

Article

Transdisciplinary Responses to Children's Health Challenges in the Context of Rapid Urbanization

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Abstract: Urban transformations are complex, dynamic, and systemic societal phenomena that have many positive and negative consequences, including irreversible changes to land-use and loss of soil permeability, deforestation and accelerating losses of biodiversity, energy consumption and increasing volumes of green-house gas emissions, demographics and greater socio-economic inequalities, and accelerating incidences of non-communicable diseases. These omnipresent diseases (e.g., asthma, cancers, cardiovascular diseases, type 2 diabetes) have no cultural, geographical, or socio-economic boundaries and they impact all age groups including children and young adults. Local and national authorities North and South of the Equator, and international organizations and networks, have rarely responded effectively to children's health challenges in the context of rapid urban development. The purpose of this article is to describe and illustrate more effective approaches. It proposes new ideas, founded on collective thinking involving several disciplines and professions, and new working methods, founded on collaboration with community associations in civil society. Both promote shared understandings about the complex, dynamic, systemic, and emergent nature of urban health risks for children. The article explains why transdisciplinary contributions should be distinguished from multi- and inter-disciplinary contributions, and it presents examples of participatory action research in the WHO European region about children's health.

Keywords: European cities; children's health; non-communicable diseases; transdisciplinary contributions; urban health risks

1. Introduction

Change is a core component of human life, health, human habitats, and the world. Change has been interpreted as a natural condition for individuals, households, and societies. However, some changes are gradual and predictable, whereas others are abrupt, radical, unpredictable, and perhaps disruptive. Change can derive from both internal and external parameters. History confirms that societies are assessed by the way they interpret and respond to internal and external parameters. In recent decades, this approach has been associated with concepts including adaptation, resilience, and sustainable development. Moran [1] and Bennett [2] agree that responses to ecological, economic, and health threats have highlighted the capability of different societies to respond to risks in both short- and long-term perspectives.

The foundation, construction, and growth of cities since the beginning of urban history about 10,000 years ago has undergone a series of cycles of urban expansion associated with demographic and economic growth, as well as technological innovations applied to agriculture and food production, the construction of large buildings, infrastructure and communal services, and novel communication

and transportation systems. Innovations in public health were also fundamental parameters that sustained urban populations despite major threats from infectious diseases. In many European cities and countries, societal responses were instrumental in counteracting public health threats by reducing illness and mortality during the last half of the 19th century [3]. A key challenge today is whether effective responses will be implemented to reduce increasing trends in chronic, non-communicable illnesses, especially among children and young adults. These collective responses should be more comprehensive than projects on specific sites or urban neighborhoods; they should be defined as societal transitions that become transformations at micro-, meso-, and macro-levels.

Constructing urban environments that support, nurture, and sustain the health and well-being of current and future generations of children requires political commitment and communal engagement in collaboration with private enterprises in the planning, housing, and construction sectors. This concerted action should be a core component of sustainable development at both national and local levels. The United Nations 2030 Agenda for Sustainable Development and the New Urban Agenda provide frameworks defined by 17 SDGs and 169 targets [4].

There are two main origins of the construction of cities. The first is grounded in idealism, symbolism, and utopian thinking [5]. Utopian visions provided conceptual foundations for planning, designing and constructing new cities in the last century including Canberra (Australia), Chandigarh (India), Brasilia (Brazil), and Putrajaya (Malaysia). This first origin is founded on ideas about the radical transformation of existing landscapes, whether agricultural fields, small towns, or pristine natural ecosystems. These visions of human habitats were often expressions of national development and economic growth. A rare example of sustaining communities by urban planning was the novel vision of garden cities proposed by Ebenezer Howard [6]. He was preoccupied by housing and feeding a rapidly growing urban population at the end of the nineteenth century. His vision of garden cities was a network of small, self-sufficient human habitats connected together by a railway service; the antithesis of so much suburban sprawl constructed on the outskirts of cities during the last century.

The second origin of constructing cities is defined by authoritarian interventions to change existing built environments or natural landscapes. Examples of this type of contribution include the reconstruction of the city of Lisbon, after the earthquake of 1755, using a different layout of building sites, streets and public spaces compared with those that had been demolished. During the nineteenth century, collaboration between individuals and institutions leading the housing reform movement and the Public Health movement, in British and many other European cities, proved effective in implementing corrective measures that reduced health risks from infectious diseases, including cholera, influenza, and tuberculosis, that were rampant in many cities. Then, the concerted action of architects, engineers, medical practitioners, politicians, and social reformers addressed housing and health problems of epidemic proportions [3]. A sanitary engineering approach, based on corrective and remedial measures, was effective in removing unsanitary conditions by demolishing buildings and reconstructing neighborhoods with drainage, sewage, and water infrastructure and services. This second origin of urban planning changed an extant situation by incremental and localized modifications. This approach is pertinent in many cities South of the Equator that have accommodated rapid population increases without adequate provisions for affordable and safe housing, communal services and infrastructure, thus creating compound health risks.

The long history of epidemics of contagious diseases, including cholera, influenza, typhoid, and tuberculosis, confirm that the built environment is only one of many composite variables that define healthy living environments for children and all other age groups. Recently, this component of public health has been supplemented by formerly unknown urban health challenges, including SARS coronavirus, Ebola, avian flu and H1N1viruses. The agents of these communicable infections are new and highly unpredictable [7]. In 2003, the case of the outbreak of severe acute respiratory syndrome virus (SARS) confirmed how buildings and urban neighborhoods are unable to function normally when public health is challenged by threats of new epidemics that transgress national boundaries, in this case, from Guangzhou, China, and Hong Kong to Toronto, Canada, and 28 other countries [8].

Both types of incremental and radical transformation of cities confirm that urban development is a societal process that defines and implements change for several purposes, and at different geo-political levels (from individual buildings, to neighborhoods, cities, and mega-urban regions) [9]. We consider that many contributions about urban transformations have focused too heavily on the physical or built environment and change related to technological innovation that is often proposed by an elite group of experts [10]. In contrast, this article enlarges these contributions by reconsidering fundamental meanings of urban transformations proposed to improve public health and well-being in cities. It argues that cognitive and behavioral change, whether individual, household, group, or societal, is necessary in conjunction with the provision of urban infrastructure and community services. It reconsiders how these change processes embody fundamental ideas and core values about health and quality of life.

The following section presents key concepts and their applications in response to contemporary urban health challenges in Europe, and especially children's health and well-being. Both incremental and radical change are considered in the framework of research on transitions, transformations and social change. These concepts are considered in relation to responses to urban health challenges for children and young adults in the European region.

The research method for this article is the documentary analysis of published databases, statistics, and reports that record the development of chronic health risks in cities, and especially for children living in the European region. These official documents have been published since the 1990s, and collectively they indicate increasing incidences of negative impacts of urban living conditions and lifestyles in European cities. These trends indicate ineffective societal responses despite empirical data and scientific knowledge about them.

In essence, planning and constructing urban environments that promote and protect the health and well-being of current and future generations of children and young adults should be considered as an enlarged public health challenge that is a core component of sustainable development in a rapidly changing world. This enlarged interpretation is not mono- or multi- disciplinary but explicitly inter- and trans-disciplinary. It requires collaboration and coordinated interventions of consortiums of individuals and institutions both within and beyond the health and medical disciplines and professions.

2. Urban Transitions and Transformations

2.1. Incremental and Radical Urban Change

Transitions and transformations are two nomad concepts borrowed from the biological sciences and increasingly used in urban planning, sociology and political science in relation to sustainability [2]. Transition denotes incremental change processes, over relatively long periods, and a shift from one condition or state to another. A common example is the human lifecycle developing through childhood to adolescence and adulthood. A societal example is the demographic transition that comprised a significant and enduring change in population dynamics from high birth and death rates to a new societal state of low birth and death rates in many countries [11]. This well-known transition occurred over a long period for a number of reasons that included the provision of paid employment, access to affordable health and medical services, and sanitary housing and living conditions in rapidly growing post-industrial cities.

Transition management is a term used to control or orientate societal transitions towards desired outcomes, or objectives, by the collective definition and implementation of step-by-step phases that comprise a multi-phase process [12]. For example, political decisions to shift from high fossil fuel consumption in the transport sector to increasing uses of renewable energy sources with low carbon footprints require a policy mix of means and measures to ensure that objectives will be achieved. This is precisely the case regarding incentives introduced by the national government of Norway for purchasing electric motor cars during the last decade. The provision of new infrastructure is a prerequisite before consumption patterns can change. In principle, this example illustrates that societal transitions encompass interconnected sets of behavioral, financial, political and technological

parameters, as well as rethinking fundamental values about the status of humans on Earth and in the biosphere.

Transformation is interpreted as radical or complete change, in contrast to piecemeal and incremental change that characterized much urban development during the last two centuries to counteract infectious diseases (see above). The key question is to identify and implement those interventions required to overcome persistent problems that are major threats to public health; in particular, to counteract recent alarming trends in the growing incidence of chronic, non-communicable diseases, especially among children and young adults in many European countries [13].

Empirical research since the 1990s confirms that residents and visitors in many European cities are confronted by chronic problems in cities that impact negatively on health and well-being. For example, increasing levels of air and water pollution, accelerating losses of biodiversity, growing socio-economic inequalities, a persistent lack of affordable housing, and access to affordable primary health care [14]. The World Health Organization European Region (WHO-Europe) is one of WHO's six regional offices in the world. It comprises 53 countries, extending from Iceland and Portugal, by the Atlantic Ocean, to Siberia and the Russian Federation, bordering Pacific ocean. In this vast region, health threats for children include poor indoor air quality and outdoor air pollution, poor water quality and inadequate sanitation, unhealthy nutrition and food contamination, unsafe building standards and play areas, hazardous chemicals, ionizing and non-ionizing radiation, risks of traffic accidents from road transport, natural disasters and climate change, poverty, adverse social and communal environments, and negative impacts of armed conflicts [15]. Multiple public health threats of these kinds should create local and national responses that promote and protect health and quality of life in cities, especially those populations at high risk.

One coordinated response at the European level was the endorsement of the Children's Environmental Health Action Plan for Europe (CEHAPE) in 2004 at the fourth Ministerial Conference on Environment and Health. This Action Plan was defined in order to implement coordinated interventions at the local (city), the national (country), and the Regional (Europe) levels according to the specific population health circumstances, and the priorities and the resources in cities and countries [15]. These actions are also framed by comparative data and information about the health of children across the region that have been collected systematically by the WHO Regional Office for Europe [16]. This Action Plan incorporated targets included in the Millennium Development Goals (MDGs).

A growing volume of data, statistics and other kinds of information about urban health risks indicate large differences between cities as well as intra-urban differences within cities [17]. Despite the accumulation of empirical knowledge in the European region, societal responses from both the private and public sectors are not providing effective counter measures in many European countries at either national or local levels. Licari et al. proposed six categories of responses that can be implemented at either national, or local levels. These categories are:

- Enacting and enforcing legislation to protect and promote children's health;
- Disseminating educational programs about children's health;
- Engaging relevant stakeholders in specific initiatives;
- Producing knowledge by empirical research and implementing case studies;
- Monitoring environmental exposures and health impacts;
- Improving health care and welfare [15].

Alone, these six categories of responses may not be effective in dealing with urban health risks that children face in the European region. In spite of good intentions, there is too little attention to the role and responsibility of private enterprises, especially those multinational companies that market and produce tobacco, soft drinks, candies, and industrially produced foods that are known to impact negatively on children's health. The commitment of private enterprises to reduce health risks for

children and young adults is essential if effective responses are to be formulated and implemented. This is precisely because these risks should be understood as complex and persistent in many cities. The emergent properties of these kinds of problems will now be briefly presented.

2.2. *The Complex Nature of Persistent Public Health Problems*

The term ‘persistent problems’ was proposed by Broerse and Bunders to analyze why reforms to health systems and services have not always led to intended changes [18]. In transition theory, ‘persistent problems’ has been used to understand situations that are considered in terms of alternative plausible futures. Persistent problems can be characterized by their multiple causes and consequences, grounded in societal norms, institutions and structures. Owing to their systemic nature, they cannot be resolved by simple solutions [19]. They are difficult to understand and manage owing to a large number of individuals and institutions involved. They are multi-level and have a dynamic nature because any change can be dispersed across the whole system. Finally, they are enduring, sometimes resisting change. This emergent and systemic interpretation suggests that the complex multi-level dynamics of societal change cannot be understood by any single research method. It also indicates why enduring problems with agro-industrial food systems, housing markets, and public transport that all influence health and well-being are not resolved.

Alternatives to persistent problems in cities and large metropolitan areas require interventions that cannot be wholly defined and controlled by scientific methods that produce more empirical data and information. Scientific and evidence-based knowledge about children’s health is necessary but not sufficient to define priorities and make decisions about implementing policies and programs at national and local levels [20]. In essence, there are three types of empirical knowledge about health risk factors that impact children’s health: First knowledge from rigorous scientific research (including systematic reviews and randomized controlled trials); second, knowledge from experiences in one or more cities or countries that have not been evaluated using scientific methods (such as case studies or interventions in specific localities); third, recognition of a lack of data and information about health hazards (in such cases the precautionary principle should be used). These kinds of knowledge and levels of understanding confirm that judgments and subjective values need to be expressed and applied about the rights of children and the responsibility of society to protect future generations who generally have no voice in decision-making.

This article posits that virtuous relations between knowledge produced by scientific research, and professional skills and competences, can be combined with community-based knowledge and know-how to implement child friendly urban environments that are environmentally responsible, economically fair, socially inclusive, and just. The article explains that both incremental and radical transitions and transformations are indispensable in order to implement the goals and targets of the United Nations 2030 Agenda for Sustainable Development. Our research endorses the proposition by Lawrence, Capron, and Siri [21] that urban planning and the construction sector provide a range of settings for effective responses to many contemporary challenges including growing cases of inadequate affordable housing and persistent homelessness, lack of access to primary health care and growing incidences of chronic diseases, and increasing socio-economic inequalities as well as social exclusion.

A later section of this article discusses and illustrates how community associations, private enterprises, public administrations, and local authorities can form transdisciplinary consortiums to promote and protect children’s health and well-being. It explains that transformational change and transitions are created by comprehensive systems of relational thinking that transgress conventional boundaries of scientific knowledge, founded only on discipline-based competences, and professional skills that have segmented ways of understanding problematic situations that bypass the borders of any single discipline or profession. Our research confirms that individual creativity of professional practitioners, and the mono-disciplinary expertise of scientists, are not sufficient to deal with urban health challenges [20]. In contrast, a growing number of realizations confirm that innovative programs and projects benefit from the competences and skills of partnerships of researchers, practitioners and

representatives of civil society. We propose that these realizations can serve as beacons for change in other cities around the world.

3. Rethinking Health and Well-Being

3.1. Demedicalizing Health

Health is interpreted as a dynamic condition or state of human beings resulting from interrelations between their biological, chemical, economic, physical, and social environment. Health is place-based; it should be considered as locality specific, not just population specific [22]. All the components of human habitats should be compatible with basic human needs and full functional activity, including biological reproduction over a long period. Health is the result of eight classes of interacting factors explained elsewhere [22,23]. These include both direct pathological effects of chemicals, some biological agents and radiation; the influences of climatic, geographical, physical factors; the contribution of cultural, psychological and social dimensions of daily life; and built environments and infrastructure including housing, transport and other characteristics of human habitats [24]. For example, improved access to education, health care and medical services is a common characteristic of urban neighbourhoods that is rare in many rural areas.

Health is both an individual and a collective condition. It is an asset, and a resource for everyday life, rather than a standard, or goal, or outcome, that ought to be achieved. This interpretation is appropriate for studies of interrelations between health, human behaviour, built and natural environments, because environmental and social conditions in specific localities do impact on human relations, they may induce stress, and they can have positive or negative impacts on health and well-being. This interpretation of health, founded on core principles of ecological public health, implies that the capacity of the medical and health-care sector to deal with health promotion and prevention is limited. Therefore, Freudenberg et al. explained that close collaboration with other sectors is not only beneficial, but essential in order to improve health and well-being [25].

These examples also confirm the pertinence of ecological public health and the need to ‘de-medicalize’ common interpretations of obesity and other societal disorders, such as the attention deficit disorder in children. David Katz [26] stated that medical practitioners are not well trained to address the obesity epidemic because obesity is not a disease. He explained that obesity is a well-known risk factor that occurs independently of illness, disease or death. His critical reflection enables researchers, practitioners and policy makers to account for the crucial role of the built environment in influencing health, well-being, and life styles [27]. Recently, the term ‘obesogenic environment’ has been increasingly used to describe the explicit contribution of built environments in influencing unhealthy livelihoods including lack of access to fresh foods and sedentary lifestyles [28].

This article interprets health as a dynamic condition that should be understood comprehensively before it is integrated into programs, projects and plans for urban development [22,23]. The complex interrelations between health and built environments across the multiple levels of housing, neighbourhoods, cities and mega-urban regions are explained elsewhere [19]. The growing incidence of non-communicable diseases (e.g., asthma, cancers, hypertension, cardiovascular diseases, and type 2 diabetes) provides an opportunity for architects, landscape and urban planners, as well as health and medical practitioners, to rethink **how** built environments become settings for everyday life and how they influence lifestyles, including food consumption, physical activity and children’s play [29]. Built environment professionals should assume a more active role in transforming unhealthy living conditions by innovative and creative projects that become catalysts for societal transitions that promote and protect health and well-being.

Since 2000, there has been a proliferation of empirical research and scientific publications that aimed to identify and measure relationships between specific characteristics of urban areas (e.g., ambient air quality and indoor air pollution), and health of population groups according to demographic variables (e.g., age, ethnicity, and gender), socio-economic variables (e.g., education and

training, employment status and income), and geographical location (street, neighborhood, city, or region). Examples include contributions in *Urban Health* edited by Galea, Ettman, and Vlahov [30]. They document interdisciplinary research about urban health including biological, environmental, economic, social, political, and psychological factors. Interdisciplinary conceptual frameworks have been applied in studies of intra-urban health differences, and growing inequalities between diverse population groups in specific cities have been recorded. The next section explains why increasing attention has been given to the health of children, youth, and young adults, especially those who live in cities.

3.2. Children's Health in an Urbanizing World

During the last century, the development of scientific research and public health policies about environmental health risk factors and other health hazards focused mainly on dose, exposure and responses for adults. However, during the early years of life infants and children are more vulnerable to chemical and toxic agents, accidental injury, and contaminated food and water. The health of infants, children, and adolescents has become an international preoccupation [31,32].

In many European countries, the status of children has changed radically especially in relation to protecting their physical and mental health and their right to education and social justice [33]. Whereas parents commonly had full jurisdiction over their children a century ago, today the health and well-being of infants, children, adolescents, and young adults is increasingly considered as a shared responsibility of parents and society. This social change influences current shared commitments about access to education, health care, social justice and community services, including welfare. In this sense, the health and well-being of children is associated with the collective future of human societies.

In 2004, eleven countries in the European Region committed themselves to joint action with WHO, the European Commission (EC) and other international organizations to develop an on-line database and information system. The resulting European Environment and Health Information System (ENHIS) is designed to generate and analyze data and information about environmental health to support relevant policies in Europe, with a focus children's health. The system is based on a set of environmental health indicators developed and updated by the ENHIS and ENHIS-2 projects [34]. The system uses health impact assessment methods and will contribute to the European Community Health Indicators system. ENHIS uses the Driving Force, Pressure, Status, Exposure, Effect, Action (DPSEEA) framework, focusing specifically on the links between exposure, effects and action.

Data and information have been collected at the country level using the ENHIS framework in order to formulate a Child and Adolescent Health Strategy (2015–2020), that was adopted in 2014 by all Member States of the WHO European Region. The Strategy's implementation was monitored through country profiles compiling existing health data and a survey sent to all 53 European Ministries of health. Responses from 48 countries have been presented graphically, quantitatively and qualitatively [35].

Licari et al. confirmed findings reported by Smith, Corvalan and Kjellstrom, (1999) that "the burden of diseases attributable to environmental factors is greater in children and the poorest sector of society. Globally, 43% of the total burden of environment-related disease falls on children under 5 years of age, even though they make up only 12% of the population." They also concluded that "in the poorest countries, up to 80% of the burden of disease in children under 5 years of age is of environmental origin" ([35], p. 8). Notably, housing and local environmental conditions have a significant influence on the health and well-being of children but this is rarely endorsed by housing, building and land-use planning policies this century.

ENHIS data and statistics confirm that accidental injuries are the leading cause of death in children after the first year of life in the European Region with just over 75,000 fatalities each year ([36], p. 31). "Deaths are only the tip of the iceberg: it is estimated that for each child dying from unintentional injuries in the home or at leisure, there are 160 hospital admissions and 2000 emergency department visits. This estimate implies that there would be around 4.5 million hospital admissions and 56 million emergency department visits for child injuries in the Region annually" ([36], p. 31). High risks of

injury from road traffic accidents is one reason why parents prefer that their children do not cycle or walk to school, or play in streets. The fear of accidental injury probably contributes to the lack of physical activity among children in the European region. Complementary data and statistics also indicate that physical activity is low among children in several European countries ([17], pp. 148–149). Children between 5 and 17 years old rarely meet the WHO global recommendations on physical activity for health. In particular, statistics show that only 34% of children undertake physical activity that meets the current WHO guidelines. In principle, WHO recommended that children in this age group should have 60 minutes of physical activity each day [37].

Research suggests that nutrition during childhood and fetal development influences the onset of disease later in life ([36], p. 87). Data sets and other information collected by WHO-Regional Office for Europe confirm that children in several European countries suffer from a double burden of malnutrition resulting in undernutrition and overnutrition ([17], pp.151–152). The most important health risks are associated with the constituents of food. Excessive food intake and high sugar content relative to energy needs leads to obesity, cardiovascular disease, and increased risks of diabetes and cancer; excessive saturated fats lead to obesity, arteriosclerosis and cardiovascular disease; and excessive salt leads to high blood pressure and cardiovascular disease. High exposure to chemicals and contaminants in childhood is likely to have a significant impact on health in adult life ([36], p. 93).

ENHIS data and statistics confirm that obesity continues to increase in many European countries while neighborhoods of children with undernutrition coexist. Public policies and interventions to counteract increasing incidences of obesity should be high priority, whereas WHO-EURO noted that several countries are not systematically monitoring these trends especially among children under 5 years. However, data in the United Kingdom show that one in three children are obese by age 9 [38]. More generally, although data and statistics about obesity increase public health concerns, policy responses are timid, especially regarding the marketing and sales of tobacco, soft drinks, candies, and processed foods in schools and residential neighborhoods (see later).

ENHIS data and statistics indicate that childhood asthma and allergies have increased during the last few decades. Notably, asthma is the most common chronic disease among children and is one of the major causes of hospitalization among those aged under 15 years ([36], p. 51). Asthma occurs in all European countries regardless of level of economic development, but over 80% of asthma deaths occur in low- and lower-middle-income countries. Recent reviews indicate an increasing prevalence of allergic diseases in the European Region, no longer restricted to specific seasons or environments ([36], p. 51).

These and other official statistics confirm public health problems at city, country, regional and international levels. Consequently, interventions that address these concerns only on specific sites are too limited in scope and purpose to enact systemic societal transitions that transgresses cultural, geographical and socio-economic boundaries. More radical change requires thinking about how to shift from incremental to societal change that is transformative at micro-, meso-, and macro-levels.

4. Promoting Health by Radical Change

The preceding section included a summary of data, statistics and other kinds of knowledge about environmental health risks and ongoing trends about the health of children in the WHO European region. Notably, the reported trends in the region occur irrespective of the socio-development of countries and despite laudable initiatives by the European Commission, the European Environment Agency and the WHO Regional Office for Europe. This section explains that alternative approaches are necessary if radical changes that counteract these societal trends are to be transformative. At the outset we note that the six responses proposed in the Children's Environmental Health Action Plan for Europe (CEHAPE) need to be complemented by other more systemic conceptual and methodological approaches which are explicitly transdisciplinary. This type of approach will now be explained.

4.1. Implementing Transdisciplinary Contributions

Public health and urban planning have a long history of symbiotic interrelations that gathered momentum in the nineteenth century in order to eradicate vectors of infectious illness and disease. This kind of disciplinary and professional collaboration is urgently needed again in order to formulate and implement innovative approaches to counteract the growing incidence of non-communicable diseases, especially among children and young adults. Our research indicates that the most effective programs and projects that implement child friendly environments that are safe and healthy are occurring at the city and local government level. Examples in the WHO-European region include cities participating in the WHO Healthy Cities project described elsewhere [24]. The Copenhagen Consensus of Mayors, adopted on the Tuesday 13th February 2018, is fully aligned with the United Nations 2030 Agenda for Sustainable Development, and serves to guide the contribution of the World Health Organization to the Healthy Cities project during the whole period of this agenda until 2030 [39].

The Healthy Cities project is explicitly a collaborative one founded on partnerships between researchers, practitioners, policy makers, and citizens. Collectively, these partnerships collect and analyze empirical research and conduct field studies prior to the definition of policies and programs that promote health in cities. The long-term goal of the WHO Healthy Cities project is to integrate health in the agenda of policy decision-makers in cities, to create a strong partnership for health promotion between groups in the public and private sectors, and to apply community-based participatory approaches when implementing projects [21].

This article proposes that cities and local authorities are pertinent settings for effective responses to urban health challenges because their local populations experience and interpret them as part of their livelihoods, and they seek creative and pertinent ways of responding to them. There is now ample evidence that community associations, private enterprises, public administrations, and local authorities can form multi-agent partnerships that address those problematic situations that impact negatively on the health and well-being of all age groups. These partnerships debate local concerns and persistent problems in order to propose efficient responses to them.

Many innovative programs and projects that have benefited from the competences and skills of public health researchers and built environment practitioners can serve as beacons for change in other cities around the World [40]. These innovative contributions have generally recognized the limits of discipline bounded knowledge and sector based professional know-how. They have been examples of mode 2 knowledge production, citizen science, the co-production of knowledge and transdisciplinary contributions that are meant to change problematic situations.

Transdisciplinary contributions create a shared or common understanding of a situation or subject [20,23]. These contributions combine different kinds of individual and collective knowledge and diverse ways of knowing, including collective and creative thinking listed in Table 1. Disciplinary, multidisciplinary, interdisciplinary and transdisciplinary contributions are defined in Table 2, because they are different yet complementary and they can benefit each other.

Table 1. Core characteristics of transdisciplinary contributions.

Conceptual Framework	Sharing information and knowledge between two or more disciplines and other types of non-scientific knowledge and know-how to develop a shared conceptual framework.
Complexity	Differences, emergence and conflicting values are acknowledged and addressed.
Context	Contextual contingencies of research and practice are taken into account.
Agency	Participation between researchers, practitioners, policy makers and other representatives of society is applied using diverse communication tools and methods.
Change	Understanding real world situations and persistent problems in order to change them is a primary goal.
Multiple Methods	Diverse sources of data and information as well as mixed research methods are applied.
Creativity	Synergies between knowledge cultures, public policies, project implementation and human behaviour are encouraged to implement change.

Table 2. Terminology: Diverse disciplinarity.

At the outset, we define key terms used for diverse disciplinary approaches because there is no consensus about their definitions:	
Disciplinarity	Refers to the definition and specialization of academic disciplines such that each discipline has its own concepts, definitions and methodological protocols for the study of its precisely defined domain of competence. For example, in the domain of environmental sciences, different definitions, concepts and methods coexist in biology, chemistry, geology, and physics. This means that collaboration across disciplinary boundaries requires a shared working definition before collaboration is possible.
Multidisciplinary	Refers to an additive approach including multiple contributions that remain within disciplinary conceptual and methodological boundaries. Each contributor applies disciplinary concepts and methods without intending to collaborate with others. This approach is frequently applied in environmental impact assessments (EIA) of large-scale housing developments and urban infrastructure projects.
Interdisciplinary	Contributions involve intentional collaborative actions that are applied by researchers in at least two different disciplines to achieve a shared research goal about a common subject. This kind of collaboration has created new disciplines, including architectural psychology and environmental sociology. Sharing of combination of concepts and methods is intended between different disciplines, but the whole process does not extend beyond scientific knowledge, protocols and know-how.
Transdisciplinary	Contributions extend beyond scientific knowledge by including non-academic researchers and institutions, such as representatives of the private sector, public administrations, community associations and citizens. Transdisciplinary contributions enable the cross-fertilisation of knowledge and the experiences of people educated in disciplines, trained in professions, and experienced in policy making. Collaborative planning and participatory design are tangible ways of co-producing new built environments with the involvement of representatives from industry, researchers, practitioners, policy makers and citizens.

We emphasize that without specialized disciplinary studies of the processes and outcomes of urbanization no in-depth knowledge and data about urban demographics, urban economies, housing, building and infrastructure, and population health and well-being would be available. The shift from disciplinary research agendas to other types of collaborative research highlights the need to combine different disciplinary competences. Combinations of scientific and expert knowledge enable a better understanding of contemporary real-world situations, including the drivers and consequences of

urbanization and their impacts on public health [40]. Key issues that need to be addressed include the social and political agendas of research and how specialized knowledge is used in society; the degree of autonomy and independence of scientists and researchers in relation to the funders of empirical research; and the role and function of practitioners who depend on private and public mandates; the contribution of non-governmental organizations in deciding an order of priorities, and the allocation of monetary and non-monetary resources to deal with them. The following section provides a few examples of transdisciplinary contributions involving participatory action research about children's health.

4.2. Participatory Action Research with Children

Since the 1990s there has been a large volume of action research involving children and young adults as participants rather than subjects [41–43]. This participatory research with children developed with pioneer projects that raised awareness about environmental issues [44]. Since then, the scope of participatory research projects has been enlarged to include community health, drug resistance strategies, social work, disabled and ethnic minority children.

“Community-based participatory research (CBPR) engages the multiple stakeholders, including the public and community providers, who affect and are affected by a problem of concern. This collaborative approach to research equitably involves all partners in the research process and recognizes the unique strengths that each brings. CBPR begins with a research topic of importance to the community and aims to combine knowledge with taking actions, including social change, to improve health.” [45]

One community-led project that applied transdisciplinary research methods in the early 1990s involved residents of Corkerhill, on the outskirts of Glasgow, in Scotland [46]. The local residents designated two representatives who collaborated with academic researchers and professional health and welfare staff during the project. The main objective of the project, initiated by the residents, was to better understand the causes of accidental injury and child illnesses in relation to road traffic and substandard housing conditions. The project consortium used multiple research methods to develop a better understanding of health risks and child safety by incorporating the knowledge and experiences of residents. The research methods included interviews with adolescents, their parents, and local professionals in the health care sector. A local census by household survey was also completed with 95% of all households. Analysis of population-based data and statistics about accidents and their consequences were completed. After the study, significant improvements to residential environments in Corkerhill were completed by an area-based regeneration project. This kind of project has been implemented in many cities and towns in the United Kingdom. New residential buildings have replaced substandard housing, and new landscaping has provided safe outdoor play areas for children.

Other initiatives by European local authorities and community associations to promote and protect children's health have addressed obesity and sedentary lifestyles. Some initiatives have occurred in schools with the aim of changing food and drink consumed by students, and promoting physical activity. For example, the City of Malmö in southern Sweden has made a commitment to promoting food consumption that is affordable and health promoting for all citizens [47]. Local initiatives during the last 20 years have been grounded in public procurement that began in local schools. Today, not less than half of all school meals for students are made with organic produce. All meals are planned for a balanced diet and a relatively low environmental impact. This intentional focus on children and youth is meant to influence their food consumption in later years across the life span.

Notably, the City of Malmö has implemented a healthy public food initiative beyond schools to influence food consumption of the general public. Andersson and Nilsson explain that this initiative involves local farmers, cafes and restaurants, and small retailers [47]. The objective is to increase public awareness about the environmental, economic, energy and health costs of producing, processing and consuming mass-produced food that contradicts some core principles of sustainable development.

This example shows that public procurement can support societal transitions towards more sustainable food systems in cities rather than being restricted to incremental change on a few selected sites.

5. Discussion

Redefining and implementing research and practice about the interrelations between children's health and built environments illustrates a growing concern about the limitations of conventional knowledge production (that is autonomous, discipline based, hierarchical, and grounded on academic criteria). This article presents a comprehensive approach that is necessary in order to bridge the knowledge–practice divide in the environmental, energy, health, housing, land-use, and transport sectors. It confirms that transdisciplinary knowledge production and intersectoral professional practice have shifted beyond conventional research agendas to address societal concerns not confined to disciplinary conceptual frameworks and professional competences. Hence the limitations of conventional research and practice have been recognized. In particular, this article questions those who request more scientific research before policy changes and innovative projects are implemented to promote and sustain public health in the context of rapid urbanization. Today, there is an 'applicability gap' between 'what is known' about urban health challenges and 'what is done' to reduce health risks more effectively, especially for children in the European region. The 50-year history of health risks of tobacco smoking is just one example, among many others, that this applicability gap should be reconsidered as a persistent problem that requires a societal response involving ethical commitment, political responsibility and communal engagement in addition to empirical knowledge and know-how. The article also confirms that transdisciplinary contributions can address fundamental societal challenges and persistent problems, such as non-communicable diseases that are major risks to children's health. It has explained and illustrated why collective understanding, political commitment, and innovative responses can be co-created with the active involvement of children and young adults.

Finally, we acknowledge that the specialized knowledge professional practitioners about built environments, and scientific knowledge from epidemiological research about public health, have produced important results that are still not widely used in housing, building and land-use planning policy definition and project implementation [19,48]. Overcoming or reducing this applicability gap is a prerequisite for promoting health and quality of life of all age groups. Whether this is achieved will depend on the social and political agendas of public institutions, the motives of private companies and enterprises, and the moral responsibility of politicians, practitioners, and researchers.

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