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An effective suicide prevention program in the Israeli Defense Forces: A cohort study

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ABSTRACT

Objective: To evaluate the effectiveness of the IDF Suicide Prevention Program, implemented since 2006.
Design: Quasi-experimental (before and after) cohort study.
Participants: Two cohorts of IDF mandatory service soldiers: the first inducted prior to (1992–2005, $n = 766,107$) and the second subsequent to (2006–2012, $n = 405,252$) the launching of the intervention program.
Exposure: The IDF Suicide Prevention Program is a population-based program, incorporating: reducing weapon availability, de-stigmatizing help-seeking behavior, integrating mental health officers into service units, and training commanders and soldiers to recognize suicide risk factors and warning signs.
Main outcome measure: Suicide rate and time to suicide in cohorts before and after exposure to the Suicide Prevention Program.
Results: Trend analysis showed lower suicide rates in the cohort after intervention. The hazard ratio for the intervention effect on time to suicide was 0.44 (95% CI = 0.34–0.56, $P < .001$) among males. Lower risk was associated with: male gender; born in Israel; higher socio-economic status; higher intelligence score; and serving in a combat unit (HR = 0.43: 95% CI = 0.33–0.55).
Conclusions: There was a 57% decrease in the suicide rate following the administration of the IDF Suicide Prevention Program. The effect of the intervention appears to be related to use of a weapon, and being able to benefit from improved help-seeking and de-stigmatization. Future efforts should seek to extend the program's prevention reach to other demographic groups of soldiers. The success of the IDF program may inform suicide prevention in other military organizations and in the civilian sector.

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1. Introduction

Suicide is a major cause of death in young adults worldwide [15,30], and the leading cause of death in the military in peacetime [5,31,39]. Increased attention to military suicide prevention was stimulated by the rising suicide rate in The US Army, despite considerable investment in mental health services [24,33], contrasting with minor change in the civilian suicide rate [32]. While causal factors remain uncertain [20,33,38], depression and alcohol-related problems appear to be more important than military factors, such as deployment [20,25,32,38]. Effective prevention in both civilian and military population requires

identifying factors contributing to suicide. That prevention refers to physician education in depression recognition and treatment and restricting access to lethal methods reduce suicide rates [27]. Prevention measures considered effective in civilian settings may be less suitable for military personnel because they might sometimes fail to address risk factors important in a military setting [13,17].

While suicide is currently the leading cause of death in the Israel Defence Force (IDF) [39], in contrast to the US Army's, the IDF suicide rate has declined since 2006. In 2012, the IDF suicide rate was 7:100,000 – the lowest level in 14 years [1]. This decline coincided with the implementation of a suicide prevention program [40].

The multifactorial nature of suicide risk requires a multicomponent prevention approach in the civilian sector, combining population-based screening and education with targeted interventions for

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individuals at higher risk [2,27,36]. Evaluation of multilevel strategies and their components, including mediating and moderating variables, is essential for estimating program effectiveness, yet program evaluation is seldom conducted [43].

A recent systematic review [6] of military-based suicide prevention programs concluded that multicomponent interventions in military personnel may reduce suicide rates, but these declines may merely parallel general population trends. The suicide prevention program in the US Air Force [22,23], at 2003 did not identify which of the many components was related to outcome, or what changes (such as help-seeking or antidepressant prescription rate) mediated program efficacy [22]. They looked at these component in a later publication at 2010 finding that their multilayered suicide prevent program focusing on leadership involvement, psycho-education, mental health stigma reduction and early prevention and intervention worked as a whole during the programs time, when implemented to the full but worked less at 2004 when it was not as fully implemented as planed ([23] In examining the effectiveness of the IDF Suicide Prevention Program (SPP), we incorporated potential mediating and moderating factors in the investigation. The current study adopted a quasi-experimental design and a retrospective analysis of cohorts before (1992–2005) and after (2006–2012) the 2006 [40] launch of the intervention [22]. The main outcome measure was time to suicide for both cohorts.

2. Methods

2.1. Study design

To determine the effectiveness of the IDF SPP, we conducted a quasi-experimental design and retrospective analysis of cohorts inducted into the IDF, before (1992–2005) and after (2006–2012) the implementation of the intervention [22].

The intervention consisted of a multicomponent suicide prevention plan that was initiated in 2006, and outcomes were suicide rates and time to suicide in the unexposed cohort and the exposed cohort [40].

2.2. Study participants

The potential study population consisted of 1,347,644 active duty mandatory service IDF soldiers that served during the years 1992–2012. Excluded a subsection of the population (n = 176,287) that does not represent the regular mandatory service IDF soldiers (several population groups defer military service, such as academic reserve soldiers and conscription evaders). This left 1,171,357 active duty mandatory service IDF soldiers, whose average age was 19 years. National military service is mandatory for all Jewish Israeli citizens over the age of 18 years. (Arab citizens are exempted upon request, and other exemptions on religious, physical or psychological grounds may apply). Men serve three years in the IDF and women serve two years. Soldiers were aged 17–24 years. during mandatory service. The final study population included 1,171,357 active IDF soldiers with an average age of 19 years (Table 1); almost equal proportions of males and females; 95% of the Jewish faith; and 17% assigned to a combat unit. At induction, 97% has no prior mental health diagnosis.

2.3. Ethics approval

The institutional review board of IDF Medical Corps approved the study and waived the requirement for informed consent in order to protect participant anonymity.

2.4. Methods of measurement

2.4.1. Predictor (explanatory) variables

2.4.1.1. *The IDF Suicide Prevention Program.* In 2005, a joint venture between the IDF's Department of Mental Health and the Personnel Directorate initiated the development of a broad Suicide Prevention Program (SPP), resulting in a directive by the IDF Chief of Staff authorizing the implementation of a systematic SPP at several levels.

First, weapon accessibility was significantly restricted [12,26,34]. Secondly, existing procedures and commands were revised and new ones formulated to improve screening and

Table 1
Population characteristics of 1,171,359 soldiers in the IDF suicide prevention study.

Characteristics	No of prevention (n = 766,107)		Prevention (n = 405,252)		Total (n = 1,171,359)		P
	Count	%	Count	%	Count	%	
Gender							
Male	401,297	52.4	223,794	55.2	625,091	53.4	
Female	364,810	47.6	181,458	44.8	546,268	46.6	<0.000
Jewish Faith							
Jewish	730,742	95.4	376,154	92.8	1,106,896	94.5	
Other	35,365	4.6	376,154	7.2	64,463	5.5	<0.000
Mental health diagnosis[a]	22,562	2.9	8,493	2.1	31,055	2.7	<0.000
Combat duty	113,236	15.2	78,348	20.1	191,584	16.9	<0.000
Birthplace							
Israel	631,198	82.4	330,306	81.5	961,504	82.1	
Former Soviet Union	97,853	12.8	48,283	11.9	146,136	12.5	
Asia	2,370	0.3	883	0.2	3253	0.3	
Africa	580	0.1	215	0.1	795	0.1	
Western Europe	24,029	3.1	18,861	4.7	42,890	3.7	
Ethiopia	9,874	1.3	6,594	1.6	16,468	1.4	<0.000
Socio-economic status							
Low	178,660	23.5	99,902	24.9	278,562	24.0	
Average	410,727	54.0	214,186	53.4	624,913	53.8	
High	171,365	22.5	87,041	21.7	258,406	22.2	<0.000
Intellect Rating Score							
Low	111,661	14.7	76,028	19.7	187,689	16.4	
Average	557,142	73.2	265,531	68.8	822,673	71.8	
High	91,968	12.1	44,141	11.4	136,109	11.9	<0.000

[a] Prior to induction.

management of suicidal soldiers The third level of intervention identified specific populations profiled for intervention by employing two indices:

- service timeline, which identified soldiers during periods of military service characterized by higher rates of suicide (e.g., boot camp, first year of service, six months prior to discharge, and periods of transition upon reassignment to new army units) [3,4,7,11];
- characteristics of soldier subgroups identified with an increased suicide risk [8] and "gate-keeper" groups (the IDF considers all soldiers and commanders as "gate-keepers" through mutual responsibility for their comrades and soldiers) [27].

Reduction of the stigma associated with help-seeking behavior was achieved through education and integrating Mental Health Officers (MHO) in various army units [9], as well as increasing the availability of MHOs through the Human Resources Division [10,41].

A suicide review process developed as part of the program included data collection, post-suicide case assessment and psychological autopsy, and dissemination of useful findings and recommendations to MHO's, commanders, and soldiers. The suicide review process consists of two parallel investigative routes: an internal IDF mechanism for examining suicides, and a civilian expert team to provide an external perspective, additional quality assurance, and a link to the academic community [1].

2.4.1.2. Socio-demographic variables. Socio-demographic data were retrieved using the Human Resource IDF database.

The variables were sex, age, religion, education, and country of origin (defined by birth country for immigrants, by the father's birth country for Israeli-born soldiers, and by the grandfather's country of birth in cases when the father was Israeli-born).

Socio-economic status was determined by residence location, rated 1–10, where higher numbers indicated higher socio-economic status, in three categories [18]: low (1–3), medium (4–6), and high (7–10).

2.4.1.3. Army induction characteristics. All conscripts in Israel are legally required to report to the recruiting office. During the conscription process, they are interviewed and evaluated by a trained examiner. If emotional or behavioral problems are suspected, the conscript is referred to a clinical social worker or clinical psychologist for a semi-structured interview, followed by further evaluation, as needed [7]. This evaluation provides an Intellect Rating and a Medical and Mental Health profile.

The Intellect Rating Score (IRS) [7] comprises four sub-tests measuring intellectual ability. The total score is a valid measure of general intelligence equivalent to a normally distributed IQ score [14].

All four sub-tests were presented in a multiple-choice format. One general score and four sub-test scores were computed. A general score at the 95th percentile is equivalent to an IQ above 135, and the correlation between the general IRS score and the WAIS total IQ is > .90 [19]. Moreover, the IRS is positively related to the soldier's rank at discharge [42].

We divided the soldiers into three groups based on IRS scores: low (10–30), average (40–60), and high (70–90). The tests are administered by a trained evaluator and include the following components: Arithmetic (numerical reasoning), Similarities (verbal abstraction and categorization), Raven's Progressive Matrices (non-verbal abstract reasoning), and Otis (verbal intelligence test).

2.4.1.4. Medical profile (Military Fitness Rating Scale). At induction, each conscript is assigned a medical profile score indicating physical and emotional fitness as well as physical limitations (e.g., visual and hearing levels). A soldier's profile classification determines their assignment to specific units, particularly combat and non-combat units. This profile is modifiable during military service, at the initiative of either commanders or the soldier, as a result of changes in the soldier's physical or mental state. A request to upgrade the medical profile usually stems from the soldier's willingness to assume more demanding and responsible army roles.

We divided the soldiers into four categories according to their medical and mental health profile: released from duty; low fit/unfit for combat duty; medium fit for combat duty, excluding infantry; highly fit for combat front-line duty. This classification was employed throughout the study in order to discern the variable combat service (medium fit and highly fit) vs. non-combat service (discharged and low fit/unfit).

2.4.1.5. Pre-induction mental health diagnoses. Family physicians are legally obligated to report to the recruitment center any information related to mental health diagnoses of enlisted soldiers, with the information recorded in the military medical database.

2.4.1.6. Army experiences. Additionally, we recorded length of army service and type (combatant vs. non-combatant).

2.4.2. Outcome variable
The main outcome variable was time-to-death-by-suicide. Of the 1,171,357 soldiers enrolled in the study, 462 deaths were classified as suicide following an extensive official cause-of-death investigation, carried out routinely after every non-combat death. After excluding 29 suicide deaths of soldiers who were inducted before the intervention began but died by suicide afterwards, the suicide group comprised 433 deaths by suicide over a 20-year period, 1992–2012.

Data for each soldier covered his service period. Each death by suicide was considered an event. Cases were "censored" if follow-up period ended without suicide or by dropping out of the follow-up (mostly by early discharge) before the end of the period (three years for men and two years for women). Soldiers whose service period straddled pre-intervention were censored at time of inception of program and included in the analyses. Time to event was measured in person-years.

2.4.3. Suicide rates
Soldiers enter or are discharged from the army at specific periods throughout the year after completing mandatory service. Thus, at least three cohorts would be serving in the IDF at any given time. We calculated the suicide rate by dividing the entire population into cohorts, based on their enlistment date. The suicide rate was determined by dividing the number of suicides in the two- or three-year cohorts by the number of person-years for any given cohort. By convention, we report the suicide rate per 100,000 person-years.

2.5. Statistical data analysis

Suicide rates per 100,000 person-years were calculated for each induction year for males and females. To assess suicide trends during the investigated period, we performed a linear regression model, with suicide rate as dependent variable, and exposure to the program and year of induction as independent variables. Separate models were carried out for male and female.

Cox proportional hazards regression was used to examine the relationship of exposure to the SPP to death by suicide, generating

hazard ratios and 95% confidence intervals [21]. We performed univariate and multivariate models, adjusted for socio-demographic variables found to be statistically significant in univariate analysis. Log minus log plots for each variable verified the assumption of hazard proportionality.

Proportional hazard assumptions were tested graphically and statistically in a survival regression analysis, with assumptions being met for all presented models. Analyses were performed with IBM SPSS Statistics for Windows, version 21.0. Armonk, NY: IBM Corp.

All confidence intervals and significance tests were significant at $P < .05$ and were calculated by using robust variance estimates. Models included gender, socio-economic status, country of birth, religion, and intellect rating score, pre-induction mental health diagnosis, and combat unit.

3. Results

3.1. Population characteristics

The final cohort's population characteristics ($n = 1,171,359$) and comparison before and after prevention are presented in Table 1.

Before prevention, compared with after prevention, were characterized by a higher proportion of religious identification as Jewish (95.4% vs. 92.8%, respectively; $P < .001$) and a higher proportion of mental health diagnosis prior to induction (2.9% vs. 2.1%, $P < 001$). Lower socio-economic status was more prevalent before prevention (23.5% vs. 24.9%; $P < .001$) as was lower intellectual rating score (14.7% vs. 19.7%, $P < .001$). Contrary after prevention, compared with before prevention were characterized by a higher proportion of male (55.2% vs. 52.4%, $p < 001$), as well as combat duty (20.1% vs. 15.2%, $P < 001$), born in Western Europe (4.3% vs. 3.1%; $P < .001$) and in Ethiopia (1.6% vs. 1.3%; $P < .001$). Age at induction day before and after prevention was 18.7 ± 0.7 and 18.8 ± 0.7, respectively.

There were 344 suicides reported during the 14 years prior to the intervention (1992–2005: 24.6 suicides per year; 93% male). Eighty-nine suicides were reported during the seven years after the intervention commenced (2006–2012: 12.7 suicides per year; 87% male). The population characteristics of all these 433 soldiers during the study follow-up are presented in Table 2 and Fig. 1.
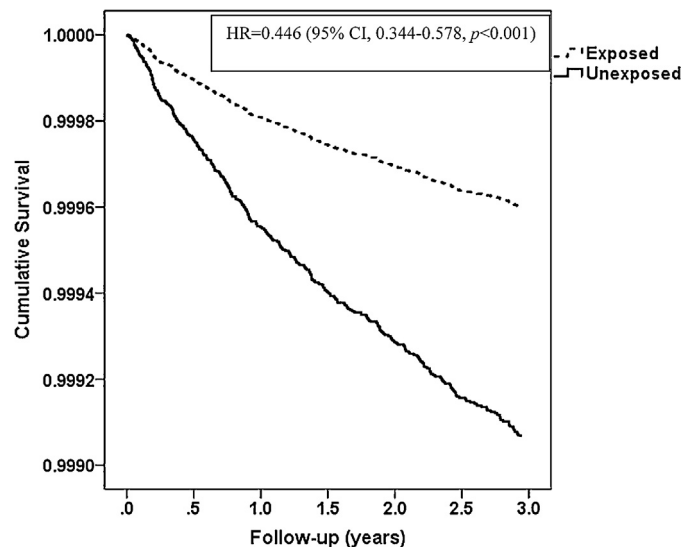

Fig. 1. Cumulative survival in exposed and unexposed males adjusted for religion, birth country, Intellect rating score, SES, mental health and combat.

Rates for male soldiers were higher than for females, 38/100,000 and 6/100,000 suicides per year, respectively between years 2003–2005 (Table 4). Although the suicide rate declined over the entire period of study, a sharper decrease for males followed implementation of the program ($b = -21.4$; $P = .015$). The most pronounced decrease in mortality rates occurred 2009–2012 (RR = 0.30, 95% CI = 0.20–0.43). No change was observed in females following the SPS ($b = 1.57$; $P = .56$), perhaps because of the 433 suicides, 397 (92%) were male and only 36 (8%) were female (Table 2).

Years in service had no effect on suicide rates in either gender. Jewish religious affiliation accounted for 87% of the suicides, 93% had no previous mental health diagnosis, and 32% had served in a combat unit.

We fit a Cox regression model, which covered the entire period, using exposure to the SPP as the explanatory variable. Suicide rates dropped from an average of 23/100,000 per year prior to the intervention to 11/100,100 per year subsequent to the intervention (Table 3). The hazard ratio was 0.48 (95% CI: 0.37–0.60) and adjusting for other explanatory variables lowered the hazard ratio to 0.43 (95% CI: 0.33–0.55).

To evaluate whether the linear trend was linked to the implementation of the SPP, we divided the entire period into 3-year intervals and conducted a Cox regression analysis. As observed in the trend analysis, although the suicide rate appeared to be declining throughout the study period (Table 4), the decline became statistically significant only after 2006, following the implementation of the SPP. The most striking decrease in mortality rates occurred 2009–2012 (RR = 0.30, 95% CI = 0.20–0.43). This pattern was statistically confined to males, where in 2009–2012, the RR = 0.28 (95% CI = 0.19–0.42; Table 4). The greater effect in males altered male:female suicide ratios from 13:1 prior to the SPP to 6:1 post-SPP. The post-SPP male:female suicide ratio became comparable to the ratio for the entire Israel population in the corresponding years namely 5.5:1 until 2005, and 4.7:1 2005–2010 [12].

Jewish soldiers were twice as likely to die by suicide compared with non-Jewish soldiers, and soldiers born in countries other than Israel had a higher risk for suicide, with the highest hazards ratios observed for Ethiopian-born soldiers (HR = 4.79, 95% CI: 3.23–7.29). Differences in socio-economic-status, intellect rating score, and serving in a combat unit were not statistically significant explanatory variables. Soldiers reporting no mental health

Table 2
Characteristics of 433 soldier suicides during study follow-up.

Characteristics	No of prevention ($n = 344$)		Prevention ($n = 89$)		Total ($n = 433$)	
	Count	%	Count	%	Count	%
Male	320	93.0	77	86.5	397	91.7
Jewish Faith	302	87.8	73	82.0	375	86.6
Mental health diagnosis[a]	27	7.9	3	3.4	30	6.9
Combat duty	94	29.1	35	40.7	129	31.5
Birthplace						
Israel	249	72.4	54	60.7	303	70.0
Former Soviet Union	60	17.4	16	18.0	76	17.6
Asia	1	0.3	1	1.1	2	0.5
Western Europe	17	4.9	7	7.9	24	5.5
Ethiopia	17	4.9	11	12.4	28	6.5
Socio-economic status						
Low	103	30.0	30	34.5	133	30.9
Average	180	52.5	43	49.4	223	51.9
High	60	17.5	14	16.1	74	17.2
Intellect Rating Score						
Low	50	14.8	24	27.3	74	17.3
Average	229	67.6	50	56.8	279	65.3
High	60	17.7	14	15.9	74	17.3

[a] Prior to induction.

Table 3
Effects of suicide prevention program.

	Male		Female	
	No of prevention	Prevention	No of prevention	Prevention
Participants	401,297	223,794	364,810	181,458
Suicide number	320	77	24	12
Median follow-up (years)	2.93	2.58	1.7	1.9
Cumulative follow-up (person-years)	898,825	482,542	577,954	317,537
Suicide rate (per 100,000 person-years)	35.6	16.0	4.3	3.5
Mean time to suicide (years ± SD)	1.1 ± 0.8	1.1 ± 0.8	0.7 ± 0.5	0.8 ± 0.45
Univariate hazard ratio	1	0.44 (0.34–0.56)	1	0.90 (0.45–1.83)
Multivariate hazard ratio	1	0.43 (0.33–0.55)	–[a]	–[a]

[a] Due to lack of effect and population size, we did not perform multivariate analyses for the female population.

Table 4
Relative risk of suicide mortality among IDF soldiers, 1992–2012, by gender, according to recruitment years.

Years	Male[b]		Female	
	Suicide rate (person-years per 100,000)	Relative risk (95% CI)	Suicide rate (person-years per 100,000)	Relative risk (95% CI)
Univariate				
1992–1996	39	1.00	6	1.00
1997–1999	31	0.79 (0.59–1.06)	4	0.71 (0.25–2.01)
2000–2002	34	0.88 (0.66–1.66)	1	0.13 (0.02–1.01)
2003–2005	38	0.83 (0.60–1.17)	6	0.97 (0.36–2.61)
2006–2008	20	0.52 (0.37–0.73)[a]	3	0.61 (0.37–0.73)
2009–2012	13	0.30 (0.20–0.43)[a]	4	0.70 (0.27–1.81)
Multivariate[c]				
1992–1996	39	1.00		
1997–1999	31	0.72 (0.53–0.99)		
2000–2002	34	0.77 (0.57–1.03)		
2003–2005	38	0.82 (0.58–1.17)		
2006–2008	20	0.50 (0.35–0.71)[a]		
2009–2012	13	0.28 (0.19–0.42)[a]		

[a] $P < .001$.
[b] Linear Trend: $P = .003$.
[c] Adjusted for religion, country of birth, SES, mental health diagnosis and combat duty.

diagnosis prior to induction were twice as likely to die by suicide as soldiers bearing a mental health diagnosis (Table 5).

No significant differences were found, comparing the time to death by suicide after induction in males prior to and subsequent to the activation of SPP ($1.1 ± 0.8$ years; $P = .835$).

Table 5
Estimated hazards ratio (HR) and 95% confidence intervals (CI) from a Cox proportional hazard model of time to suicide, IDF suicide prevention study, male gender, 1992–2012.

Variables	Univariate HR (95% CI)	Multivariate HR (95% CI)[d]
Exposed (unexposed)[a]	0.44 (0.34–0.56)[b]	0.42 (0.33–0.54)[b]
Non-Jewish (Jewish)	2.37 (1.79–3.13)[b]	2.09 (1.53–2.85)[b]
Birthplace (Israel)		
Former Soviet Union	1.69 (1.30–2.20)[b]	1.35 (1.02–1.79)
Asia	1.90 (0.47–7.62)	1.71 (0.43–6.89)
Western Europe	1.95 (1.28–2.95)[c]	1.98 (1.29–3.04)[c]
Ethiopia	4.83 (3.27–7.12)[b]	4.79 (3.23–7.09)[b]
Socio-economic status (high)		
Medium	1.17 (0.89–1.54)	1.07 (0.81–1.41)
Low	1.50 (1.12–2.01)	1.29 (0.95–1.73)
Intellectual Rating Score (high)		
Average	1.20 (0.86–1.68)	
Low	0.93 (0.71–1.21)	
No mental health diagnosis (yes)	2.15 (1.48–3.14)[b]	2.05 (1.40–3.00)[b]
No Combat duty (yes)	1.11 (0.90–1.37)	

[a] Reference categories in parentheses.
[b] $P < .001$.
[c] $P < .01$.
[d] Adjusted for all other explanatory variables.

Finally, in male recruitments, results from multivariable (adjusted for religion, birth country, Intellect rating score, SES, mental health and combat) Cox regression analysis shows a decrease in Suicide in both periods, HR per recruitment year was 0.965 (95% CI; 0.935–0.996; $P = 0.026$) before Intervention and HR = 0.850 (95% CI; 0.745–0.970; $P = 0.016$) after intervention (Fig. 1).

4. Discussion

There was a 57% decrease in the suicide rate following the administration of the IDF Suicide Prevention Program as shown at the years 2006–2012, compared with 1992–2005. These results were robust in male soldiers, but not in female soldiers, because females accounted for only 8% of all suicides, making this prevention effect difficult to detect. Exploratory analyses demonstrated a higher risk of suicide for Jewish soldiers, those born outside Israel and for soldiers without a known mental health diagnosis prior to induction.

During the follow-up period, although there was a reduction of percentage in the Israeli-born population, Jewish faith and in the mentally health diagnosed enlisted soldiers (Tables 1 and 2). There was an increase in the proportion of male, combat duty (weapons carrying soldiers) and Israeli Ethiopian, all reported in IDF past researches as being a relative risk factors to suicide [1,3,26].

As mentioned above, there are several known elements contributing to the elevation in suicide rate. One of the most critical elements is the high accessibility to weapons [12,26,35].

Civilian suicide prevention programs may impact suicide rates [27]. The best evidence-based interventions reducing the suicide rate are:

- restriction of access to lethal methods, such as firearms and medications;
- physician education in depression recognition and treatment, and improved screening [27].

As for the mean time to suicide, no differences found comparison the two periods before and after SPP. In both periods, the mean time to suicide was 1.1 year ± 0.8 (Table 3). This finding is in line with previous studies [3,4,7,16]. The first few stages of military service are regarded as critical adaptation periods. These new transitional situations require coping and adjustment resources. During this time, the new recruit faces simultaneously a number of lifestyle changes, such as those related to living conditions (transition from home to base); separation from familiar supports (family and friends); and different sleeping and eating arrangements, sometimes with a deficiency in these basic needs [40].

As a result, a high percentage of military suicide cases (38%) occur within the first six months of military service, particularly during the basic and initial training periods [3,4,7].

Our current results support the hypothesis that multicomponent interventions in military personnel also reduce the risk of suicide [6]. This study sought to avoid some of the methodological problems found in previous studies including: not reporting study population characteristics, lack of formal program evaluation, no comparison between the intervention group and an untreated group, and a relatively short evaluation period [6].

A robust suicide reduction effect in the military was previously reported [22] by the US Air Force. In that study approximately 5,000,000 soldiers on active duty were divided into two cohorts, prior to and subsequent to the implementation of a multimodal suicide prevention program [22]. The average suicide rate in IDF [40] declined from a pre-intervention period level of 13.5/100,000 per year, to 9.2/100,000 per year in the post-implementation period, a 33% decline. The findings are comparable despite methodological differences such as a shorter evaluation period (12 years) [40] compared with 18 years in the current study, the statistical methods applied differed (relative risk vs. Cox regression analysis), and potentially the population characteristics differed because military service in Israel is mandatory.

Several soldier characteristics influenced the effect of the IDF Suicide Prevention Program. The association between being Israeli-born and suicide rate may reflect a first generation effect, as reported in immigrant studies [16,28,29,37]. Sixty-three percent of the soldiers who committed suicide were Israeli-born, and the vast majority of these were Jewish. Regarding foreign-born suiciding soldiers, 56% were born in the former Soviet Union, and 22% were born in Ethiopia [1]. Perhaps the content of education of soldiers in screening, help-seeking and de-stigmatization of suicide may need to be tailored to different cultural and religious backgrounds more effectively.

Not reporting a mental health diagnosis prior to induction may reflect concealing information for reasons, such as shame or stigma, or lack of insight into psychopathology, which in turn also reduces the probability of receiving timely psychiatric help.

Previous studies have described the suicidal soldier's profile: male, aged 19–20 years, during the first year of service, having higher intellectual capabilities, having an intact medical profile, and typically posted in front-line units [4,37]. The decrease in the suicide rate after 2005 in the current study was manifested primarily in male soldiers, one of the higher risk subgroup identifiers. Others including front-line or combat unit soldiers and officers may need more emphasis on help-seeking.

A specific set of measures was directed at reducing access to firearms when not essential, such as when on leave, and likely explains fewer IDF firearm suicides taking place when soldiers are on leave [26].

Research on suicide prevention poses formidable methodological challenges, and those inclined to doubt will find limitations in every study [44]. This study has some limitations. The SSP did not alter time to a suicide, a primary a priori outcome measure, and the quasi-experimental design of the study lacked random assignment and a parallel treatment group. Associations identified in quasi-experiments meet one important requirement of causality, namely the intervention precedes the outcome, and the outcome can be demonstrated to vary statistically with the intervention. One element of the SPP, namely decreased weapon availability, may account for the entire suicide prevention effect, because between 2007–2012, 84% of the soldiers died by firearms and 13% by hanging [1]. Thus, interventions that specifically impact firearm availability will have a disproportionately big effect. Moreover, the major component gun control, that is likely to be a major candidate for the "active" ingredient, given no other compelling information, is also not likely to be easily transferable to other military services or countries. Future studies are needed to examine in more detail the impact of prevention efforts on other possible mediating effects, such as help-seeking and antidepressant prescriptions [26,34].

Nevertheless as concluded in the AFSPP, reductions in suicide rates cannot be simply maintained by virtue of a program's inherent momentum. Programmatic efforts must be continuously supported and monitored to ensure sustained effects [23].

The success of the IDF Suicide Prevention Program offers the hope that similar programs can succeed in military settings in other countries. Careful attention must be paid to the main risk factors, which may vary among national military forces, and guide adjustment of the emphasis on different aspects of suicide prevention, such as means restriction, enhanced diagnosis and treatment of mood disorders, and PTSD and substance use disorders by both general medical and mental health professionals in the military [44].

Disclosure of interest

The authors declare that they have no competing interest.

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