

Knowledge Mapping on Environmental Health in Context of City Planning

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ABSTRACT

Throughout history, the planning of ancient civilizations, such as the Indus Valley, Greek, Roman and Egyptian, placed a significant emphasis on health as a key factor for the well-being of their inhabitants. Today, the relationship between environment, health and place remains a widely explored topic in literature. This study aims to provide a comprehensive exploration of the literature to identify key thematic areas, temporal focus, shifts in ideologies and gaps and overlaps in existing knowledge by employing a bibliometric analysis including 2775 relevant articles. The most prominent authors, publications and institutions were identified using a keyword analysis, a co-citation analysis and a social network analysis. The research also included a content analysis of the articles to identify important thematic areas and time frames. Key findings indicate that the role of place and planning for health has been thoroughly discussed, with an emphasis on urban strategies to improve health conditions. However, the literature also highlights a gap in research on the impact of land-use distribution in a city on environmental health. A model of primary links between urban planning, health and the environment has been generated, visualizing their interconnectedness. By mapping the existing knowledge on environmental health in the context of city planning, this research provides a comprehensive understanding of the topic and identifies areas for future research and policy development. The study's contributions include a visual portrayal of the interdependence of urban planning, health and the environment, as well as a thorough investigation of the literature on environmental health in relation to city design.

Keywords: Public Health, Place, Environment, Bibliometric analysis, Land-use distribution, Health promotion, Social determinants of health, City Planning, Urban Planning.

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Received: 13-12-2023;

Revised: 01-02-2024;

Accepted: 12-03-2024.

INTRODUCTION

Urbanization is expected to continue to increase as more people move from rural areas to cities in search of better opportunities and amenities. The migration of the world's population from rural to urban regions affects the living standards, lifestyle and health.^[1,2] City planning has an impact on the health, well-being and the liveability of the people^[3,4] Several pertinent references back up the notion that while city planning and environmental health have been extensively investigated, there is a dearth of comprehensive literature analysis. For example, Nieuwenhuijsen (2016)^[5] conducted a review of urban and transportation planning, environmental exposures and health, emphasizing the significant variance in environmental exposures within cities, such as air pollution, noise, temperature and green space. Furthermore, Green (2012)^[6] examined the evolution and process of city health

development planning, emphasizing the significance of city planning in public health and health promotion. Furthermore, Jiang *et al.* (2017)^[7] examined urban public health policies related to urban equality, vulnerability and environmental sustainability, spurring further research into policies and activities to improve city planning for environmental health protection.

Studies have looked into a variety of topics, including the impact of urban planning on health, the significance of environmental health in city design and the need for additional research. For example, Sallis *et al.* (2016)^[8] explore the use of science to inform city planning policy and practice, emphasizing the importance of improved research translation in increasing the effect of health research on urban and transportation planning decisions. Furthermore, Hooper *et al.* (2021)^[9] investigate the potential for planning support systems to bridge the research-translation gap between public health and urban planning, emphasizing the importance of providing designers and planners with multidisciplinary, science-based information so that they can make evidence-informed decisions that positively influence urban design and planning. Furthermore, Barton and Grant (2012)^[10] examine urban planning for healthy cities, emphasizing



DOI: 10.5530/jscires.13.2.27

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the importance of good strategic integration of health and planning.

Smit *et al.* (2011)^[11] stressed the importance of urban planning and design for health equity in low and middle-income nations. Furthermore, Galea and Vlahov (2005)^[12] emphasized the impact of city life on health, defining it as the physical environment, the social environment and access to health and social services. Furthermore, a bibliometric analysis and research trend forecast for healthy urban planning were performed, suggesting the expanding relevance of this field of study.^[13] However, a full review of the literature is still absent, as noted by, who questioned the legitimacy of evidence-based urban health planning (Mirzoev *et al.*, 2019).^[14]

In the light of the same, the present study aims to explore the literature and understand the coverage of exploration of city planning and environmental health through a detailed bibliometric analysis. This study pioneers new territory at the nexus of environmental health and urban development. Bibliometric analysis includes a thorough and systematic evaluation of the literature, highlighting important themes, temporal shifts and knowledge gaps. By clearly outlining the research design, approach and methods, we provide a transparent and replicable platform for future research. Our graphic representation of the interconnection of urban planning, health and the environment offers new perspectives on the role of place and planning in environmental health. This study makes a unique contribution to the field by underlining the importance of policymakers considering the impact of urban planning on environmental health, as well as recommending topics for further research and policy development.

This study aims to answer the following research questions:

1. What are the key thematic areas discussed in the literature on city planning and environmental health?
2. How has the temporal focus and shifts in ideologies evolved in this literature over time?
3. What gaps and overlaps exist in existing knowledge in the field of city planning and environmental health?
4. How can a model of primary links between urban planning, health and the environment be generated and visualized to highlight their interconnectedness?

By addressing these research questions, this study offers original insights and contributes uniquely to the existing body of knowledge in the intersection of environmental health and city planning.

LITERATURE REVIEW

Environmental health and city planning have been researched for a long time. Before 1990s, there was an increase in community studies that examined living in specific places.^[15-17] The impact of the local environmental conditions on the health of the population was not given enough attention.^[18] This lack of focus on local environment could be attributed to the advances in statistical, computational and survey methodologies that improved considerably during that time frame and provided researchers an ability to assimilate and consecutively analyse large data on individuals thereby increasing such studies significantly. Opportunities given by data and new techniques were driving the research.^[19] Associations demonstrated between the role of location or place and the physical and mental health were derived from the demographic characteristics of the residing population such as the class composition and age structure distribution. In these studies, emphasis was on mental health,^[20-23] disability,^[24-27] caring^[28] and inequalities in health.^[29-31]

A small number of research additionally examined the effect of certain environmental pathogens or technical evaluations of spatial patterns of illness incidence using Geographic Information System (GIS).^[32,33] The prevailing belief at the time was that there was a need to investigate directly those aspects of the physical surroundings that might have an impact on health and that public health might be improved by putting more emphasis on places.^[34] Because it comprises social relationships as well as physical resources and also constitutes them, place is important for health variation.^[35,36] While the majority of authors concurred that there is a fundamental connection between place and health, there was a second school of thought where a few authors came to contradicting conclusion, namely that it is crucial to lay a greater emphasis on individuals.^[37] and that in addition to the most important individual determinants of health behaviours or health, there were no effects of residence area.^[38]

After taking into account a number of compositional factors, studies conducted in the late 1990s it was discovered that there was some effect of area. Individual socio-economic variables and area-based indicators both independently influenced health outcomes.^[38,31] There has been an increase in the amount of literature on the effects of income inequality, social capital and social cohesiveness on health.^[39-44] Researchers have tended to come to the conclusion that a person's place of residence affects their health, though probably not as much as their individual characteristics. Additionally, attention has switched to how local and individual factors interact. It has been noted that there does not appear to be a single, all-encompassing "area effect on health," but rather a variety of area effects on various health outcomes, depending on the population and the type of location. The major focus shifted from disease centric studies to more social perspective studies with emphasis on poverty and mortality^[45] neighbourhood characteristics^[46] affluence and deprivation,^[47-50]

health behaviours and physical or mental functioning.^[47,51-53] The fundamental idea was that the socio-physical environment's characteristics, which are independent of an individual's behaviour, may play a significant role in the relationship between low socio-economic level and excess mortality.^[54] Once individual socio-economic indicators are taken into account, neighbourhood characteristics play a part in health outcomes.^[46,45]

More empirical studies on the causes of health outcomes in relation to 'location' (physical environment) was published in the 2000s. The findings reveal the separation of the fields of planning and health into their own areas of expertise.^[55-57,4] It provides theoretical justifications for trusting the empirical connections that land use can affect people's lifestyles, which then affects their health.^[58,59] The local level linkage between health outcomes and urban land use patterns have not been a topic of popular research until recently because of issues with data requirement and processing complexity.^[60] Studies have tended to concentrate on developed countries, while correlations in underdeveloped nations are less documented. The correlations at the individual level are highlighted (one type of urban area with one type of health outcome).

Major themes that were discussed during the 2000's include planning for land use, managing public health and regulating the environment,^[61-63] Environmental exposures including air pollution, thermal discomfort, noise amongst others,^[64-67] there have been many studies attempting to find statistical correlations between health outcomes and different types of land-uses in urban areas individually.^[58,68] Other focus areas (elaborating on the urban causal factors pertaining to single health outcomes) included High blood pressure,^[69] asthma,^[70] cardiovascular disease,^[68,59] mental diseases,^[71] cancer^[72] injury,^[73] Obesity^[58] and other general health concerns.^[74,75]

It has been hypothesized that green spaces are good for both mental and physical wellbeing.^[75,76] Researchers have linked multiple times, living near green areas to a lower incidence of mental health issues, low birth weight cardiovascular and cerebrovascular disorders and cancer.^[71,74,75,77,78] Increased low birth weight, depression, cancer and excessive mortality have all been linked to proximity to industrial areas in an urban setting.^[72,79,80] Those areas where a higher percentage of land was allocated to hospitals, clinics and medical services and other social infrastructure like schools, halls, community centres in neighbourhoods, tend to have better health results.^[58,81] It is also observed by researchers that higher urban land usage is significantly linked to an increase in the likelihood of unfavourable birth and pregnancy outcomes like low birth weights and a small gestational age^[82] and asthma symptoms.^[70] This study seeks to understand the such themes by conducting a thorough review of the existing literature. Using bibliometric analysis to identify major themes, temporal shifts and research gaps. The findings highlight the necessity of

incorporating environmental health into city design, as well as the need for further research. This literature evaluation serves as a basis for the study, providing a thorough understanding of the topic.

RESEARCH METHODOLOGY

The present study aims to explore and map the knowledge domain of environmental health and city planning through historical focus to contemporary approaches. Dataset from dimensions.ai (a database source) was taken for conducting a bibliometric analysis of the literature. The Dimension.ai database is used in the study because of its wide coverage and user-friendly interface. It provides a comprehensive set of search and analysis options, making it an excellent choice for bibliometric analysis. Peponi and Morgado (2020)^[83] highlighted the use of bibliometric analysis in a variety of domains, including urban governance, planning, design and development, highlighting its adaptability and importance in urban studies. Jia *et al.* (2021)^[13] stressed the importance of bibliometric analysis in identifying research trends in healthy urban planning over the last 40 years, demonstrating its applicability for studying urban planning literature. The database source was chosen based on the findings that a higher proportion of publications indexed in Dimensions are open access than those indexed by WoS and this is especially true for publications originating outside North America and Europe.^[84] Carefully keywords were selected through the preliminary literature as follows- "Environmental Health" AND "Urban Planning" OR "Urban" OR "City Planning" OR "Public Health" OR "Environment" OR "Evidence" OR "Association" OR "Health and Place" OR "Pollution and Health" NOT "COVID-19". A special function of not covid 19 was particularly added in the literature search to remove the bias against high number of recent covid related studies in urban context which represents a special category of unique event with high impact globally creating a sudden influx of articles in literature. A Total of 4163 number of publications on the theme of environmental health and urban areas were downloaded in the timeframe from 1955 to 2022. Within this dataset Open access articles were 2501 and closed articles were 1662. The search was limited to research papers and not books, review papers and opinions. On further screening only 2775 papers were found relevant to the theme of the research and were analyzed further. For the purpose of understanding the historical evolution and the current interest the literature was subdivided in categories which were mapped into 7-time frames. Keyword associations were seen using VOS viewer and linkages were explored to understand the context of research in various domain. Thematic mapping was done to understand the development of key themes in the domains and their present status of coverage in the literature in terms of frequency. This thematic mapping helped in identifying the emerging themes, well researched themes, under explored themes and gaps in the literature. The findings were further dissected to understand the

coverage of land-use or planning related studies in context of environmental health and subsequent gaps in the same.

Total number of citations received by the published articles. Total Citations of the articles included in the bibliometric analysis-77840. Less citations in the year 2020-2022 due to the short time since their publication. Country co-authorship (international collaboration) for Environmental Health publications. 56 out of the 109 countries had at least 5 publications. Highest collaborations by US. A total of 210 unique keywords were identified through content analysis and coding of the most cited papers downloaded as a dataset from dimension.ai.

These keywords were categorized into 16 categories based on the overall theme they represent. Theme included-Measures, Socioeconomic Factors, Natural Environmental Factors, Assessment, Urban Planning, Risks Association, Behavior and Lifestyle, Built Environmental Factors, Diseases, Demographics Factors, Climate Change, Environmental Health Concepts, Spatial Aspects, Study Methods Sustainability, Countries and Medicine. Links between various key words across literature were studied. Association, Behavior and Lifestyle, Built Environmental Factors, Diseases, Demographics Factors, Climate Change, Environmental Health Concepts, Spatial Aspects, Study Methods Sustainability and Medicine. The analysis includes temporal

analysis of the major themes through 1950's to recent literature, network visualization to better understand the various linkages discussed in literature followed by thematic mapping to quantify the extent and coverage of themes in the literature and identify the gaps. A detailed analysis of the literature establishing association between city planning and health is also conducted to understand the factors researched and the gaps therein.

To map the conceptual structure of the research field, the study used Multiple Correspondence Analysis (MCA) with Biblioshiny for thematic mapping, key topics and gap detection. MCA assisted the grouping of similar qualities in a two-dimensional plot, allowing for the depiction of the proximity and correlations between different terms. Furthermore, thematic maps were used to evaluate the importance and evolution of research topics, with a focus on their density and centrality. This technique enabled a thorough grasp of the major topics in the literature while also identifying less established regions and developing patterns, indicating future research needs. Using the different correlations of urban planning and health outcomes, this study develops a model by articulating the various associations described in the literature. The model incorporates exposure pathways, response planning and proven consequences in terms of increasing or decreasing health outcome risks. Figure 1 shows the methodology adopted for this research.

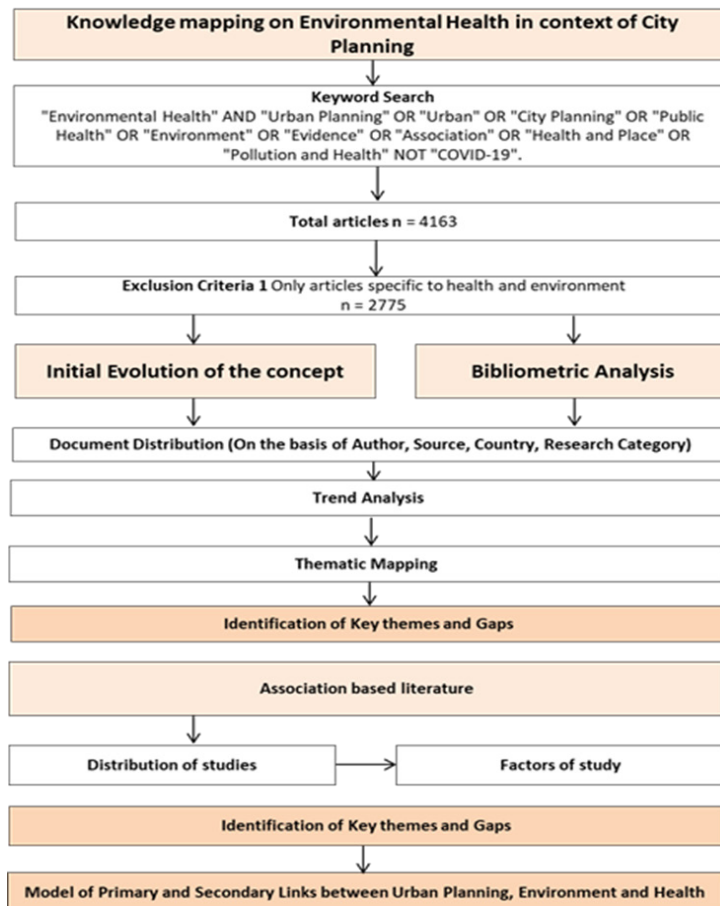


Figure 1: Research Methodology.

RESULTS

Themes in the literature

It was revealed during the study that in context of Health, Environmental Health has been in focus since early 1980s with Natural Environmental factors like environmental quality, exposure and risks, evident through the frequency of occurrence in the search. Place and Planning and its role in health also shows

up prominently from 1975 onwards and its emphasis is increasing. Focus on measures or adaptation strategies is also observed to be increasing with time with more emphasis on strategies at urban level. Climate change is gaining more and more focus in the study. Demographic, socio-economic, behavioral and lifestyles are also among the key themes that appear in the study as observed from Table 1.

Table 1: Keyword Theme Occurrence in literature from 1955 to 2022.

Rank	Themes in Literature	Total No's	1955-1965	1965-1975	1975-1985	1985-1995	1995-2005	2005-2015	2015-2022
1	Environmental Health Concepts	1482	1	9	26	49	179	439	779
2	Natural Environmental Factors	1063	3	10	16	45	135	242	612
3	Place and Planning	959	3	1	22	42	89	263	539
4	Techniques of studying	889		14	15	40	68	235	517
5	Health Risks	873		3	7	27	95	233	508
6	Assessment and Association	753		9	6	12	76	214	436
7	Measures	686	1	4	7	22	74	179	399
8	Diseases	474		6	8	15	53	91	301
9	Demographics Factors	316		3	4	5	35	107	162
10	Behavior and Lifestyle	268	1	2	8	11	30	53	163
11	Climate Change	253			1	4	13	102	133
12	Socioeconomic Factors	230		2	4	5	15	73	131
13	Spatial Aspects	128			2	6	17	38	65
14	Medical Perspectives	98		4	7	14	15	22	36

(Source: Author)

As per the analysis it was discovered that during 1955-1965, it formed the developing time period that focused on the concept of health with limited mentions of the theme areas. During 1965-1975, techniques of study of associations between health, environment or cities or urban areas were more focused domain including the continuing exploration of the role of environment in health of people. Multiple instances of focus on studies about the empirical association between health and place were found. 1975-1985 saw the rise in frequency of keywords within the themes of environmental health, place and planning, natural factors and various methods of studying. While comparing from the previous decade, place and planning relationship is more evident during the study along with an increase in the exploration of climate change and spatial aspects. 1985-1995 witnessed a focus shift towards health risks and measures including the emerging themes of the previous time periods.

The next time period of 1995-2005 saw a surge of research in the overall concept, this was found in very high number of publications in this time frame with an increase in the coverage of all previous as well as new themes emerged with more emphasis such as diseases and health risks and the focus on behavior and lifestyle and its role in urban health. It was also found that a significant increase in the studies were based on association and assessment along with an increased observed mention of the theme lifestyle and behavior around this duration. In the next time period of 2005-2015 there was a greater focus on climate change. Studies also circled back to include more studies exploring the socio-economic factors while assessing health risks of the population. In 2015-2022 the focus shifted to disease specific studies with lifestyle and behavior related studies. This progression and shift of focus from one theme to another over the years shows the dynamic nature of the entire domain of health and place.

City planning or planning was used widely with keywords like committees, sanitation, reports, hygiene, health, occupational exposure. This was in the earlier duration where the domain of urban planning had emerged from sanitation, water and hygiene issues. More recent connections between city or urban area or urban planning are observed with air pollution, climate change, environmental health and health impact assessment indicating a shift in the approach from issues to causes as demonstrated through Figure 2. Terms like health, community health, health risks etc. were initially being used in relation to sanitation, mortality, occupational risks, urban environment, prevention and control. Whereas in more recent literature the context has shifted to exposure, pollution, cross sectional study, association, quality of life which indicates the progression in trend to a more complex causal approach of health in context of urban environments.

Thematic Mapping

A thematic map (Figure 3) was generated to identify the emerging topics and under researched subthemes in the domain of public health or environmental health and city planning. The thematic map consists of four quadrants depicting the density and centrality of the sub themes based on their occurrence and frequency of occurrence in the literature. The degree of a network's contact with other networks is measured by its centrality, which is regarded as "a measure of the relevance of an issue in the growth of the overall research field under study." The density reveals the level of theme development and gauges the network's underlying strength. The first quadrant (a) showing a high density and a high centrality also known as the "motor themes", includes those sub themes that are crucial in the development of the concept and have been established as well research themes important in the

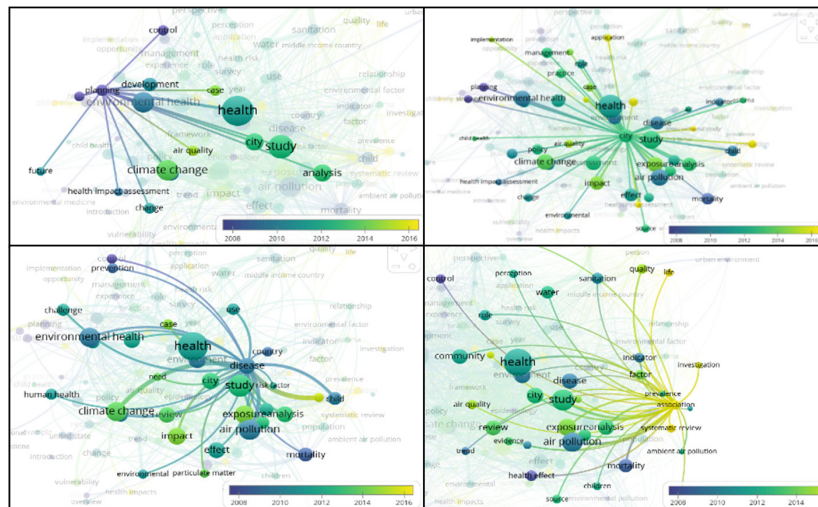


Figure 2: Keyword linkages across time frames (Source: Author analysis using VOS viewer).

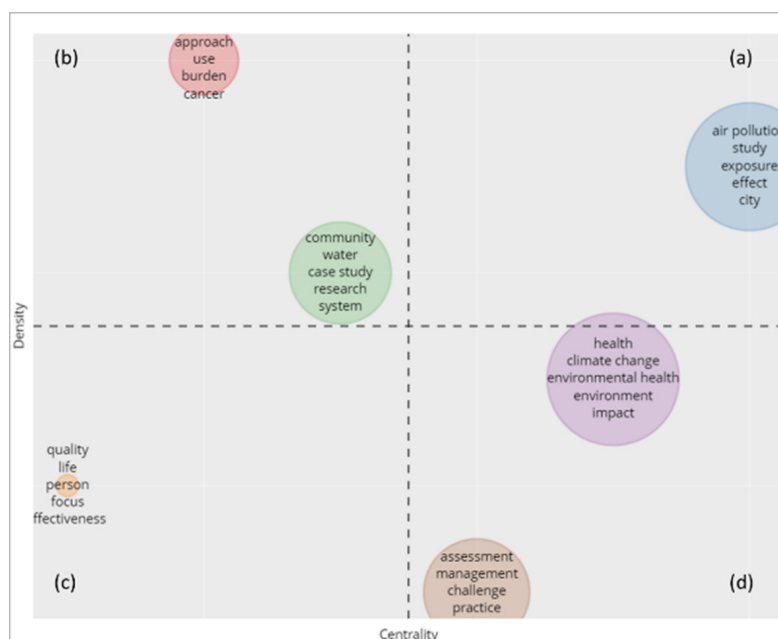


Figure 3: Thematic Mapping of Sub Themes (Source: Author Analysis using Biblioshiny).

sector. This quadrant includes themes like “air pollution” and its impact on cities, “exposure studies”, “mortality” and the concept of risk. Accordingly, the analysis was done and it was found that as concepts it is important to understand environmental health and city planning mentioned as themes have been well established. The next quadrant (b) is the “niche quadrant” that shows such sub themes that are well researched but very specialized themes. It was observed that this quadrant included sub themes that largely fall into the medical sector with sub themes of “disease”, “disease burden”, “approach”, “risk factors” and “estimation”. This shows the focus of such concepts like estimation of risk are generally covered through a medical perspective and not particularly through the planning perspective. Other niche sub themes include “water”, “sanitation”, “experiences” and “case study-based research”.

The next quadrant is of peripheral themes including both the emerging and the declining sub themes of the field with low density and low centrality. Peripheral themes identified are “quality of life” and socio-economic aspects of the demography, showing that there has been a decline in the theme of social aspects while considering the domain of environmental health and city planning. Next quadrant is the high centrality and low-density quadrant also known as the transversal and general, basic themes which are important in the environmental health research domain, however are still not well developed or researched and give opportunity for further exploration. This quadrant includes “environmental health” its impact and assessment, “evidence” “management”, “practice” (in the planning domain) and “challenges” in doing the same. The thematic mapping analysis shows how the sub themes have been covered in the literature and identifies certain gap areas in the literature through a scientific methodology. The identified gap areas include the potential impacts of environmental risks, climate variability and its impact

on health, environmental risks or health risks itself is a sub theme of limited research along with sub themes like population health, health benefits, urban environments and threats associated within, frameworks, responses and implications of environmental health in an urban context.

Association Based Literature

It is interesting to note that only 1.5% studies reviewed demonstrated any kind of association (Figure 4). Within such studies, highest share of 55.81% studies focused on the health impacts of air pollution with impacts like prevalence or risk of mortality, Cardiopulmonary, Cardiorespiratory, Asthma and other respiratory diseases, depression, lung function, bone strength, suicide, stroke etc. This is followed by a focus on water and sanitation with 13.95% and associating the prevalence of trachoma, cancer, diarrhea and suicide with either the consumption of contaminated water or lack of water and sanitation facilities. Other environmental factors like heat, soil contamination and the quality of built environment were relatively less in the chosen dataset of particular interest with just 2.3% of studies each. In the studies demonstrating association it was also observed that transportation land use was of major concern in urban areas followed by residential, industrial, recreational. It is noteworthy that the number of studies proving any kind of association majorly focused on establishing a relation between environmental factors and health outcome while the matter of place remained largely untouched. Within the entire dataset research, specifically, looking at various urban land-uses were only 6.3% substantiating the categorization of environmental health risk in context of urban or city planning in the emerging themes quadrant. Within this 6.3%, distribution analysis of land use sectors and focus on environmental health shows the following results:

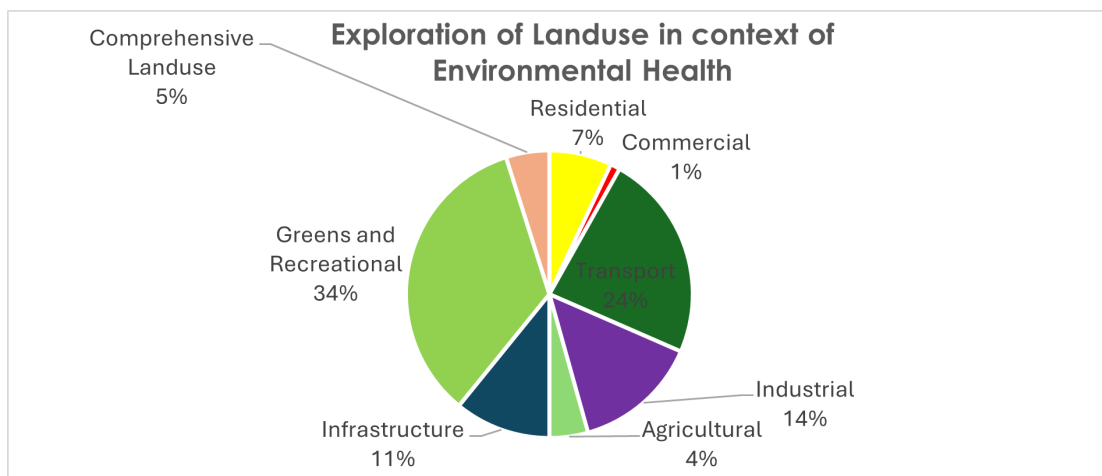


Figure 4: Exploration of land-use in the context of environmental health in literature (source: Analysis of the dataset download).

This distribution study shows that comprehensively land-use has not been widely researched when exploring environmental health. Focus is evident on greens and recreational spaces and their role in promoting health, transport sector also has been widely explored in relation to air pollution and related health concerns. This shows that there is a gap in literature pertaining to land-use distribution in a city and its impact on environmental health.

Model of primary and secondary links

The literature particularly focusing on the relationship thus found through the literature can be summarized through a model consisting of primary links of urban planning and health with environment as factor, this includes aspects of planning (spatial and non-spatial), health risk exposure pathways, planning responses and resulting response outcomes with respect to health (Figure 5). Secondary links that were also identified through literature are socio-demographic (age, gender, ethnicity levels), health behavior (eating, smoking, drinking, exercise) and health literacy (understand basic health information and services need to make appropriate health decisions).

Through literature it is found that health risks (Obesity, Cardiovascular diseases, Circulatory diseases etc.,) can be decreased and better health outcomes (mental well-being, cognitive function) can be promoted through multiple planning responses. The health risk exposure pathways are the pressures that need to be addressed within the aspects and appropriate planning responses need to be identified for each context to result in better health outcomes. It was also found that these linkages are not linear in nature and have multiple exposure pathways which can have multiple planning responses.

Place and environment can have a significant impact on health outcomes. A person's health may be influenced by elements like air pollution, accessibility to green spaces, walkability and the availability of wholesome food. The built environment, which includes the planning of cities and neighborhoods, can have a big impact on people's levels of physical activity, which in turn can have an impact on their health. Socioeconomic factors, such as income, education and access to healthcare, can also have a significant impact on health outcomes. There is growing recognition of the importance of the social determinants of health, including factors such as social isolation, discrimination and access to social support, in shaping health outcomes.

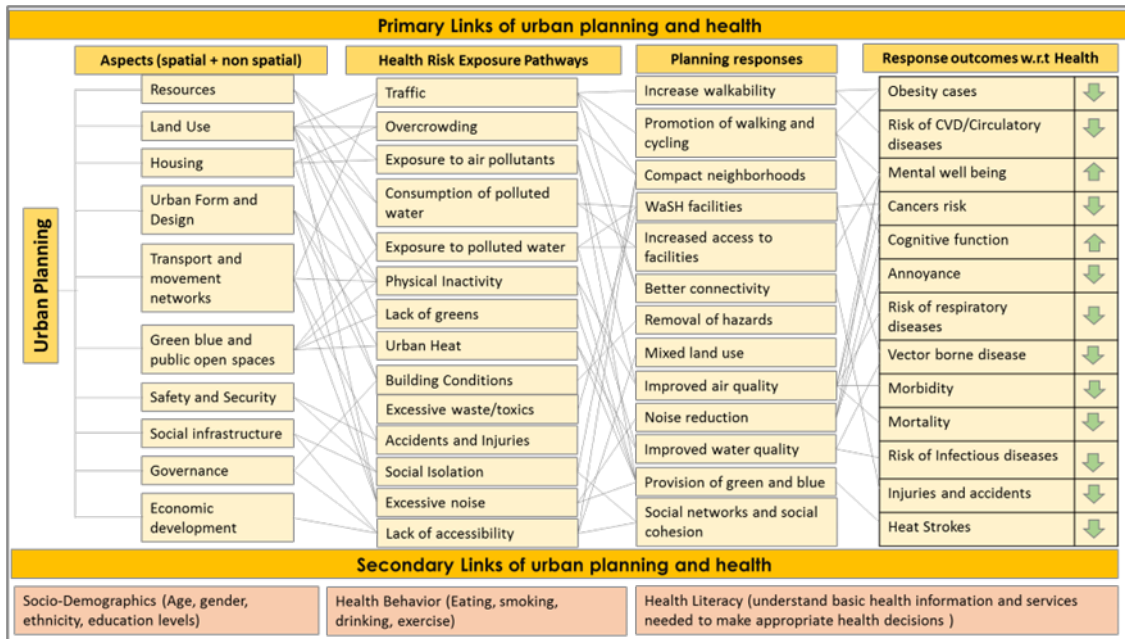


Figure 5: Primary and Secondary Links of Urban Planning and Health Source: Author, based on synthesis of literature.

Interventions that focus on improving the built environment, promoting active transportation and increasing access to healthy food can be effective in improving health outcomes.

Future Research Scope

The study findings indicate a need for further research on integrating environmental health in city planning. Three future research avenues as per the findings:

1. Developing comprehensive assessment tools for environmental health in urban planning.
2. Examining the impact of environmental health integration on public health outcomes.
3. Investigating the role of urban planning policies in promoting environmental health.

These areas will deepen our understanding of the topic and inform policy-making.

CONCLUSION

Environmental health has been long associated as a sub domain of both public health and urban or city planning domains. The evolution of city planning itself has originated through public health concerns which were largely due to environmental factors. With the increasing urban pressures, it has been observed an emergence of the once divergent link between both the domains. Through the bibliometric analysis, it was found that throughout history there has been a constant link that was discussed in the literature pertaining to the importance of place in context of health. While a segment of authors argued that place was secondary while compared with other individual and socio-economic factors, there was a strong emergence of authors and scholars who stated that place is, if not more, not a secondary factor. Concept of environmental health thus emerged as a continuous theme of interest with varied sub themes. It was found that there was a key shift in the approach towards how both themes have been researched in the literature.

In the earlier years of the concept development stage, focus was on the exploration of the role of environment in health of people. With such emergence, the focus progressed towards place and planning, natural factors and the various methods of studying. In the more recent literature, it was found that emphasis was on disease specific studies with lifestyle and behavior related explorations. Thematic mapping of the literature reveals that though the concept of environmental health and urban planning is well established, there are niche areas which are very specialized in nature and majorly showed that literature was more evident from a medical background or perspective rather than spatial context. Thus, it could be concluded that though the concept of disease, health risks and prevention of negative health outcomes have been well researched, it has been predominantly studied with a medical perspective or medical enquiry and not in context of city planning or urban planning.

The peripheral themes in the literature that show a declining or an emerging sub theme showed that within a timeframe, socio-economic factor based, lifestyle based and individual choice-based studies with health in focus have started to decline and a wider approach of physical spatial factors have started to emerge as a transversal theme. Focus is now developing in “environmental health” its impact and assessment of risk; focus has increased towards evidence of impact and risks associated with environmental factors while monitoring population health. While these sub themes are emerging, they are also still not well researched and provide city planners, public health practitioners and decision makers an opportunity to explore such sub themes further to better understand the assessment risk in context of

environmental health and city planning which will help in better city planning with health into consideration.

It was also found through this research, that while solely looking at the aspect of land use or urban spatial activities, there is a huge potential of further exploration on how comprehensive land use, or the mix of various land-uses have an impact on health while considering the environmental pressures of the urban area. Present research is found to be oriented towards singular associations, however literature suggested there are present, in an urban area, multiple causal factors which contribute towards multiple health risks. The complexity of such urban casual factors needs further exploration for better framework designs that can be applied and tested on different cases.

ACKNOWLEDGEMENT

The authors acknowledge the reviewers for their insightful comments and suggestions that lead to improve the quality of this manuscript.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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Cite this article: Tiwari P, Mathur M. Knowledge Mapping on Environmental Health in Context of City Planning. *J Scientometric Res*. 10.5530/jscires.13.2.27.