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Framing exposure to excessive and improper lighting as light-public health

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Abstract

Excessive or improper lighting can affect human health and well-being. However, lighting is seldom considered within frameworks analyzing the interrelations between the urban environment and the health and well-being of communities. Lighting-related concerns are often conceptualized and discussed in environmental terms through the light pollution frame. Positively, this frame emphasizes human responsibility for the environmental detriment and animal harm caused by lighting and promotes the discussion of aesthetics and existential dimensions connected to nocturnal darkness. Negatively, it is flawed with epistemological shortcomings and normativity; it is prone to the risk of ideological and political polarisation and tends to underemphasize the health implications of excessive and improper lighting. This study addresses this gap by arguing for the advantages of a public health framing of lighting-related concerns. In particular, it highlights how this perspective can better capture the health implications of lighting and inform urban policies. Placing light concerns within a public health framework entails presenting a relatively known landscape that resonates with the value systems of virtually everyone. This approach supports the creation of a common, multi-stakeholder space in discussions on lighting policies, balancing considerations of urban security, safety, inclusivity, and accessibility as different dimensions of diverse populations' health and well-being. By emphasizing the public health dimension, this study contributes to the discourse on lighting as a determinant of health and well-being. Such a holistic framework aligns with the United Nations Sustainable Development Goal 3 on good health and well-being by fostering conditions that advance health for all, addressing lighting not merely as an environmental issue but as a critical public health priority.

1 Introduction

Several frameworks have been developed to analyze the interrelations between the urban environment and health and well-being and to inform targeted policies and designs [1, 2]. However, while some urban determinants recur frequently in these studies (such as pollution, urban form, presence of natural spaces, urban uses and activities, and social patterns), artificial light at night (ALAN) is almost absent. This gap in research is particularly problematic if we consider that nowadays, more than 80% of the world's population lives under a skyglow dome — an effect of artificial lights raising night sky

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luminance — topmost in North America and Europe, where only 1% of the population can see a completely natural sky at night [3].

Concerns over excessive and improper illumination are often conceptualized in environmental terms, resorting to the notion of light pollution, a global problem that is getting worse, and of which urban night-time lighting is the primary cause. Virtually everywhere, but especially in economically developed countries, individuals are exposed to excessive or improper artificial light indoors and outdoors during the day and at night [4]. Moreover, the recent widespread diffusion of mobile devices for reading, communication, and entertainment has further changed human habits and increased our overall exposure to improper light [5, 6], thus exacerbating the adverse effects of light on our health. While light pollution has been recognized as an environmental and quality of life issue for years, only relatively recently has the evidence about the role of ALAN in disrupting the biological clocks of living organisms and other health-related effects consolidated. Against this background, this study asks: What are the limitations of the light pollution frame, and can a public health perspective provide a more comprehensive approach to addressing lighting-related concerns?

Exposure to excessive or improper lighting can be described as a health risk factor and should be addressed through public health activities, especially in urban environments. Framing lighting concerns through a public health lens builds on established approaches in public health research, where urban environmental determinants of health, such as air pollution and noise, have been analyzed as factors influencing population well-being [2, 7, 8]. The use of framing theory, particularly as conceptualized by Lakoff [9, 10], provides a theoretical foundation for this shift by illustrating how different frames structure public understanding and policy responses. Public health frameworks are particularly effective in translating complex scientific evidence into actionable policies, as demonstrated in other domains of environmental health [11, 12]. Such an approach aligns with the United Nations Sustainable Development Goal 3 (SDG3), which emphasizes "ensuring healthy lives and promoting well-being for all people of all ages" [13], by addressing lighting as a determinant of health and well-being in urban areas, underscoring the need for policies that promote healthy living environments.

This article advocates light-public health as the fundamental arena for conceptualizing and communicating lighting-related concerns, namely, considering lighting as a matter of public health relevance. The following provides an overview of the diverse concerns raised by excessive or improper lighting, including ecological, experience of darkness, safety, and health issues. Then, the notion of light pollution as the current frame of reference for excessive or improper lighting is critically analyzed. Afterward, it is argued that a public health framing provides a more effective and policy-relevant framework for addressing lighting concerns, reinforcing their relevance to urban health policies and global health goals such as SDG3.

2 Diverse concerns over excessive and improper lighting

In the literature, concerns over excessive and improper lighting primarily involve considerations of ecology, experience of darkness, safety, inclusivity and accessibility of urban spaces, and health.

2.1 Ecology

ALAN raises several ecological concerns because of the harm it causes to fauna and flora. This harm is here called *direct*, in that excessive lighting is the immediate cause of detriment. Numerous ecological consequences, such as those affecting organismal migrations, interspecific interactions, communication patterns, foraging, reproduction behavior, and mortality, have been documented [14–16]. Recent studies have shown that ALAN can alter species' natural rhythms and disrupt ecological interactions, leading to cascading effects across entire ecosystems [17]. The extent of these disruptions varies across taxa, with nocturnal species being particularly vulnerable due to their reliance on darkness for essential behaviors. The *indirect* harm associated with energy generation is also a part of the ecological problem, as lighting largely contributes to global electricity consumption and greenhouse gas emissions. Energy waste encompasses both the inefficient allocation of public funds and the unnecessary overproduction of energy for lighting, which adversely affects the environment and wildlife. Beyond individual species, ALAN is increasingly recognized as a driver of biodiversity loss, with significant implications for ecosystem stability and function [16]. Direct and indirect ecological harms pose an intergenerational justice issue.

2.2 Lack of darkness

The virtual absence of darkness raises essential issues of heritage and tradition preservation, as well as questions about the significance of darkness in the human experience of self and perception of reality. Urban residents are particularly disconnected from experiences such as stargazing and their positive effects on health and well-being [18]. Beyond its aesthetic and existential significance, darkness fosters not only contemplation and reflection but also social bonding and shared experiences, as natural nighttime environments create unique settings for human connection [19]. According to Kyba et al. [20], there is a "shifting baseline syndrome" that will essentially prevent younger and future generations from appreciating the aesthetic, spiritual, and cultural experiences associated with darkness. Even worse, they may also fail to perceive its absence, instead regarding current levels of artificial night lighting as "normal." This can also be conceived as an intergenerational justice issue. Researchers have emphasized the beneficial aspects of darkness, noting its potential to cultivate conviviality, foster intimacy, and enhance a sense of connection to nature as a way to appreciate its benefits without necessarily pointing out the negative aspects of over-illumination [19, 21]. Multiple international initiatives exist to reduce the impact of excessive and improper lighting and promote darkness. Some initiatives relate to time, namely through diminishing the use of light in specific periods, such as during the Eart Hour or International Dark Sky Week [22, 23]. Other initiatives relate to space, aiming to create or preserve areas with little or no impact from ALAN, such as the Very Important Dark Area Network and the International Dark Sky Places [24, 25]. Locally, policy plans have been propounded to mitigate improper and excessive lighting and the preservation of the dark sky, such as the 2021 All-Party Parliamentary Group (APPG) for Dark Skies plan in the UK [26], and local authorities have adopted improved outdoor lighting ordinances, e.g., Ann Arbor City [27].

2.3 Safety, inclusivity, and accessibility

Urban lighting hugely contributes to shaping public spaces and social life. Light impacts security, safety, and trust in the city and its citizens. Better, not simplistically more, light solutions can promote socialization and the use of public spaces, for instance, by considering the notion of variability. Variable lighting solutions can alleviate problems of over-illumination and consumption while also including considerations of temporal and spatial variability of urban lighting and night-time ambiance, which can promote social life [28]. For instance, it has been shown that different combinations of overall illuminance and color temperature of the night lighting in an urban park affect mood and emotions [29]. Recent findings indicate that high visual accessibility (extensive, uniform illumination of surroundings) in a park at night can enhance visitors' restorative experience, while overly focused path lighting may diminish the sense of escape and fascination contributing to psychological restoration [30]. Indeed, changing the lighting characteristics of lighting systems can affect people's emotions and their willingness to engage in outdoor activities. For example, poor street lighting can negatively affect older people's perception of safety and discourage walking and other out-of-home activities, which are crucial for their physical and psychosocial well-being [31]. At the same time, older adults often report issues with high-CCT LED streetlights, which can create excessive glare and discomfort, particularly in areas with high-contrast lighting. Furthermore, the effects of different lighting conditions on individuals with visual impairments remain underexplored, highlighting the need for more inclusive lighting designs that accommodate diverse visual needs [32, 33].

Moreover, while some locations profit from lighting that is intentionally deployed to enhance value through place-making and to emphasize urban heritage, identity, and aesthetics, other locations – often social housing estates – are distinguished by significant over-illumination, in which lighting is a purely engineering solution to technical problems of order, security, and policing [34]. In terms of security, evidence regarding the impact of street lighting modifications on traffic accidents remains inconclusive [35]. While data on the relationship between lighting and crime also present mixed findings, most studies indicate that enhanced lighting significantly reduces crime rates in urban areas [36]. A related matter is people's feeling of personal safety at night, which is a dimension of well-being. Street lighting is commonly regarded as the salient environmental characteristic affecting the perception of personal safety [37]. However, extremely bright illumination does not automatically equate to better overall comfort; spaces lit by tall, high-intensity lamps are often rated the safest, but this lighting approach can discourage solitude, intimacy, and contemplation, whereas more discreet ambient lighting encourages people to explore and connect with the nightscape [38].

Public lighting involves issues of equity and social justice. Yang et al. [39] remarked that safety considerations should promote inclusion. Recent data from the USA, where it was found that artificial light at night level in the top 20% of most vulnerable communities was 2.46-fold higher than that in the 20% of least vulnerable communities, illustrate the problem [40]. Urban planning and design activities should thus envision lighting systems that take into due consideration the requirements of all community members, especially those who are marginalized or underprivileged, in a manner that does not create a sense of surveillance or harassment for individuals or groups [39]. In addition, public spaces that offer people a choice in how to interact, by providing both well-lit

communal areas and dimmer, more secluded spots, are generally preferred by users, indicating that a slight trade-off in perceived safety is acceptable if it grants individuals greater privacy and autonomy in nighttime settings [41].

2.4 Health

Light affects physiology and behavior, including entraining circadian rhythms, with effects, among other things, on sleep, metabolism, and cognition, which are of particular worry in urban contexts [42]. Artificial light at night has a detrimental effect on health through the suppression of melatonin, whose production and release follow a daily circadian rhythm, with peak levels occurring at night. The scientific evidence suggests that the role of melatonin is not limited to sleep disorders, but it may affect a vast array of biological functions and processes, including cancer, metabolic, cardiovascular, and neurodegenerative disorders, gastrointestinal conditions, pain syndromes, and reproductive functions [43, 44]. To give a few examples, a recent Chinese nationwide cohort study found a positive association between outdoor ALAN exposure and the risk of developing cardiovascular disease [45]. Sun et al. [46] found a positive association between outdoor ALAN exposure and gestational diabetes mellitus. Paksarian et al. [47] found evidence associating outdoor ALAN with less favorable sleep patterns and mood and anxiety disorders in adolescents. Furthermore, outdoor ALAN has been recognized as a major and novel risk factor for obesity [48, 49].

Melatonin has an anticancer mechanism, and evidence from animal models and ecological and epidemiologic studies has accumulated on the increased risk of developing cancer due to exposure to artificial light at night [49–51]. This concern holds not only for exposure to indoor lighting, thus being a work environment worry as in the case of night shifts, but also for outdoor lighting [52, 53]. Moreover, improper exposure to light could affect human health since the beginning, as ALAN has been shown to influence obstetric outcomes [54], and impact epigenetics and metabolism [55], predisposing current and future generations to diseases, including cancer, neurodegeneration, and psychiatric disorders [42, 56].

Although most research shows the negative effects of excessive and improper exposure to light, discordance among studies exists. For instance, Liang et al. [57] did not observe significant associations of ALAN with cardiovascular disease mortality in their UK prospective cohort study. Numerous studies have shown the association between ALAN and breast cancer [50, 58–61], supported by review studies [42, 44, 62], yet this evidence cannot be considered definitive, as other researchers have found weak or negative associations [63, 64]. Therefore, the evidence about the influence of exposure to excessive and improper lighting is still mixed, but there is growing support for the negative effects of ALAN, including outdoor ALAN, which should not be overlooked.

Hence, while the consequences of exposure to ALAN from the perspectives of human health, ecology, economy, intergenerational justice, and human experiences of darkness suggest that there should be a significant decrease in lighting, well-being and social justice considerations of security, safety, inclusivity, and accessibility tell us that there is not a simple solution. However, the need for safety, inclusivity, and accessibility should not justify excessive lighting. Rather, a well-balanced approach is required—one that reduces light pollution while maintaining adequate illumination levels for public safety and urban usability.

3 A critical eye on the light pollution framing

Technically, light pollution describes the negative or undesired consequences of artificial light at night. They are skyglow (the diffuse luminance of the night sky), glare (uncomfortably bright light), light trespass (artificial light that is projected into areas where it is not wanted), and clutter (excessive grouping of lights). Thus, it describes negative aspects intrinsic to night-time lighting affecting human vision. The International Commission on Illumination offers a more comprehensive understanding of light pollution, defining it as "the sum total of all adverse effects of artificial light" in the International Lighting Vocabulary [65], thus including a broad range of issues. This section examines the notion of light pollution and the implications of its use as a frame of reference to conceive and address concerns over excessive and improper lighting.

Lakoff described frames as mental structures shaping the way we see the world and, therefore, shaping "the goals we seek, the plans we make, the way we act, and what counts as a good or bad outcome of our actions" (9, p.xv). The term *frame* intends to reflect the unconscious mental processes through which we think, which are the basis of all our knowledge. According to Lakoff, all thinking and talking involve framing. Since "frames come in systems, a single word typically activates not only its defining frame but also much of the system its defining frame is in" [10, p.72]]. Sets of thought are put in motion through frames when any information is communicated, and notably information about global problems, where there is no such thing as unframed information [66]. In their critical analysis of the notion of light pollution, Stone [67] warned that while this provides a frame of reference to assess the conditions under which there is too much light, it also tends to delimit the space within which the discussion of the problem happens, not only among academics or stakeholders but within the political discourse and in the media.

Probably due to its development in the seventies – when astronomers assumed anti-waste communication and conceptual tools to criticize excessive night-time brightness – communication about excessive lighting adopts the language and is often conceived as an environmental problem [68]. While the light pollution framing may be inevitable at this point, there is a need to reflect on what this space can include, in what terms, and what may fall aside as a consequence of framing illumination-related concerns primarily as an environmental problem. The following three issues are worth being discerned.

Firstly, shaping concerns over excessive and improper lighting in terms of an environmental problem entails light pollution sharing epistemological shortcomings common to environmental themes. Such frames share the fact of presenting to the audience a relatively unknown or uncertain conceptual landscape where most people exhibit environmental hypocognition [10]. Hypocognition is the lack of cognitive or linguistic representations of concepts to describe ideas or experiences. Although environmental problems are not only discussed by scientists or activists, these issues still lack depth in the consciousness of many. Indeed, the framing of environmental threats is seldom about the environment itself but is tied up and overlaps with other areas, such as economics, food, health, etc. Problematically, environmental issues face the challenge of finding resonance in the frame circuitry based on long-rooted value systems that do not include environmental ideals [69]. Thus, a major problem of the environment frame is that for most people, the environment and, thus, nature are perceived as something

separate from them [10]. Something that needs to be tied up to something else to be conceived and offer an intelligible explanation for action-taking.

Secondly, the notion of light pollution is not neutral because it does not merely describe the adverse effects of excessive lighting but also provides an evaluation of the consequences of lighting technologies and infrastructure [67]. The notion conveys a descriptive statement and a valuative assessment at the same time, which normatively classifies some lighting as bad or wrong [67]. While historically light at night has been sought for safety and protection and for a long time has been overall considered as something good, in the last decades, it has started to be viewed negatively until being equated to a pollutant, which complements a technical/scientific appraisal of illumination with a moral connotation. As Garrard [70] pointed out, the pollution concept redefines a scientific issue in terms of a social problem and provides a normative claim that there is too much of something in the environment. In their work on the moral geographies of light pollution in Britain, Dunnett [71] analyzed the messages of the UK's Campaign for Dark Skies. In those messages, excessive artificial light is often presented as recent, irresponsible, and unnatural, in sharp contrast to the positive traits of darkness sublime. In Dunnett's words: "By setting the campaign against light pollution in this moral context, an evocative measure of the value of dark night skies is effectively wielded" [71, p.628]]. We consider the negative connotation of light pollution problematic because it overtly and excessively steers the perception and limits the discussion about lighting. Conversely, a valuable feature of a frame is its prowess in building common spaces for finding solutions [72].

Thirdly, the environmental problem framing implies the risk of positioning lighting issues in a politically and ideologically polarised arena. As noted by Pothukuchi, defining light pollution and balancing competing values in its mitigation, such as the need for security versus avoiding energy waste, are political acts [73]. One of the predominant characteristics of light pollution, as an environmental phenomenon, is reducing energy waste and the search for energy efficiency. For instance, Lam [74] reported that the Hong Kong government defines light pollution exclusively in terms of energy wastage. As remarked by the author, the effect is that light pollution essentially becomes an environmental problem, i.e., a climate change issue, which faces the same problems. For Lam, one of the observed undesirable effects is that people distance themselves from the problem, which is no longer personal and imminent but global and distant [74]. The quintessential and most debated environmental problem is climate change, a topic about which the scientific unanimity developed over the past 40 years contrasts sharply with the political division surrounding it [75]. Despite the scientific evidence, there is a public discussion about climate change, and people express, in different fora and through various media, their politically and ideologically informed *beliefs* about it [76]. Framing lighting issues primarily as an environmental problem involves the risk that policy-making incorporating health concerns could be hindered by political and ideological disputes.

4 Light-public health

The risk to human health posed by exposure to excessive lighting can be described as a health risk factor and should be conceptualized and communicated within a public health frame to be adequately addressed through public health activities, especially in

urban environments. Adopting a public health lens entails not only mitigating the direct physiological impacts of artificial lighting but also enhancing psychosocial well-being.

Public health activities are intended to comprise collective actions that aim to protect and promote the health of the public. Indeed, the two distinctive traits of public health are the focus on the health of populations and the prominent role of government. Although collective action in the form of government intervention is not a necessary condition, government intervention is often essential to public health because it is frequently required for numerous actors to work in close coordination to achieve positive public health outcomes [77]. Health risk factors are any attribute, characteristic, or exposure of an individual that increases the likelihood of developing a disease [78]. Typically, they include inherent factors (e.g., age), lifestyle and behavior (e.g., smoking), environmental factors (e.g., exposure to air pollution), occupational factors (e.g., night shifts), and clinical factors (e.g., high blood pressure). Some factors are connected; for instance, high blood pressure can be linked to inherent factors and lifestyle choices.

Exposure to excessive and improper artificial lighting can negatively affect human health through environmental exposure, as would be the case for people living in unduly lit urban areas or anyone exposed to light trespass, or individual lifestyle and behaviour, such as extensive use of mobile devices at night. Occupational factors should be considered as well. In 2009, Kantermann and Noerreberg [79] expressed reservations about interpreting artificial light at night as a health risk factor. Due to a lack of decisive scientific evidence about the mechanisms and extent of the damage caused to people's health, they suggested that artificial light at night could be interpreted as a health risk predictor. Health risk predictors are used to calculate the probability that a particular disease will occur. They may be risk factors or not. This means that while it is accepted as uncontroversial that shift work is detrimental to health, this may not be caused by the exposure to artificial light at night and the consequent disruption of circadian rhythms and suppression of melatonin production. According to the authors, lighting may be a surrogate indicator for other lifestyle and occupational aspects that negatively impact health [79]. Nowadays, although additional research is needed to clarify the impact on specific diseases, the detrimental effect of excessive lighting on human health can be considered ascertained [4, 80]. Kantermann himself, in 2018, reported that there is a scientifically grounded concern that ALAN can have negative health consequences [81]. Against this background, and considering that when outdoors, more than 80% of the world's population experience a skyglow dome [3], and when indoors, widespread improper lighting settings and use of mobile devices raise serious concerns [5], it is appropriate to consider and treat excessive lighting, both indoors and outdoors, as a matter of public health. Framing excessive lighting as light-public health involves, as with any other type of framing, delimiting the space within which the discussion of the problem happens. Aware of this, some desirable effects can be described.

First, shaping concerns over excessive lighting in public health terms entails involving health and well-being themes in lighting policies and investment strategies, which, instead, still tend to focus on cost, energy efficiency, and city branding [82]. It shortens the distance between health research and health policy impact by providing reasons and conceptual tools readily available to policymakers and local administrators for improving lighting policies and investment strategies.

Second, framing concerns over excessive lighting as light-public health means presenting to the public a relatively known landscape that adequately resonates with the value systems of virtually everyone. This can facilitate acceptance of potential changes to outdoor illumination to decrease exposure to artificial light and help individuals find motivations to modify their behavior (e.g., restraining the use of mobile devices at night or adhering to good interior design practices in installing home lighting systems). Furthermore, and partially connected to the next point, it is a way to frame concerns over excessive and improper exposure to light that fosters public participation in finding solutions through community engagement, which, as noted, is a desirable feature in a frame. A concrete example is the ongoing ENLIGHTENme project, which aims to collect evidence about the physiological and social impacts of artificial lighting on health and well-being to improve lighting policies. The project focuses on people older than 65 years in three case cities (Bologna in Italy, Amsterdam in The Netherlands, and Tartu in Estonia). Representatives of this population, which is one of the most vulnerable to artificial lighting in urban settings (besides being about one-fifth of European citizens), participate together with researchers and stakeholders in urban laboratories ad hoc created for implementing research and co-design of indoor and outdoor solutions through public engagement [82].

Third, health promotion and disease prevention are the main scope of the public health agency, which pursues them by addressing health disparities and inequalities. As such, the light-public health frame provides tools to involve and balance considerations of security, safety, inclusivity, and accessibility in the discussion on lighting policies as different dimensions of diverse populations' health and well-being. In fact, some groups in society are particularly vulnerable to lighting due to biological reasons, and there is also high variation in how socially and economically vulnerable individuals can respond to the uneven distribution of risk factors, such as artificial light at night [40]. Public participation within the light-public health frame can help raise awareness of lighting issues and find solutions to improve the health and well-being of the community.

Figure 1 presents the Light-Public Health Framework, which conceptualizes excessive and improper lighting as a public health issue. The framework highlights the interconnected dimensions of Health & Well-being, Urban Environment, and Lighting Policies, emphasizing how lighting policies mediate both the ecological and social implications of artificial light. By framing lighting concerns through a public health lens, this approach offers a structured way to address issues related to human health, safety, inclusivity, and urban policy.

The light pollution frame emphasizes our responsibility for the environmental detriment and animal harm caused by excessive lighting and inefficient policies. It is also a valuable frame to discuss aesthetics and other existential experiences connected to nocturnal darkness. As these are highly cogent issues, abandoning the environmental framing is undesirable. The public health and the environmental frames can and should coexist. However, there is a need for light-public health to gain ground because the concern about human health within the environmental discussion requires considering the adverse effects of excessive lighting on human health as a facet of a broader problem, as well as balancing human interests against those of other entities, as they would be intertwined with concerns over the other major areas of environmental interest. While this is not wrong, it only marginally accounts for the magnitude and severity of the threat posed to human health by improper and excessive lighting.

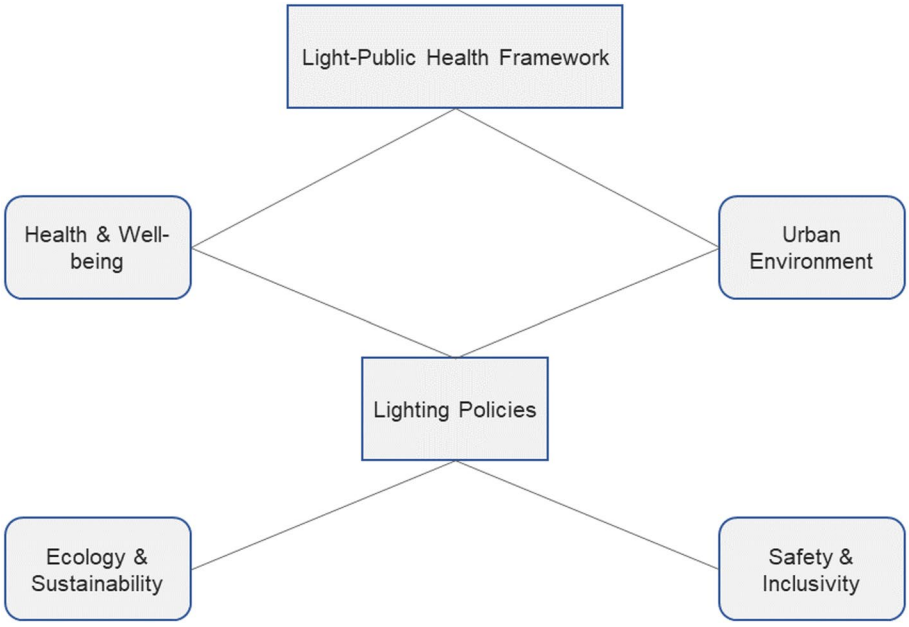

Fig. 1 The Light-Public Health Framework. A conceptual representation of how lighting policies shape the health, ecological, and social impacts of artificial light

5 Concluding remarks

5.1 Main contributions

This article has illustrated some perks of using light-public health as a frame for lighting-related concerns. While living in cities may expose people to negative and more concentrated impacts on health than in peri-urban and rural contexts, such as pollutants and lack of natural spaces, cities can produce important benefits that overcome possible urban-related health risks if well planned and managed. This makes it crucial to consider cities as health enhancers by including and explaining all the determinants that affect the health and well-being of people [83].

The light-public health frame allows to timely address human health issues, including the physiological effects, as well as socio-economic and legal determinants of health in relation to lighting, inequalities in exposure to light, and other dimensions of well-being, such as safety (factual and perceived), inclusivity, and accessibility. Embedding considerations of artificial light at night into a public health framework can boost the conceptualization of lighting as an urban health determinant, thus strengthening its inclusion in the wider healthy urban planning discourse. The focus on present human health does not entail neglecting other dimensions of the lighting problem; it involves providing the public and policymakers with more adequate tools to address the issue of excessive exposure to light, together with other, more consolidated goals related to urban lighting planning and design, such as safety and security promotion, energy efficiency of lighting, and aesthetic valorization of the urban realm.

5.2 Policy implications

Framing lighting as a public health issue strengthens its relevance for urban policies and supports the aim of SDG3. Urban policy comprises any policy that is particularly relevant for cities, and as such, it should also include policies that relate to urban public health. This perspective repositions lighting within urban health frameworks to actively

foster healthier, more sustainable living environments. To this end, lighting policies and planning guidelines should incorporate health impact assessments that consider effects on sleep, psychological restoration, and perceptions of safety. Interventions could include minimizing over-illumination, reducing glare, favouring warmer lighting spectra, and employing ambient or indirect lighting strategies. These measures are particularly important in contexts such as urban parks, pedestrian corridors, residential areas, and neighbourhoods with older populations, but not only. In a wide range of urban settings, lighting can strongly influence physical and mental well-being. Such an approach is consistent with several specific targets of Sustainable Development Goal 3. It supports the promotion of mental health and well-being (Target 3.4), responds to concerns about injuries in traffic environments by addressing nighttime visibility (Target 3.6), and contributes to the broader objective of reducing illness caused by environmental exposures (Target 3.9), insofar as excessive and improperly managed artificial lighting can be considered part of the broader urban environmental landscape that affects human health.

By addressing lighting as a determinant of health, policymakers can move toward a more comprehensive urban health strategy that considers the nuanced impacts of artificial light on daily life and long-term well-being. The light-public health lens may strengthen the capacity to impact lighting policies at a societal level and could offer a new perspective to investigate light and health factors further in a more comprehensive way. Therefore, researchers and stakeholders are encouraged to use the light-public health framework to conceptualize and communicate on lighting-related matters increasingly. Further research is needed to consolidate the findings on the relationship between lighting and health and well-being to better inform healthy urban lighting policies.

Author contributions
All authors contributed to the conceptualization of the study. MA drafted the manuscript. DM supervised the work. EC managed the project. ST acquired funding. All authors reviewed and approved the final manuscript.

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Data availability
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Declarations

Ethics approval and consent to participate
N/A.

Competing interests
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