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Original Article

The Impact of the COVID-19 Pandemic on Suicide Attempts in Kerman Province: An Interrupted Time Series Analysis

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Abstract

Background: The COVID-19 pandemic has had a significant impact on global suicide attempt rates. This study evaluated the effect of the COVID-19 pandemic on suicide attempts in the Kerman Province, eastern Iran.

Methods: This is a cross-sectional study. Data on suicide attempt cases in Kerman Province was obtained from the database of Mental, Social, and Addiction Health Office of the Deputy for Health of Medical Sciences Universities from 2018 to 2021. An interrupted time-series model was used to assess the changes in suicide attempts before and after the pandemic.

Results: Suicide attempts exhibited a decreasing trend before the pandemic, with a monthly decrease of 0.9% (P<0.001). The immediate effect of the pandemic indicated that, at the beginning of the pandemic, there was a 4.5% increase in suicide attempts (P=0.134). The sustained effect of the pandemic showed that in the months following the onset of the pandemic, the rate of suicide attempts increased by 1.8% compared to before the pandemic (P<0.001). By the end of 2021, the number of suicide attempts per month exceeded the predicted amount based on pre-pandemic data. Factors such as marital status, education, occupation, place of residence, and previous suicide attempts were found to influence suicide attempts during the pandemic.

Conclusion: Given the significant increase in suicide attempts following the onset of the pandemic, it is crucial to prioritize the implementation of prevention and intervention programs during this crisis.

Keywords: Suicide attempt; COVID-19; Pandemics; Interrupted time series analysis; Iran

Introduction

Suicide attempts (SA) are a self-harming behavior with the intent to die (1). There are at least 20 SA for every completed suicide (CS) (2). Suicide is a significant global public health concern, representing approximately 1.3% of all deaths worldwide in 2019 (3). Approximately, 79% of all suicides occur in low- and middle-income countries (4), including

Iran, which is the most populous country in the Eastern Mediterranean Region (5).

Suicide has multiple biological, psychological, clinical, social, and environmental risk factors (6). The COVID-19 pandemic has imposed numerous health, economic, educational, and social challenges on the world (7). The pandemic has significantly impacted mental health (8) and has led to a high prevalence of undesirable psychiatric symptoms, such as stress, anxiety, depression, anger, panic disorder, impulsivity, sleep disorders, somatization disorders, and suicidal behavior (9, 10). Mental disorders and higher unemployment rates can potentially increase the incidence of suicide worldwide during the pandemic (11). There is a positive relationship between anxiety related to COVID-19 and depression, associated with suicidal ideation (SI) (12, 13). Therefore, the pandemic may have changed the rate of suicidal behaviors (13).

Previous studies have yielded inconsistent findings regarding the influence of the COVID-19 pandemic on suicide rates. Some studies have reported an overall increase in SI, SA, and CS during the pandemic compared to pre-pandemic periods (9, 14-23). Conversely, some regions, such as Frankfurt, Korea, France, and Denmark, have reported decreases or no significant changes in SA rates during the pandemic (24-27).

Kerman Province, the largest province in Iran (28), has experienced an increase in poor mental health during the pandemic (29), as well as a rise in CS rates in the first year of the pandemic (30). However, it is unclear whether the SA rate changed after the pandemic in Kerman Province. Furthermore, limited research exists on COVID-19's effects on SA in the second-year post-pandemic. Therefore, we analyzed data on SA before and after the pandemic (2018–2021) to assess SA by focusing on high-risk groups.

Methods

The statistical population of this cross-sectional study included individuals living in Kerman Province, which has 23 counties and a population of 3,164,718 according to the 2016 national census (30). The SA data for Kerman Province was collected from the Mental, Social, and Addiction Health Office database of the Deputy for Health of Medical Sciences Universities in Kerman, Rafsanjan, Jiroft, and Bam. The data covers reports from all hospitals and health centers in 22 cities of the province, excluding Sirjan, from 2018 to 2021. The validity and coverage of the dataset were assessed through a rigorous process of data verification and validation, following the guidelines outlined by the WHO for the collection of suicide-related data (31). Additionally, the dataset's coverage encompasses a comprehensive representation of the population within the specified geographic areas, ensuring a robust and inclusive depiction of SA within the province.

The first COVID-19 case in Iran was confirmed in February 2019 (32), with March 20, 2020, marking the start of the pandemic for this study. Data were organized by year using the Solar Hijri calendar (from 1397 SH to 1400 SH) (33) and matched with the Gregorian calendar, as shown in Table 1.

Table 1: Match Solar Hijri calendar to Gregorian calendar

Variable	GC	SH	Present in this article
Before the pandemic	21 March 2018 – 20 March 2019	1397	2018
	21 March 2019 – 19 March 2020	1398	2019
After the pandemic	20 March 2020 – 20 March 2021	1399	2020
	21 March 2021 – 20 March 2022	1400	2021

Statistical Methods

Descriptive statistics were computed as the mean (SD) and frequency (%). The chi-square test and the Mann-Whitney test were performed to compare categorical variables and quantitative variables before and after the pandemic. Data analysis was conducted using SPSS software (ver. 24 (IBM Corp., Armonk, NY, USA)). The significance level was set at 0.05.

Interrupted time-series (ITS) analysis

To model monthly changes in SA before and after the pandemic, we employed an ITS Poisson regression model, a widely used method for analyzing count time series data (34).

This model assesses the impact of COVID-19 on SA by examining the incidence rate ratio (IRR), which is the exponential of the difference in the log of the expected counts.

- **IRR Before the Pandemic:** Reflects the monthly trend changes in SA leading up to the pandemic.
- **Immediate Effect:** Indicates changes in SA at the onset of the pandemic, typically observed over a short period (a few days or weeks) (35).
- **Sustained Effect:** Represents the exponential of the difference in the regression line slope after and before the pandemic, indicating how the monthly trend of changes in SA in the months following the pandemic onset has changed compared to before.

Data analysis was conducted using R software version 4.1.0.

Ethics approval

This study was approved by the Ethics Committee of Rafsanjan University of Medical Sciences (Code: IR.RUMS.REC.1400.013).

Results

Overall, 19,881 SA cases were recorded in 22 cities of Kerman Province from 2018 to 2021. The frequency of SA was higher after the pandemic, with the highest frequency recorded in 2021 (Table 2).

Table 2: Frequency of SA in Kerman Province by Period and Year

Period	Frequency (%)	Year	Frequency (%)
Before the pandemic	9489 (47.7)	2018	4920 (24.7)
		2019	4569 (23.0)
After the pandemic	10392 (52.3)	2020	4830 (24.3)
		2021	5562 (28.0)

Model of monthly changes in SA before and after the COVID-19 pandemic

The average monthly number of SA was higher after the pandemic (427.88±56.11) than before (399.39±58.92), with a statistically significant difference (P<0.001) (Table 3).

Table 3: Monthly average of SA before and after the COVID-19 pandemic

Period	Months	Mean	SD	Min	Max	P-value
Before the pandemic	23	399.39	58.92	300.0	506.0	<0.001
After the pandemic	25	427.88	56.11	305.0	553.0	

The SA rate had a decreasing trend before the pandemic, with a monthly decrease of 0.9% (P<0.001). The immediate effect of the pandemic indicated a 4.5% increase in the SA rate (*P*=0.134). The sustained effect showed that in the months following the onset of the pandemic, the SA rate increased by 1.8% compared to before the pandemic (*P*<0.001) (Table 4).

Table 4: Monthly Change in IRR of SA Before, Immediately, and During the First Year of the COVID-19 Pandemic

Variable	CI for IRR			
	IRR	2·50%	97.5%	*P*-value
Before the pandemic (23 month)	0.991	0.988	0.994	<0.001
Immediate effect (few days)	1.045	0.987	1.106	0.134
Sustained effect (25 month)	1.018	1.014	1.022	<0.001

Before the pandemic, the SA monthly trend was decreasing, followed by a slight increase at the beginning of the pandemic, and then a steep upward trend. By the end of 2021, the monthly number of SA exceeded the predicted number based on pre-pandemic data. According to the seasonal effect, a sinusoidal trend is observed almost every year (Fig. 1).

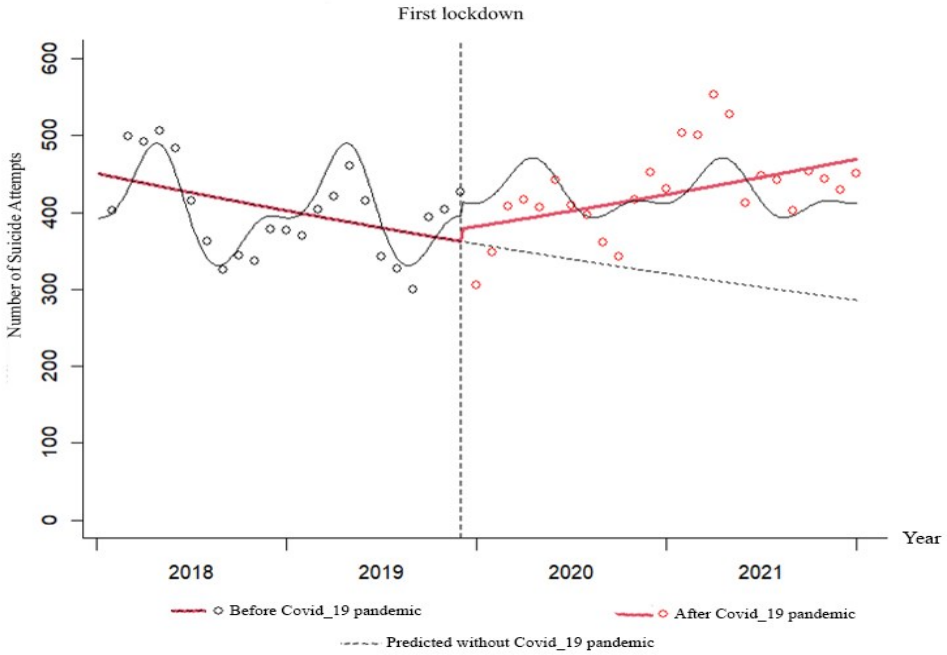

Fig. 1: Monthly Trends of SA Before and After the COVID-19 Pandemic

In Fig. 1, the gray dots represent the number of SA per month before the pandemic, and red dots represent the number of SA per month after the pandemic. The red line, before the first lockdown, denotes the trend of changes before the pandemic. The red line after the first lockdown, displays the trend after the pandemic. The dashed gray line after the first lockdown, illustrates the predicted trend based on the data before the COVID-19 lockdown.

Sociodemographic characteristics of people who attempted suicide

The average age of SA was 25.38±9.98 (range 7-97) years. The average age of SA was significantly lower after the pandemic than before (Table 5).

Table 5: Comparison of age before and after the pandemic

Period	Mean	SD	Min	Max	P-value
Before the pandemic	25.59	9.959	9	92	<0.001
After the pandemic	25.20	9.992	9	97	

Following the pandemic, there was a slight increase in SA among men, while a decrease was noted among women (*P*=0.345). The percentage of SA increased among singles but decreased among married individuals (*P*<0.001). Additionally, SA slightly decreased among illiterate individuals and significantly reduced among those with academic education, while it increased among individuals with a diploma or lower education level (*P*<0.001). Post-pandemic, SA slightly decreased among housewives but increased among students, as well as both employed and unemployed individuals (*P*<0.001). Furthermore, SA decreased among city residents but increased among village residents (*P*<0.001). The percentage of SA increased among individuals with or without a prior history of SA (*P*<0.001). Notably, SA involving self-poisoning methods increased, while other methods decreased (*P*<0.001). Lastly, post-pandemic, deaths increased, and survival rates decreased following SA (*P*<0.001) (Table 6).

Table 6: Comparison of frequency of SA according to sociodemographic and SA characteristics in Kerman Province Before and after the pandemic

Category	Variables	Frequency (%)		P-value
		Before	After	
Gender	Male	3759 (39.6)	4185 (40.3)	0. 345
	Female	5730 (60.4)	6207 (59.7)	
Marital status	Single	4633 (48.8)	5568 (53.6	<0.001
	Married	4100 (43.2)	4349 (41.8)	
	Unknown	756 (8.0)	475 (4.6)	
Education	Illiterate	308 (3.2)	316 (3.0)	<0.001
	Diploma or lower	5829 (61.4)	8085 (77.8)	
	Academic	1818 (19.2)	640 (6.2)	
	Unknown	1534 (16.2)	1351 (13.0)	
Occupation	Housewife	3071 (32.4)	3242 (31.2)	<0.001
	Employed	1670 (17.6)	2224 (21.4)	
	School or University students	1882 (19.8)	2254 (21.7)	
	Unemployed	1204 (12.7	1766 (17.0)	
	Unknown	1662 (17.5)	906 (8.7)	
Place of residence	City	7171 (75.6)	7471 (71.9)	<0.001
	Village	2077 (21.9)	2684 (25.8)	
	Unknown	241 (2.5)	237 (2.3)	
previous SA	No	7219 (76.1)	8594 (82.7)	<0.001
	Yes	478 (5.0)	668 (6.4)	
	Unknown	1792 (18.9)	1130 (10.9)	
Method of SA	Self-poisoning	8148 (85.9)	9469 (91.1)	<0.001
	Other	1236 (13.0)	863 (8.3)	
	Unknown	105 (1.1)	60 (0.6)	
Result of SA	Survival	9238 (97.4)	10052 (96.7)	0.009
	Death	251 (2.6)	340 (3.3)	

Discussion

This study showed a decline in SA from March 2018 to February 2020, followed by a slight increase at the start of the pandemic and a significant rise afterward. By the end of 2021, the number of SA cases surpassed predictions based on pre-COVID-19 data. These findings align with increased suicidal behavior in many countries during the pandemic (20-22). Contributing factors include heightened depression and anxiety (21), reluctance to seek help (22), social changes (36), and a sense of life's worthlessness due to high COVID-19 death rates (37). Conversely, some countries reported decreased or stable suicide rates during the pandemic (24-26), possibly due to work-from-home policies, reduced hours, government support, and limited access to illegal drugs (26). Despite the decrease in SA, the number of CS remained unchanged, suggesting that unreported SA may have risen due to occurring at home and using non-lethal methods (24).

Researching sensitive topics like SA during public health crises presents significant challenges and biases that must be addressed. One major concern is the potential underreporting of SA during the outbreak. With healthcare resources stretched thin and disruptions to routine data collection, surveillance may have been compromised (38), leading to an inaccurate representation of suicidal behavior. Suicidal behavior is complex, influenced by various individual, social, economic, and environmental factors (39). During crises, these factors may be amplified or altered in ways not fully understood. Disentangling these influences requires extensive and nuanced research (40). Variations in reporting practices across regions could further compound biases, complicating conclusions. Future research should enhance surveillance systems and data collection, standardize reporting, and adopt a multidisciplinary approach to better understand suicidal behavior during public health crises.

Comparing sociodemographic characteristics before and after the pandemic, the mean age of SA was significantly lower post-pandemic. SI was more prevalent in younger individuals during this time (41). The pandemic exacerbated mental health problems such as anxiety, insomnia, depression, self-harm, and SI (42). Young people face immense pressure to achieve financial independence while dealing with family issues (43). Many do not disclose SI due to fears about confidentiality and potential hospitalization (44), which may contribute to increased SA among younger individuals.

Post-pandemic, SA increased among men but decreased among women. The pandemic significantly impacted men's mental health, leading to more SA due to job losses and economic stress (45, 46). Lockdowns reduced social interaction, worsening mental health, especially for men with smaller social circles. In contrast, women showed stronger protective capacities through social networks and family connections (47). Increased substance abuse during the pandemic also heightened suicidal behavior risk among men, who often use substances to cope (48). Societal norms and stigma have made men less likely to seek professional help for mental health issues, a situation further complicated by disruptions in mental health services during the pandemic (49). The pandemic worsened pre-existing mental health conditions, necessitating targeted interventions for men (20).

Following the pandemic, SA increased among single individuals. Loneliness is associated with increased SI and SA during this time (50). Stay-at-home policies intensified feelings of loneliness among singles, potentially contributing to the rise in SA. However, as restrictions eased and people returned to pre-pandemic conditions, SA may have decreased among this group.

SA slightly increased among school or university students, particularly the unemployed, and also among those with a diploma or lower education. Unemployment, poverty, loneliness, and hopelessness contribute to rising depression, anxiety, post-traumatic stress disorder, and suicide risk (11). Economic instability and job loss during the pandemic particularly affected individuals with lower education. Financial insecurity, linked to

mental health issues, could lead to increased feelings of hopelessness or despair, influencing the rise in SA among this demographic.

The SA trend increased among village resident's post-pandemic. After the COVID-19 lockdown, many returned to their villages, lost jobs, and faced significant stress and negative emotions, resulting in SA. Two case reports detailed men who returned home due to pandemic-related issues and exhibited symptoms of the disease without a formal diagnosis. Villagers harbored fears and misconceptions about COVID-19, and the resulting prejudice, along with the victims' concerns, drove them to attempt suicide as a means of avoiding the disease (51).

SA increased among individuals without a prior history of SA. Suicide risk factors include previous SA, family history, depression, hopelessness, financial loss, and treatment barriers (52). The pandemic has created a "new pool" of individuals who, despite being psychologically healthy before, have been pushed to the brink by the compounding stressors of the pandemic, leading to a significant rise in suicidal behavior (22). This trend underscores the need for emergency interventions during crises. Additionally, SA risk has risen among individuals with mental disorders (53), potentially leading to increased SA among those with a history of SA and mental disorders.

Self-poisoning became the most common method of SA after the pandemic, particularly among adolescents (22, 53, 54). This rise may be linked to the pandemic's mental health impact, with social isolation and school closures contributing to increased depression and anxiety. This public health issue highlights the urgent need to strengthen suicide prevention and mental health support services for vulnerable groups.

The percentage of deaths following SA increased after the pandemic. Key risk factors for death include previous psychiatric treatment, prior SA, and somatic disorders (55). Exacerbated mental health issues created new stressors, leading some to make serious decisions to commit suicide, potentially resulting in more lethal methods. Given the differences in characteristics of suicide attempters before and after the pandemic, further examination of these characteristics in the pandemic's third year is suggested, along with analysis of SA data in Sirjan County post-pandemic.

Conclusion

The number of SA was higher after the COVID-19 pandemic than the predicted number of SA based on data from before the pandemic. Factors such as marital status, education, occupation, place of residence, and previous SA can influence the decision to attempt suicide during the pandemic. Therefore, prevention and intervention programs are urgently needed during a crisis. Moreover, monitoring the real-time and long-term suicide risk as the pandemic evolves is necessary.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interests.

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