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An Investigation of the Mortality Caused by Accidents and Incidents in Babol Based on the International Classification of Diseases (ICD10)

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ABSTRACT

Background and Objective: Accidents as the second cause of disability and the main cause of disability and death can lead to physical and mental disorders and even death. The present study was conducted to investigate the mortality caused by accidents and incidents in Babol, Northern Iran, based on the international classification of diseases.

Methods: This cross-sectional study was conducted retrospectively on all the deaths recorded during the years 2016-2022 in registration and classification system of causes of death caused by accidents and incidents at the health department of Babol. Deaths caused by accidents and incidents were extracted and analyzed based on ICD-10.

Findings: Out of 18265 deaths, 1305 cases (15.7%) were related to accidents and incidents, of which 686 deaths (52.57%) were caused by traffic accidents. The highest frequency of accidents and incidents was 576 cases (44.13%) due to a person being injured in an unknown (traffic) accident and 182 cases (13.95%) being exposed to an unknown factor. The mean age in deaths caused by accidents and incidents in the traffic accident group was 46.05±22.07 and in the non-traffic accident group was 43.35±23.49 years (p=0.033). As the decades of age increased, the death rate increased (p<0.001).

Conclusion: Based on the results of this study, most of the deaths caused by accidents and incidents based on the classification system of the causes of death were due to the injury of a person in an unknown accident, exposure to unknown factors and poisoning.

Keywords: *Accidents and Incidents, Death Rate, Traffic Accidents, Disease Classification System*.

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Introduction

Accidents are considered as the second cause of paralysis and the main cause of disability and death, and it is one of the conditions that can lead to physical and mental disorders and in severe cases to death. Accidents are the cause of the death of five million people in the world and tens of millions of people with disabilities every year (1). According to the definition of the World Health Organization, an accident is defined as an unexpected and unplanned event that can lead to injury. Injuries are generally divided into two categories: intentional (including injuries caused by road accidents, poisoning, etc.) and unintentional (including self-harm, drowning, etc.) (2). According to the latest reports, road traffic injuries (RTIs) are the eighth cause of death worldwide, which includes 1.35 million deaths every year. 93% of road traffic deaths occur in low-income and middle-income countries, including Iran (3). Road accidents in Iran are the second cause of death and the first cause of years of life lost to due to premature mortality (YLLs) and the most common cause of injury (4). Traffic accidents and death and disability caused by traffic accidents are higher than the global average (5).

Deaths caused by road accidents are the deaths that happen at the time of the accident or thirty days after it and due to injuries caused by the accident (5). The Global Burden of Disease in 2022 announced that 738 million people died in 2017 due to traffic accidents (6). Death rates from traffic accidents have decreased in high-income countries. However, in low- and middle-income countries, it has remained constant (7). Currently, traffic accidents are the most important causes of death, disability, staggering hospital costs and economic damage to societies (8, 9).

The results of studies related to the most common cause of accidents and deaths are contradictory. The results of a study by Rahmani et al. in Iran showed that the general pattern of deaths caused by traffic accidents from 2006 to 2012 was decreasing with a mild slope (10), which was the same in Iran until 2017 as well (11). In a study by Azami-Aghdash et al., the most common causes of accidents were road accidents (50.1%) followed by falls (33.3%), and motorcyclists accounted for the most victims (45%) (12). In the study of Sadeghi-Bazargani et al., out of 7818 deaths caused by road accidents, 3051 cases (39.02%) were related to car accidents and trauma, and more than two thirds of them were men (71%) (13). The results of the study by Botchey et al. reported and recorded the most common cause of death as road traffic accidents (36.8%), falls (26.4%), hit by a person or object (20.1%) (14). In a study by Zheng et al., the most common causes of accidents were reported as falls, road accidents, animal bites and stings (15).

Examining the trend of the death index due to accidents and its causes in different regions can be helpful for determining the current situation and making policies in the field of health (16). In fact, determining the state of mortality and its related causes in society, in order to identify risk factors and deal with the factors that cause them, is the main strategy to increase life expectancy and improve human health (17). Knowing the characteristics of the population structure and its determining factors such as mortality, birth and migration is a fundamental need for social economic planning (18). In this regard, the World Health Organization has provided rules and guidelines related to the correct completion of the death certificate, the selection of the underlying cause of death and their coding method. In Iran, similar to most countries in the world, the causes of death are coded according to the tenth edition of the International Classification of Diseases and Mortality (ICD-10). In general, the international classification of diseases is a suitable platform for preparing and comparing mortality statistics at the international level in countries that have accepted the standards announced by WHO (19). Planning and prioritizing health and medical research programs and evaluating the effectiveness of public health programs for future health policy is based on a valid and complete death certificate (20). The International Classification of Diseases is a classification system that provides standardization and comparability of mortality data at different local, regional and international

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levels. The present study was conducted in order to investigate the trend of deaths due to accidents and incidents resulting from them based on the approach of the international unit in Babol, northern Iran. By referring to this study, the relevant officials can, considering the burden of the problem in the society, provide suitable solutions for planning to reduce accidents and accidents and the burden caused by it.

Methods

After being approved by the Ethics Committee of Babol University of Medical Sciences with the code IR.MUBABOL.REC.1402.058 and making the necessary arrangements with the Health Vice-Chancellor of Babol University of Medical Sciences and obtaining the necessary permits, this retrospective cross-sectional study was conducted by collecting data related to all deaths in Babol over the years 2016-2022, which were recorded in the system of registration and classification of causes of death in health department of Babol University of Medical Sciences. Deaths caused by accidents and incidents included traffic and non-traffic accidents and incidents (drowning, electrocution, falls, collision with objects, poisoning, etc.).

The sources of obtaining the causes of death were the system of registration of causes and classification of death in the deputy health department (integrated system of the Ministry of Health, Treatment and Medical Education), based on valid death certificates from the cemetery, forensic medicine, hospitals and all experienced doctors to register the causes of death. In this study, all registered deaths in Babol during the years 2016-2022 were examined in the system of registration and classification of causes of death, which were considered among accidents and incidents in the international classification and were in all age groups. The causes of death were coded according to the 10th edition of the International Classification of Diseases and Mortality (ICD-10). The codes related to the causes of death examined in the project include non-traffic accidents: fall W01-W19, electric shock X33, W85-W87, impact or contact with objects X36, W20-W22, W23, W27, W30, W31, drowning W67-W74, poisonings X40-X57, T50. Others were X39, X58, X59, W99, T14.0, T82.2, T81.9, T80.1. The traffic accidents included codes V01-V99 (21). After extracting the data, the trend of mortality between the mentioned years and based on the mentioned factors, based on independent chi-square and t tests and the Cochran-Armitage-Trend Test) was analyzed using SPSS version 22 and STATA version 14 and $p<0.05$ was considered significant.

Results

Out of 18,265 deaths during 2016-2022, 1,305 cases (7.15%) were related to accidents and incidents. Of these, 686 deaths (52.57%) were caused by traffic accidents and other non-traffic cases. Of the non-traffic deaths, 439 (33.64%) were unintentional and 180 (13.79%) non-traffic deaths were intentional. The average age of all the deceased people due to accidents and incidents was 44.77±22.78 years, the minimum age was 3 months and the maximum age was 98 years. 954 people were male (73.10%) and 750 people (57.47%) were rural (Table 1).

The years with the highest number of deaths due to accidents and incidents were 2021 (231 deaths), 2022 (208 deaths) and 2016 (197 deaths), respectively. The highest percentage of deaths due to accidents and incidents with 197 cases (9.04%) of all cases was in 2016 and the lowest percentage of deaths due to accidents and incidents was 166 cases (5.59%) of all deaths in 2020 ($p=0.021$) (Figure 1).

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The findings of the subgroups of deaths caused by accidents and incidents based on the classification system of causes of death showed that the highest frequency of accidents and incidents was due to a person being injured in an unspecified (traffic) vehicle accident in 576 cases (44.13%), exposure to an unknown factor causing other injuries was 182 cases (13.95%) and intentional self-poisoning by exposure to pesticides was 182 cases (13.95%) (Table 2).

Table 1. Demographic information of deceased persons due to accidents and incidents in Babol in the years 2016-2022

Variable	n=1305 Number(%)	Type of death caused by accidents and incidents Traffic 686(52.57) Number(%)	Non-traffic 619(47.43) Number(%)	p-value
Gender				
Male	954(73.10)	509(53.35)	445(46.65)	<0.001
Female	351(26.90)	177(50.43)	174(49.57)	
Age range				
0-9	46(3.52)	24(52.17)	22(47.83)	
10-19	129(9.88)	72(55.81)	57(44.19)	
20-29	226(17.3)	89(39.38)	137(60.62)	
30-39	220(16.87)	101(45.91)	119(54.09)	
40-49	158(12.11)	92(58.23)	66(41.77)	<0.001
50-59	158(12.11)	100(63.29)	58(36.71)	
60-69	131(10.04)	85(64.89)	46(35.11)	
70-79	127(9.73)	78(61.42)	49(38.58)	
80-120	110(8.44)	45(40.91)	65(59.09)	
Age				
Below 50	779(59.69)	378(48.53)	401(51.47)	<0.001
Above 50	526(40.31)	308(58.56)	218(41.44)	
Residence status				
Urban	555(42.53)	227(49.91)	278(50.09)	0.098
Rural	750(57.47)	409(54.54)	341(45.46)	
Residential sector				
Babol kenar	91(6.97)	50(54.95)	41(45.05)	
East Bandepei	84(6.44)	41(48.81)	43(51.19)	
West Bandepei	84(6.44)	50(59.53)	34(40.47)	0.238
Gatab	130(9.96)	62(47.69)	68(52.31)	
Laleh Abad	157(12.03)	93(59.24)	64(40.76)	
Central	759(58.16)	390(51.38)	369(48.62)	
The province of death				
Mazandaran	1197(91.72)	612(51.13)	585(48.87)	0.001
Other provinces	108(8.28)	74(68.52)	34(31.48)	

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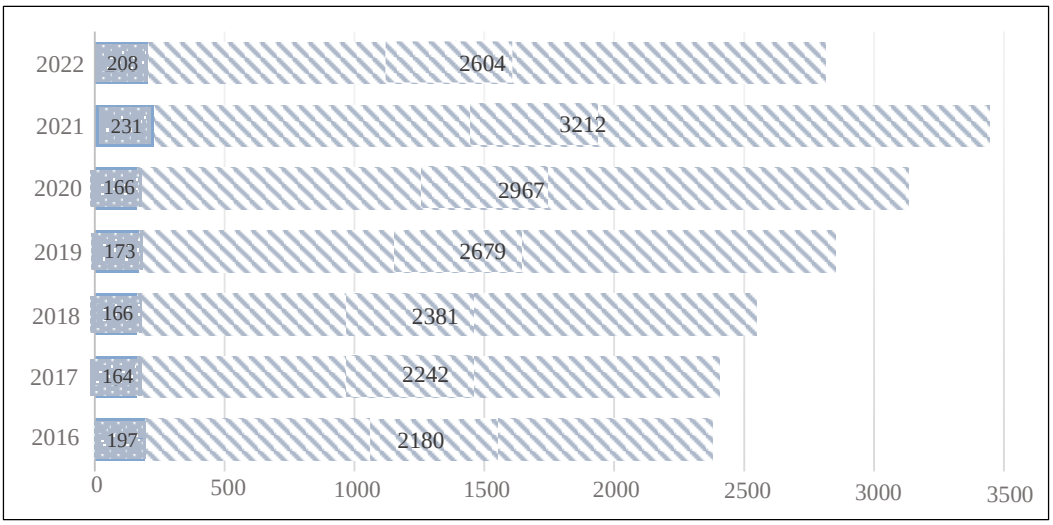


Figure 1. The share of the frequency of deaths caused by accidents and incidents from the total deaths in Babol by the years 2016-2022

Table 2. Frequency of deaths caused by accidents and incidents based on the classification system of causes of death in Babol in 2016-2022

Row	Deaths due to accidents and incidents based on ICD Code	ICD Code	Type of incident (traffic/non-traffic)	N=1305 Number(%)
1	Injuring a person in an unspecified vehicle accident	V89.9	traffic	576(44.14)
2	Exposure to an unspecified agent causing other injuries and unspecified injuries	X59.9	non-traffic	182(13.95)
3	Deliberately poisoning oneself by exposure to pesticides	X68	non-traffic	74(5.67)
4	Other specified locations	W01.8, W05.8, W06.8, W10.8, W17.8, W18.8, W19.8, W25.8, W33.8, W50.8, W55.8, W69.8, W70.8, W73.8, W74.8, W79.8, W85.8, W86.8, W87.8, X06.8, X08.8, X12.8, X42.8, X44.8, X48.8, X64.8, X68.8, X69.8, X76.8, X84.8, X94.8, X95.8, X99.8	non-traffic	66(5.06)
5	Uncertain falls and other cases of falling from one level to another	W17, W19	non-traffic	67(5.13)
6	Abuse by a striking object, execution by rope, strangulation or shooting or explosive substance or by drugs, medicinal and biological substances, shooting, corrosive substance and chemical substance	X85, X86, X90, X91, X93, X94, X95, X96, X99	non-traffic	45(3.45)

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7	Injury of a car passenger (anyone) in an unspecified traffic or motorcycle accident and injury of the driver in a non-traffic accident	V49.9, V89.2, V87.7, V49.6, V10.0, V48.0, V49.8, V50.6, V43.6, V47.9, V40.9, V86.3, V87.7	traffic	43(3.30)
8	Accidental poisoning with narcotics and hallucinogenic drugs, neuropsychiatric drugs, pesticides, gases and vapors, and other chemical and toxic substances	X40, X41, X42, X44, X45, X47, X48, X49, X57	non-traffic	38(2.91)
9	Intentional self-harm by unspecified methods or by execution by rope, strangulation and suffocation or by smoke, fire and flames or other specified methods	X70, X76, X83, X84	non-traffic	33(2.53)
10	Exposure to unspecified current of construction and industrial electricity or smoke, fire or flammable substance or combustion and burning of clothes or an unspecified cause of fracture	W87, X09, X59.0, X06, W86, X08, X40.6, W12.6, X04, W85, X58	non-traffic	31(2.38)
11	domestic incidents	X70.0, X68.0, W01.0, W19.0, X13.0, W20.0, X83.0, X44.0, X84.0, W86.0, W87.0, X06.0	non-traffic	20(1.53)
12	Inhaling and swallowing food that causes obstruction of the respiratory tract	W79	non-traffic	13(1.00)
13	traffic accident	V03.1	traffic	13(1.00)
14	Unclear whether the accident is non-traffic or traffic	V06.9, V03.9, V01.9, V04.9	traffic	13(1.00)
15	Injury of the driver in a traffic accident	V53.5, V43.5, V23.4, V10.4	traffic	11(0.84)
16	Pedestrian injuries in an accident with a car, van, truck or small truck	V03	traffic	9(0.69)
17	Drowning and immersion in water while being in natural waters	W69	non-traffic	7(0.55)
18	Being hit by a thrown, dropped or falling object	W20	non-traffic	7(0.55)
19	Falling on a level surface due to slipping, sliding and tripping	W01	non-traffic	4(0.32)
20	Deliberate self-poisoning by and exposure to other unspecified drugs, pharmaceuticals, and biologicals	X64	non-traffic	4(0.32)

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21	Uncertain submersion and drowning in water	W74	non-traffic	4(0.32)
22	Inhalation and swallowing of other objects (respiratory tract obstruction)	W80	non-traffic	2(0.15)
23	Collision with or being hit by other objects	W22	non-traffic	2(0.15)
24	Contact with broken glass	W25	non-traffic	2(0.15)
25	Street and highway	W22.4, W86.4	non-traffic	2(0.15)
26	Other aircraft accidents that cause injury to passengers	V95.8	traffic	2(0.15)
27	Other cases falling on same level	W18	non-traffic	2(0.15)
28	Drowning and immersion in water after falling into natural waters	W70	non-traffic	2(0.15)
29	School, other organizations and government administrative areas	X91.2	non-traffic	2(0.15)
30	Falling out of bed	W06	non-traffic	1(0.08)
31	Falling from a building or facade under construction	W13	non-traffic	1(0.08)
32	Injury of the driver of a special agricultural vehicle in traffic and non-traffic accidents	V84.0, V84.5, V49.4, V47, V48, V83, V37, V87.8, V87.2, V04, V09.0, V48.1, V86.1, V49.5, V29.6, V23.9, V84.9	traffic	17(1.31)
33	Trade and services of the region	W36.5	non-traffic	1(0.08)
34	Non-traffic accident, unspecified vehicular and motorized or non-motorized accident	V01.0, V99, V89	traffic	3(0.23)
35	Contact with hot liquids or hot substances	X12, X19	non-traffic	2(0.15)
36	Deliberate self-poisoning by exposure to non-narcotic pain relievers, antipyretics, antirheumatic drugs, chemicals, and narcotic drugs	X60, X69, X62	non-traffic	3(0.23)
37	Farm	W70.7	non-traffic	1(0.08)

In terms of the age-specific mortality rate, the mortality rate has generally increased almost with the increase of decades of age; the results of the Cochran-Armitage test showed that this trend was statistically significant ($p<0.001$) (Figure 2).

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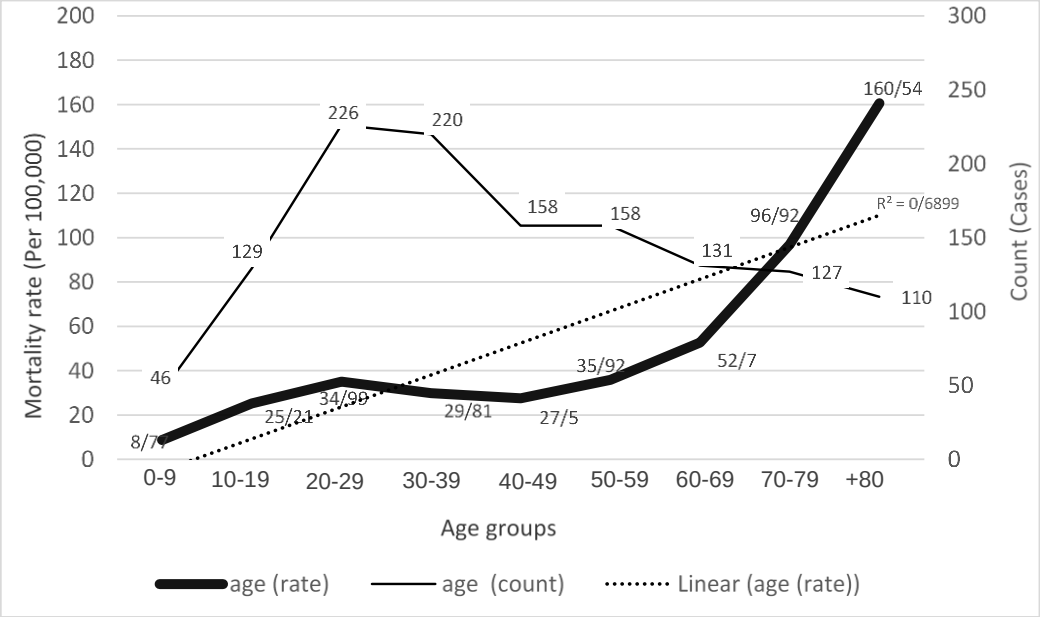


Figure 2. The trend of the number and death rate of accidents and incidents in one hundred thousand people in Babol during the studied years according to decades of age (2016-2022)

The mean and standard deviation of age in deaths caused by accidents and incidents in the traffic accident group was 46.05±22.07 and in the non-traffic accident group was 43.35±23.49 (p=0.033). The lowest mean age in traffic accidents was related to 2016 and the highest was related to 2021. Also, the lowest mean age in non-traffic accidents was in 2019 and the highest in 2016 (Figure 3).

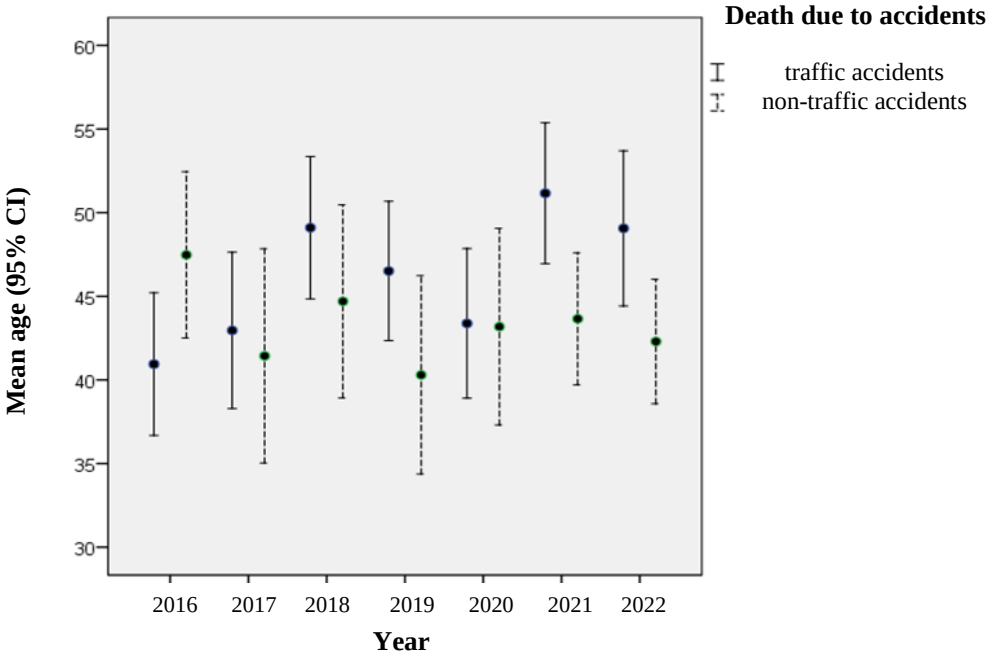


Figure 3. The mean age of people who died from traffic and non-traffic accidents in the years 2016-2022 in Babol

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Discussion

In the present study, most of the reported deaths are caused by traffic accidents. More than 50% of people were men and also less than 50 years old. Most of the people died in Mazandaran province and in the hospital. The most common cause of death was injury to a person in unspecified (traffic) vehicle accidents. The year 2021 recorded the highest number of deaths. Considering this issue, we have had a significant upward trend in the evaluation of death due to accidents and incidents during these 7 years (2016-2022). The most common cause of death due to trauma is injury to a person in unknown vehicle accidents and then being exposed to an unknown factor causing other injuries and unknown injuries and then intentional self-poisoning by exposure to pesticides. In terms of age-specific mortality rate, the mortality rate generally increases with the increase of decades of age.

In the present study, 2019 was among the lowest years of deaths due to accidents. Accordingly, the findings of our study are similar to the study conducted by Qureshi et al. They noted that mandatory social quarantine in Missouri City reduced the number of road accidents (22). Considering the outbreak of COVID-19 at the end of 2019 and the initial lack of knowledge about this virus, early quarantines of people can justify this decrease in deaths caused by road accidents. A 2017 Global Burden of Disease study by James et al. noted that age-standardized road injury incidence rates increased between 1990 and 2017, while death rates decreased. Regionally, age-standardized mortality rates decreased in all but two regions, South Asia and South Latin America, where rates did not change significantly (6). This suggests that, while road traffic mortality have improved in recent decades, there are still disparate incidence rates and significant geographic heterogeneity. Our study was conducted in a country in Southwest Asia, and these findings are due to the upward trend of the standardized rate of death due to accidents in this region. This process, due to the lack of proper follow-up, can be associated with more deaths and requires immediate preventive measures through mandatory training to increase safety, use of public transport and other things.

In this study, it is stated that traffic accidents include the highest death rate among accidents and incidents. In the study conducted by Jamali-Dolatabad et al., who investigated the 14-year trend (2006-2019) of pedestrian deaths, it was pointed out that age over 65, lower education, cases with head trauma and pre-hospital death, accidents in the city, the type of vehicle and self-employed jobs had a direct relationship with pedestrian mortality (23). In the study conducted by Yazdani Charati et al., it was pointed out that the number of people who died in traffic accidents in Sari was 112 in 2014, which was higher than other incidents and accidents (24). From the studies of other countries, we can refer to the study of Zheng et al. in which falls in 36% of cases and road traffic injuries in 35% of cases were the main mechanism of trauma (15). In another study in India, nearly a third of the injured were due to non-accidental transport accidents caused by motorcycles and a second due to non-accidental accidents caused by cars (25). It seems that the mass production of cars in the last 2 decades, which has not been accompanied by progress in other injury prevention components such as environmental and behavioral changes, causes an increase in traffic accidents. Askarishahi et al. mentioned that an average of 27 people per hundred thousand people were killed in driving accidents during the years 2006-2017. Also, the highest number of deaths belongs to Semnan and Markazi provinces with 6.52 and 43 people, respectively, and the lowest belongs to Tehran, Alborz, and Ardabil provinces with 1.12 and 17.9 people, respectively, per hundred thousand people during 2009-2017 (11). The high statistics of this type of death reminds us that in health planning, attention should be directed to environmental, social and cultural factors; there are certain deaths that are not related to germs and pathogens, but are completely social and cultural. We need social and cultural policies to promote health. Such deaths, which are entirely due to economic and social conditions, highlight the role of social factors in improving health and reforming health policies. These deaths have no medical

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treatment and must be reduced through prevention and mainly based on social policies. In post-epidemiological transition conditions, health cannot be imagined without considering its social dimension, and improving the level of health requires attention to the relationship between health and social policies.

According to this study, young people constitute a large number of victims of accidents and incidents, both traffic and non-traffic, which is consistent with the findings of studies by Alberdi et al. and Majercik et al. (26, 27). Peterson et al. point out that in elderly people (≥75), unintentional falls and suicide are the most important causes of death in the older age group (28). Seid et al. reported that older age was a statistically significant predictor of mortality among victims. They also reported that road accidents are a major public health problem and immediate preventive measures of road accidents and immediate treatment of victims are necessary to reduce morbidity and mortality among victims (29). Since the studied cases are often of working and production age and many of them are part of the active workforce of the society, their injuries impose serious social and economic costs compared to other groups. Therefore, it is important to pay more attention to injury prevention in this group. On the other hand, the high proportion of unintentional injuries in the rate of death, disability and lost years of life, especially at young ages, shows that this category of causes of death needs careful investigation. An interesting and valid point that fits in this section can be found in the study of Bäckström et al., who pointed out that during 14 years (1999-2012) the epidemiology of injury in Sweden has changed in later years. Because death due to injury has decreased in the working age group and has increased among people of 64 years and older. They also reported that this can be attributed mainly to the reduction in traffic-related deaths (30). These findings show the attention that should be paid to the issue of deaths caused by unintentional injuries in the country. Correct planning can prevent the wastage of human capital as well as the country's financial capital in supporting the victims of these accidents and those who died at the appropriate age for work and activity. Solutions such as approving appropriate laws and cultural development in the use of vehicles, especially at a young age, and paying more attention to educating people, especially in relation to prevention strategies, including not driving for long distances, can have a good effect on reducing these accidents (31, 32).

Among the limitations of the present study, we can point out the unavailability of information about some variables such as job status, education, etc., and we need to record these things more precisely along with other things. Also, due to the lack of available variables, we only examined the analysis based on gender, age, and place of residence, it is necessary to collect more information in the death registration system.

According to the results of this study, in a 7-year survey from 2016-2022, we see a high contribution of traffic accidents and exposure to an unknown factor causing injuries in deaths caused by accidents and then intentional self-poisoning by exposure to pesticides. Considering that this death trend is increasing and this is observed in younger groups, it is suggested that health policy makers take basic measures to improve roads, improve car safety, educate and promote safety culture, and create strong and deterrent laws to reduce accidents and incidents, especially non-traffic accidents, they should take deliberate actions, which can be done through education with the help of social media.

Conflict of interest: The authors declare that they have no conflict of interest.

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