Bullying and Weapon Carrying
A Meta-analysis

Mitch van Geel, PhD; Paul Vedder, PhD; Jenny Tanilon, PhD

**IMPORTANCE** Studies suggest that adolescents involved in bullying are more likely to carry weapons than their uninvolved peers.

**OBJECTIVE** To use meta-analyses to determine whether victims, bullies, and bully-victims are more likely to carry weapons than uninvolved peers.

**DATA SOURCES** PsycINFO, ERIC, MEDLINE, LILACS, EMBASE, and Dissertation Abstracts International were searched for relevant publications (1950 through January 2014). The reference list of a review article and reference lists of retrieved articles were checked for further relevant studies.

**STUDY SELECTION** Studies were included if they provided an effect size comparing the weapon carrying of adolescent victims, bullies, or bully-victims with that of uninvolved peers. Studies that included individuals older than 21 years were excluded, as were studies that focused on incarcerated youth or youth diagnosed as having a psychopathologic condition.

**DATA EXTRACTION AND SYNTHESIS** Studies were coded independently by 2 of us. The agreement rate was 93%. Effect sizes were coded that compared victims, bullies, or bully-victims with uninvolved peers. Meta-analyses were based on 22 studies for victims (n = 257,179), 15 studies for bullies (n = 236,145), and 8 studies for bully-victims (n = 199,563).

**MAIN OUTCOMES AND MEASURES** This study focused on weapon carrying among adolescents. Hypotheses were formulated before the study.

**RESULTS** Victims (odds ratio [OR], 1.97; 95% CI, 1.62-2.39), bullies (OR, 3.25; 95% CI, 2.72-3.89), and bully-victims (OR, 4.95; 95% CI, 3.77-6.50) were more likely to carry weapons than uninvolved peers. Analyses provided no indication of publication bias. Studies conducted in the United States found stronger relations between being a bully-victim and weapon carrying (OR, 7.84; 95% CI, 6.02-10.21) than studies from other countries (OR, 3.62; 95% CI, 2.30-5.68; Q₁ = 8.401; P = .004).

**CONCLUSIONS AND RELEVANCE** Involvement in bullying as a victim, bully, or bully-victim is related to weapon carrying.
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dolescent weapon carrying is related to physical fighting, injury, and hospitalization.\textsuperscript{1}\textsuperscript{-2} In a study among 13,710 youths, 1 in 6 adolescents reported bringing a weapon to school in the past 30 days.\textsuperscript{3} One of the driving factors behind adolescent weapon carrying seems to be the involvement in bullying. Research suggests that those adolescents who are involved in bullying are more likely to carry weapons than peers who are not involved in bullying.\textsuperscript{4} Furthermore, perpetrators of high school homicides were more likely the victims of bullying than their peers,\textsuperscript{5,6} and the combination of bullying victimization and access to and interest in firearms is characteristic of the perpetrators of high school homicides.\textsuperscript{6} Bullying may be defined as repeated harassment, either physical or verbal, with an imbalance in power between bully and victim.\textsuperscript{7,8} Although the effects are roughly the same, the prevalence rates of bullying may differ, with between 15\% to 50\% of adolescents involved in bullying as a victim, a bully, or both.\textsuperscript{4} Victims may carry weapons for self-protection, whereas bullies may carry weapons to intimidate others or as governed by an antisocial personality relating to both bullying and weapon carrying.\textsuperscript{9} Studies\textsuperscript{4,10} suggest that bully-victims, defined as those who are simultaneously both bullies and victims, are at the highest risk of carrying weapons. Bully-victims might already have aggressive personalities and thus be especially prone to carry weapons when provoked.\textsuperscript{8} Alternatively, it has been suggested that bully-victims may have the highest incidence of weapon carrying because they share the risk factors of both bullies and victims.\textsuperscript{11}

In the current study, we performed 3 meta-analyses to analyze whether victims, bullies, and bully-victims were more likely to carry weapons than their peers who were not involved in bullying. The potential existence of publication bias was addressed, and moderator analyses were performed to analyze how obtained effect sizes were dependent on the methodologic quality of the included studies. Finally, most studies on adolescent weapon carrying have been conducted in the United States. The United States may differ from other countries in terms of access to weapons and opinions toward weapon carrying\textsuperscript{12}; thus, moderator analyses were performed to compare effect sizes between studies in the United States and studies in other countries.

Methods

\textbf{Study Retrieval and Selection}

The search engines PsycINFO, ERIC, MEDLINE, LILACS, EMBASE, and Dissertation Abstracts International were searched (1950 through January 2014) using the keywords bully*, peer victim*, mobbing, and ragging in combination with weapon*, kni*e*, gun*, and firearm*. In all databases except Dissertation Abstracts International, we searched the full text of the articles; in Dissertation Abstracts International, the abstracts were searched. The review by Brennan and Moore\textsuperscript{13} was also searched for relevant publications. In addition, the reference lists of retrieved articles were scanned to find potential articles for inclusion in the meta-analysis. This search strategy yielded 1112 studies. A flow diagram of the search results is provided in Figure 1.

Figure 1. Flow Diagram of the Literature Search Results

<table>
<thead>
<tr>
<th>Identification</th>
<th>Screening</th>
<th>Eligibility</th>
<th>Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>1163 Records identified through database searching</td>
<td>1112 Records after duplicates removed</td>
<td>0 Studies included in qualitative synthesis</td>
<td>25 Studies included in quantitative synthesis (meta-analysis)</td>
</tr>
<tr>
<td>7 Additional records identified through other sources</td>
<td>957 Records excluded</td>
<td>130 Full-text articles excluded, with reasons</td>
<td></td>
</tr>
</tbody>
</table>

group involved in bullying with an uninvolved control group. Several studies\(^{9,16,19,21,22,25}\) provided correlations or mean scores instead of ORs. From these studies we coded correlations and the Cohen \(d\). The correlations and Cohen \(d\) were then converted into ORs using the Comprehensive Meta-Analysis program (Biostat). Several studies distinguished between relational (eg, exclusion or name calling) and physical victimization (eg, hitting, pushing, or shoving)\(^{15,19,20,23}\) or weapon carrying inside and outside school.\(^{26}\) In these studies, the effect sizes for different types of bullying or weapon carrying were averaged to create a general estimate of the association between bullying and weapon carrying.\(^{3,4}\) Three studies\(^{13,26,32}\) provided gradations in bullying involvement (eg, none to once or twice to sometimes weekly). In these studies, we used the uninvolved children as a control group and combined the other gradations into an involved group. In longitudinal studies, we coded the associations between bullying involvement and weapon carrying at the first moment of measurement.\(^{9,32}\) Only one study\(^9\) provided both peer and other reports of involvement in bullying. From this study, we coded the self-report of involvement in bullying to ensure comparability with the other studies. Two studies\(^4,26\) used the same data for participants from the United States. Because samples included in a meta-analysis must be independent, both articles could not be included in the same meta-analysis. We chose to include the study with the larger sample size in the meta-analyses on bullies and victims. However, the article with the larger sample size did not include bully-victims as a category, so the article with the smaller sample size was included in the meta-analysis on bully-victims. Of 2 other studies\(^19,20\) that used the same data, we coded the article\(^19\) that analyzed the larger data set for the bully and victim meta-analyses. However, only the article using the smaller data set\(^29\) included an effect size for bully-victims and was therefore used in the meta-analysis on bully-victims. Two of us (M.v.G. and J.T.) independently coded the effect sizes and the moderators. The coded moderators were study design, response rate, the confounders that were controlled for in a study, and the country where a study was conducted. Differences were resolved through discussion. Before discussion, we coded identically 93% of the time.

### Statistical Analysis

Data were analyzed using the Comprehensive Meta-Analysis program. The ORs were used as effect sizes. Other effect sizes were transformed into ORs before the analyses. Three meta-analyses were conducted to compare weapon carrying of victims, bullies, and bully-victims with a control group of uninvolved peers. Because nonsignificant results may be missing, the effect sizes computed in the meta-analysis may be inflated. To assess the risk of publication bias, we computed the Orwin fail-safe \(N\), which estimates how many studies with nonsignificant results would be needed to nullify a meta-analytically obtained effect size. If many studies would be needed, we may conclude that although the meta-analytically obtained effect size may be slightly inflated, the significant effect is not due to publication bias. A rule of thumb that has been suggested is that the number of studies estimated by the Orwin fail-safe \(N\) procedure must exceed \(5k + 10\),\(^{35}\) where \(k\) stands for the number of samples included in the meta-analysis. We calculated the association between the standardized effect sizes and the variances of these effect sizes as well, using the Kendall \(\tau\) method. A high Kendall \(\tau\) coefficient suggests that small studies with nonsignificant results tend not to be published, whereas a nonsignificant Kendall \(\tau\) coefficient suggests the absence of such publication bias. We used the Duval and Tweedie trim-and-fill procedure, which imputes effect sizes until the error distribution closely approximates normality; this procedure provides a more unbiased estimate of the effect size than the observed estimate. The \(Q\) test is used in the current study to assess heterogeneity; a significant \(Q\) test result suggests true heterogeneity in included effect sizes. The \(F\) was used to quantify the heterogeneity of the effect sizes of the included studies; the \(F\) can be interpreted as the percentage of total variability in a set of effect sizes due to true heterogeneity.\(^{36}\) The \(Q\) statistic was used to test for the significance of moderators.\(^{34}\) Data were analyzed using a random-effects model, which does not assume a common underlying effect size for all included studies and is commonly more appropriate for meta-analyses based on a literature search than a fixed-effects model.\(^{34}\)

### Results

#### Meta-analysis on Victims

Twenty-two studies eligible for inclusion yielded 31 effect sizes. These 22 studies concerned a total of 257 179 youths, ranging in age from 11 to 21 years. Analyses revealed a significant association between victim status and weapon carrying (OR, 1.97; 95% CI, 1.62-2.39). The analysis is summarized in the Table. The forest plot is provided in Figure 2. The Kendall \(\tau\) was 0.12 (\(z = 0.91, P = .36\)). The Duval and Tweedie trim-and-fill procedure suggested that one study needed to be imputed, but the adjusted effect size (OR, 1.95; 95% CI, 1.60-2.36) remained similar to the observed effect size. The Orwin fail-safe \(N\) indicated that 179 studies with an OR of 1.00 would be needed to reduce the obtained effect size to a trivial OR of 1.10 (\(5k + 10\) benchmark = 165). The Kendall \(\tau\), the Duval and

<table>
<thead>
<tr>
<th>Role</th>
<th>No. of Studies</th>
<th>No. of Effect Sizes</th>
<th>No. of Adolescents</th>
<th>Odds Ratio (95% CI)</th>
<th>(Q)</th>
<th>(I^2)</th>
<th>Orwin Fail-Safe (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victims</td>
<td>22</td>
<td>31</td>
<td>257 179</td>
<td>1.97 (1.62-2.39)</td>
<td>855.635</td>
<td>96.494</td>
<td>179</td>
</tr>
<tr>
<td>Bullies</td>
<td>15</td>
<td>24</td>
<td>236 145</td>
<td>3.25 (2.71-3.89)</td>
<td>426.878</td>
<td>94.105</td>
<td>213</td>
</tr>
<tr>
<td>Bully-Victims</td>
<td>8</td>
<td>14</td>
<td>199 563</td>
<td>4.95 (3.77-6.50)</td>
<td>220.530</td>
<td>94.105</td>
<td>257</td>
</tr>
</tbody>
</table>

* \(P < .001\).
Tweedle trim-and-fill procedure, and the Orwin fail-safe N suggest the absence of publication bias. Moderator analyses were performed to compare the studies on methodologic characteristics. Studies using convenience samples did not significantly differ in effect sizes from studies using other designs \((Q_1 = 0.419, P = .52)\). Studies that obtained a response rate of 75% or higher did not significantly differ in effect sizes from studies with response rates lower than 75% \((Q_1 = 2.032, P = .15)\). Studies that controlled for confounders did not differ in effect sizes from studies that did not control for confounders \((Q_1 = 0.553, P = .46)\). Moderator analysis also indicated that effect sizes did not significantly differ between studies conducted in the United States and studies conducted in other countries \((Q_1 = 2.537, P = .11)\).

Meta-analysis on Bullies
Fifteen studies eligible for inclusion yielded 24 effect sizes. These 15 studies concerned a total of 236,145 youths, ranging in age from 11 to 21 years. Analyses revealed a significant association between bully status and weapon carrying \((OR, 3.25; 95\% CI, 2.71-3.89)\). The analysis is summarized in the Table. The forest plot is provided in Figure 3. The Kendall \(\tau\) was 0.11 \((z = 0.71, P = .47)\). The Duval and Tweedie trim-and-fill procedure suggested that 10 studies needed to be imputed, creating a still significant unbiased estimate \((OR, 2.30; 95\% CI, 1.90-2.77)\). The Orwin fail-safe N indicated that 213 studies with an OR of 1.00 would be needed to reduce the obtained effect size to a trivial OR of 1.10 \((5k + 10\text{ benchmark} = 135)\). The Kendall \(\tau\), the Duval and Tweedie trim-and-fill procedure, and the Orwin fail-safe N suggest that the significant association between bully status and weapon carrying was not due to publication bias. Moderator analyses were performed to compare the studies on methodologic characteristics. Studies that used convenience samples did not significantly differ in effect sizes from studies using other designs \((Q_1 = 0.213, P = .65)\). Studies that obtained a response rate of 75% or higher \((OR, 3.31; 95\% CI, 2.69-4.08)\) had significantly higher effect sizes than studies with response rates lower than 75% \((OR, 1.92; 95\% CI, 1.27-2.91; Q_1 = 5.296; P = .02)\). Studies that controlled for confounders did not significantly differ from studies that did not control for confounders \((Q_1 = 0.038, P = .85)\). Moderator analysis also indicated that effect sizes did not significantly differ between studies conducted in the United States and studies conducted in other countries \((Q_1 = 3.406, P = .06)\).
Eight studies eligible for inclusion yielded 14 effect sizes. These 8 studies concerned a total of 199,563 youths, ranging in age from 11 to 21 years. Analyses revealed a significant association between bully-victim status and weapon carrying (OR, 4.95; 95% CI, 3.77-6.50). The analysis is summarized in the Table. The forest plot is provided in Figure 4. The Kendall τ was −0.20 (z = 0.99, P = .32). The Duval and Tweedle trim-and-fill procedure suggested that no studies needed to be imputed and that the obtained estimate and the unbiased estimate were similar. The Orwin fail-safe N indicated that 257 studies with an OR of 1.00 would be needed to reduce the obtained effect size to a trivial OR of 1.10 (5k + 10 benchmark = 80). The Kendall τ, the Duval and Tweedle trim-and-fill procedure, and the Orwin fail-safe N suggest that the obtained significant effect size is not due to publication bias.
Only one study concerning bully-victims used a convenience sample, and only 2 studies reported response rates lower than 75%; given these low numbers, we chose not to perform moderator analyses on these characteristics. Studies that controlled for confounders did not significantly differ from studies that did not control for confounders (Qs = 2.196, P = .14). Moderator analysis also indicated that effect sizes differed between studies conducted in the United States (OR, 7.84; 95% CI, 6.02-10.21) and studies conducted in other countries (3.62; 2.30-5.68; Qs = 8.401; P = .004).

### Discussion

This meta-analysis was conducted to examine the association between involvement in bullying and weapon carrying. We found that victims, bullies, and bully-victims were more likely to carry weapons than their uninvolved peers. We found no indication that these results were affected by publication bias. For the bullies, studies that reached response rates of 75% or higher reported higher effect sizes, whereas all other moderator analyses on methodologic characteristics were nonsignificant. This finding suggests that effect sizes are not inflated by the inclusion of relatively lower quality studies. Results for victims and bullies revealed that effect sizes did not differ between studies conducted in the United States and studies conducted in other countries. However, in line with results reported by Nansel and colleagues, we found that bully-victims were more likely to report weapon carrying in the United States than in other countries.

Victims, bullies, and bully-victims report more weapon carrying than their peers. In itself, this finding is already cause for intervention because adolescents that carry weapons are more likely to get into fights, be hospitalized, be injured, or injure others than their peers who do not carry weapons. Furthermore, it has been suggested that an interest in weapons and a history of peer victimization are key aspects of high school homicides. It is possible that bully-victims as opposed to victims are most likely to commit high school homicides. The current meta-analysis points out that bully-victims are more likely to carry weapons than victims, even more so in the United States, where guns are easily accessible and where most high school homicides take place. In addition to this, bully-victims are not only more likely to carry a weapon than victims, a study by Srabstein and Piazza points out that bully-victims are also more likely to actually report using a weapon than victims.

When interpreting the results of the current study, several limitations must be kept in mind. The studies included in the meta-analyses are subject to bias that may have affected the outcomes of the analyses. We found no indication that study designs, response rates, and not controlling for confounders inflated effect sizes, but there are other potential sources of bias that we could not analyze in the current study. Many of the studies were based on measures for which the psychometric properties were not tested. We found only one study that used peer reports of bullying. All other studies used only self-reports; thus, we cannot analyze how far the obtained results may have been inflated by same-method variance. In addition, we compared studies that controlled for confounders with studies that did not control for confounders. Because of the wide range of confounders included in the studies, we could not analyze the extent to which separate confounders may have affected the effect sizes. Weapon carrying was measured inconsistently across studies. Studies differed in the time span for which they inquired about weapon carrying, the type of weapons that they inquired about, and the locations in which weapons were carried. We could not systematize these differences in a manner that allowed for meaningful comparison, but it is likely that these differences are related to differences in effect sizes among studies.

The analyses on bully-victims were performed with only 8 studies. Preferably, the results on bully-victims should be updated when more studies become available. Because of the low number of studies and missing information in the included studies, we could not analyze the moderators, study design, and response rates for the bully-victims. Our meta-analysis was mostly based on cross-sectional studies; more longitudinal studies should be conducted to test whether involvement in bullying increases weapon carrying or whether weapon carrying increases the involvement in bullying. Although this meta-analysis may point out strong associations between involvement in bullying and weapon carrying, it does not clarify why adolescents involved in bullying are more likely to carry weapons than uninvolved peers. Qualitative studies and more theoretically oriented studies should clarify this.

### Conclusions

Earlier meta-analyses already suggested that bullying is related to both emotional and physical well-being. The current meta-analysis suggests that bullying is related to weapon carrying among adolescents and further establishes bullying as a risk factor for adolescent problem behavior. Given the wide range of negative implications bullying may have, it is important that schools endeavor to reduce bullying among their students, preferably by using evidence-based methods.
Bullying and Weapon Carrying


