



The impact of smart transportation on the mental health of urban drivers (Case study: District 22, Tehran)

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Abstract:

With the expansion of urbanization and the increase in traffic challenges, the use of Intelligent Transportation Systems (ITS) has become a key solution for improving the efficiency and safety of urban transport. These technologies utilize tools such as machine learning, the Internet of Things (IoT), and 5G networks to predict traffic patterns, optimize routes, and reduce driving-related stress. On the other hand, the mental health of vehicle drivers, especially in large metropolitan areas, is influenced by various factors such as job pressures, traffic congestion, and exposure to stressful situations. Studies show that urban drivers often suffer from issues like anxiety, insomnia, and depression, which can negatively impact the safety and quality of transportation services. This article takes an analytical-descriptive approach to examine the role of smart transportation in the mental health of drivers in District 22 of Tehran. The findings indicate that strategies like real-time monitoring of driver health through smart systems, the use of predictive algorithms to alleviate traffic, and improving communication between vehicles and infrastructure can help reduce psychological pressures and enhance safety. Moreover, integrating these technologies with educational programs and psychological support for drivers represents a significant step towards sustainable urban development. Implementing intelligent transportation systems not only increases urban traffic efficiency but also plays a crucial role in improving drivers' mental health by reducing stress factors. Achieving safe, efficient, and humane transportation requires collaboration among urban planning disciplines, psychologists, electronic engineers, and city managers. The aim of this research was to investigate the impact of smart transportation on the health of drivers in District 22 of Tehran. Methodologically, this research is applied in nature and combines descriptive-analytical approaches based on field studies, documentation, and library research. The necessary information was collected through a questionnaire and analyzed using SPSS software.

Keywords: Smart transportation, mental health, drivers, District 22 of Tehran.



1-Introduction

The global proportion of urban population is on the rise. In 1900, about 13% of the world's population lived in cities, whereas this figure reached 60% by 2020 (Esmaeili et al., 2023). The recent surge in urbanization is a severe global issue that requires a multifaceted response to accommodate the increasing population in urban areas. The influx of people into cities is projected by the United Nations to push the global urban population to approximately 4.9 billion by 2030 (Tekler et al., 2022; Kang et al., 2016). One of the fundamental challenges faced by urban societies in this century is urban transportation, which necessitates significant changes in policies, planning, design, and travel methods to mitigate the negative impacts of this sector (Barros et al., 2020). Transportation plays a central role in social and economic development (Zhang et al., 2025). Today, with the growth of cities, the development, management, and utilization of transportation systems have become essential for advanced countries and play a key role in the daily lives of citizens. When properly planned, the use of transportation modes can serve as effective tools for smart monitoring (Quessada, Pereira et al., 2020). Intelligent transportation systems are considered one of the effective components of a smart city (Tamane, Dey et al., 2020), involving the use of information and communication technologies to manage infrastructure, vehicles, users, and traffic flows, which are interconnected with other modes of transport (Payne, 2015). Urban transportation is one of the challenges that consumes a significant amount of time for the active residents of large cities every day. Furthermore, increased fatigue reduces individuals' tolerance levels and indirectly affects them. The emergence of the negative and harmful effects of transportation in recent years has attracted the attention of urban managers, bringing the topic of sustainable transportation to the forefront (Amanpour et al., 2014). One of the innovative approaches to developing sustainable transportation in cities is the concept of intelligent transportation. Urban intelligent transportation systems are one of the achievements of information and communication technology in urban transportation, significantly impacting economic, social, and environmental aspects (Gonzalez, 2019).

In fact, the contradiction between economic growth and environmental preservation, the confrontation of the postmodern citizen with the industrial (modern) city, and the inability to meet the needs of contemporary citizens have led to the emergence of the sustainable smart city approach. This approach seeks to address these issues with the help of information and communication technology, including the Internet of Things (Hatami et al., 2021). A key aspect of the smart city approach is smart transportation (Parastesh et al., 2018). There is potential for integrating transportation through smart transport systems based on technology. Information and communication technology can unify all elements involved and influencing the transportation system, including networks, vehicles, and people, by facilitating easy and inexpensive information exchange through technology, thereby creating optimal productivity for the transportation system (Kaveh et al., 2021). In Iran, the concept of smart transportation has been discussed in a holistic manner along with sustainable development, emphasizing long-term social and ecological health (Ahmadian, 2022). Since the central focus of development is a healthy individual, and contemporary societies seek to create suitable conditions for necessary production and acceleration towards comprehensive development, it is evident that examining and clarifying all factors affecting health is essential for researchers and health advocates (Zarangi et al., 2024). However, today, when we look at the state of mass urbanization, especially in developing countries, we notice numerous technical, economic,



and cultural problems, as well as a shortage of effective urban human resources, which have diminished the quality of life indicators (Ziyari et al., 2014). This has directly impacted the quality of the environment and urban health. The reality is that many urban areas are simultaneously experiencing demographic and structural growth (Marshal et al., 2025). However, the capacity and facilities of urbanization are not equipped to address such growth, and these changes affect the foundations and infrastructure of cities, reducing the health indicators of urban areas and their citizens (Hatami Nejad, 2013). Such conditions not only threaten public health indicators but also limit access to recreational facilities, ultimately leading to a further decline in access to sustainable development indicators (Lotfi et al., 2013).

It is clear that the health of both mind and body is the economic and social backbone of any country, and progress in this area represents a significant human investment. (Mireh et al., 2017) Mental health does not merely mean the absence of psychological disorders; it also refers to flexible and balanced responses to various life experiences. (Moore et al., 2018) Therefore, an individual with good mental health should demonstrate rational behavior when facing different economic and social issues or when confronted with adverse conditions. (Helbic, 2018) In this context, there is growing concern over the factors threatening health, with an emphasis on the connection between urban environments and the physical and mental well-being of city dwellers. Decisions are being made to enhance issues such as urban ecological health, social welfare, and the improvement of human quality of life. (Thompson, 2017) Undoubtedly, mental health plays a crucial role in ensuring the dynamism and effectiveness of any society. (Saidi Monfared et al., 2019) Over the past few decades, we have witnessed profound changes in the interests of urban planners and specialists aimed at promoting mental health through urban planning and design. (Dong & Qin, 2017) Lifestyle, local social structures, work and living environments, and general economic, social, cultural, and environmental conditions significantly influence individuals' mental health. Poor urban environmental qualities, such as air pollution, inadequate waste management, and noise pollution, also pose threats to residents of metropolitan areas. Environmental designers like William White, Ildefons Cerdà, Kevin Lynch, and Christopher Alexander believe that the design and visual quality of urban environments impact people's behavior and their mental health, and this has been proven. (Ghafari et al., 2023)

2-Statement of the Problem

The transportation of goods and passengers is recognized as one of humanity's most essential needs and is given special attention in urban planning. Several issues arise from this, including environmental pollution, material and moral damages from accidents, wasted time and energy, traffic congestion, and mental health concerns. Therefore, to overcome these challenges, it is clear that traditional methods are insufficient. With a nod to advancements in communication and electronics technology, intelligent transportation systems have become a focus for experts in this field to address transportation problems in human societies (Ghanbarpour et al., 2022). Today, transportation is considered a vital and foundational component of the national economy. This sector encompasses activities that are extensively involved in the production, distribution, and consumption of goods and services, playing a significant role in the economic activities of countries (Pouya et al., 2022). A smooth and safe transportation system is one of the necessary infrastructures for the development



of industries and the enhancement of social welfare in any country. Currently, transportation-related issues have made the provision of safe and efficient transport one of the most pressing concerns for many developed and developing nations (Ramazanzadeh et al., 2022).

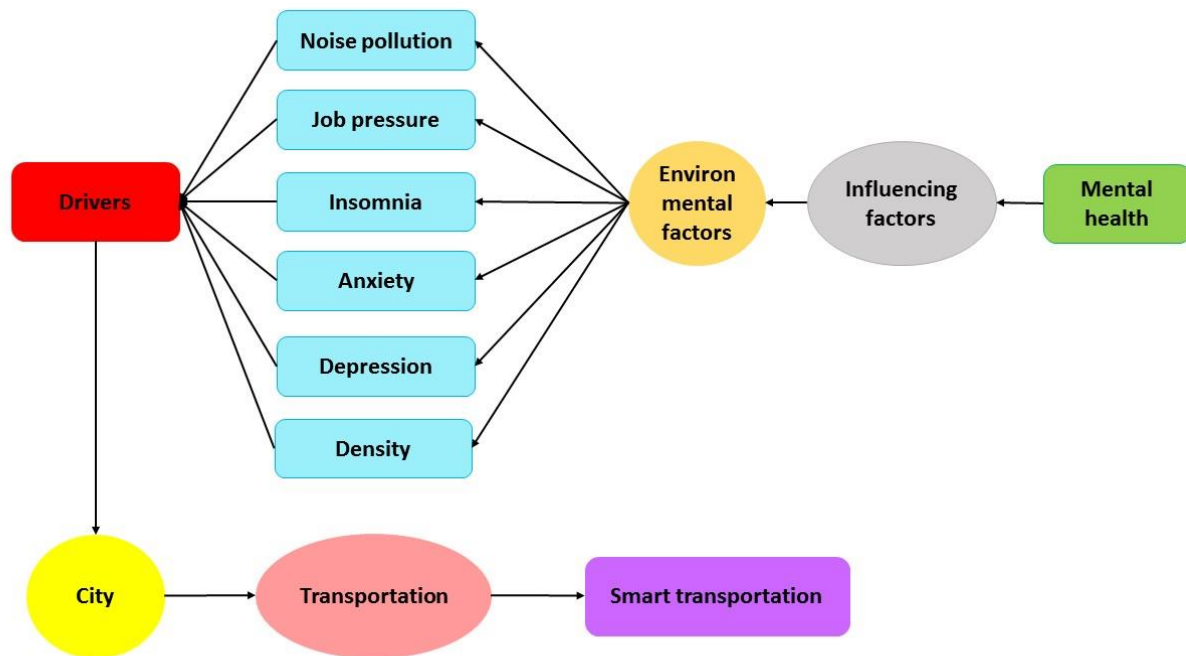
One of the major issues facing large cities like Tehran is traffic congestion, particularly the overcrowding of vehicles on streets and highways. Addressing traffic problems, especially vehicle density, has become a concern for city officials and the government. High vehicle density poses challenges for citizens, such as wasted time (De Palma et al., 2021) and physical and mental health issues (Hazel, 2017), each of which can lead to a relative decline in the population. Thus, tackling this issue has become a central focus in urban management and urban transportation demand (Shahbazi, 2023). Our physical, emotional, and mental well-being are all interconnected, influencing how we perceive ourselves in the world and how we relate to others. This includes maintaining good mental health, which is crucial at every stage of life—from infancy to adulthood. Daily life, relationships, and physical health can be adversely affected by mental illness (Connell, 2022). Mental health issues affect a significant portion of the population over a lifetime and account for nearly a quarter of the global disease burden. Furthermore, mental health disorders are a major public health concern that has significantly increased in recent years. In response, the WHO adopted a mental health action plan between 2013 and 2020 (Organization, 2021).

Mental health is the ability of individuals to interact with one another in ways that enhance mental well-being, to develop and optimally utilize cognitive, emotional, and relational capabilities, and to achieve personal and group goals that align with justice. While gender is not explicitly mentioned in this definition, it can impact the production of mental health at all levels—individuals, groups, and the mental health environment. In the global public health agenda, it has now been established that mental disorders affect all age groups and are responsible for significant burdens (Egan et al., 2021). A major discussion within the fields of health, citizenship rights, and justice in mental and physical health is that mental and physical health, along with other basic human needs such as food, housing, clothing, education, and security, are fundamental rights of every human being and constitute civil and social rights (Hadian et al., 2013; Farmer, 2015).

Based on studies conducted in urban areas, there has not been adequate performance in creating a healthy environment for citizens. Issues such as air pollution, inadequate sidewalks, unequal distribution of urban facilities and services—especially healthcare services, delays in waste collection, improper waste disposal or recycling, neglect of transportation matters, and more highlight this significant problem in cities. It can be said that the urban health system is a crucial determinant of equity and equality in the mental and physical health of citizens. Urban mental health encompasses social factors related to an individual's mental well-being, environmental health, healthy living conditions, road safety, healthy lifestyles, security, violence, food health, recreational facilities, and individuals' sense of belonging to the community. Studies of the current conditions in Iran indicate major inefficiencies, injustices, and weaknesses in the urban health system. One principle that could serve as a roadmap for managing the city of Tehran in addressing challenges and improving smart transportation development is the concept of a smart city, as this approach is seen as an effective means for achieving better urban management in the field of transportation. The smart transportation trend in Tehran aims to reduce unnecessary costs, enhance mental health,

increase sustainable income, ensure safety, and improve the quality of urban life. Therefore, on one hand, integrated management for the development of smart transportation in Tehran is essential, and on the other hand, the process of smartening transportation is of great significance. In this context, the present research aims to examine and study the status of smart transportation in District 22 of Tehran. Accordingly, the main question arises: What impact does the examination of smart transportation in District 22 of Tehran have on the mental health of urban drivers? This is particularly important because drivers play a crucial role in preventing traffic accidents, and the nature of their job has a direct connection to people, making it necessary for them to maintain a higher level of mental health due to the high-risk nature of their work.

Figure 1 - Conceptual Model



3-Theoretical Foundations

❖ Intelligent Transportation Systems

Although many intelligent transportation systems have been registered, a comprehensive definition of ITS has not yet been established due to its relative novelty. The most common definition of ITS is as follows: the application of information technologies to improve the performance of transportation systems (Hejabian Nejad et al., 2015). ITS refers to a collection of tools, facilities, and expertise, including traffic engineering concepts, software, hardware, and telecommunications technologies, which are used in a coordinated and integrated manner to enhance efficiency and safety in transportation (Ahmadian, 2022).



❖ Mental Health

According to the World Health Organization, health refers not only to individual well-being but also encompasses the feelings of satisfaction and joy in physical, mental, and social aspects of a person's life (Uslu et al, 2009). In 1986, the Ottawa Charter was developed with the aim of promoting health (Rahimi et al, 2022). The World Health Organization (1977) defined health as a state of complete physical, mental, and social well-being, not merely the absence of disease or infirmity. Mental health is characterized by emotional and psychological well-being, the absence of anxiety and disruptive symptoms in life, the capacity to establish and maintain positive and satisfying relationships with others, and the ability to cope effectively with life's stresses and contradictions (Weist, 2015).

4- The Impact of Transportation on Mental Health

Initially, it is important to recognize that the phenomenon of transportation has been on the rise in recent years, which will aid in a better understanding of the topic. Driving places individuals in specific and unique situations, and these conditions reveal certain personality-based behaviors of the driver more clearly and objectively. On the other hand, driving is also a social behavior that influences a wide range of cognitive, emotional, and personality actions of individuals; therefore, those who engage in driving must be aware of their psychological state. In fact, determining whether risky driving behaviors belong to one of two categories can provide two different research perspectives. It can be said that driving violations may occur due to mental health issues. Previous research has shown a significant relationship between mental health and the field of transportation. Health has been a concern since the dawn of humanity, but whenever it has been discussed, the physical aspect has generally been the focus, with less attention given to other dimensions of health, particularly the psychological aspect. The World Health Organization emphasizes to country officials the importance of ensuring the physical, mental, and social health of individuals, stressing that none of these three dimensions takes precedence over the others. According to reports from this organization, the world will witness major changes in the epidemiology of diseases and the health needs of individuals over the next two decades.

Stress is defined as any disturbance that disrupts an individual's mental well-being and physical peace. It has a significant impact on a person's cardiovascular and immune systems, and when it becomes chronic, it leaves individuals highly vulnerable to specific and infectious diseases, slowing down their recovery process (Segerstrom, 2024). Additionally, it imposes a considerable financial burden on society. Identifying individual stress can greatly benefit both personal health and the well-being of the community. The results of stress assessments are utilized for various practical purposes, including examining the stress levels of drivers in road and street conditions (Taghavi et al., 2016). Stress among race car drivers, which is closely linked to mental health, is also noteworthy. Among the various types of stress that affect mental health, driver stress has been recognized as a significant factor influencing driver awareness and performance, directly impacting aggression and risky behaviors on the road (Pour Mohammadi, 2017).



Behavioral and psychological assessment of any group, particularly those in the workforce who interact directly with recipients of services, is crucial. Mental health encompasses a state of successful mental processes, efficient activities, effective and fruitful relationships, adaptability to changes, and the ability to align with favorable conditions (Keyes, 2024). This recent definition is the result of forty years of work by specialists aimed at providing a comprehensive definition of mental health. It is believed that individuals who do not enjoy optimal mental health put themselves and others at risk when they occupy positions as private or public drivers (Shakarian, 2020). In this context, it has been noted that individuals who engage in risky driving behaviors are likely to have other psychological and behavioral disorders as well. This finding was also echoed in research by Blows and colleagues (Blows, 2015). Iversen and Rundmo discovered that drivers who score higher on psychological abnormality, as a component of mental health, are more likely to engage in risky driving, have more accidents, or have a higher probability of being involved in accidents. These drivers tend to disregard laws and do not consider law-abiding behavior as a clear objective (Iversen, 2020). Considering health and well-being as the positive aspect of mental health is an approach that many researchers are currently focusing on.

Traffic psychology is a branch of applied psychology that focuses on studying traffic behavior. Its primary goal is to enhance the safety of individuals participating in traffic and to maintain the improvements achieved as long as possible. The causes of fatal and non-fatal accidents are largely rooted in the traffic behavior and mental experiences of road participants. Patterns of critical accidents indicate that these incidents involve not only technical factors but also human factors. Given the significant role of individual, psychological, and medical factors in traffic, understanding how individuals apply behavioral principles can greatly influence the development and safety of traffic behavior. This knowledge helps individuals adjust their behavior in various traffic situations, including driving, cycling, walking, and other forms of movement in shared spaces. Behavioral and cultural patterns are key determinants of how people utilize space.

5- Background of the Research

- ❖ In 2024, Khaledi and colleagues conducted a study examining the mental health of urban public transportation drivers. They stated that the role of drivers in road accidents is significant; in other words, they are concerned with public safety and well-being. Intercity public transportation drivers experience mental health issues, primarily anxiety and insomnia. Given their role in society, it is recommended that municipal authorities pay closer attention to these issues. Their mental health is particularly important since driving is a stressful job. The study identified factors such as insomnia, followed by social dysfunction, physical symptoms, and depression as key indicators. Furthermore, in terms of frequency, the sequence of subscales was as follows: symptoms of anxiety and insomnia, physical symptoms, social dysfunction, and depression.
- ❖ In their research published in 2022 in the Journal of Industry Technology Development, Pouya and his colleagues articulated their findings regarding strategies to address the fundamental challenges in the field of intelligent transportation technology. They stated that in today's world, transportation infrastructure is crucial for the economic and social



development of countries. In this process, the role of transportation systems in optimizing costs and travel time, increasing speed of movement, ensuring safety, and enhancing the level of services provided is undeniable. Each country requires a wide-ranging and reliable transportation network to elevate its economic, cultural, security, and political capabilities. In economic terms, the set of services that facilitates the transfer and movement of production resources holds economic value and is considered part of the production flow. Furthermore, transportation adds value in the distribution of goods and services. The transportation system occupies a special place in policymaking and investment decisions within countries. Achieving a safe, fast, efficient, clean, and reliable transportation system that is world-class and the best in the Middle East, as outlined in the country's vision document, underscores the importance of focusing on this strategic issue, which also plays a significant role in national power and security. This research aims first to explore, through library studies and the examination of higher-level documents, the question of what the challenges of the transportation system in the country are. Subsequently, by reviewing the opinions of experts through the establishment of a specialized panel, it seeks to identify which challenges in this industry can be addressed through smart technology. The results indicate that 15 out of the 27 challenges faced by this industry can be resolved through smart technology, including the coordination of decision-making bodies, efficient maintenance of the network, and the development of multimodal transportation infrastructure.

Table 1 - Background of Domestic Research in Iran

Row	Research background				
	Research title	Author	Year	Magazine name	Keywords
1	Social determinants of positive mental health in Iranian adults.	Falahat and colleagues	2023	Psychiatry and Clinical Psychology in Iran	Mental health, social components, health, modeling, structural equations
	Overall achievements and results	Considering the importance of promoting positive mental health in preventing psychosocial disorders, enhancing physical health and productivity, and identifying the social components that affect it in order to implement necessary interventions to improve the mental health of the community, it is essential. The present study, based on the World Health Organization model, indicates that perceived stress is the most significant mediating factor that causes the transmission of structural determinants affecting the mental health of Iranian adults. Additionally, perceived stress has the most substantial direct negative impact on positive mental health.			
	Extracted indicators	Improving socioeconomic status through increased social support and job satisfaction has led to an increase in the level of positive mental health among Iranian adults, and on the other hand, reducing perceived stress			



			both directly and indirectly explains the effect of structural social determinants on positive mental health.				
	Background of the research method						
	Research method	Research objective	Statistical population	Research context	Data collection method	Data analysis method	Data analysis tools
	quantitative	Survey analysis	Men and women aged 30 to 60	Tehran's 22 districts	Questionnaire	Structural equations	SPSS

Table 2 - Background of Persian research

Row	Research background				
2	Research title	Author	Year	Magazine name	Keywords
	Evaluation of citizens' behavioral patterns in smart urban transportation stations (Case study: Shahid Kharrazi Smart Station, Shahinshahr)	Zoghdar and colleagues	2018	Architecture	Behavioral science, smart station, city culture, transportation
	Overall achievements and results	As the population increases, their management also becomes more and more difficult; controlling a large population without using new information and communication technologies will be very difficult. The topics of smart citizens, smart economy, smart transportation, and... are among the topics related to smart cities. Now, how different groups of people deal with and adapt to this smartization in cities is important. Analyzing the acceptance and integration of people with the organization of smart stations in developing cities in the smart public transportation network is one of the goals of this research. The present article tries to evaluate and analyze the hypothesis (low-income groups not adapting to the smartization of cities). As a result, it was estimated that groups of citizens who make up 0.1 of the total population that use it daily are economically low-income groups of society and are less involved in the smartization of public transportation. Therefore, as a result, designs should be done in a way that encourages this group of citizens to participate.			
	Extracted indicators	General community cooperation in making transportation smarter is considered very important in this regard.			



Background of the research method							
Research method	Research objective	Statistical population	Research context	Data collection method	Data analysis method	Data analysis tools	
Mixed	Descriptive analysis (survey)	Men and women	Shahin shahr	Documentary -field library	Structural equations	SPSS	

- ❖ Erika Reinhardt and colleagues published their study in the BMJ in 2024, titled Public transport policy, social participation and mental health in older age: a quasi-experimental evaluation of the free bus pass in England, stating that the history of social participation and social isolation are key determinants of mental health in older age, but there is limited evidence on how public policies might help reduce isolation, promote social participation and improve mental health among older people. This study examined the impact of introducing an age-appropriate transport policy, the free bus pass, on the mental health of older people in England. Eligibility for a free bus pass was associated with public transport use among older people. Model IV suggests that public transport use reduces depressive symptoms by 0.952 points (95% CI -1.712 to -0.192) on the Centre for Epidemiological Studies Depression Scale. The IV models also suggest that public transport use reduces feelings of loneliness. Free bus travel is associated with reduced symptoms of depression and loneliness among older adults. Transportation policies may increase social participation among older adults, resulting in significant mental health benefits.
- ❖ Rachel, in a 2020 study published in the Journal of Transportation and Health under the title Transportation and Other Social Needs as Indicators of Mental Health Conditions, stated that the study sought to determine whether reporting a history of depression, anxiety, PTSD, bipolar disorder, drug or alcohol use disorder, ADHD, schizophrenia, or current depressive symptoms was associated with seeking help for any of 12 social needs. Reporting a mental health condition was associated with a greater likelihood of seeking help with transportation, food, health care, and personal safety. Of these, the strongest and most consistent associations were with transportation needs. In post hoc analyses, most of the associations between transportation needs and mental health remained significant after adjusting for potential confounders. Compared with participants who did not report a history of mental illness, those who reported mental health conditions were more likely to call 2-1-1 and seek transportation assistance. Community-based agencies that provide transportation or mental health services can partner to build connections between services and increase capacity to address transportation and mental health needs.



Table 3 - Background of research outside Iran

Row	Research background						
3	Research title		Author	Year	Magazine name		Keywords
	How does the cost of public transport affect mental health and well-being?		Mikhail Foster and colleagues	2024	Coventry University		Transportation, mental health, cost
	Overall achievements and results		Transport cost is an important determinant of mode choice and often plays a significant role in household expenditure. Until now, the broader literature on transport and health has not examined evidence on the relationship between the cost of public transport and mental health and well-being. The relationship between the financial costs of public transport (including interventions that affect this, such as subsidies and concessionary passes) on quantitative measures of mental health, mental illness and/or mental well-being, among any group of people who use public transport				
	Extracted indicators		All included studies examined public transport passes or fare reductions available to specific demographic groups (mainly older people, although one study focused on young people). All six suggested that these interventions to reduce the cost of public transport had a positive impact on mental health.				
	Background of the research method						
	Research method	Research objective	Statistical population	Research context	Data collection method	Data analysis method	Data analysis tools
	Qualitative	Content analysis	Women and men	Britain and the United States	Library	Content analysis	Analysis by researcher

Table 4 - Background of research outside Iran

Row	Research background				
4	Research title	Author	Year	Magazine name	Keywords



	Intelligent transportation systems in smart cities: A systematic review.	Abolhassan et al.	2023	Peshawar Conference, Pakistan	Big data, big data analytics, smart cities, intelligent transportation systems, artificial intelligence, SDN, blockchain, VANETs		
	Overall achievements and results	The idea of Smart Cities (SCs) was developed to digitize conventional urban living areas and redevelop them using digital devices to enhance the lifestyle and security of the residents. Smart cities cover a wide range of applications such as smart government, smart energy, smart transportation, smart health, and smart education. This paper explores this topic. Mobility-related applications such as smart transportation. We have. Focusing on smart transportation such as traffic safety, passenger and driver safety, obstacle detection, accident prevention, crime prevention and detection, etc. Most importantly, smart vehicles such as drones have played a key role in facilitating the use of these gadgets in urban environments.					
	Extracted indicators	The smart transportation index is important in the city, and by progressing towards smart transportation, we can have safe transportation.					
Background of the research method							
	Research method	Research objective	Statistical population	Research context	Data collection method	Data analysis method	Data analysis tools
	Qualitative	Descriptive analysis	-	-	Library documents	Analysis by researcher	-

6-Research method

The present research is descriptive-analytical and employs a mixed-methods approach. Data collection for this study was conducted through both library research and fieldwork, utilizing a researcher-designed questionnaire, which was based on a Likert scale. The statistical population for this research focused on candidates for urban expert positions. Accordingly, considering these limitations and reviewing various studies in this area, a sample size of 300 individuals was determined. The sample size is crucial in statistical analysis, as it significantly affects the reliability and validity of the results. Participants were identified and selected through urban experts via a gradual process and referrals from individuals. In this study, data was collected from 100 individuals in municipalities and related organizations that are involved in legislation and urban affairs, 50 individuals from universities with relevance to urban issues, and 150 urban drivers who face these challenges directly. The validity of the research was confirmed by urban planning experts and professors. To ensure the reliability of the analysis in the questionnaire, this index was calculated



using Cronbach's alpha statistics. SPSS software was utilized for the statistical analysis in this research, which we hope will be of interest to our esteemed readers.

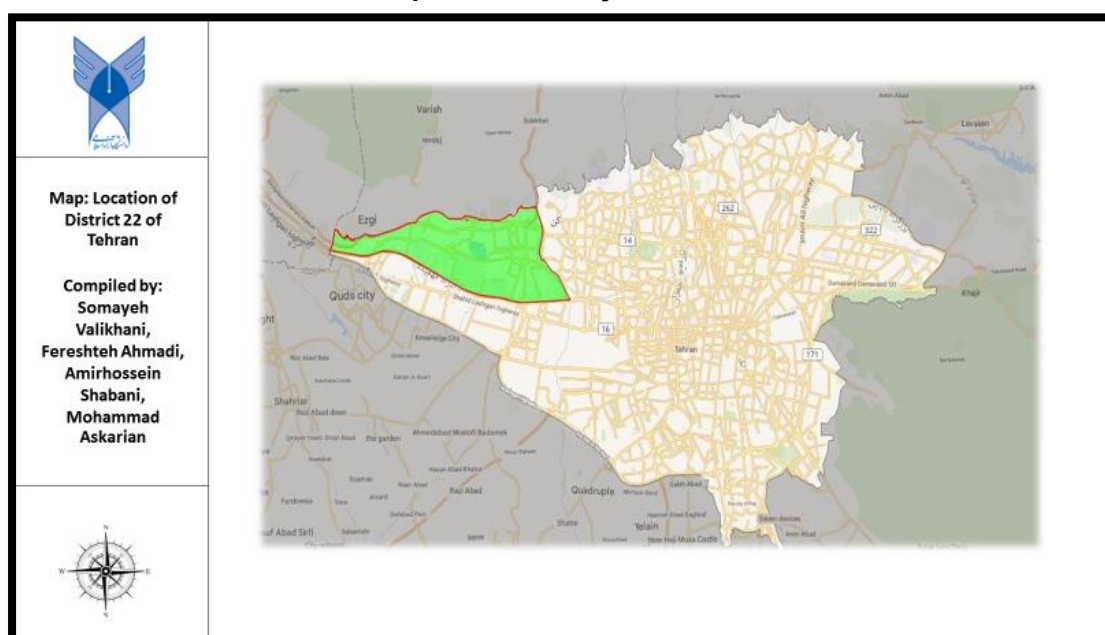
7-Importance and Necessity of Research

The transportation industry is a fundamental pillar of economic and social development, with drivers serving as the primary operators of this system, playing a crucial role in its efficiency. With the advancement of intelligent transportation technologies (such as connected vehicles, advanced navigation systems, and real-time monitoring), examining the impact of these technologies on drivers' mental health has become an important and urgent issue. The mental health of drivers is vital for transportation safety, as they often face significant psychological pressures such as stress, fatigue, loneliness, and aggressive behaviors, which can lead to decreased concentration, increased human errors, and road accidents. Studies have shown that stress and fatigue among drivers are major contributing factors in over 20 percent of fatal accidents. Professional drivers (like truck and bus drivers) are particularly vulnerable to mental health disorders such as anxiety and depression.

8--Study Area

Region 22 of Tehran Municipality is a region in the northwest of Tehran. This region is located downstream of the Kan and Vardij River watershed, which is bordered by the central Alborz Mountains to the north, the Kan River to the east, the Tehran-Karaj Freeway to the south, and the Vardavrd forests to the west. Region 22 has 6 districts, 12 neighborhoods, and 28 towns with an area of 5,881 hectares. The citizens of Region 22 have good access to the Tehran-Karaj Freeway to the south, the Shahid Kharrazi Highway to the north, the Azadegan Highway to the west, and the Shahid Hamedani Highway in the middle of this region to the Tehran highway network and the intercity network of the northern regions of Iran.

Map No. 1 - Study Area





9- Sample Size

To calculate the sample size, Cochran's formula was used with a standard error of 5% and a confidence level of 96%. Based on this formula, the sample size was determined to be 300 individuals. The questionnaire was distributed proportionately among the citizens of Afif Abad Street and was analyzed using a Likert scale, with responses numbered from 1 (very low) to 5 (very high), and then entered into SPSS 19 for analysis.

Cochran's formula

$$n = \frac{z^2 pq}{d^2}$$

$$n = \frac{(1/96)^2 \times 0/5 \times 0/5}{(0/5)^2} = 300$$

10 - Hypothesis, Variable, and Research Question

Every research project aims to answer hypotheses that form in the mind of the researcher. These hypotheses arise from various studies, observations, and field investigations conducted by the researcher.

❖ Hypothesis

It appears that intelligent transportation systems have an impact on the mental health of drivers.

❖ Variable

Table 1 – Research Variables

Variable type	Variable	Indicators
Independent variables	Environmental indicators include psychological indicators, objective indicators, and social indicators	Noise pollution, congestion, job stress, anxiety, insomnia, depression
Dependent variables	Mental health	Traffic



❖ Question

Main Question: How does smart transportation in Tehran affect the mental health of drivers? Sub-question (1) (What - Library-based): What is the impact of smart transportation systems on reducing stress, managing traffic, and improving the mental health of drivers?

Sub-question (2) (Why - Field-based): How are smart transportation and the mental health of drivers related in the city of Tehran?

Sub-question (3) (How - Prescriptive): How can data mining and smart transportation systems be used to identify risky behavioral patterns among drivers and provide psychological interventions for mental health?

11-Analysis Results

❖ Analysis of Variance

Table 2 - Normality Results Using the Kolmogorov-Smirnov Test

		Y
N		300
Normal Parameters ^{a,b}	Mean	3.4399
	Std. Deviation	0.59592
Kolmogorov-Smirnov Z		1.046
Asymp sig .(2-tailed)		0.224

According to the table of the dependent variable of mental health (Y), the result of the Kolmogorov-Smirnov test indicates a normal distribution, as the significance level obtained from this test is 0.224, which is greater than 0.05.



Table 3 - Examination of Normality Using the Kolmogorov-Smirnov Test

		Y
N		300
Normal Parameters ^{a,b}	Mean	3.4603
	Std. Deviation	0.68108
Kolmogorov-Smirnov Z		1.185
Asymp sig. (2-tailed)		0.120

Considering the independent variable of stress related to driver behavior, traffic, noise pollution, etc. (X1), the result of the Kolmogorov-Smirnov test indicates a normal distribution, as the significance level obtained from this test is 0.120, which is greater than 0.05.

Table No. 4 - Pearson Correlation Coefficient

		Y	X1
Y	Pearson Correlation	1	0.872
	Sig. (2-tailed)		0.000
	N	300	300
X1	Pearson Correlation	.0.872	
	Sig. (2-tailed)	0.000	
	N	300	300

The output of the correlation coefficient is displayed in the table above. The correlation coefficient is shown along with its exact p-value (sig), which examines the relationship between the two variables. The value of r is 0.872, indicating a strong relationship between the two variables of mental health and traffic in drivers.

Table 5 – Pearson Correlation Coefficient

		Y	X2
Y	Pearson Correlation	1	0.794



X2	Sig. (2-tailed)		0.000
	N	300	300
	Pearson Correlation	0.974	1
	Sig. (2-tailed)	0.000	
	N	300	300

The output of the correlation coefficient is displayed in the table above. The correlation coefficient, along with the corresponding exact p-value (sig), is shown to examine the relationship between the two variables. The value of r is 0.974, indicating a strong relationship between traffic and mental health.

❖ Results of Regression

Table 6 - Results of Regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.996a	.993	.992	.05171

Table 7 - Results of Regression

Model Summaryb						
Model	Change Statistics					Durbin-Watson
	R Square Change	F Change	df1	df2	Sig. F Change	
1	.993	11466.473	2	381	.000	1.556

The mentioned figure relates to the descriptive statistics of the estimated values provided by the regression, the errors (residuals) of the estimated standardized values, and the standardized errors (residuals). Since the Durbin-Watson statistic is 1.556, which falls between 1.5 and 2.5, the assumption of no autocorrelation among the errors is not rejected, allowing for the use of regression analysis. In the mentioned figure, based on the values in the beta column, it can be concluded that all variables have an impact on mental health, with a significance level of less than 0.05. The variable with the greatest effect is "stress," with a value of 0.736.



Table 8 - Results of Regression

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	61.331	2	30.666	11466.476	0.000
	Residual	0.460	381	0.003		
	Total	61.791	300			

Table 8 - Results of Regression

Coefficients			
Model		Unstandardized Coefficients	
		B	Std. Error
1	(Constant)	0.286	0.21
	X1	0.277	0.09
	X2	0.616	0.08

❖ Hypothesis Testing

Based on this perspective, a five-point Likert scale can be converted into an interval scale by assigning values from 1 to 5, and a one-sample t-test is used to test the above hypotheses.

$H_0: \mu \leq 3$ (It seems that smart transportation does not have an impact on the mental health of drivers in Tehran's District 22.)
 $H_1: \mu > 3$ (It seems that intelligent transportation has an impact on the mental health of drivers in Tehran, District 22.)

Table 10 – T-test

	N	Mean	Std. Deviation	Std. Error Mean
Y	300	3.4399	0.59592	0.4505



Table 11 – T-test

	Test Value = 3					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Y	9.765	300	0.000	43987	0.3510	0.5288

In the mentioned figure, all factors have a significance level of less than 0.05, which means that the average of all factors has a significant difference from the number 3. Considering the values in the two columns for the lower and upper limits of these factors, both are positive. It can be concluded that the average of all factors is greater than 3. Therefore, the status of these factors is high, and the research hypotheses are confirmed.

$\{H_0: \mu \leq 3$ (It seems that factors such as density, noise pollution, and others do not have a positive correlation with mental health..)
 $\{H_1: \mu > 3$ (.) It seems that factors such as density, noise pollution, and others are associated with an increase in mental health.

Table 12 - T-test to examine the relationship between components such as mental disorder, noise pollution, etc. and mental health

	N	Mean	Std. Deviation	Std. Error Mean
X2	300	3.5655	0.71179	0.5381

	Test Value = 3					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
X2	10.510	383	0.000	0.56550	0.4593	0.6717

In the above figure, the sig of all factors is less than 0.05, which means that the average of all factors has a significant difference with the number 3. Considering the values of the two columns, the lower and upper limits of these factors are both positive, it can be said that the average of all factors is greater than 3, as a result, the status of these factors is at a high level and the research hypotheses are confirmed.

12-Discussion

The present study was designed and conducted to investigate the mental health of drivers. This study was conducted on 300 drivers, university professors and city managers in the form of an online



questionnaire. Based on the findings from the analysis of the questionnaire, it had content validity. The results of the analysis in the questionnaire included congestion, traffic, job pressure, anxiety, insomnia and depression. The above mentioned Cronbach's alpha coefficient showed a relatively high validity of the present tool. It also indicated the stability and reliability of the tool in question in measuring mental health. The components raised in the mental health questionnaire of drivers were tolerance of psychological stress. According to the findings, researcher Ji and his colleagues believe that drivers must tolerate psychological stress, which means resistance to events. They believe that this change plays an important role in driving. According to the study, other researchers believe that the variables mentioned in the mental health of drivers are one of the characteristics that cause risky behaviors and, as a result, increase traffic insecurity. According to the variables and indicators mentioned, the results obtained stated that the mental health of drivers is one of the key factors in traffic safety, reducing accidents and improving the quality of life. Drivers who suffer from stress, fatigue, anxiety, etc. are more likely to commit human and high-risk violations. Studies show that personality traits such as irritability, excitement seeking and extroversion are associated with risky behaviors. Drivers with low mental health experience reduced concentration and disregard for traffic regulations. Actions can be taken by using intelligent systems to monitor the condition of drivers. The mental health of drivers is not only an individual issue, but also a social and public safety issue in the city and outside the city. Rather, it is a social and public safety issue. Improving the mental health of drivers through smart education monitoring and careful policymaking can lead to a reduction in fatal accidents, increased road and street safety, and improved quality of life for drivers. Ultimately, safe driving requires a calm mind and a healthy psyche.

13- Conclusion

As the total analysis and findings in this study show, considering that smart transportation in Tehran has a great impact on various factors such as the environment, reducing traffic load on short trips, security, and creating mental health in the city, etc., it is necessary to pay more attention to urban axes and their special design. It is necessary to formulate specific rules for each area, taking into account the appropriate location of streets and general principles for appropriate facilities for drivers such as paying loans to buy smart cars, smart traffic signs, and appropriate lighting, reducing noise, air pollution, looping pedestrian paths, etc., all of which should be done in accordance with the patterns and infrastructure of that place for the mental health of drivers. Also, paying attention to the above factors and special design for urban routes is very effective in making these passages pleasant and suitable for use.

14-Suggestions

- 1- Using intelligent monitoring systems for drivers' mental state
- 2- Facial recognition technology and facial expressions: Using smart cameras in cars or transportation terminals to detect fatigue, stress, anger of drivers and automatic warnings
- 3- Heart rate and breathing monitoring: Integrating wearable sensors such as: smart watches with smart transportation systems to monitor symptoms of stress and fatigue



- 4- Developing psychological training programs and digital coaching: Designing applications based on artificial intelligence that teach breathing exercises, meditation and relaxation techniques to drivers
- 5- Improving the work environment with smart technologies: Intelligent adjustment of car cabin conditions, i.e. systems that adjust the temperature, light and music inside the cabin based on the driver's mental state. For example, playing soothing music if stress is detected
- 6- Intelligent routing to reduce psychological stress: Routing algorithms that consider traffic, road conditions and even the driver's personal preferences to reduce stress.
- 7- Creating psychological support networks for drivers: Online counseling lines that are quickly accessible through smart transportation applications by setting up psychological counseling organizations for drivers
- 8- Driver support community: Creating social platforms to exchange experiences and receive psychological support for drivers
- 9- Predicting psychological risks with artificial intelligence: Using behavioral data of drivers (such as stopping time, driving style, etc.) to identify stressful patterns and provide preventive solutions
- 10- Supporting policies and regulations: Mandatory mental health standards in the transportation industry, mandatory rules for periodic check-ups for drivers
- 11- Financial incentives for healthy drivers: Providing financial incentives or insurance to drivers who participate in mental health promotion programs.
- 12- Fatigue and stress warning systems using biometric sensors prevent accidents
- 13- Self-driving and semi-autonomous vehicles provide more opportunity for rest and relaxation by reducing the mental burden of the driver

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