09	4,49
	Physical Wellbeing	Q.3	3,33	3,27	2,80	3,69	3,18	2,80	3,27	3,16	3,32	3,48	3,25	3,53	3,69	3,27	3,67
	Mental Wellbeing	Q.4	3,24	3,32	2,53	3,77	3,00	2,53	2,82	3,40	3,25	3,10	3,36	3,32	3,51	3,77	3,59
	Social Wellbeing	Q.5	3,65	3,67	2,82	4,00	2,82	3,67	3,50	3,77	3,75	3,62	3,61	3,63	3,91	4,00	3,90
	SPHW	Y	3,48	3,53	3,04	3,78	3,04	3,27	3,35	3,47	3,49	3,53	3,54	3,57	3,61	3,66	3,78

Source: Author's elaboration.

6.1. Interpretation of Results and Implications for Urban Regeneration

For exploring the degree to which Neighbourhood Advantage for Health (X) for the neighbourhood associate to Status of Perceived Health and Wellbeing (Y) of the community living within the neighbourhood, and for identify which dimensions of NAH are more relevant for SPHW. The scale for scores of NAH (for the neighbourhood) and SPHW (for the resident community) range from 1 (negative) to 5 (positive), reflecting the mean value among all individuals living in the same neighbourhood. Results for "Survey A, B, C" and "Respondent Profile" were interpreted, and to confirm the results of this survey study, surveys results were crossed with secondary data gathered from ISTAT, GIS, and Web-based databases, and direct on-field observations. This was done in order to provide potential explanations for patterns emerged in this study. Before going further and exploring the relationship between factors of NAH and SPHW within each neighbourhood, it is useful to recall the classification for describing the kind of residential areas being studied. According to this classification, relying on density, proximity from Pellaro Centro, and kind of area (see data in Tab. 10), we can define the 11 neighbourhoods being studied as follow: Pellaro Centro as the core urban coastal area; Ribergo, Lume as the semi-urban hilly area; On south east, Fiumarella and Bocale as

semi-urban coastal area; On the north, Pantanello and Occhio, San Leo and Mortara as semi-urban coastal area; and San Giovanni as semi-rural and Macellari as rural area. In this spatial and geographical setting, the neighbourhood Pellaro Centro exerts a crucial role for other neighbourhoods as it represents the vibrant core centre within the whole sub-municipal area of Pellaro. This neighbourhood can be defined as a sort of downtown for the whole area being studied. The neighbourhood of Pellaro Centro is the densest and more populated across all areas being studied. Also, it is the first for educational and income level for the whole area. Pellaro Centro features mixed land-use throughout a grid-based masterplan (see aerial photo of Pellaro Centro in Appendix 5), still the size of street and buildings seems to have a *human scale*, streets are about 6 meters wide and there is a prevalence well maintained residential buildings. As it emerged in the analysis, Pellaro Centro is the more *walkable* (see Q.13 in Survey C), the neighbourhood is dense of residential and commercial buildings just next to economic activities. As expected, Pellaro Centro is the leading neighbourhood for State of Perceived Health and Wellbeing (SPHW) and the second one for Neighbourhood Advantage for Health (NAH) (Fig. 29 and Fig. 30 below). Since the strong association of SPHW with NAH, Pellaro Centro was considered as a baseline for comparisons with other neighbourhoods under study.

Fig. 29: SPHW (Y- green) and Neighbourhood Advantage for Health (X - red).

Source: Author's elaboration.

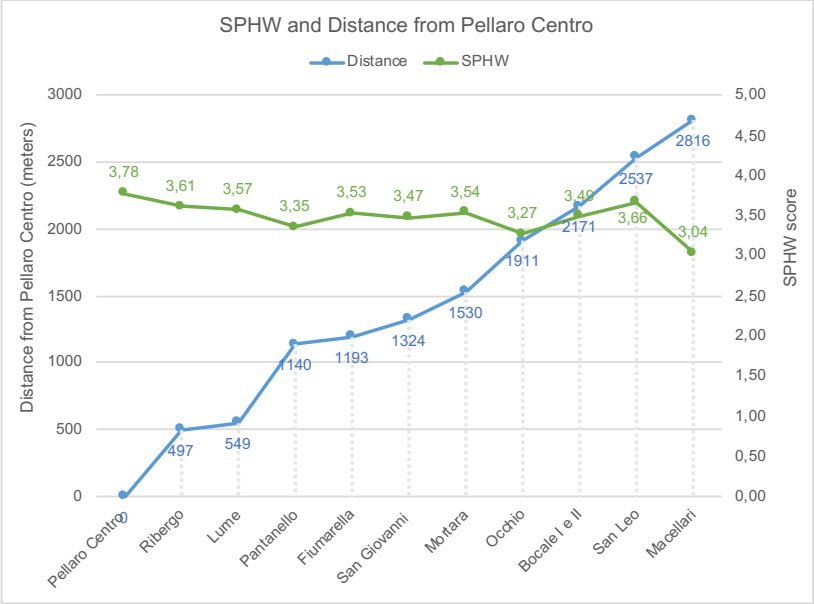
Fig. 30: SPHW (Y- green) and Neighbourhood Advantage for Health (X - red).

Source: Author's elaboration.

The descriptive analysis of the variations in State of Perceived Health and Wellbeing (SPHW-Y) across different neighbourhoods suggest that there exists both a gap and a gradient in perceived

health and wellbeing across the communities[107] of the 11 neighbourhoods being studied (5.2). Indeed, there exist health inequalities among the communities living within different neighbourhoods all the way through the spectrum of State of Perceived Health and Wellbeing (Tab. 1), and, into this spectrum there is an evident gap between Pellaro Centro (SPHW=3,78) and Macellari (SPHW=3,04). Thus, as a first fundamental finding, we can say that there exist inequalities in SPHW across the 11 neighbourhood being studied. These variances exist both as a SPHW gap (Macellari vs Pellaro) and as a SPHW gradient throughout all the SPHW spectrum.

Graph 8: SPHW and distance from Pellaro Centro (downtown).



Source: Author's elaboration of Survey A and Google Earth data.

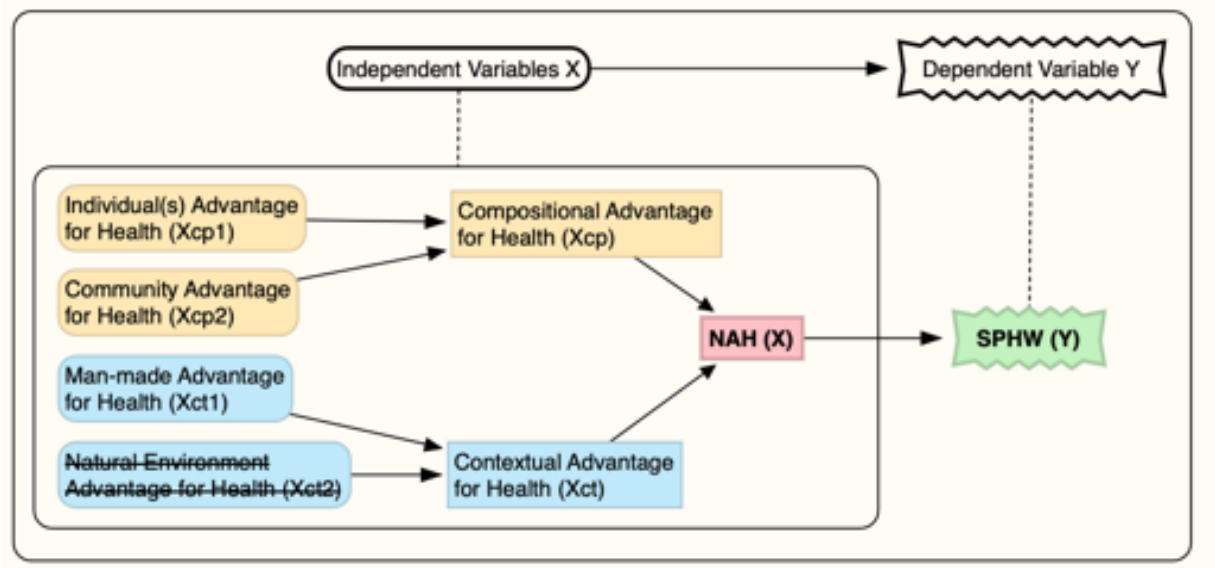
Graph 8 above depicts the relationship between SPHW scores and their distance from Pellaro Centro, which lies at the bottom left at a value of 0 and it is the leading neighbourhood for SPHW score. Interestingly, the distance of each neighbourhood under study from Pellaro Centro is negatively related to their relative SPHW score. The adjusted R-square between the two variables is 0,38 (38%) and the P-value is 0,043 (Regr. 10 in Appendix 4), thus, it can be considered a significant inverse relationship. Specifically, on the left side of Graph 8 we find Pellaro Centro, the core urban area, instead, on the opposite side, we find Macellari which is the more internal neighbourhood located into a rural area and more distant from Pellaro Centro. As suggested from the convergence of SPHW and "distance from Pellaro Centro" in Graph 8, it comes out that there is an inverse relationship between SPHW scores and the distance of each neighbourhood from Pellaro Centro, indicating that the greater distance from Pellaro Centro, fewer the SPHW score. However, this relationship does not apply to neighbourhoods such as San Leo and Mortara as they are characterised by high values of SPHW.

Fig. 31 and Fig. 32 visualise the adjusted theoretical model of NAH affecting SPHW that was earlier defined in chapter 3 - section 3.4. Findings of Analysis 1 suggest that greater the Neighbourhood Health Advantage for Health (NAH), higher the level of SPHW of the community living within the neighbourhood. The same trend seems to occur when investigating the relationship between Compositional Advantage for Health (Xcp) and Contextual Advantage for Health (Xct) to SPHW (see Analysis 2 in section 5.3.2). According to the results of the analyses, we can say that

[107] Community is intended as a sample of 5% for each age cohort of the total population living within each neighborhood being studied. Further information on the sample can be found in Tab. 2 in Appendix 2.

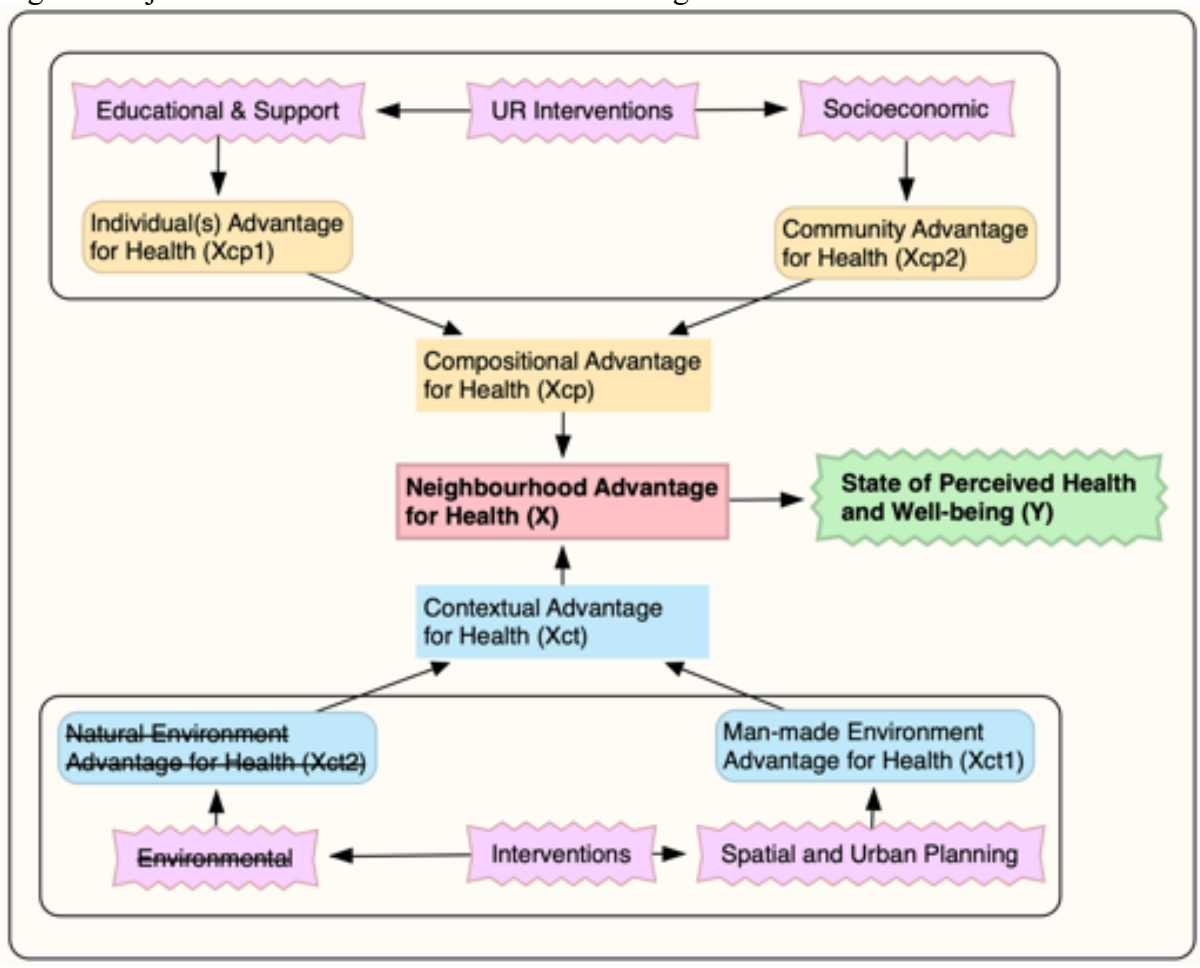
there exist significant associations between and SPHW and all factors of NAH such as Xcp, Xct, Xcp1, Xcp2, Xct, Xct1, but the relationship SPHW to Xct2 was not significative meaning that the influence of the Natural Environment Advantage for Health (Xct2) can be not considered for the purpose of a neighbourhood-based analysis.

Fig. 31: Adjusted visual theoretical model of NAH affecting SPHW.



Source: Author's elaboration.

Fig. 32: Adjusted theoretical model of NAH affecting SPHW.



Source: Author's elaboration.

The classification of NAH in Fig. 31 and Fig. 32 above provides four basic categories of NHA to foster for urban regeneration at the neighbourhood level. These are the individual characteristics of the residents (Xcp1) and the community (Xcp2), and the man-made environment (Xct1). As emerged from the analysis, however, we will not consider factors of the natural environment (Xct2) as not significant to a neighbourhood scale as that object of study. Therefore, the categories collapse to three types, namely, two a-spatial and one spatial. These three categories allow us to make a first classification of the domains in which urban regeneration aimed at health could intervene *directly* in order to influence *indirectly* the health and well-being of the community within the neighbourhood. Also, Fig. 31 and 32 depict the adjusted theoretical model of NAH *not* considering the natural environment as a significative variable for SPHW. One explanation for the weakness of the correlation between Xcp2 and SPHW could lie in the fact that questions asked to respondents lacked their initial investigation purposes, or, even more, the effect of the natural environment on health is not detectable as the studied area is too small (6 sqKm), thus, climatically and geographical variations may not be observable between neighbourhoods located in the same urban area. In light of this result, we can therefore remove the influence of the natural environment (Xct2) on SPHW. This non-significance represents a weakness that emerged in the NAH model, which could be due to a lack of consistency in the questions in the questionnaire and the limits of the sample of participants studied. However, at the same time, this weakness of the relationship between Xct2 and SPHW could be interpreted as a strength for model of NAH model as it aimed at a very small scale which could be not relevant to capture variations of the natural environment affecting health between neighbourhoods lying in the same urban area as the one being studied.

The second research question (RQ2) [108] of this study investigates which specific factors of the NAH may be relevant for urban regeneration at a neighbourhood scale. This correlation analysis was crucial to identify which specific a-spatial and spatial factors of NAH should be considered in urban regeneration at a neighbourhood scale. To provide an answer for RQ2 the author carried out a descriptive correlation analysis all the compositional factors (within Xcp1 and Xcp2) and all contextual factors (within Xct1) that are significantly associated to SPHW (Y). Such a correlation analyse was developed for exploring the degree to which Neighbourhood Advantage for Health (X) for the neighbourhood associate to Status of Perceived Health and Wellbeing (Y) of the community living within the neighbourhood, and for identify which dimensions of NAH are more relevant for SPHW. These specific factors of NAH (X) have been selected only if they had a minimum correlation of 40% to SPHW (Y). According to this criterium, the specific factors emerged as significative for SPHW are outlined in Tab. 11 below (see also Tab. 15 in Appendix 2), where specific factors of Xcp and Xct are more related to SPHW (section 5.4).

The results of Analysis 3 (SPHW to all factors of NAH) are depicted in Tab. 11 (see also Analysis 3 in section 5.3.) where significant factors[109] within Compositional Advantage for Health (Xcp) and Contextual Advantage for Health (Xct) have been grouped for macro areas for interventions (Tab. 11). Factors contributing to NAH are grouped for macro areas such as Individual(s) Advantage for Health (individual's awareness of determinants of health and behaviours, socioeconomic position, and active mobility); Community Advantage for Health (safety, social and institutional support, economic accessibility); and Man-made Environment Advantage for Health (Visual and functional built environment, restorative built environment and housing). This distinction is crucial for developing broad categories for interventions to foster NAH. The order of the neighbourhoods in Tab. 11 (Macellari to Pellaro) follows their relative SPHW score to capture variations across neighbourhoods' performances through a gradient-coloured scale from red (negative) to yellow (normal) to green (positive). The scale for scores of NAH (for the

[108] RQ 2: *Which specific factors of NAH are more relevant for health and wellbeing, and thus for urban regeneration at the neighbourhood level?*
[109] For further information on the factors in Tab 19 please look to Tab. 6, 7, 8 - Appendix 2

neighbourhood) and SPHW (for the resident community) range from 1 (negative) to 5 (positive), the scores reflect the mean value among all individuals living in the same neighbourhood and belonging to the same community. Maximum, minimum, and medium values of significative factors of NAH are highlighted in Tab. 11 through a coloured gradient scale for better capturing their distribution across the 11 neighbourhoods being studied.

Tab 11: Mean values for all factors of NAH and objective measures significant to SPHW (Y).

Adv.	Macro areas		Name of the variable	Correlation	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Invidual(s) Adv. for Health (Xcp1)		Q.1	Age	**0,569**	3,82	3,90	3,59	3,95	3,91	3,86	4,18	3,97	4,40	4,09	4,07
	Individual's awareness of determinants of health	Q.2	Education	**0,541**	3,59	3,60	3,55	3,60	3,59	3,62	4,11	3,76	3,83	3,18	3,98
		Q.3	Income	**0,662**	2,94	3,23	3,18	2,91	3,13	3,14	3,46	3,66	3,66	4,14	3,55
		Q.4	Nutrition	**0,646**	3,47	3,27	3,55	3,49	3,48	3,66	3,68	3,87	3,94	3,55	3,81
		Q.5	Water intake	0,479	2,53	3,30	3,68	3,33	3,34	3,17	2,89	3,29	3,51	3,41	3,25
		Q.7	Lifestyle	**0,611**	2,41	3,13	3,09	3,07	2,93	3,45	3,36	3,03	2,97	3,09	3,18
	SEP	Q.9	Father's education	**0,778**	1,47	2,00	1,88	2,17	2,23	1,90	2,09	2,18	1,84	2,14	2,50
		Q.10	Mother's education	**0,833**	1,55	1,81	1,85	2,19	2,21	2,09	1,94	2,20	1,94	2,05	2,52
		Q.12	Household income	**0,833**	1,10	1,78	1,52	1,51	1,99	1,75	1,89	1,77	1,74	1,95	2,18
	Active mobility	Q.13	Physical activities	**0,519**	2,65	3,00	2,95	2,89	2,77	3,68	3,04	3,16	2,81	3,26	3,23
Community Adv. for Health (Xp2)	Safety	Q.17	Safety	**0,608**	3,06	2,43	2,91	3,37	3,36	3,03	3,11	3,18	3,00	3,68	3,57
		Q.18	See other people walking	**0,663**	1,76	1,90	2,14	1,88	2,23	2,00	1,75	2,37	2,11	2,14	2,80
	Social support	Q.20	Social cohesion	**0,731**	2,71	2,40	2,36	2,91	3,04	2,93	3,14	3,16	3,17	3,18	3,11
		Q.21	Trust	**0,901**	2,24	2,37	2,45	2,72	2,82	3,00	3,00	2,92	3,09	3,50	3,13
		Q.22	Sharing values	**0,548**	2,24	2,47	1,95	2,37	2,82	2,31	2,82	2,79	2,69	3,91	2,67
		Q.25	Stigma free	**0,842**	1,94	2,00	1,82	2,39	2,23	2,38	2,32	2,58	2,34	2,91	3,16
		Q.27	Sense of belonging	**0,732**	2,12	2,43	1,91	2,46	2,73	2,34	2,68	2,61	2,69	3,05	2,76
	Institutional support	Q.28	Institutional presence	0,473	1,88	1,87	1,77	1,79	1,80	1,69	2,29	2,16	2,03	2,82	2,12
		Q.30	Not-for-profit presence	0,476	2,06	2,27	1,59	2,11	2,38	1,83	2,21	2,42	2,03	2,45	2,67
	Economic accessibility	Q.31	Price of healthy food	**0,500**	2,94	3,13	3,00	3,23	2,95	3,31	4,46	3,34	3,60	3,45	3,55
		Q.32	Economic accessibility	**0,690**	2,24	2,57	2,09	2,72	2,61	2,45	2,75	2,92	2,66	3,50	2,92

Adv.	Macro areas		Name of the variable	Correlation	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Man-made Env. Adv. for Health (Xct1)	Visual BE	Q.1	Aesthetic pleasant	**0,762**	1,88	2,03	1,82	2,26	2,21	2,03	2,71	2,61	2,34	3,00	2,71
		Q.3	Street quality	**0,697**	1,24	1,33	1,50	1,63	1,36	1,66	1,61	2,00	1,43	2,14	1,78
		Q.4	Sidewalks quality	**0,760**	1,18	1,33	1,14	1,44	1,34	1,38	1,21	1,71	1,51	1,64	1,81
	Functional BE	Q.6	Walk to food store	**0,862**	1,65	2,57	2,77	2,53	2,55	2,86	2,36	3,16	3,31	3,18	4,12
		Q.7	Presence of food store	**0,627**	1,29	2,60	2,64	2,16	2,07	1,59	1,89	2,47	2,37	3,36	3,51
		Q.8	Presence of commercial	0,495	1,12	2,83	2,68	1,65	1,80	1,76	1,64	2,24	1,86	3,73	3,35
		Q.10	Proximity to healthcare	0,466	1,35	1,13	1,95	2,14	1,32	1,45	1,21	2,03	2,17	1,95	1,83
		Q.11	Opportunity for physical activity	**0,673**	2,00	1,57	1,68	1,58	1,93	2,14	2,14	2,24	2,34	2,45	2,59
	Restorative BE	Q.13	Pleasant walking	**0,515**	2,41	2,10	1,91	1,77	2,54	2,41	2,18	2,61	2,37	2,64	3,14
	Housing	Q.15	Home quality	**0,507**	2,94	3,10	2,91	3,16	2,95	2,69	3,00	3,37	2,97	3,59	3,51
		Q.16	Home comfort	**0,637**	3,06	3,53	3,05	3,53	3,29	3,41	3,21	3,71	3,34	3,55	3,76

Adv.	Macro areas		Name of the variable	Correlation	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Res. Pr.	Resp. Profile	Q.14	Proximity_from_the_center	**0,700**	3,53	3,61	3,94	3,97	3,72	4,37	3,21	4,52	4,52	4,78	4,82
	Resp. Profile	Q.13	Physical_Activity	**0,519**	2,65	3,00	2,95	2,89	2,77	3,68	3,04	3,16	2,81	3,26	3,23

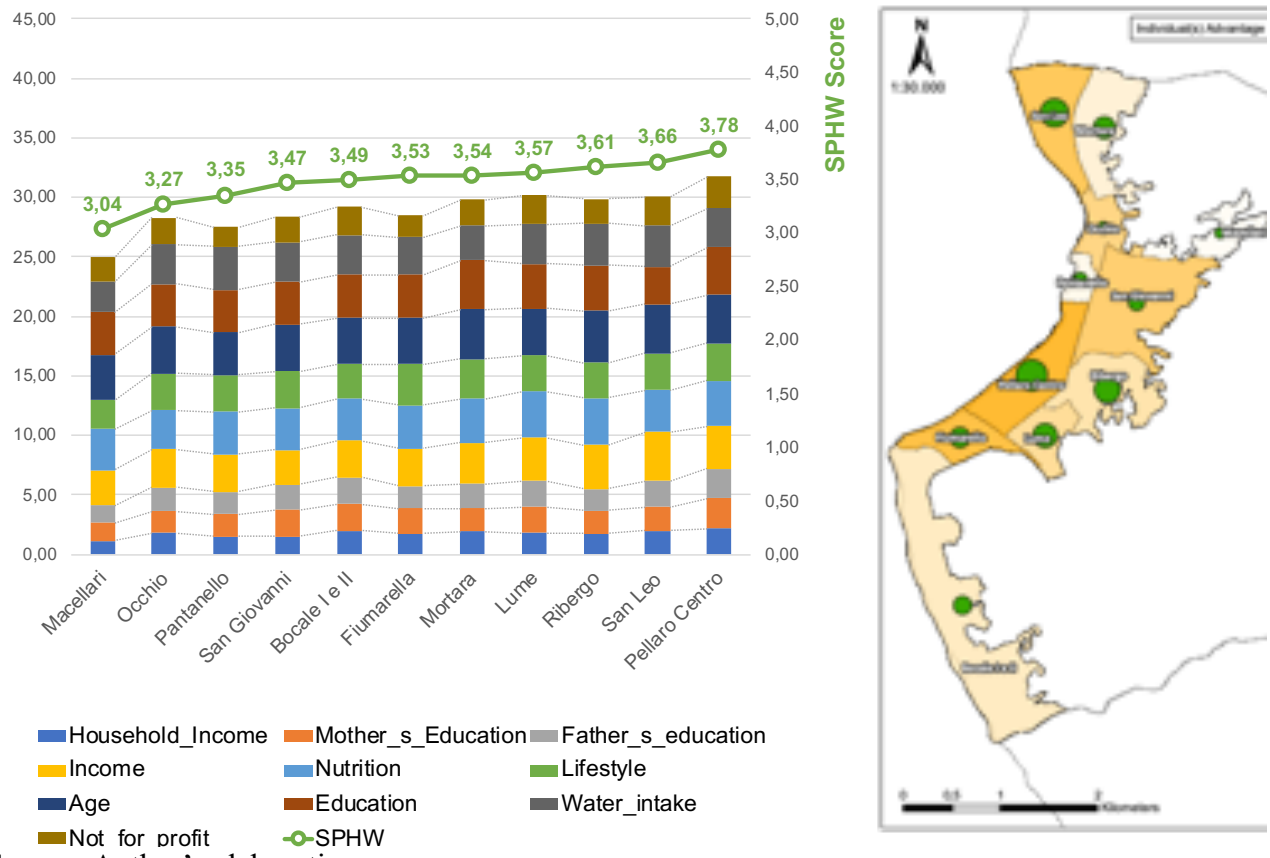
Source: Author's elaboration of Survey A, B, C, and Respondent Profile.

- Results in Tab. 11 express the mean values for the score of all factors -grouped for macro areas of interventions as described above- contributing to NAH across the 11 neighbourhoods understudy. At a first glance, the prevalence of red cells suggests a distribution of minimum values on the left part of Tab. 11, referring to neighbourhoods such as Macellari (rural), Occhio (coastal semi-urban), Pantanello (coastal semi-urban) San Giovanni (semi-urban). Conversely, on the right side of Tab. 11, we find neighbourhoods who performed over the mean value of NAH such as Lume (hilly semi-urban), Ribergo (hilly semi-urban), San Leo (semi-urban), and Pellaro Centro (coastal urban core) that is the leading neighbourhood for SPHW and second best for NAH. In the following sections, the author describes the associations between all compositional factors (Xcp1 and Xcp2 - sections 6.1.1. and 6.2.2.) and contextual factors (Xct1- section 6.2.3.) of NAH to SPHW for each one of the 11 neighbourhoods being studied, suggesting interventions for urban regeneration to foster NAH for enhancing health and wellbeing at the neighbourhood level.

6.1.1. Individual (s) Advantage for Health (Xcp1) and urban regeneration interventions

The individual factors of NAH (Xcp1) refer to variables that are relevant from a medical perspective. Graph 8 depicts the relationship between the sum of the factors related to Individual(s) Individual(s) Advantage for Health (Xcp1) and SPHW across the 11 neighbourhoods being studied. Such a sum refers to the Cumulative Compositional Advantage for Health,[110] as it is evident from Graph 8, greater is the Cumulative Compositional Advantage for Health, higher the value of SPHW. The individual factors that emerged as relevant to SPHW were classified into three macro-areas as follows:

Graph 9: Cumulative Individual(s) Advantage for Health (Xcp1) to SPHW (Y).



Source: Author's elaboration

<u>Individual's awareness about the main determinants of health</u>

(Q.1, 2, 3, 4, 5, 7 in Survey B - Appendix 1 and Tab. 11, 13 in Appendix 2).

- Age, educational level, income, eating habits and daily consumption of water and lifestyle, are crucial determinants of health (WHO, 2018; Duncan and Kawachi, 2018). Individuals who are more aware of the influence of such factors on their health can modify their health-related choices and behaviours in order to positively influence their health and wellbeing. Holding this perspective, greater values of *individual awareness of the determinants of health* have been recorded in the urban area of Pellaro Centro and in the semi-urban area of San Leo, where 14% and 14.6% of the population respectively have a master or bachelor's degree. These neighbourhoods performed the highest values of SPHW (Table 11). In contrast, the lower levels of individual awareness have been recorded in the neighbourhood of Macellari where only 5% of the population has a higher education and 21% are not educated, these -negative- values for education are the highest across all neighbourhoods being studied. Also,

[110] Cumulative Compositional Advantage for Health refers to the sum of the factors emerged as significant in the descriptive correlation analysis.

according to the results of the analysis, Macellari represents the neighbourhood where the lowest SPHW score was recorded. Therefore, there seems to be an association between education level, individuals' awareness of the determinants of health, and SPHW. However, it is clear that where education levels are low, urban regeneration has a limited freedom of action as the process to enhance education levels require years of training.

→ *Implications:* To indirectly improve health and well-being, urban regeneration programs could provide informative neighbourhood-based campaigns for residents in order to raise their awareness about the risk-factors and behaviours that can negatively affect their health and wellbeing.

Socio-economic position -SEP-

(Q. 9, 10, 12 in Survey B - Appendix 1 and Tab. 11, 13 in Appendix 2).

Individuals' socioeconomic position, or SEP, is a crucial determinant for health (Marmot and Wilkinson, 1999; Kawachi et al., 2002; Evans & Kantrowitz; 2002), certainly it is the most investigated in the medical and social sciences. According to Costa (2014), the SEP depends on the quantity of distributive and relational resources available for the individual; these resources affect individuals' behaviours and habits therefore increasing, or decreasing if SEP is higher, their exposure to health risk factors. Galobardes et al. (2006) affirms that factors of SEP are childhood circumstances in which individuals were born, parents' education, income, education and kind of occupation. As expected, the results of this study confirm that factors such as income (Q.12 in Tab.11) and parents' education (Q.9,10 in Tab.11) associate to SPHW. From the analysis of cumulative SEP for each neighbourhood (Table 19 in Appendix 2) it emerges that the lower values for factors of SEP, the lower their SPHW score, among these neighbourhood we find Macellari where only the 28% of the population is employed and the average household income and parent's educational level are the lowest among all neighbourhoods (Q.23 in Tab. 11 and Tab. 13 in Appendix 2).

→ *Implications:* Urban regeneration interventions in deprived areas should consider addressing factors responsible for low individuals' levels of SEP within the neighbourhood. Specifically, *household income* levels that in this study associated at 83% to SPHW. Economic and financial aids are suggested for helping household and individuals in a state of socioeconomic disadvantage in order to enhance their purchase power especially for accessing primary goods and healthy foods.

Propensity to physical activity

(Q.13 - Survey B - Appendix 1 and Tab. 11, 13 in Appendix 2).

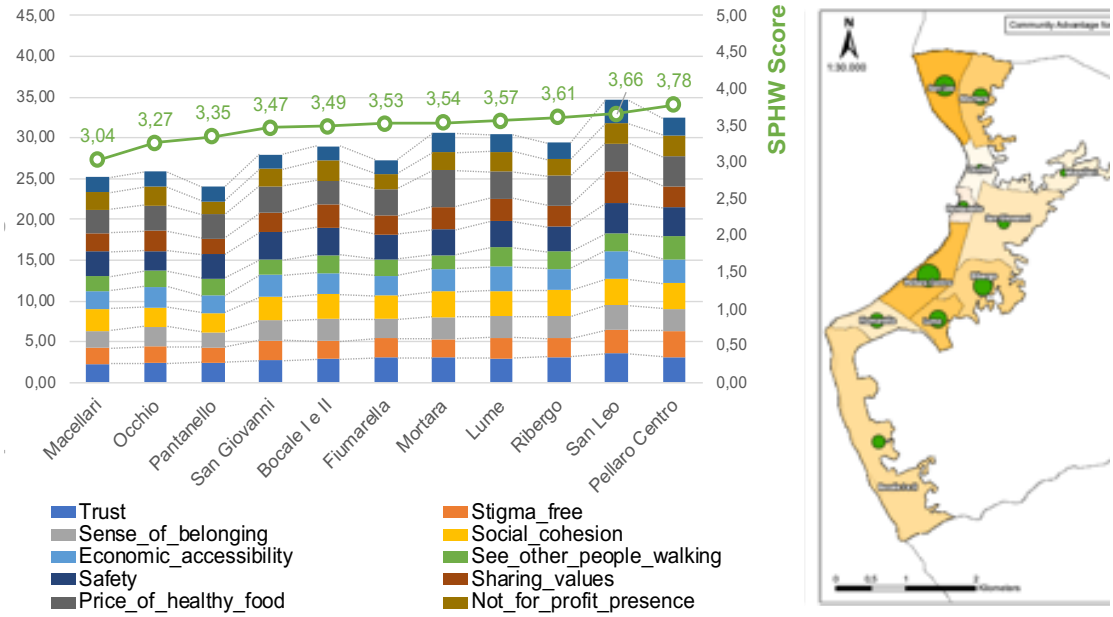
Physical *inactivity* is the fourth leading cause of mortality (Zieff et al., 2018) therefore influencing individuals' life expectancy. Physical activity is fundamental determinant for individuals' physical and mental health (Perdue, 2003; WHO, 2008). The results of this study showed that greater values of SPHW were recorded in neighbourhoods where levels of individuals' physical activity are higher (Q. 13 Survey B in Tab. 11). This association can be explained by two considerations: respondents do not practice physical activity because they are not inclined to practice them or for lack of free time, or simply because the spatial setting of the neighbourhood is not *conducive* for practicing physical activity. This second case is highlighted by Ewing (2005) which emphasizes the role of the spatiality of the built environment as an element that can favour or limit the levels of physical activity. It seems that the presence of recreational spaces can increase the opportunity for the individual to practice physical activity, thus indirectly affecting his health.

→ *Implications:* Urban regeneration interventions should aim to improve accessibility to recreational spaces for practicing physical activities thus indirectly stimulate individual's propensity for physical activities and therefore physical health. To doing so, it is recommended that urban regeneration targets firstly interstitial unused areas within the neighbourhood.

6.1.2. Community Advantage for Health (Xcp2) and urban regeneration interventions

The social and community environment within the neighbourhood affect individuals' health and wellbeing. Thus, this category of NAH contains variables that from a sociological perspective can influence the level of health and well-being of individuals. Putnam (2001) argues that higher levels of social capital (defined as quantity and quality of social interactions within the community) are positively associated to higher educational performance and childhood well-being, less TV-watching, lower levels of crime, less tax-evasion, greater tolerance and economic and civic equality, and higher levels of health. In the opposite direction, social exclusion and a low *sense of belonging to the community* are predictors of psychological stress (Ward-Thompson et al., 2016). In addition, factors such as institutional support and economic accessibility within the neighbourhood have been associated with community health and wellbeing (Bernard et al., 2014; Duncan and Kawachi, 2018). Also, when referring to the community environment, we should also consider the degree of perceived safety from crime within the neighbourhood. In fact, as emerged from recent studies, the fear of being victims of crimes and violence, while walking within the neighbourhood, limits social interactions (Clark et al., 2013). This has an effect for both mental health (as it springs in fear for the external environment) and for physical health (social limitations increase the levels of physical *inactivity* and therefore sedentary behaviours that negatively influence health).

Graph 10: Cumulative Community Advantage for Health (Xcp2) to SPHW (Y).



Source: Author's elaboration.

Graph 10 above depicts the relationship between the factors related to Community Advantage for Health (Xcp2) and SPHW across the 11 neighbourhoods being studied. Such a sum refers to the Cumulative Compositional Advantage for Health[111], as the trend in Graph 9 suggests, greater is the value of SPHW and higher the Cumulative Community Advantage for Health. This study investigated

[111] Cumulative Community Advantage for Health refers to the sum of the factors emerged as significant in the descriptive correlation analysis.

the variables mentioned above existing within the domain of Xcp2, such factors of Xcp2 were classified into three macro-areas as follows:

Safety

(Q. 17, 18 and Survey B - Appendix 1 and Tab. 13 in Appendix 2).

- Respondents of this study were asked to evaluate the general level of safety within their neighbourhood (Q.17 - Survey B) and, specifically, to respond about to which extent they feel safe in walking in the evening inside this (Q.17 - Survey B). Communities that expressed a positive level of safety are the same that excel in perceived health and well-being (SPHW) and vice versa (Table 19-Appendix 2). In particular, high levels of safety emerged in neighbourhoods with a high density of both residents and businesses (Pellaro Centro and San Leo). An explanation to this association could lie in the fact that in highly urbanized and densely populated areas characterized by a widespread presence of economic activities, and greater presence of public spaces, there is more transit of people and therefore greater social control, or *eyes-on-the-street* as defined by Jane Jacobs (1961). Moreover, the analysis of the data also showed that lower levels of security were recorded in settlements with a linear form, without public spaces, an explanation could be that less dense areas are also the least social controlled.

→ *Implications:* Urban regeneration should include interventions to increase the security of the neighbourhood in order to indirectly improve health. In order to do so, changes in the destination of use of abandoned buildings are recommended, especially in monofunctional areas, so as to create a vibrant mixed-use environment and to increase the number of users of that neighbourhood and therefore bringing social control within it.

Social support within the community

(Q. 20, 21, 22, 25, 27 - Survey B - Appendix 1 and Tab. 13 in Appendix 2).

- This macro area includes community-based factors such as *social cohesion* (Q.20 in Tab.11), *trust* between residents (Q.21 in Tab.11), *sharing of the same values* (Q.22 in Tab. 11), opinion that residents have about their neighbourhood compared to others in the entire study area (Q.25 in Tab.11), and individual's sense of belonging to the local community (Q.27 in Tab. 11). As emerged from the analysis, the neighbourhood where social support values reach the maximum score (San Leo) boasts a high value of SPHW, ranking in second place among all the 11 neighbourhoods being studied. Furthermore, it seems that factors such as the institutional presence (Q. 28 in Tab.11) and the presence of not-for-profit organizations (Q. 30 in Tab.11) reach high scores in neighbourhoods with higher level of social support and SPHW.

→ *Implications:* Urban regeneration should favour social support within the neighbourhood by involving social and cultural organizations and by promoting meetings between community members and institutional and not-for-profit organizations, so as to favour the development of new synergies and social interactions within the neighbourhood.

Economic accessibility

(Q. 31, 32 - Survey B - Appendix 1 and Tab. 13 in Appendix 2).

- Bernard et al. 2014 sustains that the neighbourhood encompasses multiple domains to which residents can access through specific rules, the extent to which they can access to these domains indirectly affect their health and wellbeing. Among these domains we find the economic domain to which residents' access through the rule of *price*. For example, the price of fruit and vegetables in inner residential areas is higher than *central* neighbourhoods due to a higher transportation cost of these goods in the specific inner area. Furthermore, we should

consider that in neighbourhoods with more presence of economic activities the competition between traders keeps prices low. In addition, as we have seen in the literature, individuals' income is a fundamental determinant of health (Duncan and Kawachi, 2018) and lower income level can limit the access of residents to the economic domain of their neighbourhood. Therefore, we can say that enhancing the opportunity for low-income residents and socioeconomic disadvantaged households to access to primary goods such as healthy food should be a priority for urban regeneration aiming to health. Holding this perspective and respectively to this study, this study investigated the differences in terms of economic accessibility to healthy food and primary goods across the neighbourhoods being studied. From the results of the analysis, it comes out that respondents, living in more *isolated* and socioeconomic disadvantaged neighbourhoods, indicated a lower level of accessibility to healthy foods and primary goods (Q. 31, 32 in Tab.11). In these neighbourhoods, the presence of commercial activities is scarce and the levels of perceived health and well-being are among the lowest in the whole spectrum of SPHW. Also, in such neighbourhoods, respondents indicate that their eating habits are not very healthy (Q.4 -Survey B in Tab.11). On the contrary, in denser neighbourhoods and with a greater presence of economic activities, it seems that residents indicate greater accessibility to healthy food and primary goods, also, in these areas the levels of SPHW are higher.

→ *Implications:* Urban regeneration should consider factors responsible for economic accessibility of primary good and services within the neighbourhood. Specifically, it is recommended for regeneration strategies aiming to health to consider financial aids and food stamps for supporting disadvantaged individuals and households to access healthy nutrition and lifestyle, including the opportunity to access other health-related primary goods.

6.1.3. Man-made Advantage for Health (Xct1) and urban regeneration interventions

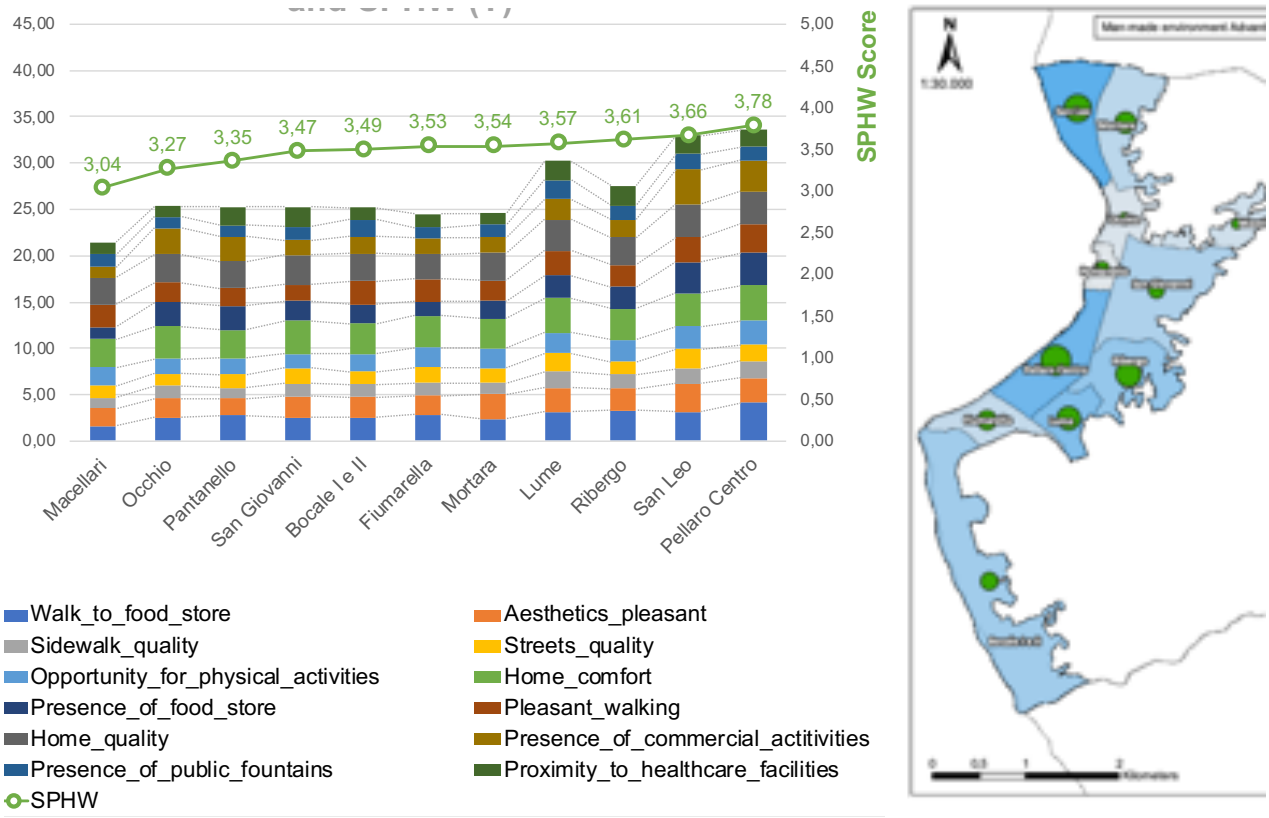
This category provides a list of the relevant variables from an urban planning perspective and their effect on public health. Graph 10 below depicts the relationship between the sum of the factors related to Man-made Advantage for Health (Xcp2) and SPHW across the 11 neighbourhoods being studied. Such a sum refers to the Cumulative *Man-made Advantage for Health (Xct1)*[112], as it is suggested from Graph 11, greater the Cumulative Man-made Advantage for Health, higher the value of SPHW.

Manuell Castell (1977) defined the built environment as a physical *shell,* in which human activities occur. Jackson (2003), Lovasi (2012) and James et al. (2013) define the built environment considering its recurrent elements, that is, any kind of building, transportation system, and architectural and aesthetic characteristics. All these factors indirectly influence both mental health (Evans, 2003, Brown et al., 2008 Ochodo, 2014) and physical health (Lavin et al., 2006; James, 2013). McKeown (1991) affirm that an important step forward in curbing human diseases was due to the progress of urbanism. The very first aim of urbanism was to address the scarce hygienic conditions of industrial cities (Schilling, 2005) by providing the population with proper residential services and addressing overcrowding and poor hygiene conditions occurred at the time due to fast population growth. Even today, but with a different perspective, urbanism shaping the built environment plays a fundamental role in health (Gullon & Lovasi, 2018, Jackson, 2003). The category of NAH referring to the man-made environment can be considered the most important in a perspective of urban regeneration aiming to health. Indeed, differently from urban renewal practices, urban regeneration encompasses social and economic dimensions (Roberts, Roberts, and Sykes, 2000; Porter and Shaw, 2009; Tallon, 2013). Also, urban regeneration interventions hold a strong spatial dimension, but as emerged in the literature the link between urban regeneration and health is always indirect (Duncan

[112] Cumulative Man-made Advantage for Health refers to the sum of the factors emerged as significant in the descriptive correlation analysis.

and Kawachi, 2018) and all the factors of the man-made environment interact with each other in a complex way, influencing people's behaviours and habits and thus indirectly their physical and mental health (Gullon & Lovasi, 2018). In this study, I investigated the factors of the Man-made Environment Advantage for Health (Xct1) that are indirectly linked to health and well-being. I classified such contextual factors into four macro areas as follows:

Graph 11: Cumulative Man-made Advantage for Health (Xct1) to SPHW (Y).



Source: Author's elaboration.

Architectural and aesthetic features of the man-made environment

(Q.1, 3, 4 - Survey C - Appendix 2 and Tab. 14 in Appendix 2).

- For visual characteristics of the built environment I refers to aesthetic quality of the built environment (Smith, 19174). In particular, the aesthetic characteristics of the built environment refer to the type and quality of construction materials and the state of conservation of facades and external elements of the buildings; the aesthetic conditions of the neighbourhood influence individuals' emotional state acting as factors for psychological stress (Ochodo, 2014) thus influencing mental health. Indeed, decaying buildings with sign of physical disorder such as broken downspouts, peeling paint, cracks and holes in walls or ceilings are stressors that affect mental health (Rauh, 2002; Lehman et al., 2008). As expected, in this study it was found that the lowest scores for the aesthetic characteristics of the built environment were recorded in deprived neighbourhoods such as Pantanello (1.82) and Macellari (1.88), the same where SPHW levels are lowest among all other neighbourhoods. Moreover, according to the analysis of ISTAT database (Tab.10 - Appendix 2), in the neighbourhood of Macellari the percentage of buildings in *very low* preservation status is 12% on the total buildings existing within the neighbourhoods these data have been confirmed by the direct observations made in the field during which it has emerged that most of the residential buildings within Macellari are incomplete or show poor quality. In contrast, the neighbourhood where aesthetic characteristics of the built environment are high quality is San Leo (3.00), in the same neighbourhood the second maximum value for SPHW (3.68) was

recorded. To reinforce this finding and make a comparison with Macellari, from the elaboration of ISTAT data emerges that only 2% of the buildings in San leo are in a *very low* state of conservation. Moreover, from direct observations it emerges that San Leo is a fasten expanding neighbourhood where a relevant part of high-density residential buildings has been built only in the last 10 years. Also, as emerged from direct and Google Earth observations, the major part of the buildings in San Leo can be defined in a very good state of conservation.

→ *Implications:* Aesthetic quality of the built environment should play a crucial role in urban regeneration practices aiming to health, especially mental health. Therefore, extraordinary maintenance interventions in decaying neighbourhoods are suggested, specifically, renewal of the facades of the decaying buildings, and replacement of damaged external elements such as gutters and roofs. Financial aid and public incentives are suggested for residents in order to stimulate them to adopt such physical changes to their residential buildings.

Functionality of the man-made environment

(Q.6, 7, 8, 10, 11 - Survey C - Appendix 2 and Tab. 14 in Appendix 2).

When referring to the functionality of the built environment, I mean elements of the built environment such as urban form and physical setting of the area, included transportation modes (pedestrian, cycle and driveway paths) and distribution within the area of residential, commercial, productive and healthcare activities. As emerged in the literature review, these factors interact with each other affecting health (Jackson, 2003; Duncand and Kawachi, 2018). Also, the distribution and quantity of these fundamental elements across the neighbourhood could encourage people to walk, thus increasing their daily-energy consumption (Ulmer, 2015) and, consequently, decreasing their weight and sedentary behaviours (Berrigan & McKinno, 2008) with direct consequences in terms of health. For example, the presence and quality (in term of continuity, constructing materials, and even surfaces) of sidewalks within the neighbourhoods is fundamental factor that indirectly affect individuals' health as it creates favourable conditions for residents to walk for going to work or performing routine daily activities (Cervero and Kockelman, 1997; Perdue, 2003; Ewing et al., 2006). Indeed, individual's active mobility is comparable to a moderate level of physical activity (Frank et al., 2005) and therefore has a positive effect on physical and mental health. Recently it has been proven that, in neighbourhoods with more walkable built environment, residents boast lower levels of obesity and diabetes (Creatore et al., 2016). Furthermore, the presence of commercial activities within the neighbourhood and home proximity to grocery stores encourage individuals within the community to prefer active mobility (Moudon et al., 2006), thus reducing the use of car (Handy et al., 2002; 2010). Also, the presence of recreational public spaces, facilities and gyms for practicing physical activity are associated with higher levels of health and wellbeing (Browson et al., 2003; Mackenbach et al., 2018), that is another evidence of the indirect link between the built environment and health. This research has investigated the presence of the factors mentioned above within the neighbourhoods being studied. Results show that in neighbourhoods such as Pellaro and San Leo, where the highest values of SPHW were recorded, there is a higher quality of sidewalks (Q.4 Survey B in Tab.11), quantity of commercial activities (Q.8 Survey B in Tab.11), recreational spaces for physical activities (Q.11 Survey B in Tab.11), and quantity of food stores (Q.7 Survey B in Tab.11) at a walking distance from respondents' home (Q.6 Survey B in Tab.11). Also, in these residential areas, physical activity levels are among the higher registered for all neighbourhoods (Q.13 Survey B in Tab.11) as well as the levels of SPHW. On the opposite, in areas where these factors are scarcely present and poorly distributed, lower levels of physical activity and SPHW were registered. Interestingly from a regeneration perspective, and fundamental for regeneration in socio-economically disadvantaged neighbourhoods, it appears that the socio-economic position (SEP) is not a moderate variable of active mobility

(Van Dyck et al., 2010); in other words, if the conditions of the built environment are favourable, individuals belonging to any socio-economic group can benefit from it. This consideration is a clear evidence on how urban regeneration on the built environment in deprived neighbourhood can positively and indirectly influence health and wellbeing.

→ *Implications:* Urban regeneration at the neighbourhood level should consider the functional built environment as a priority for interventions aiming to health. Increasing mixed land-use and street connectivity should be included as regeneration interventions that can have lasting public health and wellbeing benefits. Specifically, urban regeneration interventions are suggested to improve the quality and continuity of the pedestrian layer of the neighbourhood. It is suggested the creation of pedestrian and cycle paths, separated by vehicular traffic, to stimulate the community to walk or practice intense physical activity. The network of sidewalks should favour individuals to reach commercial activities and grocery stores within the neighbourhood. Interventions such as the redevelopment of unused interstitial areas are recommended as priority interventions in order to provide neighbourhood users and residents with free equipment for practicing physical activities.

Recreational spaces for leisure time and resting

(Q.13 - Survey C - Appendix 2 and Tab. 14 in Appendix 2).

This category refers to those areas within the neighbourhood that can be defined as public spaces equipped with urban furniture favourable for individuals for resting and socialize. These spaces have a double utility as they offer to the residents the opportunity to recover from fatigue and stress (Kaplan et al., 1998), and at the same time enhance the social environment within the neighbourhood (Fleming, 1985; Gehl, 2010) that in the relevant literature is defined a determinant of mental health (Frumkin, Lawrence and Jackson, 2004). On the contrary, the lack of space for socialization is indirectly associated with adverse health effects such as depression, increased consumption of antidepressants and delirium (Ulrich, 1991; Jackson, 2003; Melis et al., 2015). As applied to this study and from direct field observations and spatial measurements through Google Earth, it emerged that in neighbourhoods with a greater presence of squares and recreational spaces (provided with benches protected by shadow-bearing elements such as trees and shelters), residents' report higher values of pleasantness for walking (Q.13 Survey C in Tab.11) and stop by (Q.12 Survey C in Tab.11). In the same neighbourhoods, these values are associated with higher scores of SPHW. Conversely, in areas where these spatial conditions are poor, lower scores of SPHW occurred.

→ *Implications:* Urban regeneration should increase the presence of recreational spaces for resting and socializing, including the urban furniture within such spaces consisting in urban elements for resting (including urban furniture for sitting, sleeping, and relaxing) and pedestrian paths. The presence of recreational spaces with such characteristics attract residents in the same area, favouring social proximity due to the co-location of residents within the same space. This mechanism increases social interactions and trust among community members with positive consequences for mental health and social wellbeing. At the same time recreational spaces provide the opportunity for residents to restore from fatigue and stress affecting positively physical health.

Housing

(Q.15, 16 - Survey C - Appendix 2 and Tab. 14 in Appendix 2);

Individuals spend most of their lives in their neighbourhood (National Research Council, 1981; Dannenberg et al., 2011), specifically at their homes (Capolongo, 2013a). It is therefore clear that the home quality and comfort are crucial determinants for health and well-being.

When I refer to home, I mean the smaller scale, and if we want more intimate, of the man-made environment. The analysis of the relevant literature showed that neighbourhoods with a prevalence of homes characterized by negative conditions such as poor maintenance, air conditioning problems and humidity can cause individual psychological stress in residents (Freeman, 1984; Halpern, 1995; Evans et al., 2003) as well as poor development of cognitive functions in children (Johnson et al., 2002; Dalgard & Tambs, 1997; Leventhal & Brooks-Gunn, 2000; Weich et al., 2002) and increased allergies for residents (Rauh et al. al., 2002). Conversely, home environment characterized by large windows with pleasant views of the exterior and by the presence of the courtyard were associated with positive levels of mental health of their residents (Douglas & Douglas, 2003). From the analysis of the NAH dimensions related to housing it emerged that higher SPHW scores were recorded in neighbourhoods where respondents indicate a better comfort (Q.16 Survey C in Tab.11) and internal quality (Q.15 Survey C in Tab.11) within their home. On the opposite, lower scores of SPHW were registered in neighbourhoods where respondents indicated lower levels of home quality and comfort. Additionally, the secondary ISTAT data reinforce these evidences as the analysis of these data shows that in the neighbourhoods with higher levels of comfort and quality of housing, the state of conservation of residential buildings is higher.

→ *Implications:* Urban regeneration aiming to health at neighbourhood level should consider the quality of public housing and residential dwellings as a macro-area for direct regeneration interventions to affect indirectly health. Spatial and technological improvements for enhancing home quality and comfort are recommended such as address negative conditions such as poor maintenance, air conditioning problems and humidity. In addition, it is crucial to offer economic incentives for stimulating residents to undertake such improvements to their home.

Chapter 7

7. CONCLUSIONS

This research introduces the concept of Neighbourhood Advantage for Health (NAH) with the intention of providing a set of interventions and guidelines for urban regeneration to shape indirectly health and wellbeing at the neighbourhood level. The NAH is based on the basic classification of the health determinants described by Macintyre et al. (2002) which relies on compositional and contextual explanations for geographical variations in terms of health between different urban areas. This classification has been further expanded by integrating significant health determinants such as the characteristics of individuals, community, built environment and natural environment into the concept of NAH. To this end, the author adopted the conceptual model proposed by Von Szombathely et al. (2017) to capture the relationship between health and the urban area further enhanced with the specific factors relevant for health as suggested by Krefis et al. (2018). However, differently from these models that do not establish a specific urban scale for real-world application, the theoretical model of NAH focuses on a neighbourhood scale following the methodological suggestions of Duncan and Kawachi (2018) to operationalize the neighbourhood as a unit of study and collect data on the health and wellbeing of residents. Furthermore, for the specific purpose of urban regeneration, the NAH model considers compositional and contextual factors grouping them according to the suggestions offered by Barton & Grant (2006), Kramer et al. (2017) and Diaz Roux (2003; 2007) whom describe the indirect relationships through which compositional and contextual factors influence health and wellbeing within the neighbourhood. In addition, the model of NAH encompasses all the urban features at the neighbourhood level that emerged in the literature as being indirectly relevant to health. The description of the NAH model including all its variables is extensively described in chapter 3 (section 3.3) in this research work.

The construct of NAH classifies the determinants of health within the neighbourhood into two broad categories defined for compositional or contextual determinants; these determinants affect indirectly health and wellbeing. While for compositional determinants we refer to *a-spatial* factors related to the individual characteristics of the residents (e.g., genetic predispositions, exposure to risk factors such as alcohol and tobacco consumption, food habits and lifestyle) and socio-economic features of the community (e.g., support and social cohesion, institutional presence, economic accessibility to food and primary resources within the neighbourhood), we refer to the contextual determinants of health as the spatial factors such as the features of the built environment (e.g., urban form, transportation pattern, land-use, distribution of economic activities, residential and productive settlements, presence of recreational and *restorative* spaces for resting and practicing physical activities) and the characteristics and quality of the natural environment (e.g., land morphology, hydrography, landscape, naturalistic value, pollution levels). These categories allow us to outline a classification of the domains on which urban regeneration aimed at health could intervene directly in order to influence indirectly the health and well-being of the community residing in the neighbourhood. However, as emerged from the analysis, we will not consider factors of the *natural environment* as they emerged as not significant at a neighbourhood scale. To describe the factors and related indirect influences for perceived health and wellbeing, this study categorizes the factors responsible for NAH into macro areas of intervention for urban regeneration aiming to health and wellbeing at the neighbourhood level.

The first research question[113] (RQ1) in this study was explored and the results of the analysis (section 5.3.1.) indicate that there are variations of NAH (X) between different neighbourhoods that can be associated with the relative differences in health and well-being perceived (State of Perceived

[113] RQ 1: To which extent NAH associates with State of Perceived Health and Wellbeing (SPHW)?

Health and Wellbeing - SPHW - Y) by the community of residents. Specifically, the results of the analysis conducted in Chap.4 show a positive association between the NAH (X) and SPHW (Y) scores of 58% (R-squared= 0.585; Adj. R-squared = 0.539; P-value = 0.016; Regr. 1 in Appendix 4). However, this association remains significant when the NAH for each neighbourhood has been decomposed into "Compositional Advantage for Health" (Xcp – R-squared=0.797; Adj. R-squared = 0.775; P-value = 0.001; Regr.2 in Appendix 4) and "Contextual Advantage for Health "(Xct – R-squared=0,363; Adj. R-squared = 0.292; P-value = 0.05; Regr.5 in Appendix 4), to capture compositional and contextual factors within the neighbourhood. Thus, we can state that the first research question (RQ1 in Chap. 4) has been largely exhausted. Moreover, from the further results of the correlation analysis between SPHW and the factors belonging to Xcp (Xcp1, Xcp2) and Xct (Xct1, and Xct2) suggest that there are significant associations between SPHW and specific a-spatial, or compositional factors, concerning both the individual characteristics of the residents within the neighbourhood (Xcp1 - R-squared = 0.727; Adj. R-squared = 0.696; P-value = 0.001; Regr.3 in Appendix 4) that of the community considered in its entirety (Xcp2 - R-squared = 0.514; Adj. R-squared = 0.460, P-value = 0.013, Regr.4 in Appendix 4), while only spatial or contextual factors relating to the built environment of the neighbourhood (Xct1) present significant associations with SPHW. In light of this we can therefore remove the influence of the natural environment (Xct2) on the state of health and well-being perceived within the neighbourhood (SPHW). This non-significance represents a weakness that emerged in the NAH model, which could be due to a lack of consistency in the questions in the questionnaire and the limits of the sample of participants studied. At the same time, however, this non-correlation between Xct2 and SPHW could be interpreted as an element of strength of the NAH model since this is aimed at a very small scale and therefore not significant to capture variations of the natural environment between neighbourhoods engaged in the same urban area as the one studied. Therefore, from these deductions based on the interpretation of the results of the analysis, we can sustain that the NAH model is a potential predictor of perceived health and wellbeing at a neighbourhood scale, but at the same time NAH is not a valid tool to explain geographical variations of health which are related to determinants of health within the natural environment.

The second research question[114] (RQ2) of this study investigated which specific factors of the NAH may be relevant to urban regeneration at a neighbourhood scale. To do this, I developed a correlation analysis between the compositional factors that can be inscribed in the Xcp1 and Xcp2 domain and contextual factors included in Xct1 that are most associated with the perceived health and well-being status (SPHW-Y) for each community living in the neighbourhoods under exam. These specific factors of NAH (X) have been selected only if they have a minimum correlation of 40% with SPHW (Y). Findings suggest that NAH do positively associate to the SPHW within the community as neighbourhoods where higher performances of NAH were registered boast greater score in SPHW, specifically, associations are related to specific compositional and contextual factors within the neighbourhood such as individuals' awareness about the determinants of and risk factors for health, individuals' socioeconomic position (SEP), individuals' propensity for practicing physical activities; safety within the neighbourhood; social support within the community; economic accessibility to the economic domain of the local community; architectural and aesthetic feature of the visual and functional dimensions of the man-made environment; land-use distribution; presence of and accessibility to recreational spaces for leisure time, resting, and practicing physical activities; housing quality and overall performances of the disposable residential units. The results of this analysis are indicated in full in Table 19 (Appendix 2) where for each NAH factor emerged as significant for SPHW the relevant sensible values were identified such as the maximum, average and minimum score recorded for each factor in different quarters. This analysis was crucial for the purpose of this study, as it allowed to identify which specific a-spatial and above all spatial NAH

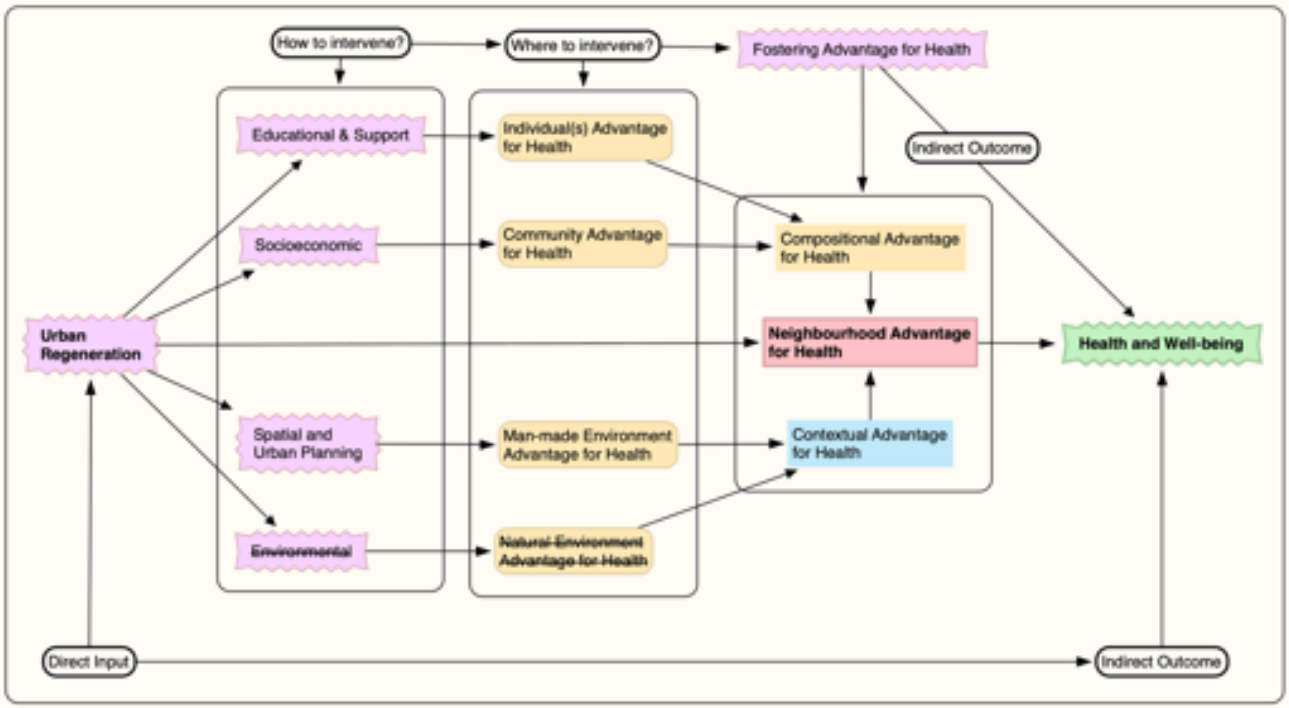
[114] RQ 2: Which specific factors of NAH are more relevant for perceived health and wellbeing (SPHW), and thus to consider for urban regeneration at the neighborhood level?

elements should be better considered in urban regeneration at a neighbourhood scale (Analysis 3 in section 3.3.). Therefore, the second research question (RQ) can be considered answered, thus, now we can provide guidelines for urban regeneration to foster Neighbourhood Advantage for Health (NAH) for enhancing health and wellbeing within the community through socioeconomic and spatial interventions. The guidelines developed in this work for fostering NAH could serve as an interpretative grid for practitioners and local decision-makers to deliver effective neighbourhood-based regeneration interventions to enhance indirectly community health and wellbeing.

7.1. Fostering Neighborhood Advantage for Health: Guidelines for Urban Regeneration

Observing the variations between the scores for the same NAH factors in neighborhoods under study, it emerged that there exist recurrent elements of NAH that are *predictors* for perceived health and well-being. Assuming this perspective, it is therefore fundamental that urban regeneration aiming at health considers the evidence emerged in this study therefore intervening in urban areas according to precise principles for fostering NAH as a primary regeneration strategy. It is noteworthy to consider that the influence of urban regeneration for health is always indirect therefore there is no direct connection between urban regeneration and health, but instead there are urban conditions and settings that are conducive to health and wellbeing that regeneration can recreate in order to influence individual's behaviors and habits and thus indirectly influence their state of health. In addition, the importance of this research work for urban regeneration is based on the transferability of the NAH concept to other geographical contexts similar to the one being studied with a maximum population of about 13,000 people.

Fig. 33: Fostering Neighborhood Advantage for Health (NAH).



Source: Author's elaboration.

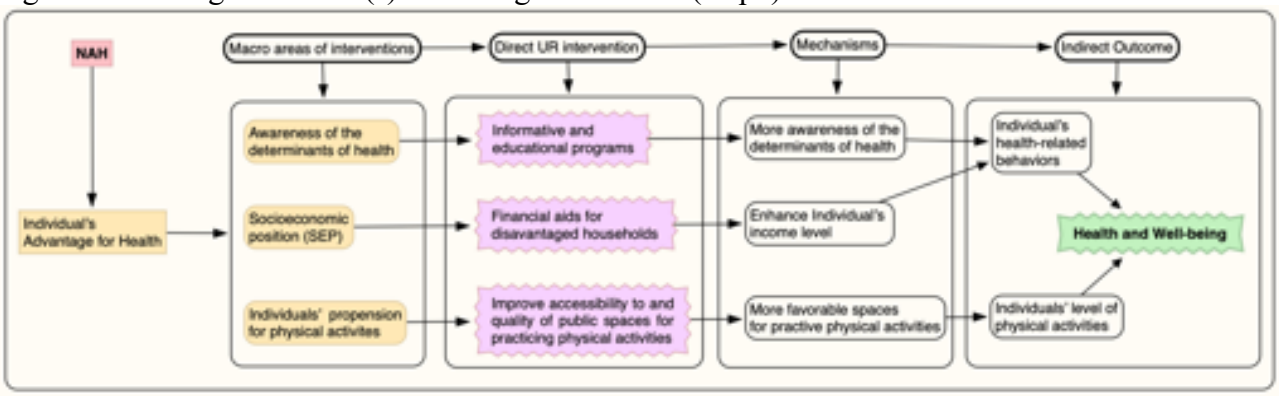
Fig. 33 above provides basic explanations on how NAH can be directly enhanced by urban regeneration (direct input) in order to indirectly influence health and wellbeing (indirect outcome). Urban regeneration in this case was classified into three areas for intervening directly on the factors responsible for the NAH such as individual factors (Individuals Advantage for Health), community factors (Community Advantage for Health) and the built environment factors (Man-made Advantage for Health). On following principle.

7.1.1. Fostering Individual(s) Advantage for Health

Δ Principle: Individuals' traits, socioeconomic condition and health-related behaviors influence their health and wellbeing, these factors should be considered by urban regeneration interventions.

Φ Criterion: Individuals' characteristics relevant for health and well-being represent the Individual's Advantage for Health that can be classified as the follow: individual awareness of the determinants of health, socioeconomic position (SEP), and propensity to physical activity (Fig. 34). Better these factors were, higher health and wellbeing were observed.

Fig. 34: Fostering Individual(s) Advantage for Health (Xcp1)



Source: Author's elaboration.

> *Individuals' awareness:* To increase individual's awareness of the fundamental determinants of health, urban regeneration should provide interventions such as educational campaigns for residents to promote and disseminate health-related information for the population. These educational campaigns should aim to increase individual's awareness of the following health-related topics: age, education, income, eating habits (including daily consumption of water) and lifestyle. Through these educational intervention's individuals will increase their awareness of the basic factors that can harm, or improve their health, so they will gain the opportunity to change their health-related behaviors and make better choices for health and wellbeing.

> *SEP:* Individuals' socioeconomic position (SEP) is a fundamental determinant of health as it directly influences individuals' behaviors and habits and therefore indirectly affecting health. When we refer to the SEP, we mean individual factors such as income, educational attainment, and occupation. In this case, to tackle low levels of SEP urban regeneration should intervene on the income level of individuals providing monetary aid to families and socioeconomically disadvantaged individuals thus expanding their purchase power to enable them to access economically to primary goods and services for health including: healthy nutrition, medicines, higher education, cultural and recreational events.

> *Propensity for physical activity*: individuals who practice moderate or intense physical activity gain in physical and mental health. Sometimes individual characteristics such as the sedentary lifestyle and spatial characteristics of the neighborhood of residence are limiting factors for levels of physical activity. Therefore, in this case, urban regeneration for health must have a dual purpose: to inform residents of the benefits derived from practicing physical activity on the one hand and to address the lack of public spaces equipped with urban furniture suitable for practicing physical activity on the other. Moreover, in increasing the quality and quantity of such recreational spaces for physical exercise, it is recommended for urban

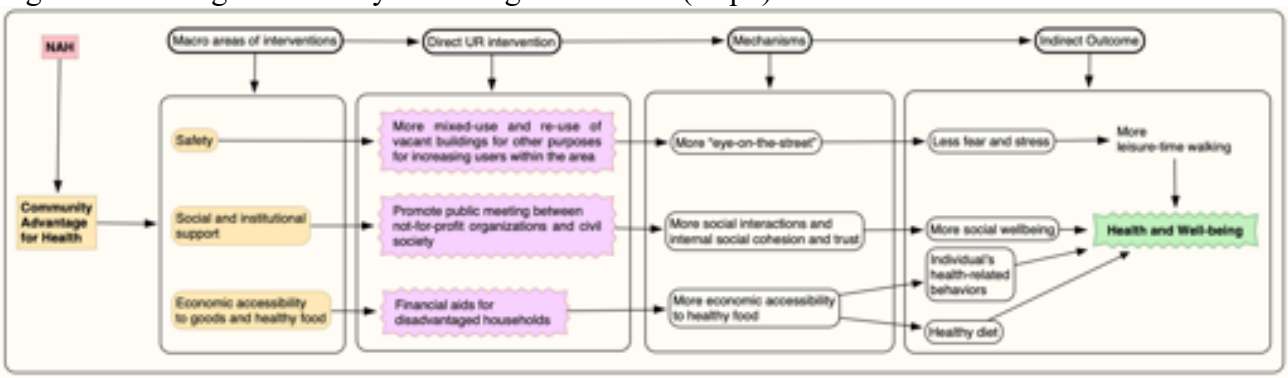
regeneration to target interstitial and unused areas within the neighborhood in order to reuse them as a new key space for fostering indirectly health.

7.1.2. Fostering Community Advantage for Health

Δ Principle: Community's characteristics influence residents' health and wellbeing; therefore, these community particularities should be a target of regeneration interventions.

Φ Criterion: The characteristics of the community that are relevant to residents' health and the wellbeing are the following: security within the neighborhood, social and institutional support and economic accessibility to goods and services (Fig. 35).

Fig. 35: Fostering Community Advantage for Health (Xcp2)



Source: Author's elaboration.

> *Safety:* the degree of safety within the neighborhood is a crucial factor for the expansion of social interactions within the neighborhood as in less safe residential areas residents are more afraid of leaving home for their daily activities and walking within the neighborhood during their leisure time. Fear to explore the neighborhood triggers individuals' psychological stress and therefore affecting negatively mental and even physical health as individuals, staying home, are more sedentary. As emerged in this study, neighborhood safety associate with the variety (mixed-use) and quantity of economic and activities and number of sidewalks within it; this is due to the fact that the greater the transit of people who use the services of the neighborhood and the higher the level of social control (eyes-on-the-street) present, with a consequent reduction of crimes. Holding this perspective, the task of regeneration is to recreate a mixed-use of unused areas of the neighborhood, in order to increase the quantity and variety of services and users in the area therefore increasing social control and discouraging crimes. In doing so, residents of the neighborhood will feel more confident in exploring their neighborhood with positive consequences for socialization among residents and more safety for practicing physical activity.

> *Social and institutional support*: individuals living within community prone to social support report higher levels of health and wellbeing. Social support indicators are the following: trust among the inhabitants, sharing of the same values and sense of belonging. As emerged from this study, social support within the community associates with the presence of not-for-profit institutions and organizations within the area. In light of this, urban regeneration should stimulate social interaction within the community to influence indirectly mental health and social wellbeing of the residents, promoting informal meetings between civil society, public institutions and not-for-profit organizations. In doing so, urban regeneration can directly increase social interactions within the community with a consequent increase in social cohesion and trust among the residents and therefore indirectly social wellbeing within the community.

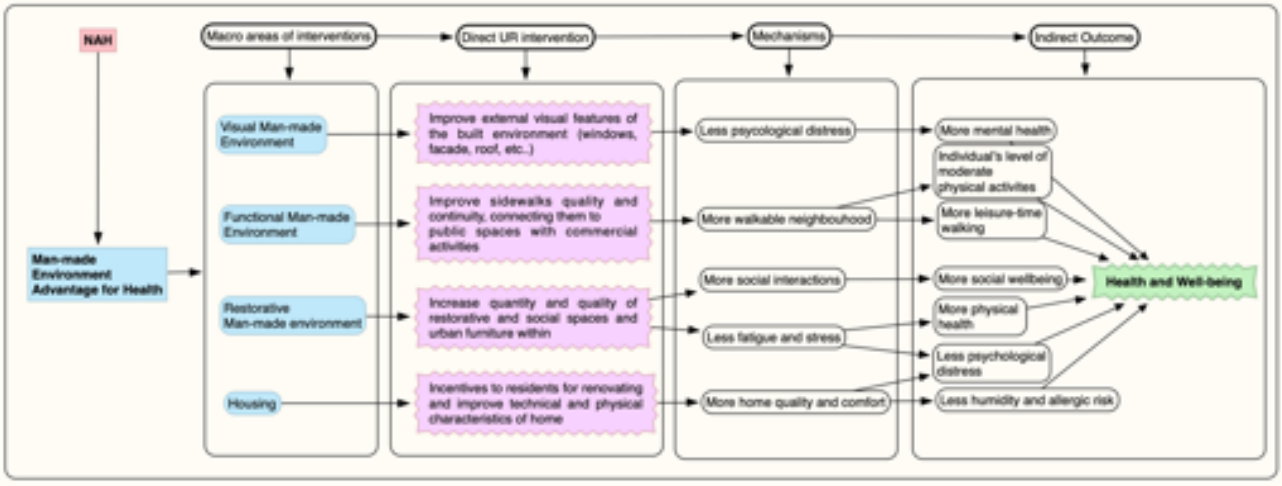
> *Economic accessibility to primary goods and healthy foods*: economic accessibility to primary goods and services within the community is a fundamental determinant for individuals' health. Economic accessibility is unavoidably linked to individuals' SEP and the price of goods and services within the neighborhood where individuals live. For example, buying healthy food in some areas may be cheaper than in others, and these variations of price for healthy food may depend on the amount of businesses selling healthy food, as the competition between traders lowers the prices of goods. Thus, urban regeneration aiming to health should consider such factors. Financial aids or food stamps are recommended for empowering individuals and households in potential socioeconomic hardship to access primary health-related goods such as healthy food.

7.1.3. Fostering Man-made Advantage for Health

Δ Principle: There exist characteristics of the man-made environment that influence indirectly the state of health and wellbeing of the residents, consequentially, these physical features of the neighborhood should be targeted by urban regeneration interventions.

Φ Criterion: The characteristics of the man-made environment that are relevant for health and wellbeing are the following: visual, functional, and *restorative* characteristics of the man-made environment including the quality and comfort of the housing units (Fig. 36).

Fig. 36: Fostering Man-made Advantage for Health (Xct1)



Source: Author's elaboration.

> *Visual Man-made Environment*: the visual characteristics of the built environment include aesthetic characteristics, including the type and quality of the construction materials, the state of conservation of facades and fixtures and the state of general physical disorder within the neighborhood. Decaying buildings with evident sign of deprivation such as broken windows, peeling paint, cracks and holes in walls or ceilings are stressor factors that affecting mental health as these stressors affect individual's emotional state. In light of this evidence, urban regeneration for health should consider extraordinary maintenance and a place-based plan for ordinary interventions on the facades of buildings, replacement of external elements such as fixtures and roofing. To stimulate residents to adopt such changes at their buildings, policies based on financial incentives for interventions are suggested.

> *Functional characteristics of the man-made environment* refers to the specific setting of the man-made environment within the neighborhood including internal minor connections (pedestrian, cycle and driveway paths) and distribution of residential, commercial, productive activities. These factors influence the degree to which the man-made environment is

functional for health. When these factors are properly distributed in the same neighborhood, they encourage people to walk, thus increasing individuals' *energy* consumption and consequently decreasing their weight and sedentary behaviors with obvious consequences in terms of physical health. For example, the presence and quality of sidewalks is a key factor that indirectly affect individuals' health of as sidewalks quality and their continuity to walkable destinations within the neighborhood stimulate residents to walk for performing daily activities including work. Walking is comparable to a moderate level of physical activity and therefore it positively affects individuals' health. Finally, with regard to the distribution of activities and recreational spaces within the man-made environment, it seems that the presence of public spaces and facilities for physical activity associates with higher levels of health and wellbeing within the community. Interestingly from a regeneration perspective for socio-economically disadvantaged neighborhoods, it seems that the socioeconomic position (SEP) is not a moderating variable of active mobility, in other words, if the conditions of the built environment are favorable, the individuals belonging to any socioeconomic group can benefit from it. In light of this, urban regeneration aiming at health should consider such functional factors of the man-made environment. It is recommended that priority interventions such as improving the neighborhood's pedestrian connective tissue both in terms of quality of walkways and continuity. Also, interventions for the redevelopment of unused interstitial areas are recommended in order to provide the population with proper *urban-equipment* for physical activities and open-air sports. In addition, it is suggested the creation of pedestrian and cycle paths separated by vehicular traffic to offer the community the opportunity to practice physical activity.

> *Restorative man-made environment* includes recreational spaces for leisure-time walking. These spaces refer to areas within the neighborhood that can be defined as public spaces equipped with urban furniture supportive for rest, practicing physical activities and social interactions. These spaces have a double utility for health as they offer residents the opportunity to rest and recover from fatigue and stress while walking and at the same time these areas improve the sociality of the neighborhood as many people gather together in such spaces increasing social interactions within the community. Conversely, the lack of space for socialization is indirectly associated with negative health effects such as depression, increased consumption of antidepressants and delirium. Thus, urban regeneration aiming at health and wellbeing should increase the presence of restorative spaces, including providing them of urban furniture for practicing sports and physical activities and for favoring social interactions while being relieved from fatigue and stress.

> *Home quality and comfort:* people spend more than half of their lives at home therefore home quality and comfort of the home are crucial determinants for individuals' health and wellbeing. The residential dwelling represents the smallest and most intimate scale of the man-made environment. Negative factors such as low maintenance, air conditioning and humidity problems can cause individual psychological stress in residents, possibility to develop allergies and even poor development of cognitive functions in children. In contrast, residential dwellings characterized by large windows with pleasant views of the outside and the presence of the courtyard were associated with positive levels of mental health. In light of this evidence, urban regeneration aiming to health should consider residential dwellings as a health-related intervention. Therefore, economic incentives are recommended for residents who desire to intervene with technical improvements to their home.

7.2. Audience of this Research Work

The area being studied matches the administrative boundary of the Italian ex *circoscrizione* that is a sub-municipal unit of the Italian municipalities. This choice reflects the strong perspective on urban

policy of my work as the intent was to provide Italian policy-makers with an urban regeneration scheme which could be operationalized immediately at neighbourhood level as it is adaptable at the recurrent morphology and administrative geography of Italian cities. The concept of NAH and the scheme to foster NAH within the neighbourhood aim to offer a solid foundation for researchers, practitioners and policy-makers to test new hypotheses and deliver urban regeneration strategies and policy interventions for enhancing public health and wellbeing at the neighbourhood level. The effectiveness to fostering Neighbourhood Advantage for Health is related to the common ground on which all stakeholders can conformably play. As it emerged in the literature review (section 2.1.) the factors emerged as relevant for health interact with each other, therefore, to adopt this framework it is crucial that citizens, private, and public sectors form effective partnerships to deliver *improvements* at the same time.

7.3. Suggestions for Future Studies

Future studies could investigate urban health benefit (NAH) at a more detailed scale. For each dimension of the NAH (individual, community and built environment) we could explore elements such as the *permeability* and accessibility of the urban fabric and the relationship with health and wellbeing. Even more, it would be significant to observe the influence of colours of the environment built on mental health and social wellbeing. Furthermore, it could be fundamental to measure differences in health between neighbourhoods lacking internal spatial continuity and those internally disconnected by the presence of physical barriers such as railway infrastructures and motorways which cut in half a whole settlement. Also, one could investigate how the concept of NAH fits into a larger scale, which could be an urban area with a larger population than the communities surveyed in this study. Finally, it would be interesting to explore at which urban scale the effect of the natural environment for health can be identified and which elements of the natural environment are more relevant to health and wellbeing.

7.4. Limitations

It is beyond the scope of this study to assess state of real health and wellbeing of the participants to the survey as well as provide causal explanations for the relationship between NAH and real health. Validity of the sample being studied can be unrepresentative of people with severe disabilities and minority groups. Also, this study does not aim to replace any previous medical study investigating similar neighbourhood-related dynamics in the public health field, but rather to offer new insights for investigating the neighbourhood effect on public health with an urban regeneration perspective. Survey A for SPHW was cross-sectional and associations between variables were reinforced through objective and direct on-field measures. Since the survey to estimate SPHW was developed on the basis of two prominent surveys[115] for assessing health and wellbeing of a population sample, it is important to highlight that internal validity of Survey A could be exposed to methodological bias. The same applies to Surveys B and C where questions have been developed according to several audit tools.

[115] To investigate the five dimensions of health, significative questions within the Short Form 12 (Q.1, Q. 8, and Q. 12) and WEMWBS (Q. 3 and 5) have been adopted according to their original scope as well as their scale ranging from 1 to 5. For more information on the surveys see Chap 4.

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APPENDIX 1 - Surveys

Respondents Profile

Aim
This questionnaire is intended to collect your characteristics such as demographic, socioeconomic and health-related data. Your identity will not be revealed as the survey is totally ANONIMOUS.

1. Day and Time: _____;
2. Gender: ☐ Male; ☐ Female; ☐ Other;
3. Age _____years;
4. Weight _____Kg;
5. Height _____cm;
6. Body Mass Index _____kg/cm;

7. What is your race?
   - ☐ Caucasian (White);
   - ☐ Black (African);
   - ☐ Asian (Arabic, Chinese, Indian, etc ...);
   - ☐ Latin (Spanish, South American);
   - ☐ Other_____.

8. What is your marital status?
   - ☐ Celibate / Nubile (Never married);
   - ☐ Married or Living together;
   - ☐ Separated; ☐ Divorced; ☐ Widowed;

9. How many people are part of your household including you? _____;

10. Indicate the neighbourhood within Pellaro where you live:
    ☐ Bocale I e II; ☐ Fiumarella; ☐ Lume; ☐ Macellari; ☐ Mortara; ☐ Occhio;
    ☐ Pantanello; ☐ Pellaro Centro; ☐ Ribergo; ☐ San Giovanni; ☐ San Leo;

11. How would you define your neighbourhood? ☐ Coastal ☐ Hilly

12. Which is your address (NO civic number) _____;

13. Indicate the proximity of your home to a well-known point in your neighbourhood:
    ☐ Near the Station _____; ☐ Near the Church _____;
    ☐ Near the Square _____; ☐ Near the Bar _____;
    ☐ Near the Shop _____; ☐ Near the Bakery _____;
    ☐ Near the Bus stop _____; ☐ Near the Pub _____;
    ☐ Near the Pizzeria _____; ☐ Near the Restaurant _____;

14. How distant is your home from the centre of your neighbourhood?
    ☐ Far; ☐ Medium distance; ☐ Close by;

15. What neighbourhood do you work within the City of Reggio Calabria? (If you work outside the City, please choose: I work outside the City; if you don't have a precise working location, please choose: I don't have a precise working location).
    ☐ Centro Storico; ☐ Pineta Zerbi, Tremulini, Eremo; ☐ Santa Caterina, San Brunello, Vito;
    ☐ Trabocchetto, Condera, Spirito Santo; ☐ Ferrovieri, Stadio, Gebbione; ☐ Sbarre;
    ☐ San Giorgio, Modena, San Sperato; ☐ Catona, Salice, Rosalì, Villa San Giuseppe;
    ☐ Gallico, Sambatello; ☐ Archi; ☐ Ortì, Podargoni, Terreti; ☐ Cannavò, Mosorrofa, Cataforio;
    ☐ Ravagnese; ☐ Gallina; ☐ Pellaro; ☐ I work outside the City;
    ☐ I don't have a precise working location; ☐ I don't know;

16. What transportation mode do you use to go to work?
☐ Car; ☐ Train or Bus; ☐ By walk; ☐ Bike; ☐ By walk and bike;

17. How long do you take to get to work? _____ minutes;

18. What is your job?
☐ Housewife; ☐ Student; ☐ Retired; ☐ Unemployed; ☐ Industry worker; ☐ Agriculture worker;
☐ Service worker; ☐ Office employee; ☐ Freelance professional; ☐ Commerce; ☐ Craftsman;
☐ Entrepreneur; ☐ Manager; ☐ Army, police, fireman, etc…; ☐ Other _____;

19. Which of these options best describes your current work situation?
☐ Permanent employed; ☐ Fixed-term employed; ☐ Retired; ☐ I work when I want;
☐ Not working and not looking for a job; ☐ Unemployed looking for a job;
☐ Disabled and not looking for a job; ☐ Disabled and looking for work;

20. Education
☐ None; ☐ Primary school; ☐ 12th grade or less; ☐ High school graduate;
☐ Bachelor degree; ☐ Master degree; ☐ Specialisation/Doctorate/Master;

21. Father's Education
☐ None; ☐ Primary school; ☐ 12th grade or less; ☐ High school graduate;
☐ Bachelor degree; ☐ Master degree; ☐ Specialisation/Doctorate/Master;

22. Mother's Education
☐ None; ☐ Primary school; ☐ 12th grade or less; ☐ High school graduate;
☐ Bachelor degree; ☐ Master degree; ☐ Specialisation/Doctorate/Master;

23. What is household income in the last 12 months? If you do not know it, please estimate.
☐ Less than 5.000 Euro; ☐ From 5.000 to 10.000 Euro; ☐ From 10.000 to 15.000 Euro;
☐ From 15.000 to 20.000 Euro; ☐ From 20.000 to 25.000 Euro; ☐ From 25.000 to 30.000 Euro;
☐ From 30.000 to 40.000 Euro; ☐ From 40.000 to 50.000 Euro; ☐ From 50.000 to 60.000 Euro;
☐ From 60.000 to 70.000 Euro; ☐ From 70.000 to 90.000 Euro; ☐ Over 90.000 Euro

24. Do you have private health or life insurance?
☐ No; ☐ Yes, life insurance; ☐ Yes, health insurance; ☐ Yes, other kind of insurances

25. Are you affected by the following diseases?
☐ High blood pressure; ☐ Diabetes; ☐ Heart Diseases; ☐ Cancer; ☐ Chronic bronchitis;
☐ Asthma; ☐ Depression; ☐ I am not affected by any of these diseases;

26. Do you take medicine for the following diseases?
☐ High blood pressure; ☐ Diabetes; ☐ Heart Diseases; ☐ Cancer; ☐ Chronic bronchitis;
☐ Asthma; ☐ Depression; ☐ I am not affected by any of these diseases;

27. Do you suffer from angina pectoris or have you ever had a heart attack? ☐ Yes ☐ No

28. Have you ever had a stroke or a Transient Ischemic Attack (TIA)? ☐ Yes ☐ No

29. Have you been affected by cancer? ☐ Yes ☐ No

30. Smoker: ☐ Yes ☐ No ☐ Former smoker

31. If do you smoke, how long are you smoking? (If less than 1 year write 1) _____;

32. If you smoke, how many cigarettes per day? _____;

33. If you're a former smoker, from how long have you quit smoking? _____;

34. Do you drink alcoholic beverage? ☐ Yes ☐ No

35. If yes, how many alcoholic units per week? (1 unit of alcohol per day corresponds to: 1 glass of wine, 1 can of beer, 1 cup of hard liquor / bitter / vodka / whiskey) you can also indicate more than one choice per week:

☐ Less than or equal to 2 glasses of beer; ☐ Less than or equal to 2 glasses of wine;
☐ Less than or equal to 2 small cups of hard liquor;
☐ More than 2 glasses of beer; ☐ More than 2 glasses of wine;
☐ More than 2 small glasses of hard liquor;
☐ More than or equal to 4 glasses of wine; ☐ More than or equal to 4 cans of beer;
☐ More than or equal to 4 small glasses of hard liquor;

36. How many hours a day do you spend at the computer?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

37. How many hours a day do you spend at the TV?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

38. How many hours a day do you spend at the smartphone or iPad?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

39. Are you a member of one or more not-for-profit organizations?

☐ Yes ☐ No

40. If Yes, how many hours a week are you involved in not-for-profit activities

☐ I am not involved in not-for-profit activities; ☐ Less than 2 hours;
☐ From 2 hours to 4 hours; ☐ From 4 hours to 6 hours; ☐ From 8 hours to 12 hours;
☐ Over 12 hours;

41. Do you usually perform physical activity during the day?

☐ Low (I move inside my home or office from one room to another).
☐ Moderate (I move to do the shopping on foot, walking, meeting people outside).
☐ Intense (gym, running, fitness).

42. If you practice mild physical activity, how many hours per day?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

43. If you practice moderate physical activity, how many hours per day?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

44. If you practice intense physical activity, how many hours per day?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

SURVEY A: State of Perceived Health and Well-being (SPHW);

Aim
This survey asks for your views about your perceived health and well-being. This information will help keep track of how you feel and how well you are able to do your usual and social activities. Answer each question by choosing just one answer. If you are unsure how to answer a question, please give the best answer you can.

1. In general, would you say your health is:
☐ Excellent
☐ Very good
☐ Good
☐ Fair
☐ Poor

These questions are about how you have been feeling during the past 4 weeks. The following questions are about activities you might do during a typical day. For each question, please give the one answer that comes closest to the way you have been feeling.

2. During the past 4 weeks, did pain interfere with your working and household activities;
☐ Not at all
☐ A little bit
☐ Moderately
☐ Quite a bit
☐ Extremely

3. During the past 4 weeks, I've been feeling calm and relaxed;
☐ None of the time
☐ Rarely
☐ Some of the time
☐ Often
☐ All of the time

4. During the past 4 weeks, I've had energy to spare;
☐ None of the time
☐ Rarely
☐ Some of the time
☐ Often
☐ All of the time

5. During the past 4 weeks, did physical health or emotional problems interfered with your social activities with friends and relatives?
☐ All of the time
☐ Most of the time
☐ A some of the time
☐ A little of the time
☐ None of the time

SURVEY B: Resident perception of the compositional sector of the neighbourhood of residence;

Aim
This survey asks for your views about your health-related and social behaviours, and some socioeconomic information about the of the neighbourhood where you live within Pellaro. Your identity will not be revealed as the survey is totally ANONIMOUS. Answer each question by choosing just one answer. If you are unsure how to answer a question, please give the best answer you can.

1. Age
Score: Not at all (5) - A little bit (4) - Moderately (3) - Quite a bit (2) - Extremely (1)
To which extent do you think that your age negatively affects your health?
☐ Extremely ☐ Quite a bit ☐ Moderately ☐ A little bit ☐ Not at all

2. Education
To which extent do you think that your education positively affects your health?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

3. Income
Score: Not at all (5) - A little bit (4) - Moderately (3) - Quite a bit (2) - Extremely (1)
To which extent do you think that your income negatively affects your lifestyle?
☐ Extremely ☐ Quite a bit ☐ Moderately ☐ A little bit ☐ Not at all

4. Nutrition
To which extent do you think that your food habits are healthy (many vegetables, few carbs and proteins)?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

5. Water intake
To which extent do you drink water properly during day?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

6. Health and urban environment
In your opinion, how much your health directly depends from the quality of the urban environment in which you live?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

7. Lifestyle
To which extent do you think that your lifestyle is healthy?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

8. Education: Q.20 in Respondent Profile (Appendix 1);
9. Father's education: Q.21 in Respondent Profile (Appendix 1);
10. Mother's education: Q.22 in Respondent Profile (Appendix 1);
11. Occupational stability: Q.23 in Respondent Profile (Appendix 1);
12. Household income: Q.24 in Respondent Profile (Appendix 1);
13. Physical activities: Q.25 in Respondent Profile (Appendix 1);
14. Active transportation: Q.26 in Respondent Profile (Appendix 1);
15. Anti-alcohol attitude: Q.27 in Respondent Profile (Appendix 1);
16. Anti-smoking attitude: Q.28 in Respondent Profile (Appendix 1);

17. Safety
To which extent do you think that your neighbourhood is safe? (e.g.: walking in the neighbourhood in the evening without any problem);
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

18. See other people walking
To which extent do you see other people walking in your neighbourhood?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

19. Family support
To which extent do you perceive your family support?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

20. Social cohesion
To which extent do you think that your neighbours are likely to help you if needed?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

21. Trust
To which extent do you think that you can trust your neighbours?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

22. Sharing values
To which extent do you think that the members of your community share the same values?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

23. Conviviality
To which extent do you think that your community is convivial (eat and joke together)?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

24. Diversity
To which extent do you think that your neighbourhood ethnically and culturally diverse?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

25. Stigma-free
To which extent do you think that your neighbourhood is the best among those in Pellaro?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

26. Cultural events
To which extent do you think that your neighbourhood is interesting for cultural events?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

27. Sense of belonging
To which extent do you think that there is sense of community in your neighbourhood?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

28. Institutional presence
To which extent do you perceive the presence of the institutions in your neighbourhood?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

29. Decisions involvement
To which extent do you feel involved in public decisions regarding your neighbourhood?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

30. Not-for-profit presence
To which extent do you perceive the presence of not-for-profit organizations in your neighbourhood?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

31. Price of healthy food
To which extent do you think that the healthy food you buy in your neighbourhood is cheap?
☐ None of the time ☐ Rarely ☐ Some of the time ☐ Often ☐ All of the time

32. Economic accessibility
To which extent do you think that prices for food, rent, and commodities are cheap?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

SURVEY C: Residents perception of the contextual sector of the neighbourhood of residence;

Aim
This survey asks for your views about the man-made and natural environment of the neighbourhood where you live within Pellaro. Your identity will not be revealed as the survey is totally ANONIMOUS. Answer each question by choosing just one answer. If you are unsure how to answer a question, please give the best answer you can.

1. Aesthetics pleasant
To which extent do you think that your neighbourhood is aesthetically pleasant (e.g.: pleasant buildings and houses)?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

2. Cleanliness
To which extent do you think that your neighbourhood is clean (e.g.: garbage, dirty streets, etc…)?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

3. Street quality
32. To which extent do you think that the streets in your neighbourhood are of high quality?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

4. Sidewalks quality
To which extent do you think that the sidewalks in your neighbourhood are of high quality?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

5. Presence of healthy food-store
To which extent can you find healthy food in your neighbourhood?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

6. Walking to food-store
To which extent can your reach by walking food-stores in your neighbourhood?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

7. Presence of food-stores
To which extent do you think that your neighbourhood is provided with food stores?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

8. Presence of commercial activities
To which extent do you think that your neighbourhood is provided with shops and other commercial activities?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

9. Presence of public spaces
To which extent do you think that your neighbourhood is provided with public spaces?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

10. Proximity to healthcare facilities
To which extent can you reach health-facilities by walking from your neighbourhood?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

11. Opportunity for physical activities
To which extent do you think that your neighbourhood offers opportunities for practice physical activities? (walk, run and bike lanes, gym or spaces for physical activities)
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

12. Shadowed public spaces with benches where to rest
To which extent do you think that your neighbourhood is provided with public spaces with shadows and benches for resting?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

13. Pleasant walking
To which extent do you think that your neighbourhood is pleasant for walking?

☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

14. Traffic-free
Score: Not at all (5) - A little bit (4) - Moderately (3) - Quite a bit (2) - Extremely (1)
To which extent do you think that there is traffic (congested) in your neighbourhood?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

15. Home quality
To which extent do you think that your home is conducive (appropriate?) for your wellbeing?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

16. Home comfort
To which extent do you think that your neighbourhood is comfortable?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

17. Natural environment
In general, how do you evaluate the quality of the natural environment of your neighbourhood?
☐ Very bad ☐ Bad ☐ Sufficient ☐ Good ☐ Excellent

18. Potable water availability
To which extent do you think that water in your neighbourhood is potable?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

19. Home exposure to the South
To which extent do you think that your home is exposed to the South?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

20. Temperature too warm in the summer
Score: Not at all (5) - A little bit (4) - Moderately (3) - Quite a bit (2) - Extremely (1)
To which extent do you think that your neighbourhood is warm in the summer?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

21. Temperature too cold in the winter
Score: Not at all (5) - A little bit (4) - Moderately (3) - Quite a bit (2) - Extremely (1)
To which extent do you think that your neighbourhood is cold in the winter?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

22. Sunny
To which extent do you think that your neighbourhood is sunny?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

23. Too windy
Not at all (5) - A little bit (4) - Moderately (3) - Quite a bit (2) - Extremely (1)
To which extent do you think that your neighbourhood is exposed to wind or windy?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

24. Too rainy
Score: Not at all (5) - A little bit (4) - Moderately (3) - Quite a bit (2) - Extremely (1)
To which extent do you think that your neighbourhood is exposed to the rain? (e.g.: intensity and streets flooding, etc…)
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

25. Noise-pollution free
Score: Not at all (5) - A little bit (4) - Moderately (3) - Quite a bit (2) - Extremely (1)
To which extent do you think that your neighbourhood is noisy? (e.g.: car traffic, construction, factories, etc…)
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

26. Air-pollution free
Score: Not at all (5) - A little bit (4) - Moderately (3) - Quite a bit (2) - Extremely (1)
To which extent do you think that the air in your neighbourhood is polluted?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

27. Water-pollution free
Score: Not at all (5) - A little bit (4) - Moderately (3) - Quite a bit (2) - Extremely (1)
To which extent do you think that the water in your neighbourhood is polluted?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

28. Soil-pollution free
Score: Not at all (5) - A little bit (4) - Moderately (3) - Quite a bit (2) - Extremely (1)
To which extent do you think that the soil in your neighbourhood is polluted?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

29. Landscape
To which extent do you think that your neighbourhood boasts high-quality landscape features?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

30. Presence of green spaces
To which extent do you think that your neighbourhood is provided of green spaces?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

31. Presence of public fountains
To which extent do you think that your neighbourhood is provided with public fountains?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

32. Presence of walkable paths provided with trees
To which extent do you think that the presence of walkable paths provided with trees is appropriate in your neighbourhood?
☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

APPENDIX 2 - Tables

Tab 1: ISTAT secondary data of the municipality of Reggio Calabria

Circoscrizione No.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV		
Sub-municipal Area	**Centro Storico**	**Pineta Zerbi - Tremulini - Eremo**	**Santa Caterina - San Brunello Vito**	**Trabocchetto - Condera - Spirito Santo**	**Ferrovieri - Stadio - Gebbione**	**Sbarre**	**San Giorgio - Modena - San Sperato**	**Catona - Salice - Rosali - Villa San Giuseppe**	**Gallico - Sambatello**	**Archi**	**Orti - Podargoni - Terreti**	**Cannavò - Mosorrofa - Cataforio**	**Ravagnese**	**Gallina**	**Pellaro**	**Total**	**Average**
ISTAT Census tracks	320	294	109	101	220	200	203	209	129	80	33	38	107	78	182	2303	
Area sq Km	1	3	6	5	2	2	3	16	15	9	62	46	21	24	25	239	/
Population	9690	12124	9382	17374	16723	18864	15388	14004	11408	9150	2026	6796	17518	7350	13020	180817	/
Foreign population	710	507	301	946	1013	1123	594	645	441	245	36	175	605	178	559	8078	/
Density (P/sq Km)	6597	4789	1634	3297	7568	10537	5479	865	750	1061	33	149	834	310	520	/	/
Housing conditions Index	25	26	55	36	30	36	42	45	55	49	48	63	33	32	31	/	2961,5
Aging Index	267	246	212	120	203	148	99	113	99	147	235	109	76	80	120	/	40,5
Drop school Index	2	2	3	3	3	4	5	6	3	6	5	4	4	3	3	/	151,5
High-school or Degree Index	87	80	75	72	71	74	67	62	67	58	52	48	61	61	65	/	3,8
Employment rate	40	36	36	39	34	37	37	33	37	33	29	35	39	39	37	/	66,7
Unemployment rate	14	19	20	20	23	21	24	26	23	25	26	26	25	24	24	/	36,1
Young unemployment rate	9	10	10	11	13	13	14	19	15	17	17	14	12	13	12	/	22,6
Rate of households in economic disavantage	2	3	3	4	4	5	7	8	6	6	4	6	7	6	5	/	13,3
Social and material vulnerability Index	88	92	97	96	99	101	116	122	99	112	121	102	104	99	93	/	5,1
Price housing Euro/sqm	1349	1019	1014	984	915	879	810	766	865	885	574	655	747	766	780	/	102,6
Healthcare facilities	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	867,2
Source: https://www.istat.it/it/archivio/104317																	

Source: Author's elaboration.

Tab 2: Population and sample size

	Data	Unit	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro	Total
	No. Census Tracks	No.	7	10	7	14	30	6	8	8	25	6	29	150
	Kind of area	/	Hilly	Coastal	Coastal	Hilly	Coastal	Coastal	Hilly	Hilly	Hilly	Coastal	Coastal	/
	Area	sqKm	0,24	0,27	0,12	0,84	1,56	0,36	0,48	0,30	0,58	0,60	0,65	6,01
	Density	P/sqkm	1582,86	2444,23	2837,87	1993,27	1076,04	1732,23	1745,06	2368,94	1878,35	1270,31	3565,96	0,00
Population	**Total Population**	**No.**	**380**	**655**	**350**	**1665**	**1683**	**618**	**838**	**716**	**1093**	**767**	**2331**	**11096**
25y to 69y	Population	No.	220	405	202	1020	1031	373	521	441	644	462	1428	6747
	5% Population	No.	11	20,25	10,1	51	51,55	18,65	26,05	22,05	32,2	23,1	71,4	337,35
	Respondents	No.	**17**	**24**	**16**	**57**	**59**	**25**	**30**	**27**	**39**	**29**	**77**	**400**
25y to 29y	Population	No.	27	55	30	99	116	56	65	41	62	56	143	750
	5% Population	No.	1,35	2,75	1,5	4,95	5,8	2,8	3,25	2,05	3,1	2,8	7,15	37,5
	Respondents	No.	2	3	2	6	6	3	4	3	4	3	8	44
30y to 34y	Population	No.	29	59	22	125	111	44	76	54	60	69	184	833
	5% Population	No.	1,45	2,95	1,1	6,25	5,55	2,2	3,8	2,7	3	3,45	9,2	41,65
	Respondents	No.	2	3	2	7	6	3	4	3	4	4	10	48
35y to 39y	Population	No.	22	49	19	134	131	60	50	60	90	60	191	866
	5% Population	No.	1,1	2,45	0,95	6,7	6,55	3	2,5	3	4,5	3	9,55	43,3
	Respondents	No.	2	3	2	7	7	4	3	4	5	4	10	51
40y to 44y	Population	No.	24	35	26	140	133	41	58	57	106	60	182	862
	5% Population	No.	1,2	1,75	1,3	7	6,65	2,05	2,9	2,85	5,3	3	9,1	43,1
	Respondents	No.	2	2	2	8	7	3	3	3	6	4	10	50
45y to 49y	Population	No.	21	49	39	128	129	47	62	55	80	49	186	845
	5% Population	No.	1,05	2,45	1,95	6,4	6,45	2,35	3,1	2,75	4	2,45	9,3	42,25
	Respondents	No.	2	3	3	7	7	3	4	3	5	3	10	50
50y to 54y	Population	No.	29	47	30	105	114	40	63	46	65	52	170	761
	5% Population	No.	1,45	2,35	1,5	5,25	5,7	2	3,15	2,3	3,25	2,6	8,5	38,05
	Respondents	No.	2	3	2	6	7	3	4	3	4	3	9	46
55y to 59y	Population	No.	27	41	13	105	117	32	55	43	63	47	138	681
	5% Population	No.	1,35	2,05	0,65	5,25	5,85	1,6	2,75	2,15	3,15	2,35	6,9	34,05
	Respondents	No.	2	3	1	6	7	2	3	3	4	3	7	41
60y to 64y	Population	No.	27	38	13	99	105	32	52	45	67	44	130	652
	5% Population	No.	1,35	1,9	0,65	4,95	5,25	1,6	2,6	2,25	3,35	2,2	6,5	32,6
	Respondents	No.	2	2	1	5	7	2	3	3	4	3	7	39
65y to 69y	Population	No.	14	32	10	85	75	21	40	40	51	25	104	497
	5% Population	No.	0,7	1,6	0,5	4,25	3,75	1,05	2	2	2,55	1,25	5,2	24,85
	Respondents	No.	1	2	1	5	5	2	2	2	3	2	6	31
Source: https://www.istat.it/it/archivio/104317														

Source: Author's elaboration.

Table 3: ISTAT census tracks data aggregated for neighbourhood

				Population																				Education						Occupation and Income							Commute		Housing							Built Environment									
Neighbourhood	ISTAT census track	Kind of area	Area	Population	Population (25y to 70y)	Population (25y to 70y) 5%	Respondents (25y to 70y)	Foreigns	Density	Male	Female	Population (< 5y to 24y)	Population (25y to 29y)	Population (30y to 34y)	Population (35y to 39y)	Population (40y to 44y)	Population (45y to 49y)	Population (50y to 54y)	Population (55y to 59y)	Population (60y to 64y)	Population (65y to 69y)	Population (70y to 74y)	Population (> 74y)	Master or bachelor degree (no.)	High-school diploma (No.)	Middle-school attainment (No.)	Primary school attainment (No.)	Educated	Not educated	Worforce 15y+	Employed	Unemployed	Neet	Housewife	Students	Earners	Commute inside RC	Commute outside RC	Residential units	Vacant residential units No.	Area of residential units	Renters	Owners	Househod No.	Households components No.	Buildings No.	Used buildings No.	Residential buildings No.	Commercial buildings No.	Residential buildings before 1919	Residential buildings (no.)	High preservation (No.)	Good preservation (No.)	Low preservation (No.)	Very low preservation (No.)
Bocale I e II	1835	Coast	0,1	54,0	34	1,7		3,0	481,8	25	29	15	4	3	4	7	2	7	2	5	0	1	4	9	20	16	3	1	1	18	15	3	27	7	5	8	24	1	25	33	2556	3	15	26	54	50	50	50	0	0	59	1	42	7	0
Bocale I e II	1845	Coast	0,1	2,0	2	0,1		0,0	31,8	1	1	0	0	1	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	2	0	1	9	80	0	0	1	2	12	12	10	2	0	10	0	5	5	0
Bocale I e II	1846	Coast	0,1	91,0	54	2,7		4,0	1493,2	50	41	21	4	6	5	8	11	5	4	4	7	7	9	12	34	18	17	6	1	35	26	4	46	14	6	20	34	1	37	31	3775	3	29	38	91	53	51	50	1	0	69	2	42	6	0
Bocale I e II	1847	Coast	0,0	4,0	2	0,1		0,0	97,5	3	1	2	0	0	0	0	1	1	0	0	0	0	0	0	3	1	0	0	0	1	1	0	3	1	2	0	1	1	1	2	84	0	1	1	4	2	2	2	0	0	2	0	0	2	0
Bocale I e II	1848	Coast	0,1	180,0	113	5,65		7,0	3426,5	94	86	50	10	16	11	8	11	10	14	16	17	7	10	21	73	43	26	7	1	76	57	9	85	25	16	32	65	5	67	65	6798	14	44	67	180	78	73	67	6	0	132	0	23	38	6
Bocale I e II	1850	Coast	0,1	25,0	13	0,65		2,0	253,8	10	15	7	2	1	4	0	2	2	0	1	1	4	1	1	9	5	5	1	1	6	4	2	15	3	3	7	8	1	10	41	971	3	7	10	25	54	46	33	13	0	52	2	13	11	7
Bocale I e II	1851	Coast	0,1	327,0	196	9,8		10,0	6531,4	161	166	69	19	25	19	25	26	22	29	22	9	16	46	44	120	63	59	23	3	133	116	10	156	33	22	78	126	16	145	27	14591	12	95	145	327	57	55	51	4	0	172	1	15	20	15
Bocale I e II	1853	Coast	0,0	78,0	54	2,7		2,0	57649,7	42	36	18	12	5	5	7	6	2	7	4	6	3	3	10	25	26	12	1	0	29	23	3	39	15	9	12	29	6	29	44	3111	3	24	30	78	60	57	53	4	0	84	1	19	27	6
Bocale I e II	1854	Coast	0,0	4,0	2	0,1		0,0	97,5	3	1	0	1	1	0	0	0	0	0	0	0	0	2	1	1	0	2	0	0	2	2	0	2	0	0	2	2	0	3	26	575	0	2	3	4	22	22	22	0	0	29	0	4	18	0
Bocale I e II	1855	Coast	0,0	23,0	15	0,75		2,0	527,9	13	10	4	2	1	1	2	2	2	3	0	2	1	3	2	8	7	6	0	0	12	8	2	11	1	3	6	6	2	9	1	696	0	7	9	23	1	1	1	0	0	1	0	0	1	0
Bocale I e II	1859	Coast	0,1	94,0	62	3,1		8,0	1811,8	49	45	23	7	5	3	7	10	12	8	6	4	2	7	10	34	28	16	4	0	47	31	9	41	11	10	17	36	6	38	3	3913	7	23	38	94	4	4	4	0	0	41	0	4	0	0
Bocale I e II	2444	Coast	0,1	0,0	0	0		0,0	0,0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	0	0	0	0	0	44	43	33	10	0	39	1	28	4	0
Bocale I e II	2445	Coast	0,0	69,0	37	1,85		7,0	2960,0	29	40	20	4	4	8	4	5	6	4	0	2	2	10	1	19	20	16	6	1	21	14	1	34	11	6	12	27	1	24	6	2038	9	11	24	69	21	19	19	0	2	34	3	6	9	1
Bocale I e II	2450	Coast	0,1	97,0	56	2,8		2,0	1635,1	49	48	28	5	7	11	7	4	6	4	9	3	2	11	4	34	29	20	6	0	37	24	7	47	11	10	20	39	3	40	16	4845	8	22	40	97	23	21	21	0	0	60	2	11	6	2
Bocale I e II	2451	Coast	0,0	11,0	7	0,35		0,0	349,8	5	6	4	1	0	1	2	2	1	0	0	0	0	0	1	6	3	0	1	0	8	8	0	2	0	1	0	9	1	4	28	755	0	3	4	11	27	26	25	1	0	38	0	17	8	0
Bocale I e II	2452	Coast	0,1	51,0	37	1,85		1,0	691,8	24	27	12	6	4	7	1	7	3	4	3	2	1	1	4	29	8	3	0	0	23	15	3	20	6	5	6	17	2	22	68	1937	2	9	22	51	71	71	69	2	0	91	1	65	3	0
Bocale I e II	2453	Coast	0,1	0,0	0	0		0,0	0,0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55	0	0	0	0	0	48	48	42	6	0	55	0	3	27	12
Bocale I e II	2454	Coast	0,0	53,0	31	1,55		4,0	4121,6	25	28	12	2	3	5	7	3	4	3	2	2	2	8	11	16	12	10	2	0	22	21	0	23	3	4	15	24	0	23	9	2258	2	16	23	53	16	14	13	1	0	32	0	3	7	3
Bocale I e II	2455	Coast	0,0	38,0	23	1,15		1,0	2552,9	15	23	7	2	0	3	3	4	2	3	3	3	4	4	7	12	8	8	1	0	15	8	4	18	3	1	12	13	0	17	0	1885	0	12	17	38	18	18	9	9	0	17	0	0	8	1
Bocale I e II	2456	Coast	0,0	98,0	59	2,95		10,0	5648,1	41	57	27	5	9	10	13	6	4	4	2	6	4	8	19	37	12	15	3	0	46	36	7	33	6	4	18	44	5	35	9	3795	6	27	36	98	23	23	22	1	0	45	0	5	15	2
Bocale I e II	2457	Coast	0,1	84,0	49	2,45		4,0	1255,0	38	46	26	7	1	5	6	6	11	10	1	2	1	8	8	31	19	14	8	0	38	32	3	31	10	5	12	37	11	29	66	2896	3	16	29	84	51	51	43	8	0	95	0	15	23	5
Bocale I e II	2458	Coast	0,0	88,0	52	2,6		2,0	1935,3	51	37	25	7	5	5	12	8	4	3	6	2	4	7	4	39	25	13	5	0	39	33	2	41	12	11	16	32	8	32	0	3446	2	23	32	88	4	4	4	0	0	32	0	1	2	1
Bocale I e II	2459	Coast	0,0	47,0	27	1,35		4,0	5712,9	25	22	14	3	2	6	1	2	3	3	5	2	2	4	3	17	12	9	1	2	15	11	2	27	7	7	9	18	2	17	17	1454	1	12	17	47	23	23	23	0	0	34	4	6	10	3
Bocale I e II	2460	Coast	0,0	0,0	0	0		0,0	0,0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	19	19	17	2	0	21	0	4	8	5
Bocale I e II	2467	Coast	0,1	0,0	0	0		0,0	0,0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	21	21	15	6	0	20	0	11	4	0
Bocale I e II	2498	Coast	0,1	84,0	55	2,75		1,0	638,2	42	42	25	6	7	9	4	4	0	10	12	3	2	2	15	32	15	8	7	0	33	29	2	33	8	4	16	37	1	31	2	4278	1	22	31	84	4	4	4	0	0	33	0	0	0	4
Bocale I e II	2499	Coast	0,1	2,0	2	0,1		1,0	34,7	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	1	1	0	1	1	0	0	1	0	2	1	340	0	1	2	2	1	1	1	0	0	1	0	1	0	0
Bocale I e II	2501	Coast	0,0	1,0	1	0,05		0,0	59,7	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1	0	70	0	0	1	1	1	1	1	0	0	1	1	0	0	0
Bocale I e II	2502	Coast	0,1	58,0	32	1,6		0,0	806,0	28	30	16	3	4	4	6	5	5	0	3	2	3	7	5	22	16	10	3	1	23	18	3	28	5	4	12	18	3	22	1	2750	0	15	23	58	3	3	3	0	0	23	0	0	1	2
Bocale I e II	2503	Coast	0,0	20,0	16	0,8		0,0	1156,3	10	10	4	4	1	3	3	2	2	1	0	0	0	0	2	14	1	0	1	0	13	12	0	4	2	0	0	10	4	9	0	1060	0	8	9	20	2	2	2	0	0	11	0	0	0	2
Bocale I e II	**30**	**Coast**	**1,6**	**1683,0**	1031	51,6		**75,0**	1076,0	**835**	**848**	429	**116**	**111**	**131**	**133**	**129**	**114**	**117**	**105**	**75**	**68**	**155**	**196**	**636**	**388**	**272**	**87**	**12**	**695**	**547**	**76**	**768**	**195**	**138**	**331**	**659**	**80**	**673**	**640**	**70957**	**79**	**444**	**678**	**1683**	**813**	**785**	**709**	**76**	**2**	**1333**	**19**	**343**	**270**	**77**
Fiumarella	1833	Coast	0,0	35,0	22	1,1		2,0	7881,1	18	17	6	2	3	2	2	3	2	5	0	3	3	4	5	10	8	8	3	1	18	13	2	14	1	3	6	16	1	16	32	1950	1	10	16	35	21	21	20	1	0	54	0	17	3	0
Fiumarella	1834	Coast	0,0	90,0	44	2,2		0,0	1973,8	41	49	29	2	10	6	7	6	6	4	2	1	6	11	14	30	17	9	8	0	40	33	5	33	6	8	14	44	6	39	22	4531	3	31	39	90	39	39	36	3	0	64	0	26	10	0
Fiumarella	2441	Coast	0,1	276,0	175	8,75		7,0	3043,6	146	130	80	33	16	27	17	25	18	10	19	10	8	13	30	101	68	44	11	0	119	92	11	116	38	20	42	108	14	97	53	10319	17	63	99	276	79	77	77	0	0	169	0	58	19	0
Fiumarella	2442	Coast	0,1	137,0	92	4,6		4,0	2230,4	69	68	36	14	13	17	8	6	9	9	9	7	5	4	16	44	42	16	9	1	69	51	14	47	13	12	14	62	9	51	73	6751	12	31	51	137	59	59	56	3	0	150	0	48	8	0
Fiumarella	2443	Coast	0,1	8,0	5	0,25		0,0	67,7	4	4	1	1	0	1	2	0	0	1	0	0	2	0	2	5	0	0	1	0	4	4	0	3	0	2	1	3	0	3	78	520	0	3	3	8	60	60	60	0	0	88	3	56	1	0
Fiumarella	2447	Coast	0,0	72,0	35	1,75		4,0	1976,7	35	37	25	4	2	7	5	7	5	3	2	0	5	7	3	27	15	16	10	0	26	22	3	34	9	11	12	28	3	25	0	2909	1	17	25	72	4	4	4	0	0	25	0	2	0	2
Fiumarella	**6**	**Coast**	**0,4**	**618,0**	373	18,7		**17,0**	1732,2	**313**	**305**	177	**56**	**44**	**60**	**41**	**47**	**40**	**32**	**32**	**21**	**29**	**39**	**70**	**217**	**150**	**93**	**42**	**2**	**276**	**215**	**35**	**247**	**67**	**56**	**89**	**261**	**33**	**231**	**258**	**26980**	**34**	**155**	**233**	**618**	**262**	**260**	**253**	**7**	**0**	**550**	**3**	**207**	**41**	**2**
Lume	1819	Hilly	0,0	222,0	145	7,25		4,0	5237,6	104	118	46	16	19	17	10	12	14	20	18	19	7	24	26	100	38	33	8	2	107	66	20	89	15	9	58	78	6	93	30	9185	18	74	93	222	31	31	28	3	0	134	1	20	5	2
Lume	1820	Hilly	0,1	56,0	35	1,75		1,0	559,0	29	27	17	6	3	5	1	5	5	4	2	4	0	4	9	17	14	10	1	0	26	17	2	21	5	5	9	27	4	20	53	2019	2	16	21	56	59	59	54	5	0	106	4	39	5	6
Lume	1829	Hilly	0,0	85,0	49	2,45		1,0	20691,3	41	44	25	3	4	9	6	7	6	2	6	6	4	7	10	23	22	18	7	0	31	25	3	39	8	7	21	42	0	32	28	2692	2	21	32	85	32	32	32	0	0	63	0	31	1	0
Lume	1830	Hilly	0,0	63,0	37	1,85		8,0	1609,0	32	31	17	3	5	7	7	4	3	3	4	1	3	6	7	16	18	15	3	1	25	21	1	29	9	7	11	30	3	25	28	2265	13	10	25	63	15	15	15	0	0	184	0	15	0	0
Lume	2433	Hilly	0,1	174,0	108	5,4		15,0	2833,6	87	87	48	6	14	16	17	18	12	7	10	8	7	11	15	59	38	28	17	1	78	59	14	63	20	8	30	76	5	67	40	8014	12	40	68	174	45	45	43	2	0	123	1	35	7	0
Lume	2434	Hilly	0,0	40,0	25	1,25		1,0	8890,9	19	21	12	3	2	2	4	4	2	4	2	2	2	1	3	15	11	7	2	0	18	15	2	16	5	3	5	19	2	14	13	1344	4	10	14	40	11	11	10	1	0	30	0	10	0	0
Lume	2435	Hilly	0,0	18,0	10	0,5		9,0	2674,6	9	9	7	2	0	0	3	2	2	1	0	0	1	0	1	3	11	2	0	0	8	3	1	9	2	2	3	2	1	5	8	320	3	2	5	18	11	11	11	0	0	13	0	11	0	0
Lume	2436	Hilly	0,0	58,0	32	1,6		6,0	1325,0	26	32	21	2	7	4	9	3	2	2	3	0	2	3	8	17	15	5	8	1	21	16	5	22	4	7	6	28	1	22	36	2352	8	8	22	58	41	41	39	2	0	63	0	35	4	0
Lume	**8**	**Hilly**	**0,3**	**716,0**	441	22,1		**45,0**	2368,9	**347**	**369**	193	**41**	**54**	**60**	**57**	**55**	**46**	**43**	**45**	**40**	**26**	**56**	**79**	**250**	**167**	**118**	**46**	**5**	**314**	**222**	**48**	**288**	**68**	**48**	**143**	**302**	**22**	**278**	**236**	**28191**	**62**	**181**	**280**	**716**	**245**	**245**	**232**	**13**	**0**	**716**	**6**	**196**	**22**	**8**
Macellari	2368	Hilly	0,0	77,0	45	2,25		3,0	#DIV/0!	33	44	17	7	5	2	6	4	6	4	7	4	3	12	1	12	32	21	6	3	28	16	5	43	9	9	21	27	0	31	22	2709	2	23	31	77	55	52	48	4	3	53	0	10	28	10
Macellari	1784	Hilly	0,0	4,0	2	0,1		0,0	683,3	3	1	2	0	0	0	0	1	0	1	0	0	0	0	0	2	0	1	0	0	3	2	1	0	0	0	0	2	0	1	0	145	1	0	1	4	2	2	1	1	0	1	1	0	0	0
Macellari	1786	Hilly	0,1	114,0	65	3,25		2,0	1360,3	57	57	28	7	7	11	5	5	9	6	8	7	9	12	4	30	31	30	8	4	39	31	4	60	16	8	28	42	4	41	0	4946	3	28	41	114	16	16	12	4	0	41	0	8	4	0
Macellari	2379	Hilly	0,0	58,0	34	1,7		0,0	2105,9	28	30	18	3	8	4	4	4	4	1	4	2	3	3	4	18	14	14	6	1	23	15	5	24	8	5	8	26	1	21	0	2128	1	14	21	58	7	6	6	0	0	21	0	1	5	0
Macellari	2381	Hilly	0,1	59,0	30	1,5		1,0	611,7	32	27	21	3	1	2	3	5	5	8	3	0	2	6	6	17	18	9	5	0	27	21	3	24	3	11	9	28	1	20	16	2330	1	16	20	59	46	38	30	8	0	38	2	10	11	7
Macellari	1772	Hilly	0,0	29,0	21	1,05		0,0	53703,7	14	15	5	3	4	2	3	0	2	2	4	1	1	2	2	5	9	9	2	0	12	10	1	13	5	0	5	13	0	12	1	1195	1	8	12	29	10	7	7	0	0	13	2	4	1	0
Macellari	2378	Hilly	0,0	39,0	23	1,15		2,0	1506,7	21	18	13	4	4	1	3	2	3	5	1	0	0	3	4	12	14	5	0	0	15	13	2	17	5	5	6	18	1	14	14	1602	0	13	14	39	23	22	18	4	0	28	7	4	5	2
Macellari	**7**	**Hilly**	**0,2**	**380,0**	220	11		**8,0**	1582,9	**188**	**192**	104	**27**	**29**	**22**	**24**	**21**	**29**	**27**	**27**	**14**	**18**	**38**	**21**	**96**	**118**	**89**	**27**	**8**	**147**	**108**	**21**	**181**	**46**	**38**	**77**	**156**	**7**	**140**	**53**	**15055**	**9**	**102**	**140**	**380**	**159**	**143**	**122**	**21**	**3**	**195**	**12**	**37**	**54**	**19**
Occhio	2376	Coast	0,0	50,0	31	1,55		1,0	#DIV/0!	20	30	16	4	1	5	3	5	4	3	4	2	1	2	2	15	18	7	6	0	19	11	5	18	7	2	5	23	2	16	5	2559	4	8	16	50	13	9	8	1	0	22	4	3	1	0
Occhio	1781	Coast	0,0	52,0	40	2		5,0	4156,0	22	30	7	11	4	4	2	5	2	7	3	2	1	4	9	14	17	8	2	0	20	13	2	28	10	4	8	15	3	22	8	2054	4	12	22	52	13	13	12	1	0	32	3	8	1	0
Occhio	1782	Coast	0,0	35,0	20	1		3,0	1281,0	16	19	8	4	3	0	0	2	5	3	2	1	0	7	2	9	13	4	5	0	13	9	1	18	3	2	11	11	0	14	9	1448	3	10	14	35	16	13	11	2	0	23	8	3	0	0
Occhio	1783	Coast	0,1	157,0	96	4,8		7,0	2373,1	78	79	43	13	15	6	16	7	16	8	8	7	6	12	9	50	44	31	12	1	67	49	7	67	18	9	30	66	4	59	35	6889	18	30	59	157	78	44	44	0	0	100	17	13	12	2
Occhio	1796	Coast	0,0	119,0	76	3,8		13,0	5748,0	57	62	20	11	10	10	6	8	4	9	10	8	10	13	16	36	25	36	3	1	48	38	6	64	20	9	29	43	5	49	18	4617	16	19	49	119	32	32	25	7	0	74	11	11	3	0
Occhio	2373	Coast	0,0	56,0	37	1,85		5,0	5517,8	27	29	12	5	6	4	2	4	7	5	2	2	1	6	4	24	8	11	5	0	24	21	3	23	5	4	10	21	3	22	2	2208	2	14	22	56	12	10	8	2	0	27	3	1	4	0
Occhio	2374	Coast	0,0	19,0	15	0,75		0,0	1280,6	8	11	4	2	5	2	1	2	1	0	2	0	0	0	4	7	5	0	0	0	10	8	1	6	2	2	1	11	1	9	3	915	0	8	9	19	11	9	7	2	0	13	5	0	2	0
Occhio	2375	Coast	0,0	73,0	41	2,05		1,0	1646,7	36	37	21	2	8	12	2	5	1	4	3	4	5	6	8	23	18	9	8	0	30	26	2	30	10	5	12	30	4	26	15	2917	2	18	26	73	34	23	18	5	0	49	1	6	11	0
Occhio	2377	Coast	0,0	15,0	8	0,4		2,0	409,6	6	9	3	0	1	1	0	1	0	2	2	1	1	3	2	4	4	3	1	0	4	2	2	8	2	0	6	4	0	7	3	637	0	5	7	15	17	12	7	5	0	10	7	0	0	0
Occhio	2383	Coast	0,0	79,0	41	2,05		0,0	2235,0	40	39	22	3	6	5	3	10	7	0	2	5	4	12	7	31	16	15	3	2	32	22	5	38	7	8	16	30	4	30	15	2975	2	18	30	79	30	29	27	2	0	45	3	13	11	0
Occhio	**10**	**Coast**	**0,3**	**655,0**	405	20,3		**37,0**	2444,2	**310**	**345**	156	**55**	**59**	**49**	**35**	**49**	**47**	**41**	**38**	**32**	**29**	**65**	**63**	**213**	**168**	**124**	**45**	**4**	**267**	**199**	**34**	**300**	**84**	**45**	**128**	**254**	**26**	**254**	**113**	**27219**	**51**	**142**	**254**	**655**	**256**	**194**	**167**	**27**	**0**	**395**	**62**	**58**	**45**	**2**
Pellaro Centro	1800	Coast	0,0	22,0	15	0,75		2,0	1594,8	13	9	4	3	1	1	3	1	3	0	1	2	2	1	1	9	5	4	2	0	10	8	0	10	3	0	6	7	0	9	2	1004	1	6	9	22	8	8	6	2	1	11	0	5	1	0
Pellaro Centro	1802	Coast	0,0	1,0	1	0,05		0,0	38,6	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	24	117	0	0	1	1	22	22	21	1	4	25	7	8	5	1
Pellaro Centro	1816	Coast	0,0	1,0	1	0,05		0,0	311,5	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	1	4	100	0	1	1	1	6	6	4	2	0	5	0	1	3	0
Pellaro Centro	1817	Coast	0,1	809,0	507	25,4		30,0	14802,8	389	420	209	50	63	56	54	74	63	65	45	37	29	64	119	316	180	103	39	5	369	283	42	335	95	66	131	351	31	317	84	30945	117	173	317	809	48	46	40	6	0	447	1	23	16	0
Pellaro Centro	1831	Coast	0,0	15,0	13	0,65		2,0	2654,9	9	6	1	3	2	1	0	0	2	3	2	0	0	1	2	10	2	1	0	0	10	9	0	5	2	1	2	9	0	7	15	656	0	5	7	15	7	7	6	1	0	30	0	6	0	0
Pellaro Centro	1832	Coast	0,0	97,0	58	2,9		8,0	3401,5	46	51	26	11	6	9	9	8	4	8	0	3	1	12	19	39	14	11	7	0	43	36	5	38	8	10	16	46	7	41	17	3898	7	26	41	97	33	32	30	2	0	82	3	24	3	0
Pellaro Centro	2391	Coast	0,1	44,0	26	1,3		2,0	649,6	18	26	14	0	0	1	10	8	3	1	2	1	3	1	8	19	11	3	1	1	20	18	0	19	4	5	5	22	2	20	39	2221	5	10	20	44	48	48	42	6	1	58	12	19	7	4
Pellaro Centro	2394	Coast	0,0	16,0	9	0,45		0,0	770,3	10	6	5	1	0	2	2	0	1	1	0	2	2	0	1	3	6	2	3	0	3	3	0	8	4	0	3	3	0	5	3	607	0	5	5	16	8	8	6	2	2	8	0	6	0	0
Pellaro Centro	2397	Coast	0,0	10,0	7	0,35		0,0	223,0	5	5	1	2	1	0	1	0	1	1	0	1	0	2	1	5	1	1	1	0	4	3	0	5	3	0	2	3	0	4	8	436	1	0	4	10	16	16	11	5	2	12	3	7	0	1
Pellaro Centro	2416	Coast	0,0	180,0	109	5,45		18,0	6570,1	88	92	36	9	15	7	18	17	17	6	11	9	12	23	33	75	35	21	12	0	71	57	7	92	23	17	40	55	10	79	8	7911	20	51	80	180	18	15	14	1	0	93	2	4	6	2
Pellaro Centro	2417	Coast	0,0	2,0	1	0,05		0,0	1090,5	1	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0	2	1	0	1	0	0	1	1	45	0	1	1	2	4	2	2	0	0	2	0	1	1	0
Pellaro Centro	2418	Coast	0,0	0,0	0	0		0,0	0,0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
Pellaro Centro	2419	Coast	0,1	54,0	29	1,45		4,0	526,1	23	31	19	3	2	4	4	4	6	2	3	1	2	4	14	19	9	4	7	0	22	21	0	25	4	9	7	25	2	22	3	2842	3	14	22	54	30	23	11	12	0	26	1	3	7	0
Pellaro Centro	2420	Coast	0,0	116,0	56	2,8		5,0	2935,8	44	72	24	6	9	8	7	8	7	7	3	1	15	21	15	46	21	16	6	0	46	38	2	53	8	6	37	37	5	44	15	4670	5	35	44	104	44	40	31	9	0	63	1	4	19	7
Pellaro Centro	2421	Coast	0,0	4,0	3	0,15		0,0	2399,5	3	1	1	0	1	0	0	0	0	1	1	0	0	0	3	0	0	0	0	0	3	3	0	0	0	0	0	2	0	2	1	204	0	1	2	4	1	1	1	0	0	3	0	0	1	0
Pellaro Centro	2422	Coast	0,0	0,0	0	0		0,0	0,0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	1	1	1	0	0	5	0	0	1	0
Pellaro Centro	2423	Coast	0,0	4,0	3	0,15		0,0	2847,0	0	4	0	0	1	0	0	0	0	0	1	0	1	0	0	3	0	1	0	0	2	1	1	2	1	0	1	1	0	3	4	280	0	3	3	4	3	3	3	0	0	8	0	1	2	0
Pellaro Centro	2424	Coast	0,0	1,0	1	0,05		0,0	313,6	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1	0	1	2	80	0	1	1	1	2	2	2	0	0	4	0	0	1	1
Pellaro Centro	2425	Coast	0,0	1,0	1	0,05		0,0	614,3	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1	0	1	2	80	0	1	1	1	2	2	2	0	0	4	0	0	1	1
Pellaro Centro	2426	Coast	0,0	1,0	0	0		0,0	578,7	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	120	0	1	1	1	4	4	2	2	0	4	0	0	2	0
Pellaro Centro	2427	Coast	0,0	7,0	3	0,15		0,0	4383,2	1	6	3	0	0	0	0	1	1	0	0	1	0	1	1	2	1	0	2	0	2	2	0	4	0	2	2	4	1	3	0	335	0	2	3	7	5	4	2	2	0	3	0	0	2	0
Pellaro Centro	2428	Coast	0,0	165,0	95	4,75		13,0	5757,2	84	81	52	5	18	16	10	18	12	4	7	5	8	10	30	51	31	20	11	2	73	53	9	55	19	13	17	72	6	59	14	6639	14	37	60	165	25	25	23	2	0	109	2	15	6	0
Pellaro Centro	2429	Coast	0,0	87,0	54	2,7		5,0	124285,7	42	45	17	6	5	6	7	6	6	6	7	5	5	11	12	35	18	17	2	1	36	28	3	42	11	8	21	29	5	36	3	4690	9	21	36	87	3	3	3	0	0	6	0	0	3	0
Pellaro Centro	2430	Coast	0,0	70,0	46	2,3		5,0	2937,4	31	39	17	5	9	11	6	3	4	2	3	3	2	5	12	27	11	10	1	2	34	29	5	24	6	5	11	35	4	27	12	2482	2	20	27	70	20	19	15	4	0	40	0	1	13	1
Pellaro Centro	2437	Coast	0,1	538,0	341	17,1		2,0	8002,6	265	273	141	34	41	62	45	30	35	26	43	25	27	29	41	178	151	93	41	1	224	170	24	222	70	34	76	220	19	192	21	18270	79	96	192	538	51	51	38	13	0	255	0	20	17	1
Pellaro Centro	2438	Coast	0,0	29,0	14	0,7		2,0	2992,5	14	15	4	3	3	1	2	2	0	0	1	2	5	6	2	11	0	11	3	1	9	7	2	17	3	2	12	8	0	14	17	1909	3	9	14	29	23	23	22	1	0	39	0	19	2	1
Pellaro Centro	2439	Coast	0,0	34,0	22	1,1		0,0	8234,4	17	17	9	0	6	4	1	3	2	4	1	1	0	3	11	11	4	4	3	0	18	14	1	11	1	4	6	17	1	13	11	1318	2	8	13	34	11	11	11	0	0	41	1	9	1	0
Pellaro Centro	2440	Coast	0,0	12,0	8	0,4		1,0	340,0	5	7	4	2	1	0	3	2	0	0	0	0	0	0	3	5	1	1	1	0	8	8	0	1	1	0	0	11	0	7	53	487	0	4	7	12	43	43	41	2	0	67	0	36	5	0
Pellaro Centro	2623	Coast	0,0	11,0	5	0,25		4,0	333,2	5	6	5	0	0	2	0	1	0	1	0	1	0	1	0	3	3	2	1	0	3	2	0	5	2	1	2	4	0	3	42	225	1	1	3	11	43	38	27	11	0	50	0	11	16	0
Pellaro Centro	**29**	**Coast**	**0,7**	**2331,0**	1428	71,4		**103,0**	3566,0	**1114**	**1217**	592	**143**	**184**	**191**	**182**	**186**	**170**	**138**	**130**	**104**	**113**	**198**	**328**	**871**	**504**	**327**	**144**	**13**	**1012**	**795**	**101**	**978**	**269**	**183**	**400**	**963**	**93**	**913**	**409**	**92571**	**269**	**532**	**915**	**2319**	**530**	**504**	**417**	**87**	**10**	**1500**	**33**	**223**	**141**	**20**
Ribergo	1811	Hilly	0,1	129,0	78	3,9		0,0	935,0	55	74	44	10	9	7	9	12	10	12	8	1	2	5	15	63	25	10	5	1	66	52	8	43	9	16	13	67	8	44	47	6006	2	34	44	129	73	73	69	4	7	98	14	47	3	5
Ribergo	1812	Hilly	0,0	48,0	27	1,35		0,0	1056,1	22	26	10	3	1	2	6	4	4	1	3	3	5	6	7	17	9	8	3	2	20	14	1	24	3	5	15	18	0	24	25	2619	2	16	24	48	42	41	37	4	17	49	6	23	3	5
Ribergo	1813	Hilly	0,1	34,0	24	1,2		3,0	357,0	15	19	8	5	2	1	3	1	5	3	2	2	0	2	5	12	7	4	2	3	20	13	3	10	0	2	6	15	0	14	9	2021	4	9	14	34	23	20	18	2	4	26	4	9	1	4
Ribergo	1814	Hilly	0,0	18,0	10	0,5		0,0	28938,9	7	11	1	2	0	0	3	3	1	0	1	0	0	7	1	6	2	5	2	1	5	5	0	12	5	0	5	5	1	8	2	649	2	6	8	18	2	2	2	0	0	10	0	2	0	0
Ribergo	1815	Hilly	0,0	274,0	169	8,45		16,0	5922,7	130	144	84	13	16	27	34	21	11	17	16	14	11	10	34	104	52	37	29	0	113	80	17	103	31	16	45	126	12	95	11	10074	10	73	95	274	28	28	25	3	0	136	2	22	1	0
Ribergo	1818	Hilly	0,0	92,0	54	2,7		0,0	2572,4	46	46	29	8	4	6	10	3	3	7	8	5	6	3	16	32	19	12	8	0	34	26	4	42	8	11	15	41	3	30	28	4079	6	22	30	92	26	26	23	3	0	74	0	21	2	0
Ribergo	2400	Hilly	0,0	27,0	17	0,85		0,0	7081,0	15	12	9	0	3	3	3	2	1	2	2	1	1	0	2	13	6	1	2	0	14	6	1	7	1	1	5	12	1	11	4	1180	3	8	11	27	5	5	5	0	0	19	0	4	1	0
Ribergo	2401	Hilly	0,0	29,0	13	0,65		0,0	11354,7	13	16	8	0	0	0	4	3	2	1	3	0	4	4	2	8	11	5	2	1	6	6	0	19	2	4	9	11	1	12	4	1829	0	9	12	29	8	8	8	0	0	16	0	7	1	0
Ribergo	2402	Hilly	0,0	14,0	9	0,45		0,0	7021,1	4	10	5	0	0	3	2	2	2	0	0	0	0	0	2	7	3	0	1	0	6	5	1	6	3	3	0	9	0	5	10	613	1	4	5	14	6	6	6	0	0	16	0	5	1	0
Ribergo	2403	Hilly	0,0	10,0	4	0,2		0,0	16583,7	3	7	2	0	0	1	2	0	0	0	0	1	1	3	0	4	0	3	2	1	3	3	0	6	2	1	3	4	0	5	2	408	2	3	5	10	4	4	4	0	0	7	0	3	1	0
Ribergo	2404	Hilly	0,0	33,0	14	0,7		1,0	14614,7	16	17	7	2	1	3	2	0	1	2	0	3	7	5	1	12	7	12	1	0	10	3	3	20	1	2	15	8	0	20	14	1641	12	6	20	33	7	7	7	0	0	34	0	5	2	0
Ribergo	2405	Hilly	0,0	5,0	2	0,1		0,0	4524,9	3	2	3	0	0	0	1	0	1	0	0	0	0	0	2	0	1	1	1	0	1	1	0	2	0	1	1	3	1	1	1	140	0	1	1	5	3	3	3	0	0	31	0	3	2	0
Ribergo	2406	Hilly	0,0	0,0	0	0		0,0	0,0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	3	3	3	0	0	9	0	3	0	0
Ribergo	2407	Hilly	0,0	11,0	4	0,2		0,0	21526,4	5	6	2	0	0	2	0	0	0	0	1	1	1	4	0	3	1	3	3	0	3	2	1	6	1	0	5	4	0	7	0	565	1	6	7	11	4	4	4	0	0	7	0	3	1	0
Ribergo	2408	Hilly	0,0	2,0	1	0,05		0,0	3590,7	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	0	0	1	1	0	1	0	0	0	1	0	1	9	80	0	1	1	2	3	3	3	0	0	10	0	3	0	0
Ribergo	2409	Hilly	0,0	42,0	23	1,15		2,0	3018,8	15	27	8	3	3	2	2	4	3	3	1	2	2	9	3	10	15	9	2	2	18	9	1	21	5	1	14	9	2	18	18	1731	10	6	18	42	24	24	20	4	0	39	0	17	3	0
Ribergo	2410	Hilly	0,0	20,0	14	0,7		0,0	37313,4	10	10	0	0	2	1	1	1	6	2	1	0	4	2	1	5	9	5	0	0	7	6	0	13	5	0	8	2	1	11	4	839	4	6	11	20	5	5	5	0	0	15	0	4	1	0
Ribergo	2411	Hilly	0,0	7,0	1	0,05		0,0	12216,4	3	4	3	0	0	0	1	0	0	0	0	2	1	0	2	1	2	2	0	1	0	0	0	4	0	0	3	2	0	3	4	205	1	2	3	7	3	3	3	0	0	7	0	3	0	0
Ribergo	2412	Hilly	0,0	0,0	0	0		0,0	0,0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	8	8	8	0	0	15	0	5	1	2
Ribergo	2413	Hilly	0,1	164,0	102	5,1		13,0	2838,2	76	88	51	10	12	12	13	18	6	10	11	10	2	9	20	60	30	27	15	1	66	54	9	72	19	16	25	75	9	58	16	6221	12	39	58	164	31	31	27	4	0	80	0	18	7	2
Ribergo	2414	Hilly	0,0	43,0	26	1,3		1,0	1382,0	21	22	12	1	3	10	3	1	3	0	2	3	2	3	3	17	7	7	4	0	18	10	7	14	2	1	9	18	0	16	25	1962	2	12	16	43	33	33	25	8	0	48	1	18	6	0
Ribergo	2415	Hilly	0,0	13,0	6	0,3		0,0	545,4	7	6	5	0	0	0	1	2	2	0	0	1	0	2	1	4	5	3	0	0	5	2	0	8	3	3	1	5	1	4	46	394	0	4	4	13	30	30	28	2	0	66	2	14	8	4
Ribergo	2431	Hilly	0,0	42,0	25	1,25		3,0	2181,1	23	19	14	1	3	8	2	2	1	0	6	2	2	1	2	11	12	8	4	0	15	15	0	17	7	2	5	24	1	13	9	1425	0	11	13	42	21	20	15	5	0	26	1	14	0	0
Ribergo	2463	Hilly	0,0	28,0	17	0,85		1,0	675,5	10	18	10	3	1	2	4	1	2	2	1	1	1	0	3	11	3	6	1	0	11	8	1	9	3	2	4	14	0	8	9	831	0	6	8	28	13	11	11	0	0	19	2	7	2	0
Ribergo	2495	Hilly	0,0	8,0	4	0,2		0,0	501,4	3	5	2	1	0	0	0	1	1	1	0	0	0	2	0	4	3	0	0	1	2	2	0	6	1	3	2	3	2	3	8	258	1	2	3	8	6	6	6	0	0	11	0	6	0	0
Ribergo	**25**	**Hilly**	**0,6**	**1093,0**	644	32,2		**40,0**	1878,4	**503**	**590**	317	**62**	**60**	**90**	**106**	**80**	**65**	**63**	**67**	**51**	**54**	**78**	**120**	**405**	**228**	**170**	**89**	**13**	**445**	**323**	**57**	**465**	**111**	**90**	**209**	**476**	**43**	**411**	**329**	**45770**	**75**	**286**	**411**	**1093**	**411**	**404**	**365**	**39**	**28**	**868**	**32**	**266**	**45**	**22**
San Giovanni	2385	Hilly	0,0	3,0	3	0,15		0,0	#DIV/0!	2	1	0	1	0	0	0	0	0	1	1	0	0	0	0	1	1	1	0	0	1	0	1	2	1	0	1	0	0	1	10	80	0	1	1	3	8	8	7	1	0	11	2	2	2	1
San Giovanni	1795	Hilly	0,1	55,0	38	1,9		6,0	743,0	27	28	10	7	6	2	5	3	1	6	5	3	1	6	4	17	11	13	8	1	22	13	4	29	6	5	13	18	1	22	82	1684	6	10	22	55	96	82	71	11	5	112	19	20	22	10
San Giovanni	1794	Hilly	0,1	106,0	65	3,25		11,0	916,3	51	55	22	9	5	10	10	6	7	9	4	5	3	16	4	28	26	34	8	1	47	27	9	46	14	2	22	30	1	47	14	4740	13	24	48	106	31	30	28	2	0	61	5	14	8	1
San Giovanni	2388	Hilly	0,0	123,0	72	3,6		9,0	8321,5	66	57	42	7	7	12	16	15	1	5	5	4	3	6	11	38	36	28	5	0	48	41	3	51	11	11	17	61	3	39	12	4816	4	26	39	123	23	20	19	1	0	52	0	15	4	0
San Giovanni	1797	Hilly	0,0	176,0	106	5,3		11,0	95600,2	94	82	44	15	12	20	9	8	15	7	8	12	10	16	9	49	39	44	14	8	80	55	17	63	15	2	41	63	9	68	57	6237	9	45	68	176	97	95	86	9	3	128	16	26	31	13
San Giovanni	1801	Hilly	0,1	44,0	30	1,5		0,0	555,7	22	22	10	2	2	5	6	2	3	3	4	3	2	2	2	19	12	6	5	0	17	11	3	22	9	4	7	17	2	20	44	2420	3	12	20	44	48	47	37	10	1	64	14	14	8	1
San Giovanni	1803	Hilly	0,0	6,0	3	0,15		0,0	172,3	1	5	1	1	1	0	0	0	0	1	0	0	2	0	2	2	0	0	2	1	1	3	0	1	3	0	3	1	0	4	7	360	0	3	4	6	10	10	9	1	2	11	1	6	0	2
San Giovanni	2382	Hilly	0,3	532,0	321	16,1		9,0	2051,9	256	276	158	24	44	42	40	43	39	33	31	25	21	32	46	173	145	89	42	7	226	167	30	217	55	42	95	218	15	194	54	21596	10	142	195	532	122	110	98	12	0	251	15	31	43	9
San Giovanni	2392	Hilly	0,1	35,0	21	1,05		1,0	643,9	16	19	7	2	0	3	0	5	2	6	3	0	1	6	5	12	11	5	1	0	11	11	0	21	4	5	8	14	0	12	37	1108	2	8	12	35	35	35	25	10	0	54	6	7	12	0
San Giovanni	2393	Hilly	0,0	106,0	73	3,65		3,0	4330,9	52	54	21	7	13	6	11	9	4	7	9	7	1	11	14	50	20	12	6	2	47	45	2	47	10	9	24	49	1	40	13	4201	5	26	40	104	29	27	25	2	2	53	4	17	3	1
San Giovanni	2395	Hilly	0,1	244,0	147	7,35		24,0	3014,0	123	121	69	13	16	14	26	18	16	19	12	13	9	19	24	100	55	41	11	1	94	77	9	119	35	23	48	89	12	94	16	10657	11	71	95	244	38	38	35	3	3	111	6	20	9	0
San Giovanni	2396	Hilly	0,0	147,0	89	4,45		6,0	4853,4	75	72	36	9	12	15	10	11	8	7	10	7	9	13	18	54	37	24	4	0	64	52	11	65	13	13	31	63	3	55	24	5971	8	37	55	147	43	42	41	1	3	86	6	27	6	2
San Giovanni	2399	Hilly	0,1	88,0	52	2,6		8,0	1661,5	39	49	26	2	7	5	7	8	9	2	6	6	3	7	7	34	14	16	5	2	38	35	3	34	5	6	18	37	2	33	16	3889	0	22	33	88	37	36	35	1	7	49	12	16	4	3
San Giovanni	2398	Hilly	0,0	0,0	0	0		0,0	0,0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	4	4	3	1	1	4	1	1	0	1
San Giovanni	**14**	**Hilly**	**0,8**	**1665,0**	1020	51		**88,0**	1993,3	**824**	**841**	446	**99**	**125**	**134**	**140**	**128**	**105**	**105**	**99**	**85**	**63**	**136**	**144**	**575**	**409**	**316**	**109**	**22**	**697**	**535**	**93**	**719**	**178**	**122**	**328**	**660**	**49**	**629**	**389**	**67759**	**71**	**427**	**632**	**1663**	**621**	**584**	**519**	**65**	**27**	**1047**	**107**	**216**	**152**	**44**
Pantanello	1799	Coast	0,0	10,0	5	0,25		0,0	304,5	5	5	1	0	2	1	0	1	0	0	0	1	2	2	2	3	2	3	0	0	2	2	0	7	2	0	4	1	1	4	34	373	0	4	4	10	27	26	25	1	0	43	5	17	2	1
Pantanello	2384	Coast	0,0	168,0	96	4,8		2,0	5053,4	84	84	52	15	7	8	11	20	13	9	7	6	8	12	19	62	39	29	11	0	70	54	10	71	20	20	25	82	11	58	29	5827	10	40	58	168	36	36	33	3	0	89	5	13	12	3
Pantanello	2386	Coast	0,0	23,0	16	0,8		8,0	2203,3	12	11	4	3	1	2	1	4	4	0	1	0	1	2	3	5	6	6	3	0	10	5	3	11	5	0	3	5	1	10	10	897	2	5	10	23	14	14	14	0	0	21	0	9	5	0
Pantanello	2387	Coast	0,0	45,0	26	1,3		10,0	18797,0	19	26	10	6	4	1	5	3	6	1	0	0	2	7	4	18	10	6	5	0	22	16	3	18	6	1	5	19	1	19	6	1701	6	11	19	45	6	6	6	0	0	25	0	2	4	0
Pantanello	2389	Coast	0,0	49,0	32	1,6		0,0	4586,7	27	22	17	4	7	4	3	6	5	0	2	1	0	0	12	15	12	3	2	0	19	18	1	20	6	6	4	20	5	19	27	2005	10	7	19	49	15	15	15	0	0	46	2	6	7	0
Pantanello	2390	Coast	0,0	22,0	12	0,6		0,0	652,3	10	12	5	2	0	0	1	1	2	3	1	2	2	3	5	5	7	4	1	0	8	8	0	13	3	2	5	10	0	12	0	1357	2	9	12	22	8	8	3	5	0	14	1	1	1	0
Pantanello	1798	Coast	0,0	33,0	15	0,75		0,0	#DIV/0!	17	16	11	0	1	3	5	4	0	0	2	0	4	3	1	13	7	9	1	0	13	8	2	14	3	2	9	14	1	11	18	1144	0	7	11	33	17	17	17	0	0	32	0	14	3	0
Pantanello	**7**	**Coast**	**0,1**	**350,0**	202	10,1		**20,0**	2837,9	**174**	**176**	100	**30**	**22**	**19**	**26**	**39**	**30**	**13**	**13**	**10**	**19**	**29**	**46**	**121**	**83**	**60**	**23**	**0**	**144**	**111**	**19**	**154**	**45**	**31**	**55**	**151**	**20**	**133**	**124**	**13304**	**30**	**83**	**133**	**350**	**123**	**122**	**113**	**9**	**0**	**270**	**13**	**62**	**34**	**4**
Mortara	1764	Hilly	0,1	75,0	44	2,2		6,0	860,9	34	41	24	11	3	3	4	8	6	4	4	1	2	5	6	33	14	12	4	2	22	16	3	40	11	8	11	27	2	25	4	2958	0	21	25	75	27	16	14	2	0	29	7	4	3	0
Mortara	1765	Hilly	0,0	38,0	22	1,1		1,0	806,6	19	19	9	2	6	4	3	1	1	0	1	4	1	6	8	10	3	8	2	0	14	12	1	15	1	0	8	14	1	15	6	1445	2	9	15	38	23	19	13	6	0	22	3	8	1	1
Mortara	1775	Hilly	0,1	68,0	47	2,35		4,0	1145,7	35	33	17	7	8	3	4	6	7	7	4	1	0	4	8	31	18	6	2	0	34	27	7	28	7	9	9	30	3	23	11	2651	1	18	23	68	18	10	7	3	0	11	3	3	1	0
Mortara	2369	Hilly	0,1	41,0	27	1,35		0,0	477,5	22	19	10	2	3	1	4	4	6	2	2	3	0	4	3	22	11	2	3	0	15	12	1	25	4	8	11	15	2	15	12	1784	1	11	15	41	39	34	22	12	0	32	9	10	3	0
Mortara	2370	Hilly	0,0	99,0	58	2,9		3,0	2902,5	56	43	27	3	7	10	7	8	6	6	7	4	6	8	9	40	24	14	5	2	47	36	4	38	12	4	16	45	1	33	40	3786	5	19	34	99	43	42	41	1	0	77	18	20	3	0
Mortara	2371	Hilly	0,1	75,0	49	2,45		5,0	1047,4	40	35	15	6	8	5	4	5	9	5	5	2	4	7	12	34	14	6	5	2	33	26	2	38	5	9	17	29	0	29	5	3796	1	20	29	75	31	22	17	5	0	36	8	6	3	0
Mortara	1777	Hilly	0,1	329,0	204	10,2		12,0	3461,2	157	172	84	24	30	19	24	19	20	24	25	19	13	28	42	128	63	54	26	1	142	106	24	138	37	26	58	143	13	124	35	14646	8	87	126	329	112	101	84	17	0	197	27	41	16	0
Mortara	1780	Hilly	0,0	113,0	70	3,5		5,0	#DIV/0!	51	62	32	10	11	5	8	11	8	7	4	6	2	9	11	45	29	17	5	0	54	43	5	45	9	10	18	46	5	46	33	4941	3	34	47	113	72	53	42	11	0	95	20	15	7	0
Mortara	**8**	**Hilly**	**0,5**	**838,0**	521	26,1		**36,0**	1745,1	**414**	**424**	218	**65**	**76**	**50**	**58**	**62**	**63**	**55**	**52**	**40**	**28**	**71**	**99**	**343**	**176**	**119**	**52**	**7**	**361**	**278**	**47**	**367**	**86**	**74**	**148**	**349**	**27**	**310**	**146**	**36007**	**21**	**219**	**314**	**838**	**365**	**297**	**240**	**57**	**0**	**499**	**95**	**107**	**37**	**1**
San Leo	1763	Coast	0,2	16,0	9	0,45		0,0	106,1	8	8	1	0	0	2	1	0	0	2	2	2	3	3	0	7	3	2	3	0	6	4	1	9	0	0	9	4	0	11	31	846	2	4	11	16	41	32	25	7	0	42	6	10	7	2
San Leo	1776	Coast	0,0	210,0	125	6,25		23,0	6108,2	92	118	52	21	23	14	17	9	13	10	13	5	11	22	32	79	37	32	16	0	97	68	10	84	17	18	40	86	9	81	10	8185	29	39	81	210	50	38	35	3	0	99	9	12	13	1
San Leo	1778	Coast	0,1	35,0	19	0,95		4,0	338,2	15	20	8	2	3	3	2	1	3	1	2	2	1	7	3	5	15	7	2	2	10	8	2	20	9	3	7	12	1	14	71	2081	1	12	14	35	89	82	70	12	0	89	11	24	34	1
San Leo	1779	Coast	0,1	169,0	106	5,3		5,0	1421,8	84	85	34	11	12	14	15	11	13	15	8	7	4	25	29	58	44	18	13	0	77	57	7	75	15	14	37	65	6	70	16	7971	12	47	71	169	37	30	21	9	0	97	8	9	4	0
San Leo	2367	Coast	0,1	106,0	69	3,45		0,0	888,2	51	55	24	10	6	7	7	9	7	10	9	4	2	11	18	38	27	15	6	0	43	36	5	53	14	14	21	51	4	42	12	4034	3	33	43	106	43	31	27	4	0	54	11	12	4	0
San Leo	2372	Coast	0,1	231,0	134	6,7		10,0	3002,3	113	118	64	12	25	20	18	19	16	9	10	5	11	22	30	72	48	30	20	5	101	83	8	86	21	14	37	105	10	91	16	9452	11	68	92	231	58	45	38	7	0	114	10	17	9	2
San Leo	**6**	**Coast**	**0,6**	**767,0**	462	23,1		**42,0**	1270,3	**363**	**404**	183	**56**	**69**	**60**	**60**	**49**	**52**	**47**	**44**	**25**	**32**	**90**	**112**	**259**	**174**	**104**	**60**	**7**	**334**	**256**	**33**	**327**	**76**	**63**	**151**	**323**	**30**	**309**	**156**	**32569**	**58**	**203**	**312**	**767**	**318**	**258**	**216**	**42**	**0**	**495**	**55**	**84**	**71**	**6**

Source: Author's elaboration of ISTAT database.

Table 4: Description of Respondent Profile survey.

Survey	Respondent Profile				
Aim	Collect participant's data such as demographic, socioeconomic and health-related data;				
Items	44 items				
No.	Observation	Units and scales for category	No.	Observation	Units and scales for category
1	Day and time	Central European Time (CET+1)	23	Hosehold income	Less than 5,000; 5,000 to 10,000; 10,000 to 15,000; 15,000 to 20,000; 20,000 to 25,000; 25,000 to 30,000; 30,000 to 40,000; 40,000 to 50,000; 50,000 to 60,000; 60,000 to 70,000; 70,000 to 90,000; over 90,000;
2	Gender	Male; Female; Other;	24	Insurance	No; Yes, life; Yes, health; Yes, other;
3	Age	Years;	25	Diseases	High blood pressure; Diabetes; Heart diseases; Cancer; Asthma; Depression; None;
4	Weight	Kg;	26	Medicine for diseases	High blood pressure; Diabetes; Heart diseases; Cancer; Asthma; Depression; None;
5	Height	cm;	27	Angina/Heart attack	Yes; No;
6	BMI	Kg/cm;	28	Transient Ischemic Attack (TIA)	Yes; No;
7	Race	Caucasican; Black; Asian; Other;	29	Cancer	Yes; No;
8	Marital Status	Celibate or Nubile; Married; Divorced; Widowed;	30	Smoker	Yes; No;
9	Household size	No. of people;	31	Time smoking	Years;
10	Neighborhood	Name of the neighborhood;	32	Cigarettes per day	No. Cigarettes/day;
11	Kind of area	Coastal; Hilly	33	Time quit smoking	Years;
12	Address	Just street name (NO number for privacy);	34	Alcohol intake	Yes; No;
13	Proximity to a well-known point	Station; Church; Square; Bar; Shop; Bakery; Bus stop; Club; Pub; Pizzeria; Restaurant;	35	Alcohol units intake	No. Alcoholic units/week;
14	Proximity from the center of the neighborhood	Far; Medium distance; Close by	36	Computer or laptop usage	1 to 10 hours/day;
15	Commute to work	Name of the neighborhood where commuting	37	TV watching	2 to 10 hours/day;
16	Transportation mode to commute	Car; Train or Bus; Bike; By walk; Other;	38	Smartphone usage	3 to 10 hours/day;
17	Time to go to work	Minutes	39	Not-for-profit	Yes; No;
18	Occupation	Housewife; Student; Retired; Unemployed; Industry worker; Service worker; Office employee; Freelance professional; Commerce; Craftsman; Entrepreneur; Manager; Army or Law Enforcement;	40	Not-for-profit attituded	Not involved; Less than 2 h/day; 2 to 4 /day; 4 to 6 h/day; 8 to 12 h/days; Over 12 h/day;
19	Occupation stability	Permanent employed; Fixed term employed; Retired; I work when I want; Not working and not looking for a job; Unemployed looking for a job; Disabled and not looking for a job; Disabled and looking for a job;	41	Physical activities	Low; Moderate; Intense;
20	Education	None; Primary; 12th grade or less; High-school graduate; Bachelor Degree; Master Degree; Specialisation/Master/PhD;	42	Low physical activities	1 to 10 hours/day;
21	Father's education	None; Primary; 12th grade or less; High-school graduate; Bachelor Degree; Master Degree; Specialisation/Master/PhD;	43	Moderate physical activities	1 to 10 hours/day;
22	Mother's education	None; Primary; 12th grade or less; High-school graduate; Bachelor Degree; Master Degree; Specialisation/Master/PhD;	44	Intense physical activities	1 to 10 hours/day;

Source: Author's elaboration of survey Respondents Profile results.

Tab. 5: Description of variables and scale for Survey A.

SURVEY										
Aim	Estimate State of Perceived Health and Well-being (SPHW) within the									
Items	5 items									
Proxy for	State of Perceived Health and Well-being			Scale for Survey A						
Direction	1 (-)(-); 2 (-); 3 (0); 4 (+); 5 (+)(+);			Direction	(-)(-)	(-)	0	(+)	(+) (+)	
Score	1 (Very Low); 2 (Low); 3 (Normal); 4 (High); 5 (Very High);			Magnitude	Very Low	Low	Normal	High	Very High	
Adv	No.	Variable	Question	Score	1	2	3	4	5	
SPHW (Y)	1	Absence of Disease	In general, would you say your health is...;	Excellent (5) - Poor (1)	Poor	Fair	Good	Very Good	Excellent	
	2	Absence of Infirmity	During the past 4 weeks, pain interferred with your working and household activities;	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all	
	3	Physical Well-being	During the past 4 weeks, I've had energy to spare;	None of the time (5) - All of the time (1)	None of the time	Rarely	Some of the time	Often	All of the time	
	4	Mental Well-being	During the past 4 weeks, I've been feeling calm and relaxed;	None of the time (5) - All of the time (1)	None of the time	Rarely	Some of the time	Often	All of the time	
	5	Social well-being	During the past 4 weeks, physical health or emotional problems interfered with your social activities with friends and relative;	None of the time (5) - All of the time (1)	All of the time	Most of the time	Some of the time	A little of the time	None of the time	

Source: Author's elaboration of Survey A dataset.

Tab. 6: Description of variables and scale for Survey B.

SURVEY B										
Aim			Quantify Neighborhood Compositional Advantage for Health							
Items			32 items							
Proxy for			Compositional Advantage for Health (a-spatially bounded)		Scale for Survey B					
Direction			1 (-)(-); 2 (-); 3 (0); 4 (+); 5 (+)(+);		Direction	(-)(-)	(-)	0	(+)	(+) (+)
Score			1 (Very Low); 2 (Low); 3 (Normal); 4 (High); 5 (Very High);		Magnitude	Very Low	Low	Normal	High	Very High
Advantage		No.	Variable	To which extent do...?	Score	1	2	3	4	5
Invidual(s) Advantage for Health (Xcp1)	Individual's awareness and self-control	1	Age (awarness)	You think that your age negatively affects your health?	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all
		2	Education (awareness)	You think that your education positively affects your health?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		3	Income (awareness)	You think that your income negatively affects your lifestyle?	Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all
		4	Nutrition (awareness)	You think that your food habits are healthy (e.g., vegetables, few carbs and proteins)?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		5	Water intake (awareness)	You drink water properly during day?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		6	Health and urban environment (awareness)	Your health directly depends from the quality of the urban environment in which you live?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		7	Lifestyle (awareness)	You think that your lifestyle is healthy?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
	Socio-economic position (SEP)	8	Education attainment	Objective measure: What is your educational level?	None (1) to PhD (5)	None	Primary or 12th grade or	High-school/Bachelor	Master degree	Specialisation/Master/Phd
		9	Father's education	Objective measure:What is your educational level?	None (1) to PhD (5)	None	Primary or 12th grade or	High-school/Bachelor	Master degree	Specialisation/Master/Phd
		10	Mother's education	Objective measure: What is your educational level?	None (1) to PhD (5)	None	Primary or 12th grade or	High-school/Bachelor	Master degree	Specialisation/Master/Phd
		11	Occupational stability	Objective measure: Which of these statements best describes your current occupational status?	Unemployed (1) to Full-time Employed (5)	Unemployed looking for a job;	Fixed-term employed ;	I work when I want;	Not working and not looking	Permanent employed or Retired;
		12	Household income	Objective measure: What is your household income in the last 12 months?	Less than 5,000 Euro (1) to over 90,000 (5)	Less than 5,000 to 10,000	10,000 to 25,000	25,000 to 50,000	50,000 to 90,000	Over 90,000
	Active mobility	13	Physical activities	Objective measure: What kind of physical activities do you perform during the day?	Low (1) to Intensive (5)	Low	Low	Moderate	Intense	Intense
		14	Active transportation	Objective measure: How do you move for your activities?	Car (1) to By walk and Bike (5)	Car	Train or Bus	By walk	Bike	Walk + Bike
	Risk factors	15	Anti-alcohol attitude	Objective measure: How many Alcoholic Units (AU) do you drink per week?	More than 4 AU/week (1) to None or less	4 AU or over	more than 2 AU	2 AU	less than 2 AU	less than 1 AU or none
		16	Anti-smoking attitude	Objective measure: Do you smoke or are you a former-smoker?	Yes (1) to No (5)	Yes	Ex-smoker	Ex-smoker	Ex-smoker	No
Commmunity Advantage for Health (Xcp2)	Safety	17	Safety	You think that your neighbourhood is safe? (e.g.: walking in the neighbourhood in the evening	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		18	See other people walking	You see other people walking in your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
	Supportive social environment	19	Family support	You perceive your family support?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		20	Social cohesion	You think that your neighbours are likely to help you if needed?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		21	Trust	You think that you can trust your neighbours?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		22	Sharing values	You think that the members of your community share the same values?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		23	Conviviality	You think that your community is convivial (eat and joke together)?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		24	Diversity	You think that your neighbourhood ethnically and culturally diverse?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		25	Stigma free	You think that your community is the best among those in Pellaro?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		26	Cultural events	You think that your neighbourhood is interesting for cultural events?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		27	Sense of belonging	You think that there is sense of community in your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
	Institutional support	28	Institutional presence	Perceive the presence of the institutions in your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		29	Decision involvement	You feel involved in public decisions regarding your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		30	Not-for-profit presence	You perceive the presence of not-for-profit organizations in your neighbourhood?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
	Economic accessibility	31	Price of healthy food	You think that the healthy food you buy in your neighbourhood is cheap?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		32	Economic accessibility	You think that prices for food, rent, and commodities are cheap?	Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely

Source: Author's elaboration of Survey B dataset

Tab. 7: Description of variables and scale for Survey C.

SURVEY C											
Aim			Quantify Neighborhood Contextual Advantage for Health								
Items			32 items								
Proxy for			Contextual Advantage for Health (spatially bounded)			Scale for Survey C					
Direction			1 (-)(-); 2 (-); 3 (0); 4 (+); 5 (+)(+);			Direction	(-)(-)	(-)	0	(+)	(+) (+)
Score			1 (Very Low); 2 (Low); 3 (Normal); 4 (High); 5 (Very High);			Magnitude	Very Low	Low	Normal	High	Very High
Advantag		No.	Variable	To which extent do...?		Score	1	2	3	4	5
Man-made environment Advantage for Health (Xct1)	Visual built environment	1	Aesthetic pleasant	You think that your neighbourhood is aesthetically pleasant? (e.g.: pleasant buildings and houses)		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		2	Cleanliness	You think that your neighbourhood is clean? (e.g.: garbage, dirty streets, etc…)		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		3	Street quality	You think that the streets in your neighbourhood are of high quality?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		4	Sidewalks quality	You think that the sidewalks in your neighbourhood are of high quality?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
	Functional built environment and land-use	5	Presence of healthy-food stores	You find healthy food in your neighbourhood?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		6	Walk to food store	Your reach by walking food-stores in your neighbourhood?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		7	Presence of food store	You think that your neighbourhood is provided with food stores?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		8	Presence of commercial activities	You think that your neighbourhood is provided with shops and other commercial activities?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		9	Presence of public spaces	You think that your neighbourhood is provided with public spaces?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		10	Proximity to healthcare facilities	You reach health-facilities by walking from your neighbourhood?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		11	Opportunity for physical activity	You think that your neighbourhood offers opportunities for practice physical activities? (walk, run and bike lanes, gym or spaces for physical activities)		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
	Restorative built environment	12	Shadowed public spaces with benches where to rest	You think that your neighbourhood is provided with public spaces with shadows and benches for resting?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		13	Pleasant walking	You think that your neighbourhood is pleasant for walking?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		14	Traffic free	You think that there is traffic in your neighbourhood?		Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all
	Housing	15	Home quality	You think that your home is conducive for your wellbeing?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		16	Home comfort	You think that your neighbourhood is comfortable?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
Natural environment Advantage for Health (Xct2)	Geographical location	17	Natural environment	You evaluate the quality of the natural environment of your neighbourhood?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		18	Potable water availability	You think that water in your neighbourhood is potable?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		19	Home exposure to the South	You think that your home is exposed to the South?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
	Climatical	20	Temperature too warm in the summer	You think that your neighbourhood is warm in the summer?		Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all
		21	Temperature too cold in the winter	You think that your neighbourhood is cold in the winter?		Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all
		22	Sunny	You think that your neighbourhood is sunny (exposed to the sun…)?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		23	Wind intensity	You think that your neighbourhood is exposed to wind or windy?		Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all
		24	Precipitation intensity	You think that your neighbourhood is exposed to the rain? (e.g.: intensity and streets flooding, etc…)		Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all
	Pollution free	25	Noise-pollution free	You think that your neighbourhood is noisy? (e.g.: car traffic, construction, factories, etc…)		Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all
		26	Air-pollution free	You think that the air in your neighbourhood is polluted?		Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all
		27	Water-pollution free	You think that the water in your neighbourhood is polluted?		Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all
		28	Soil-pollution free	You think that the soil in your neighbourhood is polluted?		Not at all (5) - Extremely (1)	Extremely	Quite a bit	Moderately	A little bit	Not at all
	Natural amenities	29	Landscape	You think that your neighbourhood boasts high-quality landscape features?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		30	Presence of green spaces	You think that your neighbourhood is provided of green spaces?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		31	Presence of public fountains	To which extent do you think that your neighbourhood is provided with public fountains?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely
		32	Presence of walkable paths provided with trees	You think that the presence of walkable paths with trees is appropriate in your neighbourhood?		Extremely (5) - Not at all (1)	Not at all	A little bit	Moderately	Quite a bit	Extremely

Source: Author's elaboration of Survey C dataset.

Tab. 8: Description and scales for Question 8 to 16 within Survey B.

Item No.	8; 9; 10;				
Question	What is your educational level?				
Variable	Education attainment	Weight	Category	Score	Magnitude
	None	0,71	1	0,71	Very Low
	Primary school	0,71	2	1,43	Very Low
	12th grade or less	0,71	3	2,14	Low
	High school graduate	0,71	4	2,86	Normal
	Bachelor degree	0,71	5	3,57	High
	Master degree	0,71	6	4,29	Very High
	PhD/Specialisation/Master	0,71	7	5,00	Very High
Item No.	11				
Question	Which of these opinions best describes your current occupational situation?				
Variable	Occupational stability	Weight	Category	Score	Magnitude
	Permanent employed or Retired	1,00	5	5,00	Very High
	Not working and not looking for job	1,00	4	4,00	High
	I work when I want	1,00	3	3,00	Normal
	Fixed-term employed	1,00	2	2,00	Low
	Unemployed looking for job	1,00	1	1,00	Very Low
Item No.	12				
Question	What is your household income in the last 12 months?				
Variable	Income	Weight	Category	Score	Magnitude
	Less than 5.000 Euro	0,42	1	0,42	Very Low
	From 5.000 Euro to 10.000 Euro	0,42	2	0,83	Very Low
	From 10.000 Euro to 15.000 Euro	0,42	3	1,25	Low
	From 15.000 Euro to 20.000 Euro	0,42	4	1,67	Low
	From 20.000 Euro to 25.000 Euro	0,42	5	2,08	Low
	From 25.000 Euro to 30.000 Euro	0,42	6	2,50	Normal
	From 30.000 Euro to 40.000 Euro	0,42	7	2,92	Normal
	From 40.000 Euro to 50.000 Euro	0,42	8	3,33	Normal
	From 50.000 Euro to 60.000 Euro	0,42	9	3,75	High
	From 60.000 Euro to 70.000 Euro	0,42	10	4,17	High
	From 70.000 Euro to 90.000 Euro	0,42	11	4,58	Very High
	Over 90.000 Euro	0,42	12	5,00	Very High
Item No.	13				
Question	What kind of physical activities do you perform during the day?				
Variable	Physical activities levels	Weight	Category	Score	Magnitude
	Low	1,67	1	1,67	Very Low to Low
	Moderate	1,67	2	3,33	Normal
	Intense	1,67	3	5,00	Very High to High
Item No.	14				
Question	How do you commute for your activities?				
Variable	Active transportation	Weight	Category	Score	Magnitude
	Walk and Bike	1,00	5	5,00	Very High
	Bike	1,00	4	4,00	High
	By walk	1,00	3	3,00	Normal
	Train or Bus	1,00	2	2,00	Low
	Car	1,00	1	1,00	Very Low
Item No.	15				
Question	How many alcoholic units do you drink per week?				
Variable	Anti-alcohol attitude	Weight	Category	Score	Magnitude
	None or less than or equal to 2 glasses of beer	0,56	9	5,00	Very High
	None or less than or equal to 2 glasses of wine	0,56	8	4,44	High
	None or than or equal to 2 small glasses of hard liquor	0,56	7	3,89	High
	More than 2 glasses of beer	0,56	6	3,33	Normal
	More than 2 glasses of wine	0,56	5	2,78	Normal
	More than 2 small glass of hard liquor	0,56	4	2,22	Normal
	More than or equal 4 glasses of beer	0,56	3	1,67	High
	More than or equal to 4 glasses of wine	0,56	2	1,11	Low
	More than or equal to 4 small glasses of hard liquor	0,56	1	0,56	Very Low
Item No.	16				
Question	Do you smoke?				
Variable	Anti-smoking attitude	Weight	Category	Score	Magniture
	No	1,67	3	5,00	Very High to High
	Ex-smoker	1,67	2	3,33	Normal
	Yes	1,67	1	1,67	Very Low to Low

Source: Author's elaboration of Respondent Profile dataset.

Tab 9: Score for SPHW(Y), NAH (X), Xcp, Xcp1, Xcp2, Xct, Xct1, Xct2

Variable	Source	Variable	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Respondents No.	Respondent Profile	/	17	30	22	57	56	29	28	38	35	23	83
Variable	**Source**	**Variable**	**Macellari**	**Occhio**	**Pantanello**	**San Giovanni**	**Bocale I e II**	**Fiumarella**	**Mortara**	**Lume**	**Ribergo**	**San Leo**	**Pellaro Centro**
State of Perceived Health and Well-being	Survey A	Y	3,04	3,27	3,35	3,47	3,49	3,53	3,54	3,57	3,61	3,66	3,78
Neighborhood Advantage for Health	Survey B and C	X	2,51	2,51	2,37	2,58	2,66	2,56	2,66	2,80	2,68	2,92	2,90
Compositional Advantage for Health	Survey B	X cp	2,49	2,63	2,49	2,67	2,74	2,72	2,77	2,81	2,76	2,94	3,00
Individual(s) Advantage for Health	Survey B	Xcp1	2,53	2,86	2,76	2,82	2,85	2,97	2,85	2,91	2,88	2,84	3,12
Community Advantage for Health	Survey B	Xcp2	2,46	2,40	2,21	2,53	2,63	2,46	2,69	2,71	2,64	3,04	2,89
Contextual Advantage for Health	Survey C	X ct	2,53	2,39	2,25	2,48	2,57	2,41	2,56	2,79	2,60	2,90	2,80
Man-made environment Advantage for He	Survey C	Xct1	2,12	2,17	2,09	2,19	2,26	2,17	2,19	2,61	2,32	2,83	2,80
Natural environment Advantage for Health	Survey C	Xct2	2,95	2,61	2,42	2,77	2,88	2,65	2,94	2,98	2,88	2,98	2,80

Source: Author's elaboration.

Tab 10: secondary data from ISTAT and Google Maps

Variable	Source	Unit	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
All Buildings	ISTAT	No.	159	256	123	621	813	262	365	245	411	318	530
Area of residential units	ISTAT	sqm	15055	27219	13304	67759	70957	26980	36007	28191	45770	32569	92571
Commercial buildings	ISTAT	No.	21	27	9	65	76	7	57	13	39	42	87
Commute inside municipality	ISTAT	No.	156	254	151	660	659	261	349	302	476	323	963
Commute outside municipality	ISTAT	No.	7	26	20	49	80	33	27	22	43	30	93
Density (p/sqm)	ISTAT	P/sqm	1583	2444	2838	1993	1076	1732	1745	2369	1878	1270	3566
Distance (meters) from Pellaro	Gogle Earth	m	2816	1911	1140	1324	2171	1193	1530	549	497	2537	0
Driving Distance	Gogle Earth	m	3700	2200	1400	2000	2800	1100	3700	1100	1000	2600	0
Earners	ISTAT	No.	77	128	55	328	331	89	148	143	209	151	400
Educated	ISTAT	No.	27	45	23	109	87	42	52	46	89	60	144
Employed	ISTAT	No.	108	199	111	535	547	215	278	222	323	256	795
Good preservation	ISTAT	No.	37	58	62	216	343	207	107	196	266	84	223
High preservation	ISTAT	No.	12	62	13	107	19	3	95	6	32	55	33
High-school diploma	ISTAT	No.	96	213	121	575	636	217	343	250	405	259	871
Househod No.	ISTAT	No.	140	254	133	632	678	233	314	280	411	312	915
Households components	ISTAT	No.	380	655	350	1663	1683	618	838	716	1093	767	2319
Housewife	ISTAT	No.	46	84	45	178	195	67	86	68	111	76	269
Low preservation	ISTAT	No.	54	45	34	152	270	41	37	22	45	71	141
Master or bachelor degree	ISTAT	No.	21	63	46	144	196	70	99	79	120	112	328
Middle-school attainment	ISTAT	No.	118	168	83	409	388	150	176	167	228	174	504
Neet	ISTAT	No.	181	300	154	719	768	247	367	288	465	327	978
Not educated	ISTAT	No.	8	4	0	22	12	2	7	5	13	7	13
Owners	ISTAT	No.	102	142	83	427	444	155	219	181	286	203	532
Primary school attainment	ISTAT	No.	89	124	60	316	272	93	119	118	170	104	327
Renters	ISTAT	No.	9	51	30	71	79	34	21	62	75	58	269
Residential buildings	ISTAT	No.	122	167	113	519	709	253	240	232	365	216	417
Residential buildings before 1919	ISTAT	No.	3	0	0	27	2	0	0	0	28	0	10
Residential units	ISTAT	No.	140	254	133	629	673	231	310	278	411	309	913
Residential units	ISTAT	No.	195	395	270	1047	1333	550	499	716	868	495	1500
Students	ISTAT	No.	38	45	31	122	138	56	74	48	90	63	183
Time drive to Pellaro	Gogle Earth	min	10	7	5	7	13	5	8	4	6	7	0
Time walking to Pellaro	Gogle Earth	min	41	24	16	23	27	11	41	13	13	32	0
Unemployed	ISTAT	No.	21	34	19	93	76	35	47	48	57	33	101
Used buildings	ISTAT	No.	143	194	122	584	785	260	297	245	404	258	504
Vacant residential units	ISTAT	No.	53	113	124	389	640	258	146	236	329	156	409
Very low preservation	ISTAT	No.	19	2	4	44	77	2	1	8	22	6	20
Walking Distance to Pellaro	Gogle Earth	m	3100	2000	1300	1800	2200	850	3200	1000	850	2600	0
Worforce 15y+	ISTAT	No.	147	267	144	697	695	276	361	314	445	334	1012

Source: Author's elaboration.

Tab 11: primary data from Respondent Profile

Variable	Source	Question	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Day and Time	Respondent Profile	Q.1	/	/	/	/	/	/	/	/	/	/	/
Female	Respondent Profile	Q.2	3,00	11,00	7,00	14,00	19,00	16,00	6,00	17,00	10,00	10,00	48,00
Age	Respondent Profile	Q.3	46,65	48,63	44,36	45,18	45,45	45,93	45,89	41,82	48,54	45,70	45,48
Weight	Respondent Profile	Q.4	74,82	71,47	71,09	73,11	73,29	72,10	60,36	72,05	69,23	79,70	73,84
Height	Respondent Profile	Q.5	162,53	167,53	162,77	167,82	167,02	170,28	162,46	166,71	163,89	168,70	169,33
BMI	Respondent Profile	Q.6	28,16	25,50	27,06	25,84	26,18	24,85	22,82	25,84	25,69	27,95	25,60
Race	Respondent Profile	Q.7	/	/	/	/	/	/	/	/	/	/	/
Marital Status	Respondent Profile	Q.8	/	/	/	/	/	/	/	/	/	/	/
Household size	Respondent Profile	Q.9	3,41	3,10	3,73	3,09	3,36	2,76	3,07	3,24	2,63	3,43	2,84
Neighborhood	Respondent Profile	Q.10	/	/	/	/	/	/	/	/	/	/	/
Kind of area	Respondent Profile	Q.11	/	/	/	/	/	/	/	/	/	/	/
Address	Respondent Profile	Q.12	/	/	/	/	/	/	/	/	/	/	/
Proximity to a well known point	Respondent Profile	Q.13	/	/	/	/	/	/	/	/	/	/	/
Proximity from the center	Respondent Profile	Q.14	3,53	3,61	3,94	3,97	3,72	4,37	3,21	4,52	4,52	4,78	4,82
Commute to work	Respondent Profile	Q.15	/	/	/	/	/	/	/	/	/	/	/
Active transportation (score)	Respondent Profile	Q.16	2,35	2,50	2,27	2,72	2,20	2,18	2,14	2,32	2,43	2,12	2,33
Time to work	Respondent Profile	Q.17	5,82	5,67	8,14	9,91	27,07	9,07	9,93	15,32	6,77	54,05	11,10
Occupation	Respondent Profile	Q.18	7,00	4,00	1,00	10,00	9,00	3,00	4,00	7,00	6,00	1,00	6,00
Occupation Stability	Respondent Profile	Q.19	3,90	4,13	3,92	3,49	3,95	3,66	3,66	3,39	4,00	2,95	3,87
Education	Respondent Profile	Q.20	2,69	3,10	3,05	3,11	3,21	3,40	2,96	3,21	3,12	2,79	3,39
Father's education	Respondent Profile	Q.21	1,47	2,00	1,88	2,17	2,23	1,90	2,09	2,18	1,84	2,14	2,50
Mother's Education	Respondent Profile	Q.22	1,55	1,81	1,85	2,19	2,21	2,09	1,94	2,20	1,94	2,05	2,52
Household Income	Respondent Profile	Q.23	1,10	1,78	1,52	1,51	1,99	1,75	1,89	1,77	1,74	1,95	2,18
Insurance	Respondent Profile	Q.24	6,00	6,00	2,00	11,00	12,00	7,00	12,00	13,00	5,00	7,00	35,00
NCDs	Respondent Profile	Q.25	5,00	14,00	6,00	26,00	11,00	6,00	6,00	8,00	14,00	1,00	19,00
Medicines for NCDs	Respondent Profile	Q.26	1,00	14,00	6,00	23,00	8,00	5,00	6,00	8,00	14,00	1,00	16,00
Angina/Heart attack	Respondent Profile	Q.27	0,00	0,00	0,00	0,00	1,00	2,00	0,00	1,00	0,00	0,00	3,00
Transient Ischemic Attack	Respondent Profile	Q.28	0,00	1,00	0,00	3,00	1,00	0,00	0,00	0,00	0,00	1,00	2,00
Cancer	Respondent Profile	Q.29	1,00	1,00	4,00	1,00	4,00	2,00	0,00	2,00	0,00	0,00	5,00
Male	Respondent Profile	Q.2a	14,00	19,00	15,00	43,00	37,00	13,00	22,00	21,00	25,00	13,00	35,00
Anti-smoking attitude	Respondent Profile	Q.30	2,06	2,61	2,05	2,63	2,62	3,22	2,08	2,19	2,38	2,35	3,03
Time smoking	Respondent Profile	Q.31	48,00	74,00	35,00	283,00	198,00	230,00	30,00	58,00	80,00	45,00	397,00
Cigarettes/day	Respondent Profile	Q.32	1,59	2,33	0,55	4,07	2,66	5,83	1,43	1,18	2,14	0,65	3,58
Time quit smoking	Respondent Profile	Q.33	0,00	28,00	5,00	115,00	67,00	76,00	99,00	5,00	148,00	0,00	206,00
Alcohol intake	Respondent Profile	Q.34	6,00	13,00	3,00	32,00	21,00	14,00	2,00	18,00	11,00	14,00	48,00
Alcohol units/week (score)	Respondent Profile	Q.35	0,52	0,67	0,08	0,86	0,55	1,51	0,04	0,79	0,51	1,39	1,10
PC or Laptop usage (hours/day)	Respondent Profile	Q.36	1,35	2,60	2,77	2,81	3,05	2,21	3,18	2,08	2,54	1,64	2,90
TV watching (hours/day)	Respondent Profile	Q.37	1,71	2,40	1,59	1,70	1,88	1,31	1,07	1,63	2,31	1,64	1,70
Smartphone usage(hours/day)	Respondent Profile	Q.38	2,65	2,43	3,45	3,19	2,20	3,48	2,96	2,89	2,43	2,32	2,33
Not-for-profit	Respondent Profile	Q.39	2,00	4,00	1,00	11,00	26,00	7,00	3,00	11,00	6,00	1,00	23,00
Not- for-profit attitude	Respondent Profile	Q.40	0,24	1,00	0,14	0,81	1,68	1,17	0,21	0,84	0,69	0,09	0,90
Physical Activities (score)	Respondent Profile	Q.41	2,65	3,00	2,95	2,89	2,77	3,68	3,04	3,16	2,81	3,26	3,23
Low (hour/day)	Respondent Profile	Q.42	2,00	1,27	2,41	1,26	1,43	1,03	2,21	1,37	1,63	0,64	1,18
Moderate (hour/day)	Respondent Profile	Q.43	0,76	1,50	0,77	0,74	0,88	0,55	0,32	0,79	1,54	1,64	0,89
Intense (hour/day)	Respondent Profile	Q.44	0,24	0,33	0,27	0,65	0,80	1,14	0,32	0,50	0,09	1,14	0,59

Source: Author's elaboration.

Tab 12: SPHW (Y) primary data from Survey A

Source	Source	Variable	Mean	Median	Minimum	Maximum	Macellari	Occhio	antanell	ian Giovanr	Bocale I e II	Fiumarella	Mortara	Lume	Ribergc	San Leo	llaro Cent
Survey A	Absence_of_Disease	Q.1	2,987	2,929	2,647	3,241	2,65	3,20	2,82	2,82	2,89	3,14	2,93	3,18	2,80	3,18	3,24
Survey A	Absence_of_Infirmity	Q.2	4,204	4,211	3,529	4,536	3,53	4,13	4,36	4,21	4,25	4,31	4,54	4,18	4,14	4,09	4,49
Survey A	Physical_We_being	Q.3	3,329	3,273	2,800	3,686	3,18	2,80	3,27	3,16	3,32	3,48	3,25	3,53	3,69	3,27	3,67
Survey A	Mental_Well_being	Q.4	3,242	3,316	2,533	3,773	3,00	2,53	2,82	3,40	3,25	3,10	3,36	3,32	3,51	3,77	3,59
Survey A	Social_well_being	Q.5	3,654	3,667	2,824	4,000	2,82	3,67	3,50	3,77	3,75	3,62	3,61	3,63	3,91	4,00	3,90
Survey A	SPHW	Y	3,483	3,531	3,035	3,781	3,04	3,27	3,35	3,47	3,49	3,53	3,54	3,57	3,61	3,66	3,78

Source: Author's elaboration.

Tab 13: primary data for Xcp, Xcp1, Xcp2 from Survey B

	Variable	Source	Question	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Individual(s) Sector (Xcp1)	Age	Survey B	Q.1	3,82	3,90	3,59	3,95	3,91	3,86	4,18	3,97	4,40	4,09	4,07
	Education	Survey B	Q.2	3,59	3,60	3,55	3,60	3,59	3,62	4,11	3,76	3,83	3,18	3,98
	Income	Survey B	Q.3	2,94	3,23	3,18	2,91	3,13	3,14	3,46	3,66	3,66	4,14	3,55
	Nutrition	Survey B	Q.4	3,47	3,27	3,55	3,49	3,48	3,66	3,68	3,87	3,94	3,55	3,81
	Water intake	Survey B	Q.5	2,53	3,30	3,68	3,33	3,34	3,17	2,89	3,29	3,51	3,41	3,25
	Health and urban environment	Survey B	Q.6	3,41	3,73	3,91	3,19	3,52	3,21	4,04	3,76	3,03	3,05	3,88
	Lifestyle	Survey B	Q.7	2,41	3,13	3,09	3,07	2,93	3,45	3,36	3,03	2,97	3,09	3,18
	Education	Survey B	Q.8	2,69	3,10	3,05	3,11	3,21	3,40	2,96	3,21	3,12	2,79	3,39
	Father's education	Survey B	Q.9	1,47	2,00	1,88	2,17	2,23	1,90	2,09	2,18	1,84	2,14	2,50
	Mother's Education	Survey B	Q.10	1,55	1,81	1,85	2,19	2,21	2,09	1,94	2,20	1,94	2,05	2,52
	Occupation Stability	Survey B	Q.11	3,90	4,13	3,92	3,49	3,95	3,66	3,66	3,39	4,00	2,95	3,87
	Household Income	Survey B	Q.12	1,10	1,78	1,52	1,51	1,99	1,75	1,89	1,77	1,74	1,95	2,18
	Physical Activity	Survey B	Q.13	2,65	3,00	2,95	2,89	2,77	3,68	3,04	3,16	2,81	3,26	3,23
	Active Transportation	Survey B	Q.14	2,35	2,50	2,27	2,72	2,20	2,18	2,14	2,32	2,43	2,12	2,33
	Anti-alcohol attitude	Survey B	Q.15	0,52	0,67	0,08	0,86	0,55	1,51	0,04	0,79	0,51	1,39	1,14
	Anti-smoking attitude	Survey B	Q.16	2,06	2,61	2,05	2,63	2,62	3,22	2,08	2,19	2,38	2,35	3,03
	Individual(s) Advantage for Health (Xcp1)		**Xcp1**	**2,53**	**2,86**	**2,76**	**2,82**	**2,85**	**2,97**	**2,85**	**2,91**	**2,88**	**2,84**	**3,12**
Community Sector (Xcp2)	Safety	Survey B	Q.17	3,06	2,43	2,91	3,37	3,36	3,03	3,11	3,18	3,00	3,68	3,57
	See other people walking	Survey B	Q.18	1,76	1,90	2,14	1,88	2,23	2,00	1,75	2,37	2,11	2,14	2,80
	Family support	Survey B	Q.19	3,71	3,73	3,18	3,79	3,82	3,66	4,14	3,61	3,34	4,09	3,95
	Social cohesion	Survey B	Q.20	2,71	2,40	2,36	2,91	3,04	2,93	3,14	3,16	3,17	3,18	3,11
	Trust	Survey B	Q.21	2,24	2,37	2,45	2,72	2,82	3,00	3,00	2,92	3,09	3,50	3,13
	Sharing values	Survey B	Q.22	2,24	2,47	1,95	2,37	2,82	2,31	2,82	2,79	2,69	3,91	2,67
	Conviviality	Survey B	Q.23	3,00	2,60	2,09	2,60	2,77	2,59	2,75	2,71	2,69	2,77	2,86
	Diversity	Survey B	Q.24	2,59	2,97	2,59	2,44	2,46	2,31	2,25	2,71	3,06	2,55	2,61
	Stigma free	Survey B	Q.25	1,94	2,00	1,82	2,39	2,23	2,38	2,32	2,58	2,34	2,91	3,16
	Cultural events	Survey B	Q.26	2,41	1,80	2,05	1,82	2,13	1,90	1,64	2,08	1,97	2,45	2,34
	Sense of belonging	Survey B	Q.27	2,12	2,43	1,91	2,46	2,73	2,34	2,68	2,61	2,69	3,05	2,76
	Institutional presence	Survey B	Q.28	1,88	1,87	1,77	1,79	1,80	1,69	2,29	2,16	2,03	2,82	2,12
	Decisions involment	Survey B	Q.29	2,41	1,40	1,50	1,84	2,00	1,69	1,64	1,87	1,80	2,18	1,99
	Not-for-profit presence	Survey B	Q.30	2,06	2,27	1,59	2,11	2,38	1,83	2,21	2,42	2,03	2,45	2,67
	Price of healthy food	Survey B	Q.31	2,94	3,13	3,00	3,23	2,95	3,31	4,46	3,34	3,60	3,45	3,55
	Economic accessibility	Survey B	Q.32	2,24	2,57	2,09	2,72	2,61	2,45	2,75	2,92	2,66	3,50	2,92
	Community Advantage for Health		**Xcp2**	**2,46**	**2,40**	**2,21**	**2,53**	**2,63**	**2,46**	**2,69**	**2,71**	**2,64**	**3,04**	**2,89**
	Compositional Advantage for Health		**X cp**	**2,49**	**2,63**	**2,49**	**2,68**	**2,75**	**2,72**	**2,77**	**2,81**	**2,76**	**2,94**	**3,01**

Source: Author's elaboration.

Tab 14: primary data for Xct, Xct1, Xct2 from Survey C

	Variable	Source	Question	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Man-made Environment Sector (Xct1)	Aesthetics pleasant	Survey C	Q.1	1,88	2,03	1,82	2,26	2,21	2,03	2,71	2,61	2,34	3,00	2,71
	Cleanliness	Survey C	Q.2	2,53	1,83	1,91	2,33	3,00	1,97	1,96	2,55	2,51	2,41	2,48
	Streets quality	Survey C	Q.3	1,24	1,33	1,50	1,63	1,36	1,66	1,61	2,00	1,43	2,14	1,78
	Sidewalk quality	Survey C	Q.4	1,18	1,33	1,14	1,44	1,34	1,38	1,21	1,71	1,51	1,64	1,81
	Presence of healthy food-store	Survey C	Q.5	3,29	3,50	3,00	3,00	3,21	3,21	3,43	3,29	3,00	3,64	3,46
	Walk to food store	Survey C	Q.6	1,65	2,57	2,77	2,53	2,55	2,86	2,36	3,16	3,31	3,18	4,12
	Presence of food store	Survey C	Q.7	1,29	2,60	2,64	2,16	2,07	1,59	1,89	2,47	2,37	3,36	3,51
	Presence of commercial actitivities	Survey C	Q.8	1,12	2,83	2,68	1,65	1,80	1,76	1,64	2,24	1,86	3,73	3,35
	Presence of public spaces	Survey C	Q.9	2,47	1,37	1,41	1,37	1,73	1,45	1,93	2,24	1,37	2,68	2,06
	Proximity to healthcare facilities	Survey C	Q.10	1,35	1,13	1,95	2,14	1,32	1,45	1,21	2,03	2,17	1,95	1,83
	Opportunity for physical activities	Survey C	Q.11	2,00	1,57	1,68	1,58	1,93	2,14	2,14	2,24	2,34	2,45	2,59
	Shadowed public spaces provided with be	Survey C	Q.12	2,06	1,30	1,27	1,23	1,71	1,59	1,00	2,45	1,43	2,23	2,23
	Pleasant walking	Survey C	Q.13	2,41	2,10	1,91	1,77	2,54	2,41	2,18	2,61	2,37	2,64	3,14
	Too traffic	Survey C	Q.14	3,47	2,63	1,77	3,21	3,14	3,14	3,57	3,03	2,83	3,05	2,43
	Home quality	Survey C	Q.15	2,94	3,10	2,91	3,16	2,95	2,69	3,00	3,37	2,97	3,59	3,51
	Home comfort	Survey C	Q.16	3,06	3,53	3,05	3,53	3,29	3,41	3,21	3,71	3,34	3,55	3,76
	Man-made Environment Advantage for H	**ealth**	**Xct1**	**2,12**	**2,17**	**2,09**	**2,19**	**2,26**	**2,17**	**2,19**	**2,61**	**2,32**	**2,83**	**2,80**
Natural Environment Sector (Xct2)	Natural environment	Survey C	Q.17	2,59	2,70	2,36	2,77	2,88	2,76	3,07	3,08	2,60	3,05	2,99
	Potable water availability	Survey C	Q.18	1,71	1,33	1,45	1,54	1,75	1,28	1,07	1,66	1,23	1,95	1,40
	Home exposure to South	Survey C	Q.19	3,24	3,37	2,95	3,70	3,29	3,21	2,82	3,68	3,66	3,82	3,73
	Temperature too warm	Survey C	Q.20	2,41	2,10	2,32	2,56	2,45	2,52	2,79	3,05	2,91	2,05	2,36
	Temperature too cold	Survey C	Q.21	3,35	3,00	3,09	3,05	3,20	2,93	3,43	3,45	3,46	2,68	3,20
	Sunny	Survey C	Q.22	3,59	3,80	3,45	3,70	3,77	3,93	3,36	3,84	3,57	3,86	3,94
	Wind intensity	Survey C	Q.23	2,76	2,00	2,09	2,18	2,05	1,52	2,75	2,16	2,23	2,45	1,63
	Precipitation intensity	Survey C	Q.24	3,00	2,63	2,55	2,75	3,09	2,69	2,75	3,08	3,03	3,00	3,06
	Noise pollution free	Survey C	Q.25	3,82	3,47	2,55	3,86	4,00	3,45	3,71	3,58	3,86	3,45	3,29
	Air pollution free	Survey C	Q.26	3,47	3,37	3,14	3,70	3,89	3,79	3,86	3,68	3,97	4,00	3,67
	Water pollution free	Survey C	Q.27	3,18	2,70	3,14	3,12	3,41	3,24	3,79	3,18	2,91	3,27	2,82
	Soil pollution free	Survey C	Q.28	3,41	3,33	3,05	3,30	3,34	3,38	3,71	3,63	3,89	3,82	3,35
	Landscape	Survey C	Q.29	3,12	2,73	2,32	2,72	2,84	2,69	2,46	2,63	2,74	2,95	3,35
	Precence of green spaces	Survey C	Q.30	3,47	2,07	1,64	1,88	2,04	2,00	3,46	2,47	2,49	2,82	2,20
	Presence of public fountains	Survey C	Q.31	1,35	1,17	1,18	1,44	1,84	1,14	1,39	2,05	1,54	1,73	1,49
	Presence of walkable paths provided with	Survey C	Q.32	2,71	1,97	1,41	2,00	2,18	1,93	2,54	2,47	2,00	2,73	2,28
	Natural Environment Advantage for Hea	**lth**	**Xct2**	**2,95**	**2,61**	**2,42**	**2,77**	**2,88**	**2,65**	**2,94**	**2,98**	**2,88**	**2,98**	**2,80**
	Contextual Advantage for Health		**X ct**	**2,53**	**2,39**	**2,25**	**2,48**	**2,57**	**2,41**	**2,56**	**2,79**	**2,60**	**2,90**	**2,80**

Source: Author's elaboration.

Tab 15: All factors significant to SPHW (Y) for each neighborhood under study.

Adv.	Macro areas		Name of the variable	Correlation	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Invidual(s) Adv. for Health (Xcp1)	Individual's awareness of determinants of health	Q.1	Age	**0,569**	3,82	3,90	3,59	3,95	3,91	3,86	4,18	3,97	4,40	4,09	4,07
		Q.2	Education	**0,541**	3,59	3,60	3,55	3,60	3,59	3,62	4,11	3,76	3,83	3,18	3,98
		Q.3	Income	**0,662**	2,94	3,23	3,18	2,91	3,13	3,14	3,46	3,66	3,66	4,14	3,55
		Q.4	Nutrition	**0,646**	3,47	3,27	3,55	3,49	3,48	3,66	3,68	3,87	3,94	3,55	3,81
		Q.5	Water intake	0,479	2,53	3,30	3,68	3,33	3,34	3,17	2,89	3,29	3,51	3,41	3,25
		Q.7	Lifestyle	**0,611**	2,41	3,13	3,09	3,07	2,93	3,45	3,36	3,03	2,97	3,09	3,18
	SEP	Q.9	Father's education	**0,778**	1,47	2,00	1,88	2,17	2,23	1,90	2,09	2,18	1,84	2,14	2,50
		Q.10	Mother's education	**0,833**	1,55	1,81	1,85	2,19	2,21	2,09	1,94	2,20	1,94	2,05	2,52
		Q.12	Household income	**0,833**	1,10	1,78	1,52	1,51	1,99	1,75	1,89	1,77	1,74	1,95	2,18
	Active mobility	Q.13	Physical activities	**0,519**	2,65	3,00	2,95	2,89	2,77	3,68	3,04	3,16	2,81	3,26	3,23
Commmunity Adv. for Health (Xp2)	Safety	Q.17	Safety	**0,608**	3,06	2,43	2,91	3,37	3,36	3,03	3,11	3,18	3,00	3,68	3,57
		Q.18	See other people walking	**0,663**	1,76	1,90	2,14	1,88	2,23	2,00	1,75	2,37	2,11	2,14	2,80
	Social support	Q.20	Social cohesion	**0,731**	2,71	2,40	2,36	2,91	3,04	2,93	3,14	3,16	3,17	3,18	3,11
		Q.21	Trust	**0,901**	2,24	2,37	2,45	2,72	2,82	3,00	3,00	2,92	3,09	3,50	3,13
		Q.22	Sharing values	**0,548**	2,24	2,47	1,95	2,37	2,82	2,31	2,82	2,79	2,69	3,91	2,67
		Q.25	Stigma free	**0,842**	1,94	2,00	1,82	2,39	2,23	2,38	2,32	2,58	2,34	2,91	3,16
		Q.27	Sense of belonging	**0,732**	2,12	2,43	1,91	2,46	2,73	2,34	2,68	2,61	2,69	3,05	2,76
	Institutional support	Q.28	Institutional presence	0,473	1,88	1,87	1,77	1,79	1,80	1,69	2,29	2,16	2,03	2,82	2,12
		Q.30	Not-for-profit presence	0,476	2,06	2,27	1,59	2,11	2,38	1,83	2,21	2,42	2,03	2,45	2,67
	Economic accessibility	Q.31	Price of healthy food	**0,500**	2,94	3,13	3,00	3,23	2,95	3,31	4,46	3,34	3,60	3,45	3,55
		Q.32	Economic accessibility	**0,690**	2,24	2,57	2,09	2,72	2,61	2,45	2,75	2,92	2,66	3,50	2,92

Adv.	Macro areas		Name of the variable	Correlation	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Man-made Env. Adv. for Health (Xct1)	Visual BE	Q.1	Aesthetic pleasant	**0,762**	1,88	2,03	1,82	2,26	2,21	2,03	2,71	2,61	2,34	3,00	2,71
		Q.3	Street quality	**0,697**	1,24	1,33	1,50	1,63	1,36	1,66	1,61	2,00	1,43	2,14	1,78
		Q.4	Sidewalks quality	**0,760**	1,18	1,33	1,14	1,44	1,34	1,38	1,21	1,71	1,51	1,64	1,81
	Functional BE	Q.6	Walk to food store	**0,862**	1,65	2,57	2,77	2,53	2,55	2,86	2,36	3,16	3,31	3,18	4,12
		Q.7	Presence of food store	**0,627**	1,29	2,60	2,64	2,16	2,07	1,59	1,89	2,47	2,37	3,36	3,51
		Q.8	Presence of commercial	0,495	1,12	2,83	2,68	1,65	1,80	1,76	1,64	2,24	1,86	3,73	3,35
		Q.10	Proximity to healthcare	0,466	1,35	1,13	1,95	2,14	1,32	1,45	1,21	2,03	2,17	1,95	1,83
		Q.11	Opportunity for physical activity	**0,673**	2,00	1,57	1,68	1,58	1,93	2,14	2,14	2,24	2,34	2,45	2,59
	Restorative BE	Q.13	Pleasant walking	**0,515**	2,41	2,10	1,91	1,77	2,54	2,41	2,18	2,61	2,37	2,64	3,14
	Housing	Q.15	Home quality	**0,507**	2,94	3,10	2,91	3,16	2,95	2,69	3,00	3,37	2,97	3,59	3,51
		Q.16	Home comfort	**0,637**	3,06	3,53	3,05	3,53	3,29	3,41	3,21	3,71	3,34	3,55	3,76

Adv.	Macro areas		Name of the variable	Correlation	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Res. Pr.	Resp. Profile	Q.14	Proximity_from_the_center	**0,700**	3,53	3,61	3,94	3,97	3,72	4,37	3,21	4,52	4,52	4,78	4,82
	Resp. Profile	Q.13	Physical_Activity	**0,519**	2,65	3,00	2,95	2,89	2,77	3,68	3,04	3,16	2,81	3,26	3,23
	Resp. Profile	Q.6	BMI	-0,347	28,16	25,50	27,06	25,84	26,18	24,85	22,82	25,84	25,69	27,95	25,60

Adv.	Macro areas		Name of the variable	Correlation	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
ISTAT	ISTAT	/	Master_or_bachelor_degree	**0,693**	21	63	46	144	196	70	99	79	120	112	328
	ISTAT	/	Educated	**0,643**	27	45	23	109	87	42	52	46	89	60	144
	ISTAT	/	High_school_diploma	**0,622**	96	213	121	575	636	217	343	250	405	259	871
	ISTAT	/	Employed	**0,607**	108	199	111	535	547	215	278	222	323	256	795
	ISTAT	/	Area_of_residential_units	**0,596**	15055	27219	13304	67759	70957	26980	36007	28191	45770	32569	92571
	ISTAT	/	Good_preservation	**0,554**	37	58	62	216	343	207	107	196	266	84	223
	ISTAT	/	Earners	**0,545**	77	128	55	328	331	89	148	143	209	151	400
	ISTAT	/	Commercial_buildings	0,471	21	27	9	65	76	7	57	13	39	42	87
	ISTAT	/	Used_buildings	0,427	143	194	122	584	785	260	297	245	404	258	504
	ISTAT	/	Buildings	0,425	159	256	123	621	813	262	365	245	411	318	530
	ISTAT	/	Residential_buildings	0,406	122	167	113	519	709	253	240	232	365	216	417

Adv.	Macro areas		Name of the variable	Correlation	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Web	Gogle Earth	/	Walking_Distance_to_Pellaro_C	**-0,536**	3100	2000	1300	1800	2200	850	3200	1000	850	2600	0
	Gogle Earth	/	Time_walking_to_Pellaro_Centr	**-0,547**	41	24	16	23	27	11	41	13	13	32	0
	Gogle Earth	/	Distance in meters from Pellaro	**-0,616**	2816	1911	1140	1324	2171	1193	1530	549	497	2537	0

Source: Author's elaboration.

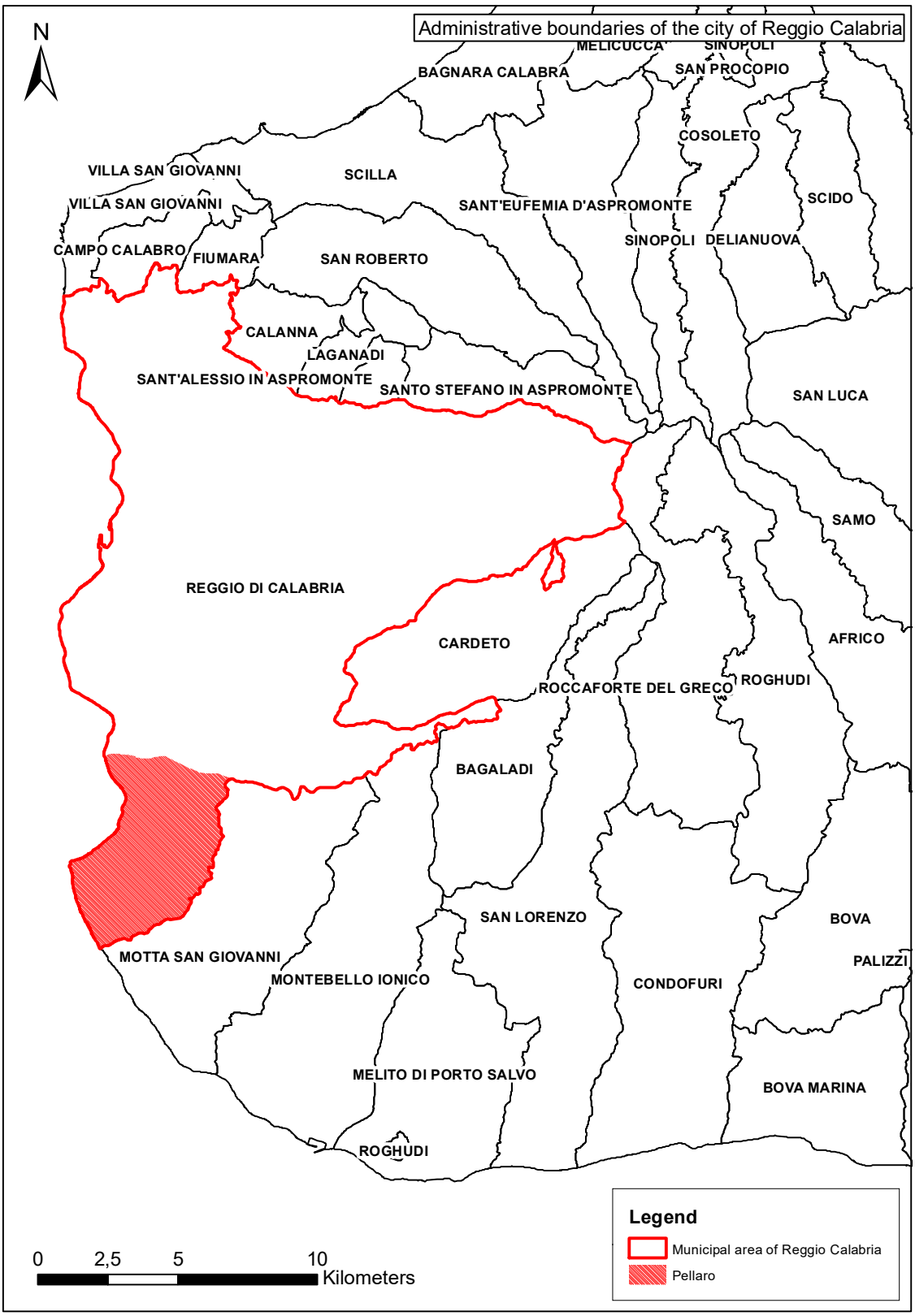
Tab. 16: Synthesis of the results for NAH by correlation (R2) to SPHW and mean values.

	Name of the variable	R2	Macellari	Occhio	Pantanello	San Giovanni	Bocale I e II	Fiumarella	Mortara	Lume	Ribergo	San Leo	Pellaro Centro
Y	**SPHW**	**1,000**	**3,04**	**3,27**	**3,35**	**3,47**	**3,49**	**3,53**	**3,54**	**3,57**	**3,61**	**3,66**	**3,78**
X	**NAH**	**0,585**	**2,51**	**2,51**	**2,37**	**2,58**	**2,66**	**2,56**	**2,66**	**2,80**	**2,68**	**2,92**	**2,90**
X cp	**Compositive Adv for Health**	**0,797**	**2,49**	**2,63**	**2,49**	**2,67**	**2,74**	**2,72**	**2,77**	**2,81**	**2,76**	**2,94**	**3,00**
Xcp1	Individual(s) Adv for Health	**0,727**	2,53	2,86	2,76	2,82	2,85	2,97	2,85	2,91	2,88	2,84	3,12
Xcp2	Community Adv for Health	**0,514**	2,46	2,40	2,21	2,53	2,63	2,46	2,69	2,71	2,64	3,04	2,89
X ct	**Contextual Adv for Health**	**0,363**	2,53	2,39	2,25	2,48	2,57	2,41	2,56	2,79	2,60	2,90	2,80
Xct1	Man-made Env Adv for Health	**0,513**	2,12	2,17	2,09	2,19	2,26	2,17	2,19	2,61	2,32	2,83	2,80
Xct2	Natural Env Adv for health	**0,051**	2,95	2,61	2,42	2,77	2,88	2,65	2,94	2,98	2,88	2,98	2,80

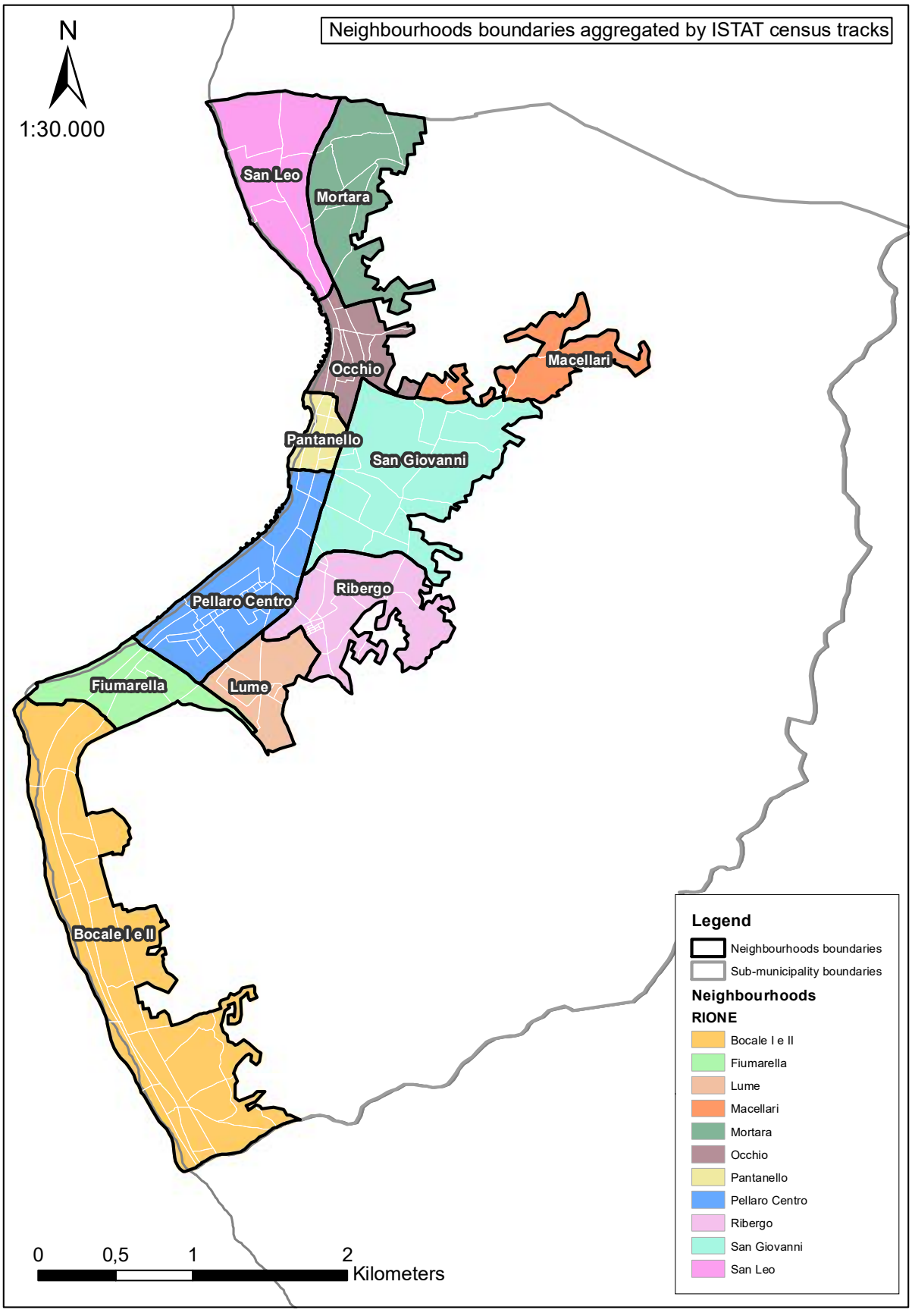
Source: Author's elaboration.

APPENDIX 3 - Maps

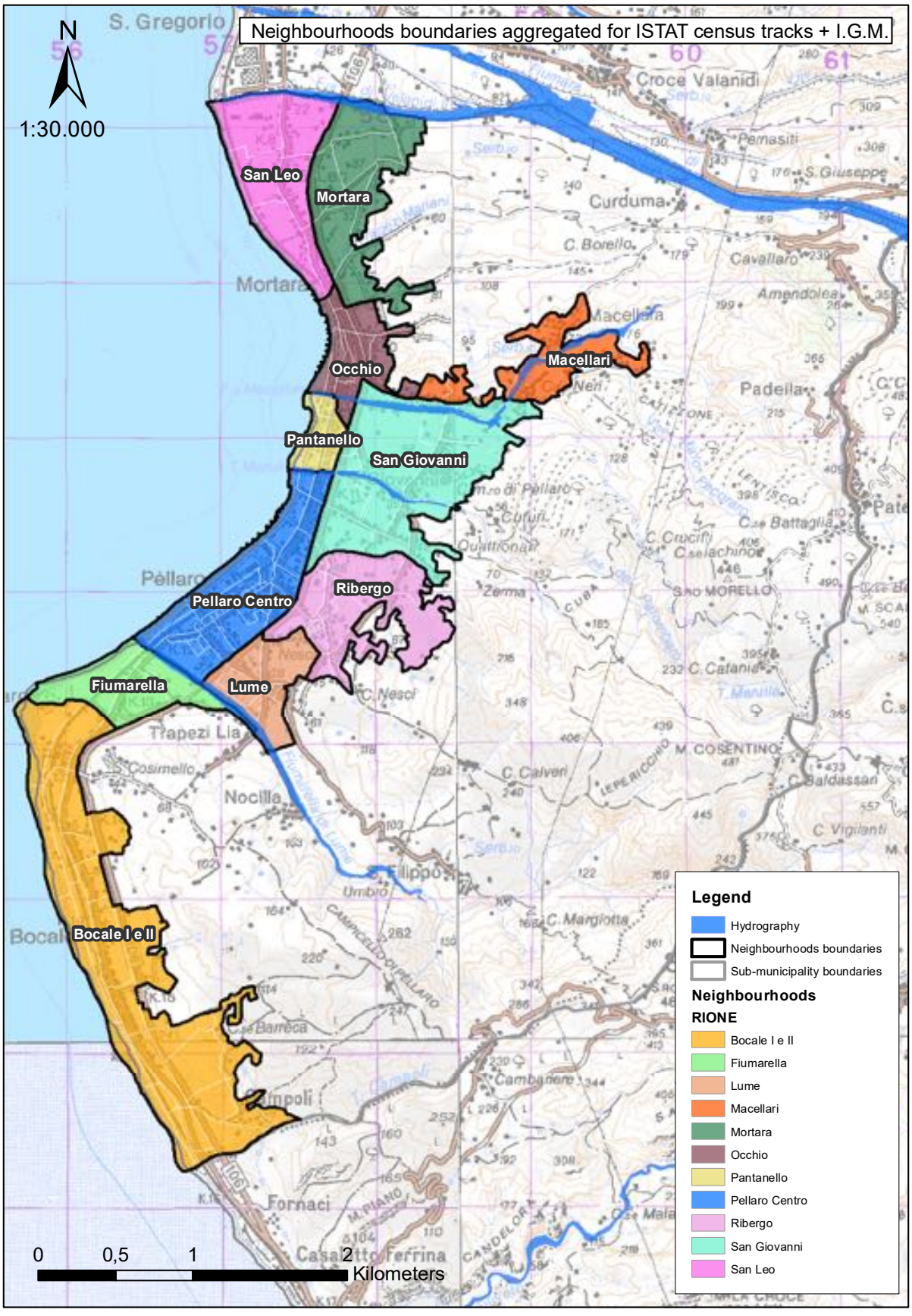
Map 1: Administrative boundaries of the city of RC;



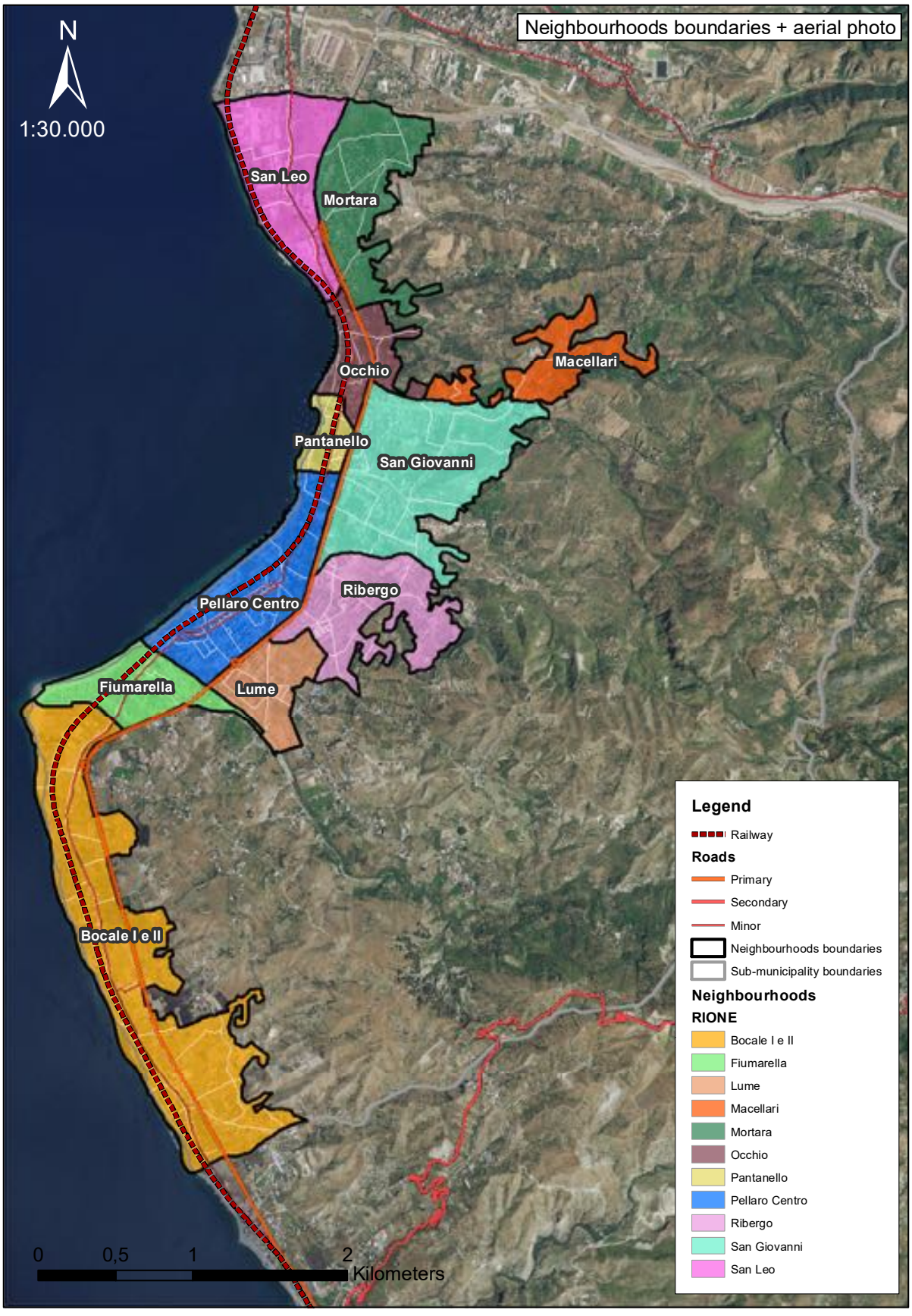
Map 2: Neighborhoods boundaries aggregated by ISTAT census tracks;



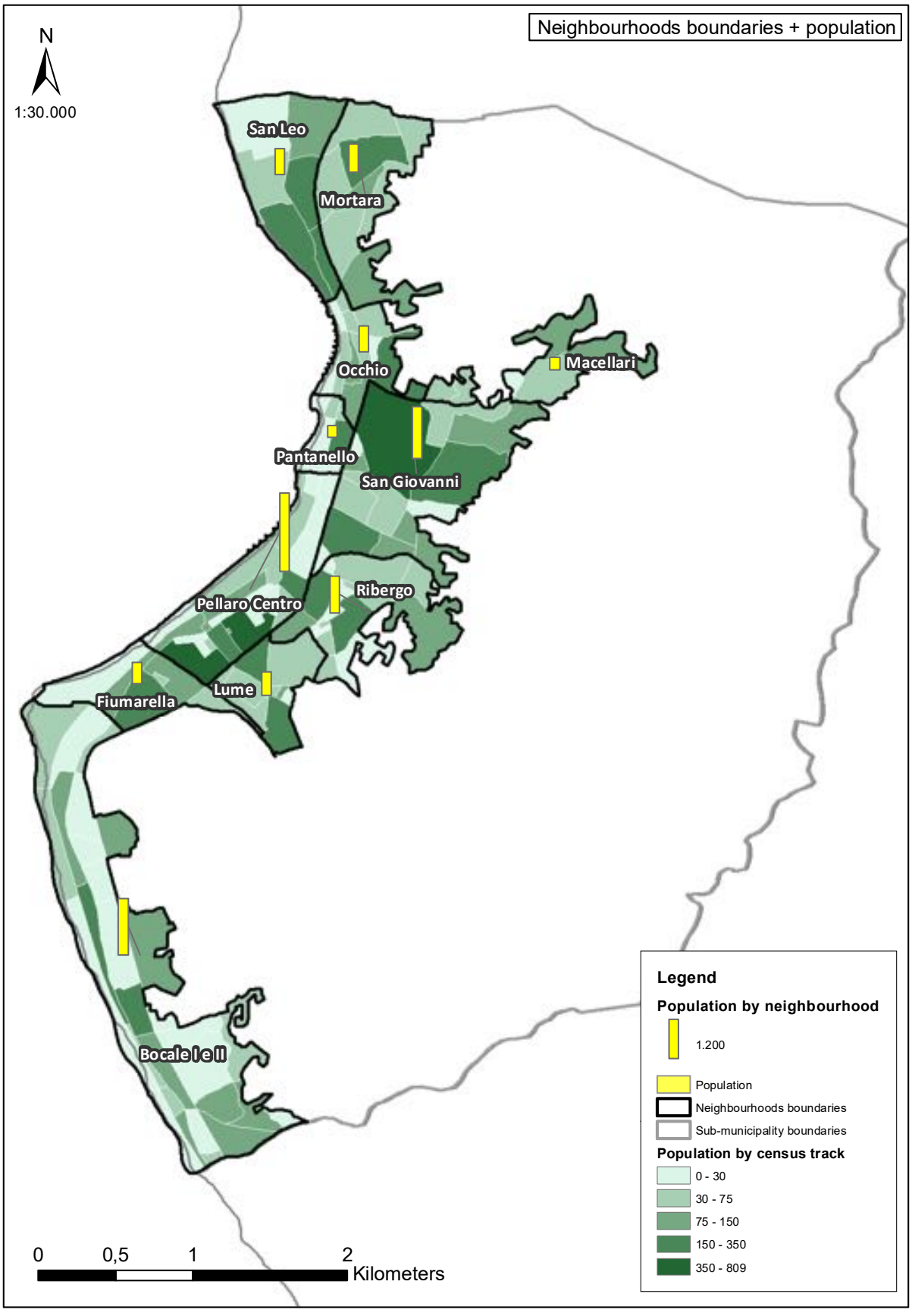
Map 3: Neighborhoods boundaries aggregated by ISTAT census tracks + IGM 50.000 + hydrography



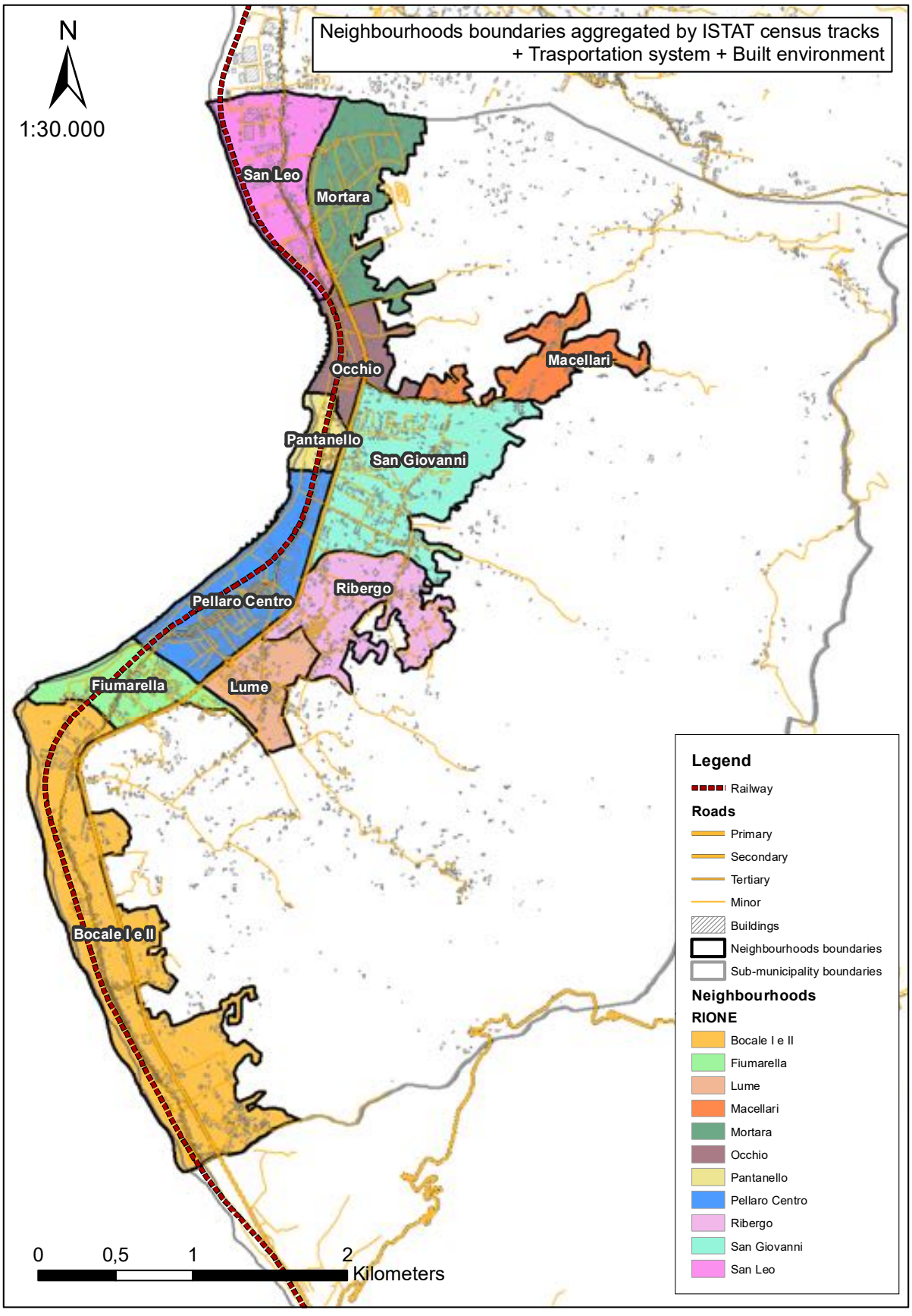
Map 4: Neighborhoods boundaries aggregated by ISTAT census tracks + aerial photo;



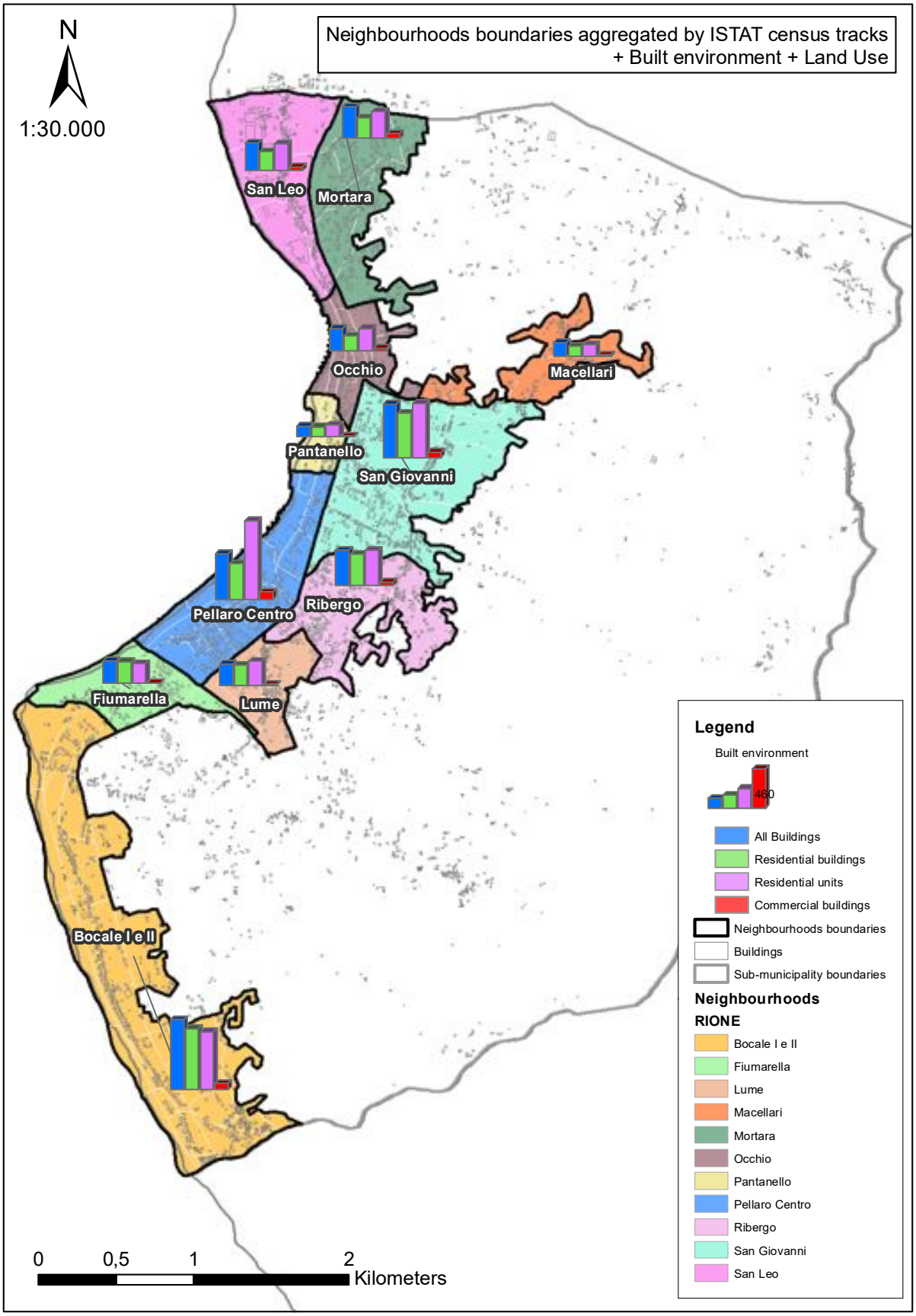
Map 5: Neighborhoods boundaries aggregated by ISTAT census tracks + population



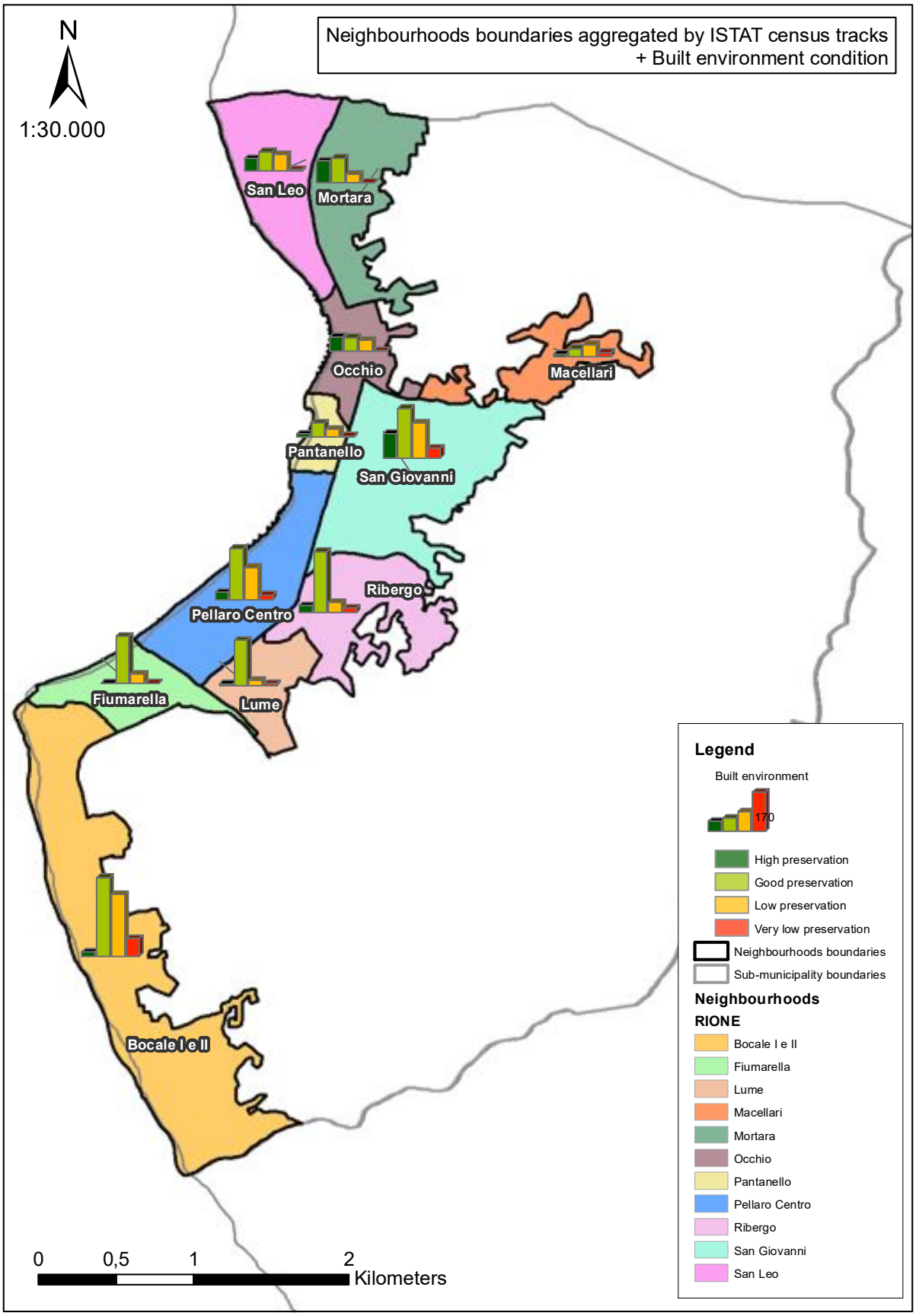
Map 6: Neighborhoods boundaries aggregated by ISTAT census tracks + transportation system + built environment


Neighbourhoods boundaries aggregated by ISTAT census tracks
+ Trasportation system + Built environment
N
1:30.000
San Leo
Mortara
Occhio
Macellari
Pantanello
San Giovanni
Ribergo
Pellaro Centro
Fiumarella
Lume
Bocale I e II
0
0,5
1
2
Kilometers
Legend
Railway
Roads
Primary
Secondary
Tertiary
Minor
Buildings
Neighbourhoods boundaries
Sub-municipality boundaries
Neighbourhoods
RIONE
Bocale I e II
Fiumarella
Lume
Macellari
Mortara
Occhio
Pantanello
Pellaro Centro
Ribergo
San Giovanni
San Leo

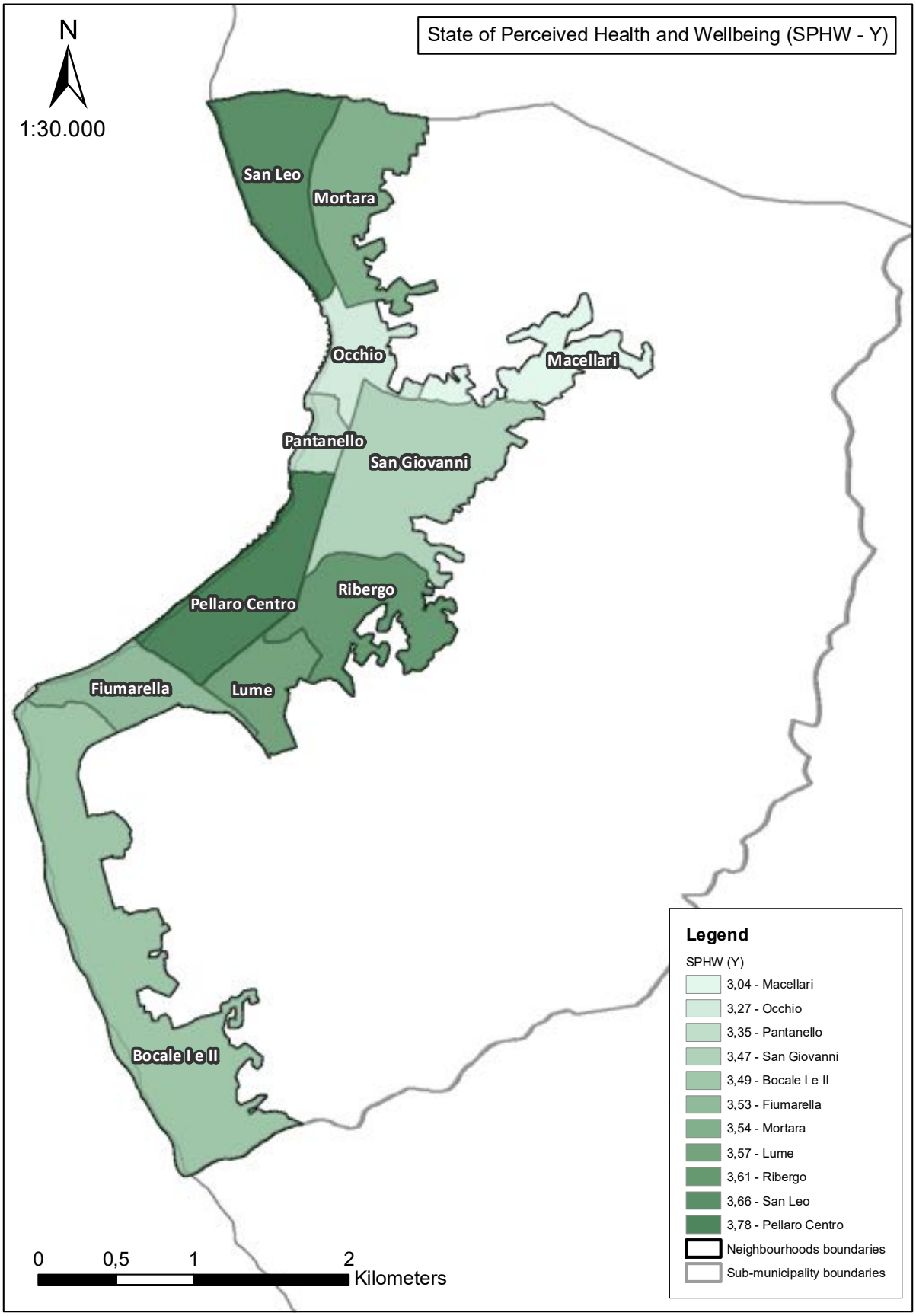
Map 7: Neighborhoods boundaries aggregated by ISTAT census tracks + land use



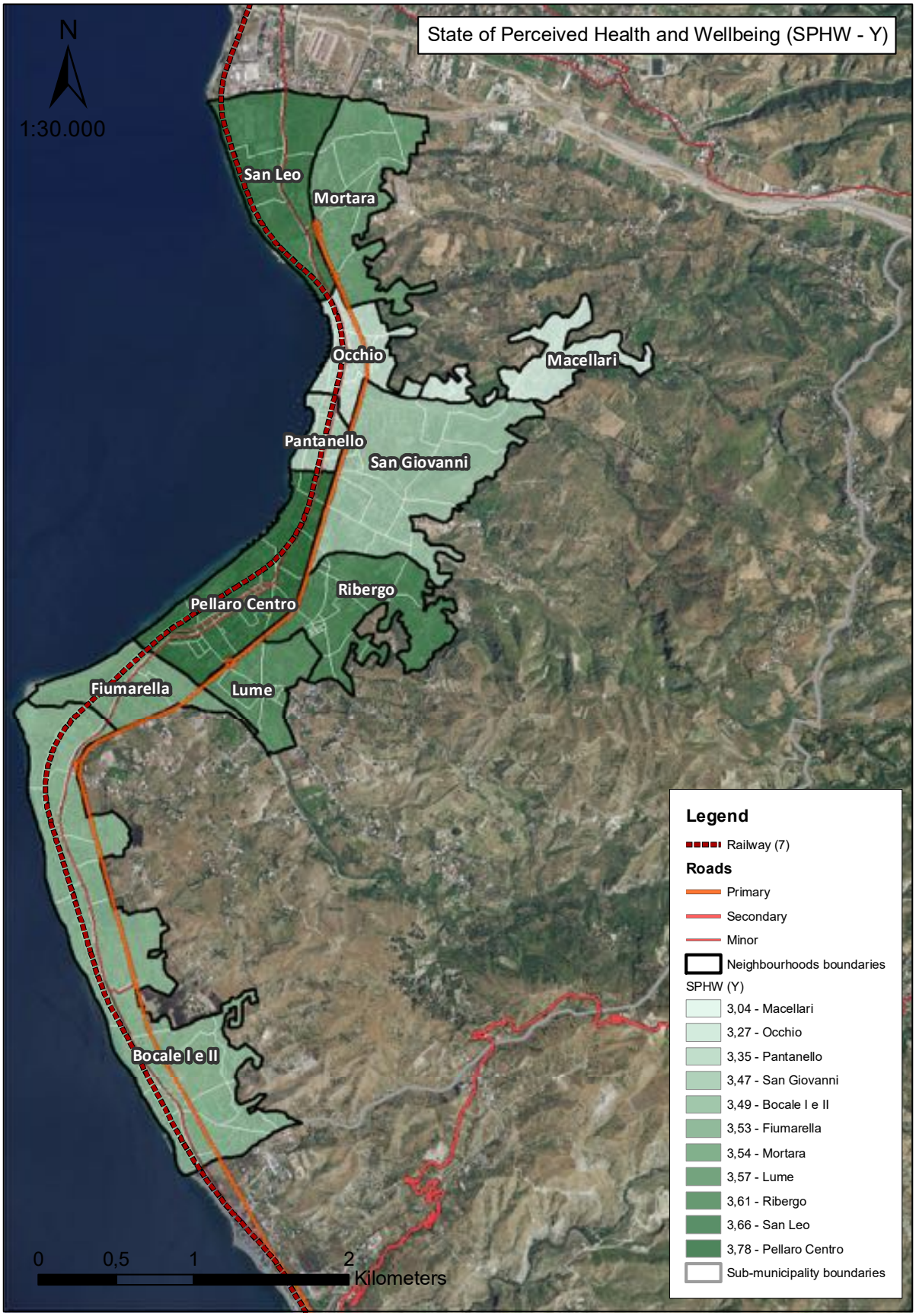
Map 8: Neighborhoods boundaries aggregated by ISTAT census tracks + built environment conditions



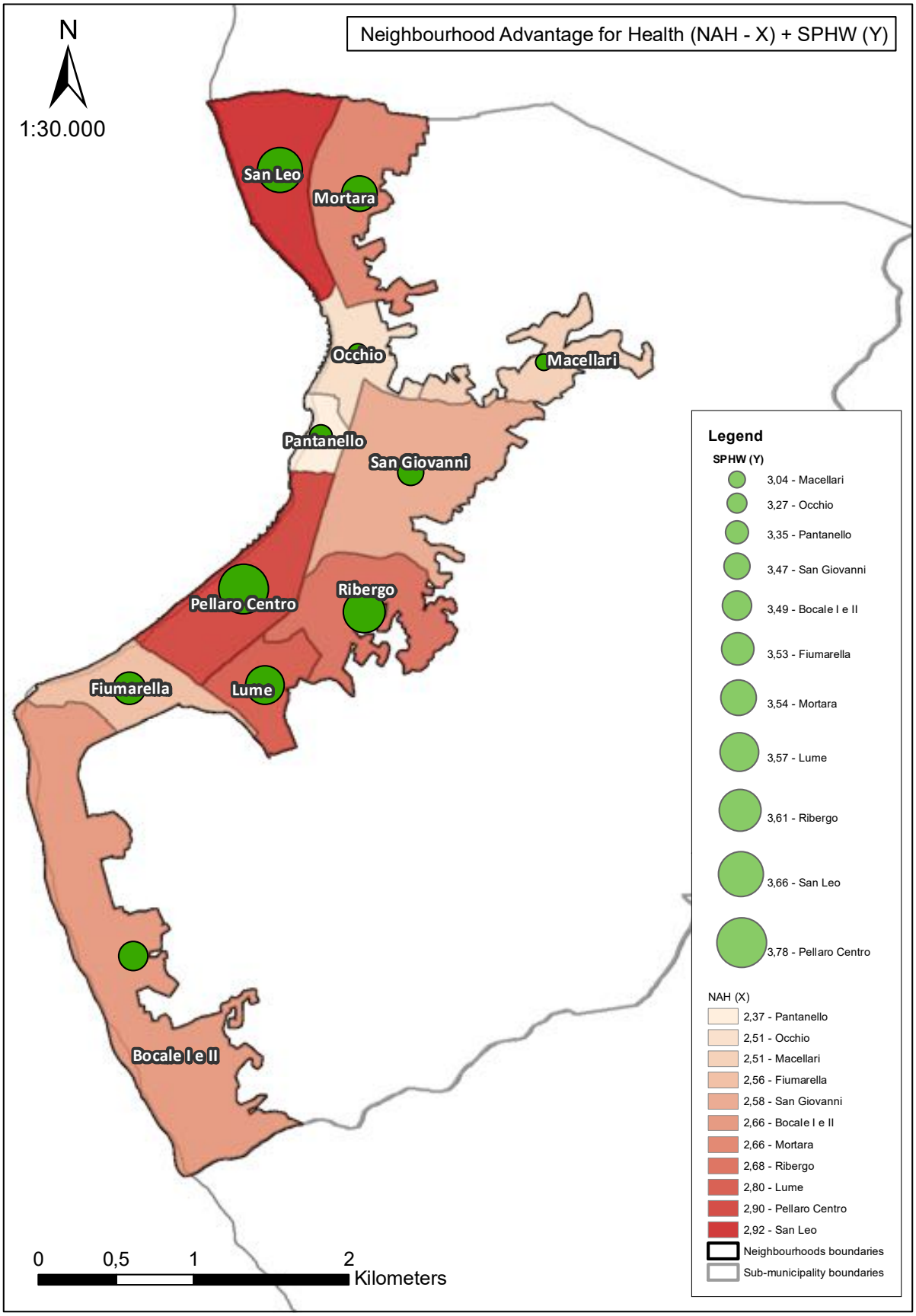
Map 9: State of Perceived Health and Wellbeing (SPHW - Y)



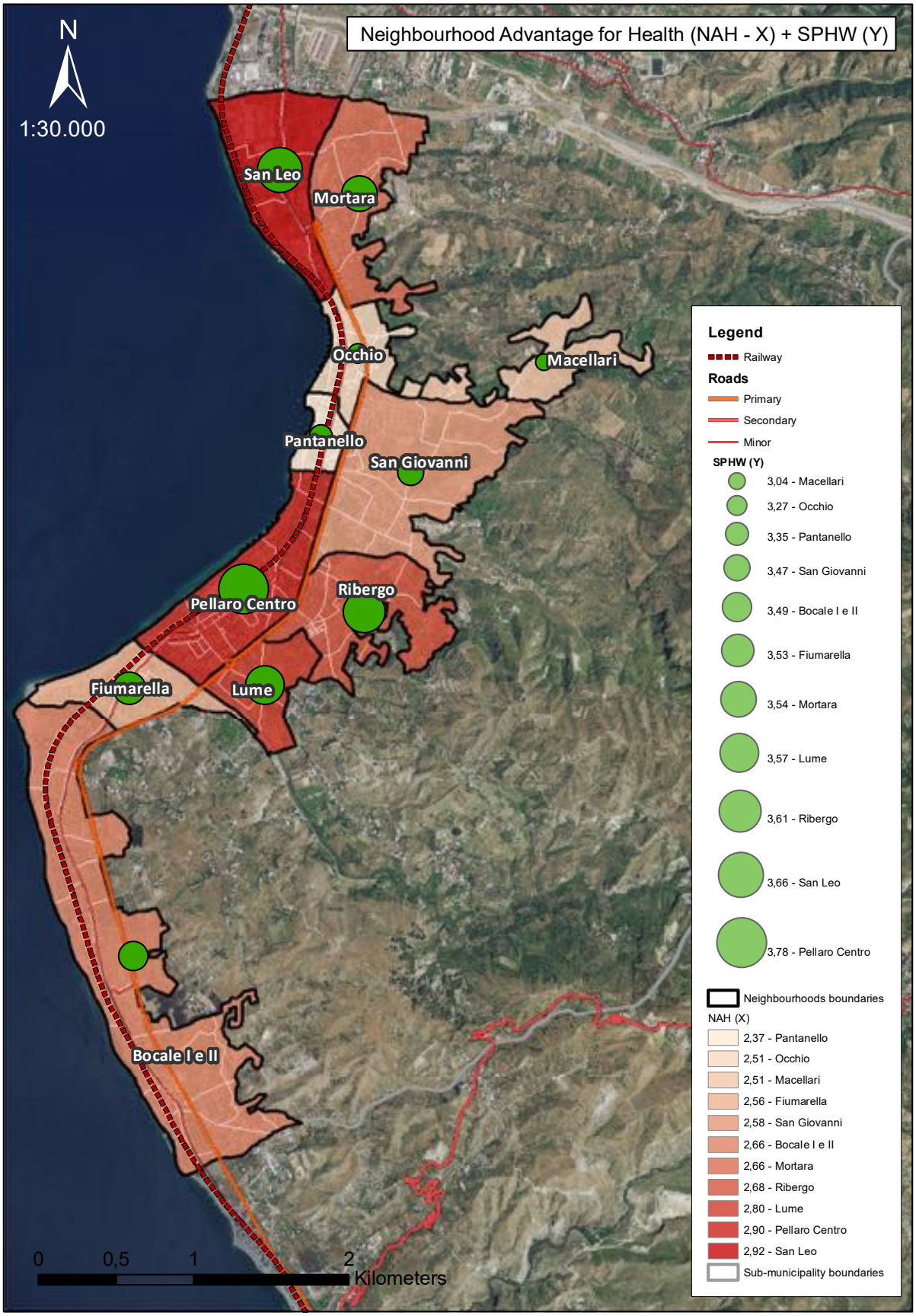
Map 9a: State of Perceived Health and Wellbeing (SPHW - Y) + transportation system



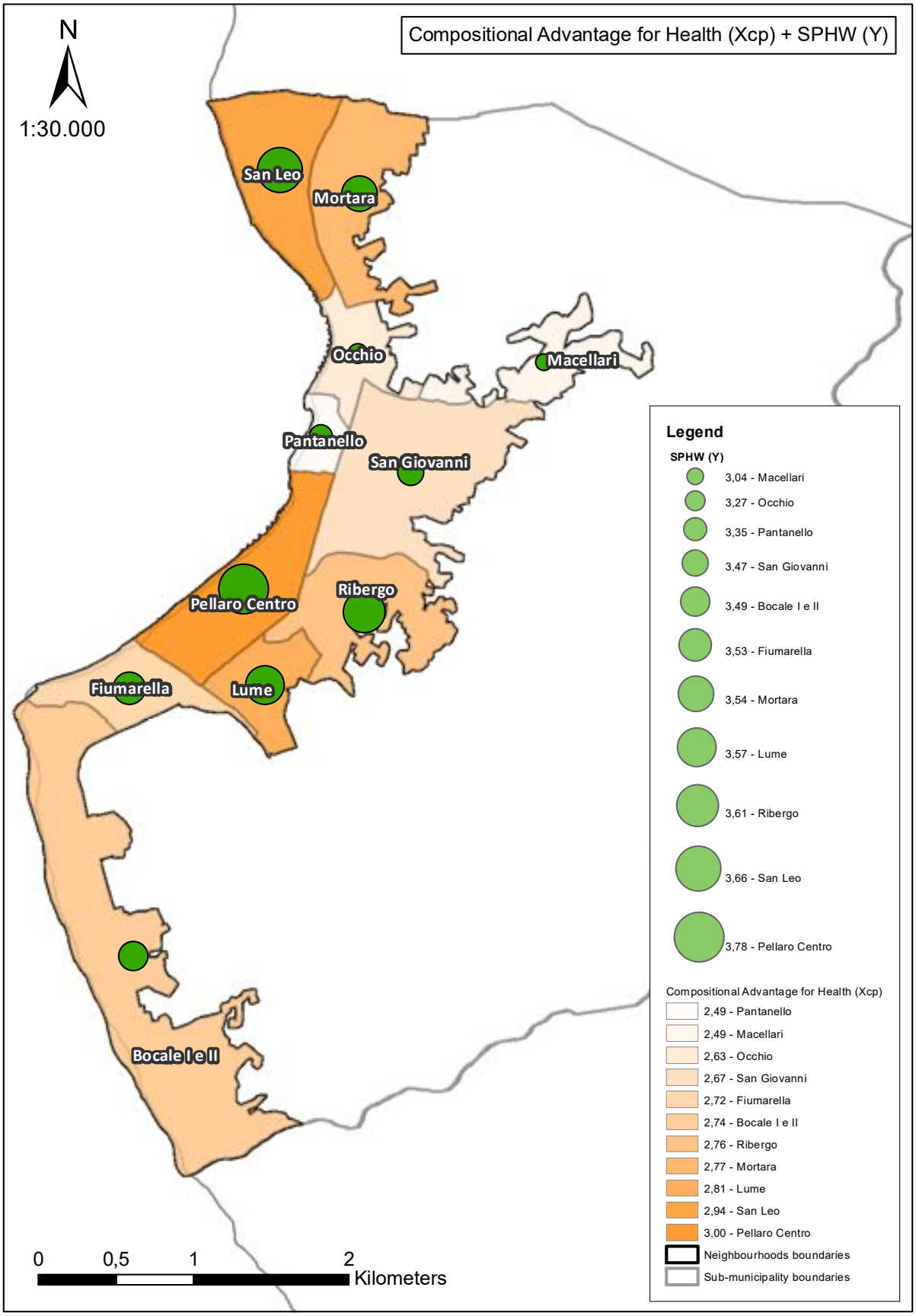
Map 10: Neighborhood Advantage for Health (NAH - X) + SPHW (Y)



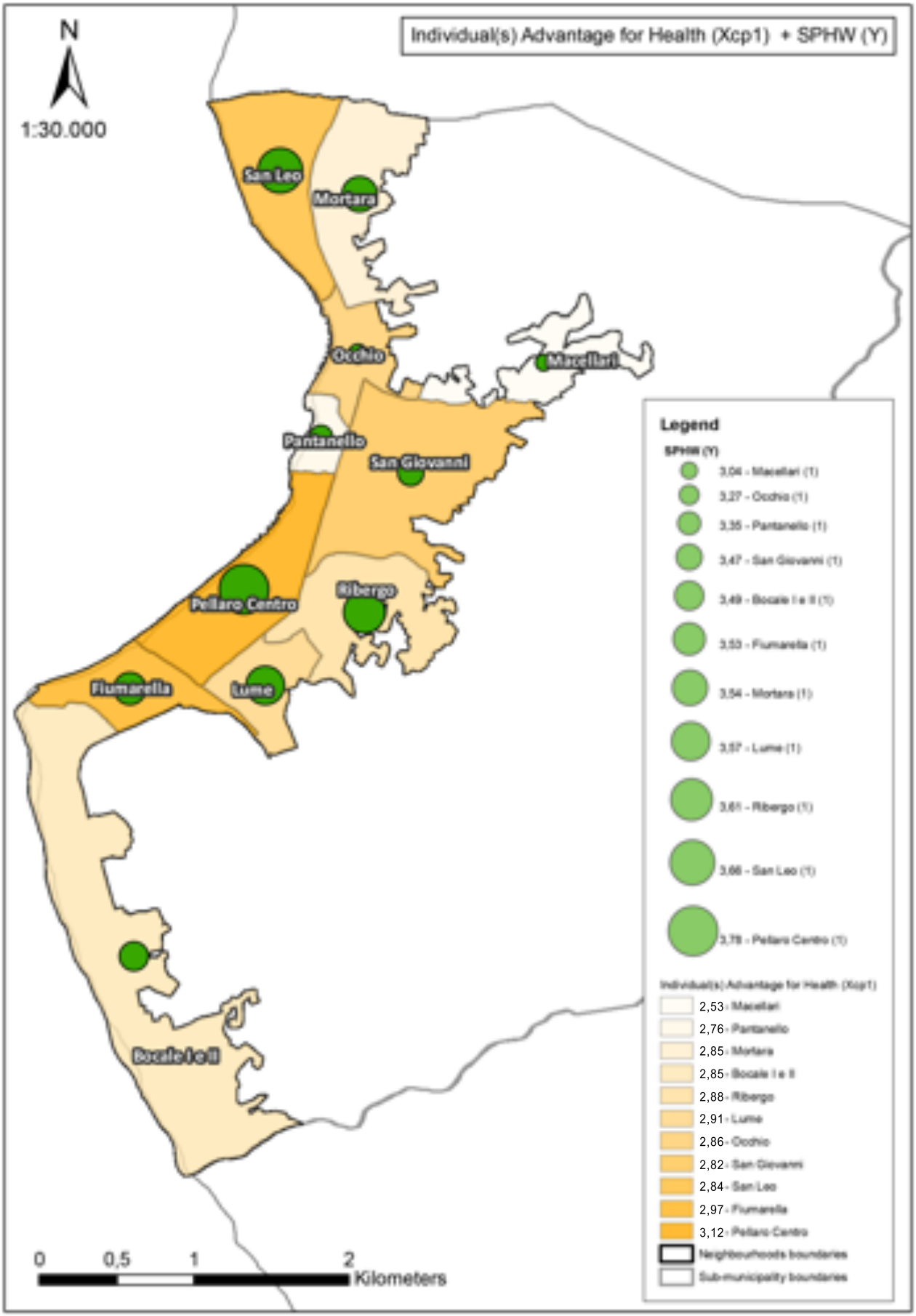
Map 10a: Neighborhood Advantage for Health (NAH - X) + SPHW (Y) + transportation system



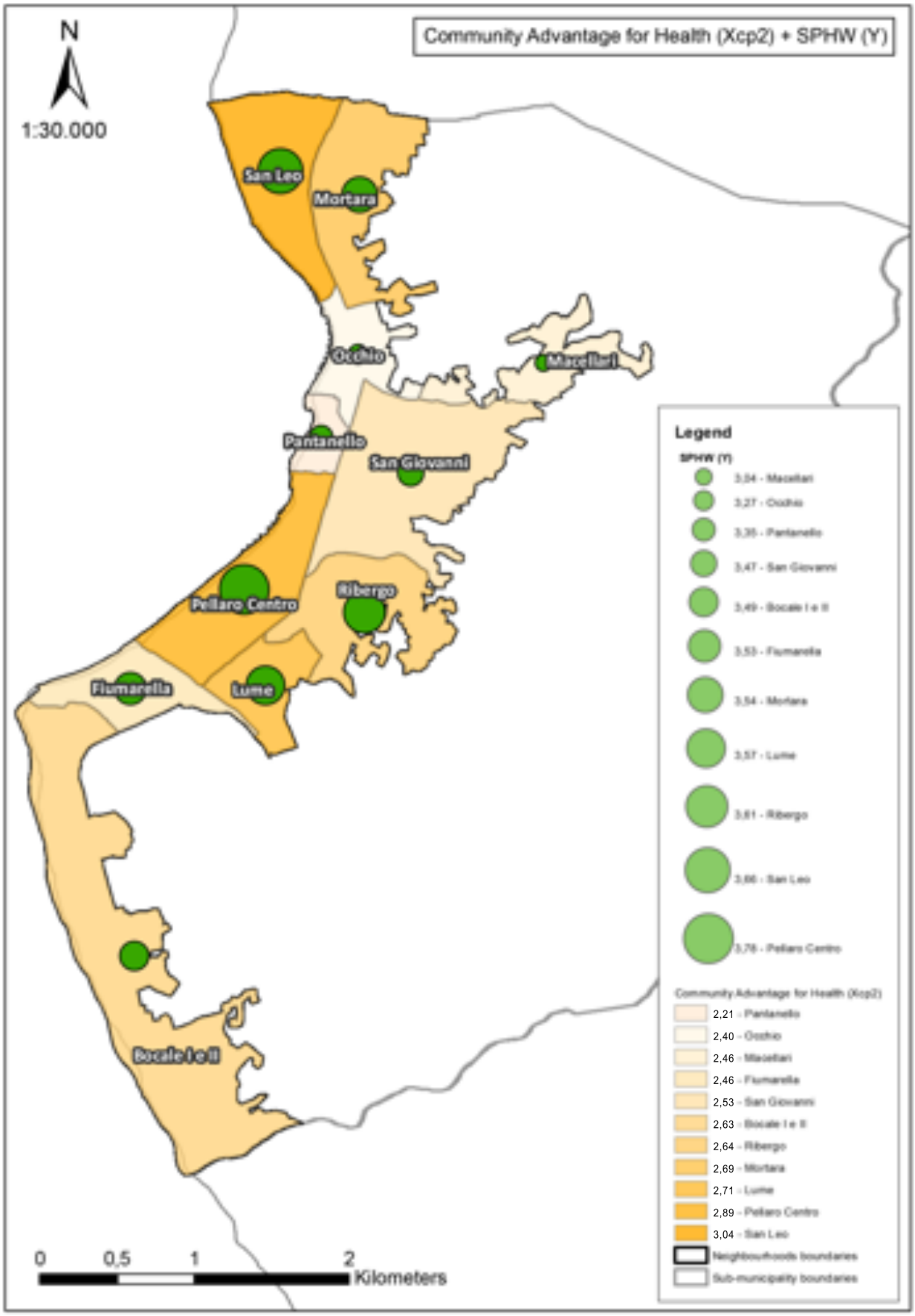
Map 11: Compositional Advantage for Health (Xcp) + SPHW (Y)



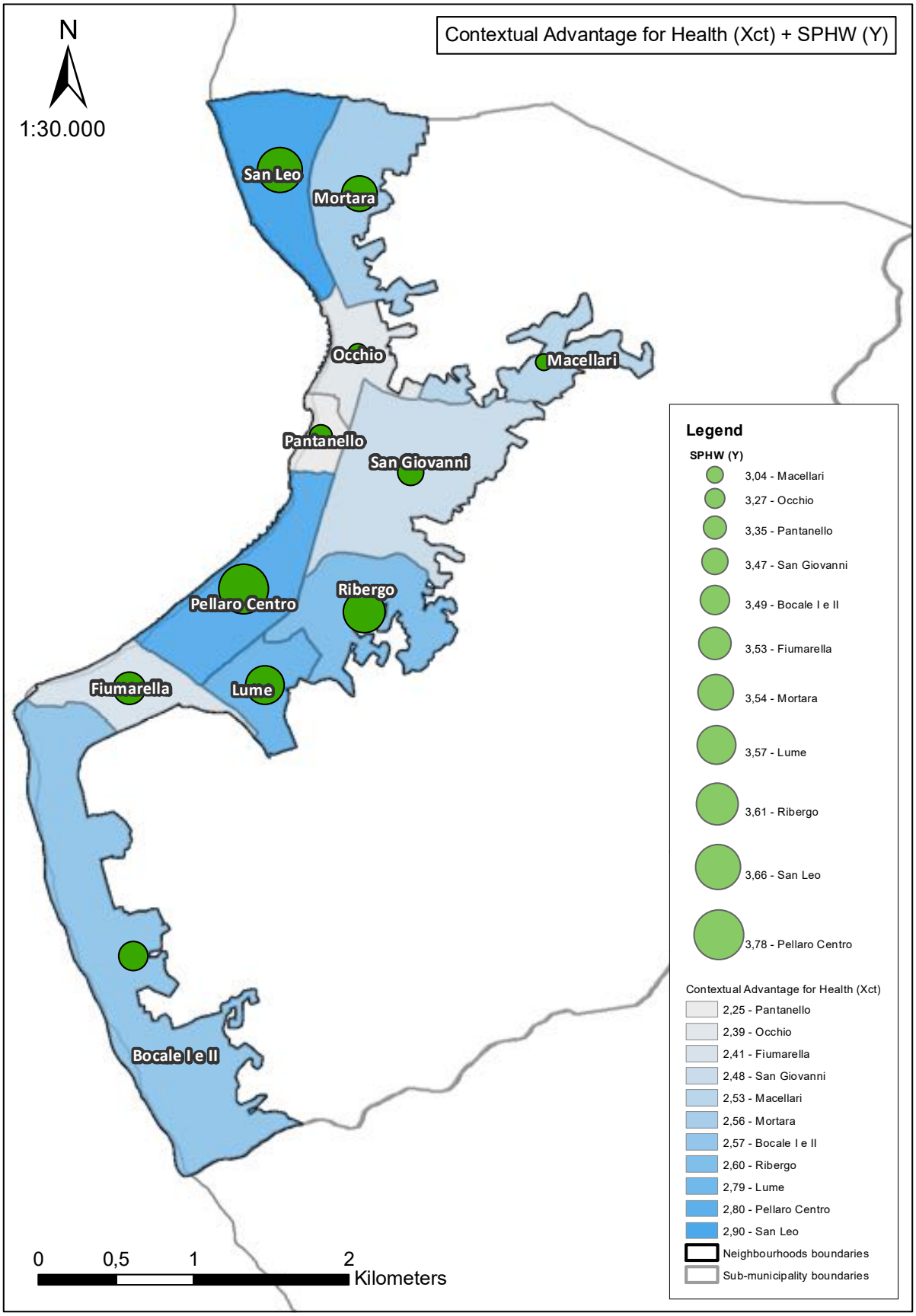
Map 12: Individual Advantage for Health (Xcp1) (Y)



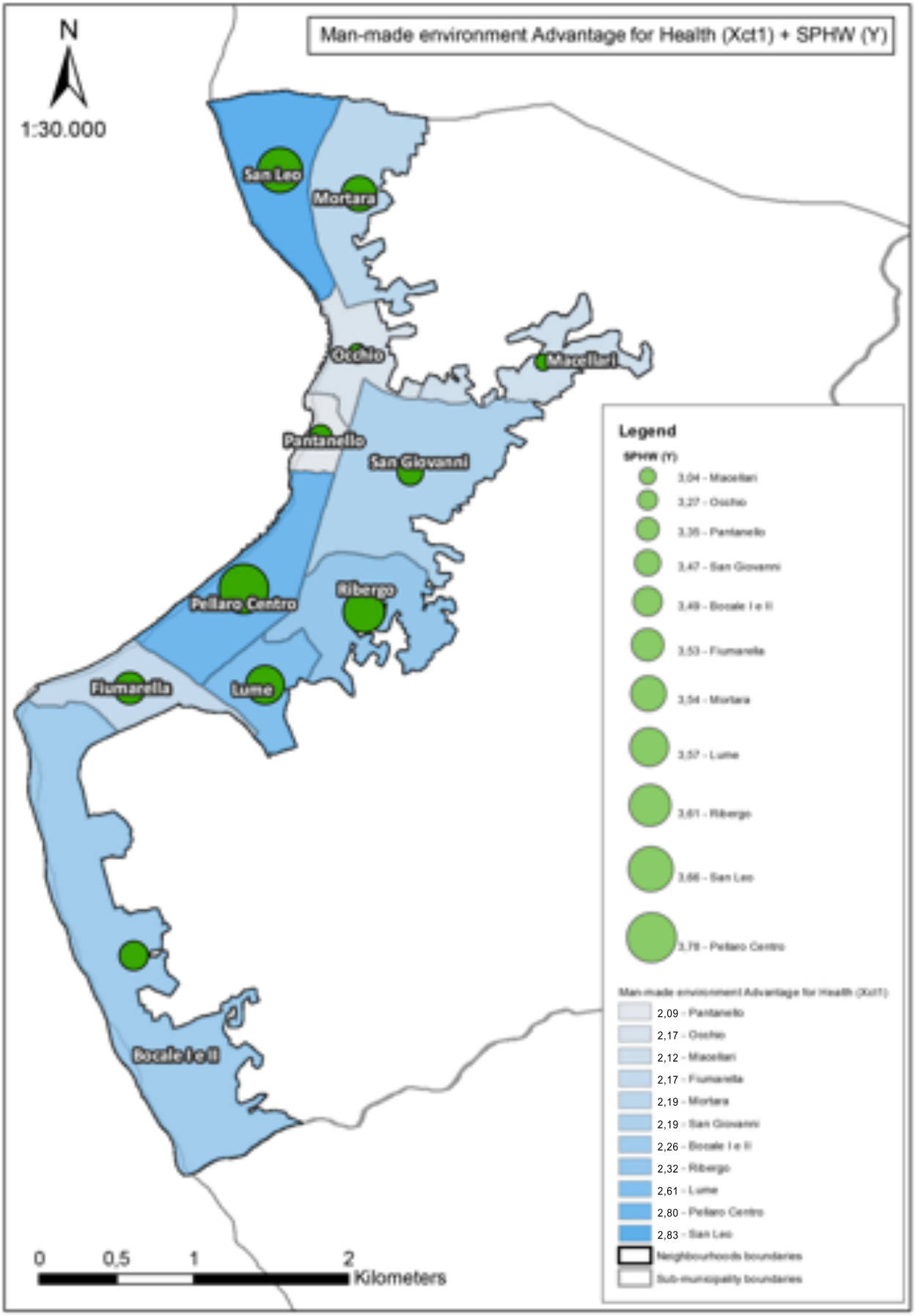
Map 13: Community Advantage for Health (Xcp2) + SPHW (Y)



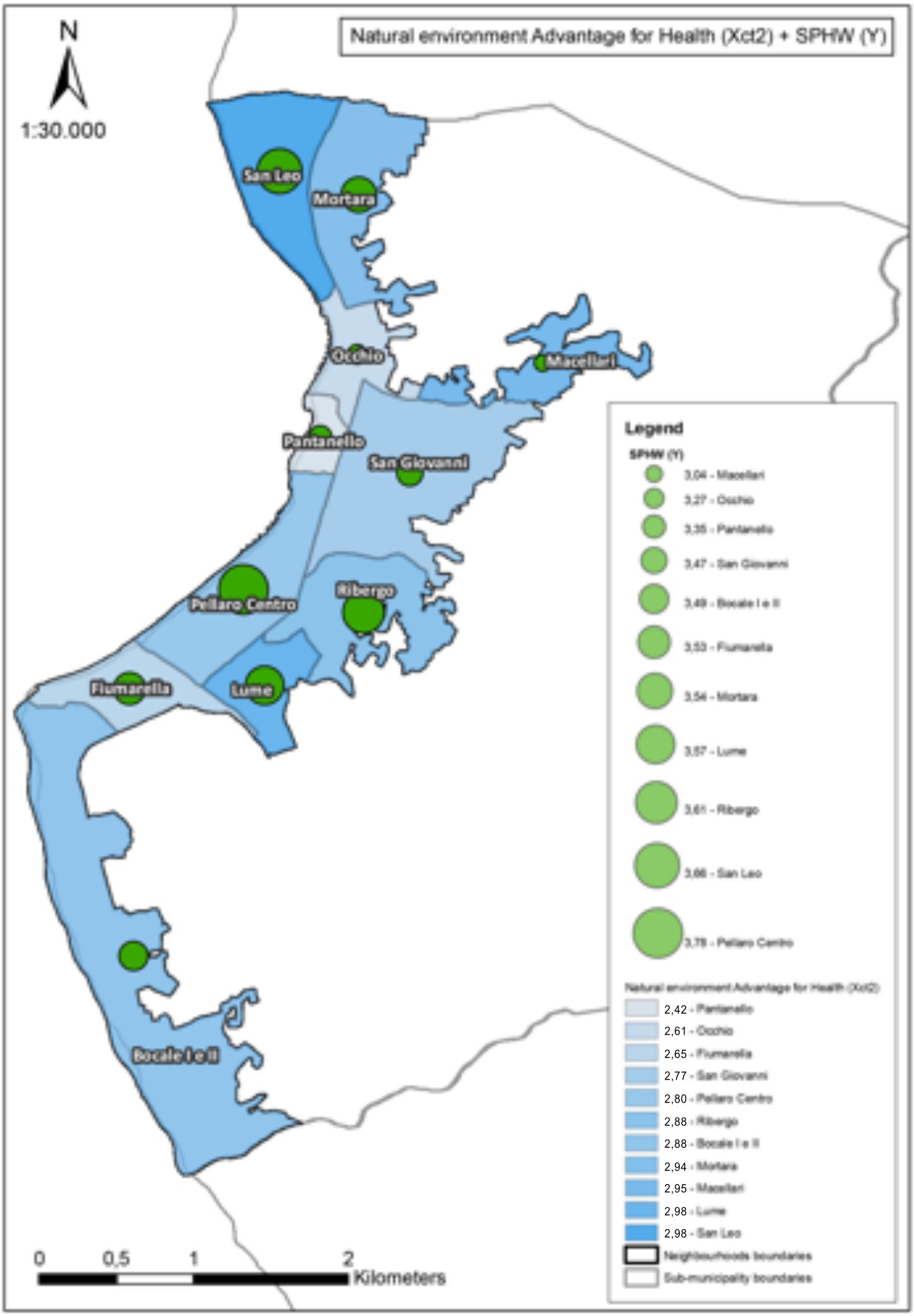
Map 14: Contextual Advantage for Health (Xct) + SPHW (Y)



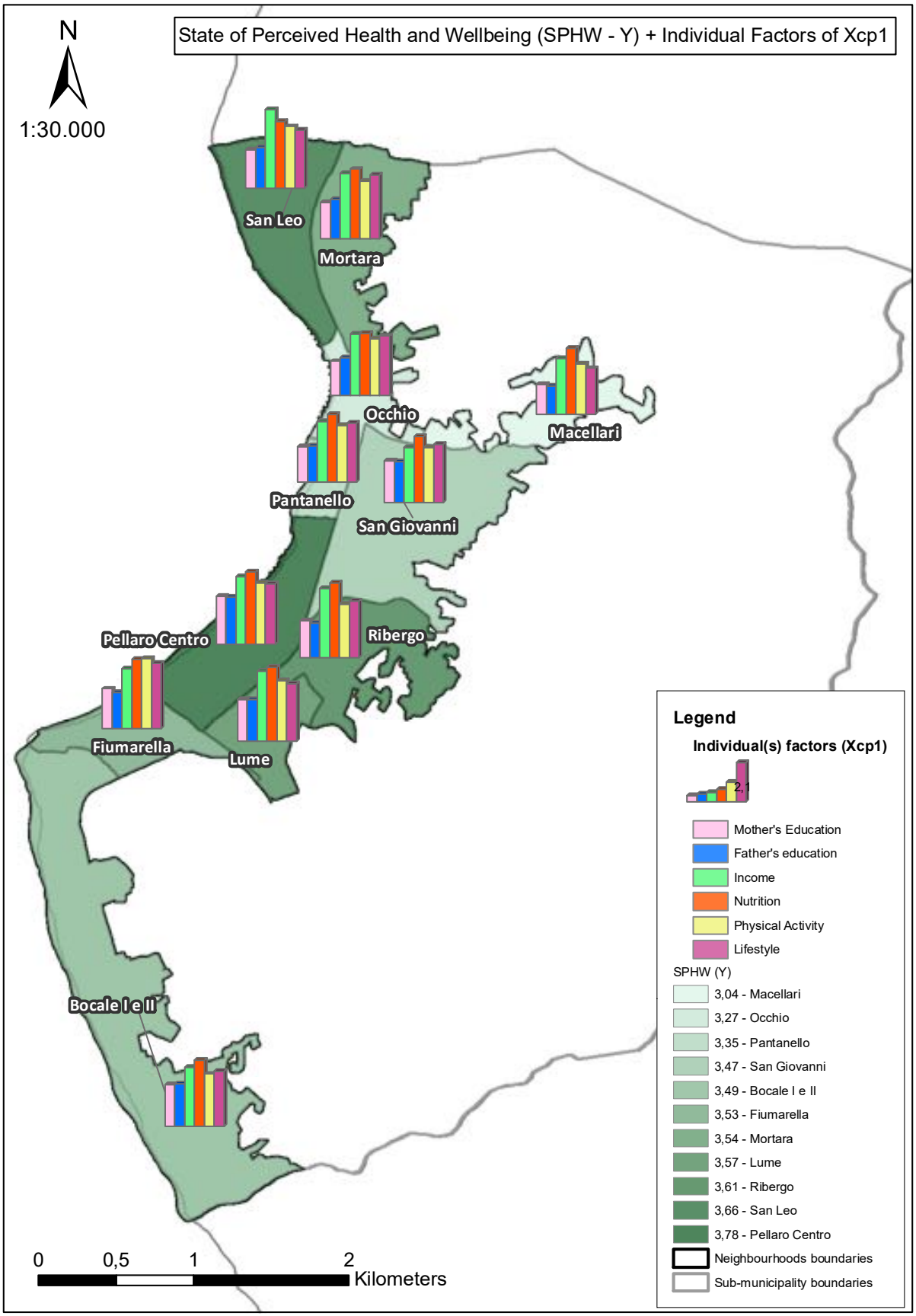
Map 15: Man-made Environment Advantage for Health (Xcp1) (Y)



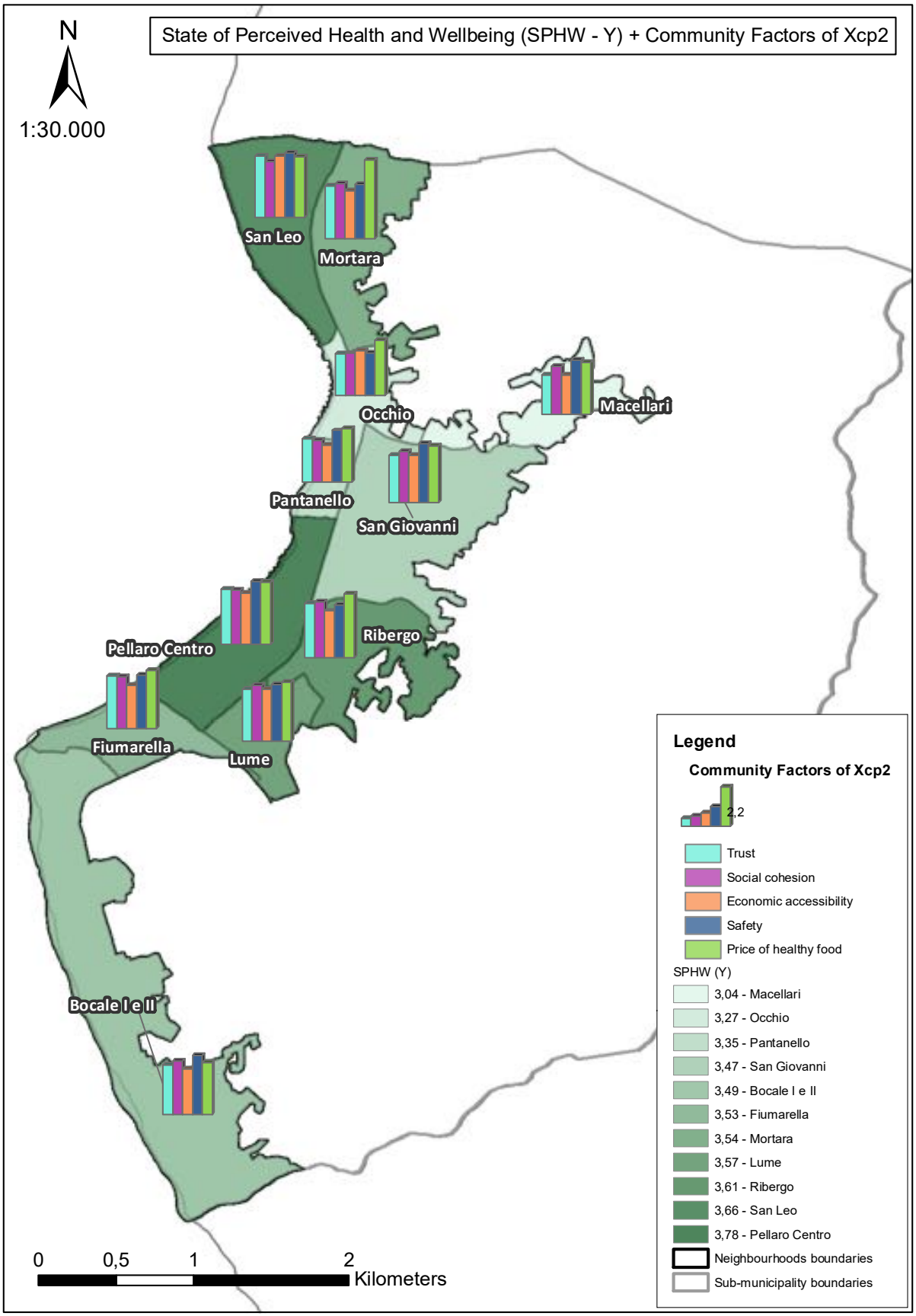
Map 16: Natural Environment Advantage for Health (Xcp2) + SPHW (Y)



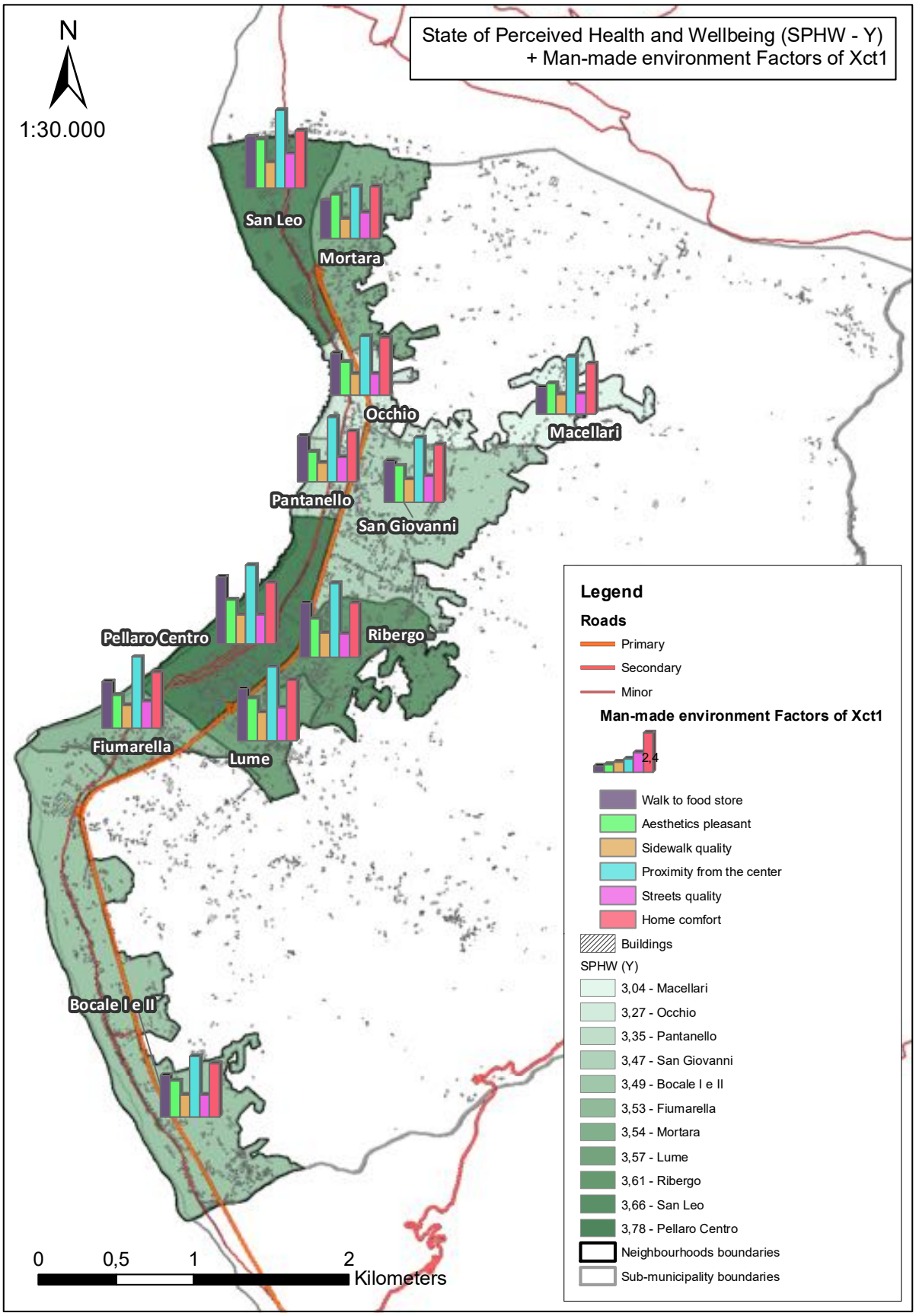
Map 17: SPHW + Individual's Factors (Xcp1) such as Income + Mother's and father's education + Education + Lifestyle + Physical activities score;



Map 18: SPHW + Community's Factors (Xcp2) such as Trust + Social cohesion + Safety + Economic accessibility;



Map 19: SPHW + Man-made environment Factors (Xct1) such as walk to food store, aesthetics, sidewalks quality + proximity +street quality + home comfort + good preservation



APPENDIX 4 - Regressions

Regr. 1 -SPHW to NAH

Model: Y to X
Dependent Variable: Y
Independent Variables:
X
Equation:
Predicted Y = 1,069 + 0,911*X

R-Squared	Adj.R-Sqr.	Std.Err.Reg.	Std.Dep.Var.	# Fitted	# Missing	t(003%,9)	Confidence
0,585	0,539	0,138	0,203	11	0	2,262	0,95

Variable	Coefficient	Std. Error	t-Statistic	P-value	Lower95%	Upper95%	VIF	Std. Coefficient
Constant	1,069	0,679	1,573	0,150	-0,468	2,605	0,000	0,000
X	0,911	0,256	3,561	0,006	0,332	1,490		

Source	Deg. Freedom	Sum Squares	Mean Square	F-Statistic	P-value
Regression	1	0,242	0,242	12,684	0,006
Residual	9	0,172	0,019		
Total	10	0,414			

	Mean Error	RMSE	MAE	Minimum	Maximum	MAPE	J-B
Fitted (n=11)	0,000	0,125	0,096			2,9%	

Source: Author's elaboration.

Regr. 2 -SPHW to Xcp

Model: Y to Xcp
Dependent Variable: Y
Independent Variables:
X_cp
Equation:
Predicted Y = 0,403 + 1,129*X_cp

R-Squared	Adj.R-Sqr.	Std.Err.Reg.	Std.Dep.Var.	# Fitted	# Missing	t(003%,9)	Confidence
0,797	0,775	0,097	0,203	11	0	2,262	0,95

Variable	Coefficient	Std. Error	t-Statistic	P-value	Lower95%	Upper95%	VIF	Std. Coefficient
Constant	0,403	0,518	0,777	0,457	-0,770	1,575	0,000	0,000
X_cp	1,129	0,190	5,952	0,000	0,700	1,558		

Source	Deg. Freedom	Sum Squares	Mean Square	F-Statistic	P-value
Regression	1	0,330	0,330	35,427	0,000
Residual	9	0,084	0,009320		
Total	10	0,414			

	Mean Error	RMSE	MAE	Minimum	Maximum	MAPE	J-B
Fitted (n=11)	0,000	0,087	0,067			2,0%	

Source: Author's elaboration.

Regr. 3 -SPHW to Xcp1

Model: Y to Xcp1
Dependent Variable: Y
Independent Variables:
Xcp1_
Equation:
Predicted Y = 0,017 + 1,215*Xcp1_

R-Squared	Adj.R-Sqr.	Std.Err.Reg.	Std.Dep.Var.	# Fitted	# Missing	t(003%,9)	Confidence
0,727	0,696	0,112	0,203	11	0	2,262	0,95

Variable	Coefficient	Std. Error	t-Statistic	P-value	Lower95%	Upper95%	VIF	Std. Coefficient
Constant	0,017	0,710	0,023	0,982	-1,589	1,622	0,000	0,000
Xcp1_	1,215	0,248	4,891	0,001	0,653	1,777		

Source	Deg. Freedom	Sum Squares	Mean Square	F-Statistic	P-value
Regression	1	0,301	0,301	23,917	0,001
Residual	9	0,113	0,013		
Total	10	0,414			

	Mean Error	RMSE	MAE	Minimum	Maximum	MAPE	J-B
Fitted (n=11)	0,000	0,101	0,074			2,1%	

Source: Author's elaboration.

Regr. 4 -SPHW to Xcp2

Model: Y to Xcp2
Dependent Variable: Y
Independent Variables:
Xcp2_
Equation:
Predicted Y = 1,841 + 0,630*Xcp2_

R-Squared	Adj.R-Sqr.	Std.Err.Reg.	Std.Dep.Var.	# Fitted	# Missing	t(003%,9)	Confidence
0,514	0,460	0,150	0,203	11	0	2,262	0,95

Variable	Coefficient	Std. Error	t-Statistic	P-value	Lower95%	Upper95%	VIF	Std. Coefficient
Constant	1,841	0,534	3,444	0,007	0,632	3,050	0,000	0,000
Xcp2_	0,630	0,204	3,084	0,013	0,168	1,093		

Source	Deg. Freedom	Sum Squares	Mean Square	F-Statistic	P-value
Regression	1	0,213	0,213	9,511	0,013
Residual	9	0,201	0,022		
Total	10	0,414			

	Mean Error	RMSE	MAE	Minimum	Maximum	MAPE	J-B
Fitted (n=11)	0,000	0,135	0,098			2,9%	

Source: Author's elaboration.

Regr. 5 -SPHW to Xct

Model: Y to Xct
Dependent Variable: Y
Independent Variables:
X_ct
Equation:
Predicted Y = 1,868 + 0,628*X_ct

R-Squared	Adj.R-Sqr.	Std.Err.Reg.	Std.Dep.Var.	# Fitted	# Missing	t(003%,9)	Confidence
0,363	0,292	0,171	0,203	11	0	2,262	0,95

Variable	Coefficient	Std. Error	t-Statistic	P-value	Lower95%	Upper95%	VIF	Std. Coefficient
Constant	1,868	0,715	2,611	0,028	0,250	3,486	0,000	0,000
X_ct	0,628	0,277	2,264	0,050	0,000382	1,255		

Source	Deg. Freedom	Sum Squares	Mean Square	F-Statistic	P-value
Regression	1	0,150	0,150	5,124	0,050
Residual	9	0,264	0,029		
Total	10	0,414			

	Mean Error	RMSE	MAE	Minimum	Maximum	MAPE	J-B
Fitted (n=11)	0,000	0,155	0,110			3,3%	

Source: Author's elaboration.

Regr. 6 -SPHW to Xct1

Model: Y to Xct1
Dependent Variable: Y
Independent Variables:
Xct1_
Equation:
Predicted Y = 2,226 + 0,537*Xct1_

R-Squared	Adj.R-Sqr.	Std.Err.Reg.	Std.Dep.Var.	# Fitted	# Missing	t(003%,9)	Confidence
0,513	0,459	0,150	0,203	11	0	2,262	0,95

Variable	Coefficient	Std. Error	t-Statistic	P-value	Lower95%	Upper95%	VIF	Std. Coefficient
Constant	2,226	0,410	5,427	0,000	1,298	3,155	0,000	0,000
Xct1_	0,537	0,174	3,082	0,013	0,143	0,931		

Source	Deg. Freedom	Sum Squares	Mean Square	F-Statistic	P-value
Regression	1	0,213	0,213	9,496	0,013
Residual	9	0,201	0,022		
Total	10	0,414			

	Mean Error	RMSE	MAE	Minimum	Maximum	MAPE	J-B
Fitted (n=11)	0,000	0,135	0,108			3,2%	

Source: Author's elaboration.

Regr. 7 -SPHW to Xct2

Model: Y to Xct2
Dependent Variable: Y
Independent Variables:
Xct2_
Equation:
Predicted Y = 2,765 + 0,256*Xct2_

R-Squared	Adj.R-Sqr.	Std.Err.Reg.	Std.Dep.Var.	# Fitted	# Missing	t(003%,9)	Confidence
0,051	-0,054	0,209	0,203	11	0	2,262	0,95

Adj. R-sqr. is negative because the standard error of the regression is greater than the standard deviation of the dependent variable.

Variable	Coefficient	Std. Error	t-Statistic	P-value	Lower95%	Upper95%	VIF	Std. Coefficient
Constant	2,765	1,034	2,675	0,025	0,427	5,104	0,000	0,000
Xct2_	0,256	0,368	0,696	0,504	-0,576	1,088		

Source	Deg. Freedom	Sum Squares	Mean Square	F-Statistic	P-value
Regression	1	0,021	0,021	0,484	0,504
Residual	9	0,393	0,044		
Total	10	0,414			

	Mean Error	RMSE	MAE	Minimum	Maximum	MAPE	J-B
Fitted (n=11)	0,000	0,189	0,125			3,7%	

Source: Author's elaboration.

Regr. 8 -SPHW to X, Xcp, Xcp1, Xcp2, Xct, Xct1, Xct2

Descriptive Statistics Y to all

Variable	Sample size	Mean	Median	Std.Dev.	Root.M.Sqr.	Std.Err.Mean	Minimum	Maximum
Y	11	3,483	3,531	0,203	3,488	0,061	3,035	3,781
X	11	2,651	2,655	0,171	2,656	0,052	2,369	2,922
X_cp	11	2,729	2,743	0,161	2,734	0,049	2,485	3,004
X_ct	11	2,572	2,564	0,195	2,579	0,059	2,253	2,902
Xcp1_	11	2,854	2,852	0,143	2,857	0,043	2,530	3,120
Xcp2_	11	2,605	2,634	0,231	2,614	0,070	2,213	3,040
Xct1_	11	2,340	2,192	0,272	2,355	0,082	2,088	2,827
Xct2_	11	2,804	2,875	0,180	2,809	0,054	2,418	2,982

Correlations and Squared Correlations -vs- Y (n=11)

Variable	Correlation	Squared
Y	1,000	1,000
X	**0,765**	0,585
X_cp	**0,893**	0,797
X_ct	**0,602**	0,363
Xcp1_	**0,852**	0,727
Xcp2_	**0,717**	0,514
Xct1_	**0,717**	0,513
Xct2_	0,226	0,051

Source: Author's elaboration.

Regr. 9 -Summary of SPHW to X, Xcp, Xcp1, Xcp2, Xct, Xct1, Xct2

Dependent Variable: Y	Y to X	Y to Xcp	Model 3	Y to Xcp1	Y to Xcp2	Y to Xct1	Y to Xct2
Run Time	10.24.2018 21:20	10.24.2018 21:21	10.24.2018 21:22	10.24.2018 21:23	10.24.2018 21:23	10.24.2018 21:24	10.24.2018 21:24
# Fitted	11	11	11	11	11	11	11
Mean	3,483	3,483	3,483	3,483	3,483	3,483	3,483
Standard Deviation	0,203	0,203	0,203	0,203	0,203	0,203	0,203
Number Of Variables	1	1	1	1	1	1	1
Standard Error of Regression	0,138	0,097	0,171	0,112	0,150	0,150	0,209
R-squared	0,585	0,797	0,363	0,727	0,514	0,513	0,051
Adjusted R-squared	0,539	0,775	0,292	0,696	0,460	0,459	-0,054
Mean Absolute Error	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Mean Absolute Percentage Error							
Maximum VIF							
Normality Test	_	_	_	_	_	_	_
Coefficients:	Model 1	Y to Xcp	Model 3	Y to Xcp1	Y to Xcp2	Y to Xct1	Y to Xct2
Constant	1,069 (0,150)	0,403 (0,457)	1,868 (0,028)	0,017 (0,982)	1,841 (0,007)	2,226 (0,000)	2,765 (0,025)
X	0,911 (0,006)						
X_cp		1,129 (0,000)					
X_ct			0,628 (0,050)				
Xcp1_				1,215 (0,001)			
Xcp2_					0,630 (0,013)		
Xct1_						0,537 (0,013)	
Xct2_							0,256 (0,504)

Source: Author's elaboration.

Regr. 10 - Correlation analysis - all factors to SPHW

Correlations -vs- State_of_Perceived_Health_and_Well_being (n=11)

Variable	Correlation
State_of_Perceived_Health_and_Well_being	1,000
Trust	**0,901**
Walk_to_food_store	**0,862**
Stigma_free	**0,842**
Household_Income	**0,833**
Mother_s_Education	**0,833**
Father_s_education	**0,778**
Aesthetics_pleasant	**0,762**
Sidewalk_quality	**0,760**
Sense_of_belonging	**0,732**
Social_cohesion	**0,731**
Proximity_from_the_center	**0,700**
Streets_quality	**0,697**
Economic_accessibility	**0,690**
Opportunity_for_physical_activities	**0,673**
See_other_people_walking	**0,663**
Income	**0,662**
Nutrition	**0,646**
Home_comfort	**0,637**
Air_pollution_free	**0,629**
Presence_of_food_store	**0,627**
Lifestyle	**0,611**
Safety	**0,608**
Natural_environment	**0,601**
Age	**0,569**
Sharing_values	**0,548**
Education	**0,541**
Physical_Activity	**0,519**
Pleasant_walking	**0,515**
Home_quality	**0,507**
Price_of_healthy_food	**0,500**
Presence_of_commercial_actitivities	**0,495**
Water_intake	**0,479**
Home_exposure_to__south	**0,477**
Not_for_profit_presence	**0,476**
Institutional_presence	**0,473**
Proximity_to_healthcare_facilities	**0,466**
Not_for_profit	**0,427**
Anti_alcohol_attitude	**0,419**
Anti_smoking_attitude	**0,418**
Soil_pollution_free	**0,410**
Intense_hour_day	**0,409**
BMI	**-0,347**

Source: Author's elaboration.

APPENDIX 5 - Neighbourhoods aerial photos and schemes

Neighbouhood 1: Macellari

Source: Author elaboration

Neighbouhood 2: Occhio

Source: Author elaboration

Neighbouhood 3: Pantanello

Source: Author elaboration

Neighbouhood 4: San Giovanni

Source: Author elaboration

Neighbouhood 5: Bocale I e II

Source: Author elaboration

Neighbouhood 6: Fiumarella

Source: Author elaboration

Neighbouhood 7: Mortara

Source: Author elaboration

Neighbouhood 9: Lume

Source: Author elaboration

Neighbouhood 8: Ribergo

Source: Author elaboration

Neighbouhood 10: San Leo

Source: Author elaboration

Neighbouhood 11: Pellaro Centro

Source: Author elaboration