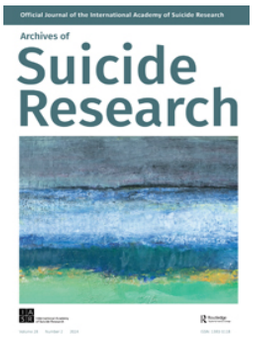

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Suicides, Other External Causes of Death, and Psychiatric Status in Suicide Attempters: A National Registry-Based Analysis in Israel, 2006-2020

Gad Lubin, Ziona Haklai, and Nehama Goldberger

ABSTRACT

Objective: To assess risk factors and rates of suicide and other external cause deaths, among suicide attempters compared to the total population, stratified by psychiatric hospitalization discharge and mental diagnosis.

Methods: A national registry-based analysis of suicide and external cause mortality was performed among suicide attempters between 2006 and 2020 in Israel in the National Hospital ED database. Data was stratified by psychiatric hospitalization status by linking to the national psychiatric case registry. Age adjusted mortality rates were calculated.

Methods: A multivariate cox regression model assessed the relative risk of demographic factors and psychiatric diagnosis and hospitalization on outcomes.

Results: Among 57,579 first suicide attempters, of whom 16,874 had a psychiatric hospitalization, there were 853 suicides (1.5%) and 473 deaths from other external causes (0.8%), 485 suicides (2.9%) and 199 external cause deaths (1.2%) in the psychiatric group. Suicide risk was highest in the year after the attempt, but continued throughout the study, particularly in the psychiatric hospitalized group. Suicide rates within one year of first suicide attempt were 137 (95% CI 122-152) times higher than the total population, 190 (155-233) times in females and 128 (112-145) times in males, 178 (153-207), 243 (181-325) and 158 (132-190) times higher, respectively, in those with a psychiatric hospitalization.

Conclusions: We found a greatly increased risk for suicide and significant increase for other external causes of death amongst a cohort of suicide attempters, compared to the total population, particularly those with a history of psychiatric hospitalization.

KEYWORDS

External cause deaths; psychiatric suicide risk; suicide following attempt

HIGHLIGHTS

- Past suicide attempters might have much higher risk for suicide than already known.
- Their risk for death by other external causes is also significantly higher.
- Having past suicide attempts and psychiatric admissions leads to highest risk.

Abbreviations: CBS: Central Bureau of Statistics; NPCR: National psychiatric case register; FSU: Former Soviet Union; CI: confidence intervals; ED: emergency departments; HR: hazard ratio

Supplemental data for this article can be accessed online at https://doi.org/10.1080/13811118.2024.2372609.

INTRODUCTION

Identifying persons at high risk for suicide is an essential basis for suicide prevention. In a recent review article, Fazel et al have reported that individual predisposing factors for suicide include psychiatric disorders, a previous suicide attempt, childhood sexual abuse and a family history of suicidal behavior (Fazel & Runeson, 2020). In survival analysis of risk factors for suicidal behavior, a previous suicide attempt was reported to be the most significant predictor for a future suicide death or suicide attempt (Leon et al., 1989).

Further studies examined risk of suicide during psychiatric hospitalization. A meta-analysis found a prior suicide attempt or self-harm to have the strongest association, followed by a diagnosis of schizophrenia, in particular combined with depressive symptoms or affective disorders (Large et al., 2011). Similarly, in a study of inpatient suicides in Israel, strong risk factors were diagnoses of schizoaffective disorders, affective disorders or schizophrenia and past suicidal attempts (Levi et al.,2016).

In a study of risk factors for prior suicide attempts in psychiatric inpatients in the USA with severe mental diagnoses, suicide attempters suffered from more subjective depression, suicide ideation and less reasons for living, and also were characterized by more impulsivity and aggression and amongst other factors had more family history of suicidality, childhood abuse and substance abuse or alcoholism (Mann et al., 1999).

In a follow-up study of patients in Israel for suicide after psychiatric hospitalization, the highest risk group was those diagnosed with affective disorder followed by non-affective psychotic disorders while a previous suicide attempt within 30 days preceding a hospitalization significantly increased suicide risk (Goldberger et al., 2015).

Further general population studies also showed a higher risk for suicide following a suicide attempt. In a USA study examining risk factors for suicide among 19,057 previous suicide attempters, 571 people died by suicide during the 8-year study period. The level of risk was directly proportional to the number of previous suicide attempts. Additionally, more than half of the group, had a psychiatric diagnosis (Doshi et al., 2020).

A study conducted in Sweden followed up 39,685 patients with different psychiatric diagnoses following a suicide attempt for 21-31 years and compared rates of suicide mortality to a control group (Tidemalm et al., 2008). The highest risk diagnosis compared to the control group was schizophrenia (4.1-fold higher), followed by affective bipolar and unipolar disorder (3.5-fold higher).

A meta-analysis in the LANCET of 62 studies of repeated suicide attempts and suicide death among previous suicide attempters found clinical risk factors associated with suicide included a recognized mental disorder, repeated suicide attempts and a physical illness (Liu et al., 2022).

Studies of causes of death in people with a prior suicide attempt have found higher mortality from other causes as well as suicide. Among a group who attempted suicide by self-medication poisoning in Helsinki, Finland an increased risk of suicide continued throughout the four-decade follow-up period. Increased mortality was also found due to accidents or an unknown cause (Suominen et al., 2004). Causes of death were examined among 11,583 emergency room patients at a general hospital in Oxford, England, who attempted suicide in 1978-1997. During 3-23 years of follow-up, the overall mortality

rate was 2.2 times higher than expected, suicide was 17 times higher and unspecified causes and poisoning "accident" were 15 times higher (Hawton et al., 2006). In a follow-up of 40,346 self-harm patients in 2000-2010, 19% of deaths were by suicide, 1.6% of patients (2.6% of males and 0.9% of females), with the risk 49 times that of the general population. The absolute risk was higher in males, but relative to the general population, was higher in females. There was also a large number of deaths from accidents, mainly by poisoning, which could indicate an underestimate of suicide deaths (Hawton et al., 2015).

A five-year follow-up of 302 serious suicide attempters in Australia found an overall mortality rate of 8.9%, 59.2% of whom died by suicide, with high excess mortality compared to the general population from suicide and traffic accidents (Beautrais, 2003).

The high rates of accidental deaths in these studies supports the fact that the accuracy of suicide statistics is likely to be limited, while some deaths coded as accidents or of an uncertain cause are in fact suicide. A research study that conducted an in depth investigation of deaths of undetermined intent and ill-defined causes in Tel Aviv, Israel, for 2005-2008, found 42% more suicides than officially reported (Bakst et al., 2016).

A systematic review of studies that examined the reliability of suicide statistics, mostly reevaluation studies, found that 13 of the 31 studies reported fairly reliable suicide statistics with underreporting of 0-10%, but others reported much higher underreporting, 12 studies with more than 30% (Tøllefsen et al., 2012).

A national suicide prevention program was established in Israel from 2015 by government decision, led by the Ministry of Health together with other government ministries. Amongst its activities is gradual introduction of school based awareness programs, cooperation with local authorities in suicide prevention efforts and training courses for teachers, school counselors and psychologists and other professionals as gatekeepers.

Israel has a complete database on admissions to emergency departments for suicide attempts, as well as a registry of all patients ever admitted to psychiatric facilities and a national cause of death database which can all be accurately linked by a unique encrypted identity number. We know of no other complete national follow-up study to determine suicide or deaths from other external causes after a suicide attempt over a long period, and compare risks amongst those who had a psychiatric hospitalization with the total population. Have there been changes over time, maybe reflecting the efficacy of the suicide prevention program? Do the rates of other external causes of death give an indication of the reliability or underestimate of suicide deaths? Results on risk factors can contribute to the implementation of better interventions and prevention plans. Since the follow-up was till 2020, the first year of the COVID-19 pandemic, the trend results may show its effects, although early stage information has found no rise in suicide worldwide (Pirkis et al., 2022, Yan et al., 2023) or in Israel (Goldberger et al., 2023b).

METHODS

Data on suicide attempts between 2006 and 2020 in Israel were obtained from the National Hospital Emergency Department (ED) database, maintained by the Ministry of Health.

This database includes all ED admissions to general hospitals in Israel and includes demographics, reason for admission, admission time and dates and discharge diagnoses. Individuals in Israel have unique identity numbers, which are encrypted to protect patient privacy, but allow matching of records belonging to the same individual and linking to other databases. Suicide attempts were identified through the reason for admission recorded as a suicide attempt, or through the discharge diagnoses from the ED of suicide (ICD-9 codes E950-E959). Although these ICD codes include all deliberate self-harm, we assumed that those leading to an ED admission had a relatively high level of potential lethality and therefore could also be classified as suicide attempts

The study population included persons with a suicide attempt between 2006 and 2020 where the first suicide attempt in the study period was used for each person, and they were then aged 15 and above.

The nationwide database of causes of death, maintained by the Central Bureau of Statistics (CBS), for the years 2006-2020, was linked to the database of persons who attempted suicide by encrypted identity number. Suicide deaths were identified by ICD-10 codes X60-X84, Y87.0 and other external causes included accidents (V01-X59, Y85-Y86), homicide (X85-Y09, Y87.1), events of undetermined intent (Y10-Y34, Y87.2) and other external causes (Y35-Y84).

The study population was further linked to the national psychiatric case register (NPCR) which cumulatively enters all admissions and discharges to psychiatric inpatient facilities in Israel, to identify suicide attempters ever hospitalized, either before or after their attempt, with a discharge diagnosis of serious mental illness, ICD-10 codes of F10-F69 or F90-F98.

The aim of this study was to assess the risk factors and rates of suicide and death by other external causes in the study population of suicide attempters compared to the total population, changes over time, stratified by having had a psychiatric diagnosis in psychiatric inpatient facilities, and exploring the factors contributing to this risk.

ANALYSIS

We computed the time from first attempt in the study period (2006-2020) until death, by suicide or other external causes. We excluded deaths occurring in-hospital within 2 weeks of a hospitalized attempt, on the assumption that the attempt led to a completed suicide, and our study was to identify suicide following unsuccessful attempts.

We calculated the percentage of suicide attempters with a suicide death within 2 years of the first attempt by year to examine the change over time. Age adjusted rates for suicide and other external causes of mortality were calculated for deaths within a year of the first attempt in the study period and for the entire study period, stratified by sex. Age adjustment was by direct standardization with the 2009 Israeli population as the standard population and by age groups of 15-24, 25-44, 45-64, 65-74 and 75 and above. The baseline study population was used as denominator populations for 1-year mortality over the study period, and person years for the whole period were estimated from mid-year population estimates by age of the suicide attempters study group. Rate ratios compared to the total Israeli population were calculated.

A multivariate cox regression model was built to assess the relative risk of different factors on the suicide outcome for suicide attempters. Time in the study was calculated from first suicide attempt in the period 2006-2020 until death or end of study period. Factors included sex, age (grouped), ethnic status: Jews and Others compared to Arabs, immigrant status: immigrants since 1990 from the former Soviet Union (FSU), from other countries and from Ethiopia since 1980, compared to Israeli born/earlier immigrants, and psychiatric diagnosis. The most severe psychiatric diagnosis for each person was used (in order of severity): schizophrenic/acute psychiatric disorder (ICD-10 diagnoses F20-F29), affective disorders (F30-F39), neurotic disorders (F40-F59) and personality disorders (F60-F69) compared to those without mental diagnoses or less severe diagnoses.

All analyses were performed using SAS 9.4.

ETHICAL SAFEGUARDS

Confidentiality was strictly assured since the authors who analyzed the data had no access to the identity of the persons linked by the databases. The study was approved by the Jerusalem Mental Health Center committee on research involving human subjects.

RESULTS

Study Population

There were 57,579 persons in the ER database with a first suicide attempt between 2006 and 2020 aged 15 and above of whom 16,874 ever had a psychiatric hospitalization with a mental diagnosis at discharge. Table 1 shows their characteristics and outcomes.

Follow-up was for a maximum of 15 years from first suicide attempt in 2006, and average follow-up time was 6.9 years. Thus, total person-years of follow-up was 399,700 for the total population and 116,793 for those with psychiatric hospitalizations.

The study population had more females (56%) than males, and the majority were young at the first suicide attempt, 45% between 15 and 24 years, and 30% between 25 and 44 years. 21% were Arabs, similar to their proportion in the population. 14% were immigrants from the FSU, 3% immigrants from other countries since 1990, and 2% immigrants from Ethiopia. Among those with psychiatric hospitalizations, schizophrenia or an acute psychotic diagnosis were most prevalent (41%), followed by affective disorders (28%) and neurotic disorders (17%), personality disorders (9%) and drug or alcohol addiction (4%).

Number of Suicides and Deaths

There were 853 completed suicides over the 14-year study period, 1.5% of the study population of all first suicide attempters. 485 of these suicides were amongst people with a psychiatric diagnosis following hospitalization either before or after the attempted suicide, 2.9% of this group. There were also 473 deaths from other external causes (0.8% of total study group), 199 among the psychiatric hospitalization subgroup

TABLE 1. Characteristics and outcomes of study population – persons with suicide attempt between 2006 and 2020, aged 15 and above at 1st attempt in period.

	All study population			Thereof with serious psychiatric hospitalization[1]		
	Number (% of total)	Completed suicides (N,% of group)	Other external deaths (N,% of group)	Number (% of total)	Completed suicides (N,% of group)	Other external deaths (N,% of group)
Total	57,579	853 (1.5%)	473 (0.8%)	16,874	485 (2.9%)	199 (1.2%)
Sex						
Male	25,083 (44%)	581 (2.3%)	307 (1.2%)	8,390 (50%)	320 (3.8%)	127 (1.5%)
Female	32,496 (56%)	272 (0.8%)	166 (0.5%)	8,484 (50%)	165 (1.9%)	72 (0.8%)
Age at 1st attempt						
15-24	26,141 (45%)	145 (0.6%)	95 (0.4%)	4,626 (27%)	86 (1.9%)	32 (0.7%)
25-44	17,257 (30%)	312 (1.8%)	171 (1.0%)	6,534 (39%)	199 (3.0%)	86 (1.3%)
45-64	9,364 (16%)	259 (2.8%)	105 (1.1%)	4,220 (25%)	146 (3.5%)	52 (1.2%)
65-74	2,200 (4%)	72 (3.3%)	39 (1.8%)	888 (5%)	33 (3.7%)	17 (1.9%)
75+	2,617 (5%)	65 (2.5%)	63 (2.4%)	606 (4%)	21 (3.5%)	12 (2.0%)
Ethnic group[2]						
Jews and Others	45,218 (79%)	812 (1.8%)	400 (0.9%)	14,963 (89%)	472 (3.2%)	184 (1.2%)
Arabs	12,203 (21%)	41 (0.3%)	72 (0.6%)	1,900 (11%)	13 (0.7%)	15 (0.8%)
Immigration group						
Immigrants from FSU since 1990	8,019 (14%)	173 (2.2%)	87 (1.1%)	2,553 (15%)	82 (3.2%)	39 (1.5%)
Immigrants from Ethiopia	941 (2%)	28 (3.0%)	9 (.)	342 (2%)	20 (5.8%)	3 (.)
Other immigrants since 1990	1,842 (3%)	28 (1.5%)	4 (.)	606 (4%)	15 (2.5%)	1 (.)
Non-immigrants/earlier immigrants	46,777 (81%)	624 (1.3%)	373 (0.8%)	13,373 (79%)	368 (2.8%)	156 (1.2%)
Psychiatric diagnosis[3]						
Schizophrenia/acute psychotic (F20-F29)				6,841 (41%)	195 (2.9%)	98 (1.4%)
Affective (F30-F39)				4,700 (28%)	181 (3.9%)	56 (1.2%)
Neurotic (F40-F59)				2,810 (17%)	55 (2.0%)	17 (0.6%)
Personality disorders (F60-F69)				1,504 (9%)	33 (2.2%)	13 (0.9%)
Drug/alcohol (F10-F19)				709 (4%)	17 (2.4%)	12 (1.7%)
Childhood onset (F90-F98)				310 (2%)	4 (.)	3 (.)
Time in study (years)						
Mean (Standard deviation)	6.9 (4.3)			6.9 (4.4)		

[1]Persons who ever had a psychiatric hospitalization with discharge diagnosis of serious mental illness.
[2]Missing for 158 persons.
[3]Most severe discharge diagnosis for each person.
(.) Small number of cases, percentage not calculated.

(1.2%). Rates of suicide, increased per age group at first attempt, until age 65-74 years. There were higher rates of suicide in males (2.3%) than females (0.8%), in Jews and Others (1.8%) than Arabs (0.3%), and in immigrants from the FSU (2.2%) and Ethiopia (3.0%). Similar differences were found for other external causes of deaths, although with a smaller gap between Jews and Others (0.9%) and Arabs (0.6%).

Among the psychiatric hospitalization group, suicide was high for all age groups over 24. Highest rates of suicides were among those with affective disorders (3.9%), followed by those with schizophrenia or other psychotic disorders (2.9%), drug or alcohol addiction (2.4%) and personality disorders (2.2%).

We examined details of other external causes of deaths, and found a significant number from undetermined intent poisoning (80 deaths), firearm discharge (12 deaths) and hanging/strangulation or suffocation (9 deaths). Accidental deaths included pedestrians, cyclists, motorcycle riders or car occupants injured in traffic accidents (66 deaths), falls from one level to another (48 deaths), unspecified threat to breathing (29 deaths), exposure to smoke, fire and flames (36 deaths), poisonings (32 deaths) and exposure to unspecified factor (65 deaths).

Timing of the Suicide Death from First Attempt

Figure 1 shows the percentage of all deaths in the study, by time from first suicide attempt for those with psychiatric hospitalizations compared to those without. The risk was high during the period shortly after the suicide attempt, in particular in the group without psychiatric hospitalization, 43% occurring within 6 months of their first attempt and 25% within a month, compared to 31% and 10% of the psychiatric hospitalization group. Among the psychiatric hospitalization group, almost half of the suicides (47%) occurred 2 years or more after the first suicide attempt, compared to 34% of the non-hospitalized group.

Figure 2 shows the percentage of persons with suicide deaths within 2 years of the first suicide attempt by the year of their first attempt. The percentage was relatively stable between 2006 and 2009, 1.5%-1.7% for the psychiatric group and 0.8% to 1.1% for

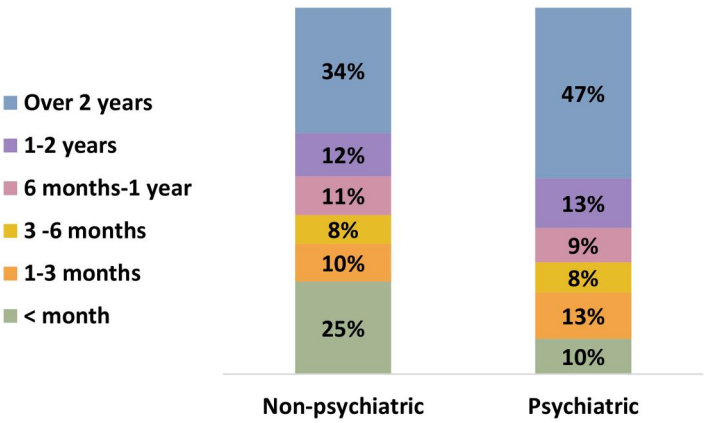

FIGURE 1. Time from first suicide attempt till suicide death, percentage of all suicides in the study period.

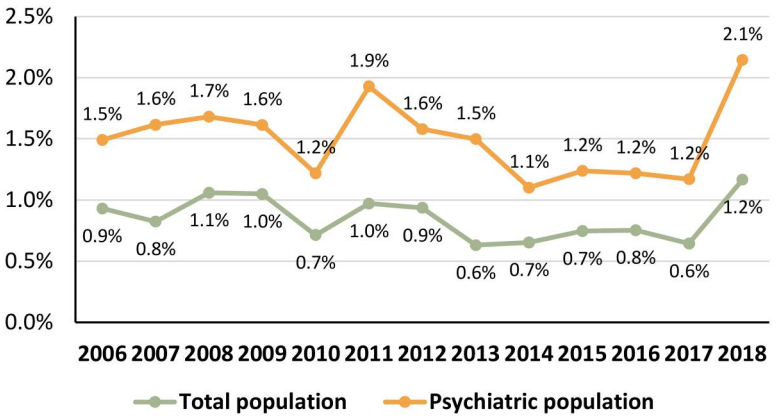

FIGURE 2. Suicide within 2 years of first attempt in study period by year of first attempt.

the total population, and similar in 2011-2012. It was lower in 2013-2017, 1.1%-1.2% for the psychiatric group and 0.6%-0.8% for the total population, but it increased steeply for those with a first suicide attempt in 2018 to 2.1% for the psychiatric group and 1.2% for the total population.

Suicide and Mortality Rates

Table 2 shows the suicide and other external cause mortality rates for the study population compared to the total population mortality rates. In accordance with the aforementioned high risk of suicide during the period shortly after the first attempt, rates of suicide within one year of the first attempt were much higher than total population rates, 137 (95% CI 122-152) times higher, 190 (155-233) times higher in females and 128 (112-145) times higher in males, and even higher in those with a psychiatric hospitalization, 178 (153-207) times higher, 243 (181-325) and 158 (132-190) times higher, respectively. Throughout the entire study period, the rate ratios were lower, 43 (39-46) times higher in the study population and 67 (61-74) times higher in the psychiatric group.

Other external causes of mortality were also considerably higher, 19.6 (16.8-22.8) times for one year mortality, with little difference between the entire study population and those with psychiatric hospitalizations. For the entire study period, the rate ratio was also similar, 7.1 (6.4-7.9) for the study population and 8.2 (7.1-9.5) for those with psychiatric hospitalizations, with a small difference between males and females.

Cox regression Analysis

The results of multivariate analysis Cox models for suicide and for death from other external causes are shown in Table 3. For suicide, the hazard ratios (HR) show a more than 2-fold higher risk for males than females (HR 2.7, 95% CI 2.3-3.1), 3-fold higher for Jews and Others than Arabs, HR 3.3 (2.4-4.5), and higher risk for immigrants from Ethiopia and the FSU, HR 2.1 (1.4-3.1) and 1.3 (1.1-1.5), respectively, compared to Israeli-born/earlier immigrants. There was an increasing risk with age. Among those

TABLE 2. Age adjusted suicide and mortality rates per 100,000 person-years and rate ratios.

	Suicide/mortality rates			Rate ratios (95% CI)	
Group/sex	Total population	Study population	Thereof with psychiatric hospitalization[1]	Study population/ total population	Psychiatric study population[1]/ total population
	Suicide (2006-2019)		Suicide within a year of 1st attempt in study period (2006-2019)		
Males	11.3	1440.4	1785.4	128 (112-145)	158 (132-190)
Females	2.8	522.8	667.5	190 (155-233)	243 (181-325)
Total	6.9	935.8	1219.5	137 (122-152)	178 (153-207)
	Other external cause (2006-2019)		Other external cause mortality within a year of 1st attempt in study period (2006-2019)		
Males	33.0	692.1	661.7	21.0 (17.4-25.2)	20.1 (14.8-27.1)
Females	15.2	275.7	326.3	18.1 (13.8-23.6)	21.4 (14.2-32.3)
Total	23.8	460.1	477.3	19.3 (16.6-22.5)	20.0 (15.8-25.5)
	Suicide (2006-2020)		Suicide over whole study period (2006-2020)		
Males	11.2	484.8	666.8	43 (39-48)	59 (52-68)
Females	2.8	160.0	299.0	58 (51-67)	109 (92-128)
Total	6.8	289.9	460.3	43 (39-46)	67 (61-74)
	Other external cause (2006-2020))		Other external cause mortality over whole study period (2006-2020)		
Males	32.5	265.9	274.3	8.2 (7.2-9.4)	8.4 (6.9-10.4)
Females	15.0	102.3	131.4	6.8 (5.7-8.1)	8.7 (6.9-11.1)
Total	23.5	166.2	192.8	7.1 (6.4-7.9)	8.2 (7.1-9.5)

[1]Persons who ever had a psychiatric hospitalization with discharge diagnosis of serious mental illness.

TABLE 3. Hazard ratios from multivariate cox regression model for suicide and other external cause mortality amongst suicide attempters, with attempt in 2006-2020.

Effect	Hazard ratio with 95% CI	
	Suicide	Other external cause mortality
Males vs females	2.68** (2.32–3.10)	2.43** (2.01–2.94)
Age of 1st attempt:		
25-44 vs 15-24	2.55** (2.08–3.12)	2.46** (1.90–3.17)
45-64 vs 15-24	3.50** (2.84–4.31)	2.87** (2.16–3.82)
65-74 vs 15-24	4.96** (3.71–6.62)	5.99** (4.08–8.78)
75+ vs 15-24	4.98** (3.70–6.71)	10.11** (7.27–14.05)
Ethnic group: Jews and Others vs Arabs	3.28** (2.38–4.51)	1.01 (0.77–1.31)
Immigrant status:		
Immigrants from FSU[1] vs non-immigrants[2]	1.25* (1.06–1.48)	1.16 (0.91–1.47)
Immigrants from Ethiopia vs non-immigrants[2]	2.10** (1.43–3.09)	1.25 (0.64–2.44)
Immigrants from other countries[1] vs non-immigrant[s2]	0.95 (0.65–1.39)	0.27* (0.10–0.73)
Psychiatric disorder diagnosis:		
Schizophrenia/acute psychotic vs none/less severe	1.88** (1.58–2.25)	1.49* (1.17–1.88)
Affective disorders vs none/less severe	2.75** (2.29–3.29)	1.25 (0.93–1.67)
Neurotic disorders vs none/less severe	1.66** (1.25–2.20)	0.75 (0.46–1.22)
Personality disorders vs none/less severe	1.91** (1.34–2.73)	1.17 (0.67–2.05)

*$0.05 < p <= 0.001$ **$p < 0.001$.
[1]Immigrants since 1990.
[2]Israeli-born or earlier immigrants.

with psychiatric disorders, the risk was highest for affective disorder, HR 2.8 (2.3-3.3) followed by personality disorder (1.9, 1.3-2.7) and schizophrenia/acute psychotic disorders (1.9, 1.6-.2.3), compared to those not diagnosed or with less severe disorders. For other external deaths, significant results were found only for age, sex, immigrants from other countries and those with schizophrenia or other acute psychotic diagnosis, HR = 1.5 (2.2-1.9).

In a further analysis, when all those with psychiatric diagnoses were grouped together and compared with those without a diagnosis, the HR was 2.1 (1.8—2.4) for suicide and 1.3 (1.2-1.6) for external deaths.

We checked for the proportional hazards assumption by adding time interactions with the variables in the model. The interactions with sex were significant in the final model as shown in Table S1. There were no major changes in the other HRs. The time interaction leads to a reduction in HR for males compared to females over time, from 3.1 (3.5-2.7) at baseline to a non-significant 1.6 (0.9-2.6) after 14 years.

A highly significant time interaction was found in the psychiatric group status when all psychiatric diagnoses were grouped together, shown in Table S2. Estimates of HRs for those with a psychiatric disorder diagnosis compared to those without, at different times throughout the study, show an increase from 1.8 (1.5-2.2) at baseline to 4.3 (2.5-7.4) after 14 years.

DISCUSSION

The results of the study support previous findings that a suicidal attempt is a dominant risk factor for suicide death. The magnitude of the risk found here, over 100 fold during one year from first suicidal attempt and over 40 fold in a multi-year follow-up, compared to the total population rates (Table 2), are figures which, to the best of our knowledge, are higher than any figure previously detected, such as the 49 fold risk reported

in England (Hawton et al., 2015). The particularly high rate ratios may be due to the relatively low total population rates in Israel, 5.7 per 100,000 population in 2020 compared, for example, to the USA (14.1), the UK (8.4) and Australia (12.4) (OECD. Stat, 2023).

This highlights the extreme importance of providing a therapeutic intervention in the short and most sensitive period, as well as the need to maintain continuing follow up over years, given the high level of risk that remains even after a significant period of time, in particular in those hospitalized with psychiatric disorders for whom the relative risk compared to those without disorders increased over time (Table S2).

These data reinforce an approach that sees the level of suicidality of an individual as a trait, on top of an acute state. Unlike affective crises that usually have restricted episodes, the suicidal tendency may be stable and chronic. Differences in genetic research findings between markers related to mental disorders and those found to be related to suicide, also support the need to deepen our knowledge about specific treatments for suicide prevention, beyond those for depression or other mental disorders (Sokolowski & Wasserman, 2020).

This finding emphasizes the need for extra caution in understanding and determining suicide attempts and self-harm events as "demonstrative", or "manipulative" in origin. Avoiding a judgmental attitude under these circumstances is appropriate. The treatment approach should evaluate specific events on a continuum starting with stress signs and help seeking behavior, and ending as serious life-threatening events that might cause death.

However, we found groups with lower risk for suicide following a suicide attempt. The youngest age group (15-24) compared to older ages, the Arab population compared to Jews and Others and females compared to males. As reported by the ministry of health publication, these groups all have relatively high suicide attempt rates, but lower suicide rates: The highest suicide attempt rates are found for those aged 18-21 followed by 22-24 and 15-17 year olds and females have higher rates than males for all age groups under 45. In the case of Arabs, the suicide rates are considerably lower than Jews and Others, particularly for females, while the suicide attempt rate are similar and were even higher than Jews and Others for females between 2010-2016 (Goldberger et al., 2023a). Here the suicide attempt could be seen as more of a cry for help or pain to the community, and not necessarily reflecting a desire for a fatal outcome. Clearly, these suicide attempters also need to be treated, but it is important to understand the root cause of their behavior and try and solve their problem, and not just treat their mental health.

In the current study immigrants from the former Soviet Union and Ethiopia had higher risk of suicide after an attempt compared to non-immigrants, consistent with their higher suicide rates, which can reflect the difficulty of adjustment to a new country and culture, and perhaps the suicide rates in their country of origin, as discussed by Youngman et al. (2021).

The addition of another risk factor, a background of psychiatric hospitalization, significantly increases the level of risk, about 2 times or more, regardless of the exact diagnosis. The highest risk (Table 3) was among those diagnosed with affective disorders followed by personality and psychotic disorders, as in previous studies (Goldberger et al., 2015, Tidemalm et al., 2008).

The complex combinations demonstrated in this study as leading to higher suicide rates are consistent with the "stress diathesis" model of understanding the background of suicide (Mann et al., 1999). This study demonstrated a complex causal puzzle. The practical significance of this may be the recognition that neutralizing components of this puzzle, sometimes even one component, may save lives. Thus, a proactive therapeutic approach is needed, unlike a tendency, familiar even among some therapeutic professionals, that sees suicidal danger as a deterministic one that cannot be avoided in most cases.

Thus, treatment which alleviates mental symptoms, as well as overcoming feelings of loneliness and "no way out" through an interpersonal therapeutic relationship, may be pieces that neutralize puzzle components and may save lives.

In the trend data (Figure 2) we found lower 2 year suicide rates following attempts in 2013-2017 which may be at least partially a result of the national suicide prevention program. our study group of suicide attempters showed a significant rise in suicide following attempts in 2018, both those with and without psychiatric hospitalizations, partially concurrent with the first year of the COVID-19 pandemic in 2020, and unlike the nationwide suicide rates (19) which remained stable. There is evidence that general population exposure to a common stress may be related to a decrease in suicide rates. Indeed, high-quality evidence found no significant increase in suicide, during the first 9–15 months of the COVID-19 pandemic in the majority of the 33 countries analyzed (15). Does such external stress raise the risk of a suicide crisis among previously suicidal individuals and as such, reflect an opposite influence compared to the general population? This suggestion may find support in a systematic review meta-analysis that showed an upward trend in suicidal ideation and suicide attempts during the COVID-19 pandemic, although the suicide rate remained stable (Goldberger et al., 2023a).

As with suicides, we found the risk for mortality from external causes such as accidents of various types many times higher in the study population of suicide attempters than the total population, although less associated with psychiatric hospitalization and diagnoses. This may be explained firstly by the low level of reliability of suicide statistics, mainly due to the difficulty in distinguishing suicide from deaths with apparent other unnatural external causes of death, leading to suicide rate underestimation. Hence, some of the presumed deaths from external causes were in fact suicides. Additionally there are similar behavioral characteristics that may exacerbate the risk for all external causes of death, including suicide and accidents. These characteristics include aggression and impulsivity, irrespective of the existence of a mental disorder, and hostility due to depressive background (Fazel & Runeson, 2020). Thus, treatment for these symptoms may reduce both suicide and other external causes of death.

LIMITATIONS

Data on suicides and suicide attempts may be under-reported, and we used the available data. We did not have data on emigration from Israel, which may lead to an over-estimation of the study population. The strengths of this study are the reliable linkage of three large national databases over a 15 year study period allowing detailed analysis of risk factors and suicide trends following suicide attempts.

CONCLUSIONS

We found a greatly increased risk for suicide and significant increase in risk for other external causes of death amongst a cohort of suicide attempters, compared to the total population. Suicide risk was even higher in persons with a psychiatric hospitalization. The risks were highest in the period closely following the suicide attempt, particularly in the non-psychiatric attempters. There is evidence of a rise in suicide amongst previous attempters is the first year of the COVID-19 pandemic.

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ETHICS APPROVAL

Confidentiality was strictly assured since the authors who analyzed the data had no access to the identity of the persons linked by the databases. The study was approved by the Jerusalem Mental Health Center committee on research involving human subjects.

AUTHORS' CONTRIBUTIONS

All authors have seen the manuscript and consent to publication.

DISCLOSURE STATEMENT

The authors have no competing interests to declare.

AUTHOR NOTES

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DATA AVAILABILITY STATEMENT

For reasons of protection of privacy, the data sets for this study are not publicly available.

REFERENCES

Bakst, S. S., Braun, T., Zucker, I., Amitai, Z., & Shohat, T. (2016). The accuracy of suicide statistics: Are true suicide deaths misclassified? *Social Psychiatry and Psychiatric Epidemiology*, *51*(1), 115–123. https://doi.org/10.1007/s00127-015-1119-x

Beautrais, A. L. (2003). Subsequent mortality in medically serious suicide attempts: A 5 years follow up. Aust N Z J *Psychiatry*, *37*(5), 595–599. https://doi.org/10.1046/j.1440-1614.2003.01236.x

Doshi, R. D., Chen, K., Wang, F., Schwartz, H., Herzog, A., & Aseltine, R. H. Jr. (2020). Identifying risk factors for mortality among patients previously hospitalized for suicide attempt. *Scientific Reports*, *10*(1), 15223. https://doi.org/10.1038/s41598-020-71320-3

Fazel, S., & Runeson, B. (2020). Suicide. *The New England Journal of Medicine*, *382*(3), 266–274. https://doi.org/10.1056/NEJMra1902944

Goldberger, N., Aburbeh, M., Haklai, Z. (2023a). Suicidality in Israel *Ministry of Health* (Hebrew). https://www.gov.il/BlobFolder/reports/suicides/he/files_publications_units_info_loss_2022.pdf.

Goldberger, N., Haklai, Z., Aburbeh, M., Gordon, E. S. (2023b). *Ministry of Health*, (Hebrew). https://www.gov.il/BlobFolder/reports/leading-causes-of-death-in-israel/he/files_publications_units_ info_Leading_Causes_2020.pdf

Goldberger, N., Haklai, Z., Pugachova, I., & Levav, I. (2015). Suicides among persons with psychiatric hospitalizations. *Israel Journal of Psychiatry and Related Sciences*, *52*(1), 25–32.

Hawton, K., Bergen, H., Cooper, J., Turnbull, P., Waters, K., Ness, J., & Kapur, N. (2015). Suicide following self-harm: Findings from the Multicentre Study of self-harm in England, 2000–2012. *Journal of Affective Disorders*, *175*, 147–151. https://doi.org/10.1016/j.jad.2014.12.062

Hawton, K., Harriss, L., & Zahl, D. (2006). Deaths from all causes in a long-term follow-up study of 11583 deliberate self-harm patients. *Psychological Medicine*, *36*(3), 397–405. https://doi.org/10.1017/S0033291705006914

Large, M., Smith, G., Sharma, S., Nielssen, O., & Singh, S. P. (2011). Systematic review and meta-analysis of the clinical factors associated with the suicide of psychiatric in-patients. *Acta Psychiatrica Scandinavica*, *124*(1), 18–29. https://doi.org/10.1111/j.1600-0447.2010.01672.x

Leon, C. L., Friedman, R. A., Sweeney, J. A., Brown, R. P., & Mann, J. J. (1989). Statistical issues in the identification of risk factors for suicidal behavior: The application of survival analysis. *Psychiatry Research*, *31*(1), 99–108. https://doi.org/10.1016/0165-1781(90)90112-i

Levi, L., Werbeloff, N., Pugachova, I., Yoffe, R., Large, M., Davidson, M., & Weiser, M. (2016). Has deinstitutionalization affected inpatient suicide? Psychiatric inpatient suicide rates between 1990 and 2013 in Israel. *Schizophrenia Research*, *173*(1-2), 75–78. https://doi.org/10.1016/j.schres.2016.03.007.

Liu, B.-P., Jia, C.-X., Qin, P., Zhang, Y.-Y., Yu, Y.-K., Luo, X., & Li, S.-X. (2022). Associating factors of suicide and repetition following self-harm: A systematic review and meta-analysis of longitudinal studies. *Lancet*, *49*(101461), 1–19. https://doi.org/10.1016/j.eclinm.2022.101461

Mann, J. J., Waternaux, C., Haas, G. L., & Malone, K. M. (1999). Toward a clinical model of suicidal behavior in psychiatric patients. *The American Journal of Psychiatry*, *156*(2), 181–189. https://doi.org/10.1176/ajp.156.2.181

OECD. Stat. (2023). Extracted 23 November 2023. https://stats.oecd.org/#.

Pirkis, J., Gunnell, D., Shin, S., Del Pozo-Banos, M., Arya, V., Aguilar, P. A., Appleby, L., Arafat, S. M. Y., Arensman, E., Ayuso-Mateos, J. L., Balhara, Y. P. S., Bantjes, J., Baran, A., Behera, C., Bertolote, J., Borges, G., Bray, M., Brečić, P., Caine, E., … Spittal, M. J. (2022). Suicide numbers during the first 9-15 months of the COVID-19 pandemic compared with pre-existing trends: An interrupted time series analysis in 33 countries. *EClinicalMedicine*, *51*, 101573. https://doi.org/10.1016/j.eclinm.2022.101573

Sokolowski, M., & Wasserman, D. (2020). Genetic origins of suicidality? A synopsis of genes in suicidal behaviours, with regard to evidence diversity, disorder specifity and neurodevelopmental brain transcriptomics. *European Neuropsychopharmacology: The Journal of the European College of Neuropsychopharmacology*, *37*, 1–11. https://doi.org/10.1016/j.euroneuro.2020.06.002

Suominen, K., Isometsä, E., Suokas, J., Haukka, J., Achte, K., & Lönnqvist, J. (2004). Completed suicide after a suicide attempt: A 37-year follow-up study. *The American Journal of Psychiatry*, *161*(3), 562–563. https://doi.org/10.1176/appi.ajp.161.3.562

Tidemalm, D., Långström, N., Lichtenstein, P., & Runeson, B. (2008). Risk of suicide attempt according to coexisting psychiatric disorder: Swedish cohort study with long term follow-up. *BMJ (Clinical Research ed.)*, *337*, a2205. https://doi.org/10.1136/bmj.a2205

Tøllefsen, I. M., Hem, E., & Ekeberg, Ø. (2012). The reliability of suicide statistics: A systematic review. *BMC Psychiatry*, *12*(1), 9. https://doi.org/10.1186/1471-244X-12-9

Yan, Y., Hou, J., Li, Q., & Yu, N. X. (2023). Suicide before and during the COVID-19 pandemic: A systematic review with meta-analysis. *International Journal of Environmental Research and Public Health*, *20*(4), 3346. https://doi.org/10.3390/ijerph20043346

Youngman, R., Zilber, N., Haklai, Z., & Goldberger, N. (2021). Suicide rates and risk factors for suicide among Israeli immigrants from Ethiopia (1985–2017). *Israel Journal of Health Policy Research*, *10*(1), 27. https://doi.org/10.1186/s13584-021-00454-0