

Suicide by firearm in Switzerland: who uses the army weapon? Results from the national survey between 2000 and 2010

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Summary

AIMS: In comparison with other central European countries, Switzerland has a high prevalence of gun ownership and a high rate of suicide by shooting. After the Army XXI reform in 2003, which reduced personnel from about 400,000 to approximately 200,000, a decline in suicides by firearms and a decline in the total number of suicides was observed in national data spanning the period from 2000 to 2010. It is, however, unclear whether this decline can be linked to the reduced availability of military guns. This study explored whether the decline in suicide by firearms is related to the decline of suicides by army weapons.

METHODS: In 83.1% (n = 1112) of the 1338 suicides by firearm between 2000 and 2010 in Switzerland, the firearm could be categorised as an army weapon or a non-army weapon. The army weapon was used in 39.1% of these suicides. In comparison with other firearms, those who used army weapons tended to be younger and more likely to have a university degree. A prior suicide attempt was found less often in cases using a military weapon than other firearms. After the Army XXI reform, there was a significant drop in suicides by males aged 18 to 43 years using an army weapon, but no change in male suicide rates in the same age group who used a non-army weapon. The drop was statistically linked to a reduction of suicide by the army gun.

RESULTS: The army weapon was used in 39.1% of suicides by firearm between 2000 and 2010 in Switzerland. In comparison with other methods, those who used army weapons tended to be younger and more likely to have a university degree. A prior suicide attempt was found less often in cases using a military weapon than other methods. After the Army XXI reform, there was a significant drop in suicides by males aged 18 to 43 years using an army weapon, but no change in males' suicide rates in the same age group who used a non-army weapon. The drop was statistically linked to a reduction of suicide by the army gun.

CONCLUSIONS: Males who use army weapons differ from those who use other types of weapons. The significant drop in suicides was found in males aged 18 to 43 but there was no change in males of the same age group who used a non-army weapon. These results support the hypotheses that the observed drop in suicides is linked to the Army XXI reform and that restriction of access to guns is essential for reducing suicides by firearm.

Keywords: suicide, firearms, means restriction, depression, army weapon, suicide prevention, homicide

Introduction

In no other European country do so many people die by suicide with firearms as in Switzerland [1]. Among males who die by suicide, firearms are the most common method (29.7%) in Switzerland [2], as well as in the USA [2, 3]. Moreover, suicide by firearm is the method with the highest lethality [4]; more than 86% of people who attempt this suicide method die [5, 6]. Therefore, a better understanding of how to prevent suicide by shooting is particularly necessary.

In contrast to most other central European countries, Switzerland has a militia army. The army drafts active service members for annual military exercises. Between these military drills, the enlisted store their army firearms mostly at home and the majority of these weapons usually go into private ownership after the period of service has expired. Firearms are present in about one third of Swiss households [1]. In about 40% of suicides using firearms, army weapons are used [7]. In contrast to the USA, firearm-related homicides play a much smaller role in Switzerland; they account for less than 10% of all firearm-related fatalities [8].

In some aspects, preventing suicide by shooting differs from prevention of most other suicide methods. Often, shooting is carried out in an impulsive manner [9]. It has been demonstrated that people who die by suicide using guns are less likely to have a psychiatric history than those who use other methods [10]. This makes it particularly difficult to prevent gun-caused suicide by improving effective

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treatment or prevention, or by identifying groups at risk. Restriction of means (reducing the access to guns) is essential for reducing suicide by firearms.

Suicide prevention by restriction of means is particularly promising in the case of firearms. Numerous studies from various countries have shown that, in a given population, the occurrence of households with firearms correlates with the frequency of suicides by this method [1, 6, 8, 11–22]. The occurrence of households with firearms further correlates with the total suicide rate [12–18, 23–30]. People dying by suicide using firearms mostly use weapons that they own themselves or that belong to a family member living in the same household [31–33]. The reduction of firearms in households goes with a reduction in suicides by firearms [23, 24, 34–40]. Restrictive laws regulating the possession of firearms can achieve a restriction of access to firearms and, thus, a restriction of means. Secure firearm storage [4, 18], “background checks” [34, 41, 42], or a waiting period before a gun can be purchased, have also proved to prevent suicides [42, 43].

Firearms can also be used for homicide or to threaten third persons such as family members [44]. Independent of the act a firearm is used for, the presence of a gun in general is understood to signify the existence of violence, which itself is a risk factor for suicide in later life [45].

This study intends to supplement the research by Reisch et al. [46], which examined the effect of the Swiss Army XXI reform in 2003. In 2003, the Swiss army was restructured by new legislation commonly referred to as “Army XXI.” The reduction of troops from approximately 400,000 to 200,000 was mainly achieved by early discharges, with the upper age limit of service being reduced from 43 to 33 years. As such, the percentage of households with firearms was lowered significantly. Reisch et al. [46] showed that there was an actual decline in suicides by firearms after the army reform, with only a partial shift to other suicide methods. Overall, a decline in the suicide rate in Switzerland resulted after this reform. The authors were able to show specifically that the decline in suicides by firearms was attributable to the decline in the age group (18–43 years) affected by the army reform. The study found no decrease in suicide rates in other age groups. Reisch et al. [46] based their study on data from the Swiss Federal Statistical Office (BFS). These data, however, did not allow a distinction between army firearms and other guns, and are therefore not able to demonstrate that the reduction of suicides was directly linked to a reduction of suicides by the army gun. The data set used in the present study, however, allows this. Thus, this study can now investigate whether the decline was specifically in suicides using army firearms. This study tests the hypotheses of Reisch et al. [46], that the total reduction in suicides in Switzerland was a result of the specific decrease in the number of suicides using army firearms in the age group 18 to 43 years. The expert commission on the professional confidentiality in medical sciences, the Swiss Federal Department of Home Affairs, approved this study.

The first aim of this study was to better understand the sociodemographic data of those who used an army weapon to commit suicide, in comparison with those who used another type of weapon. It also aimed to test the hypothesis that a lower availability of army firearms was connected

to a reduction in suicides using an army gun, and thus that impeding the availability of army guns is a strong suicide prevention measure. Our paper aimed to show that suicide prevention by restriction of means is particularly promising in the case of firearms and we believe that the topics raised in our paper not only concern psychiatry but are of general interest to other fields as well.

Methods

Data

The present study is part of the National Research Project “Suicide in Switzerland: A detailed national survey of the years 2000 to 2010” (NF 32003b_133070 / 1). All suicides recorded in the Swiss Institutes of Legal Medicine (IFM) in Zurich, Bern, Basel, Chur, St Gallen, Lausanne, Geneva, and Locarno from 2000 to 2010, and with an autopsy or post mortem examination, were included. Cases not recorded by IFMs but by district medical officers could not be included. The IFM files also contained the police report and in some cases reports from previous physicians. A pilot study by Habenstein et al. [47] employed a survey sheet with 68 items to ensure a uniform procedure at the different places of study by the trained assessors (master’s students). Cases declared as “uncertain suicide” in the files were excluded from the analyses. From the available IFM files, sociodemographic variables such as age, sex, marital status, education and nationality, as well as specific details of the suicide method, such as weapon used, were extracted. The IFM files from the various institutes exhibited different data quality, resulting in different case numbers for the various analyses. The data from the years 2000 to 2010 were collected retrospectively between January 2011 and December 2013. The filled forms were scanned using Teleform®, checked, and if necessary, corrected manually. The data collection for this study has been presented elsewhere [48, 49].

From the total sample, we included all suicide cases using firearms. For this specific method of suicide, the weapon type (hand-held firearm, rifle, bolt gun), the type of intended use of the weapon (army weapon, other service weapon, private weapon), and the exact designation were specifically determined in the survey sheet.

The IFM files already declared for a large part of the weapons whether they were an army weapon, private weapon, or other service weapon. In the other cases, the precise designation of the weapon usually allowed us to classify the type of firearm used. For example, the “Sturmgewehr 90” (assault rifle 90), which is the standard-issue rifle of the Swiss Army, was defined as an army weapon and a Smith & Wesson, for example, as a private weapon. Three independent experts (from the Federal Department of Defence, Population Protection, and Sport; the Military Police; and the Cantonal Police of Bern, see acknowledgment) were individually included in this assessment. There were no discrepancies in the experts’ assessment. In total, of the 1338 suicides by firearms, 1112 (83.1%) of the firearms could be categorised. The data did not allow the distinction between an army weapon of an active soldier and a secondary privatised former army firearm. With limitations, this can be deduced from the age of the person who died by suicide. It needs to be taken into account that the

last army reform lowered the age of termination of army service from 43 years to 33 years, but there is always the possibility that someone of higher age is a member of the military.

In the comparisons between army weapons and other weapons, we designated all army weapons and former army weapons as army weapons. All other weapons (sport weapons, hunting weapons, police weapons, collectors' weapons, etc.) we refer to as non-army weapons.

In order to test the hypothesis that the reduction in suicides by firearms after 2003 described by Reisch et al. [46] was due to a reduction in army firearm availability, we examined the chronological sequence of suicides using firearms for age groups 18 to 43 years and over 43 years old for army (AW) and non-army weapons (non-AW). According to Reisch et al. [46], a reduction should show itself exclusively in the age group 18 to 43 years and concerning army weapons only.

Analyses

We carried out the statistical analyses using SPSS (version 21). We used standard methods (χ^2 tests, t-tests) and the respective nonparametric test (Wilcoxon-Mann test, Whitney U-test) in the absence of normal distribution (checked with the Kolmogorow-Smirnov test). In the case of multiple testing, a Bonferroni correction was performed.

Mainly men die by suicide using firearms. The male subpopulation thus strongly influences all comparisons between suicides using firearms and other methods of suicide. For this reason, we additionally carried out all analyses as gender-specific, in order to show any particularities of women who died by suicide using firearms. In Switzerland, only men are obliged to serve in the army. Thus, over 99% of Swiss army members are male. For the comparison of suicides by army weapon with suicides by non-army weapon, we additionally carried out all analyses for men separately.

Results

Original sample

The original sample of all recorded suicides (all suicide methods) contained 6497 cases. Out of these 1338 persons died by firearms. The mean age of death is 50.3 years (standard deviation 18.6, range 12.2–99.8 years); More than two thirds were male and more than three quarters were Swiss citizens. The IRM case notes further showed that the majority lived with a partner and more than half were employed. In four of five case reports, a history of psychiatric illness was mentioned and about half had a history of a suicide attempt. For details see [table 1](#).

Suicide by army weapons versus non-army weapons

In 83.1% (n = 1112) of the 1338 suicides by firearm between 2000 and 2010 in Switzerland, the firearm could be categorised as an army weapon or a non-army weapon. All analyses comparing the two groups were based on these 1112 cases. Overall, 435 (39.1%) of these 1112 suicides by firearm were carried out with an army weapon; 677 people (60.9%) used a different weapon type. Men used an army weapon more often than women did.

The army weapon was a rifle in 228 (52.4%) cases and a handgun in 203 cases (46.7%), whereas 126 (18.6%) of the non-army weapons were rifles and 536 (79.2%) were handguns. The remaining 19 weapons were other, such as grenades or captive bolt guns.

Those who died by suicide using an army weapon were younger than those who used a non-army weapon. They were more often male, more often Swiss citizens, and less often married; they had more often obtained a university degree, were less likely to have had a suicide attempt in their case history, and were less likely to be under the influence of alcohol at the time of the suicide. As a trigger, difficulties in the workplace were more frequent, whereas physical troubles were less frequent. We found no differences in terms of partnership, unemployment, psychiatric anamnesis, farewell messages, and other triggers (see [table 2](#)).

Table 1: Original study sample: all suicides in Switzerland between 2000 and 2010.

| Variable | n (%) |
|------------------------------|-------------|
| Method | |
| Firearms | 1338 (20.6) |
| Hanging | 1282 (19.7) |
| Jumping from heights | 1054 (16.2) |
| Medication | 983 (15.1) |
| Jumping in front of a train | 560 (8.6) |
| Suicide by drowning | 527 (8.1) |
| Suffocating | 192 (3.0) |
| Incision | 172 (2.6) |
| Exhaust fumes | 119 (1.8) |
| Burning | 74 (1.1) |
| Other intoxications | 55 (0.8) |
| Other methods | 111 (1.7) |
| Missing | 30 (0.5) |
| Sex | |
| Male | 4480 (69.0) |
| Female | 2016 (31) |
| Missing | 1 (-) |
| Nationality | |
| Swiss | 4356 (79.6) |
| All others | 1119 (20.4) |
| Missing | 1022 (-) |
| Partnership | |
| Yes | 2488 (62.9) |
| No | 1469 (37.1) |
| Missing | 2540 (-) |
| Employment status | |
| Employed | 2545 (57.8) |
| Unemployed | 348 (7.9) |
| Disability pensioners | 344 (7.8) |
| Retirees | 1163 (26.4) |
| Missing | 2097 (-) |
| Psychiatric anamnesis | |
| Yes | 2623 (79.8) |
| No | 662 (20.2) |
| Missing | 3212 (-) |
| Suicide attempt in anamnesis | |
| Yes | 1072 (47.5) |
| No | 186 (52.5) |
| Missing | 4239 (-) |

Gender-specific analyses

After analysing the data of men only, we found comparable significant values for the same variables: (age: $t = 6.01$, $p < 0.001$; nationality “Swiss”: $\chi^2 = 23.13$, $p < 0.001$; marital status “married”: $\chi^2 = 12.62$, $p < 0.001$; education “university diploma”, $\chi^2 = 8.28$, $p = 0.003$; suicide attempt in case history: $\chi^2 = 4.55$, $p = 0.033$; alcohol in suicide: $\chi^2 = 5.31$, $p = 0.021$; trigger “difficulties in the workplace” $\chi^2 = 4.91$, $p = 0.027$; trigger “physical troubles” $\chi^2 = 12.35$, $p < 0.001$). We found non-significant differences for the following variables: partnership, unemployment, psychiatric anamnesis, farewell messages, and other triggers. Women did not show any significant differences when comparing those who used army to those who used other types of weapons. For details of gender specific analyses, see [table 3](#).

Age group distribution

We found clear differences in the age group distribution. Army weapons were most commonly used by 20- to 35-year-olds, whereas non-army weapons were mostly used by 40- to 60-year-olds. In old age, both types of weapons were used similarly often ([fig. 1](#)).

Due to the different numbers, the age distribution of the sample is almost exclusively determined by the values of the men. In women, no age distribution can be demonstrated because of the small number of suicides by army firearm. In non-army weapons, the age distribution is similar for women and men.

Development over the observation period 2000 to 2010

Over the entire observation period, the suicides by firearms decreased (analysis of variance [ANOVA], $F = 6.12$, $p = 0.035$). We found the maximum value in 2002. The detailed analysis showed that the decrease is due exclusively to the decrease of suicides using army firearms in the age group 18 to 43 years (ANOVA, $F = 26.70$, $p = 0.001$). We found no significant changes for suicides by army firearms in the age group over 43 years or by non-army weapons in the age groups 18 to 43 years and over 43 years ([figs 2 and 3](#)).

Discussion

Army weapons were used in 39.1% of suicides by firearms. Frei [7] found a similar rate of 41.6% for the canton of Basel, a rate which appears to be representative as it is almost identical. During the entire period, only 10 deaths

Table 2: Sociodemographic comparison of suicides using army weapons and non-army weapons.

| Variable (missing) | Total | Army weapon n (%) | Non-army weapon n (%) | Chi ² (p-value) |
|-------------------------------------|-------|----------------------|--------------------------|----------------------------|
| All | 1112 | 435 (39.1) | 677 (60.9) | |
| Sex (0) | | | | 15.74 (<0.001) |
| Male | 1048 | 425 (40.6) | 623 (59.4) | |
| Female | 64 | 10 (15.6) | 54 (84.4) | |
| Nationality (135) | | | | 23.95 (<0.001) |
| Swiss | 873 | 363 (41.6) | 510 (58.4) | |
| Others | 104 | 19 (18.3) | 85 (81.7) | |
| Relationship (322) | | | | n.s. |
| Yes | 515 | 178 (34.6) | 337 (65.4) | |
| No | 275 | 110 (40.0) | 165 (60) | |
| College or university degree (527) | | | | 9.03 (0.003) |
| Yes | 96 | 54 (56.3) | 42 (43.8) | |
| No | 489 | 194 (39.7) | 295 (60.3) | |
| Employment status (539) | | | | n.s. |
| Employed | 527 | 225 (42.7) | 302 (57.3) | |
| Unemployed | 46 | 17 (37) | 29 (63) | |
| Psychiatric anamnesis (641) | | | | n.s. |
| Yes | 281 | 106 (37.7) | 175 (62.3) | |
| No | 190 | 73 (38.8) | 117 (61.6) | |
| Suicide attempt in anamnesis (746) | | | | 7.16 (0.007) |
| Yes | 74 | 17 (23.0) | 57 (77.0) | |
| No | 292 | 116 (39.7) | 176 (60.3) | |
| Farewell actions (warning signs, 0) | | | | n.s. |
| Yes | 569 | 219 (38.5) | 350 (61.5) | |
| No | 543 | 216 (39.8) | 327 (60.2) | |
| Alcohol (730) | | | | 6.38 (0.012) |
| Yes | 154 | 44 (28.6) | 110 (71.4) | |
| No | 228 | 94 (41.2) | 134 (58.8) | |
| Trigger (37) | | | | |
| Relationship problems with partner | 183 | 73 (39.9) | 110 (60.1) | n.s. |
| Financial problems | 116 | 49 (42.2) | 67 (57.8) | n.s. |
| Workplace problems | 92 | 46 (50) | 46 (50) | 4.986 (0.026) |
| Body problems | 244 | 74 (30.3) | 170 (69.7) | 10.14 (0.001) |
| Psychological problems | 440 | 172 (39.1) | 268 (60.9) | n.s. |

n.s. = not significant

by suicides of women using army firearms in Switzerland were found. Women who shot themselves were more likely to use non-army weapons, most often sports weapons. Women in Switzerland very rarely serve in the army, and

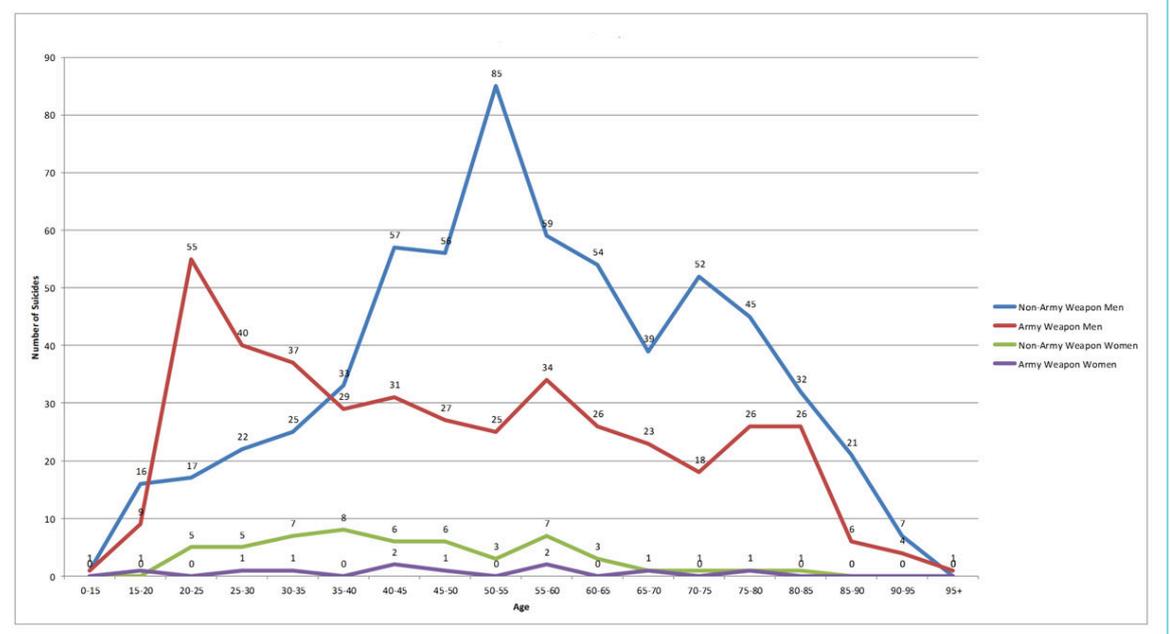
thus have almost no automatic access to firearms and are not familiar with their handling. This suggests that experience with the use of the weapon, i.e., the psychological

Table 3: Sociodemographic comparison of suicides committed by army weapons and non-army weapons (males only).

| Variable (missing) | Total | Army weapon n (%) | Non-army weapon n (%) | Chi ² (p-value) |
|---|-------|-------------------|-----------------------|----------------------------|
| All | 1048 | 425 (40.6) | 623 (59.4) | |
| Nationality (136) | | | | 20.564 (<0.001) |
| Swiss | 817 | 352 (43.1) | 465 (56.9) | |
| Others | 95 | 18 (18.9) | 77 (81.1) | |
| Relationship (306) | | | | n.s. |
| Yes | 480 | 173 (36.0) | 307 (64.0) | |
| No | 262 | 109 (41.6) | 153 (58.4) | |
| College or university degree (498) | | | | 8.28 (0.004) |
| Yes | 93 | 54 (58.1) | 39 (41.9) | |
| No | 457 | 191 (41.8) | 266 (58.2) | |
| Employment status (510) | | | | n.s. |
| Employed | 496 | 221 (44.6) | 275 (55.4) | |
| Unemployed | 42 | 17 (40.5) | 25 (59.5) | |
| Psychiatric anamnesis (613) | | | | n.s. |
| Yes | 253 | 101 (39.9) | 152 (60.1) | |
| No | 182 | 72 (39.6) | 110 (60.4) | |
| Suicide attempt in anamnesis (708) | | | | 4.549 (0.033) |
| Yes | 64 | 17 (26.6) | 47 (73.4) | |
| No | 276 | 113 (40.9) | 163 (59.1) | |
| Farewell actions (suicide warning signs; 0) | | | | n.s. |
| Yes | 534 | 216 (40.4) | 318 (59.6) | |
| No | 514 | 209 (40.7) | 305 (59.3) | |
| Alcohol (700) | | | | 5.314 (0.021) |
| Yes | 142 | 44 (31.0) | 98 (69.0) | |
| No | 206 | 89 (43.2) | 117 (56.8) | |
| Trigger (40) | | | | |
| Relationship problems with partner | 169 | 72 (42.6) | 97 (57.4) | n.s. |
| Financial problems | 112 | 48 (42.9) | 64 (57.1) | n.s. |
| Workplace problems | 87 | 45 (51.7) | 42 (48.3) | 4.911 (0.027) |
| Body problems | 235 | 72 (30.6) | 163 (69.4) | 12.353 (<0.001) |
| Psychological problems | 405 | 164 (40.5) | 241 (59.5) | n.s. |

n.s. = not significant

Figure 1: Age distribution for army weapon vs non-army weapon, men vs women.



availability, may play an important role in the likelihood of its use.

Army weapons were used by Swiss nationals more often. This can also be best explained in terms of availability, given that non-Swiss citizens do not serve in the military.

The study of age distribution shows that 20- to 35-year-olds most commonly used army weapons to die by suicide, whereas 40- to 60-year-olds use non-army weapons. The old age showed no difference in frequency. This distribution may also be explained by physical and psychological availability: 20- to 35-year-olds have frequent contact with army weapons due to military service, whereas middle-aged men and older men are more likely to possess sport,

hunting, or collector's weapons and regularly use them in leisure activities (e.g., shooting club, hunting, etc.).

Over the observation period, we can see a decline in suicides by firearms. This result is in line with Reisch et al. [46]. Through detailed analyses of the age groups and weapon types, we were able to show that this decline was exclusively due to a decrease in the number of deaths by suicide using army firearms by 18- to 43-year-olds. A decrease in suicides by other firearms was not found. Therefore a link between the decrease of suicides by firearms and the diminished availability of firearms due to the Army XXI was found. These results are in line with the hypotheses that the Army XXI had a suicide prevention effect. However, other explanations cannot be completely excluded. The general stance towards killing oneself with the

Figure 2: Number of suicides by firearm over time: men 18 to 43 years old.

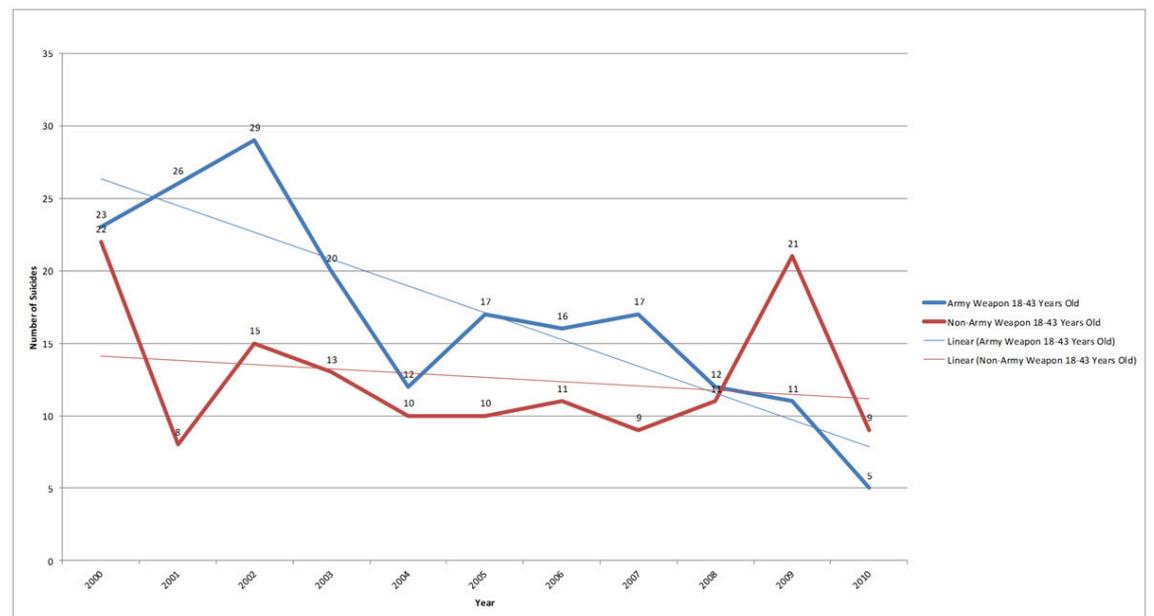
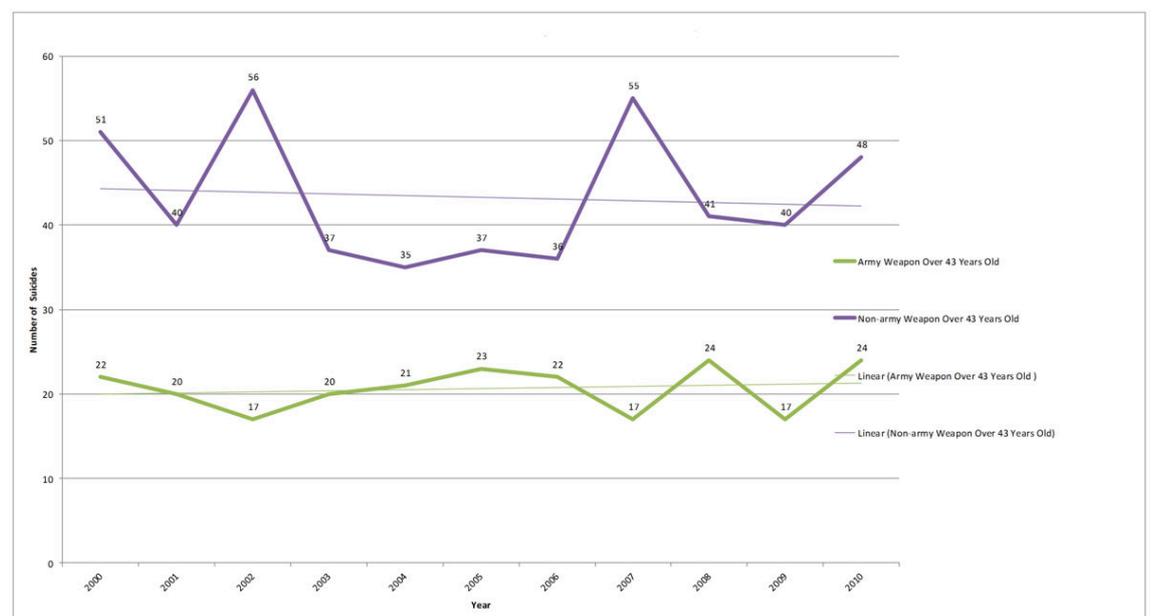


Figure 3: Number of suicides by firearm over time: men over 43 years old.



army weapon may have changed, or it may be a random effect in a time period of generally decreasing suicide numbers.

Limitations in the present study are that the data were incomplete. The Swiss Federal Statistical Office (FSO) listed 3121 suicides by firearms for the years 2000 to 2010. With 1338 suicides, we included 42.8% of all these suicides by firearms in our study. Furthermore, the data in the various IFMs are available in differing levels of completeness. The power of the analyses in women is significantly lower than the analyses in men because of the smaller number of cases. Some of the firearms were inadequately described in the files, meaning it was not possible to ascertain whether the weapon used was an army or a non-army firearm. In addition, there was no differentiation between army weapons and former army weapons (army weapons that were the property of retired members of the army), which resulted in a certain fuzziness of the term “army weapon”. It must be added that private army weapons can also be purchased, although infrequently. In most cases though, these weapons are taken over directly from active service. Moreover, there is a small proportion of firearms listed as army weapons that were primarily sold as private sport guns.

The main strength of this study lies in the differentiation of the data. The included data set contains detailed information on social, sociodemographic and medical variables. This allows precise investigation of the population of persons dying by suicide using firearms. Thus, for the first time it was possible to analyse a total Swiss data set regarding suicides by army weapons and by non-army weapons. Because the period of investigation spans 11 years, we were able to make statements on general trends over time.

Unfortunately, our data did not allow us to show that the decrease specifically started in 2003. The main reason for this is that the data collection of the sample included here began in the year 2000. A pre-post analysis of the intervention “Army XXI reform” as carried out by Reisch et al. [46] was not possible.

Conclusions

Psychiatrically healthy and integrated men are the main group that use firearms to commit suicide, independent of the type of weapon used. Therefore, suicide prevention by means restriction is important in this subpopulation. For women, however, psychiatric treatment of the population at risk “status after suicide attempt” (e.g., [50]) is an additional suicide preventive measure.

The lower number of suicides after the Army XXI reform is linked to a decrease of suicides by army firearms of 18 to 43-year-old men. This suggests that the lower availability of firearms caused by the Army XXI reform is a plausible reason for the reduction of the suicide rate in Switzerland from 2003 onwards complementing the results of Reisch et al. [46].

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Potential competing interests

No potential conflict of interest relevant to this article was declared.

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