

Curbing Lung Cancer by Humanizing Urban Roads

(Case Study: Challenges of Zanjan Imam Street Pedestrianization)

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Abstract

This study examines the challenges and outcomes associated with a pedestrianization project implemented in the polluted city center of Zanjan, Iran, where I served as the head of the research-design team. The project aimed to reduce air pollution from heavy vehicular traffic and its associated health risks, particularly in relation to cancer prevention. Throughout the research and design process, we faced significant opposition from local businesses and shop owners, highlighting a disconnect between stakeholder interests and public health objectives. Despite this resistance, the project ultimately succeeded in creating a vibrant urban public space that received widespread acclaim from the community in a densely populated area. These contrasting perspectives underscore a critical lack of awareness regarding the harmful effects of traffic-related pollution on human safety and its potential role in cancer development. This lack of understanding contributes to entrenched car-dependent behaviors and resistance to the expansion of pedestrian-friendly urban environments. This paper presents a comprehensive overview of a decade-long research process, investigating pathways to facilitate public awareness toward greater acceptance and support for pedestrianization initiatives.

Keywords: Cancer Prevention, Public Awareness, Road Pedestrianization, Traffic Pollution, Urban Public Space

1- Introduction

Ambient air pollution is a major risk factor for the disease burden in the world, which contributes significantly to the complications caused by various diseases and mortality. The burden of disease caused by air pollution has increased over 25 years, mainly due to demographic changes and rising pollution levels, especially in Asia. There is a clear difference in the negative health impacts of air pollution between countries, with higher death rates in low- and middle-income countries compared to high-income countries. The success of future efforts to reduce air pollution and its health impacts will require a

significant reduction in pollutant factors including PM_{2.5} concentrations to achieve meaningful improvements in public health [1].

In general, all countries in the Middle East and North Africa (MENA) region are exposed to particulate matter due to similar climatic, socioeconomic, and political conditions, and similar levels of technology. Residents of these countries are exposed to high levels of PM_{2.5} (particulate matter with a diameter of 2.5 µm or less) due to a variety of factors, including air pollution from industry, emissions by transportation systems, dust storms, and agricultural practices. These factors can lead to poor air quality in the region and pose health risks to people [2].

A 2021 paper published in Nature's scientific reports, argues the fine particulate matter (PM_{2.5}) originates mainly from emissions from fuel combustion, and that road transport is considered one of the main sources of PM_{2.5} emissions. The relationship between road transport and PM_{2.5} concentration is different in terms of time and space, and estimating and recognizing the nature and requirements of this diversity is important for policy-making. The study cites the statistics of premature mortality due to PM_{2.5} pollution in the US, as in 2010, about 3,605 premature deaths were attributable to PM_{2.5} emissions from on-road transportation, while from 2003 to 2016, there were an estimated total of 50,223 premature deaths due to PM_{2.5} linked to on-road transportation. The impact of on-road transportation on air quality varies significantly across different regions and time periods. Future air pollution mitigation strategies must account for the specific impacts of on-road transportation, with a focus on localized and adaptive policies [3].

Some areas most heavily impacted by traffic-related air pollution are the central regions of cities with a network of "street canyons" that lack effective traffic control programs and restrictions. These urban zones are particularly significant from a public health perspective due to their high population density. Consequently, the implementation of intelligent, human-centered urban planning and environmentally focused metropolitan policies is essential to mitigate the health risks associated with traffic-related pollution [4]. The terminology "street canyon" is defined as a confined urban space surrounded by buildings on both sides of a street, where natural air ventilation is limited, leading to the accumulation of pollutants from vehicle emissions and other sources, posing health risks to pedestrians and residents [5]. In such an atmospheric compartment, natural air ventilation through dynamical processes is drastically constrained compared with open space. The urban canopy is the location in which the majority of outdoor activities of the urban population occurs, and hence where substantial human exposure results for pedestrians, road-users and occupants of adjacent buildings which may gain their ventilation from the outdoor (canyon) environment. Exposure to such environments causes adverse health effects [6].

2- Urban Traffic and Health Risks of Ambient Air Pollution

Urban streets are important places for social and commercial outdoor activities. However, roadside air pollution poses a serious health threat to the public due to the close proximity to vehicle emissions [4]. Crilley et al. (2017) carried out a source apportionment study at a roadside environment in central London, UK. They reported transport emissions as the major contributor, at about 32% of PM_{2.5} [7].

According to WHO, in 2019, 99% of the world's population was living in places where the WHO air quality guidelines levels were not met. The combined effects of ambient air pollution and household air pollution are associated with 6.7 million premature deaths annually. Ambient (outdoor) air pollution is estimated to have caused 4.2 million premature deaths worldwide in 2019. Some 89% of those premature deaths occurred in low- and middle-income countries [8].

A 2020 article examines public health evidence and recommendations on the link between outdoor air pollution and cancer. This valuable article highlights the association between exposure to fine particulate matter (PM_{2.5}) and an increased risk of lung cancer, as well as the potential for other types of cancer affected by air pollution. The document also highlights the importance of public health interventions aimed at reducing air pollution levels for reducing these health risks [9]. Fine particulate matter (PM_{2.5}) is one of the main causes of health risks associated with air pollution. PM_{2.5} is strongly associated with an increased risk of lung cancer. Several studies have found a consistent and strong association between PM_{2.5} exposure and an increased incidence of lung cancer. Lung cancer is the most commonly diagnosed cancer worldwide and is the leading cause of cancer death, with an estimated 2.1 million new cases and 1.8 million deaths occurring in 2018, representing 11.6% of all new cancer diagnoses and 18.4% of all cancer deaths [10].

3- The Role of Urban Planning and Policies in Cancer Prevention

According to WHO, addressing air pollution, a major risk factor for noncommunicable diseases, is crucial for public health and requires coordinated efforts from policymakers across various sectors. In transportation, transitioning to clean energy sources, enhancing urban transit systems, and promoting walking and cycling are vital strategies. Additionally, prioritizing cleaner vehicles and fuels can significantly reduce emissions. Urban planning also plays a critical role by improving building energy efficiency and creating greener, more compact cities, which contribute to overall energy efficiency and help mitigate air pollution. WHO recommends that policies and investments supporting cleaner transport, energy efficient homes, power generation, industry and better municipal waste management would reduce key sources of outdoor air pollution [8].

There exists compelling and substantial evidence that demonstrates a significant association between outdoor ambient air pollution—particularly particulate matter (PM)—and the incidence and mortality of lung cancer. This link has been shown to contribute to hundreds of thousands of lung cancer fatalities each year on a global scale. The adverse health effects of PM exposure underline the urgent need for interventions aimed at improving air quality to mitigate this public health crisis [9]. Research on the relationship between outdoor air pollution and cancer focused on interventions aimed at reducing outdoor air pollution levels has led to increasing calls for cities to adopt more compact and mixed-use urban designs. A significant aspect of this approach involves a transport modal shift from private vehicles to 'active transport' [11]. Key interventions may include enhancing destination accessibility, optimizing employment distribution, increasing residential density, and addressing the availability and cost of parking. Additionally, improving active travel networks is essential to promote walking and cycling [12].

Specific strategies related to mitigating road-traffic emissions encompass various planning and development management initiatives. These include implementing car-free policies, establishing clean air zones, advancing vehicle technologies, and minimizing emissions from public-sector transport services. Other critical measures involve promoting smooth driving practices, reducing vehicle speeds, improving public transportation options, and raising public awareness regarding the adverse health impacts associated with outdoor air pollution. Collectively, these interventions not only aim to reduce pollution levels but also foster a healthier, more sustainable urban environment where active transport can flourish, thereby enhancing the overall quality of life for city dwellers [13,14]. Therefore, one of the most important strategies to reduce air pollution in cities and also to reduce people's exposure to polluted air is to revise the urban lifestyle and design large car-free zones, clean urban public spaces with dense green cover and the possibility of walking and cycling along with safety and tranquility for all citizens.

4- Methodology: The Research-Design Process

A dedicated research-design team embarked on an innovative journey that brought together a diverse group of professionals, including architects, urban planners, traffic experts, and artists. The aim was to envision and create a new street form—one that prioritizes human experience, fosters community interaction, and transforms a polluted, traffic-heavy environment into a vibrant public urban space. This transformative initiative focused on Imam Street, situated in the heart of Zanjan's historic context. The project originated with the architectural design of the library and the main entrance of the Jaameh Mosque. This initial endeavour became the catalyst for a much larger vision, as our team realized the profound potential to improve the urban landscape in its entirety. Our focus expanded to encompass the entire stretch of facades along Imam Street, specifically between Sabzeh Meydan and Enqelab Square, affecting both sides of the street. Through collaborative design processes, we explored various approaches to integrating greenery, pedestrian-friendly spaces, and artistic elements that reflect the cultural heritage of Zanjan. By reimagining this thoroughfare, we aimed not only to alleviate the impacts of traffic and visual pollutions, but also to cultivate a sense of community, sustainability, and aesthetic beauty in the urban environment.

4-1- Streetscape Pedestrianization

In the design initiative, the team consciously chose not to limit the focus to merely the side facades of the street. We posited that a street constitutes a three-dimensional space that embodies all facets of urban life, with the people who inhabit it being its most vital component. This perspective is particularly significant considering our firsthand experience of the detrimental effects caused by the chaotic *mélange* of cars, motorcycles, and pedestrians on Imam Street, a busy thoroughfare in the densely populated central zone of Zanjan. This area is historically rich, hosting notable cultural landmarks such as the historic bazaar and the revered Jaameh Mosque.

A vital urban corridor in Zanjan was reimagined by the research-design team, emphasizing a human-centric urban design aimed at enhancing public health and the

quality of life for residents, workers, and visitors. Inspiration was drawn from global trends of transforming congested roads into pedestrian-friendly spaces to address the area's unhealthy conditions and create an inviting, pollution-free environment. The design of a car-free public space was undertaken to promote walking, social interaction, and leisure activities, thus filling a notable gap in Zanjan.

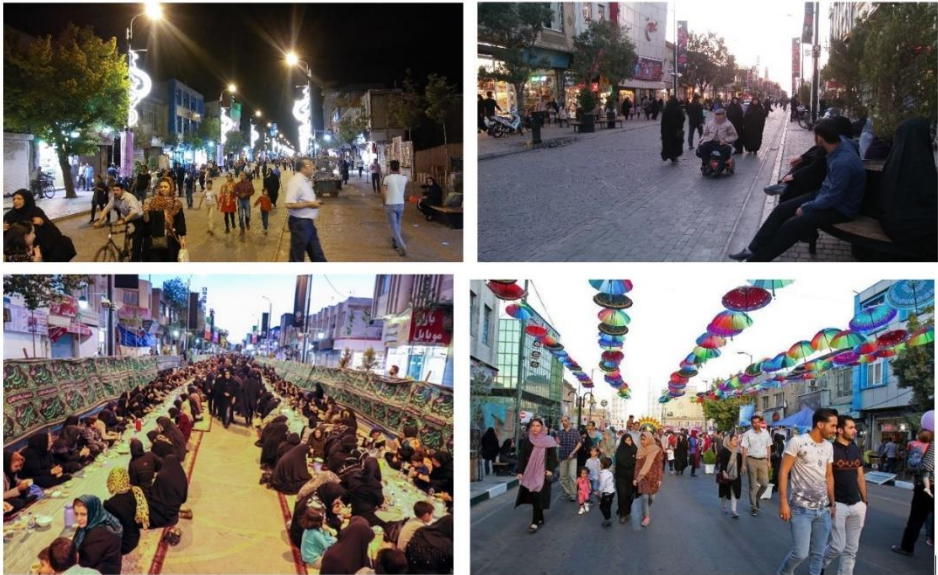


Figure 1: The humanized face of pedestrianized Imam Street in 2018

This transformation was intended to improve air quality while fostering community and cultural appreciation, reflecting a commitment to enhancing the urban fabric of Zanjan and prioritizing the well-being of its inhabitants.

4-2- Results, Feedback and Discussion

The urban regeneration project of Zanjan's Imam Street highlights the critical role of stakeholders, including influential individuals and institutions, in shaping the evolving image of Iranian cities. As the pedestrianization process unfolded, it became evident that public and personal opinions are highly sensitive to urban transformations, often resulting in mixed and sometimes opposing reactions. This dynamic reflects the vitality of the urban fabric, where feedback can stem from various economic, social, and practical concerns.

Applied environmental research by Khorrami (2021) indicates a significant reduction in traffic-related air pollutants in the pedestrianized zone of Imam Street, based on data collected across all seasons [15]. However, social research data collected from surveys and interviews during the design and implementation phases of the project revealed that principles deemed aesthetically or functionally sound by experts did not always resonate positively with certain institutions and segments of the public. Retailers, small businesses, cultural institutions, and local communities expressed direct criticisms, primarily driven by economic anxieties and social conflicts. These reactions are not unique to Zanjan; they

echo similar experiences in pedestrianization projects worldwide. For instance, in New York City, the Times Square pedestrianization initiative faced initial backlash from local businesses worried about reduced vehicle access and foot traffic. “It’s rarely a simple proposition to take away traffic lanes and parking spaces in New York City” [16]. However, over time, the project demonstrated increased footfall and sales, showcasing the potential for revitalization through careful planning and stakeholder engagement. Similarly, in Copenhagen, the pedestrianization of Strøget, one of the longest pedestrian streets in Europe, encountered resistance from shop owners concerned about accessibility. Yet, it ultimately transformed into a bustling commercial hub, attracting both locals and tourists [17]. These international examples illustrate that while the initial response to pedestrianization efforts may be fraught with criticism, the long-term benefits can lead to enhanced urban vitality and economic growth. The experiences from Zanjan’s Imam Street and other global initiatives underline the importance of involving stakeholders throughout the process to address concerns and foster a shared vision for urban development.

5- Current Situation Analysis

After nearly a decade of planning and the successful implementation of the 'Human-oriented Street' initiative in central Zanjan in 2018, the project faces significant challenges due to inadequate management and insufficient maintenance. Despite numerous public appeals on social media advocating for the revitalization of this car-free urban space, which once allowed residents to enjoy cleaner air, the local council and mayor's office have exhibited a marked disinterest in enforcing traffic restrictions. This is particularly evident with the increasing prevalence of motorcycles dominating the area. Furthermore, local residents and business owners exert additional pressure to permit private vehicle access, often utilizing both streets and pathways for parking. Consequently, the current condition of the formerly pedestrianized Imam Street illustrates a profound conflict of interest between local stakeholders and the broader public. The city council appear overwhelmed by this discord, leading to a failure in effectively addressing the competing demands. This situation underscores the complexities of urban management in balancing the needs of various beneficiaries while striving to maintain the integrity of public space.

The prevailing confusion and mismanagement surrounding urban traffic policies can be attributed to a significant lack of public and expert awareness regarding the health risks associated with traffic-related air pollution. This deficit in understanding hampers the ability of local authorities to advocate effectively for public health and environmental sustainability. Without robust scientific awareness about the well-documented effects of ambient air pollution—such as its correlation with respiratory diseases, including lung cancer—citizens may not actively advocate for necessary legislative measures aimed at safeguarding urban public spaces from vehicular emissions. As a result, their representatives in city councils and municipal offices may be swayed by the vocal demands of local stakeholders who benefit from unrestricted vehicle access. This scenario often culminates in a gradual capitulation to unlawful traffic practices and inadequate enforcement of pedestrianization policies, ultimately prioritizing short-term local interests over long-term public health benefits.

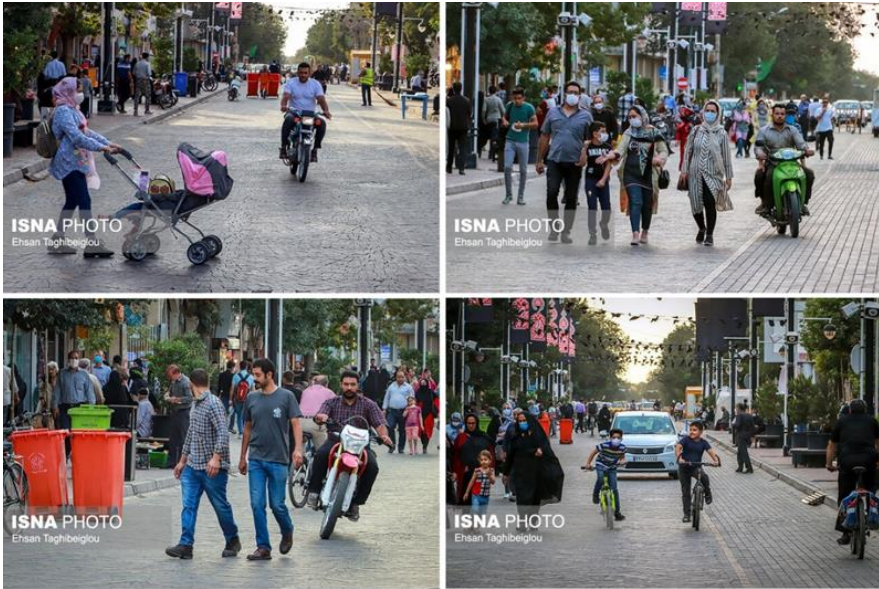


Figure 2: The current chaotic scene of Imam ‘semi-pedestrian’ Street

Internationally, similar cases illustrate the consequences of insufficient public awareness on urban initiatives to restrict traffic. For example, in Los Angeles, in 2016, community resistance to the implementation of bicycle lanes (as part of the city’s Mobility Plan 2035) often stemmed from a lack of understanding about the health and environmental benefits of reduced car dependency [18]. Similarly, in 2019, Paris implemented a series of car-reduction measures aimed at improving air quality and promoting sustainable transport. However, significant opposition emerged from local businesses concerned about potential economic repercussions, leading to protests and debates regarding the restrictions on vehicle access, often overshadowing the potential health advantages of cleaner air [19]. These examples highlight that a well-informed public is crucial for well implementing urban policies that prioritize environmental health and pedestrian accessibility. Absent such awareness, the direction of urban development can easily be swayed by a small subset of assertive interest groups, undermining broader public health considerations. John Forester’s 1989 impressive book “Planning in the Face of Power” provides a compelling perspective on the politics of professional practice in city planning, public policy making, and administration. It highlights how lack of public awareness can hinder progressive urban development plans due to the influence of small groups of vested stakeholders [20].

6- Conclusions

This study draws on research, which reveals a significant reduction in traffic-related air pollutants in the pedestrianized zone of Imam Street, underscoring its effectiveness in mitigating cancer risks in the area. This finding highlights the critical role that urban interventions can play in promoting public health and safety. Although there are various urban interventions that have proven to be effective means of cancer prevention,

international efforts to promote and implement primary prevention still lack momentum, and policymakers, local and national, remain unaware of the degree of progress and the benefits that prevention brings [10]. This also includes urban planners, architects, public and private businesses, municipal systems, city councils as well as mayors, who have direct responsibilities in shaping the fate of cities. To promote public awareness about the links between traffic-related air pollution and increased cancer risks, it is crucial to implement targeted educational initiatives. Strategies should include:

1. Public Campaigns: Run awareness campaigns that clearly communicate the health risks associated with vehicular emissions, particularly regarding cancer.

2. Community Engagement: Facilitate forums and workshops where community members can discuss urban planning and express their concerns, allowing for a more informed public discourse on health and environmental issues.

3. Partnerships with Local Institutions: Collaborate with schools, healthcare facilities, and environmental organizations to disseminate information about the benefits of reducing car dependency and shifting towards more sustainable transport modes.

Moreover, this conclusion emphasizes the significance of pedestrianization, like that of Imam Street, as a fundamental intervention in improving urban health and safety. Such initiatives not only enhance air quality but also foster community well-being and connectivity, urging citizens to advocate for policies that serve their long-term health. To acquire clean active transport, various measure should be taken into account:

- ✓ Human-oriented urban planning (such as ‘15 minutes cities’ scheme)
- ✓ Investment in environment-friendly transport modes
- ✓ Increasing public awareness about benefits of ‘active transport’

Future research should focus on longitudinal studies to assess the lasting impacts of pedestrianization on public health and air quality. Additionally, investigating the role of urban education in shaping community support for sustainable transport initiatives can reveal valuable insights for effective policymaking. By prioritizing public education and engagement, cities can align their development strategies with the overarching goal of fostering healthy living environments, ultimately enhancing the quality of life for all citizens. Strengthening public awareness is essential for ensuring that urban health initiatives are not merely implemented but embraced by the communities they aim to serve.

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