TITLE: 'Prevalence rates of drug use among school bullies and victims: A systematic review and meta-analysis of cross-sectional studies'

Sara Valdebenito, Maria Ttofi & Manuel Eisner
Institute of Criminology, University of Cambridge

Corresponding author: Sara Valdebenito
Email: sv331@cam.ac.uk
Telephone: +44 -1223767373

Declaration of interest: None of the authors have any financial interests related to findings reported in this review.

ABSTRACT

Bullying is a common aggressive behaviour in school, with a number of cross-sectional studies showing that it exhibits a high comorbidity with other problem behaviours. The present study aims to estimate the comorbidity of school bullying (perpetration and victimisation) with drug use by incorporating and meta-analysing all available evidence on the cross-sectional association between the two variables. Meta-analytic results are based on a comprehensive systematic review across 20 databases and 46 journals. A total of 61 relevant manuscripts were included in the systematic review. Following explicit methodological criteria for the inclusion/exclusion of reports, 13 of them were eligible for the meta-analysis. The association of school bullying perpetration with drug use (adjusted odds ratio *OR*=2.82; 95% *CI* 1.97-4.02; *z*=5.71; *p*< .001) suggests a very strong relationship. For example, if a quarter of children were bullies and a quarter were drug users, this value of the OR would correspond to 40.88% of bullies being also drug users, compared with 19.71% of non-bullies. The association of school bullying victimization with drug use (adjusted odds ratio *OR*=1.79; 95% *CI* 1.38 – 2.32; *z*= 4.41; *p*< .001) suggests a moderate relationship. For example, if a quarter of children were victims and a quarter were drug users, this value of the OR would correspond to 33.69% of bullied youth also being drug users, compared with 22.1% of non-bullied youth. Adjusted effect sizes are based on study findings that used statistical controls for confounding variables, thus providing the unique association of school bullying with drug use over and above other important risk factors that may explain this association. Implications for policy and intervention research arising from this review are highlighted.

Key words: systematic review, meta-analysis, bullying, drug use, cross-sectional studies.

1. INTRODUCTION

Bullying is one of the most prevalent forms of aggression in school (Nansel et al., 2001). It includes a range of direct (e.g., physical damage, injurious words, threats) and indirect behaviours (e.g., rumours or rejection of victims) characterised by being intentional, repeated over time and performed in a context of power imbalance (CDC, 2014). Although the prevalence varies among countries and cultures, a general trend seems to indicate that between 20% and 30% of schoolchildren are involved in school bullying (Craig et al., 2009; Juvonen, Graham, & Schuster, 2003).

Bullying has been the focus of intervention efforts not only because of the problematic nature of the behaviour per se, but also because of its adverse effects on children's physical and psychosocial health (Fekkes, Pijpers, Fredriks, Vogels, & Verloove-Vanhorick, 2006; Gini & Pozzoli, 2009). Notably, longitudinal studies and meta-analyses suggest that bullies are more likely to develop symptoms of depression (e.g., Ttofi, Farrington, Lösel, & Loeber, 2011a) and to be involved in delinquency (e.g., Ttofi, Farrington, Lösel, & Loeber, 2011b) as well as in violence (e.g., Ttofi, Farrington, & Lösel, 2012).

Furthermore, the cross-sectional evidence suggests that bullying can be correlated and co-occur along with other hazardous behaviours which can seriously interfere with the psychosocial development of children (Farrington, 1993, 2005; Loeber, Farrington, Stouthamer-Loeber, & Van Kammen, 1998). This includes, for instance, low self-esteem, depression, anxiety, delinquency, weapon carrying and drug use (Bradshaw, Waasdorp, Goldweber, & Johnson, 2013; Pranjic & Bajraktarevic, 2010; Ttofi & Farrington, 2008).

This paper examines the link between school bullying and drug use. Both are prevalent problem behaviours during the school years and both of them are correlated with a broad array of negative developmental outcomes (Luk, Wang, & Simons-Morton, 2012), highlighting the need for intervening early and addressing both of these risk factors which may function as a stepping stone towards other problem behaviours in adult life (Ttofi et al., 2012). Both factors, for instance, impact negatively the academic development (Beran, Hughes, & Lupart, 2008; Schwartz, 2000) and general mental health (Birkett, Espelage, & Koenig, 2009; Fleming &

Jacobsen, 2009b; Roland, 2002; Waters, Wake, Toumbourou, Wright, & Salmon, 1999; Wei, Williams, Chen, & Chang, 2010) of children.

Despite a growing body of cross-sectional research on the link between drug use and bullying behaviour during school years (Brown, Riley, Butchart, & Kann, 2008; Niemelä et al., 2011; Moon & Alarid, 2014), no previous meta-analysis has been conducted to systematically synthesize relevant evidence and to identify the magnitude and the direction of this association. The current paper addresses this gap by meta-analysing results from existing published and unpublished studies following a comprehensive systematic review. This meta-analytic investigation has obvious implications for intervention research. To the extent that a significant association between school bullying and drug use can be established, then it may be inferred that effective bullying prevention programmes could be viewed as an effective intervention strategy for the reduction of school bullying and other co-occurring problem behaviours, including drug use.

1.1 Bullying and drug use: theoretical perspectives

It is difficult to determine the exact prevalence of bullying involvement and drug use as a comorbid phenomenon, due to varying sampling and other methodological features across available studies. Luk et al., (2012) found that 5.4% of adolescents [M_{age}= 14.2; *SD*=1.42] displayed a co-morbid condition, while Radliff, Wheaton, Robinson, & Morris, (2012) found co-morbidity for 4.9% of high school students and for 1.6% of middle schoolchildren. In a sample of adolescents [M_{age}=15.3; *SD*= 1.58], Garcia Continente, Pérez Giménez, & Nebot Adell, (2010) found that 7% of boys and 9.6% of girls displayed a co-morbid condition.

Prevalence rates of drug use also vary between school students who are involved in different bullying roles as perpetrators, victims or bully-victims. Evidence suggests that perpetrators are overrepresented in drug consumption categories compared with non-bullies (Kaltiala-Heino, Rimpelä, Rantanen, & Rimpelä, 2000). Victims are also more likely to use drugs compared to non-involved individuals; however, prevalence rates are higher for perpetrators than victims of school bullying. For instance, Radliff et al., (2012) concluded that 11.4% of bullies reported marijuana use, compared with only 2% of victims and 1% of non-

involved children. Comparable evidence is available from another American survey (Bradshaw et al, 2013), asserting that bullies are two times more likely to use drugs (*OR*=2.77; *95% CI* 2.4-3.2; $p<.001$) compared with non-involved students, while the association for victims is much weaker (*OR*=1.30; *95% CI* 1.1 – 1.5 $p<.001$).

A more restricted body of research has collected information for a special group of victims who also display aggressive behaviours, known as bully-victims. The link between drug use and aggressive victims is less conclusive in the literature. While Kaltiala-Heino et al., (2000) and Bradshaw et al., (2013) suggest a high association between those acting as bully-victims and drug use (with *OR*=7.1; *95% CI* 4.1 – 12.2 and *OR*=3.4; *95% CI* 3.1 – 4.4; $p<.001$ accordingly), the conclusion of Niemelä et al., (2011) does not support such findings (*OR*= 0.3; *95% CI* .04 – 2.6; $p<.05$).

The literature offers various theoretical explanations for the link between school bullying and drug use. A notable body of research argues that drug use may function as a coping mechanism against the experience of stressful life events, including school bullying and peer victimisation. Coping theory proposes that adolescents engage in high risk behaviours in response to increased negative affects resulting from exposure to victimisation (Lazarus, 1993). Since bullying is characterised by repeated aggressive acts over time against less powerful (physically or emotionally) individuals, it is plausible that victims of school bullying may engage in substance use as a (maladaptive) way of coping with their negative school experiences.

A similar theoretical framework is that of Agnew's (1992) general strain theory of crime and deviance, which has been used in school bullying research to explain the higher prevalence of self-harm exhibited by victims as compared to non-victimised students (Hay & Meldrum, 2010). Both coping theory and general strain theory could explain the higher prevalence of substance use among school bullies. Specifically, a recent systematic review and meta-analysis of 153 studies (Cook, Williams, Guerra, Kim, & Sadek, 2010:75) concluded that bullies tend to present negative self-related cognitions, come from a conflictive family environment characterised by poor parental monitoring, being more likely to perceive the school as having a

negative atmosphere. In that context, it may be argued that the 'typical bully' is more likely to be involved in drug use as a way to cope with stressful life experiences within the family and school.

Another theoretical model suggests that substance use functions as a trigger for subsequent aggression and violence due to physiological changes (Yudko, Blanchard, Henrie, & Blanchard, 1997) or due to the involvement of drug users with deviant/delinquent groups (Bui, Ellickson, & Bell, 2000). In particular, Goldstein, (1985) argued in favour of a causal link of drug use on crime based on three mechanisms: (1) drug users become more irrational which can trigger off violent behaviours (psychopharmacological explanation) (2) drug users can be compelled to commit crime in order to finance their consumption (economic explanation), and (3) violent behaviours in drug users are the result of their participation in the illegal drugs market (systemic explanation). While any argument about a causal link between bullying and drug use can only be supported by better quality methodological criteria such as by evidence from within-individual analyses and longitudinal research (Murray, Farrington, & Eisner, 2009), the focus of the current paper is to synthesize all available cross-sectional evidence and establish the prevalence rates of drug use among school bullies and victims compared with non-involved students.

Some of the above theoretical frameworks could be transferred to the school setting in order to explain the co-occurrence of drug use and bullying behaviour. Goldstein's economically compulsive framework could explain networks supporting drug distribution within schools, while the systemic framework is in line with existing research on the deviant lifestyle of both drug users and school bullies. Copying theory may be a plausible framework explaining why bullies and their victims may engage in drug use to begin with, although alternative theoretical models could shed light on other aspects of this phenomenon (e.g. differential association theory, explaining how children learn problem behaviour from associations with delinquent peers).

All in all, children involved in school bullying as perpetrators or victims are children in need. Irrespective of whether children do drugs in order to cope with stressful life events or

simply because of their antisocial lifestyle, research efforts should be invested in understanding the extant magnitude of this phenomenon. This paper aims to address this by synthesizing all available scientific evidence arising from cross-sectional studies.

1.2 The current review

This paper aims to produce a standardised effect size on the association between bullying and drug use based on a thorough systematic review and meta-analysis. Two summary effect sizes will be reported: one on the association of bullying perpetration with drug use; and one on the association of bullying victimisation with drug use. To the best of our knowledge, there are no previous meta-analyses based on cross-sectional studies intending to summarise findings on the drug-bullying link.

The study is guided by the following research questions:

- What is the size and direction of the association between school bullying and drug use?
- Are victims of school bullying more likely to score highly on drug use when compared with non-involved children?
- Are perpetrators of school bullying more likely to score highly on drug use when compared with non-involved children?
- Is the bullying-drug link stronger for perpetrators or victims?
- Are there gender-specific effects? In other words, does bullying have a stronger impact on boys than girls?
- Are there ethnic-specific effects?

2. METHODS

2.1 Search strategies

In order to identify all possibly relevant studies and control for publication bias, an extensive search was carried out. We explored 20 databases, including searches on manuscripts produced in Latin American and other Spanish-speaking countries. In an attempt to target the grey literature (Wilson, 2009), our searches cover also databases specific to unpublished graduate theses (e.g., Ethos – Electronic Theses Online Service). We also conducted hand

searches in all volumes of 46 journals. Bibliographies from earlier narrative reviews were also checked.

2.2 Criteria for inclusion or exclusion of reports

Studies included in the meta-analysis met the following criteria:

- We targeted manuscripts measuring school bullying rather than other general forms of aggression. Papers on bullying within other settings, such as bullying at work, or other manifestations of victimisation or violence (e.g., fights, school shouting) outside or inside the school were excluded (Lambert, Scourfield, Smalley, & Jones, 2008).
- In terms of the time frame, databases and journals were searched from inception to the end of 2014.
- Included studies provided a statistical measure of the association between bullying (victimisation and/or perpetration) and drug use. For this meta-analysis, drug use refers to hard drugs, for instance cocaine and/or inhalants (e.g., Kaltiala-Heino et al., 2000), or softer drugs such as marijuana/cannabis (e.g., Liang, Flisher, & Lombard, 2007). Studies reporting on combined measures of alcohol or cigarette use plus drugs (e.g., Carlyle & Steinman, 2007) were excluded. Similarly, studies reporting on other unspecified substances were excluded (i.e., Gruber & Fineran, 2007).
- Included studies sampled children and adolescents from mainstream schools so that results are generalisable to the wider school population. Studies reporting measures for adults (e.g., Bebbington et al., 2004) or psychiatric inpatients (e.g., Luukkonen, 2010) were excluded.
- As cross-sectional studies are particularly suitable for estimating the prevalence of behaviours (Sedgwick, 2014; Levin, 2006), the present study focused only on cross-sectional research, including reports with adjusted measures of the targeted association. When the report provided adjusted and unadjusted data, we only used adjusted results for the meta-analysis.

- Sources included were book chapters (e.g., Pepler, Craig, Connolly, & Henderson, 2002) journal articles, and academic MSc and PhD theses (e.g., Edwards, 2002).

Appendix Table A presents the studies that were excluded from the meta-analysis as well as justifications on why this decision was reached.

2.3 Combining effect sizes within a report relating to the same outcome measure

In some cases reports presented more than one effect size that could be coded. For instance, some reports presented the same outcome for different groups of respondents (subgroups within the study), namely boys and girls (e.g., Pepler et al., 2002), or middle and high school students (e.g., Radliff et al., 2012) or respondents from different ethnic groups (e.g., Fernando, 2009). In these cases, the results were combined in a single summary effect size for each study under investigation.

Additionally, some studies reported separate results for pupils who were bully-victims. Since the number of studies was limited (four studies), we did not meta-analyse results for this category (e.g., comparing bully-victims and non-involved children). However, following the criteria used in previous studies (e.g., Ttofi et al., 2012) bully-victims were added (combined) to both bullies and victims categories so that the increase in the prevalence of each category was proportionate.

3. RESULTS

3.1 Systematic review

Initial online searches resulted in hundreds of hits, but only 61 reports were relevant to the aims of our systematic review, namely reports with relevant data on both school bullying (perpetration and/or victimization) and drug use. Upon further screening of the full text of these reports, it was established that the majority were not be included in the meta-analyses, because they did not provide an *adjusted* effect size on the association of drug use with either school bullying (perpetration and/ or). The meta-analyses included studies that investigated the relationship between school bullying (perpetration and/or victimization) and drug use after controlling for other childhood risk factors (e.g. child, parental, child-rearing, peer, school,

socio-economic and neighbourhood variables) that are significantly correlated with school bullying and drug use. In this way, relatively robust conclusions could be drawn about the extent to which school bullying may have an effect on the outcome measure *over* and *above* the contribution of other confounding variables. Appendix Table A gives reasons for the exclusion of the majority of these studies from the meta-analyses.

Table 1 provides further information about the 61 studies that were relevant for the aims of the systematic review. Most studies are based on samples from Europe and North America. Three studies (i.e., Brown et al., 2008; Rudatsikira, Muula, & Siziya, 2008; Siziya et al., 2013) examined populations from low-income countries in Latin America or Africa. Seventy seven per cent of the studies were retrieved from peer-reviewed journal articles. Unpublished reports are a minority, as has been found in other recent systematic reviews and meta-analyses (e.g., Ttofi et al., 2012; Lösel & Beelmann, 2003, 2006).

TABLE 1 ABOUT HERE

In almost all studies, the samples involved both boys and girls, with the exception of three studies that only reported results for boys (i.e., McMahon, Reulbach, Keeley, Perry, & Arensman, 2010; Stein et al., 2007; Waters et al., 1999). However, few studies provided results for boys and girls separately (e.g., Siziya et al., 2013). The same is applicable with variables such as ethnicity (e.g., Liang et al., 2007). In terms of age, the mean age ranged between 11 and 15 years.

Self-report questionnaires were the dominant tool to collect data in the screened reports. In fact, among the studies included in the systematic review, only one was based on multi-informant measures. In terms of the role played by schoolchildren in bullying, most of the studies encompassed measures for victims (46%) or bullies (15%) only. Thirty nine per cent of the studies measured more than two roles (e.g., bullies, victims and/or bully-victims).

Table 2 reports all manuscripts included in the meta-analyses and relevant effect sizes for each report. Not all studies provided both measures of association (bullying perpetration with drug use and bullying victimisation with drug use). Table 2 also presents covariates that were used in statistical controls across studies in order to provide the adjusted and un-

confounded effect size on the drug-bullying association. The variability in statistical controls used across studies is evident, with some studies controlling for basic demographic measures (e.g. Brown et al., 2008) while other studies controlling for a notable number of childhood variables from the individual, family and school domain (e.g. Romera et al., 2011). This could explain the notable variability in effect sizes across individual studies (see below).

TABLE 2 ABOUT HERE

3.2 Meta-analysis

A total of 13 studies provided enough statistical information to calculate an effect size on the prevalent association between bullying (perpetration and/or victimisation) and drug use. They represented a total of 152,326 cases.

3.2.1 The association between bullying perpetration at school and drug use

Figure 1 illustrates that only eight eligible studies reported effect sizes on the association of bullying *perpetration* and drug use. Individual effect sizes for each study are available in the forest plot, with most suggesting a positive association between bullying perpetration and drug use. For them, the adjusted summary effect size (under a random model) was *OR*=2.817 (*95% CI* 1.974-4.020; *z*=5.709; $p < .001$). One study (Kaltiala-Heino et al., 2000) provided a notably larger individual effect size, despite the eligibility of the study based on the inclusion criteria. Removal of this study marginally changed the summary effect size to an OR of 2.4 (95% CI: 1.7 – 3.5) hence the decision was made to keep this study in the final analyses. The final summary effect size of OR = 2.8 indicates a very strong relationship between bullying perpetration and drug use. For example, if a quarter of children were bullies and a quarter were drug users, this value of the OR would correspond to 40.88% of bullies becoming drug users, compared with 19.71% of non-bullies.

Given the heterogeneity in methodological features (e.g., location and sample size) of the studies included, heterogeneity tests were conducted. Cochran's test, *Q*, was significant at $p < .001$ level ($Q= 514.60$; $I^2= 99$), supporting the presence of high dispersion in effect size across studies. As already mentioned, this was expected given the variability in statistical controls used across studies.

FIGURE 1 ABOUT HERE

3.2.3 Bullying perpetration at school and drug use: publication bias analysis

We ran analyses for publication bias given the small number of studies included in this meta-analysis. Duval and Tweedie's trim-and-fill analysis exhibits the differences in effect sizes that could potentially be attributed to bias; the technique imputes effect sizes until the error distribution gets close to normality. In this way, the test offers the best estimate of the unbiased effect (Borenstein, Hedges, Higgins, & Rothstein, 2009). Results suggest that there were no differences in effect sizes attributable to bias. Under a fixed effect model, the point estimate for the combined studies did not differ when comparing the original and the adjusted estimate (in both cases it was *OR*= 2.94; *95%CI* 2.86 – 3.03). Correspondingly, under the random effect model, the values again did not vary (in both cases they were *OR*=2.82; *95%CI* 1.97 – 4.02). Based on the parameter of Duval and Tweedie's trim-and-fill, it seems that no studies are missing.

Additionally, Rosenthal's fail-safe N test is a technique for computing the number of missing studies that would be necessary to nullify the found effect. Small numbers of missing studies would reveal likelihood of biased effects. Test was equal 777.3, suggesting that it would be necessary to allocate and include 777.3 missing studies with no effects for every observed one to achieve the combined 2-tailed *p*-value exceeding 0.05. It therefore is highly unlikely that missing studies could alter the substantive conclusion.

3.2.4 The association between school bullying victimisation and drug use

Eleven studies were concerned with the association between bullying victimisation and drug use. Individual effect sizes across studies are shown in Figure 2. The adjusted effect size for the association between bullying victimisation and drug use, after controlling for covariates, was *OR*=1.790 (*95% CI* 1.382 – 2.318; *z*= 4.409 *p*<. 001). One study (Brown et al., 2008) provided a notably larger individual effect size, despite the eligibility of the study based on the inclusion criteria. Removal of this study marginally changed the summary effect size to an OR of 1.5 (95% CI: 1.3 – 1.9) hence the decision was made to keep this study in the final analyses. A summary effect size of OR = 1.8 indicates a moderate relationship between bullying

victimization and drug use. For example, if a quarter of children were victims and a quarter were drug users, this value of the OR would correspond to 33.69% of bullied youth becoming drug users, compared with 22.1% of non-bullied youth. Cochran's *Q* suggests substantial variability in the estimates between studies (Cochran's Q =220.682; p< .001; I^2= 95).

FIGURE 2 ABOUT HERE

3.2.5 Bullying victimisation at school and drug use: publication bias analysis

After running Duval and Tweedie's trim-and-fill procedure, there were no differences in effect sizes attributable to bias resulting from systematically missing studies from the meta-analysis. Results revealed that under a fixed effect model, the point estimate for the combined studies did not vary when comparing the original and the adjusted estimated (in both cases it was *OR*=1.78; *95%CI* 1.72 – 1.83). Correspondingly, under a random effect model, the point estimate for the combined studies did not vary (in both cases it was OR=1.78; *95%CI* 1.38 – 2.31). In other words, Duval and Tweedie's trim-and-fill procedure shows that results cannot be invalidated because of publication bias.

Rosenthal's fail-safe N test was equal to 141.3, suggesting that it would be necessary to allocate and include 141.3 missing studies with no effects for every observed one to achieve the combined 2-tailed *p*-value exceeding .05. After a systematic review that involved a search on 20 databases from different countries and in different languages, it seems improbable that this huge number of studies could be available yet missed.

4. DISCUSSION

4.1 Conclusions and Implications for Policy and Practice

This meta-analysis provides support for the strong link between bullying at school and drug use. Specifically, bullies are roughly three times more likely to take drugs compared with non-involved children. Victims, on the other hand, are roughly twice as likely to take drugs compared with non-involved youth. Although the correlational nature of these cross-sectional studies precludes any causal inference, they are consistent with the notion that bullying is an important childhood risk for the physical and mental health of students (Bradshaw et al, 2013; Brown et al., 2008). Notably, meta-analytic results are based on an adjusted effect size,

indicating the association of school bullying with drug use over and above the impact of other major childhood risk factors, thus providing the independent bullying-drug link.

Meta-analytic results are concordant with earlier research that children involved in school bullying as either perpetrators or victims are at increased risk for drug use (Sullivan, Farrell, & Kliewer, 2006). In fact, both cross-sectional and longitudinal studies suggest that bullying perpetration at school is a strong co-current correlate (Bradshaw et al., 2013) or predictor of future drug use (Farrington & Ttofi, 2011). Findings are also comparable with previous results in terms of the idea that perpetrators show more externalising problems than victims. For instance, previous meta-analyses showed that the perpetration of bullying was more predictive of violence and offending later in life than victimisation (Ttofi, Farrington, Lösel, & Loeber, 2011b;Ttofi, Farrington, & Lösel, 2012). In any case, following our results, the odds of victims for drug use are almost double those for non-involved. Although the explanations given for the drug-bullying victimisation association are not part of this research, it seems plausible that drugs aid victims in coping with the negative effects of rejection (Carlyle & Steinman 2007).

Interestingly, the magnitude of the effect sizes in the present meta-analysis is similar to earlier meta-analytic findings on the drug-crime link among adults (Bennett, Holloway, & Farrington, 2008). Although these results represent a different population, it is quite reasonable to hypothesise that externalising problem behaviours such as bullying, criminal behaviour and drug use may be viewed as manifestations of the same underlying theoretical construct expressed differently across life (Farrington, 1997; Loeber et al., 1998; Ttofi et al., 2012).

Children involved in school bullying are children that could present other associated risks for their future development. Our meta-analytic investigation, based on a thorough systematic review, supports that school bullies and their victims have a heightened risk of being involved in drug use. Therefore, intervention strategies aiming at tackling school bullying and promoting safer school communities should be promoted. It can be inferred that effective bullying prevention programmes could be seen as having a potentially positive effect in reducing associated problem behaviours such as drug use.

To the best of our knowledge, this is the first meta-analytic investigation to establish a clear link between bullying and drug use. There is a higher prevalence rate of drug use among bullies and their victims compared with non-aggressive children. To an extent, this is expectable given that existing research supports the comorbidity of aggressive, violent and other externalizing problem behaviors (Loeber, Farrington, Stouthamer-Loeber, & van Kammen, 1998). An important question arising from this research is why such a link exists. What are the mechanisms linking bullying perpetration and victimization with drug use? This question cannot be addressed from the current study findings although it could be hypothesized that this is related to the marked shared variance in risk factors predicting these co-morbid behaviors (Bebbington et al., 2004; Brown et al., 2008; Farrington, 2002).

Childhood bullying is a significant risk factor for adverse outcomes in adult life (Ttofi et al., 2011, 2012) while substance use early in youth, combined with other childhood risks, is predictive of adult substance dependence (Sartor, Lynskey, Heath, Jacob & True, 2006). Therefore, this meta-analysis highlights the importance of early intervention research in targeting school aggressive behavior and associated externalizing problems at root before they develop into more serious problems later in life. Current meta-analytic findings have important implications for policy and practice. They underline the need for school communities and relevant authorities to create a violence-free school environment and the need to devise and implement measures that promote the healthy psychosocial development of youth. More efforts should also be made to implement evidence-based policies and programmes with individual bullies and victims, perhaps based on child skills training (Lösel & Beelmann, 2003) and family-based programmes (Farrington & Welsh, 2003). Both bullying prevention programme and more general multi-component programmes may be equally beneficial for multi-problem children (Ttofi et al., 2012), reducing aggression among schoolchildren as well as other comorbid behaviours such as drug use. In fact, early intervention aimed at preventing or stopping school bullying should be understood as an early and cost-effective way to counteract risks and prevent antisocial behaviour, including drug use (Beelmann & Lösel, 2006; Farrington, 1993; Gottfredson, Wilson, & Najaka, 2002).

4.2 Limitations and future research

Despite the large number of studies indicating a link between bullying and drug use, to the best of our knowledge, this is the first quantitative synthesis of the existing research. The results of this meta-analytic investigation show that the primary studies included were mainly based national and international large-scale surveys that intended to cover many aspects of schoolchildren's health and psychosocial development. While the epidemiological nature of many of the primary studies is a positive feature supporting the meta-analytic synthesis of homogeneous studies, it also comes with some methodological concerns. Specifically, many of the included studies were based on the Global School-based Student Health Survey (GSHS) or the Health Behaviour in School-aged Children Survey (HBSC). Both surveys use only few items to measure school bullying, meaning that important aspects may not be adequately covered. Although bullying shares defining features with peer aggression and harassment, the distinctions among them point towards different legal remedies and policy repercussions (Cascardi, Brown, Iannarone, & Cardona, 2014), including practical methodological implications since broad definitions of school bullying could be responsible for overestimated prevalence rates (Cornell & Cole, 2012).

One of the initial aims of this meta-analysis was to report separate effect sizes for males and females as well as separate effect sizes for different ethnic groups. However, only one study reported data for different ethnic groups and only two studies reported gender-specific effect sizes. These limitations were present in many other covariates, making it impossible to run analyses to explain the heterogeneity of our findings.

It would be ideal if future research drew safe conclusions about variability in effect sizes based on different moderators such as gender and ethnicity. Future research should also investigate the comorbidity of bullying and drug use in low-middle income countries, especially given the higher prevalence rates of bullying in these countries (Fleming & Jacobsen, 2009a; Muula et al., 2009).

We suggest that future research should pay more attention to bully-victims and investigate the actual rates of drug use among this specific group. Due to the fact that they tend

to attack when victimised, they can also be targets of retaliation in a vicious circle of aggression (Nansel et al., 2001). Bully-victims are also more rejected than bullies or victims, experiencing frequent isolation and avoidance (Juvonen et al., 2003). Bearing in mind that it has been identified as the most at risk group (Schwartz, 2000), more research needs to be carried out into their characteristics and comorbid risks.

Finally, future research should focus on the development of better instruments for measuring school bullying, including multi-informant measures (surveys) that may potentially achieve a more precise perspective on the phenomenon of school bullying (Crothers & Levinson, 2004). This will enable investigations into whether school bullies are more likely to use drugs compared with children who score high on general aggression instruments and potentially address whether this differentiation is really necessary (Finkelhor, Turner, & Hamby, 2012).

REFERENCES

References marked with asterisks (**) indicate studies included in the meta-analysis.

**Adelmann, P. K. (2005). Social environmental factors and preteen health-related behaviors. *The Journal of Adolescent Health*, *36*(1), 36–47. doi:10.1016/j.jadohealth.2003.07.027

Agnew, R. (1992). Foundation for a General Strain Theory of Crime and Delinquency. *Criminology*, *30*(1), 47–87.

Alexander, L., Currie, C., & Mellor, A. (2004). *Bullying : Health , Well-being and Risk Behaviours* (No. HBSC Briefing Paper 10) (pp. 1–6).

Azevedo da Silva, R., Cardoso, T., Jansen, K., Dias de Mattos, L., Vanila, R., Sica, A. L., … Tavares, R. (2012). Bullying and Associated Factors in Adolescents Aged 11 to 15 Years. *Trends in Psychiatry and Psychotherapy*, *34*(1), 19–24.

Bebbington, P. E., Bhugra, D., Brugha, T., Singleton, N., Farrell, M., Jenkins, R., … Meltzer, H. (2004). Psychosis, Victimisation and Childhood Disadvantage: Evidence from the Second British National Survey of Psychiatric Morbidity. *The British Journal of Psychiatry*, *185*, 220–226. doi:10.1192/bjp.185.3.220

Beelmann, A., & Lösel, F. (2006). Child Social Skills Training in Developmental Crime Prevention : Effects on Antisocial Behavior and Social Competence. *Psicothema*, *18*, 603–610.

Bennett, T., Holloway, K., & Farrington, D. (2008). The statistical association between drug misuse and crime: A meta-analysis. *Aggression and Violent Behavior*, *13*(2), 107–118. doi:10.1016/j.avb.2008.02.001

Beran, T. N., Hughes, G., & Lupart, J. (2008). A Model of Achievement and Bullying: Analyses of the Canadian National Longitudinal Survey of Children and Youth Data. *Educational Research*, *50*(1), 25–39. doi:10.1080/00131880801920379

Birkett, M., Espelage, D. L., & Koenig, B. (2009). LGB and Questioning Students in Schools: The Moderating Effects of Homophobic Bullying and School Climate on Negative Outcomes. *Journal of Youth and Adolescence*, *38*(7), 989–1000. doi:10.1007/s10964-008-9389-1

Borenstein, M., Hedges, L., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to Meta-Analysis* (pp. i – 421). Chichester, UK: John Wiley & Sons, Ltd.

**Bradshaw, C. P., Waasdorp, T. E., Goldweber, A., & Johnson, S. L. (2013). Bullies, gangs, drugs, and school: Understanding the overlap and the role of ethnicity and urbanicity. *Journal of Youth and Adolescence*, *42*(2), 220–34. doi:10.1007/s10964-012-9863-7

**Brown, D. W., Riley, L., Butchart, A., & Kann, L. (2008). Bullying Among Youth from Eight African Countries and Associations with Adverse Health Behaviors. *Pediatric Health*, *2*(3), 289–299.

Brunner, R., Parzer, P., Haffner, J., Steen, R., Roos, J., Klett, M., & Resch, F. (2007). Prevalence and Psychological Correlates of Occasional and Repetitive Deliberate Self-

Harm in Adolescents. *Archives of Pediatrics & Adolescent Medicine*, *161*(7), 641–9. doi:10.1001/archpedi.161.7.641

Bui, K. V., Ellickson, P. L., & Bell, R. M. (2000). Cross-lagged relationships among adolescent problem drug use, delinquent behavior, and emotional distress. *Journal of Drug Issues*, *30*(2), 283–303.

Carlyle, K. E., & Steinman, K. J. (2007). Demographic Differences in the Correlates of Adolescent Bullying at School. *Journal of School Health*, *77*(9), 623–629.

Carmona-Torres, J. A., Cangas, A. J., García, G. R., Langer, A. I., & Zárate, R. (2012). Early Detection of Drug Use and Bullying in Secondary School Children by Using a Three-dimensional Simulation Program. *Cyberpsychology, Behavior and Social Networking*, *15*(1), 43–9. doi:10.1089/cyber.2010.0589

Cascardi, M., Brown, C., Iannarone, M., & Cardona, N. (2014). The Problem With Overly Broad Definitions of Bullying: Implications for the Schoolhouse, the Statehouse, and the Ivory Tower. *Journal of School Violence*, *13*(3), 253–276. doi:10.1080/15388220.2013.846861

Centers for Disease Control and Prevention. (2014). Bullying surveillance among school-aged children: Uniform definitions and recommended data elements. Centers for Disease Control and Prevention (CDC), Washington, DC: Author.

Cook, C. R., Williams, K. R., Guerra, N. G., Kim, T. E., & Sadek, S. (2010). Predictors of Bullying and Victimization in Childhood and Adolescence: A Meta-Analytic Investigation. *School Psychology Quarterly*, *25*(2), 65–83. doi:10.1037/a0020149

Cornell, D. G., & Cole, J. C. M. (2012). Assessment of Bullying. In S. R. Jimerson & M. J. Furlong (Eds.), *Handbook of School Violence and School Safety. From Research to Practice* (Second., pp. 289–303). New York: Routledge.

Craig, W., Harel-Fisch, Y., Fogel-Grinvald, H., Dostaler, S., Hetland, J., Simons-Morton, B., … Pickett, W. (2009). A Cross-national Profile of Bullying and Victimization among Adolescents in 40 Countries. *International Journal of Public Health*, *54*(S2), 216–24. doi:10.1007/s00038-009-5413-9

Crothers, L. M., & Levinson, E. M. (2004). Assessment of Bullying: A Review of Methods and Instruments. *Assessment & Diagnosis*, *82*, 496–503.

Cruzeiro, A. L. S., & Azevedo da Silva, R. (2008). Prevalence and Factors Associated with Behavioral Disorders in Adolescents: A Population-based Study. *Cadernos de Saude Pública*, *24*(9), 2013–2020.

Cuevas, C. A., Finkelhor, D., Turner, H. A., & Ormrod, R. K. (2007). Juvenile Delinquency and Victimization: A Theoretical Typology. *Journal of Interpersonal Violence*, *22*(12), 1581–602. doi:10.1177/0886260507306498

Cullen, F. T., Unnever, J. D., Hartman, J. L., Turner, M. G., & Agnew, R. (2008). Gender, Bullying Victimization, and Juvenile Delinquency: A Test of General Strain Theory. *Victims & Offenders*, *3*(4), 346–364. doi:10.1080/15564880802338468

Duffecy, J., Bleil, M. E., Labott, S. M., Browne, A., & Galvani, C. (2008). Psychopathology in Adolescents Presenting for Laparoscopic Banding. *Journal of Adolescent Health*, *43*(6), 623–625. doi:10.1016/j.jadohealth.2008.05.007

**Edwards, V. (2002). *Adolescent Substance Use and Bullying : Is There a Link?*. University of Leicester.

Farrington, D. P. (1993). Understanding and Preventing Bullying. *Crime and Justice*, *17*, 381–458.

Farrington, D. P. (1997). Human Development and Criminal Careers. In M. Maguire, R. Morgan, & R. Reiner (Eds.), *The Oxford Handbook of Criminology* (Second.). Oxford.

Farrington, D. P. (2002). Multiple risk factors for multiple problem violent boys. In R. R. Corrado, R. Roesch, S. D. Hart, & J. K. Gierowski (Eds.), Multi-problem violent youth: A foundation for comparative research on needs, interventions and outcomes. Series I: Life and Behavioural Sciences, volume 324. (pp. 23–34) Netherlands: IOS Press.

Farrington, D. P. (2005). Childhood Origins of Antisocial Behavior. *Clinical Psychology & Psychotherapy*, *12*(3), 177–190. doi:10.1002/cpp.448

Farrington, D. P., & Ttofi, M. M. (2011). Bullying as a predictor of offending , violence and later life outcomes. *Criminal Behaviour and Mental Health*, *21*, 90–98.

Farrington, D. P., & Welsh, B. C. (2003). Family-based Prevention of Offending: A Meta-analysis. *Australian and New Zealand Journal of Criminology*, *36*(2), 127–151. doi:10.1375/acri.36.2.127

Fekkes, M., Pijpers, F., Fredriks, A. M., Vogels, T., & Verloove-Vanhorick, P. (2006). Do bullied children get ill, or do ill children get bullied? A prospective cohort study on the relationship between bullying and health-related symptoms. *Pediatrics*, *117*(5), 1568–1574. doi:10.1542/peds.2005-0187

**Fernando, S. (2009). *The Association Between Bully Victimization and Risky Behaviors among Youth*. Master's thesis, University of Massachusetts.

Finkelhor, D., Turner, H. A., & Hamby, S. (2012). Let's Prevent Peer Victimization, Not just Bullying. *Child Abuse & Neglect*, 36 (4), 271 - 274. doi:10.1016/j.chiabu.2011.12.001

Fleming, L. C., & Jacobsen, K. H. (2009a). Bullying among Middle-school Students in Low and Middle Income Countries. *Health Promotion International*, *25*(1), 73–84. doi:10.1093/heapro/dap046

Fleming, L. C., & Jacobsen, K. H. (2009b). Bullying and Symptoms of Depression in Chilean Middle School Students. *Journal of School Health*, *79*(3), 130–137.

Garcia Continente, X., Pérez Giménez, A., & Nebot Adell, M. (2010). Factores Relacionados con el Acoso Escolar (Bullying) en los Adolescentes de Barcelona. *Gaceta Sanitaria / S.E.S.P.A.S*, *24*(2), 103–108. doi:10.1016/j.gaceta.2009.09.017

Gini, G., & Pozzoli, T. (2009). Association Between Bullying and Psychosomatic Problems: A Meta-analysis. *Pediatrics*, *123*, 1059–1065. doi:10.1542/peds.2008-1215

Goldstein, P. J. (1985). The drugs violence nexus: a tripartite conceptual framework. *Journal of Drug Issues*, *15*(4), 493–506.

Gottfredson, D., Wilson, D. B., & Najaka, S. (2002). School-Based Crime Prevention. In L. W. Sherman, D. P. Farrington, B. C. Welsh, & D. MacKenzie (Eds.), *Evidence-Based Crime Prevention* (pp. 56–164). London: Routledge.

Gruber, J. E., & Fineran, S. (2007). The Impact of Bullying and Sexual Harassment on Middle and High School Girls. *Violence Against Women*, *13*(6), 627–643. doi:10.1177/1077801207301557

Gruber, J. E., & Fineran, S. (2008). Comparing the Impact of Bullying and Sexual Harassment Victimization on the Mental and Physical Health of Adolescents. *Sex Roles*, *59*(1-2), 1–13. doi:10.1007/s11199-008-9431-5

Hanisch, K. A., & Hulin, C. L. (1991). General Attitudes and Organizational Withdrawal: An Evaluation of a Causal Model. *Journal of Vocational Behavior*, *39*(1), 110–128. doi:10.1016/0001-8791(91)90006-8

Hay, C., & Meldrum, R. (2010). Bullying victimization and adolescent self-harm: Testing hypotheses from general strain theory. *Journal of Youth and Adolescence*, *39*(5), 446–459. doi:10.1007/s10964-009-9502-0

Hinduja, S., & Patchin, J. W. (2008). Cyberbullying: An Exploratory Analysis of Factors Related to Offending and Victimization. *Deviant Behaviour*, *29*, 129 –156.

Jablonska, B., & Lindberg, L. (2007). Risk Behaviours, Victimisation and Mental Distress among Adolescents in Different Family Structures. *Social Psychiatry and Psychiatric Epidemiology*, *42*(8), 656–663. doi:10.1007/s00127-007-0210-3

Juvonen, J., Graham, S., & Schuster, M. A. (2003). Bullying among Young Adolescents: The Strong, the Weak, and the Troubled. *Pediatrics*, *112*, 1231–1238.

Kaltiala-Heino, R., Marttunen, M., Rantanen, P., & Rimpelä, M. (2003). Early Puberty is Associated with Mental Health Problems in Middle Adolescence. *Social Science & Medicine*, *57*(6), 1055–1064. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12878105

**Kaltiala-Heino, R., Rimpelä, M., Rantanen, P., & Rimpelä, A. (2000). Bullying at School: An Indicator of Adolescents at Risk for Mental Disorders. *Journal of Adolescence*, *23*(6), 661–764. doi:10.1006/jado.2000.0351

Konu, A. I., Lintonen, T. P., & Rimpelä, M. K. (2002). Factors Associated with Schoolchildren's General Subjective Well-being. *Health Education Research*, *17*(2), 155–165. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12036232

Konu, A., & Lintonen, T. (2006). Theory-based Survey Analysis of Well-being in Secondary Schools in Finland. *Health Promotion International*, *21*(1), 27–36. doi:10.1093/heapro/dai028

Lambert, P., Scourfield, J., Smalley, N., & Jones, R. (2008). The Social Context of School Bullying: Evidence from a Survey of Children in South Wales. *Research Papers in Education*, *23*(3), 269–291. doi:10.1080/02671520701809866

Lazarus, R. S. (1993). Coping theory and research: past, present, and future. *Psychosomatic Medicine*, *55*(3), 234–247. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8346332

Levin, K. A. (2006). Study design III: Cross-sectional studies. *Evidence-Based Dentistry*, *7*, 24–25. doi:10.1038/sj.ebd.6400375

**Liang, H., Flisher, A. J., & Lombard, C. J. (2007). Bullying, Violence, and Risk Behavior in South African School Students. *Child Abuse & Neglect*, *31*(2), 161–171. doi:10.1016/j.chiabu.2006.08.007

Loeber, R., Farrington, D. P., Stouthamer-Loeber, M., & Van Kammen, W. B. (1998). Multiple risk factors for multi-problemboys: Co-ocurrence of delinquency, substance use, attention deficit, conduct problems, physical aggression, covert behavior, depressed mood, and shy/withdrawn behavior. In R. Jessor (Ed.), *New Perspectives on Adolescent Risk Behaviour* (pp. 90–149). Cambridge: Cambridge University Press.

Lösel, F., & Beelmann, A. (2003). Effects of Child Skills Training in Preventing Antisocial Behavior: A Systematic Review of Randomized Evaluations. *The ANNALS of the American Academy of Political and Social Science*, *587*(1), 84–109. doi:10.1177/0002716202250793

Lösel, F., & Beelmann, A. (2006). Child Social Skills Training. In B. C. Welsh & D. P. Farrington (Eds.), *Preventing Crime. What works for Children, Offenders, Victims and Places.* (pp. 32–54). Dordrecht, The Netherlands: Springer.

Luk, J. W., Wang, J., & Simons-Morton, B. G. (2010). Bullying Victimization and Substance Use among U.S. Adolescents: Mediation by Depression. *Prevention Science*, *11*(4), 355–359. doi:10.1007/s11121-010-0179-0

Luk, J. W., Wang, J., & Simons-Morton, B. G. (2012). The co-occurrence of substance use and bullying behaviors among U.S. adolescents: understanding demographic characteristics and social influences. *Journal of Adolescence*, *35*(5), 1351–60. doi:10.1016/j.adolescence.2012.05.003

Luukkonen, A. (2010). *Bullying Behaviour in Relation to Psychiatric Disorders, Suicidality and Criminal Offences. A study of Under-age Adolescent Inpatients in Northern Finland*. University of Oulu.

Martinelli, V., Brondino, N., Rossi, S., Panigati, R., Magnani, R., Cappucciati, M., Vecchia, L., Tinelli, S., Emanuele, E., & Politi, P. (2011). Bullying Behaviours among Students in Pavia, Italy: Prevalence and Association with Stress and Cannabis Use. *Epidemiology and Psychiatric Sciences*, *20*(4), 339–343. doi:10.1017/S2045796011000461

McMahon, E. M., Reulbach, U., Corcoran, P., Keely, H. S., Perry, I. J., & Arensman, E. (2010). Factors Associated with Deliberate Self-harm among Irish Adolescents. *Psychological Medicine*, *40*(11), 1811–1819.

**McMahon, E. M., Reulbach, U., Keeley, H., Perry, I. J., & Arensman, E. (2010). Bullying Victimisation, Self Harm and Associated Factors in Irish Adolescent Boys. *Social Science & Medicine*, *11*, 490–7. doi:10.1016/j.socscimed.2011.12.001

Messerschmidt, J. W. (2011). The Struggle for Heterofeminine Recognition: Bullying, Embodiment, and Reactive Sexual Offending by Adolescent Girls. *Feminist Criminology*, *6*(3), 203–233. doi:10.1177/1557085111408062

Moon, B., & Alarid, L. F. (2014). School Bullying, Low Self-Control, and Opportunity. *Journal of Interpersonal Violence*, 1–18. doi:10.1177/0886260514536281

Murray, J., Farrington, D. P., & Eisner, M. P. (2009). Drawing conclusions about causes from systematic reviews of risk factors: The Cambridge Quality Checklists. *Journal of Experimental Criminology*, *5*(1), 1–23. doi:10.1007/s11292-008-9066-0

Muula, A. S., Herring, P., Siziya, S., & Rudatsikira, E. (2009). Bullying Victimization and PhysicalFfighting among Venezuelan Adolescents in Barinas: Results from the Global School-Based Health Survey 2003. *Italian Journal of Pediatrics*, *5*, 1–5. doi:10.1186/1824-7288-35-38

Nansel, T. R., Overpeck, M., Pilla, R. S., Ruan, W. J., Simons-Morton, B., & Scheidt, P. (2001). Bullying Behaviors Among US Youth: Prevalence and Association with Psychosocial Adjustment. *JAMA*, *285*(16), 2094–2100.

Niemelä, S., Brunstein-Klomek, A., Sillanmäki, L., Helenius, H., Piha, J., Kumpulainen, K., … Sourander, A. (2011). Childhood bullying behaviors at age eight and substance use at age 18 among males. A nationwide prospective study. *Addictive Behaviors*, *36*(3), 256–60. doi:10.1016/j.addbeh.2010.10.012

Peeters, M., Cillessen, A. H. N., & Scholte, R. H. J. (2010). Clueless or Powerful? Identifying Subtypes of Bullies in Adolescence. *Journal of Youth and Adolescence*, *39*(9), 1041–1052. doi:10.1007/s10964-009-9478-9

**Peltzer, K., & Pengpid, S. (2014). Cannabis Use and Its Social Correlates among In-School Adolescents in Algeria, Morocco, Palestine, Peru, and Tonga. *Mediterranean Journal of Social Sciences*, *5*(9), 558–563. doi:10.5901/mjss.2014.v5n9p558

**Pepler, D. J., Craig, W. M., Connolly, J. A., & Henderson, K. (2002). Bullying, Sexual Harassment, Dating Violence, and Substance Use among Adolescents. In C. Wekerle & A. M. Wall (Eds.), *The Violence and Addiction Equation: Theoretical and Clinical Issues in Substance Abuse and Relationship Violence* (pp. 153–168). New York: Brunner-Routledge.

Pérez Milena, A., Jiménez Pulido, I., Leal Helmling, F. J., Perez Milena, A., Martínez Fernáandez, M. L., & Alvaro Nieto, C. (2010). The Relationship between the Consumption of Alcohol, Tobacco, and Illegal Drugs During Adolescence and School Violence. *Medicina Familiar Andalucía*, *11*(1), 21–29.

Peterson, R. A., & Brown, S. P. (2005). On the use of beta coefficients in meta-analysis. *The Journal of Applied Psychology*, *90*(1), 175–81. doi:10.1037/0021-9010.90.1.175

Pranjic, N., & Bajraktarevic, A. (2010). Depression and suicide ideation among secondary school adolescents involved in school bullying. *Primary Health Care Research & Development*, *11*(1998), 349–362.

Radliff, K. M., Wheaton, J. E., Robinson, K., & Morris, J. (2012). Illuminating the Relationship Between Bullying and Substance Use among Middle and High School Youth. *Addictive Behaviors*, *37*(4), 569–572. doi:10.1016/j.addbeh.2012.01.001

Rivers, I., Poteat, V. P., Noret, N., & Ashurst, N. (2009). Observing Bullying at School: The Mental Health Implications of Witness Status. *School Psychology Quarterly*, *24*(4), 211–223. doi:10.1037/a0018164

Roland, E. (2002). Aggression , Depression , and Bullying Others. *Aggressive Behavior*, *28*(3), 198–206. doi:10.1002/ab.90022

Romani, F., & Gutiérrez, C. (2010). Self-reporting of Bullying Victimization and Related Factors in Peruvian Students of Secondary Education, 2007. *Revista Peruana de Epidemiología*, *14*(3), 1–9.

**Romera, E. M., Del Rey, R., & Ortega, R. (2011). Factors Associated with Involvement in Bullying: A Study in Nicaragua. *Psychosocial Intervention*, *20*(2), 161–170.

Rudatsikira, E., Muula, A. S., & Siziya, S. (2008). Prevalence and Correlates of Physical Fighting among School-going Adolescents in Santiago, Chile. *Revista Brasilera de Psiquiatría*, *30*(3), 197–202.

Saluja, G., Iachan, R., Scheidt, P. C., Overpeck, M. D., Sun, W., & Giedd, J. N. (2004). Prevalence of and Risk Factors for Depressive Symptoms Among Young Adolescents. *Archives of Pediatrics & Adolescent Medicine*, *158*, 760–765.

Santinello, M., & Vieno, A. (2008). Comportamenti a Rischio e Sintomi Psicologici e Somatici Negli Adolescenti Italiani. *Psicoterapia Cognitiva E Comportamentale*, *14*(1), 11–26.

Sartor, C.E., Lynskey, M.T., Heath, A.C., Jacob, T., & True, W. (2006). The role of childhood risk factors in initiation of alcohol use and progression to alcohol dependence. Addiction, 102, 216 - 225.

Schwartz, D. (2000). Subtypes of Victims and Aggressors in Children's Peer Groups. *Journal of Abnormal Child Psychology*, *28*(2), 181–192.

Sedgwick, P. (2014). Cross sectional studies: advantages and disadvantages. *BMJ*, *348*(March), g2276–g2276. doi:10.1136/bmj.g2276

**Siziya, S., Muula, A. S., Besa, C., Babaniyi, O., Songolo, P., Kankiza, N., & Rudatsikira, E. (2013). Cannabis use and its socio-demographic correlates among in-school adolescents in Zambia. *Italian Journal of Pediatrics*, *39*(1), 13. doi:10.1186/1824-7288-39-13

Sobotkova, V., Blatny, M., Jelinek, M., & Hrdlicka, M. (2012). Antisocial behavior in adolescence: Typology and relation to family context. *The Journal of Early Adolescence*, 33 (8), 1091 - 1115. doi:10.1177/0272431612445377

**Srabstein, J., & Piazza, T. (2008). Public Health, Safety and Educational Risks Associated with Bullying Behaviors in American Adolescents. *International Journal of Adolescent Medicine and Health*, *20*(2), 223–233.

Stein, J. A., Dukes, R. L., & Warren, J. I. (2007). Adolescent Male Bullies, Victims, and Bully-Victims: A Comparison of Psychosocial and Behavioral Characteristics. *Journal of Pediatric Psychology*, *32*(3), 273–282. doi:10.1093/jpepsy/jsl023

Sullivan, T. N., Farrell, A. D., & Kliewer, W. (2006). Peer Victimization in Early Adolescence: Association between Physical and Relational Victimization and Drug use, Aggression, and Delinquent Behaviors among Urban Middle School Students. *Developmental Psychopathology.*, *18*, 119–137.

Tharp-taylor, S., Haviland, A., & D'Amico, E. J. (2009). Victimization from Mental and Physical Bullying and Substance Use in Early Adolescence. *Addictive Behaviors*, *34*(6-7), 561–567. doi:10.1016/j.addbeh.2009.03.012

Ttofi, M. M., & Farrington, D. P. (2008). Bullying: Short-Term and Long-Term Effects, and the Importance of Defiance Theory in Explanation and Prevention. *Victims & Offenders*, *3*(2-3), 289–312. doi:10.1080/15564880802143397

Ttofi, M. M., Farrington, D. P., & Lösel, F. (2012). School Bullying as a Predictor of Violence Later in Life: A Systematic Review and Meta-Analysis of Prospective Longitudinal Studies. *Aggression and Violent Behavior*, 17 (5), 405 - 418.

Ttofi, M. M., Farrington, D. P., Lösel, F., & Loeber, R. (2011a). Do the Victims of School Bullies Tend to Become Depressed Later in Life? A Systematic Review and Meta-Analysis of Longitudinal Studies. *Journal of Aggresion, Conflict and Peace Research*, *3*(2), 63–73. doi:10.1108/17596591111132873

Ttofi, M. M., Farrington, D. P., Lösel, F., & Loeber, R. (2011b). The predictive efficiency of school bullying versus later offending: A systematic / meta-analytic review of longitudinal studies. *Criminal Behaviour and Mental Health*, *21*, 80–89.

Ttofi, M. M., Farrington, D. P., Lösel, F., & Loeber, R. (2011c). The predictive efficiency of school bullying versus later offending: A systematic / meta-analytic review of longitudinal studies. *Criminal Behaviour and Mental Health*, *89*, 80–89.

Vaughn, M. G., Fu, Q., Bender, K., DeLisi, M., Beaver, K. M., Perron, B. E., & Howard, M. O. (2010). Psychiatric correlates of bullying in the United States: Findings from a national sample. *The Psychiatric Quarterly*, *81*(3), 183–95. doi:10.1007/s11126-010-9128-0

Volk, A., Craig, W., Boyce, W., & King, M. (2006). Adolescent Risk Correlates of Bullying and Different Types of Victimization. *International Journal of Adolescent Medicine and Health*, *18*, 575–586.

Wang, J., Iannotti, R. J., & Luk, J. W. (2012). Patterns of adolescent bullying behaviors: Physical, verbal, exclusion, rumour, and cyber. *Journal of School Psychology*, *50*, 521–534. doi:10.1016/j.jsp.2012.03.004

Waters, E., Wake, M., Toumbourou, J., Wright, M., & Salmon, L. (1999). Prevalence of Emotional and Physical Health Concerns amongst Young People in Victoria. *Journal of Paediatric Child Health*, *35*, 28–33.

Wei, H., Williams, J. H., Chen, J., & Chang, H. (2010). The Effects of Individual Characteristics, Teacher Practice, and School Organizational Factors on Students' Bullying: A Multilevel Analysis of Public Middle Schools in Taiwan. *Children and Youth Services Review*, *32*(1), 137–143. doi:10.1016/j.childyouth.2009.08.004

Wilson, D. B. (2009). Missing a critical piece of the pie: simple document search strategies inadequate for systematic reviews. *Journal of Experimental Criminology*, *5*(4), 429–440. doi:10.1007/s11292-009-9085-5

Yudko, E., Blanchard, D. C., Henrie, J. A., & Blanchard, R. J. (1997). Emerging themes in preclinical research on alcohol and aggression. *Recent Developments in Alcoholism : An Official Publication of the American Medical Society on Alcoholism, the Research Society on Alcoholism, and the National Council on Alcoholism*, *13*, 123–138.

Zaborskis, A., & Vareikiene, I. (2008). School Bullying and its Association with Health and Lifestyle among Children. *Medicina Kaunas*, *44*(3), 232–239.

Appendix Table A

Studies excluded from the meta-analyses

	Description of exclusion criteria
1	**Alexander, Currie, & Mellor, (2004).** The exact Ns for female and male bullies are not given. All that is indicated is that 16.2% of female bullies used cannabis compared with 9% of female non-bullies; and 16.7% of male bullies used cannabis versus 12.7% of male non-bullies (see penultimate page of the report)
2	**Azevedo da Silva et al., (2012).** Although the report offers information on the association of bullying victimisation and drug use, data is presented incomplete. They report means and standard deviations, and also percentages but sample size for subgroups are not reported (see p.21-22)
3	**Bebbington et al., (2004).** The sample population consisted of school children (aged 16 onwards) and also adults up to age 74 (p. 220)
4	**Birkett et al., (2009).** Data on drug use is included in a general report of alcohol consumption (p.993). Figure 4 (p.996) doesn't offer enough statistical information.
5	**Brunner et al., (2007).** Bullying and illicit drug use are both included as predictors for self-harm (Table 1 p.644) but statistical data on the association between bullying and drug use is not provided in this report (p.632-646).
6	**Carmona-Torres, Cangas, García, Langer, & Zárate, (2012)** The study compares a paper-based and computer-based questionnaire that aims to measure bullying and drug use. Psychometric properties of the two instruments and results from factor analyses are shown (p.44). The paper does not report the association between bullying and drug use. (See table 2 and 3 in p. 45-46).
7	**Carlyle & Steinman, (2007).** The concept substance use involves alcohol and cigarettes (p.625)
8	**Cruzeiro & Azevedo da Silva, (2008).** Bullying and drug use are used as predictors for conduct problems (relevant OR given in table 1, p.2015) but the association between both variables is not reported.
9	**Cuevas, Finkelhor, Turner, & Ormrod, (2007).** The outcome measure includes alcohol and drug combined (table 2 and 3 p. 1591 and 1592)
10	**Cullen, Unnever, Hartman, Turner, & Agnew, (2008).** Statistical information on bullying victimisation versus drug use is presented on table 2 (p. 355) but the outcome measure included both drug use and alcohol use (see p. 353)
11	**Duffecy, Bleil, Labott, Browne, & Galvani, (2008).** Data on bullying and drug use are presented in table 2 (p.624) but statistical information on the association between bullying and drug use is not provided in this report.
12	**Gruber & Fineran, (2007).** The study presents data on the association of bullying with substance abuse (table 3, p. 637) but it is not clear whether substance abuse includes only drugs. On p. 633 the authors refer to the questionnaire they used to measure substance abuse by Hanisch & Hulin, (1991) but the paper makes no mention of drug use at all. Additionally it is not helpful in clarifying what involves 'substance abuse'.
13	**Gruber & Fineran, (2008).** The study presents data on the association of bullying and substance abuse (table 3, p. 9), which involves alcohol and drug use combined (p. 6).
14	**Hinduja & Patchin, (2008).** It refers to cyber bullying (p.138) and also the consumption of drugs measure is combined with liquor use (p.140).
15	**Jablonska & Lindberg, (2007).** Although drug use is measured (p.657), the study did not regard the association between bullying and drug use. *OR* on drug use are given for adolescents who had different family structures (p.659).
16	**Kaltiala-Heino, Marttunen, Rantanen, & Rimpelä, (2003).** Data on bullying perpetration and substance use are presented on table 3 (p.1060) but the statistical information on their association is not presented.
17	**Konu & Lintonen, (2006).** The outcome drug use is not measured.
18	**Konu, Lintonen, & Rimpelä, (2002).** Although drug use is measured (Table 1, p.159), the study doesn't present statistical results regarding the association between bullying and drug use.
19	**Lambert et al., (2008).** Bullying victimisation was measured along with 'being badly treated'; and the equivalent for bullying perpetration (see p. 272).
20	**Luk, Wang, & Simons-Morton, (2010)** Substance use includes alcohol and drugs (p.356).
21	**Luk et al., (2012).** Although marijuana use is measured (p. 1354), the results refer to 'substance-using bullies'. The category of substance use, combine alcohol and marijuana (figure 1 and table 3, p.1356).
22	**Martinelli et al., (2011).** Data on bullying and cannabis use are presented in table 1 (p.341) but statistical

information on the association between them is not provided. The authors present results only for significant variables and results on cannabis use are not indicated because they were non significant (p.341).

23 **McMahon, Reulbach, Corcoran, et al., (2010).** Bullying perpetration and drug abuse are used as predictors for self harm (adjusted *OR*s are given on table 2, p. 4) but no statistical information is given on the association between bullying and drug abuse.

24 **Messerschmidt, (2011).** Qualitative study (p.207), which does not report statistical results for meta-analysis.

25 **Muula, Herring, Siziya, & Rudatsikira, (2009).** Although drug use is measured, its results are presented combined with alcohol use (p.2 and table 1 p.3). The association between bullying and drug (substance abuse) is not given in this report.

26 **Nansel et al., (2001).** The study reports information for alcohol and smoking instead of actual drugs (p.2098).

27 **Pérez Milena et al., (2010).** Table 2 (p. 27) gives the percentage of non-victims, victims and perpetrators who do drugs. However, the exact sample size of each group is not specified and the OR cannot be calculated (see also p. 23 where the percentage of each group is given, but there is an overlap between groups that total more than 100%).

28 **Peeters, Cillessen, & Scholte, (2010).** Excluded for two reasons: a) drug use and bullying are used as predictors for suicidal ideation but the association of the two predictors is not given (see table 2 p. 268); and b) also, bullying is part of a total score which also includes "abuse and taunting" (see table 2, p. 268).

29 **Rivers et al., (2009).** The outcome measure, substance use, includes both drugs and alcohol use (p.215).

30 **Romani & Gutiérrez, (2010).** Although the paper includes data on the association of school bullying and drug use, it was incomplete for effect sizes calculation. The author was contacted by mail, but the additional information is not yet available.

31 **Saluja et al., (2004).** Although drug use is measured (p.762). Bullying and drug use are both used as predictors for depression (see tables 2 and 3 p. 763), but the study didn't present statistical results regarding the association between bullying and drug use.

32 **Santinello & Vieno, (2008).** Although bullying perpetration and cannabis use are measured (p.15), their association is not presented in subsequent analyses.

33 **Sobotkova, Blatny, Jelinek, & Hrdlicka, (2012).** The study focuses on Antisocial behavior. Although the authors report results on marijuana use at school (see table 3 p.9), there is not measure (p.8) referring to Bullying behavior.

34 **Tharp-taylor, Haviland, & D'Amico, (2009).** The paper shows effect sizes for bullying victimisation versus drug use after controlling for prior drug use (see table 3b, p. 565). However, the study is excluded because Risk Ratios are presented and they cannot be included in the meta-analysis.

35 **Vaughn et al., (2010).** The sample involves individuals aged 18 or older.

36 **Volk, Craig, Boyce, & King, (2006).** The statistical information provided does not allow calculating effect sizes for all the categories defined for the meta-analysis.

37 **Wang, Iannotti, & Luk, (2012).** Substance use includes alcohol and drugs (p.525).

38 **Waters et al., (1999).** The outcome measure is 'drug concern' (see table 2, p.30) and the report does not provide statistical information for bullied children versus drug use (tables 3 and 4, p.31).

39 **Zaborskis & Vareikiene, (2008)** A translation of this report was required. However, the report with results in English is not yet available.

*Table 1: Characteristics of studies included in the systematic review**

	Systematic Review		Meta-analysis	
	Number of Studies	**%**	**Number of Studies**	**%**
Total	61	100%	13	100%
Included	22	36%	-	-
Excluded	39	64%	-	-
Age of the participants				
Less than 12 years old and more than 18 years old			2	16%
Between 12 and 18 years old			11	84%
Location of the sample studied				
Europe	22	36%	3	23%
North America	23	37%	5	39%
Asia	1	2%	-	-
Latin America	8	13%	1	8%
More than 1 low-income country (comparative)	3	5%	2	15%
Africa	3	5%	2	15%
Australia and New Zealand	1	2%	-	-
Type of Publication				
Journal	57	93%	10	77%
Book	1	2%	1	8%
Reports (Governmental)	1	2%	-	-
Academic Thesis	2	3%	2	15%
Language				
English	54	88%	12	92%
Spanish	4	6%	1	8%
Italian	1	2%	-	-
Lithuanian	1	2%	-	-
Portuguese	1	2%	-	-
Type of Measure				
Self-report	58	94%	13	100%
Life-story	1	2%	-	-
Interview	1	2%	-	-
More than 1 measure	1	2%	-	-
Role in Bullying				
Victims	26	43%	6	46%
Bullies (perpetrators)	7	11%	2	15%
Bullies (perpetrators) + Victims	12	20%	-	-
More than 2 roles measured	14	23%	5	39%
Not Measured	2	3%	-	-

* A fraction of these studies are included in the meta-analysis

Table 2: Adjusted effect sizes for school bullying and drug use[1]

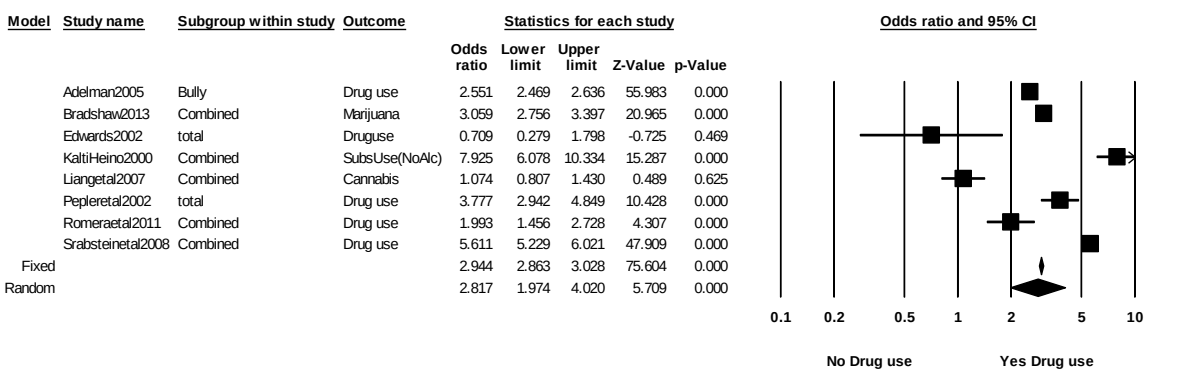
Study	Age and Sample Size	Adjusted effect size (Bullying perpetrators)	Adjusted effect size (Victims)	Covariates
1) Adelmann, (2005)	11 to 12 years (Sixth grade) N = 50148	**Drugs:** B: β= .25 p< .001 N= 50148[2]		Family violence, family substance abuse, illegal activity at school, victimization by others, family caring, teacher civility, student civility, school safety, caring by others.
2) Bradshaw et al., (2013)	12 to16 years (65.4%) 17 to 21 year (34.6%) N = 16302	**Marijuana use:** B: *OR*=2.77 (2.439-3.155) B/V: *OR*=3.71 (3.101-4.438)	**Marijuana use:** V: *OR*=1.30 (1.145-1.485) B/V: *OR*=3.71 (3.101-4.438)	Gender, age, African American ethnicity, victimization, Ease of access to substance, school enrolment, % minorities in school, school suspensions, urban schools.
3) Brown et al., (2008)	13 to 15 years N = 26510		**Drug use:** V (bullied 6-9 times in last month): *OR*= 6.1 (4.6–8.2) V (bullied 10 or more times in last month): *OR*=10.8 (8.4–13.9)	Age and sex
4) Edwards (2002)	M_{age}=14.33 *SD*=.66 N = 263	**Use of stimulants:** C: 13 [12.5% of *N*=104] B: 4 [9.8% of *N*=41] B/V: 4 [8.7% of *N*=46]	**Use of stimulants:** C: 13 [12.5% of *N*=104] V: 9 [13.4% of *N*=67] B/V: 4 [8.7% of *N*=46]	Not specified
5) Fernando (2009)	12 to18 years (High school) N = 3131		**Used marijuana** **White** V: *OR*=1.13; *95%CI* (0.87-1.46) **Hispanic** V: *OR*=1.14; *95%CI* (0.63-2.08) **Other** V: *OR*=1.49; *95%CI* (0.89-2.49) **Used marijuana at school**	Age and gender

[1] Abbreviations: *ES*, Effect size; *OR*, Odd Ratio; (confidence interval); *M*, mean; *SD*, standard deviation; *SE*, standard error; *r*, Pearson correlation; β, Beta correlation; V, victims; C, children non-involved in bullying; B, bullies or perpetrators; B/V, bully-victims.

[2] β was inputted in CMA software as a correlation coefficient. In fact, it should be said that regression coefficients and correlation coefficients are quite similar, though their distribution is different. This assumption was also confirmed by Peterson & Brown, (2005)

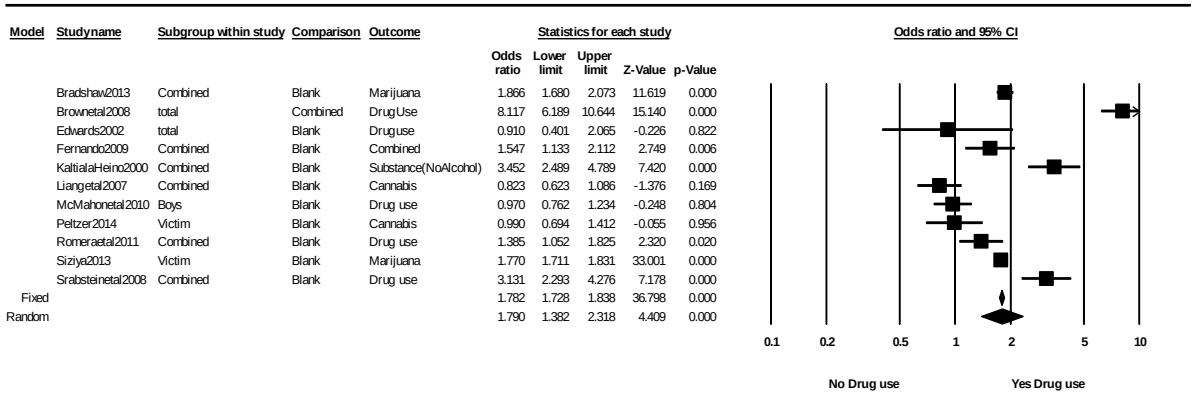
			White V: *OR*=1.47; 95%I/ (0.88-2.44) **Hispanic** V: *OR*=3.20 (1.43-7.17) **Other** V: *OR*=3.01 (1.36-6.69)	
6) Kaltiala-Heino et al., (2000)	M_{age}=15.3 *SD*=0.6 N = 17643	**Use of other substances than alcohol** B: *OR*=8.2 (6.1-11.2) B/V: *OR*=7.1 (7.1-12.2)	**Use of other substances than alcohol** V: *OR*= 2.3 (1.5-3.4) B/V: *OR*=7.1 (7.1-12.2)	Age, sex, family structure and parental education
7) Liang et al., (2007)	Two subgroups: M_{age}= 14.2 years (grade 10) M_{age}= 17.4 (grade 11) N = 5074	**Cannabis** B: *OR*=1.17 (0.80-1.71) B/V: *OR*=0.96 (0.62-1.48)	**Cannabis** V: *OR*=0.74 (0.52-1.07) B/V: *OR*=0.96 (.62-1.48)	Fighting, weapon carrying, suicidal ideation, suicide attempt, theft, vandalism, walking alone, risky passenger, risky driver, smoking, alcohol
8) McMahon et al., (2010)	15 to 17 years N = 1870		**Drug taking (Boys)** V: *OR*= 0.97 (0.76 -1.23)	Age
9) Peltzer & Pengpid, (2014)	13 to>16 N = 15226		**Cannabis** V: *OR*=0.99 (0.71 – 1.36)	Age, gender, poverty, current smoking cigarettes, physical fight, injury, fast food consumption.
10) Pepler et al., (2002)	M_{age}=12.7 *SD*=0.88. Grades 6-8 N = 922	**Drug use** B: β= .34 p< .01 N= 922		Gender, age, SES, sexual harassment, peer orientation
11) Romera, Del Rey, & Ortega, (2011)	M_{age}= 11.3 *SD*= 1.6 N = 3042	**Drug use** B: OR=1.964 (1.179 - 3.271) B/V: OR= 2.011 (1.351-2.995)	**Drug use** V: OR=0.984 (0.672-1441) B/V: OR= 2.011 (1.351-2.995)	Sex, witness of violence, negative relationship with peers, negative relationship with teachers, negative relationship between parents-teachers, victimization by adults, self-esteem, antisocial behaviour
12) Siziya et al., (2013)	< or =13 to > or =16 N = 2257		**Use of cannabis** V: *OR*=1.77 (1.71- 1.83)	Not specified
13) Srabstein & Piazza, (2008)	Three subgroups $M1_{age}$=11.5 $M2_{age}$=13.5 $M3_{age}$=15.5 N = 9938	**Use of drugs** B: *OR*=5.22 SE= 1.11 [*N*=9574] B/V: *OR*=6.39 SE=1.15 [*N*=9574]	**Use of drugs** V: *OR*=0.95 *SE*=1.20 [*N*=9574] B/V: *OR*=6.39 *SE*=1.15 [*N*=9574]	Gender, race and grade

Figure 1: Forest plot for bullying perpetration and drug use (adjusted effect size): meta-analysis of cross-sectional studies



Meta Analysis

Figure 2: Forest plot for bullying victimisation and drug use (adjusted effect size): meta-analysis of cross-sectional studies



Model	Studyname	Subgroup within study	Comparison	Outcome	Odds ratio	Lower limit	Upper limit	Z-Value	p-Value
	Bradshaw2013	Combined	Blank	Marijuana	1.866	1.680	2.073	11.619	0.000
	Brownetal2008	total	Combined	DrugUse	8.117	6.189	10.644	15.140	0.000
	Edwards2002	total	Blank	Druguse	0.910	0.401	2.065	-0.226	0.822
	Fernando2009	Combined	Blank	Combined	1.547	1.133	2.112	2.749	0.006
	KaltialaHeino2000	Combined	Blank	Substance(NoAlcohol)	3.452	2.489	4.789	7.420	0.000
	Liangetal2007	Combined	Blank	Cannabis	0.823	0.623	1.086	-1.376	0.169
	McMahonetal2010	Boys	Blank	Drug use	0.970	0.762	1.234	-0.248	0.804
	Peltzer2014	Victim	Blank	Cannabis	0.990	0.694	1.412	-0.055	0.956
	Romeraetal2011	Combined	Blank	Drug use	1.385	1.052	1.825	2.320	0.020
	Siziya2013	Victim	Blank	Marijuana	1.770	1.711	1.831	33.001	0.000
	Srabsteinetal2008	Combined	Blank	Drug use	3.131	2.293	4.276	7.178	0.000
Fixed					1.782	1.728	1.838	36.798	0.000
Random					1.790	1.382	2.318	4.409	0.000

Meta Analysis