

Trends in Suicide Attempts in Israel during COVID-19: A National Representative Cohort Retrospective Study

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ABSTRACT

Background: The pandemic outbreak that included quarantines and lockdown periods affected people's mental health negatively. The pandemic's impact on suicidal behavior is, however, unclear. The present study aimed to investigate whether the pattern of suicide attempts (SAs) in Israel changed during the pandemic, especially during the two lockdowns and immediately after them. The period three years prior to the pandemic was used as a control period for comparisons.

Method: A retrospective cohort study was conducted. The cohort consisted of all Meuhedet members between January 1, 2017, and December 31, 2020. Data were retrieved from Meuhedet Health Maintenance Organization (Meuhedet) members daily suicide attempts (SA) register.

Results: The SAs trend exponentially increasing over the years. Still, in 2020 the rate of SAs did not increase. No significant differences were found in SA rates from month to month during the pandemic. Neither were any significant differences found between any of the pandemic months and equivalent periods prior to, or following the Covid-19. However, two peaks were found in the rate of SAs in 2020: in July, the SA rate was 2.134 per 100,000 and in November it was 2.202, while the annual mean rate was 1.535 per 100,000. Both these peaks occurred during post-lockdown periods.

Conclusion: During a prolonged crisis, the rate of SAs may vary over time. It may decline in the early stages

but later increase due to cumulative stress. People living through continuous restrictions and stress may experience cumulative burnout.

INTRODUCTION*

The COVID-19 pandemic made it necessary to impose quarantines and isolation on a country-wide basis. These proved to be risk factor for mental distress among adults (1) and adolescents (2). The reasons are many and include separation from family and friends, loss of freedom, boredom, worries about the workplace and loss of financial resources, and more (1). Considerable numbers of people demonstrate psychological consequences of COVID-19 quarantines like symptoms of depression, anxiety, and post-traumatic stress, (3, 4) as well as changes in consumption habits. For example, a Belgian study found that during the quarantine, individuals consumed slightly more alcohol and smoked marginally more cigarettes compared to the period before the lockdown (5).

Evidence from the previous epidemics shows that even a year after the forced isolation the impact on people's wellbeing is still present (6).

According to numerous studies a possible result of the pandemic and the associated lockdowns that causes great concern is suicidal behavior (7-12). Thus far, the impact

* This paper was written in the year 2020, therefore most of our statements are based on the state of COVID-19 in 2020.

of the COVID-19 pandemic on suicidal behavior is not completely clear (13), although attempts are being made to learn from previous epidemics and pandemics and to be prepared with prevention and assistance programs (11, 13, 14).

COVID-19 as a stressful life event has a high potential of increasing the risk for suicide (15, 16). Extreme fear of being infected and believing one to be sick with COVID-19 has even led some individuals to suicide, even though autopsies showed them not to be infected (17, 18).

A recent study among 907 participants found that 17.5% of the subjects ($n = 159$) reported active suicidal thoughts in the previous month and 4.9% ($n = 44$) reported attempting suicide in the previous month. About 65% of those who reported having suicidal thoughts in the previous month reported their thoughts to be unequivocally linked to the COVID-19 pandemic at least part of the time, while at least 45% reported this to be the case for at least half the time (19). Another recent study investigating 12 featured countries found that worsening of pre-existing psychiatric condition and previous exposure to trauma predicted increased suicidal ideation (20). A study on adult patients who had been admitted following a suicide attempt (SA) to the trauma resuscitation room of the Medical University of Vienna, during the lockdown period, revealed an increase in attempted suicides during that period (21).

In contrast, several studies indicate a decrease in suicide rate during the epidemic. But suicide rates went up shortly after the epidemic was over (8-10, 22). For example, a recent study in Michigan, U.S., shows that during the first 12 weeks of the local outburst of COVID-19 (around March 10, 2020) emergency department encounters for SAs and intentional self-harm decreased by 39.9% as compared to previous years (23).

According to Joiner's Interpersonal-Psychological Theory of Suicide, a SA constitutes dangerous behavior that moves progressively towards more severe acts of self-directed violence and may ultimately result in death (24-26). Hence, it is necessary to be aware of and recognize suicidal behavior during a crisis such as COVID-19, which impacts multiple areas of life over a prolonged period of time. Due to the scarcity of existing knowledge on suicidal behavior during COVID-19 that was known to us at the beginning of the COVID-19 epidemic research was crucial to determine the short- and long-term implications of the pandemic on suicide-related behavior and identify high-risk groups. Yet, this study adds to the growing body of literature examining the short- and long-term impacts of the pandemic on suicide-related behavior.

THE PRESENT STUDY

The aim of the present study was to examine the rate of SAs during COVID-19 and compare it to parallel periods over the three years preceding the pandemic (2017-2019). To that end the following rates were examined and compared to other months during the pandemic as well as to parallel months in previous years: a) the rate of SAs between January and December, 2020, b) the rate of SAs between the two lockdown periods (March-April and September-October, 2020).

Based on recent findings that show a decrease in SA and conclude that initial outbreaks of COVID-19 did not increase suicide-related behavior in the short term(23), this study hypothesizes that the results will show a decrease in SAs in the two lockdown months in Israel compared to the parallel months in a previous year.

METHODS

STUDY DESIGN

In Israel, health care services are provided by four non-profit health maintenance organizations (HMOs). The HMOs are mandated by law to provide a basic level of health coverage to any Israeli citizen who wishes to join and each citizen can choose the HMO he or she prefers. Namely, health-care coverage in Israel is universal. Meuhedet Healthcare Services (Meuhedet hereafter) is the third largest HMO in Israel, serving 14% (1,135,325 members) of the total population and has a cross-country presence.

Meuhedet started in 2009 an electronic register, that includes all patient data. The records retrieved for the purposes of the current study consisted of all the patients with SAs.

Meuhedet HMO developed a unique automated daily report of suicide attempts and registers. The daily report includes persons who attempted suicide in the last 24 h, were treated in the emergency room and were then discharged or hospitalized in general hospitals in Israel. The register accumulates all the details and allows to identify high-risk groups of suicide attempts. The register includes data since 2009 on patient demographics, time of admission, day and month of the admission, and the date of medical visits prior to the suicide attempts. To investigate whether suicide-related behavior changed after the onset of the COVID-19 pandemic, we examined total daily counts of recorded encounters for a suicide attempt from this register.

The data retrieved for those patients included patient demographics, day and month of emergency department (ED) admission, whether discharged or still hospitalized

in an Israeli hospital and the date of all the mental health related medical visits that predated each specific SA.

In order to discern changes in suicide-related behavior during the two COVID-19 lockdowns, total daily counts of recorded SA visits from this register were examined for the period between January 1, 2017, to December 31, 2020.

SETTINGS

The study cohort consisted of Meuhedet members who met the study's inclusion criteria which consisted of the monthly registry of insured members. Because of confidentiality the denominator data were obtained in a statistical hierarchical tree file, making it possible to calculate the rate and other statistics regarding SA cases by month. The total rate for each month was calculated by using the number of SA cases in a given month as the nominator and the total number of insured members in that month as denominator rate. For calculating the monthly rate of each demographic category, a weighted analysis of the cases was performed by assigning a weight of 1 to the nominator (suicidal) while the weight assigned to the denominator was the monthly number of the insured members in each category of the demographic variables. To avoid duplications, weighted adjustments were made for the analyses. Three weights were defined for each analysis: (a) The year 2020 was adjusted for monthly analysis by filtering it and the weight within it was divided by 12 months; (b) In order to be able to compare the months of a year to the equivalent months in another year – the original weight was left the same since the denominator was the original one; (c) By-month comparison of various periods over the same year the weights were divided by the total number of years. The weight assigned to SAs in the nominator was always 1, since the full data for each individual were available.

PARTICIPANTS

The cohort consisted of all Meuhedet members between the years 2017-2020.

VARIABLES AND MEASUREMENT

Input variables

The input variable was defined as the records of SA cases as registered in the electronic Meuhedet patient register.

Predictor variables

The three year period (2017-2019) that predated the pandemic was used as a control period for comparisons, as were the two COVID-19 lockdown periods.

STATISTICAL ANALYSIS

Data were analysed using IBM STATISTICS SPSS, version 23.0. Descriptive statistics were compiled for all variables and are presented as frequencies and dispersion indices. Chi-square (χ^2) and post hoc tests followed by proportion test, and Bonferroni correction for more than 2X2 tables were used to evaluate the differences between the rate of suicide attempts and in each category of the demographic variables. Homogeneity of variance was assessed in ANOVA using Levene's Test for Equality of Variances, in order to be able to treat the variance among months as homogeneous. The trend in the monthly rates of SAs between January and December 2020 were examined, then compared to the monthly SA rates during the equivalent periods in the previous three years. The changes in SAs between the two lockdown periods (March-April and September-October) and between the post lockdown periods (May and November) were also examined.

Statistical significance was set at $p = 0.05$ and statistically significant values were further tested by Generalized Linear Regression (GLM) in order to identify risk factors (lockdown periods) and to control the effects of possible confounders.

ETHICS APPROVAL

This study was approved by the Meuhedet Institutional Review Board.

RESULTS

Comparison of the SA rates of the COVID-19 year and the three years before it (Table 1) found significant differences between the years ($p = .026$). The chi scores revealed that the yearly mean rate per 100,000 was higher in 2019 (Mean = 23.139; $p = 0.026$). Additionally, in both tests, one way ANOVA ($p = .026$) and the robust test equality of Welch means ($p = .039$) were found to be significant. The Games-Howell test which does not assume equal variance found differences only between the year 2019 and the year 2020 ($p = 0.047$). The comparison between 2019 and 2020 showed a significant reduction in the yearly mean rate per 100,000 (23.139 vs. 18.424; $p < .001$).

The differences between monthly SA rates in 2020 were not significant. Nor were significant differences found between the two lockdown periods and the other months. However, the Levene Statistic test in ANOVA for homogeneous variances found that while the differences among the various months were not significant, their variances were significant ($p < .001$). The rates of SAs per 100,000 that were found for July and November (2.134

Table 1. Comparison of suicide attempt rates per 100,000 between the years 2017-2020, by months

Months	COVID-19				χ^2
	2017	2018	2019	2020	
January	2.262	1.232	2.256	1.352	.026
February	1.004	1.148	0.966	1.508	
March	1.755	1.146	2.010	1.429	
April	1.504	1.880	1.768	1.349	
May	1.834	1.796	1.685	0.872	
June	1.082	1.711	2.083	1.425	
July	1.580	1.708	2.002	2.134	
August	1.677	2.110	1.919	1.814	
September	1.825	1.136	1.758	1.420	
October	1.407	1.456	2.393	1.418	
December	1.650	1.938	1.833	2.202	
January	1.400	1.613	2.467	1.49	
Mean N	1,202,613	1,228,583	1,248,542	1,264,649	
Mean rate per month	1.573	1.574	1.929	1.535	
Mean Rate per Year per 100,000	18.880	18.874	23.139	18.424	

Note: One way ANOVA: Post Hoc Multiple comparisons with Bonferroni correction. Tukey method; Total mean rate per four years was 1.653 (total mean N = 1,236,097); Framed areas indicate lockdown periods.

and 2.202 respectively), namely the months following the lockdowns, were higher than the mean monthly rate for the year (1.535). Meanwhile the SA rate for the month of May (0.872 per 100,000) which followed the first lockdown was lower than the mean monthly rate for the year. Table 2 shows the monthly rate of SAs per 100,000 in 2020.

A X^2 test revealed significant differences between the July and November SA rates and those of other months ($p = 0.046$ and $p = 0.030$ respectively).

As can be seen in Figure 1, the trend line shows that during the following months of 2020 there were waves of

Figure 1. Trend of the rate of monthly suicidal attempts

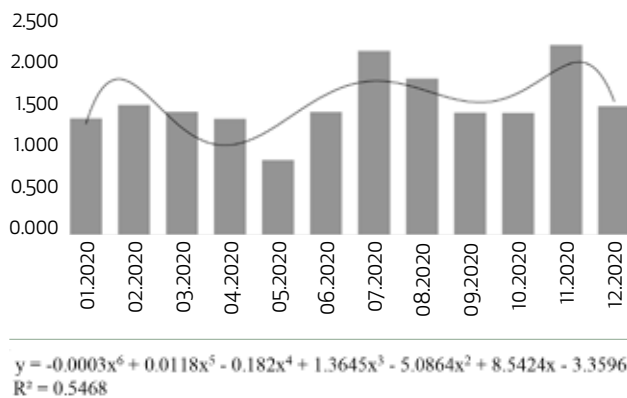


Table 2. The 2020 rate of suicide attempts per 100,000, by month

Months	N	Total n of SA cases	Rate per month	p
January	1,257,366	17	1.352	.372
February	1,259,677	19	1.508	
March	1,259,686	18	1.429	
April	1,260,349	17	1.349	
May	1,261,261	11	0.872	
June	1,263,228	18	1.425	
July	1,265,171	27	2.134	
August	1,267,833	23	1.814	
September	1,267,463	18	1.420	
October	1,269,435	18	1.418	
November	1,271,324	28	2.202	
December	1,272,998	19	1.49	
Total		233		
Mean N	1,264,649			
Mean SA cases		19,416		
Mean rate per month			1.535	
Mean Rate per Year per 100,000			18.424	

Note: One way ANOVA: Post Hoc Multiple comparisons with Bonferroni correction; Levene Statistic test in ANOVA for homogeneous variances, was found significant ($p < .001$); Framed areas indicate lockdown periods.

polynomial with 5 order patterns in SAs ($R^2 = 0.5468$).

A Z- test for the column proportion of a distribution with adjusted p values and Bonferroni correction revealed that the rate of SA during the second lockdown was not significant ($p = .859$). However, the rate of SA cases was higher ($n = 24$; 24.5%) compared to the other periods.

DISCUSSION

The aim of the present study was to compare the SA rate during COVID-19 to parallel periods over the three years prior to the epidemic. This paper was written in the year 2020, thus most of our statements are based on the state of COVID-19 in 2020, and there are various ongoing restrictions, including social distancing and quarantine. The study's hypothesis was that during the two lockdown periods the rate of SAs would be lower compared to the equivalent months in the earlier year. This hypothesis was based on recent research indicating that during the initial outbreaks of COVID-19 suicide-related behavior did not increase (23, 27). Indeed, the current study found no increase in the rate of SAs in 2020 - the year of COVID-19. No significant change in SA rates was found when comparing month by month to previous years. Neither were significant differences found when comparing each

Table 3. Comparison between stressful and non-stressful periods

	Period in 2020	Members (non-suicidal)		SA cases		Total numbers of cases	Rate per 100,000	Sig.
		Count	%	Count	%			
Pre Lockdown1	January-February	1,258,522	19.9	18	18.4	1,258,540	1.430	0.859
Lockdown1	March-April	1,260,018	19.9	18	18.4	1,260,036	1.389	
Post lockdown1	May-August	1,264,373	20.0	20	20.3	1,264,393	1.562	
Lockdown2	September-October	1,268,449	20.1	18	18.4	1,268,467	1.419	
Post lockdown2	November-December	1,272,161	20.1	24	24.5	1,272,185	1.846	

Note: SA – suicide attempt
ANOVA, test of Homogeneity of Variances; Each subscript letter denotes a subset of GROUP categories whose column proportions do not differ significantly from each other at the .05 level.

month in 2020 to the others or when comparing the two lockdown periods to the non-lockdown months. However, the uniqueness and novelty of the present study is that the current study demonstrated that during the crisis periods the rates of SAs varied. SA rates during lockdowns were significantly different from the rates in post-lockdown periods. A significant increase in SA rates was found in July, namely, two months after the first lockdown (March-April). This increase was significant even when taking into account the seasonal summer increase in SAs that usually occurs in Israel (28). It should be mentioned that studies (from the Northern Hemisphere) indicate that the highest frequency of suicide occurred in May (29, 30). Other studies point to the spring period as a time when suicides are high in comparison with the seasons (31). In Israel, as well, the highest frequency of suicide occurred in May (28). In other words, although the rate of suicide decreased during the epidemic as found in previous studies, it is in contrast to the usual trend in the world (32) and in Israel (8-10, 22).

Another increase in the SA rates was evident after the second lockdown (November), but this one occurred only a month after the lockdown. In Israel in a usual year there is no seasonal increase in SAs during November. This finding may indicate that people living through ongoing restrictions and stress may experience cumulative burnout. It may explain the shorter time gap between the second lockdown and the probable consequences of a higher SA rate during the post lockdown period. As was hypothesized, in the first third of 2020 there was a decline in the SA rates. This decline is consistent with the declining trend in SAs worldwide during COVID-19 as recently reported (27).

Another possible explanation for the decline in SAs during a crisis, at least a short term one, is that people cope by standing up to the challenge, they feel that they belong to the group of all those who face the same challenge, their coping is meaningful in the social sense, thus their focus moves from the personal to the communal and this may result in a decline in SAs. This idea is supported by Batty et al. (33) who found significant decline in suicide rates during the two world wars. A similar explanation is offered by Joiner et al. (34), who established the concept of “pulling together,” which among others satisfies the need to

belong. In that vein, one study even found a correlation between local suicide rates and the final national rankings of the local college football teams.

Additionally, another explanation for the decline in suicide rates during lockdowns may be due to reduced accessibility to lethal means (using transportation, purchasing means, being continuously accompanied by family members or roommates, etc.).

However, the long-term impact of COVID-19 lockdowns on mental health and particularly on suicide behavior still is not clear. For example, the resultant ongoing economic slump caused loss of job security and difficult economic recovery. Previously studies have found an association between the loss of a job and mental health symptoms (35). Loss of social support, another impact of COVID-19, may be a risk factor for long-term mental health problems, including the risk of suicide attempts (12). Another crucial aspect related to the lockdown policies was that people were forced to work from home. One study conducted in Israel during a COVID-19 lockdown among couples with children found an association between difficulty to tolerate uncertainty and psychological distress (36). The impact of lockdowns on psychiatric care and suicidal behavior remains scarce. Several studies found a decrease in psychiatric admissions treatment (37-39), others found an increase (40, 41). One study found that the COVID-19 pandemic has been associated with a decrease in psychiatric hospitalizations, while no significant change was observed in referrals to mental health services and suicidal behavior (42). The association between psychiatric therapy and suicidal behavior prevention is a critical component in preventing suicide behavior (43).

The present study adds to the accumulated knowledge of suicidal risk during the COVID-19 epidemic, but no less importantly it shows that suicidal behavior can be affected by public events and crises. It shows that the effect of prolonged crises is cumulative and changes over time. These are important insights in order to prevent more suicides or suicide attempts.

LIMITATIONS

The data of all the members of the HMO were extracted as hierarchical statistical files and not as individual records, in order to maintain the patients' confidentiality. Additionally, we examined total daily counts of recorded encounters for a suicide attempt from the Meuhedet HMO daily report register, it is possible that during the lockdown people who performed suicide attempts refrained from reaching a hospital more than usual, so there may be information missing. The study thus carries all the limitations related to such data. The incidence rates of the SAs are very small even when calculated on a monthly basis.

CONCLUSIONS

Previous studies have demonstrated a clear impact of COVID-19 on SA rates. It seemed that SA rates decreased during the epidemic. The current study, however, shows that the SA rates fluctuate along the period of a prolonged crisis, with significant changes between the short term, when indeed they decrease, and the long term when they may increase. Future research of suicidal behavior during crises should consider both long-term, permanent trends as well as seasonal trends.

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Conflict of Interest

None of the authors reports any conflict of interest.

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