

# Youths carrying a weapon or using a weapon in a fight: what makes the difference?

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## Abstract

The objective of this study was to characterize weapon-carrying adolescents and to assess whether weapon carriers differ from weapon users. Data were drawn from a cross-sectional school-based survey of 7548 adolescents aged 16–20 years in Switzerland. Youths carrying a weapon were compared with those who do not. Subsequently, weapon carriers were divided into those who had used it in a fight and those who had not. Individual, family, school and social factors were analyzed using bivariate and stepwise multivariate analysis. For both genders, delinquent behavior and being victim of physical violence were associated with weapon carrying. For males, quarreling while intoxicated, being an apprentice, being sensation seekers, having a tattoo, having a poor relationship with parents and practicing unsafe sex were also related to weapon carrying. Compared with weapon carriers, female weapon users were more likely to be regular smokers. Male weapon users were foreign born, urban and apprentices; had poor school connectedness; practiced unsafe sex and quarreled while intoxicated. Carrying a weapon is a relatively frequent behavior among youths in Switzerland and a sizeable proportion of weapon carriers have used it in a fight. Weapon carrying should

be part of the clinical assessment and preventive counseling of adolescents. Preventive programs specific for at-risk youth groups need to be developed.

## Introduction

Weapon carrying among adolescents is an ongoing matter of concern. Violent offenses committed with a weapon are the most dangerous offenses, often leading to serious injury, disability or death [1]. Knowing that adolescents and young adults are particularly vulnerable to violent behavior and that persons carrying a weapon are more often implicated in physical fights, it is obvious that weapon carrying is a risk behavior that deserves attention [1–4]. In addition to these direct consequences, weapon carrying is related to hospitalization as a consequence of criminal offenses as well as it is an established risk factor for other risk behaviors in adolescence [1, 5].

Carrying a weapon is a common type of violence in youth: 18.5% of American high school students report having carried a weapon in the previous month, 5.7% of them having carried a gun [6]. The Health Behavior in School-Aged Children survey reported a prevalence of weapon carrying in the preceding 30 days ranging from 10 to 22% for boys and from 2 to 5% for girls in five European countries, the United States and Israel [2].

Diverse motivations for weapon carrying have been identified: on the one hand, the association of weapon carrying and high rates of local youth violence as well as a history of sexual or physical abuse and violent victimization point at a need for self-protection and self-defense [7]. On the other

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hand, an association of weapon carrying and other delinquent and antisocial behaviors has been shown, thus rather pointing at a clustering effect of risk behaviors by vulnerable adolescents [8].

Risk factors for weapon carrying include being male, a history of substance use, living in unsafe surroundings, witnessing violence, having been a victim of violence, having high availability of weapons, a history of delinquency other than carrying a weapon and poor academic performance [9, 10]. Additionally, previous studies have shown an association between risk behaviors including violence and weapon carrying and behaviors such as being tattooed and sensation seeking [9, 11, 12].

The legislation in Switzerland prohibits the purchase, trade and possession of switchblade knives and brass knuckles. The purchase of guns and other firearms needs a registration certificate, which is handed out to persons aged 18 years and older who prove a precise need and have passed a theoretical and practical exam. However, this weapon can be passed on to another private person without restriction. Sprays of poisonous Category 3 (including pepper sprays) are not considered as weapons and therefore freely purchasable for persons aged 18 years and older. Even though the purchase of a weapon is prohibited for adolescents under age 18 years, a substantial part of youth living in Switzerland carry a weapon: Kuntsche and Klingemann [13] found that 10.6% of youths aged 15 years had carried a weapon to school.

Although there is a substantial amount of literature concerning weapon-carrying adolescents and their characteristics [2, 4, 9, 14], few researchers have been interested in characterizing adolescents using their weapon: in a longitudinal study, Henrich *et al.* found that weapon violence exposure and weapon violence commission were correlated and that the connectedness to parents and school are protecting factors for weapon violence exposure and use [29]. Furthermore, to our knowledge, there are no publications analyzing the differences between those adolescents carrying a weapon and those using a weapon in a fight.

To address these gaps, the objectives of the present research are (i) to characterize adolescents

living in Switzerland and carrying a weapon and (ii) by analyzing the subsample of weapon-carrying youths, to depict the differences between those who have used it in a fight and those who have not. Based on Jessor's [15] problem behavior theory, we hypothesize that adolescents using a weapon in a fight belong to the youth group at high risk for other deleterious behaviors, thus engaging in substance use, delinquency and unsafe sex. On the contrary, youths with a history of victimization would carry their weapon for self-defense and would thus be less implicated in other high-risk behaviors.

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## Patients and methods

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### Procedure and sample

Data were drawn from the 2002 Swiss Multicenter Adolescent Survey on Health (SMASH02), a cross-sectional study conducted among a nationally representative sample ( $N = 7548$ , 48.5% females) of post-mandatory public school students and apprentices aged 16–20 years living in Switzerland. The survey was carried out through an anonymous paper-and-pencil questionnaire that was administered in the classroom in the absence of the teachers by trained health professionals external to the school system.

In Switzerland, the education system is mostly public, and the private sector includes only 5% of the school-aged population. Most adolescents aged 16–20 years attend post-mandatory education, one-third of them as full-time students and the rest as apprentices. Apprentices have a dual formation: 1 or 2 days of class per week, while the rest of their time is devoted to work in a company related to their field of training. Full-time students prepare themselves for university studies. Being a full-time student is often related to a higher educational and socioeconomic status of parents. However, apprenticeship in Switzerland is known to be a very good formation/training with the possibility to continue further studies at university.

The sample is a random cluster of 579 classes. Language area ( $n = 3$ ), type of school ( $n = 2$ ), type

of apprenticeship ( $n = 9$ ) and year of study (up to four) were used as sampling stratification criteria. The 565 items of the questionnaire cover sociodemographic background, somatic and mental health, quality of relationships and various health-related behaviors (e.g. sensation seeking, sexuality, violence). A description of the questionnaire and sampling method has been published elsewhere [16]. The survey was approved by the ethical committee of the Medicine Faculty in Lausanne.

### Criterion variables

We used dichotomous measures for the criterion variables: [1] carrying a weapon was defined as having carried a switchblade knife, bat, brass knuckle, gun or other firearm or pepper spray or other spray at least once in the 12 months preceding the survey. Having used one of these weapons in a fight in the 12 months preceding the survey was coded as positive for [2] using a weapon. Pepper sprays are often considered as a tool for defense. However, in adolescents who use it in a fight, the purpose of the spray is clearly of an offensive nature. We therefore included pepper sprays in our analysis.

### Predictor variables

Based on the literature review and Bronfenbrenner ecological model [17], we divided the predictor variables into three groups: personal, family and school/friends. Additionally, a fourth group of predictor variables including other risk behaviors was also created.

Personal factors included age, place of birth (Switzerland/other), residency (rural/urban), depressive mood, having been a victim of physical violence in the last 12 months, having a tattoo and sensation seeking. Depressive mood was assessed through the Depressive Tendencies Scale, which is based on eight items and covers depressed symptomatology and feelings of sadness, hopelessness and unhappiness. Several studies have shown that this is a valid and reliable instrument [e.g. 18, 19]. In the present study, Cronbach's alfa was 0.89. For sensation seeking, a five-item scale was devel-

oped on the basis of the work of Gniech *et al.* [20]. Cronbach's alfa was 0.80 in this study. Both scales range from 0 (low) to 3 (high).

Family variables such as family structure (single-parent household/other), educational level of both parents (more versus less than the 9 years of mandatory education) and quality of parent-adolescent relationship were used. To measure the quality of the parent-adolescent relationship, we developed a six-item inventory. We took five items from the Inventory of Parent and Peer Attachment [21]. These items measured adolescents' perceptions of their parents' acceptance, understanding, trustfulness and sensitivity to their emotional state, as well as their own use of their parents as confidants. In addition, we created an item tapping the adolescents' perception on how much their parents trusted them (Cronbach's overall alfa in the present study was 0.85).

As school variables, we defined academic track (apprentice/student), poor school grades and truancy (skipping school at least once a month). We measured school connectedness with five items used in previous studies [22, 23], with a Cronbach's alfa of 0.61 in this study. To measure the quality of the relationship with peers, we used a four-item inventory. We took all four items from the Inventory of Parent and Peer Attachment [21]. These items measured adolescents' perceptions of their peers' acceptance, trustfulness and sensitivity to their emotional state, as well as their own use of their peers as confidants (Cronbach's overall alfa in the present study was 0.77).

Risk behaviors included daily smoking, alcohol misuse (having been drunk at least once in the last 30 days), cannabis use (having consumed cannabis at least once in the last 30 days), other drug use (such as having consumed designer drugs, medicine to get high, cocaine or heroine at least once in the last 30 days), quarrelling while intoxicated ('Have you been involved in a quarrel while under the influence of alcohol or illegal drugs?'), unsafe sex (defined by two or more positive answers to (i) having had sex before age 15 years, (ii) having had more than three partners in their lifetime, (iii) not using a condom at last intercourse and (iv)

having been pregnant or partner becoming pregnant) and delinquency other than carrying/using a weapon. We considered respondents as being delinquent if they had committed one or more of the following offenses in the 12 months preceding the survey: (i) attacked an adult; (ii) snatched or stolen a handbag, purse or cellular phone; (iii) destroyed voluntarily something not belonging to them; (iv) stolen or taken something; (v) set fire to something and (vi) sold drugs including cannabis.

### Statistical analyses

We first analyzed the whole study sample for the prevalence of carrying any weapon as well as for each type of weapon, comparing males and females and controlling for age. Second, we determined the characteristics of adolescents carrying a weapon compared with those who do not. Finally, we used the subsample of all respondents reporting to have carried a weapon to compare those who had used it in a fight with those who had not. The two latter comparisons were done separately by gender, as males are more likely than females to carry a weapon [2, 6].

We conducted a bivariate analysis with Pearson's chi-squared tests reporting prevalence and 99% confidence interval (CI) for categorical variables and Student's *t*-test reporting means and 99% CI for continuous variables. All variables significantly ( $P \leq 0.01$ ) associated with adolescent's weapon carrying and weapon use (plus age, even if not significant) were included in stepwise multivariate regressions. Statistical analyses were performed with

Stata 9.2 [24], which allows computing coefficient estimates and variances taking into account the sampling weights, clustering and stratification procedure.

## Results

### Prevalence of carrying a weapon

Our study showed that 13.7% of adolescents living in Switzerland carried a weapon in the last 12 months, with males showing a significantly higher prevalence (19.9%) than females (6.2%). While males mostly carry a knife, females are more likely to carry pepper spray (Table 1).

### Bivariate analysis

For females, sensation seeking, a history of being a victim of physical violence, feeling depressed, having a tattoo, using illegal substances other than cannabis and engaging in risk behaviors including unsafe sex, quarrelling while intoxicated and delinquency were significantly associated with weapon carrying. For males, being an apprentice, being a sensation seeker, being a victim of physical violence, feeling depressed, having a tattoo, having a poor relationship with parents and having low school connectedness and all studied risk behaviors were significantly associated with weapon carrying (Table 2).

### Multivariate analysis

Female weapon carriers were more often engaging in delinquent behaviors (adjusted odds ratio, 99%

**Table 1.** Point prevalence (given as percentage and 99% CI) and types of weapon carrying in the total sample (weighted)

Type of weapons carried	Females (N = 3385)	Males (N = 4044)	Adjusted odds ratio
Any weapon	6.2 (4.4–8.5)	19.9 (17.1–23.1)	<b>3.8 (2.6–5.6)</b>
Knife	1.5 (1.0–2.1)	11.5 (9.4–13.9)	<b>8.7 (5.7–13.3)</b>
Bat	0.2 (0.0–0.8)	4.1 (2.8–5.8)	<b>25.0 (5.2–119.6)</b>
Brass knuckle	0.2 (0.1–0.5)	3.3 (2.1–5.1)	<b>15.3 (5.8–40.6)</b>
Gun/other firearm	0.5 (0.3–1.0)	5.3 (4.1–6.8)	<b>11.0 (5.6–21.9)</b>
Pepper spray/other spray	4.6 (2.9–7.1)	4.1 (3.1–5.4)	0.9 (0.5–1.5)
Other	0.3 (0.1–0.6)	2.0 (1.3–2.9)	<b>7.0 (3.0–16.7)</b>

Odds ratios (99% CI) adjusted for age with females as reference category. In bold:  $P < 0.01$ .

**Table 2.** *Weapon carrying: point prevalence (given as percentage and 99% CI) and adjusted odds ratios (99% CI) of the whole sample*

	Males			Females		
	No weapon ( <i>N</i> = 3239)	Carrying weapon ( <i>N</i> = 805)	Adjusted odds ratio <sup>a</sup>	No weapon ( <i>N</i> = 3176)	Carrying weapon ( <i>N</i> = 209)	Adjusted odds ratio <sup>a</sup>
<b>Personal</b>						
Age (mean)	18.0 (17.8–18.2)	17.9 (17.7–18.1)	NS	17.8 (17.7–18.0)	18.1 (17.7–18.5)	NS
Foreign born	13.5 (10.8–16.7)	15.7 (10.9–22.1)	NA	12.1 (10.0–14.4)	8.7 (4.4–16.4)	NA
Urban living	41.6 (36.9–46.5)	47.3 (41.3–53.3)	NA	41.7 (36.7–46.8)	44.1 (27.3–62.4)	NA
Apprentice	<b>76.6 (70.4–81.8)</b>	<b>87.4 (82.0–91.3)</b>	1.7 (1.2–2.4)	63.2 (55.3–70.4)	60.3 (36.1–80.4)	NA
Sensation seeker (mean)	<b>1.6 (1.6–1.7)</b>	<b>2.0 (1.9–2.1)</b>	1.7 (1.3–2.2)	<b>1.2 (1.1–1.3)</b>	<b>1.5 (1.3–1.7)</b>	NS
Victim of physical violence	<b>9.4 (7.7–11.6)</b>	<b>22.5 (18.3–27.3)</b>	2.1 (1.4–3.0)	<b>5.4 (4.4–6.7)</b>	<b>18.4 (10.6–30.1)</b>	3.0 (1.4–6.3)
Depressed (mean)	<b>0.5 (0.5–0.6)</b>	<b>0.8 (0.7–0.9)</b>	NS	<b>0.8 (0.7–0.9)</b>	<b>1.1 (0.9–1.3)</b>	NS
Having a tattoo	<b>5.2 (3.9–7.0)</b>	<b>15.2 (11.3–20.1)</b>	1.8 (1.1–3.1)	<b>8.6 (7.0–10.6)</b>	<b>15.9 (8.8–27.2)</b>	NS
<b>Family</b>						
Single-parent household	21.5 (18.4–25.0)	26.4 (22.1–31.1)	NA	24.0 (21.3–27.0)	37.9 (18.2–62.6)	NA
Poor relation with parents	<b>19.9 (17.3–22.8)</b>	<b>34.7 (30.0–39.8)</b>	1.6 (1.1–2.1)	23.0 (20.0–26.4)	43.1 (23.6–65.0)	NA
Poor educational level of mother	21.8 (18.6–25.4)	23.7 (17.1–31.8)	NA	21.7 (18.9–24.9)	16.7 (9.4–28.1)	NA
Poor educational level of father	13.6 (11.3–16.3)	13.8 (10.4–18.0)	NA	14.6 (11.8–17.8)	12.2 (6.5–21.8)	NA
<b>School/peers</b>						
Poor school connectedness	<b>32.4 (27.1–38.2)</b>	<b>47.0 (40.2–53.9)</b>	NS	27.1 (23.1–31.5)	44.1 (24.4–65.7)	NA
Poor school grades	<b>21.7 (18.4–25.5)</b>	<b>28.0 (22.5–34.1)</b>	NS	21.2 (18.0–24.8)	27.3 (16.2–42.0)	NA
Truancy	20.9 (17.4–24.9)	25.4 (19.7–32.1)	NA	24.3 (20.0–29.1)	28.9 (17.6–43.6)	NA
Poor relation with peers	9.9 (7.4–13.2)	10.9 (8.0–14.8)	NA	4.8 (3.6–6.4)	7.9 (3.5–16.8)	NA
<b>Risk behaviors</b>						
Regular smoker	<b>35.8 (31.8–40.0)</b>	<b>58.3 (51.6–64.8)</b>	NS	33.9 (30.0–38.0)	49.0 (30.3–68.0)	NA
Alcohol misuse	<b>35.3 (31.3–39.5)</b>	<b>56.2 (49.9–62.2)</b>	NS	17.6 (15.1–20.4)	25.4 (15.0–39.7)	NA
Cannabis use	<b>36.0 (32.4–39.8)</b>	<b>56.5 (50.6–62.2)</b>	NS	25.7 (22.4–29.2)	37.6 (23.2–54.7)	NA
Other drug use	<b>8.7 (6.6–11.3)</b>	<b>20.6 (13.9–29.3)</b>	NS	<b>5.1 (3.8–6.8)</b>	<b>10.6 (5.6–19.3)</b>	NS
Unsafe sex	<b>10.5 (8.2–13.4)</b>	<b>28.5 (23.0–34.7)</b>	1.7 (1.1–2.7)	<b>10.9 (8.6–13.7)</b>	<b>24.7 (14.5–38.7)</b>	NS
Quarrel while under the influence of substance	<b>3.3 (2.1–5.1)</b>	<b>18.4 (12.0–27.2)</b>	2.9 (1.3–6.3)	<b>2.0 (1.4–2.8)</b>	<b>7.3 (3.4–14.9)</b>	NS
Delinquent other than weapon carrying	<b>39.6 (36.9–42.5)</b>	<b>78.0 (72.4–82.7)</b>	3.5 (2.6–4.8)	<b>21.1 (18.4–24.1)</b>	<b>53.3 (34.5–71.1)</b>	3.9 (1.5–9.9)

In bold: *P* < 0.01. NA, non-applicable; NS, non-significant.

<sup>a</sup>Backward multivariate analysis.

CI: 3.9, 1.5–9.9) and having a history of being a victim of physical violence (3.0, 1.4–6.3).

The most important factors related to weapon carrying in males were engaging in other delinquent acts (3.5, 2.6–4.8) and quarrelling while intoxicated (2.9, 1.3–6.3). Sensation seeking (1.7, 1.3–2.2), being a victim of physical violence (2.1, 1.4–3.0), having a tattoo (1.8, 1.1–3.1), practicing unsafe sex (1.7, 1.7–2.7), being an apprentice (1.7,

1.2–2.4) and having a poor relationship with parents (1.6, 1.1–2.1) also showed a significant association with weapon carrying (Table 2).

### Weapon use

Male weapon carriers used their weapon almost three times more often in a fight than female weapon carriers (2.9, 1.6–5.0), although no

differences were found between genders for each individual weapon (Table 3).

*Bivariate analysis*

Weapon-using females were significantly more often victims of physical violence and regular smokers. We found a positive association between males using a weapon in a fight and being foreign born, living in an urban area, being apprentice, having a tattoo, having a low school connectedness, using illegal drugs other than cannabis, having unsafe sex, quarrelling while intoxicated and delinquency.

*Multivariate analysis*

For female weapon users, being a regular smoker (4.9, 1.0–23.3) was the only variable that remained significant. Compared with those who did not report using a weapon in a fight, males who did use a weapon in a fight were more likely to report quarrelling while intoxicated (3.1, 1.7–5.8), being foreign born (2.7, 1.4–5.1), being apprentices (2.6, 1.2–5.7), practicing unsafe sex (2.1, 1.2–3.6), living in an urban surrounding (2.0, 1.2–3.3) and having a poor school connectedness (1.9, 1.0–3.6) (Table 4).

**Discussion**

Weapon carrying is a frequent risk behavior among adolescents living in Switzerland. Males are significantly more often implicated in this behavior: one in five adolescent males carried a weapon compared with one in 16 girls. This gender difference has been reported in previous studies [3, 4, 6, 8, 9,

25, 26]. The prevalence of weapon carrying found in our study corresponds to previous research in Switzerland [1], whereas the percentage of adolescents carrying a weapon such as gun, knife or club in the United States is higher [6]. Still, the prevalence of adolescents in Switzerland carrying a weapon is sufficiently high to cause concern because to carry a weapon may lead to the use of this weapon in a violent offense [10, 27]. Our results indicate that more than one in four males and one in eight females carrying a weapon have come to use it in a fight.

Contrary to previous research indicating that the odds of carrying a weapon increase until reaching a peak prevalence at mid-adolescence ~15 years of age [4, 8], we found no difference in age between groups in our study. Nonetheless, considering that we do not know from our data at what age youths start carrying a weapon, prevention for weapon carrying should take place early in adolescence.

For males as for females, the most important factor associated with carrying a weapon is to commit other delinquent offenses. For males, quarreling while intoxicated and sensation seeking are also associated. This may be seen as a clustering of different risk behaviors. Steinman and Zimmerman [28] advance this point even further: they consider carrying a weapon as a more serious behavior than other risk behaviors, putting those adolescents at a higher risk.

Both genders showed a significant association of weapon carrying and being a victim of physical violence. We have two possible explanations for this phenomenon: adolescents having been victims

**Table 3.** Point prevalence (given as percentage and 99% CI) of weapon using in the subsample of weapon-carrying adolescents

Type of weapons used	Females (N = 209)	Males (N = 805)	Adjusted odds ratio
Any weapon	12.2 (6.3–22.3)	28.7 (23.6–34.3)	<b>2.9 (1.4–6.1)</b>
Knife	3.6 (1.4–8.6)	7.8 (5.3–11.6)	2.3 (0.8–6.5)
Bat	2.1 (0.3–13.3)	11.9 (8.4–16.5)	6.2 (0.8–45.6)
Brass knuckle	3.8 (1.6–8.9)	9.7 (6.3–14.6)	2.7 (1.0–7.6)
Gun/other firearm	0.6 (0.1–4.8)	3 (1.4–6.5)	4.8 (0.5–43.6)
Pepper spray/other spray	8.1 (3.7–17.0)	8.2 (5.6–11.8)	1.0 (0.4–2.4)
Other	0.8 (0.1–5.2)	5.0 (2.9–8.4)	6.3 (0.9–45.2)

Odds ratios (99% CI) adjusted for age with females as reference category. In bold:  $P < 0.01$ .

**Table 4.** *Weapon using: point prevalence (given as percentage and 99% CI) and adjusted odds ratios (99% CI) of the subsample of weapon-carrying adolescents*

	Males			Females		
	Carry weapon (N = 574)	Use weapon in fight (N = 231)	Adjusted odds ratio <sup>a</sup>	Carry weapon (N = 183)	Use weapon in fight (N = 25)	Adjusted odds ratio <sup>a</sup>
<b>Personal</b>						
Age (mean)	17.9 (17.7–18.1)	17.9 (17.5–18.3)	NS	18.2 (17.7–18.6)	17.6 (17.0–18.3)	NS
Foreign born	<b>10.7 (6.7–16.8)</b>	<b>28.0 (18.2–40.5)</b>	2.7 (1.4–5.1)	7.3 (3.3–15.6)	18.5 (5.7–45.8)	NA
Urban living	<b>42.3 (36.2–48.6)</b>	<b>59.7 (48.4–70.1)</b>	2.0 (1.2–3.3)	42.8 (24.8–63.0)	53.5 (26.0–79.0)	NA
Apprentice	<b>85.0 (78.6–89.7)</b>	<b>93.3 (86.5–96.8)</b>	2.6 (1.2–5.7)	57.6 (32.0–80.0)	80.0 (52.9–93.4)	NA
Sensation seeker (mean)	2.0 (1.8–2.1)	2.2 (2.0–2.3)	NA	1.5 (1.3–1.6)	1.9 (1.4–2.4)	NA
Victim of physical violence	21.9 (17.0–27.7)	24.1 (16.4–34.0)	NA	<b>14.7 (7.7–26.2)</b>	<b>45.3 (22.0–70.8)</b>	NS
Depressed (mean)	0.8 (0.7–0.8)	0.9 (0.7–1.0)	NA	1.1 (0.9–1.3)	1.1 (0.6–1.6)	NA
Having a tattoo	<b>11.2 (7.4–16.5)</b>	<b>25.3 (16.4–37.0)</b>	NS	13.4 (6.6–25.3)	34.2 (14.7–60.9)	NA
<b>Family</b>						
Single-parent household	24.1 (19.5–29.4)	32.1 (22.2–43.9)	NA	37.4 (15.8–65.6)	41.2 (18.5–68.4)	NA
Poor relation with parents	30.8 (24.5–37.9)	44.5 (33.3–56.3)	NA	41.7 (20.1–67.1)	52.8 (27.6–76.7)	NA
Poor educational level of mother	22.2 (15.6–30.5)	27.4 (17.5–40.1)	NA	16.8 (8.8–29.7)	16.2 (4.8–42.9)	NA
Poor educational level of father	12.0 (8.5–16.8)	18.1 (11.9–26.7)	NA	12.4 (6.2–23.3)	10.9 (2.3–38.9)	NA
<b>School/peers</b>						
Poor school connectedness	<b>41.9 (35.4–48.7)</b>	<b>59.7 (45.8–72.1)</b>	1.9 (1.0–3.6)	42.6 (20.7–67.8)	54.8 (28.2–78.9)	NA
Poor school grades	25.7 (20.0–32.4)	33.7 (24.3–44.5)	NA	24.7 (13.8–40.3)	45.5 (20.3–73.2)	NA
Truancy	22.8 (16.0–31.3)	32.0 (21.8–44.3)	NA	29.0 (16.5–45.7)	28.3 (11.7–54.1)	NA
Poor relation with peers	11.6 (7.7–17.1)	9.3 (5.2–16.0)	NA	5.8 (2.4–13.5)	22.4 (5.3–60.1)	NA
<b>Risk behaviors</b>						
Regular smoker	55.2 (46.3–63.7)	66.2 (53.4–77.1)	NA	<b>44.8 (25.9–65.3)</b>	<b>79.8 (51.7–93.6)</b>	4.9 (1.0–23.3)
Alcohol misuse	55.3 (48.0–62.4)	58.4 (45.9–69.8)	NA	22.3 (12.3–36.8)	48.2 (22.3–75.0)	NA
Cannabis use	53.3 (46.7–59.7)	64.5 (53.0–74.5)	NA	37.3 (21.5–56.3)	40.1 (17.7–67.4)	NA
Other drug use	<b>17.1 (10.8–26.2)</b>	<b>29.1 (18.7–42.3)</b>	NS	9.3 (4.3–19.1)	19.8 (7.2–44.0)	NA
Unsafe sex	<b>21.2 (16.5–26.9)</b>	<b>46.5 (35.0–58.4)</b>	2.1 (1.2–3.6)	21.5 (11.8–36.0)	47.2 (21.7–74.3)	NA
Quarrel while under the influence of substance	<b>12.3 (6.5–22.0)</b>	<b>33.7 (23.3–45.9)</b>	3.1 (1.7–5.8)	5.5 (2.1–13.4)	20.1 (6.2–48.9)	NA
Delinquent other than weapon carrying	<b>73.8 (67.4–79.3)</b>	<b>88.4 (79.2–93.8)</b>	NS	52.1 (30.9–72.6)	61.9 (35.8–82.6)	NA

In bold:  $P < 0.01$ . NA, non-applicable; NS, non-significant.

<sup>a</sup>Backward multivariate analysis.

of physical violence tend to protect themselves carrying a weapon and adolescents carrying a weapon live in a more violent surrounding with an increased risk for victimization. A prospective study of US adolescents showed a reciprocal link between exposure to violence and committing weapon violence [29], thus consistent with both our explanations.

Being tattooed showed a significant association with weapon carrying in males. In previous studies, having tattoos has been linked to risk behaviors in adolescents such as interpersonal violence and substance use [11, 12]. These associations showed a large variance, according to the age at body modification, whether the tattoo was of an amateur or

professional nature and the motif and the location of the tattoo. In addition, body art represents far more than just an indicator of risk behaviors [30]. It may, for example, represent a wish for uniqueness or the search for self-identity. Professionals should therefore abstain from stigmatizing tattooed adolescents. However, the presence of a tattoo may serve as a starting point for a discussion about weapon carrying, violence and other risk behaviors in an adolescent patient.

Male apprentices carry a weapon more frequently than students. In contrast to full-time students, apprentices spend most of their working time in a company where they get a practical education. They enter professional life at a younger age, being influenced rather by adults than by same-age peers. These surroundings may push them to adopt more easily adult risk behaviors. In this line, other studies have reported that, compared with students, apprentices are more likely to use substances [31, 32] and to be sexually active [33]. The gender difference in this case could be attributed to the different types of apprenticeships males and females follow.

An interesting fact is that, although being an important risk factor for weapon carrying for both genders, being a victim of physical violence is not related to using a weapon in a fight. This seems to indicate that adolescents who have been victim of violence carry a weapon mainly for self-defense.

For both genders, we highlight a strong association between the use of a weapon in a fight and other risk behaviors, indicating a clustering effect of diverse risk behaviors by highest risk youth groups.

In our analysis, the use of a weapon in a fight among males is related to being foreign born, which can be interpreted as a proxy for race, ethnicity and cultural differences. The association of weapon carrying and race/ethnicity has been shown to be mediated by factors such as family socioeconomic status (SES) and the perception of neighborhood crime [9]. SMASH02 did not include questions about SES. We thus used the education of both parents as a proxy, which was not significantly associated with either weapon carrying or weapon using in the multivariate analysis. However, we cannot say whether the association of weapon use

and being foreign born is only present because of the confounding factors of SES and neighborhood characteristics or if, as stated by Jackman [34], cultural differences in social acceptance of violence may partially explain this association. As mentioned for tattoos, health professionals should rather use this characteristic as a starting point for discussion than as a way of stigmatizing foreign-born youths.

### **Strengths and limitations**

The main strength of our research is that it is based on a large, nationally representative sample of adolescents. From this point of view, the results can be generalized to all adolescents living in Switzerland. Additionally, to our knowledge, this is the first study focusing not only on weapon carrying but also on the difference between carrying a weapon and using it in a fight.

Nevertheless, some limitations need to be stressed. First, SMASH02 does not include information on absent students and dropouts, both of them known to engage more often in weapon carrying and other health risk behaviors [5, 9]. The mean percentage of adolescents between 16 and 20 years not included in our educational system is ~10%, and a further 5% are presumed to be absent on the day of the survey. We may thus underestimate the prevalence of weapon carrying and use among adolescents. Second, as our data are cross-sectional, causality cannot be assumed. Furthermore, we have no information about when adolescents started to carry and use weapons. We may therefore mix adolescents having carried a weapon for defense for a long time without using it with others who just started to carry a weapon for an offensive reason which may precede its use later on. Third, SMASH02 is based on a self-reporting questionnaire. Although completed anonymously, the results may be biased inasmuch as participants (especially males) may overreport risk behaviors, in order to impress others, while others (especially females) may underreport, fearing social/legal consequences [35, 36]. However, several studies indicate that when data are collected anonymously their reliability increases [36, 37]. Fourth, relatively



small prevalence rates did not allow us to further divide our sample for additional analysis such as by types of weapons or interaction tests between weapon carrying, weapon using, history of violent victimization, sensation seeking and other risk behaviors. Fifth, we do not have data regarding community or family violence that could also influence our findings. Sixth, we do not have information regarding violence against peers, which could explain, at least in part, why adolescents carry a weapon. Seventh, our data do not allow us to differentiate those using a weapon offensively from those using it defensively. Finally, in general, females engage less often in overt physical violence including weapon carrying and use [6, 8, 26]. Although we have a large sample, few girls reported using a weapon in a fight. Therefore, the power of our analyses for girls using a weapon in a fight is limited, and thus Type II errors cannot be excluded. Even so, as the literature on young females' weapon carrying and use is extremely scarce, we believe that our results are important as a first step to understand their characteristics.

## Conclusion

Carrying a weapon is a relatively frequent behavior among youths in Switzerland and a sizeable proportion of those who carry a weapon have used it in a fight. As this behavior is associated with other risk behaviors, health professionals dealing with adolescents should include weapon carrying in their clinical assessment and preventive counseling.

Urban foreign-born male adolescents who quarrel while intoxicated are the most at risk of using a weapon in a fight, and therefore, culturally sensitive prevention approaches need to be developed to decrease violence in this specific population of youths.

Nevertheless, as our study is exploratory, further research is needed to confirm and clarify our findings.

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## Conflict of interest statement

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None declared.

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