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Article

Integrating Health Into the Urban Master Plan of Vic, Barcelona: A Comprehensive Approach

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Abstract
Planning healthier cities is essential for public health. However, there is a gap between the insights from public health research and applications to planning practice. Based on a scoping review and in cooperation with urban planners and public health professionals, this study developed evidence-based tools and a comprehensive approach to help urban planners integrate health into the urban master plan (2017–2020) of a medium-sized city named Vic (Barcelona). The scoping review included a systematic review of the literature (PubMed, PRISMA protocol) and an advanced Google search for gray literature (2015–2017). The systematic review identified significant associations between urban planning attributes (n = 16) and health outcomes (n = 21). After critical appraisal with stakeholders, an urban and health association matrix was developed to help urban planners understand the connection between urban planning and health. The advanced Google search identified urban planning actions (n = 117) that had an impact on health outcomes. After critical appraisal with stakeholders, a healthy urban planning actions checklist (n = 68) was developed to help urban planners' decision-making on the inclusion of locally tailored health-enhancing urban planning actions into the urban master plan. From the reviewed evidence and tools, a comprehensive approach delineated a series of steps that successfully led urban planners to incorporate health-enhancing urban actions (n = 112) into the urban master plan. This translational research developed a comprehensive approach to include health in local urban planning. This might scale up to other European medium-sized cities to maximise the effectiveness of built environment interventions and monitor their health impact.

Keywords
Barcelona; health in the city; medium-sized city; tools; urban master plan; urban planning

Issue
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1. Introduction

Urban settings are key social determinants of health (Cockerham et al., 2017). Traffic exposure, noise, air pollution, social isolation, physical inactivity, sedentary behaviour, unhealthy diets, and crime (Giles-Corti et al., 2016; Glazener & Khreis, 2019; Sallis et al., 2016) are all city-related health hazards that have a causal role in fostering chronic disease (Giles-Corti et al., 2016; Kleinert & Horton, 2016). Given that the global urban population

is expected to double by 2050 (United Nations, 2016), cities have a central role in improving populations' health (United Nations, 2015, 2016).

Tackling the way cities are planned is to fundamentally promote urban health (Giles-Corti et al., 2016; Nieuwenhuijsen, 2020). Poor urban designs are associated with an increased risk of chronic disease and premature mortality burden (Khomenko et al., 2020) and are environmental stressors for the severity of Covid-19 (Barouki et al., 2021). Thus, improving the built environment of communities, creating walkable environments, or increasing exposure to urban green and blue spaces are current priorities for public health (Frank et al., 2019; Frank & Wali, 2021; Higgs et al., 2019; Koehler et al., 2018; Smith et al., 2021).

Several reviews have identified interventions, policies, or actions that make cities healthier (Nieuwenhuijsen, 2018, 2020; Salgado et al., 2020; Wolf et al., 2020). However, designing health-enhancing urban environments is a complex task that demands systems-based and interdisciplinary methods (Goenka & Andersen, 2016; Vardoulakis et al., 2016). In a context where translational research in urban health studies is scarce (Rubio et al., 2010), there is a current need to systematically and practically approach the design of healthier cities (Sallis et al., 2016). Thus, enhancing the adoption of best practices by using multidisciplinary and collaborative approaches with key stakeholders in real-life practice settings (Rubio et al., 2010) is a key issue to bridge research-practice gaps in healthy urban planning.

Effective environmental decision-making is required to guide the design of new neighbourhoods or the redevelopment of existing built environments to become health-enhancing (Frank et al., 2019; Koehler et al., 2018). This is especially relevant at the earliest stages of city (re)development when urban planners draw urban master plans, defined as the technical long-term city planning instrument that indicates the main city layout to guide future land use growth, development, and preservation. Urban planners have a fundamental role in designing healthier cities and with public health evolving from a bio-medical to a socio-anthropological approach (Azzopardi-Muscat et al., 2020), there is a scarcity of decision support tools and comprehensive approaches to help urban planners effectively integrate health-enhancing services and infrastructures into local urban master plans.

Some decision support tools for policy and investment decisions exist in green infrastructure (van Oijstaeijen et al., 2020), urban transport planning such as the health impact assessments (Nieuwenhuijsen et al., 2017; Ramirez-Rubio et al., 2019) or the overall urban built environment (Pineo et al., 2020). However, these have been developed for large urban and metropolitan areas rather than for small- to medium-sized cities (5,000–100,000 inhabitants) that characterise most European settlements (Servillo et al., 2017). Examples include the national public health assessment model (N-PHAM) in America and Canada (Schoner et al., 2018), the US Environmental Protection Agency's Eco-Health Relationship Browser (http://epa.gov/enviroatlas), the Australian Urban Observatory (https://auo.org.au), which also includes some medium-sized towns and cities in Australia, the Pedestrian First tools for a walkable city (https://pedestriansfirst.itdp.org), and the resources developed by the US American Planning Association on how to incorporate health into planning (https://cpe.rutgers.edu/public-health/health-in-all-policies). In a context where (a) little systematic research exists on small- and medium-sized cities compared to large cities and (b) few tools exist to match the different implementation phases of the design of urban master plans, there is a current need to "scale up" (Milat et al., 2015) real-life practices of small- and medium-sized cities that integrate health-enhancing urban actions into local urban master plans.

Given the current research-practice gaps, our study aimed to develop evidence-based tools and a comprehensive approach—in cooperation with public health professionals and urban planners—to guide urban planner's practice on integrating health into the urban master plan (2017–2020) of Vic, a medium-sized city with 45,000 inhabitants near Barcelona (Spain). This research practice study can contribute to maximising the effectiveness of health-enhancing urban environments in small- and medium-sized cities and monitoring their health impact.

2. Materials and Methods

A scoping review (Arksey & O'Malley, 2005) of two phases was performed throughout the development of the urban master plan of Vic. First, a systematic review of scientific evidence aimed to examine the relationships between urban planning attributes and health outcomes. Second, an advanced Google search of gray literature aimed to identify real-life local urban planning actions that influenced such health outcomes. Gray literature usually contains information that is not available in academic or scientific documents (Paez, 2017), a key issue to identify health-enhancing urban practices grounded in the "real world."

The reviewed evidence was then cooperatively shared and critically appraised with key stakeholders (urban planners and public health professionals) involved in the urban master plan of Vic. According to Milat et al. (2015), both a systematic use of the reviewed evidence and sharing the evidence with key stakeholders are fundamental issues when putting research into practice. Based on participatory action research, which embraces principles of participation, reflection, empowerment, and emancipation of people and groups interested in improving their social situation, an expert steering group was built to allow stakeholders and researchers become contributing actors in the research enterprise (Berg, 2004). The steering group (n = 9), led by two researchers from the University of Vic, included urban

planners from the Vic City Council (n = 1) and the supramunicipal entity Barcelona Provincial Council (n = 2), as well as public health professionals from the Barcelona Provincial Council (n = 2) and the Faculty of Medicine at the University of Vic (n = 2). In this group, researchers shared their knowledge of the reviewed evidence and discussed with stakeholders how the evidence could be made usable for urban planners to develop the Vic urban master plan. This participatory approach has been described elsewhere (Juncà et al., 2019).

2.1. Systematic Review of the Literature

2.1.1. Search Strategy and Selection Criteria

Following the PRISMA protocol for systematic reviews (http://www.prisma-statement.org), relevant scientific articles in the database PubMed were searched from January 2015 to 31 December 2017. Search terms described two key search areas: (a) urban planning and environment and (b) health and health-related concepts. The search strategy is described in Supplementary File 1.

Scientific articles were included if studies quantitatively investigated the associations between attributes of urban planning and health behaviours and outcomes. One author selected the scientific articles by examining titles and abstracts and excluded those focused on (a) private or indoor built environments, (b) natural or agricultural settings, and (c) specific clinical populations. Full-text data of eligible records were critically appraised before inclusion in the comprehensive synthesis of relevant literature. Any disagreement about document eligibility was resolved by other authors. Manual searching of reference lists also identified additional relevant studies and systematic reviews.

2.1.2. Data Extraction and Theoretical Integration of the Literature

Data from scientific studies were extracted according to the PRISMA 2009 checklist (Moher et al., 2009): details on source (authors, year, and location, i.e., country or city); objectives; study design (description of participants, interventions, comparisons, outcomes, and design); urban planning attributes and measurement methods; health outcomes and measurement methods; and synthesis of the existing associations between urban planning attributes and health outcomes.

Data on health-related urban planning attributes were categorised into five groups: traffic, density, land use mix, connectivity, and landscape (Nieuwenhuijsen, 2020; Salgado et al., 2020). Data on health outcomes were categorised into physical (physical and behavioural), social (psychological, emotional and social), environmental, and global health risk factors according to the WHO health indicators description of what makes cities healthy (WHO Regional Office for Europe, 2009).

2.1.3. Summary and Report of Key Findings

A comprehensive analysis of the reviewed evidence identified urban planning attributes related to health outcomes. After critical appraisal with key stakeholders, a Matrix table that visually summarised statistically significant relationships between urban planning attributes and health outcomes was developed. The matrix helped public health professionals and urban planners understand the connection between urban planning and health.

2.2. Advanced Google Search

2.2.1. Search Strategy and Selection Criteria

A gray literature search of documents of governmental organisations and public agencies in the advanced search platform of Google was performed. The search randomly permuted a combination of key terms in the following areas: document; urban planning; environment; health and health-related concepts; internet domains; search operators; and specific symbols that acted as filters following the Google search criteria (the Google search strategy is described in Supplementary File 2).

The authors reviewed Google records by titles and nomenclature links shown as relevant in the Google algorithm. Only the first 100 records were cross-checked since relevant records tend to appear in the first 10 pages according to the Google search criteria. Exclusion criteria of documents included scientific papers, documents from non-public profit organisations, individual authors, and documents with the internet domain ".com," which usually belongs to private companies. Inclusion criteria of documents included the full text of eligible records for national and international documents that illustrated urban planning actions within the health-related urban planning attributes that were analysed. Relevant documents were downloaded in PDF and included in the final comprehensive synthesis. Any disagreement about document eligibility was resolved by other authors.

2.2.2. Data Extraction and Theoretical Integration of the Literature

The following data were systematically extracted from the selected PDF documents: (a) author and year of publication; (b) general and specific aims; (c) description of the health-enhancing urban planning actions; and (d) measurement and evaluation methods for the urban actions if any.

2.2.3. Summary and Report of Key Findings

Data extracted from the reviewed evidence identified urban planning practices that fitted within each health-related urban planning attribute that was identified in the systematic review (traffic, density, land use mix, connectivity, and landscape). Results were critically

appraised by urban planners to discuss health-focused planning practices that could be better incorporated into Urban Master Plans of medium-sized cities. A checklist of health-focused urban planning practices was created to help urban planners include urban actions tailored to the local health characteristics and needs.

2.3. Comprehensive and Participatory Approach With Stakeholders

A first meeting with the expert steering group discussed and reached agreements on how to apply the evidence from the systematic review of the literature into practice. Initially, researchers presented a report on the urban planning attributes related to health indicators. Then, results were shared among stakeholders who highlighted the need to develop a matrix to make the connection between urban planning and health easier to understand. Stakeholders' feedback was collected to determine the exact features of the matrix. After the first meeting, a matrix was developed by researchers who sent a first draft to stakeholders by email. Minor changes were suggested, for example, adding colours to each group of health-related urban planning attributes for better understanding.

In a second meeting, the discussion reached agreements on how to apply evidence from the advanced Google search into practice. Initially, researchers presented the long list of health-focused urban actions that had been identified in the Google search. Then, urban planners provided feedback on the health-focused urban actions they perceived to be more feasible to be implemented within small-to-medium sized cities. An agreement was reached about including the perceived most feasible health-focused urban actions in a checklist as an easy way to guide urban planners' decisions on how to integrate health services and infrastructures into the city urban master plan.

A third meeting agreed on how to develop and apply a comprehensive approach that was perceived as useful for stakeholders to integrate health into the city's urban master plan. Initially, urban planners presented a general plan on how they were intending to apply the matrix and checklist to include health-focused urban planning actions in the local urban master plan. The general plan was agreed upon by stakeholders and was decided to be applied in real life. After implementation, minor changes were suggested to make implementation easier, for example, using the checklist of urban planning actions first rather than the matrix. This allowed urban planners to count the number of actions included in the urban master plan that related to each urban planning attribute and health outcome.

3. Results

The systematic review of scientific literature generated 623 scientific studies that were screened by abstract. After excluding those studies that did not quantitatively investigate the associations between attributes of urban planning, health behaviours and outcomes the full text of 169 studies was critically appraised for final eligibility. Eighty-five studies failed to meet the inclusion criteria, and 84 studies were included in the comprehensive synthesis (see Figure 1). The Google search strategy yielded more than three thousand records. From the first 100 records, eighty potentially relevant documents were identified, 62 of which met the exclusion criteria. A total of 18 documents were included for analysis (see Figure 2).

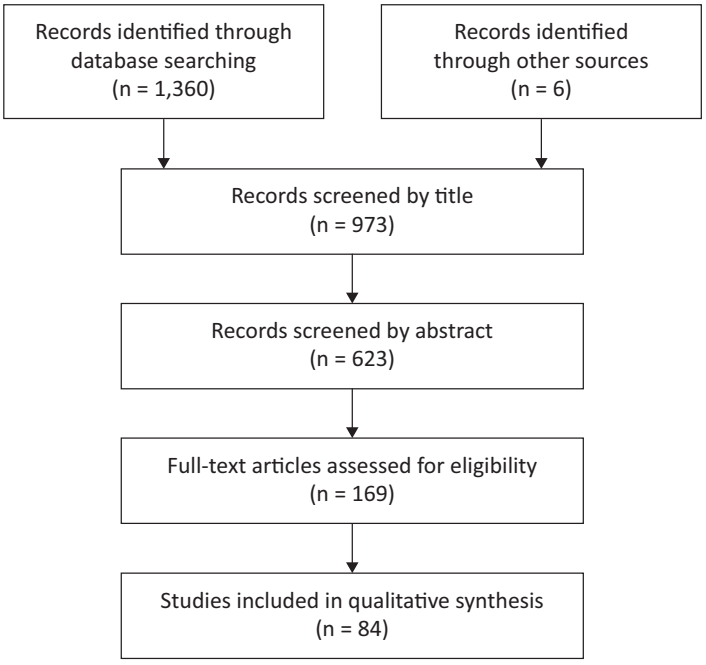

Figure 1. Flowchart diagram of the systematic review.

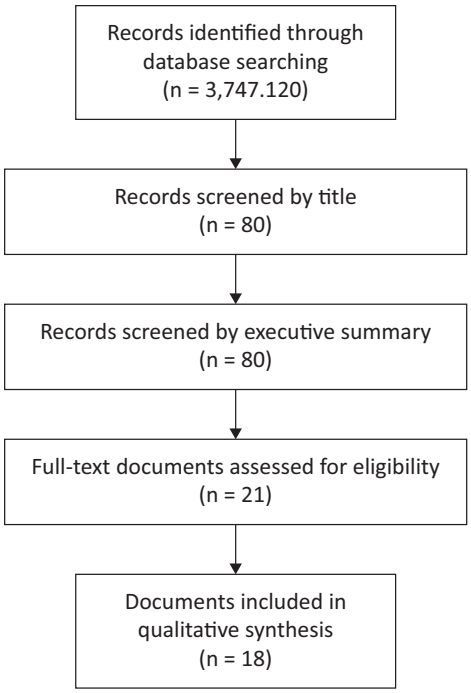

Figure 2. Flowchart diagram of the Google search.

3.1. Results From the Systematic Review

The studies were cross-sectional, systematic reviews and quantified the relationship between objective or perceived urban planning attributes and health outcomes. They were carried out in the US (n = 24), Canada (n = 12), followed by Europe (Spain, Germany, Finland, Norway, and Italy, n = 11), Asia (China and Japan, n = 7), Oceania (Australia and New Zealand, n = 5), Central and South America (Peru, Mexico, and Argentina, n = 3), South Africa (n = 1), and 21 studies were multinational including at least two different countries. The reference list is shown in Supplementary File 3.

A total of 16 urban planning attributes (see Figure 3) were significantly associated with 21 health outcomes (see Figure 4). Residential density, street connectivity, land use mix, walking and cycling infrastructures, open public spaces (i.e., green areas), aesthetic attributes, crime, traffic safety, and walkability were related to the widest range of health outcomes, especially physical activity and weight control. Significant associations between urban planning attributes and health outcomes are shown in Supplementary File 4. After critical appraisal with urban planners and public health professionals, an urban and health association matrix (UHAM) was designed to help urban planners and public health professionals understand the relationship between urban planning and health (see Figure 5).

3.2. Results From the Advanced Google Search

The selected documents (n = 18) were published by governmental organisations from Australia (n = 2), Canada (n = 2), the US (n = 1), Europe (n = 2), Hong Kong (n = 1), the UK (n = 4), Sweden (n = 1), and global public agencies (n = 5) such as the World Health Organization and Interreg Europe. They were descriptive documents that formed the basis of territorial projects and urban planning strategies that were either already developed or were future planned. The reference list is shown in Supplementary File 5.

A total of 117 urban actions fitted within the five groups of health-related urban planning attributes previously identified. Density grouped actions to promote compact cities and proximity commerce (6.84%, n = 17). Land use mix grouped actions referring to the diversity of the built-environment uses for everyone (25.90%, n = 55). Connectivity grouped actions related to urban network connectivity and pedestrian and cycling pathway designs (40.17%, n = 52). Traffic included actions related to reducing traffic volume and speed, as well as increasing road safety (23.83%, n = 28). Landscape included actions on how to improve cities' aesthetics and the greenery of public open spaces and natural areas (73.50%, n = 88). The complete list of health-enhancing urban actions is shown in Supplementary File 6.

After critical appraisal with urban planners and public health professionals, a healthy urban planning actions checklist (HUPAC) was developed to better suit small to medium-sized cities. This HUPAC was created as a menu of choices for healthy urban practices to help urban planners decide on health-focused urban planning actions that could be included in the urban master plan of the city. The HUPAC (see Table 1) consisted of 68 urban actions on density (n = 7), land use mix (n = 3), connectivity (n = 26), traffic (n = 4), and landscape (n = 28).

URBAN PLANNING ATTRIBUTES		
DENSITY	01	Population density
	02	Business density
CONNECTIVITY	03	Intersection density and street connectivity
	04	Cycling infrastructure
	05	Walkability / pedestrian infrastructure
	06	Public transport density
LAND USE MIX (DIVERSITY)	07	Health, wellness and community services
	08	Entertainment, culture and recreation services
	09	Physical and sport infrastructures
	10	Public open spaces
LANDSCAPE	11	Green and blue areas (greenness index, vegetation coverage)
	12	Aesthetic and cleanness
	13	Urban furniture
	14	Maintenance and lighting
TRAFFIC	15	Slow-moving and heavy traffic / Truck routes
	16	Traffic volume

Figure 3. Urban planning attributes (n = 16) significantly associated with health indicators.

HEALTH INDICATORS			
Physical Health	Physical	F01	Obesity and overweight
		F02	Diabetes
		F03	Cardiovascular diseases
		F04	Asthma and respiratory diseases
		F05	Functional capacity
		F06	Accidents and falls
		F07	Pain
	Behavioural	F08	Physical activity
		F09	Sedentary behavior
		F10	Food habits
Social Health	Psychological, emotional and social	S01	Support and social skills
		S02	Stress and anxiety
		S03	Depression
		S04	Cognitive function
		S05	Emotional wellbeing
		S06	Attention deficit
		S07	Mental health and psychological disorder
Environmental		A01	Noise pollution
		A02	Air pollution
Global		G01	Wellbeing and quality of life
		G02	Vitality and happiness

Figure 4. Health indicators (n = 21) significantly associated with urban planning attributes.

URBAN PLANNING ATTRIBUTES		HEALTH INDICATORS																				
		PHYSICAL HEALTH										SOCIAL HEALTH							ENVIRONMENTAL		GLOBAL	
		PHYSICAL							BEHAVIOURAL			PSYCHOLOGICAL, EMOTIONAL AND SOCIAL										
		F01	F02	F03	F04	F05	F06	F07	F08	F09	F10	S01	S02	S03	S04	S05	S06	S07	A01	A02	G01	G02
		Obesity and overweight	Diabetes	Cardiovas-cular diseases	Asthma and respiratory diseases	Functional capacity	Accidents and falls	Pain	Physical activity	Sedentary behaviour	Food habits	Support and social skills	Stress and anxiety	Depression	Cognitive function	Emotional wellbeing	Attention deficit	Mental health and phychological disorders	Noise pollution	Air pollution	Wellbeing and quality of life	Vitality and happiness
Density	Population density	1							7	1		1		1		1				1		
	Business density				1				1											1		
Connectivity	Intersection density and street connectivity	2							15	2		1								1		
	Cycling infrastructure	1	1						6													
	Walkability and pedestrian infrastructure	4	1	1		1		1	15	1										1	2	
	Public transport density	1							5	1				1								
Land use mix	All four subgroups included	3					1		10vxl	1											2	
	Health wellness and community services	2							4	2	1vxl										2	1
	Entertainment, culture and recreational services	2							6		1										2	
	Physical and sport infrastructure	2		1		1			3	1												
	Public open spaces	1		1				1	15	1			2	1				2			1	
Landscape	All four subgroups included						1		2	1												
	Green and blue areas (greeness index, vegetation coverage)	2			1	1			6	1			2	1	1	1			1	1	2	
	Aesthetic and cleanness	2	1	1			1		9	1						1	1				1	
	Urban furniture								1													
	Maintenance and lighting						1		5	1											1	
Traffic	Traffic volume	1		1					2	1							1		1	2	1	
	Truck routes	1		1	2														1	2		
	Slow-moving and heavy traffic				2		1		8	1					1							

Negative association — Number of articles found — Positive association

>5 | 2 to 5 | 1 | 1 | 2 to 5 | >5

Figure 5. The urban and health association matrix for urban planners: Understanding associations between urban planning attributes and health outcomes.

Table 1. The healthy urban planning action checklist for urban planners.

Density
Proximate Commerce
Ensure space for proximity commerce in all neighbourhoods
Plan for bicycle parking spaces and bicycle paths
Areas with fountains and shade around the trade area
Compact City
Prioritise growth within the city itself, avoiding large extensions
Reuse obsolete interior spaces of the city as a priority for growth
Improve green infrastructure in areas of high density
Ensure connectivity between the different green areas
Connectivity
Urban Network Connectivity
Maintain the continuity of sidewalks
In the new areas of growth, limit the size of the blocks
In built areas with low permeability, promote passages through buildings
Avoid overpasses or underground passes for pedestrians
In high-density pedestrian streets, avoid median-island accesses for vehicles
Ensure access to the main public buildings
Improve access to short distance parks and natural areas
Create ecological corridors along the green and blue ecosystems
Connect the bus stops with the train stations
Pedestrian Pathways Design
Separating pedestrians from vehicles using furniture, trees, etc.
Provide benches, fountains and rest areas as support for longer journeys
Outdoor lighting along the streets and pedestrian routes
Incorporate trees and other visually appealing elements along the routes
Wide pavements suitable for use
Pedestrian crossings at intersections
Ensure a network of roads in continuity with the pavements and pedestrian routes, improving the connectivity of the walking routes
Create pedestrian routes oriented towards elements or points of interest
Streets and roads accessible to users with reduced mobility: width, radius of rotation, suitable crossing time, visible access ramps, etc.
Bicycle Network Connectivity
Define a basic structure of bike lanes, with connections to the rest of the network
Provide links between different modes of transport
Bicycle Network Design
Use marks or signals to reinforce the separation between motorised areas and cyclist areas
Enlarge bicycle network if its use exceeds the capacity
Special attention to intersections to improve visibility between cyclists and cars
Reduce conflicts between cyclists and the opening of vehicle doors. Expand parking width when needed
Promote greenways with external connection
Cycling Infrastructure
Foresee spaces for parking bicycles along and at the end of the routes
Land Use Mix
Urban planning that fosters the mix of uses and activities (housing, offices, schools, trade, green areas, etc.) avoiding specialised areas in a single activity
Provide housing and work spaces in proximity to green spaces, parks, paths etc.
Promoting trade and services around housing and office areas

Table 1. (Cont.) The healthy urban planning action checklist for urban planners.

Landscape
Parks, Open Spaces, and Recreational Areas
Prioritize about open spaces as an essential part of urban development
Integrate the planning of green and blue ecosystems
Ensure access to green areas within 250m of homes
Ensure access to a large park within 10 minutes walking distance
Create or improve urban forests
Improve the access (security and visibility) of cyclists and pedestrians to large parks and green areas
Assess the different possible uses for open spaces: sports, urban gardens, children's playground, meeting point …
Create emblematic parks as key elements of the green infrastructure
Improve the equipment of the parks to facilitate their use: paths, furniture, fountains, benches, children's areas)
Planning new open spaces in proximity to public buildings and infrastructure
Designing parks considering the use and preferences of the local population and age groups
Promote partnerships with organisations and/or businesses to sponsor to maintain parks and gardens
Create a green belt around the city
Playgrounds
Include areas for sports and multi-use areas
Preserve the natural land as far as possible
Lighting to promote use during winter
Provide suitable spaces for different seasons and weather conditions
Public Space
Place green areas along the main pedestrian paths
Place squares near traffic stops
Ensure the access of cyclists to the green areas
Ensure squares and green areas have different uses
Foresee the possible uses in a variety of climatic conditions
Leisure and Sports
Improve the infrastructure to promote sport and physical activity
Provide the infrastructure to practice physical activity and sports activity in all city contexts such as public parks, trails, and recreational facilities among others.
Aesthetics
Avoid abandoned or underused spaces in the city
Green Cover and Vegetation
Use species adapted to the climatic zone
Promote green roofs and facades on buildings
Increase the number of trees in vulnerable areas
Traffic
Public Transport and Parking
Provide car parking areas to facilitate the exchange of transport mode, promoting active mobility
Provide car parking at the entrances of the city in connection with pedestrian routes
Traffic Calming
Reduce the width of the roads to promote lower speed
Incorporate speed reducers

3.3. Results From the Comprehensive Approach for Incorporating Health-Focused Urban Planning Actions Into the Urban Master Plan of Vic

As a result of the developed evidence-based support tools and in cooperation with urban planners and public health professionals, a comprehensive approach was designed to include health-focused urban planning actions in the urban master plan of Vic. The comprehensive approach delineated five specific steps (see Figure 6):

- Step 1: Urban planners identified the urban planning attributes related to health (see Figure 3).

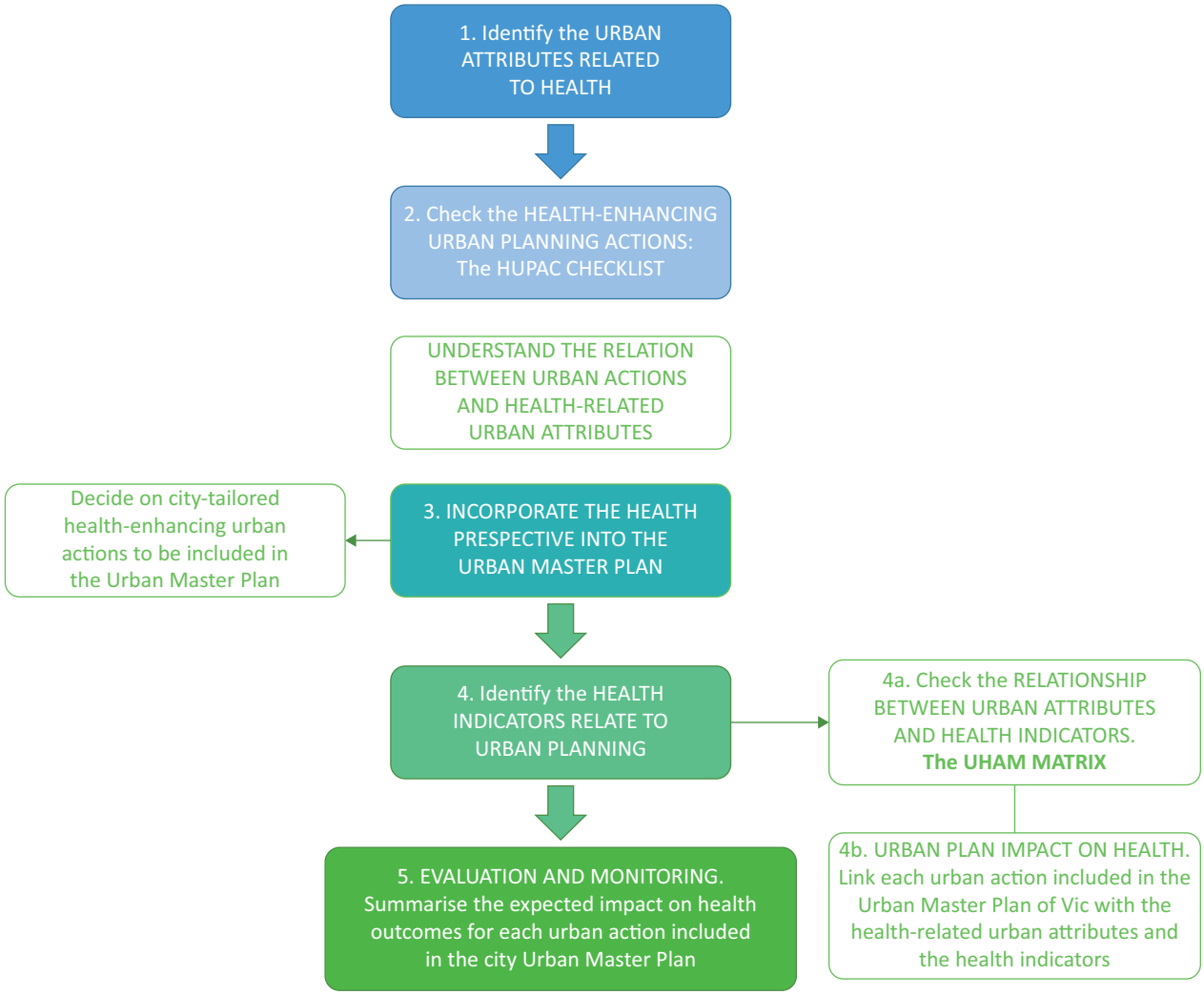

Figure 6. Comprehensive approach to connect the urban planning actions of the Vic urban master plan with the health-related urban attributes and citizens' health.

- Step 2: Urban planners checked the HUPAC as a guide to identify examples of practices for health-focused urban actions.
- Step 3: Urban planners chose and decided on city-tailored health-focused urban planning actions to be included in the Vic urban master plan.
- Step 4: Urban planners checked the UHAM to connect each urban planning action included in the Vic urban master plan with the urban planning attributes and health-related indicators identified by the reviewed evidence (Figure 7).
- Step 5: Urban planners summarised the expected impact on health for each urban planning action included in the Vic urban master plan according to the UHAM.

As a result, 112 local health-focused urban planning actions were successfully incorporated into the local urban master plan of Vic (see Supplementary File 7). Each urban planning action was related to one or several of the 16 health-related urban planning attributes. In turn, these were associated with one or several health outcomes (see Figure 6, step 4b; see also Figure 7). For example, "completing the green ring of Vic" (street connectivity and walkability) was designed to positively impact citizens' physical activity and emotional well-being. This comprehensive approach allowed urban planners to have a global overview (see Figure 6, step 5) of the expected impact the urban master plan of Vic might have on health-related urban planning attributes (see Figure 8), and the expected impact of the overall local urban planning actions included in the Vic urban master plan on health (see Figure 9).

4. Discussion

This study developed evidence-based tools and a comprehensive approach to help urban planners integrate health-focused urban planning actions into the urban master plan of a medium-sized city named Vic, Barcelona (Spain). This provided a unique opportunity to perform translational research to improve urban built

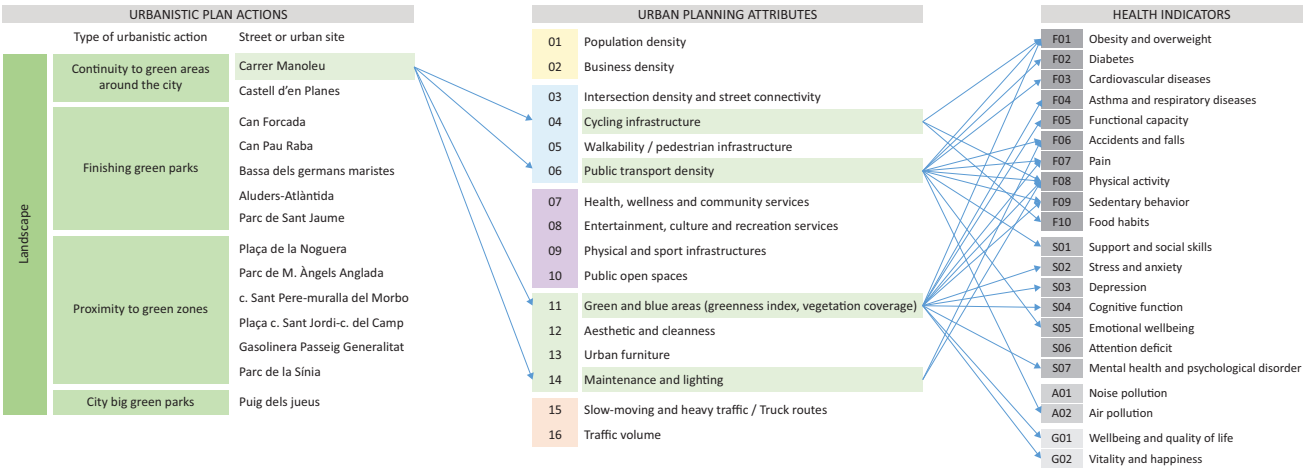

Figure 7. Example of how urban planning actions included in the Vic Urban Master Plan were linked to the health-related urban planning attributes and health indicators.

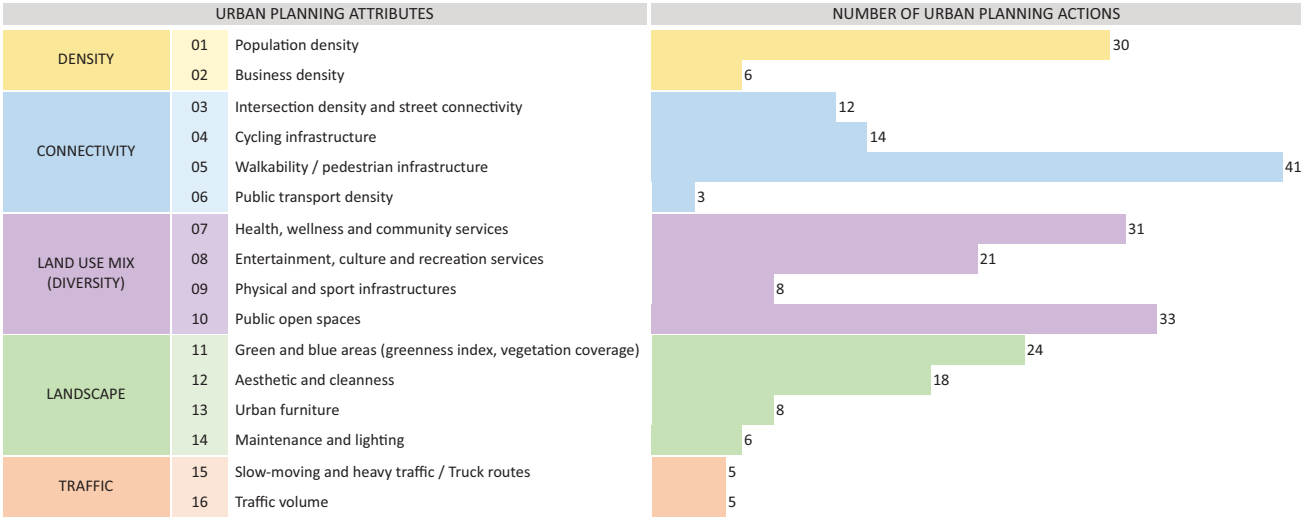

Figure 8. Overview of the number of urban planning actions included in the Vic urban master plan that relate to the health-related urban planning attributes.

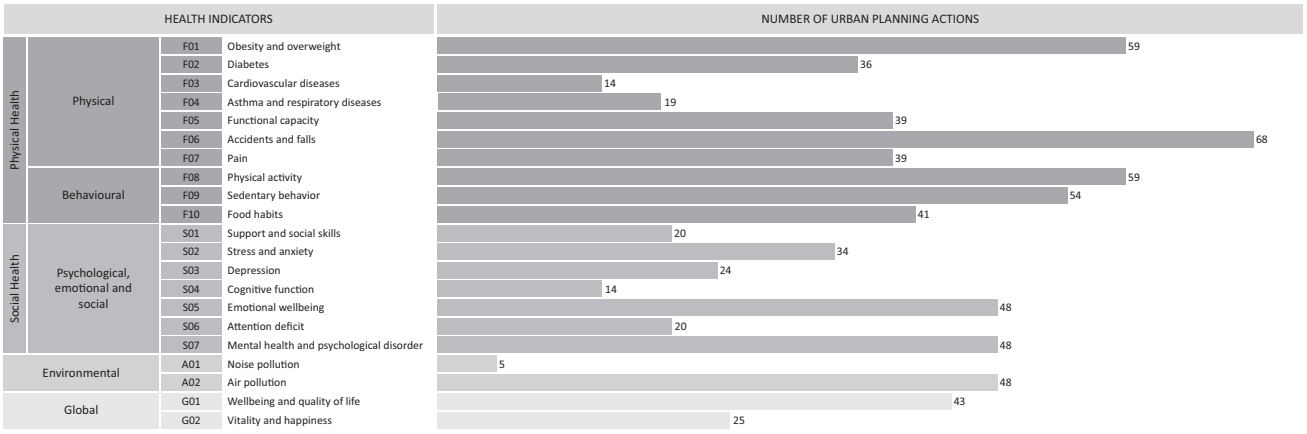

Figure 9. Overview of the number of the urban planning actions included in the Vic urban master plan that relate to the health indicators.

environments at the earliest stages of planning development in order to foster citizens' health and well-being (McKinnon et al., 2020). This study also contributes to scaling up the inclusion of health in the local urban planning of small to medium-sized cities on which the European pattern of settlements mostly depends (Servillo et al., 2017). This is a relevant public health topic that was emphasised during the pandemic when urban planning was identified as a key strategy to improve citizens' health (Frank et al., 2019).

The development process was guided by a systematic review of scientific evidence and gray literature, as well as the use of participatory approaches with stakeholders, two key factors for effective scaling up (Milat et al., 2015). The UHAM, the HUPAC, and the comprehensive approach were successfully implemented in urban planners' daily work and could be useful to help other urban planners integrate health into local urban planning. This would facilitate the much-needed multidisciplinary work across urban planning and health disciplines (McKinnon et al., 2020). The implementation of a UHAM and a HUPAC represented a low-cost translational comprehensive approach that seemed to overcome the main barriers to applying baseline research into something as practical and specific as an Urban Master Plan. The main barriers identified by stakeholders in the steering group included (a) the complexity of working multidisciplinarily with professionals that address the same issue from different perspectives and (b) applying evidence-based information in a comprehensive way so it guides professional action and decision-making. This work contributes to implementation research that is needed to enhance population health by identifying and synthesizing evidence that shifts toward greater stakeholder input (Lobb & Colditz, 2013). This shift improves the relevance of the information that is produced and guides decision-makers in their implementation of research-based interventions (Lobb & Colditz, 2013).

City planning is an essential element to fight the major global health challenges of the 21st century (Sallis et al., 2016). Therefore, facilitating the implementation of a health-oriented urban master plan is fundamental to address the existing gap between what is known in public health research and what gets implemented in urban planning practice (Milat et al., 2015). To our knowledge, research on urban health has focused on developing national urban indicators to describe what constitutes a healthy and liveable city (Alderton et al., 2019; Giles-Corti et al., 2014), exploring the capacity of urban policies to create healthy and liveable cities (Giles-Corti et al., 2020), providing quality criteria and validated instruments for evaluating municipal environmental planning in metropolitan areas (Poza-Vilches et al., 2020), understanding the influence of key actors, planning approaches and health-data characteristics to inform urban health planning (Mirzoev et al., 2019), and carrying out health impact assessments to estimate the health gains of city planning interventions like active transportation (Rojas-Rueda et al., 2012). Studies on urban health are predominantly cross-sectional and reviews (Mueller et al., 2015); therefore this study provides a systematic and practical approach to the design of health-enhancing cities (Sallis et al., 2016) with a special focus on medium-sized cities. This is especially relevant since most urban research focuses on large metropolitan areas.

Previous studies have identified similar results on the relationships between urban planning attributes and physical, behavioural, psychological, emotional, social, environmental and global health (Hankey & Marshall, 2017; Mueller et al., 2021; Sallis et al., 2016). Several systematic reviews have studied the relationships between built environments and physical activity (Smith et al., 2017), cardio-metabolic health (Chandrabose et al., 2019), mental health and wellbeing (Moore et al., 2018). However, there is a lack of comprehensive approaches—specifically tailored to urban planners—for adopting practices that enhance community health through better environmental decision-making. The development of several health-enhancing urban built environment interventions in Vic, Barcelona, could contribute to attenuating future environmental, social, and behavioural health hazards of this city.

This study has a number of limitations. First, the comprehensive approach and tools for introducing health outcomes into urban master plans were developed for a specific European, Mediterranean, medium-sized city. To be scaled up to other medium-sized cities, caution is needed and contextual differences might have to be considered. Second, it is very likely that the checklist did not include all the urban planning actions published in Google within the health-related urban planning attributes. The vast amount of existing information was a limiting factor, but many urban planning actions were listed (n = 117) and data saturation was reached. In the future, the checklist of health-focused urban planning actions should be expanded to include new urban planning actions that will be developed over time. Similarly, the UHAM should be further expanded to include any newfound relationships between urban attributes and health outcomes. Future work should also build the comprehensive approach and tools into technological platforms (i.e., web tools) to make urban planners' practice easier.

This study has a number of unique features. First, it involved applied research at the early stages of the development of urban places. Second, it involved a scoping review which is more explanatory and describes a broader field of inquiry than systematic reviews (Arksey & O'Malley, 2005). The scoping review illustrated the range and nature of real-life activity in the research practice area of urban planning and health. Third, the comprehensive approach and tools were developed by bringing together different disciplines, including public health professionals, urban planners, and researchers.

5. Conclusion

In the 21st century, addressing the social and built environment factors that influence the health of individuals and communities is a key issue for preventing disease, promoting health and well-being (Cockerham et al., 2017), and achieving the United Nations SDGs 3 and 11 for 2030. Developing evidence-based tools that help urban planners to design and build health-focused urban actions for urban master plans is a key element for the promotion of urban health. This study contributes to translational research by developing a comprehensive approach that might scale up the inclusion of health-focused urban actions in the design of other urban master plans of other small to medium-sized European cities. It represents a contribution to implementation research that is needed to enhance population health (Lobb & Colditz, 2013). This could maximize the effectiveness of creating health-enhancing urban environments from zero, allowing for a more effective evaluation and follow-up of their health impact.

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Conflict of Interests

The authors declare no conflict of interests.

Supplementary Material

Supplementary material for this article is available online in the format provided by the authors (unedited).

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