ORIGINAL ARTICLE

A Five-Year Analysis of Mortality Causes in Western Iran (2015-2019)

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Received: 09 April 2024
Revised: 29 May 2024
Accepted: 19 June 2024

Abstract

Background: Mortality statistics serve as a crucial component in community health planning systems. The causes of death can vary across different geographical areas due to factors such as indigenous culture and lifestyle. This study aimed to investigate the mortality trends and their causes from 2015 to 2019 in Hamedan province, located in the west of Iran.

Methods: This cross-sectional study examined all deaths (43,515 individuals) in Hamedan province from 2015 to 2019. Death data, including demographics and the underlying cause of death, were extracted from the mortality system of the Hamedan Health Center. Data collection utilized a checklist corresponding to the International Death Certificate issued by the WHO. Data analysis was performed using SPSS ver. 26.

Results: In 2019, the average monthly death rate was the highest compared to previous years (766.3±39.1), while this number for 2015 was 682.2±37.7. In 2019, U codes (for Emerging diseases) were used for Covid-19. The mean age of deceased females (73.3±18.2) was higher than that of deceased males (67.0±20.6), showing a significant difference (P<0.001). The top three causes of death in Hamedan during these years were cardiovascular diseases (CSDR=46.7%), neoplasms (CSDR=13.8%), and external causes of injuries (CSDR=8.8%), respectively.

Conclusion: The analysis of the findings indicates that health plans aimed at preventing mortality factors have not been very effective. Therefore, it is recommended that health officials in Hamedan province monitor mortality data and devise effective plans to control mortality factors. As these preventive plans cannot be implemented solely by the Hamadan University of Medical Sciences, other organizations in the province involved in public health need to play an effective role.

Please cite this article as: Ebrahimpour Sadagheyani H, Bouraghi H, Mohammadpour A, Khazaei P, Kimiaei F, Naderishahab M. A Five-Year Analysis of Mortality Causes in Western Iran (2015-2019). J Health Sci Surveillance Sys. 2024;12(3):302-311.

Keywords: Cause of death, International classification of diseases, Mortality, Trends

Introduction

Death is the complete cessation of the body's vital functions without return.[1] The primary goal of any society's health sector is to maintain and promote health, which involves combating all factors that endanger health.[2] Mortality, the most significant adverse outcome of health deficiency, has a high capability for quantitative measurement due to its definite nature and is considered in the statistical calculations of health sectors.[3]

Mortality data generally provide a snapshot of the diseases prevalent in a community. Mortality statistics also effectively determine the epidemiological status of diseases in a community.[4] The World Health Organization (WHO) assists countries in collecting mortality data through the International Classification

of Diseases and Related Health Problems (ICD-10). One of the main goals of the ICD is to classify the causes of mortality and facilitate the collection and presentation of required statistics in the field of mortality.[2] According to the WHO, the causes of death encompass all diseases or injuries that have directly led to or contributed to death. Moreover, all conditions, such as accidents or violence that cause such injuries are considered causes of death.[5] Investigating the causes of mortality is valuable in understanding which factor(s) the study population was most exposed to. If the mortality rate from a particular disease or condition is higher than expected, then such cases will require special attention.[6-8]

According to the 2020 report of the WHO, the first ten causes of death worldwide include ischemic heart disease, stroke, chronic obstructive pulmonary disease, lower respiratory infections, neonatal conditions, lung cancer, Alzheimer's disease, diarrheal disease, diabetes mellitus, and kidney disease. Causes of death can be grouped into three categories: communicable, non-communicable (chronic), and injuries. Globally, seven of the ten leading causes of death in 2019 were non-communicable diseases, accounting for 44% of all deaths or 80% of the top 10. However, all non-communicable diseases together accounted for 74% of deaths globally in 2019.[9]

The World Bank classifies the world's economies into four income groups based on gross national income: low, lower-middle, upper-middle, and high.[10] Iran is categorized among the lower-middle-income countries.[11] The 2020 report of the WHO shows that the ten leading causes of death in lower-middle-income countries are ischemic heart disease, stroke, neonatal conditions, chronic obstructive pulmonary disease, lower respiratory infections, diarrheal diseases, tuberculosis, liver cirrhosis, diabetes mellitus, and road injury. Lower-middle-income countries have a diverse top 10 causes of death: five non-communicable, four communicable, and one injury. Diabetes is a rising cause of death in this income group, moving from the 15th to the 9th leading cause of death, with the number of deaths from this disease nearly doubling since 2000. Diarrheal diseases remain a significant challenge as a top 10 cause of death in this income group. The most substantial increase in absolute deaths is from ischemic heart disease, rising by more than 1 million to 3.1 million since 2000.[9]

The study on the causes of death in Iran reveals that diseases of the circulatory system, accidents, and external causes of injuries rank first and second, respectively. These causes, along with cancer, respiratory diseases, congenital and chromosomal abnormalities, gastrointestinal diseases, infectious and parasitic diseases, neonatal diseases, and kidney and urinary tract diseases, collectively account for 80% of all causes of death in Iran. Various types of cancer emerged as the fourth leading cause of death from 2012 to 2016 and rose to the third leading cause in subsequent years. The results also indicate a decline in deaths due to infectious diseases and an increase in non-communicable diseases, especially cancers and accidents.[12]

The findings from studies on causes of mortality can guide future planning by health officials to reduce mortality rates.[7] For instance, mortality data can inform the focus of activities and resource allocation across transportation, food and agriculture, environment, and health.[3, 9] Given these facts and the potential for regional variations in mortality rates due to factors like indigenous culture and lifestyle, this study aims to investigate the mortality trend and its causes from 2015 to 2019 in Hamedan province, west of Iran.

Methods

This cross-sectional study examined the entire deceased population (N=43,515) in Hamedan province (west of Iran) from 2015 to 2019. Iran, located in the Middle East region of the Asian continent, had a total population of 83,000,000 people in 2019. The country comprises 31 provinces. Hamedan province, situated in the west of Iran, had a population of 1,800,000 in 2019. This province includes nine districts: Asad Abad, Bahar, Tueiserkan, Razan, Famenein, Kaboodar Ahang, Malayer, Nahavand, and Hamedan.

The death data of the research population encompassed demographic characteristics of the deceased, including age, sex, place of residence (urban and rural), city of death, and the underlying cause of death according to the codes of the 10th edition of the International Classification of Diseases and Related Health Problems (ICD-10). Based on ICD-10, the underlying causes of death were classified into the following groups, as shown in the table below:

The researchers obtained official introduction letters from the Vice Chancellor for Research of Hamadan University of Medical Sciences to collect data. They were referred to the provincial health center and Civil Registration administration. It is important to note that most of the data were sourced from the mortality registration system of Hamedan province, housed in Hamedan's Health Center. Additional data, including the total number of deaths, births, and the total population of the districts of Hamedan province, were obtained from the Civil Registration Administration in Hamedan. The required data were extracted based on a checklist that complied with the International Death Certificate provided by WHO. The most critical data for mortality is the underlying cause of death. This cause is determined based on the international codes

ICD-10 Codes	Disease Type	ICD-10 Codes	**Disease Type**
A00-B99	Infectious and parasitic	L00–L99	Skin and subcutaneous tissue
C00-D48	Neoplasms	M00–M99	Musculoskeletal system
D50–D89	Blood and blood-forming organs	N00–N99	Genitourinary system
E00–E90	Endocrine, nutritional, and metabolic diseases	O00–O99	Pregnancy, childbirth, and puerperium
F00–F99	Mental and behavioral disorders	P00–P96	Certain conditions originating in the perinatal period
G00–G99	Nervous system	Q00–Q99	Congenital malformations or deformations
H00–H59	Eye and adnexa	R00–R99	Symptoms, signs, and abnormal clinical and laboratory findings
H60–H95	Ear and mastoid process	S00–T98	Injury, poisoning, and certain other consequences of external causes
I00–I99	Circulatory system	V01–Y98	External causes of morbidity and mortality
J00–J99	Respiratory system	Z00-Z99*	Factors influencing health status and contact with health services
K00–K93	Digestive system	U00–U99	Codes for special purposes (new disease)
Z00-Z99* codes (Factors influencing health status and contact with health services) are not used to determine the causes of death.			

ICD-10, so the researchers did not encounter systematic errors or bias in data collection. The primary challenge concerning mortality data is the documentation and coding of death certificates. In this study, we assumed that the documentation of death certificates and their coding had been executed completely and accurately.

Descriptive statistics (Indices, Tables, and Graphs) and inferential statistics (Independent T-test and ANOVA at α=0.05 significance level) were employed to analyze the data. Data analysis was conducted using SPSS software version 26. Ethical issues were fully observed during data collection. Firstly, this project received approval from the ethics committee of Hamadan University of Medical Sciences with the ethical code IR.UMSHA.REC.1399.701. Secondly, during data collection, the identity information of the deceased individuals was not disclosed.

Results

The findings are presented in two figures and five tables.

Considering the months of the years from 2015 to 2019, the highest number of deaths in these five years occurred in January 2018 and December 2019, with an equal number of 858 people. The number of deaths between September and October increased every year (Figure 1).

Regarding the number of deaths, the highest count was recorded in 2019, with 9,195 deaths, having a mean and standard deviation of 766.3±39.1 per month. Conversely, the lowest count was observed in 2015, with 8,186 deaths, with a mean and standard deviation of 682.2±37.7 per month. A significant difference (P=0.001) was found in the number of deaths between 2015 and 2019 (Table 1).

Table 2 indicates that the highest number of stillbirths (448) occurred in 2017, while the lowest (283) was in 2019. The highest and lowest infant deaths, referring to infants who lived less than 365 days, were 394 and 262 in 2016 and 2019, respectively. The mean age of death did not significantly differ across any of the age groups (P>0.05), although there was a significant difference in the mean age of total deaths of individuals older than one year from 2015 to 2019 (P<0.001).

In terms of residence, the number of stillbirths over the five-year study period was 967 in urban areas and 625 in rural areas. The mean age of rural children who died before reaching one year of age was 44.0±75.7 days, identical to that in urban areas, yet there was a significant difference between the two (P=0.009). The mean age of deceased individuals (over one year) in rural areas was 70.1±20.0 years; in urban areas, it was 69.4±19.7 years, with a statistically significant difference between them (P=0.001).

Regarding gender, the number of stillbirths was higher in male infants (944) than in female infants (807). There was no significant difference between the deaths of male infants (34.4±66.0 days) and female infants (40.4±74.2 days) (P=0.202). However, this indicator significantly differed between men (67.0±20.6 years) and women (73.3±18.2 years) over one year (P<0.001). (Table 2)

The crude mortality rate in Hamedan province remained relatively stable from 2015 to 2019. However, this indicator experienced a slight increase of 2.3% in 2019 compared to previous years. In contrast to the Crude Death Rate (CDR), the Crude Birth Rate (CBR) in Hamedan province showed a consistent decline during the same period (Figure 2).

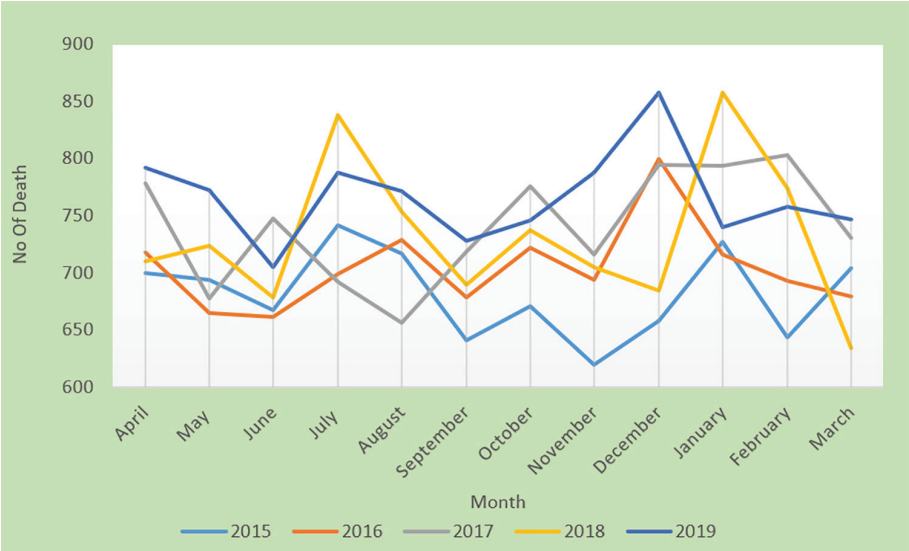

Figure 1: Mortality trend of Hamadan province by months from 2015 to 2019

Table 1: Comparison of the average death number in Hamedan province in each month from 2015 to 2019

Attributes	Year	2015	2016	2017	2018	2019	Total
Number	M±SD (Per Month)	682.2±37.7	704.8±37.2	740.7±49.5	732.4±65.4	766.3±39.1	725.3±54.1
	MIN (Per Month)	620	662	657	634	705	620
	MAX (Per Month)	742	800	803	858	858	858
P value	2015	-	0.812	0.038	0.289	0.000	0.001
	2016	-	-	0.449	0.916	0.007	
	2017	-	-	-	1.0	0.854	
	2018	-	-	-	-	0.783	
Total		8186	8457	8888	8789	9195	43515

Table 3 presents the findings on the Cause-Specific Death Rate (CSDR). The ratio of deaths due to cardiovascular diseases to total deaths was 51% in women and 43.6% in men. This ratio was 49.8% in rural areas, and in urban areas, it was 44.6%. Across the entire province, this ratio was 46.7%. The death rate due to perinatal conditions was 64.1% in infants under one year and 90.9% in stillbirths. Furthermore, the proportion of causes of death varied between men and women across all disease groups, except for blood, skin, and emerging diseases. In both urban and rural areas, the ratio was consistent for neoplasms, mental and behavioral disorders, nervous system diseases, skin and subcutaneous diseases, pregnancy, childbirth, and emerging diseases. However, it varied for other disease groups (Table 3).

According to the results presented in Table 4, circulatory system diseases were the most frequent in all districts of the province except Asad-Abad. Diseases of the circulatory system, neoplasms, and external causes were the most common causes of death in most districts of Hamedan province. The districts

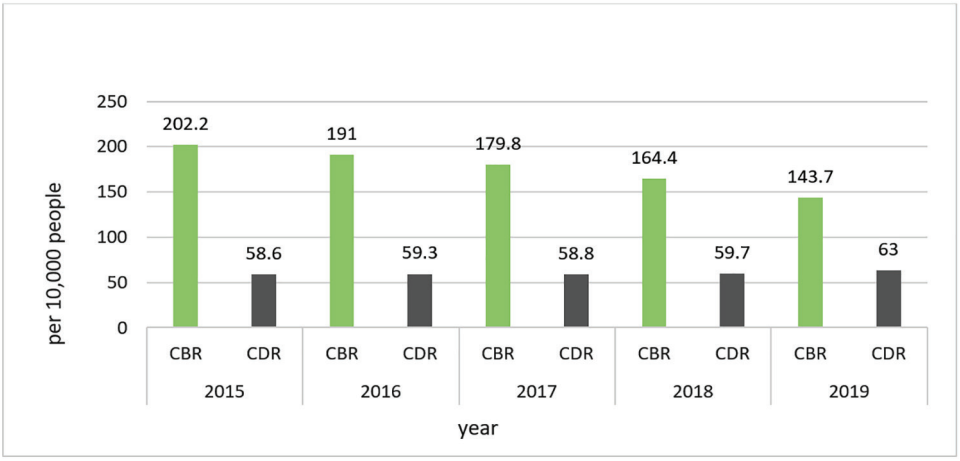

Figure 2: Crude Death and Birth Rate in Hamedan Province in 2015-2019

Table 2: Comparison of demographic characteristics of the deceased in Hamedan province from 2015 to 2019

Year		2015 N (M±SD))	2016 N (M±SD))	2017 N (M±SD))	2018 N (M±SD))	2019 N (M±SD))	Total	P value
Age Range	Max	113	130	135	122	118	-	-
	Stillborn	399	343	448	313	283	1786	-
	1-365(Day)	353 (23.1±58.2)	394 (26.75±60.4)	353 (15.9±74.6)	283 (12.6±34.9)	262 (10.7±36.7)	1645 (18.5±56.5)	0.058
	1-14	115 (5.9±4.2)	107 (6.6±4.1)	153 (5.8±4.4)	96 (6.7±4.5)	157 (6.0±4.0)	628 (6.2±4.3)	0.393
	15-24	239 (20.3±2.6)	196 (19.9±2.6)	202 (20.1±3.0)	156 (20.3±2.9)	164 (19.8±2.8)	957 (20.1±2.8)	0.230
	25-44	716 (35.2±5.8)	668 (35.0±5.8)	647 (34.9±5.9)	669 (35.2±5.6)	688 (35.3±5.7)	3388 (35.1±5.7)	0.808
	45-64	1431 (56.2±5.4)	1485 (56.5±5.5)	1576 (56.4±5.5)	1561 (56.6±5.4)	1660 (56.4±5.7)	7713 (56.4±5.5)	0.216
	>65	4933 (80.5±7.8)	5264 (80.9±8.0)	5509 (80.7±8.1)	5711 (80.9±8.1)	5981 (80.9±8.2)	27398 (80.8±8.0)	0.062
	Mean	7434	7720	8087	8193	8650	40084	0.000
Rural	>1	(68.4±20.4)	(69.7±19.8)	(69.4±20.2)	(70.5±19.1)	(70.0±19.8)	(69.6±19.9)	
	Stillborn	146	81	184	109	105	625	-
	1-365	149	147	148	118	96	658	-
	Day	33.9±65.5	(48.7±77.7)	(50.7±81.9)	(52.1±84.4)	(32.4±63.9)	(44.0±75.7)	0.009
	>1	2779 69.2±20.1	3068 70.4±19.4	3330 69.9±20.3	3317 70.6±19.7	3409 70.4±20.3	15903 (70.1±20.0)	* 0.001
	Max	108	130	135	122	103	M=119.6	-
	Stillborn	194	177	249	185	162	967	-
	1-365	167	151	192	148	144	802	-
Urban	Day	26.4±59.0	34.7±684	27.5±53.2	40.28±76.7	40.6±76.3	)33.4±66.6(	0.009
	>1	4046 68.2±20.2	4341 69.2±20.0	4487 69.1±20.1	4587 70.4±18.7	4990 69.8±19.4	22451 (69.4±19.7)	* 0.001
	Max	113	109	119	116	118	M=115	-
	Stillborn	59	85	15	19	16	194	-
	0-365	37 37.5±76.6	96 15.0±34.1	13 35.0±48.3	17 64.1±95.1	22 4.9±4.9	185 24.2±54.5	-
Unknown	>1	609 65.8±21.8	311 68.9±20.7	270 68.1±18.6	289 71.4±17.6	251 69.4±19.2	1730 68.2±20.2	-
	Stillborn	217	166	241	161	159	944	-
	1-365	179	193	188	153	140	853	-
Men	Day	32.5±64.5	32.0±60.7	33.4±64.6	42.2±76.0	±	34.4±66.0	0.202
	>1	4403 65.8±21.2	4465 66.9±20.6	4704 66.8±20.6	4728 68.1±19.8	4984 67.3±20.5	23284 67.0±20.6	** 0.000
	Max	104	130	116	104	118	M=114.4	
	Stillborn	169	164	203	147	124	807	-
	1-365	157	191	160	129	122	759	-
Women	Day	31.4±65.9	39.75±73.9	43.4±71.1	52.3±87.1	36.2±73.5	40.4±74.2	0.202
	>1	3028 72.1±18.6	3252 73.5±18.0	3383 73.1±18.9	3465 73.9±17.6	3666 73.7±18.0	16792 73.3±18.2	** 0.000
	Max	113	114	135	122	103	M=117.4	
	Stillborn	13	13	4	5	0	35	-
	1-365	17 5.5±9.7	10 7.8±9.4	5 5.6±3.0	1 5.0	0	33 6.2±8.6	-
Unknown	>1	5 76.2±9.7	3 67.0±30.0	0	0	0	8 72.8±19.7	-

*A significant difference between the rural and the urban. **A significant difference between men and women.

of Kaboodar-Ahang and Asad-Abad showed slight differences from other districts in terms of the leading causes of mortality. In Hamedan province, the top four causes of death were diseases of the circulatory system, neoplasms, external causes, and respiratory diseases (Table 4).

Table 5 reveals that over the five years under study, some causes of mortality decreased, some increased, and some remained relatively unchanged. Regrettably, diseases such as neoplasms, endocrine and metabolic disorders, mental illnesses, circulatory diseases, respiratory diseases, digestive diseases, and complications from pregnancy and childbirth showed an increasing trend. As per Table 5, the number of deaths in 2019 differed by approximately 1,000 compared to the previous four years. Notably, in 2019, the U00-U99 codes (representing emerging diseases)

Table 3: Number of deaths and Cause-Specific Death Rate (CSDR) based on demographic characteristics from 2015 and 2016

Demographics / Cause of death	Gender			Place of residence			Age groups			Total
	Unknown	Female	Male	Rural	Urban	Unknown	Stillbirth	1≥age	1<age	
Infectious and Parasitic	0	262 (1.4)	511 (2.0)	281 (1.6)	448 (1.8)	44 (2.1)	2 (0.1)	30 (1.8)	741 (1.8)	773 (1.8)
Neoplasms	0	2374 (12.9)	3648 (14.5)	2411 (14.0)	3390 (14.0)	221 (10.5)	5 (.3)	22 (1.3)	5995 (15.0)	6022 (13.8)
Blood and Blood-Forming	0	59 (.3)	63 (.3)	35 (.2)	82 (.3)	5 (.2)	0 (0.0)	11 (0.7)	111 (0.3)	122 (0.3)
Endocrine and Metabolic	0	796 (4.3)	560 (2.2)	449 (2.6)	857 (3.5)	50 (2.4)	1 (.1)	24 (1.5)	1331 (3.3)	1356 (3.1)
Mental and Behavioral	0	140 (.8)	285 (1.1)	167 (1.0)	243 (1.0)	15 (0.7)	0 (0.0)	5 (0.3)	420 (1.0)	425 (1.0)
Nervous System	0	358 (1.9)	383 (1.5)	278 (1.6)	443 (1.6)	20 (0.9)	3 (0.2)	35 (2.1)	703 (1.8)	741 (1.7)
Eye and Adnexa	0	2 (0.01)	0 (0.0)	2 (0.01)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.003)	2 (0.005)
Ear and Mastoid	0	1 (0.01)	1 (0.004)	1 (0.006)	1 (0.004)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.005)	2 (0.005)
Circulatory System	0	9364 (51.0)	10948 (43.6)	8563 (49.8)	10814 (44.6)	935 (44.3)	9 (0.5)	71 (4.3)	20232 (50.5)	20312 (46.7)
Respiratory System	0	1098 (6.0)	1805 (7.2)	901 (5.2)	1884 (7.8)	118 (5.6)	13 (0.7)	99 (6.0)	2791 (7.0)	2903 (6.7)
Digestive System	0	468 (2.5)	693 (2.8)	411 (2.4)	701 (2.9)	49 (2.3)	3 (0.2)	22 (1.3)	1138 (2.8)	1161 (2.7)
Skin and Subcutaneous	0	45 (0.2)	48 (0.2)	42 (0.2)	51 (0.2)	0 (0.0)	0 (0.0)	1 (0.1)	92 (0.2)	93 (0.2)
Musculoskeletal System	0	50 (0.3)	59 (0.2)	56 (0.3)	49 (0.2)	4 (.2)	0 (0.0)	3 (0.2)	106 (0.3)	109 (0.3)
Genitourinary System	0	691 (3.8)	936 (3.7)	581 (3.4)	987 (4.1)	59 (2.8)	7 (0.4)	19 (1.2)	1601 (4.0)	1627 (3.7)
Pregnancy, Childbirth	0	24 (0.1)	11 (0.04)	12 (0.07)	18 (0.07)	5 (0.2)	21 (1.2)	8 (0.5)	6 (0.02)	35 (0.1)
Perinatal Period Conditions	56 (88.9)	1222 (6.7)	1412 (5.6)	936 (5.4)	1437 (5.9)	317 (15.0)	1623 (90.9)	1055 (64.1)	12 (0.03)	2690 (6.2)
Congenital Malformations	7 (11.1)	146 (0.8)	180 (0.7)	133 (0.8)	164 (0.7)	36 (1.7)	98 (5.5)	193 (11.7)	42 (0.1)	333 (0.8)
Symptoms, Signs	0	460 (2.5)	474 (1.9)	329 (1.9)	538 (2.2)	67 (3.2)	0 (0.0)	8 (0.5)	926 (2.2)	934 (3.1)
Injury, Poisoning	0	5 (0.03)	11 (0.04)	2 (0.01)	14 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	16 (0.04)	16 (0.04)
External Causes	0	780 (4.2)	3037 (12.1)	1583 (9.2)	2073 (8.6)	161 (7.6)	1 (0.1)	38 (2.3)	3778 (9.4)	3817 (8.8)
Emerging Diseases	0	19 (0.1)	23 (0.1)	13 (0.1)	26 (0.1)	3 (0.1)	0 (0.0)	0 (0.0)	42 (0.1)	42 (0.1)
Total	63	18364	25088	17186	24220	2109	1786	1645	40084	43515

were used, a practice not observed in the preceding years (Table 5).

Discussion

This study aimed to investigate the mortality trend in Hamedan province (west of Iran) from 2015 to 2019. According to the findings depicted in Figure 1, the death rate did not follow a steady trend during the studied years and fluctuated throughout the different months of each year. However, the number of deaths increased between September and October each year. This finding suggests that the mortality rate can increase during certain months for various reasons. For instance, special activities such as high-risk behaviors of adolescents in the summer, increased travel in the last months of summer, and the occurrence of traffic accidents can alter the mortality rate throughout the year. According to some studies, including Kaplan (1996), mortality trends are somewhat related to unequal income distribution; thus, to control mortality trends, the government must adopt appropriate economic policies.[13]

Upon considering the study's results (Figure 1, Table 1), it was found that in 2019, the number of deaths, compared to previous years (2015-2018), was more frequent (about 1,000 deaths). These findings suggest that events in the last months of 2019 may have led to an increased mortality rate, potentially

Table 4: Number of deaths and Cause-Specific Death Rate (CSDR) in the districts of Hamedan province in 2015-2019

District / Cause of death	Asad Abad	Bahar	Tueiserkan	Razan	Famenein	Kaboodar Ahang	Malayer	Nahavand	Hamedan	Total
Infectious and Parasitic	5 (0.1)	222 (6.5)	24 (0.7)	37 (1.2)	21 (2.0)	52 (1.5)	74 (0.9)	70 (1.5)	268 (1.7)	773 (1.8)
Neoplasms	54 (21.7)	307 (9.0)	407 (11.9)	532 (17.0)	128 (11.9)	508 (14.7)	1005 (12.0)	638 (14.1)	2443 (15.4)	6022 (13.8)
Blood and Blood-Forming	3 (1.2)	13 (0.4)	9 (0.3)	7 (0.2)	3 (0.3)	8 (0.2)	17 (0.2)	7 (0.2)	55 (0.3)	122 (0.3)
Endocrine and Metabolic	6 (2.4)	128 (3.8)	78 (2.3)	73 (2.3)	31 (2.9)	115 (3.3)	147 (1.8)	83 (1.8)	695 (4.4)	1356 (3.1)
Mental and Behavioral	0 (0.0)	32 (0.9)	10 (0.3)	102 (3.3)	11 (1.0)	36 (1.0)	25 (0.3)	26 (0.6)	183 (1.2)	425 (1.0)
Nervous System	2 (0.8)	94 (2.8)	41 (1.2)	67 (2.1)	9 (0.8)	69 (2.0)	54 (0.6)	25 (0.6)	380 (2.4)	741 (1.7)
Eye and Adnexa	0 (0.0)	1 (0.03)	0 (0.0)	1 (0.03)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.005)
Ear and Mastoid	0 (0.0)	0 (0.0)	1 (0.03)	0 (0.0)	0 (0.0)	1 (0.03)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.005)
Circulatory System	34 (13.7)	1488 (43.8)	2121 (62.0)	1452 (46.5)	569 (53.0)	1037 (30.0)	4791 (57.2)	2598 (57.5)	6222 (39.1)	20312 (46.7)
Respiratory System	17 (6.8)	252 (7.4)	139 (4.1)	196 (6.3)	61 (5.7)	177 (5.1)	418 (5.0)	245 (5.4)	1398 (8.8)	2903 (6.7)
Digestive System	9 (3.6)	98 (2.9)	72 (2.1)	94 (3.0)	18 (1.7)	73 (2.1)	168 (2.0)	97 (2.1)	532 (3.3)	1161 (2.7)
Skin and Subcutaneous	1 (0.4)	2 (0.06)	3 (0.09)	3 (0.1)	2 (0.2)	0 (0.0)	1 (0.01)	46 (1.0)	35 (0.2)	93 (0.2)
Musculoskeletal System	3 (1.2)	31 (0.9)	5 (0.1)	8 (0.3)	0 (0.0)	13 (0.4)	10 (0.1)	10 (0.2)	29 (0.2)	109 (0.3)
Genitourinary System	11 (4.4)	102 (3.0)	108 (3.2)	86 (2.8)	20 (1.9)	379 (11.0)	141 (1.7)	118 (2.6)	662 (4.2)	1627 (3.7)
Pregnancy, Childbirth	0 (0.0)	0 (0.0)	1 (0.03)	9 (0.3)	2 (0.2)	0 (0.0)	13 (0.2)	4 (0.1)	6 (0.04)	35 (0.08)
Perinatal Period Conditions	87 (34.9)	222 (6.5)	154 (4.5)	204 (6.5)	60 (5.6)	300 (8.7)	399 (4.8)	131 (2.9)	1133 (7.1)	2690 (6.2)
Congenital Malformations	4 (1.6)	34 (1.0)	40 (1.2)	20 (0.6)	4 (0.4)	28 (0.8)	78 (0.9)	37 (0.8)	88 (0.6)	333 (0.8)
Symptoms, Signs	1 (0.4)	8 (0.2)	1 (0.03)	1 (0.03)	30 (2.8)	312 (9.0)	282 (3.4)	0 (0.0)	299 (1.9)	934 (2.1)
Injury, Poisoning	1 (0.4)	1 (0.03)	0 (0.0)	1 (0.03)	0 (0.0)	0 (0.0)	7 (0.08)	5 (0.1)	1 (0.01)	16 (0.04)
External Causes	11 (4.4)	355 (10.5)	203 (5.9)	229 (7.3)	102 (9.5)	341 (9.9)	740 (8.8)	379 (8.4)	1457 (9.2)	3817 (8.8)
Emerging Diseases	0 (0.0)	4 (0.1)	5 (0.1)	3 (0.1)	2 (0.2)	5 (0.1)	6 (0.07)	0 (0.0)	17 (0.1)	42 (0.1)
Total	249 (100)	3394 (100)	3422 (100)	3125 (100)	1073 (100)	3454 (100)	8376 (100)	4519 (100)	15903 (100)	43515 (100)

referring to the initial prevalence of COVID-19 in Iran. Also, based on the findings of Table 5, the number of deaths in 2019, compared to previous years, showed a difference of about 1,000 deaths. In 2019, 42 U codes were used as the cause of death, while they were not used in previous years. As known, U codes are used in ICD-10 for emerging diseases, including Covid-19. These findings indicate that more people were likely infected by the emerging disease of Covid-19 in 2019.

Regarding gender, Table 2 shows that the mean age of female deaths (73.3±18.4 years) was higher than the average age of male deaths (67.5±20.6 years). Moreover, based on the findings of Table 3, it was found that factors such as cardiovascular diseases, neoplasms, and respiratory diseases played a greater role in the death of women, with external causes of injuries ranking fifth. For men, factors such as cardiovascular disease, neoplasms, and external causes of injuries were the first three causes of death. On the other hand, the Cause-Specific Death Rate (CSDR) related to external causes of injuries in men was three times higher than in women, and the CSDR of cardiovascular diseases was higher in women compared to men. In this case, some studies' findings align with our study's findings. For example, a study conducted in Tehran by Kazemipour (2003) also showed that heart diseases had a higher percentage among women; however, deaths due to accidents and poisoning among adult men were about

Table 5: Number of deaths and Cause-Specific Death Rate (CSDR) in Hamedan province

Cause of death \ Year	2015 No. (%)	2016 No. (%)	2017 No. (%)	2018 No. (%)	2019 No. (%)	Total No. (%)
Infectious and Parasitic	262 (3.2)	175 (2.1)	121 (1.4)	114 (1.3)	101 (1.1)	773 (1.8)
Neoplasms	1052 (12.9)	1157 (13.7)	1287 (14.5)	1258 (14.3)	1268 (13.8)	6022 (13.8)
Blood and Blood-Forming	17 (0.2)	30 (0.4)	27 (0.3)	28 (0.3)	20 (0.2)	122 (0.3)
Endocrine and Metabolic	214 (2.6)	287 (3.4)	273 (3.1)	293 (3.3)	289 (3.1)	1356 (3.1)
Mental and Behavioral	77 (0.9)	76 (0.9)	64 (0.7)	110 (1.3)	98 (1.1)	425 (1.0)
Nervous System	165 (2.0)	161 (1.9)	138 (1.6)	147 (1.7)	130 (1.4)	741 (1.7)
Eye and Adnexa	0 (0.0)	1 (0.01)	1 (0.01)	0 (0.0)	0 (0.0)	2 (0.005)
Ear and Mastoid	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.02)	0 (0.0)	2 (0.005)
Circulatory System	3504 (42.8)	3908 (46.2)	4155 (46.7)	4308 (49.0)	4437 (48.3)	20312 (46.7)
Respiratory System	446 (5.4)	457 (5.4)	586 (6.6)	612 (7.0)	802 (8.7)	2903 (6.7)
Digestive System	204 (2.5)	214 (2.5)	262 (2.9)	233 (2.7)	248 (2.7)	1161 (2.7)
Skin and Subcutaneous	41 (0.5)	27 (0.3)	4 (0.05)	8 (0.1)	13 (0.1)	93 (0.2)
Musculoskeletal System	41 (0.5)	21 (0.2)	13 (0.1)	19 (0.2)	15 (0.2)	109 (0.3)
Genitourinary System	486 (5.9)	377 (4.5)	271 (3.0)	221 (2.5)	272 (3.0)	1627 (3.7)
Pregnancy, Childbirth	4 (0.0)	7 (0.1)	3 (0.03)	6 (0.1)	15 (0.2)	35 (0.1)
Perinatal Period Conditions	577 (7.0)	578 (6.8)	645 (7.3)	466 (5.3)	424 (4.6)	2690 (6.2)
Congenital Malformations	67 (0.8)	60 (0.7)	79 (0.9)	58 (0.7)	69 (0.8)	333 (0.8)
Symptoms, Signs	293 (3.6)	131 (1.5)	163 (1.8)	166 (1.9)	181 (2.0)	934 (2.1)
Injury, Poisoning	0 (0.0)	12 (0.1)	0 (0.0)	4 (0.05)	0 (0.0)	16 (0.04)
External Causes	736 (9.0)	778 (9.2)	796 (9.0)	736 (8.4)	771 (8.4)	3817 (8.8)
Emerging Diseases	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	42 (0.5)	42 (0.1)
Total	8186	8457	8888	8789	9195	43515

twice as high as in women.[14] The report issued by the National Center for Health Statistics (NCHS) in the United States on mortality in 2017 also shows that the overall mortality rate was higher for men than for women.[15] These findings show that men are more prone to mortality due to accidents and external causes for reasons such as working in high-risk jobs, and women are more prone to heart diseases for reasons such as sedentary and poor lifestyles. Therefore, to lower the mortality rate, it is necessary to apply accident prevention mechanisms that are mostly for men. Women also need to engage in physical activity and maintain a proper healthy diet to avoid exposure to cardiovascular diseases.

Table 2 indicates that the average age of the adult deceased in the rural area (70.1±20 years) was higher than the average age of the deceased in the urban area (69.4±19.7 years), with a statistically significant difference between them (P=0.001). Moreover, the average age of death in infants (less than one year) in rural areas (44.5±75.7 days) was higher than the average age of death in infants in urban areas (33.4±66.6 days). These figures suggest that rural life, in general, is safer and healthier compared to urban life. In other words, a better lifestyle, healthy food consumption, physical activity, avoidance of stress, accidents, and external causes are more prevalent in rural lifestyles than urban ones. Findings also indicate that mortality is usually higher in men and in the age group of 45-64 and urban areas. It can be concluded that these cases can have serious consequences on families, society, and the country. Therefore, paying attention to and preventing the causes of mortality is particularly important. Paying attention to lifestyle, exercising, eating healthily, avoiding carcinogens, conducting periodic tests and health check-ups, and finally implementing safety principles in accidents and external causes of injuries are among the important points that health officials of the province should deeply consider and have long-term plans such as national education on preventing causes of mortality.

The facts about crude births and death rates in the districts of Hamedan province indicate that the rate of crude birth in all districts of the province, and the province in general, had a downward trend. These findings suggest that the factors affecting population growth are declining. In other words, the events of marriage and childbearing have been affected by many factors and, therefore, have declined. It is expected that to prevent the aging of the province's population and reduce the consequences, the executive officials of the province will make effective plans. Improving the economic situation, providing marriage facilities, housing for young couples, and providing free care for infants are some of the actions that can be taken to prevent population aging.

The findings of Tables 3, 4, and 5 indicate that the first three causes of death during 2015-2019 in Hamedan province were cardiovascular diseases (CSDR=46.7), neoplasms (CSDR=13.8), and accidents and external causes of injuries (CSDR=8.8), respectively, with respiratory diseases (CSDR=7.6) in the fourth category. The study of the main causes

of death in the districts of Hamedan province also showed that almost the same trend prevails. These findings are consistent with other studies conducted in other parts of Iran. For example, the findings of studies conducted in Semnan,[2] Qazvin,[6] and Tehran[14] are in line with the findings of this study. However, the findings of a study conducted in Fars province are somewhat different from those of the current study regarding the first three causes of death.[3] It defines the first three causes of death as heart disease, symptoms and ill-defined conditions, and senility. In addition, accidents and cancers were in the fourth and fifth ranks.[3] One reason for the differences between the findings of this study and the Fars study could be that the Fars study is old. Moreover, a report issued by the NCHS showed that the first four causes of death in the USA were heart diseases, cancers, unintentional injuries, and respiratory diseases.[15]

Findings of Table 5 reveal that, unfortunately, cardiovascular diseases, neoplasms, endocrine and metabolic diseases, mental and behavioral disorders, respiratory and gastrointestinal diseases, as well as obstetric and gynecological diseases as the causes of mortality have had an upward trend, and only the accidents and external causes of injuries had a somewhat downward trend. These findings show that plans to prevent and control the causes of premature death by the relevant authorities in the province have not been very effective. However, globally, many countries also experience the major causes of death. For example, the NCHS report 2018 showed that some causes of mortality in 2017 compared with 2016 had an increasing trend. For example, factors such as unintentional injuries, respiratory diseases, stroke, Alzheimer's, diabetes, and suicide had increased in 2017 compared with 2016, and factors such as heart disease and kidney disease had decreased to some extent worldwide. The report shows that the cancer factor in 2017 compared with 2016 decreased by about 2.1 percent.[15] These findings indicate that humans are likely to face certain conditions and diseases due to urban and machine life. The only important point based on these findings is that people must understand these facts and change their lifestyle, with the help of the country's and provinces'/states' executive officials, to move from a machine life to a healthier life as much as possible.

It is very desirable that in the study, we could report the rates that show the mortality situation in different population groups of the province in a more detailed manner. However, since the researchers had limited access to detailed data about the population of the province's districts, it was impossible to calculate standardized population rates. This is one of the important limitations of the present study. However, since the study's main purpose was to investigate the causes of death and its trends in Hamedan province, it tried to properly present the related findings. In any case, future studies should be conducted in different demographic subgroups of the province to describe the situation better.

Conclusion

In general, in these five years (2015-2019), the factors affecting the mortality rate have not changed considerably except for 2019. CBR showed a decreasing trend, and the factors affecting this indicator must be investigated. What is noteworthy is that, unfortunately, the causes, including cardiovascular disease, neoplasms, respiratory diseases, mental illness, endocrine diseases, and metabolism diseases, had an upward trend in the period under study. These facts show that the mortality prevention plans of health officials in Hamedan province have not been very effective. Therefore, it is highly recommended that the health officials of Hamedan province regularly monitor the province's mortality data and make effective plans for controlling mortality factors. Since these preventive plans cannot be done by Hamadan University of Medical Sciences alone, other organizations in the province, including the Organization of Agriculture, Sports and Youth, Commercial, and all those involved in public health, must play their role in this regard.

Authors' Contribution

Dr. Ebrahimpour Sadagheyani has contributed to the drafting of the proposal, data analysis, and writing the final report and the final paper. Dr. Bouraghi contributed to writing the proposal and the final report. Dr. Mohammadpour was involved in writing the proposal, data collection, data analysis, writing the report and the final paper. Mrs. Khazaei and Mrs. Kimiaei were involved in data collection. Mrs. Naderi Shahab contributed to writing the final report and writing the article.

Acknowledgement

The present article has been adapted from the research project grant No. 9909256657 (ethical code: IR.UMSHA.REC.1399.701). The project has been supported by the Vice Chancellor for Research of Hamadan University of Medical Sciences. The authors thank the Deputy Director of Research of Hamadan University of Medical Sciences, and also the authors thank the officials of the Hamedan Health Center and the Civil Registration Office, who cooperated in collecting the necessary data.

Funding

The study was funded by Vice-chancellor for Research and Technology, Hamadan University of Medical

Sciences (No. 9909256657).

Conflict of Interest: None declared.

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