BMC Public Health

RESEARCH

Open Access

Comparison of the trend of suicide before and after the COVID-19 pandemic in Southeast Iran from 2016 to 2023

Ehsan Movahed[1], Asma Afsharmanesh[2], Hadiseh Aqarabi[3], Rasoul Raesi[4,5], Kiavash Hushmandi[6] and Salman Daneshi[7*]

Abstract

Background Suicide, as one of the most important psychological consequences of the COVID-19 pandemic, can be a threat to public health. Understanding the changes in suicide rates before and after the pandemic provides insights into the psychological effects of such crises on communities. This study aimed to compare the trends in suicide and suicide attempt rates in Southeast Iran before and after the COVID-19 pandemic, covering the period from 2016 to 2023.

Methods This descriptive-analytical study was conducted through a census method on 5676 individuals who attempted suicide from 2016 to 2023. Medical records of those who attempted suicide were collected from the integrated system of the Ministry of Health (SIB) during the specified years. The data was collected using a checklist and analyzed with descriptive and inferential statistical tests at the significance level of $P < 0.05$.

Results The findings indicate a significant increase in suicide rates after the COVID-19 pandemic, with 61.8% of the total 5,676 cases occurring post-pandemic compared to 38.2% before. The most affected demographic was young adults aged 19 to 34, whose suicide rates increased by a factor of 9.8, while women experienced a notable rise of 28.2 times in suicide rates after the pandemic. Additionally, uneducated individuals had the highest suicide rates, with a dramatic increase of 35.8 times among illiterate individuals after COVID-19, highlighting the urgent need for targeted mental health interventions and support systems.

Conclusion A significant increase in suicide rates after the COVID-19 pandemic, particularly among young adults and women, highlights the urgent need for targeted mental health interventions, especially for vulnerable groups such as housewives and single individuals. Additionally, the correlation between education levels and suicide rates underscores the importance of addressing educational disparities as part of comprehensive mental health strategies.

Keywords Suicide, COVID-19, Pandemic, Suicide rate, Mental health

*Correspondence:
Salman Daneshi
salmandaneshi008@gmail.com
[1]Department of Public Health, School of Public Health, Jiroft University of Medical Sciences, Jiroft, Iran
[2]School of Medicine, Imam Khomeini Hospital, Jiroft University of Medical Science, Jiroft, Iran
[3]School of Medicine, Imam Khomeini Hospital Jiroft University of Medical Sciences, Jiroft, Iran
[4]Department of Public Health, School of Health, Torbat Jam Faculty of Medical Sciences, Torbat Jam, Iran
[5]Department of Health Services Management, School of Health, Mashhad University of Medical Sciences, Mashhad, Iran
[6]Nephrology and Urology Research Center, Clinical Sciences Institute, Baqiyatallah University of Medical Sciences, Tehran, Iran
[7]Department of Public Health, School of Health, Jiroft University of Medical Sciences, Jiroft, Iran

Background

Suicide is one of the most complex and dangerous human behaviour's, during which a person intentionally ends his life [1]. Suicide is an important public health problem and concern worldwide and is the second leading cause of death among young people in the United State [1, 2]. Suicide is not a phenomenon that is specific to the modern era, but has its roots in the beginning of human history [3]. However, attitudes toward suicide have varied throughout history depending on time, culture, geographic environment, and life circumstances. In today's societies, suicide can be caused by various reasons or a specific factor, but it should never be considered meaningless [4]. Suicide is a way to escape from a problem or crisis that has plunged a person into severe torment and suffering [5]. Edwin Shneidman, often referred to as the father of suicidology due to his extensive research on suicide, posits that suicide is linked to unmet needs, feelings of failure, hopelessness, and helplessness. He emphasizes the internal conflict between enduring unbearable pain and the desire to escape from relationships [2].

Suicide is a person's attack on his own life, which if successful leads to his death and shows the person's desire to die. However, studies show that there is a spectrum from merely thinking about suicide to attempting it [6]. Some people plan days or even years before attempting suicide, and some do it impulsively and without prior intention. In the era of abundance of COVID-19, studies show that parallel to the spread of this disease in the world, suicide in communities has also been increasing. However, these same studies indicate that the upward trend of the desire to attempt suicide and successful suicides in Iran in this period has been higher than in other countries, especially developed countries [7].

Various studies confirm that the relationship between health, physical illness, and suicide is significant [8–10]. It seems that the history of previous medical care has a positive relationship with suicide [11]. Diseases of the central nervous system include: epilepsy, multiple sclerosis, traumatic injuries and cerebrovascular accidents, Huntington's disease, and dementia, in which the presence of a mood component is known, increases the risk of suicide [12]. Some endocrine diseases such as Cussing's, Klein's syndrome, Felter's, and porphyria, which are also associated with mood disorders, are related to an increased risk of suicide [13]. In addition to the direct effects of the disease, it has been observed that the secondary effects of the disease, such as breakup of relationships and loss of job position, can increase the chance of suicide [14].

COVID-19 can cause mental disorders by direct infection and involvement of the CNS or as a result of immune system response or therapeutic interventions. COVID-19 enters human host cells through angiotensin-converting enzyme receptor 2, which has a small distribution in the brain [15]. Like other epidemics of previous diseases, COVID-19 both unpredictable consequences and uncertainty about public safety as well as misinformation (especially in social media) can affect people's mental health including depression, anxiety, and traumatic stress. affect [16]. In addition, things related to this pandemic, such as social distancing, isolation, quarantine, and social and economic consequences can also provoke psychological consequences such as sadness, worry, fear, anger, disappointment, frustration, guilt, helplessness, and loneliness [17].

The COVID-19 pandemic has created a significant mental health challenge worldwide [18]. In some cases, these pandemics and crises can lead to suicidal behaviours (for example, suicidal thoughts, attempted suicide, and complete suicide) by having severe effects on people's mental health [18, 19]. The results of studies indicate that the prevalence of suicide is higher in individuals with mental disorders such as depression [20]. The increase in the suicide rate during and after the COVID-19 pandemic is not too unexpected because suicide cases caused by the fear of this disease have been reported in countries including Pakistan, Bangladesh, and India [21]. According to Verma et al., the prevalence of COVID-19 has led to anxiety, fear of contagion, and depression among the people of the world, and its consequences have led to the tendency and suicide attempts in susceptible people to reach their peak [22]. Also, in another study, it was found that people who experience stress and anxiety in front of COVID-19 compared to those who become anxious, but their performance is not affected, hopelessness, suicidal thoughts, religious crises, and coping with alcohol or They show drugs [23]. The COVID-19 pandemic has become a critical global health issue. Today, the nature of the disease along with its consequences and complications have been identified by conducting numerous studies. Because suicide is one of the most important psychological consequences of this epidemic. It seems that conducting more studies in this field, easy access to psychiatric and mental health services, avoiding listening and publishing information, videos, and images from unreliable sources, getting help from crisis hotlines, activating the labor market, supporting and Financial aid from the government to the vulnerable groups, publication and promotion of appropriate messages, adequate equipment for hospital and health center personnel can be effective in reducing the trend of suicide cases. By using the results of this research, while emphasizing the growth of awareness in the field of causes and methods of suicide, the necessity of this issue is pointed out to the managers and planners of health and treatment organizations to formulate suicide prevention policies in the epidemic. Selecting Southeast Iran, particularly

Table 1 This table presents the data on attempted suicides and their outcomes before and after the COVID-19 pandemic

Variable	Years	Attempted Suicide (Number/Percentage)	Action Result - Death (Number/Percentage)
Before COVID-19	2016	542 (24.9%)	32 (24.5%)
	2017	487 (22.4%)	38 (29%)
	2018	504 (23.3%)	20 (15.3%)
	2019	639 (29.4%)	41 (31.2%)
Total		**2172 (100%)**	**131 (100%)**
After COVID-19	2020	833 (23.7%)	44 (21.2%)
	2021	861 (24.5%)	45 (21.5%)
	2022	877 (25.2%)	61 (29.1%)
	2023	933 (26.6%)	59 (28.2%)
Total		**3504 (100%)**	**209 (100%)**

Kerman province, allows for a focused investigation into how a combination of cultural, geographical, socioeconomic, and pre-existing mental health issues has shaped the trends in suicide before and after the global crisis of COVID-19. Also, Data are scarce regarding suicidal ideation and attempts in Kerman province specifically after the onset of COVID-19. Therefore, this study aimed to compare the trends in suicide and suicide attempt rates in Southeast Iran before and after the COVID-19 pandemic, covering the period from 2016 to 2023.

Methods

Study design, setting, participants, and sampling

This study is a descriptive-analytical and retrospective analysis conducted through a census method on 5676 individuals who attempted suicide from 2016 to 2023.

Data collection tool and technique

Medical records of those who attempted suicide were collected from the integrated system of the Ministry of Health (SIB) during the specified years. Following approval from the thesis committee and permission from the Ethics Committee of the Research and Technology Vice-Chancellor at the University, an introductory letter was obtained from the Faculty of Medicine and presented to the Jiroft Health Center. The inclusion criteria encompassed indigenous individuals, while those with incomplete information in the target system were excluded from the study. Demographic data and findings were documented using a checklist, with all collected information recorded accordingly.

Data analysis

After entering the questionnaire data into SPSS software version 22, the number of selected samples was calculated, followed by statistical indicators related to descriptive statistics such as mean, standard deviation, frequency, and percentage. The Kolmogorov-Smirnov test was employed to assess normality. Subsequently, parametric tests like the t-test for independent samples and analysis of variance, along with their non-parametric equivalents such as the Mann-Whitney test, Kruskal-Wallis test, and chi-square test, were utilized to test the hypotheses. A significance level of less than 0.05 was established for this research.

Results

The current research analyzes data from 5,676 individuals who attempted suicide between 2016 and 2023. Table 1 presents information regarding the suicide incidents before and after the COVID-19 pandemic in the southern cities of Kerman. The findings reveal that out of the total 5,676 individuals, 2,172 (38.2%) attempted suicide before the pandemic, while 3,504 (61.8%) did so after the onset of COVID-19. Additionally, the results indicate that among these individuals, 340 (9.5%) attemptted suicide, with 131 (38.5%) occurring before the pandemic and 209 (61.5%) after COVID-19. (Table 1)

Table 1 presents data on the frequency distribution of suicide attempt methods in the southern cities of Kerman.

Table 2 This table summarizes the frequency of suicide attempts in the southern cities of Kerman, detailing various methods used before and after the COVID-19 pandemic

Variables	Years	Method of suicide attempt								
		medicine	poison	drugs	firearm	knife	burn	hanging	other	P
Before COVID-19	2016	327 (22.1%)	126 (29.5%)	29 (49.1%)	3 (30%)	6 (28.5%)	8 (36.4%)	10 (15.4%)	33 (42.3%)	0.46
	2017	335 (22.6%)	80 (18.8%)	29 (49.1%)	3 (30%)	3 (14.3%)	3 (13.6%)	21 (32.3%)	13 (16.7%)	
	2018	382 (25.7%)	91 (21.4%)	1 (1.8%)	-	3 (14.3%)	4 (18.2%)	11 (16.9%)	5 (6.4%)	
	2019	440 (29.6%)	129 (30.3%)	-	4 (40%)	9 (42.9%)	7 (31.8%)	23 (35.4%)	27 (34.6%)	
	Total	1484 (100%)	426 (100%)	59 (100%)	10(100%)	21(100%)	22(100%)	65(100%)	78(100%)	
After COVID-19	2020	580 (22.7%)	309 (27.4%)	56 (23.6%)	4 (66.6%)	6 (17.1%)	5 (31.3%)	28 (24.8%)	39 (28.7%)	
	2021	659 (25.7%)	252 (22.3%)	55 (23.3%)	-	12 (34.3%)	2 (12.4%)	14 (12.4%)	31 (22.7%)	
	2022	631 (24.6%)	282 (25.0%)	52 (21.9%)	1 (16.7%)	9 (25.7%)	1 (6.3%)	38 (33.6%)	41 (30.2%)	
	2023	691 (27.0%)	285 (25.3%)	74 (31.2%)	1 (16.7%)	8 (22.9%)	8 (50.0%)	33 (29.2%)	25 (18.4%)	
	Total	2561 (100%)	1128 (100%)	237 (100%)	6 (100%)	35 (100%)	16 (100%)	113 (100%)	136 (100%)	

Overview method of suicide attempts

Before the COVID-19 pandemic, from 2016 to 2019, the total number of recorded suicide attempts was 1,484. The most common methods included medicine and poison, with medicine usage increasing from 22.0% in 2016 to 29.6% in 2019. Poison also showed a stable prevalence, fluctuating around 30% during these years. Notably, the use of drugs was significantly high in 2016 at 49.1%, but this dropped dramatically to 1.8% in 2018. Firearm usage remained low throughout this period, while hanging showed a slight increase, peaking at 35.4% in 2019.

After COVID-19

Following the onset of the COVID-19 pandemic, total suicide attempts rose sharply to 2,561 from 2020 to 2023. This period saw an increase in medicine-related attempts from 22.7% in 2020 to 27.0% in 2023. Poison remained a common method with percentages stabilizing around 25% after an initial peak of 27.4% in 2020. Interestingly, firearm-related attempts surged to 66.6% in 2020 but fluctuated afterward, indicating a potential shift in method preference during the pandemic. The comparison between pre-pandemic and post-pandemic data reveals a significant increase in total suicide attempts, rising from 1,484 before COVID-19 to 2,561 afterward. While methods involving medicine and poison remained prevalent, there were notable shifts in the use of drugs and firearms. The increase in firearm-related attempts suggests changes in accessibility or preference for certain methods during this time.

Most common and least common methods of suicide

Most common method: hanging

The data indicates that hanging is the most common method of suicide attempt in both the pre-COVID-19 and post-COVID-19 periods. In 2019, 23 out of 65 attempts (35.4%) were reported using this method. This figure remained significant in 2023, with 33 attempts (29.2%).

Least common method: firearm

The use of firearms is the least common method. Throughout the examined periods, only 6 cases (0.2%) of total attempts were related to this method. No cases were reported in 2021, and the highest number recorded was just 4 cases (66.6%) in 2020.

The findings reveal that both before and after the COVID-19 pandemic, the highest frequency of suicides was observed in the age group of 19 to 34 years, while the lowest was noted in individuals over 65 years. Notably, the suicide rate among those aged 19 to 34 increased by a factor of 9.8 after the onset of the COVID-19 pandemic compared to the period before it. Furthermore, statistical analysis indicates a significant difference in suicide rates when comparing the pre-pandemic and post-pandemic periods across various age groups. The results indicate that in both the investigated times (before and after the COVID-19), women committed suicide more than men, so the rate of suicide after COVID-19, women are 28.2 times more than before COVID-19 and men are 1.15 times more, and this increase in suicide cases by gender is significant between the two times before and after COVID-19. The results indicate that prior to the COVID-19 pandemic, housewives had the highest incidence of suicide cases, while students reported the lowest. After the pandemic began, the highest frequency of suicides shifted to householders, with working individuals experiencing the lowest rates. Notably, there was a recorded increase of 1.37% in suicide cases among housewives. Additionally, the difference in suicide rates before and after COVID-19 is statistically significant when analyzed based on employment status. The findings indicate that in both periods studied before and after COVID-19 single individuals exhibited higher suicide rates compared to married individuals. Specifically, the suicide rate among single people after COVID-19 was 37.3 times greater than that before the pandemic, while for married individuals, this rate was 34.2 times higher. However, the difference in suicide rates between these two periods is not statistically significant when considering marital status. Additionally, data shows that there were more suicide cases among villagers than among urban dwellers both before and after the COVID-19 pandemic. After the pandemic, the suicide rate among villagers was found to be 32.3 times higher than before, and this difference is statistically significant. The results further indicate that both before and after the COVID-19 pandemic, the highest number of suicide cases was observed among uneducated individuals, while college-educated individuals had the fewest cases. Notably, the suicide rate among illiterate individuals after COVID-19 was found to be 35.8 times higher than before the pandemic. This difference in suicide rates between the two periods is statistically significant when analyzed according to educational attainment. (Table 3)

Discussion

The COVID-19 pandemic has created a significant mental health challenge worldwide. In some cases, these pandemics and crises can lead to suicidal behaviors by causing severe effects on people's mental health. Several studies have investigated the relationship between the frequency of the COVID-19 pandemic and the occurrence of mental health disorders in the community and have shown that the frequency and prevalence of this virus causes disorders such as fear, loneliness, worry, family problems, post-traumatic stress, has been [24, 25]. These factors serve as the foundation for suicidal

Table 3 Trends in suicide attempts by age group, gender, employment status, and level of education before and after the COVID-19 pandemic

Variables	**Years**	**Age groups**					
		<18	**19–34**	**35–54**	**55–64**	**>65**	**P_Value**
Befor COVID-19	2016	12 (5.4%)	438 (27.3%)	71 (24.5%)	4 (23.5%)	5 (71.4%)	0.000
	2017	37 (16.4%)	396 (24.8%)	35 (12.1%)	5 (29.4%)	-	
	2018	3 (1.3%)	378 (23.6%)	110 (38.1%)	6 (35.3%)	-	
	2019	173 (76.9%)	389 (24.3%)	73 (25.3%)	2 (11.8%)	2 (28.6%)	
	Total	225 (100%)	1601(100%)	289 (100%)	17 (100%)	7 (100%)	
After COVID-19	2020	249 (21.6%)	498 (25.6%)	82 (22.6%)	1 (4.8%)	3 (17.6%)	
	2021	288 (25.0%)	487 (25.0%)	81 (22.3%)	4 (19.0%)	1 (5.9%)	
	2022	280 (24.3%)	480 (24.6%)	104 (28.7%)	8 (38.1%)	5 (29.4%)	
	2023	337 (29.2%)	484 (24.8%)	96 (26.4%)	8 (38.1%)	8 (47.1%)	
	Total	1154 (100%)	1949 (100%)	363 (100%)	21 (100%)	17 (100%)	
Variable	**Years**	**Gender**					
		Women Frequncy (percent)		**Men Frequncy (percent)**			**P_Value**
Before COVID-19	2016	279 (21.7%)		263 (29.7%)			0.000
	2017	307 (23.8%)		180 (20.3%)			
	2018	308 (24.0%)		196 (22.2%)			
	2019	392 (30.5%)		247 (27.8%)			
	Total	1286 (100%)		886 (100%)			
After COVID-19	2020	548 (23.8)		282 (23.5)			
	2021	572 (24.9)		287 (23.9)			
	2022	578 (25.2)		298 (24.8)			
	2023	599 (26.1)		334 (27.8)			
	Total	2297 (100)		1201 (100)			
Variable	**Years**	**Employment status**					
		Unemployed	**housewife**		***employed**	***student**	**P_Value**
Before COVID-19	2016	88 (30.2%)	118 (21.5%)		123 (50.2%)	71 (42.5%)	0.000
	2017	77 (26.4%)	156 (28.3%)		96 (39.2%)	45 (26.9%)	
	2018	56 (19.2%)	85 (15.4%)		15 (6.1%)	40 (23.9%)	
	2019	70 (24.2%)	192 (34.8%)		11 (4.5%)	11 (6.7%)	
	Total	291 (100%)	551 (100%)		245 (100%)	167 (100%)	
After COVID-19	2020	32 (5.3%)	263 (21.9%)		22 (5.9%)	139 (19.1%)	
	2021	207 (34.3%)	289 (24.0%)		33 (8.8%)	168 (23.1%)	
	2022	192 (31.9%)	319 (26.5%)		102 (27.2%)	192 (26.3%)	
	2023	172 (28.5%)	332 (27.6%)		218 (58.1%)	230 (31.5%)	
	Total	603 (100%)	1203 (100%)		375 (100%)	729 (100%)	
Variable	**Years**	**Educational level**					
		Illiterate	**diploma**		**university**		**P_Value**

Table 3 (continued)

Before COVID-19	2016	346 (48.8%)	68 (18.7%)	48 (34.0%)	0.02
	2017	-	53 (14.5%)	35 (24.9%)	
	2018	106 (14.9%)	83 (22.7%)	25 (17.7%)	
	2019	257 (36.3%)	161 (44.1%)	33 (23.4%)	
	Total	709 (100%)	365 (100%)	141 (100%)	
after COVID-19	2020	423 (20.4%)	190 (19.7%)	40 (23.7%)	
	2021	503 (24.3%)	247 (25.7%)	30 (17.7%)	
	2022	564 (27.2%)	251 (26.0%)	43 (25.5%)	
	2023	582 (28.1%)	276 (28.6%)	56 (33.1%)	
	Total	2072 (100%)	964 (100%)	169 (100%)	

* Employed = self-employed, employee, farmer and worker

thoughts and behaviors. Therefore, this study aimed to compare the trends in suicide and suicide attempt rates in Southeast Iran before and after the COVID-19 pandemic, covering the period from 2016 to 2023.

The results of the research showed that the prevalence of the COVID-19 virus caused a 23.5% increase in the incidence of suicide attempts and a 22.9% increase in successful suicides after the COVID-19 virus compared to before the COVID-19 virus. The increase in suicide attempts suggests that the pandemic has exacerbated mental health issues among individuals. The increase in successful suicides indicates that not only are more individuals attempting suicide, but also that these attempts are resulting in fatalities. This could be attributed to several factors, including the lethality of methods used during the pandemic and a potential lack of access to mental health resources. In this regard, Asgharian et al. that the frequency of COVID-19 was associated with a significant increase in suicide cases in Iran, especially among young men and people with a lower education level [26]. Statistics show that the suicide rate in Iran increased [27, 28]. Another study has shown that COVID-19, livelihood problems, corruption and the inefficiency of the government in curbing this disease have increased the number of suicides, especially in the desperate youth population of Iran, and it has spread from the poor classes to the wealthy and middle classes as well [29].

In a 2020 systematic review, suicide rates among nurses are higher than in the general population and are potentially increasing in the global COVID-19 pandemic [30]. In their research, Singh et al. concluded that suicide deaths in Nepal during the years 2017–2019 were 5124, 5317 and 5785, respectively, which had an upward trend. During the COVID-19 disease, suicide cases increased by 20% [31]. In their research, Isumi and colleagues examined the monthly suicide statistics of children under 20 years of age between January 2018 and May 2020. Their results showed that in 2018 and 2019, the suicide rate increased from March to May. The suicide rate decreased slightly from March to May 2020, which was during school closures, and no significant change in the suicide rate was observed during school closures, and the suicide rate increased significantly in May compared to March. The interaction between month and school closure was not significant [32]. During the prevalence of COVID-19, studies show that parallel to the spread of this disease in the world, suicide in communities has also been increasing [33, 34]. In the study of John et al., in their research, they concluded that the report of the trend of suicide during the COVID-19virus pandemic in different countries indicated no increase in suicide rates in (Massachusetts, United States of America, Victoria, Australia and England) and a decrease in suicide cases in The early months of May have been an epidemic,

and the evidence from previous epidemics shows that a short-term reduction in suicide can occur at the beginning, when this phenomenon occurs when it is initially due to errors in calculations or statistics and information about cases. The disease is estimated to be less than the current amount, but it will increase later [35]. Although the suicide rate in Iran is lower than the world average, its increasing trend is cause for concern [27, 36]. In other studies, the rate of death due to suicide was investigated and it was found that there has been a significant increase in the number of deaths due to suicide every year and this upward trend has continued with a steep slope until now [36–38]. The emotional reporting of news related to suicide in the media can increase the risk of imitating suicidal behavior and lead to the normalization of suicidal behavior as a common and acceptable way to cope with crisis-related problems. Insufficient and wrong information, restrictions related to the epidemic (social distance, isolation and quarantine) affect economic stability. These factors may cause psychological disorders such as sadness, worry, fear, anger, annoyance, despair, guilt, helplessness, loneliness and nervousness, which are the basis of suicidal behavior. In this study and several other studies, factors affecting suicide during the COVID-19 pandemic have been studied, including factors such as gender (being female), age (19 to 34 years old), level of education (illiterate), The employment status (homemaker or unemployed) has received more attention. According to various sources, women attempt suicide 3 to 4 times more often than men [39]. In the study of Rezaie et al., young married women in rural areas of the Middle East and South Asia are the most victims [40]. In their study, Nomura et al. showed that women had the highest number of suicide deaths in July, August, and September 2020, respectively, and the results show the importance of preventing suicide related to COVID-19, especially for women [25]. The rate of suicide in old age is significant. The elderly attempt suicide less than the young. The elderly account for 25% of suicides, while they constitute only 10% of the population [41]. On the other hand, the rate of suicide among young people is increasing rapidly. Between 1970 and 1980, the suicide rate among women aged 19 to 34 increased by 40% and is still increasing. After accidents and other factors, between the ages of 19 and 34, suicide is the third leading cause of death [42]. One of the things that prevent suicide is having a steady job. A stable job with a certain income can reduce the number of suicides that lead to death, and in general, it can be said that working is protective against suicide. In the research of Asgharian et al., most of those who had a successful suicide had no stable job or were unemployed, and in the female gender, most of the people were housewives who practically did not have a steady job or source of income [26]. In Kawohl and Nordt's study, the effect of unemployment of COVID-19 on suicide was modeled based on public data from 63 countries, it was observed that the risk of suicide increased by 20 to 30% during the years 2014–2023 [43]. In the study of Mamun et al., low level of education, false beliefs and fear of other people in the village and family being affected by this disease were the reasons for the individual's suicide [44].

Limitations of the study

Conclusion

The study indicates a notable increase in suicide rates after the onset of the COVID-19 pandemic, with 61.8% of cases occurring post-pandemic compared to 38.2% before. This trend highlights a concerning escalation in mental health crises during and after the pandemic, particularly among vulnerable populations such as young adults aged 19 to 34. Moreover, the study identifies that women exhibited higher suicide rates than men both before and after COVID-19, with a significant increase for women (28.2 times) compared to men (1.15 times) following the pandemic. This gender disparity underscores the need for targeted mental health interventions that address the specific challenges faced by women, particularly those who are housewives or single individuals, as these groups showed higher incidences of suicide attempts. Furthermore, the data reveals that uneducated individuals had the highest rates of suicide, with illiterate individuals experiencing a dramatic increase in suicide rates after COVID-19, emphasizing the correlation between education levels and mental health outcomes. These findings call for urgent attention to mental health resources and support systems. The significant rise in suicide rates after COVID-19, particularly among young adults and women, necessitates comprehensive strategies that include community-based mental health services, educational programs, and targeted interventions for at-risk populations. Additionally, addressing underlying socioeconomic factors and enhancing public awareness about mental health issues are crucial steps toward mitigating this public health crisis and fostering resilience within communities affected by these alarming trends.

1. Cultural Factors: Cultural stigma surrounding mental health and suicide in Iran may affect individual's willingness to seek help or report suicidal behavior. This could result in an underestimation of the true incidence of suicide attempts and completions.
2. Variability in Reporting Methods: Different regions may have varying methods for reporting and recording suicide cases, which can lead to inconsistencies in the data collected across Southeast Iran.

3. Impact of External Factors: The study period includes significant external factors beyond COVID-19 that could influence suicide rates, such as economic challenges, social unrest, or natural disasters. These factors may confound the results and make it difficult to attribute changes solely to the pandemic.
4. Limited Generalizability: While the study focuses on Southeast Iran, the findings may not be generalizable to other regions of Iran or different cultural contexts, as factors influencing suicide can vary widely across different populations.
5. Temporal Changes in Mental Health Services: The availability and accessibility of mental health services during and after the COVID-19 pandemic may have fluctuated, impacting individuals' ability to receive timely care. This variability could affect the trends observed in suicide rates.
6. Focus on Quantitative Data: The study may primarily rely on quantitative data without incorporating qualitative insights into individual experiences, mental health challenges, or societal influences that contribute to suicidal behavior.
7. These limitations should be considered when interpreting the results of the study, as they can impact the validity and reliability of the findings related to suicide trends before and after the COVID-19 pandemic in Southeast Iran.

Acknowledgements
We want to express our sincere thanks and appreciation to the honorable research assistant of Jiroft University of Medical Sciences and all those who helped us conduct this research.

Author contributions
RR, EM, and KH analyzed and interpreted the data. SD, HA, and AA contributor in writing the manuscript. All authors read and approved the final manuscript.

Funding
This research was done with the financial support of Jiroft University of Medical Sciences.

Data availability
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
Data for this study were collected from the integrated system of the Ministry of Health (SIB) of Iran; therefore, informed consent was not required from patients. The Institutional Review Board (IRB) of Jiroft University of Medical Sciences (JUMS) approved this study, and the Biomedical Research Ethics Committee of JUMS issued an ethical code for this research (IR.JMU.REC.1403.040). All procedures involving human participants were conducted in accordance with the ethical standards of the institutional and national research committees, as well as the 1975 Helsinki Declaration and its later amendments or comparable ethical standards.

Consent for publication
Not Applicable.

Competing interests
The authors declare no competing interests.

Received: 5 November 2024 / Accepted: 31 December 2024
Published online: 07 January 2025

References

1. Solano P, Pizzorno E, Pompili M, Serafini G, Amore M. Conceptualizations of suicide through time and socio-economic factors: a historical mini-review. Ir J Psychol Med. 2018;35(1):75–86.
2. Bursztein Lipsicas C, Mäkinen IH, Apter A, De Leo D, Kerkhof A, Lönnqvist J, Michel K, Salander Renberg E, Sayil I, Schmidtke A. Attempted suicide among immigrants in European countries: an international perspective. Soc Psychiatry Psychiatr Epidemiol. 2012;47:241–51.
3. Mueller AS, Abrutyn S, Pescosolido B, Diefendorf S. The social roots of suicide: theorizing how the external social world matters to suicide and suicide prevention. Front Psychol. 2021;12:621569.
4. Brancaccio MT, Engstrom EJ, Lederer D. The politics of suicide: historical perspectives on suicidology before Durkheim. An introduction. J Social History. 2013;46(3):607–19.
5. Petrov K. The art of dying as an art of living: historical contemplations on the paradoxes of suicide and the possibilities of reflexive suicide prevention. J Med Humanit. 2013;34:347–68.
6. Deshpande C. Suicide and attempted suicide. Geerwanjyoti Prakashan; 2020.
7. Wang C, Tee M, Roy AE, Fardin MA, Srichokchatchawan W, Habib HA, Tran BX, Hussain S, Hoang MT, Le XT. The impact of COVID-19 pandemic on physical and mental health of asians: a study of seven middle-income countries in Asia. PLoS ONE. 2021;16(2):e0246824.
8. Brådvik L. Suicide risk and mental disorders. In., vol. 15: MDPI; 2018: 2028.
9. Emanuel E. Euthanasia and physician-assisted suicide: focus on the data. Med J Aust. 2017;206(8):339–40.
10. Hjelmeland H, Knizek BL. Time to change direction in suicide research. Int Handb Suicide Prev 2016:696–709.
11. Mann JJ, Apter A, Bertolote J, Beautrais A, Currier D, Haas A, Hegerl U, Lonnqvist J, Malone K, Marusic A. Suicide prevention strategies: a systematic review. JAMA. 2005;294(16):2064–74.
12. Alejos M, Vázquez-Bourgon J, Santurtún M, Riancho J, Santurtún A. Do patients diagnosed with a neurological disease present increased risk of suicide? Neurología (English Edition). 2023;38(1):41–6.
13. Ardabili MA. General Criminal Law, Tehran. In. Mizan publishing house; 2013.
14. Rogers JP, Chesney E, Oliver D, Pollak TA, McGuire P, Fusar-Poli P, Zandi MS, Lewis G, David AS. Psychiatric and neuropsychiatric presentations associated with severe coronavirus infections: a systematic review and meta-analysis with comparison to the COVID-19 pandemic. Lancet Psychiatry. 2020;7(7):611–27.
15. Zandifar A, Badrfam R. Iranian mental health during the COVID-19 epidemic. Asian J Psychiatry. 2020;51:101990.
16. Ahorsu DK, Lin C-Y, Imani V, Saffari M, Griffiths MD, Pakpour AH. The fear of COVID-19 scale: development and initial validation. Int J Mental Health Addict 2020:1–9.
17. Inoue K, Hashioka S, Kawano N. Risk of an increase in suicide rates associated with economic downturn due to COVID-19 pandemic. Asia Pac J Public Health. 2020;32(6–7):367–367.
18. Cullen W, Gulati G, Kelly BD. Mental health in the COVID-19 pandemic. QJM: Int J Med. 2020;113(5):311–2.
19. Sher L. The impact of the COVID-19 pandemic on suicide rates. QJM: Int J Med. 2020;113(10):707–12.
20. Bachmann S. Epidemiology of suicide and the psychiatric perspective. Int J Environ Res Public Health. 2018;15(7):1425.
21. Kar SK, Arafat SY, Ransing R, Menon V, Padhy SK, Sharma P, Marthoenis M. Repeated celebrity suicide in India during COVID-19 crisis: an urgent call for attention. Asian J Psychiatry. 2020;53:102382.
22. Verma SK, Verma A, Malia P, Chauhan M. Suicide hangings during pre-covid-19 and Covid-19–Myths debunked for the lower-middle-income group countries. Asian J Psychiatry. 2023;79:103349.
23. Balint L, Osvath P, Kapitany B, Rihmer Z, Nemeth A, Dome P. Suicide in Hungary during the first year of the COVID-19 pandemic: subgroup investigations. J Affect Disord. 2023;325:453–8.
24. Li D-J, Ko N-Y, Chen Y-L, Wang P-W, Chang Y-P, Yen C-F, Lu W-H. COVID-19-related factors associated with sleep disturbance and suicidal thoughts among

the Taiwanese public: a Facebook survey. Int J Environ Res Public Health. 2020;17(12):4479.
25. Nomura S, Kawashima T, Yoneoka D, Tanoue Y, Eguchi A, Gilmour S, Kawamura Y, Harada N, Hashizume M. Trends in suicide in Japan by gender during the COVID-19 pandemic, up to September 2020. Psychiatry Res. 2021;295:113622.
26. Asgharian M, firozjaee Hh, Esmaeeli M. COVID-19 and the significant increase in suicide rate in Iran. Jurisprud Criminal Law Doctrines. 2023;2(7):1–18.
27. Hassanian-Moghaddam H, Zamani N. Suicide in Iran: the facts and the figures from nationwide reports. Iran J Psychiatry. 2017;12(1):73.
28. Asadiyun M, Daliri S. Suicide attempt and suicide death in Iran: a systematic review and meta-analysis study. Iran J Psychiatry. 2023;18(2):191.
29. Rothman S, Sher L. Suicide prevention in the covid-19 era. Prev Med. 2021;152:106547.
30. Saragih ID, Tonapa SI, Saragih IS, Advani S, Batubara SO, Suarilah I, Lin C-J. Global prevalence of mental health problems among healthcare workers during the Covid-19 pandemic: a systematic review and meta-analysis. Int J Nurs Stud. 2021;121:104002.
31. Singh R, Baral KP, Mahato S. An urgent call for measures to fight against increasing suicides during COVID-19 pandemic in Nepal. Asian J Psychiatry. 2020;54:102259.
32. Isumi A, Doi S, Yamaoka Y, Takahashi K, Fujiwara T. Do suicide rates in children and adolescents change during school closure in Japan? The acute effect of the first wave of COVID-19 pandemic on child and adolescent mental health. Child Abuse Negl. 2020;110:104680.
33. Weems CF, Carrion V, McCurdy B, Scozzafava MD. Increased risk of suicide due to economic and social impacts of social distancing measures to address the Covid-19 pandemic: a forecast. Res Prepr. 2020;9:926.
34. Ettman CK, Gradus JL, Galea S. Invited commentary: reckoning with the relationship between stressors and suicide attempts in a time of COVID-19. Am J Epidemiol. 2020;189(11):1275–7.
35. John A, Pirkis J, Gunnell D, Appleby L, Morrissey J. Trends in suicide during the covid-19 pandemic. In., vol. 371: British Medical Journal Publishing Group; 2020.
36. Mirahmadizadeh A, Rezaei F, Mokhtari AM, Gholamzadeh S, Baseri A. Epidemiology of suicide attempts and deaths: a population-based study in Fars, Iran (2011–16). J Public Health. 2020;42(1):e1–11.
37. Izadi N, Mirtorabi SD, Najafi F, Nazparvar B, Nazari Kangavari H, Hashemi Nazari SS. Trend of years of life lost due to suicide in Iran (2006–2015). Int J Public Health. 2018;63:993–1000.
38. Nejad AB, Behzadi A, Ahmadi ZO, Barouni M. Determining the burden of suicidal behaviors using the DALY approach: a case study in Iran (2018–2021). Addict Health. 2023;15(3):185.
39. Tanney B, Maris R, Berman A, Silverman M. Comprehensive Textbook of Suicidology. In. RW: Maris; 2000.
40. Rezaie L, Schwebel DC. The COVID-19 pandemic and suicide by self-immolation: is risk increasing? *Burns* 2020, 46(7):1716.
41. De Leo D. Late-life suicide in an aging world. Nat Aging. 2022;2(1):7–12.
42. Janca E, Keen C, Willoughby M, Borschmann R, Sutherland G, Kwon S, Kinner SA. Sex differences in suicide, suicidal ideation, and self-harm after release from incarceration: a systematic review and meta-analysis. Soc Psychiatry Psychiatr Epidemiol. 2023;58(3):355–71.
43. Kawohl W, Nordt C. COVID-19, unemployment, and suicide. Lancet Psychiatry. 2020;7(5):389–90.
44. Mamun MA, Ullah I. COVID-19 suicides in Pakistan, dying off not COVID-19 fear but poverty?–The forthcoming economic challenges for a developing country. Brain Behav Immun. 2020;87:163–6.

Publisher's note