



Assessing the Relationship Between School Failure and Suicidal Behavior in Adolescents and Young Adults: A Systematic Review and Meta-analysis of Longitudinal Studies

P. Castellví^{1,2} · A. Miranda-Mendizábal^{2,3} · I. Alayo^{2,4} · O. Parés-Badell⁵ · J. Almenara⁶ · I. Alonso⁷ · M. J. Blasco^{2,4} · A. Cebrià⁸ · A. Gabilondo^{9,10} · M. Gili^{11,12} · C. Lagares¹³ · J. A. Piqueras¹⁴ · M. Roca^{11,12} · J. Rodríguez-Marín¹⁴ · T. Rodríguez-Jiménez¹⁴ · V. Soto-Sanz¹⁴ · J. Alonso^{2,3,4}

© Springer Science+Business Media, LLC, part of Springer Nature 2020

Abstract

There is an increasing acknowledgment that suicidal behaviors are negatively affected by school failure in adolescents and young adults. However, no systematic reviews with meta-analysis have been performed to evaluate the strength of this association. We assessed the magnitude of association of school failure as risk factor for suicide behavior in adolescents and young adults. Six international databases were searched up until January 2017. Inclusion criteria were: (1) assessment of suicide attempt or suicide; (2) case-control or cohort studies; (3) subjects aged 12–26 years; (4) school failure evaluated, which includes low academic performance, school dropout, school expulsion, and grade repetition. Random effect models were used; population attributable risks (PARs) were estimated. From 26,883 potentially eligible articles, 14 (62,298 individuals) were included. Meta-analyses could only be performed for suicide attempt. A history of school dropout (OR 6.44, 95% CI 3.03–13.65), low academic performance (OR 1.48, 95% CI 1.22–1.81), and school failure (OR 1.98, 95% CI 1.49–2.64) were significant risks of suicide attempts. Highest PAR estimates were 9.9% for school dropout, 5.1% for low academic performance, and 6.7% for any school failure. Only one study has been found for suicide, but results suggest an association with school dropout. Results show that the students who had school failure are at higher risk of suicide attempt and probably for suicide. The development of effective programs to prevent suicidal behaviors in educational settings may be an effective strategy to reduce these behaviors. However, reliable conclusions from this review are limited by the small amount of included studies for analysis.

PROSPERO Registration Number CRD42013005775.

Keywords Suicidal behavior · Adolescents and youths · School failure · Systematic review · Meta-analysis

Introduction

The World Health Organization (WHO) estimates that more than 800,000 people die each year from suicide. The annual global rate in 2012 was 11.4 per 100,000 population, accounting for 1.4% of all deaths worldwide (World Health Organization (WHO), 2014). Suicidal behavior is a

multicausal phenomenon which produces huge losses at economic, social, and psychological levels for individuals, families, and communities (World Health Organization (WHO), 2014). Furthermore, suicide in adolescents and young adults is the second leading cause of death accounting for 8.5% of all deaths in this age-group (World Health Organization (WHO), 2014). For suicide attempts, the lifetime prevalence in adolescents has been estimated to 9.7% (Evans, Hawton, Rodham, & Deeks, 2005). Therefore, the WHO developed the Mental Health Plan of Action 2013–2020 (World Health Organization (WHO), 2013), which aims to reduce the suicide rate by 10% in all countries by 2020. One action plan of the report is that prevention programs for mental disorders and suicidal behavior should be extended across all settings, such as education.

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s12310-020-09363-0>) contains supplementary material, which is available to authorized users.

✉ J. Alonso
jalonso@imim.es

Extended author information available on the last page of the article

Previous suicidal behavior, mental disorder, childhood maltreatment, and bullying victimization are the most important single risk factors for suicidal behavior among adolescents and youth (Castellvi, Lucas-Romero et al., 2017; Castellvi, Miranda-Mendizabal et al., 2017). Nevertheless, other risk factors, such as school failure, have been recently suggested as predictors (Nrugham, Holen, & Sund, 2015). Schooling time coincides with adolescence and youth, periods of many changes, a time of passage to adulthood, and an expectable life crisis process which is defined as the changes that can take place in multiple dimensions, including emotional components, psychological factors, and physical development before reaching maturity. The developmental understanding of the adolescent crisis is one in which adolescents are engaged in the exploration of becoming adults (Levesque, 2011). Health and well-being in adolescence and young adulthood depends on available opportunities to develop emotional and cognitive abilities for independence, to complete education and transition to employment, and to procure a network of lasting links (Patton et al., 2016). All these new demands make adolescents and young people a vulnerable group. In fact, most mental disorders usually begin during that period (Kessler et al., 2007).

Education is one of the strongest predictors of health: the more the schooling people have, the better their health is likely to be (World Health Organization, 2010). Although education is highly correlated with income and occupation, evidence suggests that education exerts the strongest influence on health (Molla, Madans, & Wagener, 2004). The school provides knowledge, and it is also a health promoter space of health and risky health behaviors (Patton et al., 2016). For example, school climate factors such as greater school connectedness and engagement, positive teacher relationships, and respect in school are associated with better academic outcomes, fewer behavioral problems, and better mental health (Jamal et al., 2013). Consequently, the school is presented as a framework for cognitive, emotional, and social development of the individual and also an important point of contact for prevention, identification, and treatment of mental health issues and disorders (Bruns, Walrath, Glass-Siegel, & Weist, 2004). Furthermore, education helps to alleviate poverty and disease, minimize health risks, and promote the full development of human potential (World Health Organization, 2010). However, poor mental health was significantly associated with dropout among students in vocational and higher education (Hjorth et al., 2016). Furthermore, adolescents with no post-compulsory education are also at particular risk of cumulative disadvantage through poor health, poverty, and unemployment later in life (De Ridder et al., 2012), higher total mortality, and injury mortality (Patton et al., 2016), and increasing alcohol, tobacco, and drug use (Patton et al., 2016), which may increase the probability of future suicidal behaviors.

Very few studies have examined the association between school failures with suicidal behaviors during adolescence. Other studies have reported that students dropping out from school (Fergusson & Lynskey, 1995) or having a low academic performance (Nrugham et al., 2015) have a significantly increased risk of suicide attempt. Conversely, other studies have reported substantially nonsignificant effects (Sourander et al., 2009; Young, Sweeting, & Ellaway, 2011). Discrepant results raise doubts about the true effect of school failure and related risk factors on future suicidal behaviors. Furthermore, some studies suggest that this relationship may be due to the presence of previous psychopathology or alcohol and/or substance use (Breslau, Lane, Sampson, & Kessler, 2008).

However, to the best of our knowledge, there is no systematic review or meta-analysis estimating the risk of suicidal behaviors among adolescents and youths with school failure, which includes low academic performance, school dropout, school expulsion, grade repetition. This constitutes a knowledge gap about the potential protective effects of school setting on suicidal behaviors. Our hypothesis would be school failure, and its corresponding dimensions will be associated with a consequent risk of future suicidal behaviors in young ages.

The aims of this study were to: (a) assess the association between suicide attempts and suicide in adolescents and youths with previous exposure to school failure independently of previous psychopathology, alcohol or substance use, and the quality of included studies and (b) to estimate the population attributable risks (PARs) identified.

Method

Search Strategy and Selection Criteria

A broad-scope and inclusive initial search strategy were carried out, with no restrictions in terms of population or age, in order to identify predictors of suicidal behavior. The original research protocol was previously registered at PROSPERO (Reg.: CRD42013005775). All the keywords used for inclusion and exclusion, and search terms used to identify suicidal behavior, population, and study design are provided in supplementary material. (Additional data are given in Text S1.) The search was conducted in six major international databases for publications with no restriction on language or date of publication in October 2013 and then updated in January 2017: Cochrane Library, PubMed/Medline, PsychINFO, EMBASE, Web of Science, and OpenGrey database. And reference lists from previous reviews and books were also examined. As a result, 26,883 references were initially found (Fig. 1). The recommendations of the MOOSE guide for systematic reviews in relation to handling and reporting of

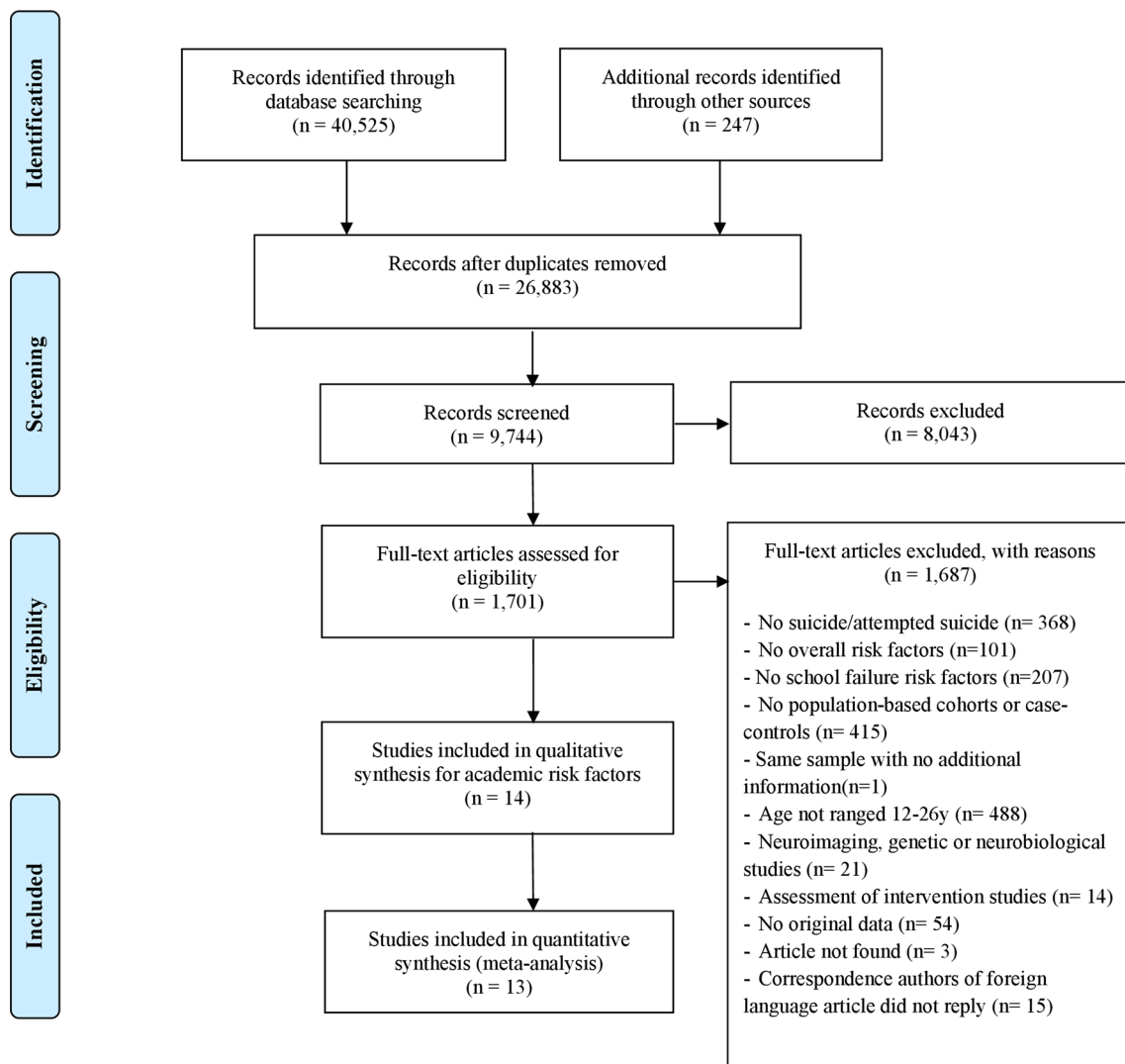


Fig. 1 Modified version of PRISMA diagram of included studies

results were considered (Moher, Liberati, Tetzlaff, Altman, & Grp, 2010; Stroup et al., 2000). (Additional data are given in Table S1.) Corresponding authors for articles written in languages other than English and Spanish were contacted.

For the broad-scope review, studies were included if they met all of the following criteria: (a) reporting suicide attempt or suicide as dependent variable; (b) assessing at least one risk factor; (c) study population age range between 12 and 26 years old, both inclusive; (d) population-based longitudinal studies (e.g., non-clinical and non-institutionalized sample cohorts, or case–controls where the control group was of the same age range and both non-clinical and non-institutionalized). Using a previous expert consensus definition (Silverman, Berman, Sanddal, O’Carroll, & Joiner, 2007), suicide death was defined as any fatal act done with the intention of taking one’s own life, and suicide attempt was defined as any act of self-injury with intention to die.

A multidisciplinary team of psychiatrists, psychologists, statisticians, epidemiologists, and public health professionals were established to perform the review. Five groups of independent peer reviewers assessed all references. During title review, discrepancies between reviewers were included. During title and abstract review phases, reviewers were blinded from seeing the article’s author, journal, and year of publication to minimize selection bias. A third independent reviewer resolved any discrepancies during abstract and full-text review.

Using the listed criteria, 222 articles were identified for qualitative synthesis from the broad review. To these studies, we then applied the following selection criteria for this article (each definition and related references are available online at Text S2): School failure, which includes (1.1) low academic performance; (1.2) school dropout; (1.3) school expulsion; and (1.4) grade repetition. The information

collected from each of the eligible articles included: authors; year of publication; country; study design; study population; sample size (number of females); outcome assessed; percentage of people exposed; age range; mean age; ethics committee approval; and meta-analysis data. From cohort studies, additional data were extracted relating to the follow-up: length; attrition rates; and the proportion of suicide behavior (attempts or deaths) during the follow-up. Information extracted about risk factors consisted of: odds ratio (OR) and 95% confidence intervals (95% CI), or beta coefficients (β) and standard error (SE), multivariate analyses prevailed over bivariate analyses.

Quality Assessment

The Newcastle–Ottawa Scale (NOS) was used for evaluation of quality of non-randomized articles (The Ottawa Research Institute, 2014). The NOS uses a “star system” in which a study is evaluated on three broad perspectives: *The Selection of the Study Groups*; *The Comparability of the Groups*; and *The Ascertainment of Either the Exposure or Outcome of Interest for Case–Control or Cohort Studies*, respectively. The scale consists of eight items with different response categories; the category which indicates the highest quality gets a star, except for the item Comparability which can get two stars. The highest score for this scale is nine stars.

Data Analyses

Meta-analyses were conducted for each variable for which there was a minimum of two studies with usable data. Adjusted OR with 95% CI was used when these data were provided in the articles; if not, unadjusted odds ratios were included. Studies that assessed favorable academic conditions, such as high academic performance, were reversed. Random effects were used because we assumed that the identified studies differed among themselves. In case of multiple publications dealing with the same sample and predictive factors, results from the longest follow-up were selected.

In order to calculate the proportion of heterogeneity, Higgins test (I^2) and its significance determined using a Chi-square test were used, p values < 0.10 being considered statistically significant. Heterogeneity was defined as: low ($< 30\%$), moderate ($30\text{--}50\%$), severe ($> 50\%$). Small-study effects (including publication bias) were determined using funnel plots. In the presence of significant asymmetry, Duval and Tweedie’s Trim and Fill test (Duval & Tweedie, 2000) was used to reduce the impact of publication bias by imputing new potential unpublished studies and obtaining a new pooled estimate.

Meta-regressions were conducted to assess the role of some mental health and environmental exposures: previous psychopathology or suicidal ideation/plan/attempt

and alcohol or substance use/disorder, and the quality of included articles using NOS score were defined as moderators of associations between previous school failure and future suicidal behavior. We estimated separate models for each variable and subsequently considered them as covariables in the multivariate models.

Population attributable risk (PAR), an indicator of the public health burden (Porta, 2014), is defined in our study as the proportion of suicidal behavior that could be theoretically avoided eliminating school failure assuming causality. PAR is also calculated from cohort studies using the formula:

$$\text{PAR} = \frac{P(\text{RR} - 1)}{1 + P(\text{RR} - 1)}$$

where P is the prevalence of risk factor obtained and RR is the relative risk of suicide attempt based on available data from the included cohort studies.

To convert the OR to RR, the following formula is used:

$$\text{RR} = \frac{\text{OR}}{(1 - P_0) + P_0\text{OR}}$$

where OR is the odds ratio of any suicidal behavior with each risk factor, and P_0 is the prevalence of suicide attempts in adolescents and youths with each risk factor, calculated through meta-analysis using data from four of the included articles. STATA software version 13 was used to perform all the analyses.

Results

Selection and Inclusion of Studies

After duplicate removals, a total of 26,883 articles were identified, of which 1701 were potentially eligible. Of those, 14 were included in the qualitative syntheses, representing data from 13 different datasets on 62,298 individuals. No corresponding authors from 15 non-English or non-Spanish potentially eligible articles were responded to our requests, and then, they were not included in the qualitative synthesis. The reasons for exclusion are detailed in Fig. 1.

Included datasets were based on samples from either the general population ($n = 5$), schools ($n = 7$), or primary care ($n = 1$) mostly from samples of the USA ($n = 6$) and Europe ($n = 5$). Nine datasets were cohorts, two case–controls, and one nested case–control. Most of the articles ($n = 12$) evaluated suicide attempt, one article suicide death, and one did not distinguish between both outcomes. One article did not reported data for meta-analyses (Table 1).

Table 1 Description of the articles included in the review

References	Country	Study design	Follow-up	Population	Sample at baseline (% women)	Sample at the end of follow-up (% attrition)	Percentage of cases during follow-up	Age range (years)	Mean age (SD)	School failure factors assessed	Controlled for	Ethical approval	Meta-analysis data
<i>Suicide</i>													
Feigelman, Joiner, Rosen, and Silva (2016) (add health)	USA	Cohort	7 years	Students	27,000 (49.6)	10,122 (37.5)	0.2	21–25	NI	Grade repetition; school expulsion	No	Yes	Yes
<i>Suicide attempt</i>													
Garmefski, Diekstra, and de Heus (1992) (monitoring the future)	The Netherlands	Nested case-control	NA	Students	13,400 (50.7)	285 cases versus 285 controls	NA	13–20	16	Low academic performance	No	NI	Yes
Lewinsohn, Rohde, and Seeley (1994)	USA	Cohort	NI	General	1710 (54)	1508 (11.8)	1.7	14–18	16.5 (1.2)	Low academic performance	Gender	NI	Yes
Fergusson, Beauvais, and Horwood (2003) and Fergusson and Lynskey (1995) (Church Health and Development Study)	New Zealand	Cohort	21 years	General	1265 (49.8)	1063 (15.9)	7.3	21–25	NI	Low academic performance; school dropout	Low academic performance (age, interaction between depression and vulnerability/resiliency factors); school dropout (no)	NI	Yes
Reinherz et al. (1995)	USA	Cohort	14 years	Students	404	385 (4.7)	4.2	18	17.9	Low academic performance; school dropout; school expulsion	No	NI	Yes

Table 1 (continued)

References	Country	Study design	Follow-up	Population	Sample at baseline (% women)	Sample at the end of follow-up (% attrition)	Percentage of cases during follow-up	Age range (years)	Mean age (SD)	School failure factors assessed	Controlled for	Ethical approval	Meta-analysis data
Lyon et al. (2000)	USA	Case-control	NA	Primary care	38 cases versus (82.2) 76 controls (81.6)	NA	NA	12–17	Cases 14.7, controls 14.9	Low academic performance; school expulsion	Low academic performance (threat of separation, alcohol/drug abuse, neglect, insomnia, suicidal ideation, truancy, age, threatens others, separated > 2 weeks); school expulsion (no)	NI	Yes
Rodriguez-Cano, Beato-Fernandez, and Llarro (2006)	Spain	Cohort	2 years	Students	1776 (49.9)	1076 (39.4)	3.8	13–15	NI	Low academic performance	Gender, previous reported suicide attempts and ideation, drugs problems, psychopathological, family and social variables	NI	No
Donald, Dower, Correa-Velez, and Jones (2006)	Australia	Case-control	NA	General	95 cases versus 380 controls (48.4)	NA	NA	18–24	NI	School dropout	Early school leaving, parental divorce, distress due to problems with parents or friends, relationship break-up, tobacco use, high alcohol use previous 12 m, depressive symptomatology, previous diagnosis of depression	NI	Yes
Fried, Williams, Cabral, and Hacker (2013) (add health)	USA	Cohort	7 years	Students	27,000 (49.6)	13,465 (49.8)	4	12–26	NI	Grade repetition; school dropout	No	Yes	Yes

Table 1 (continued)

References	Country	Study design	Follow-up	Population	Sample at baseline (% women)	Sample at the end of follow-up (% attrition)	Percentage of cases during follow-up	Age range (years)	Mean age (SD)	School failure factors assessed	Controlled for	Ethical approval	Meta-analysis data
Nrugham et al. (2015)	Norway	Cohort	6 years	Students	2792	242 (91.3)	25.6	15–20	20 (0.6)	Low academic performance	Any depressive disorder by age 15 years	Yes	Yes
Power et al. (2015) (CT)	Ireland	Cohort	8 years	Students	743	212 (28.5)	NI	19–24	20.8	School dropout	Gender, socioeconomic status	Yes	Yes
Hishinuma et al. (2018) (HSHS)	USA	Cohort	1 year	Students	7317	2083 (28.5)	2.2	14–16	NI	Low academic performance	No	Yes	Yes
<i>Suicide or suicide attempt</i>													
Sourander et al. (2009)	Finland	Cohort	16 years	General	5813 (89.7)	5302 (8.8)	1	8–24	NI	Low academic performance	NI	Yes	Yes

Quality Assessment of Studies

A majority (78.6%) of the articles had a good methodological quality (≥ 6 NOS stars). Overall, cohort studies (81.8%) had higher quality than case–controls (66.7%) (Table 2). Some quality limitations were: the outcome was self-reported ($n = 12$), and the attrition rate was $> 20\%$ ($n = 5$). Studies using case–control were not substantially different than studies using cohort design.

Risk of Suicide Death

Only one article was identified. The sample came from Add Health study from the USA using a sample of 27,000 students with a cohort design with a follow-up of 7 years. It assessed grade repetition and school dropout. Authors reported that adolescents who had been dropout the school [OR 3.33 (95% CI 1.12–9.94)] had significantly higher risk of suicide than non-exposed counterparts, but not for those students who had ever repeated a grade [OR 0.84 (95% CI 0.31–2.29)].

Risk of Suicide Attempts

A total of 12 comparisons were included for school failure [low academic performance $n = 8$ (66.7%); school dropout $n = 3$ (25%); school expulsion $n = 1$ (8.3%); grade repetition $n = 1$ (8.3%)]. Overall, students who experienced school failure had a significant higher risk of suicide attempt than non-exposed adolescents [OR 1.98 (95% CI 1.49–2.64)] with moderate heterogeneity ($I^2 = 72.9\%$, $p < 0.001$), probably due to the inclusion of several risk factors in the pooled risk. Visual inspection of funnel plots suggested some evidence of small-study effects or publication bias increasing the real risk between school failure and suicide attempt (see online supplementary material Figure S1). Consequently, the Trim and Fill test was performed to estimate a weighted OR value. The new pooled estimate [OR 1.39 (95% CI 1.04–1.87)] was lower, but its direction and significance did not change. Specifically, adolescents with low academic performance had also significant higher risk of suicide attempt [OR 1.48 (95% CI 1.22–1.81)] compared to those with higher academic performance. Moderate heterogeneity was observed ($I^2 = 43.7\%$; $p = 0.087$). Students who dropped out of school had over sixfold odds of suicide attempt than those who completed schooling [OR 6.44 (95% CI 3.03–13.65)]; nonsignificant heterogeneity was observed ($I^2 = 35.6\%$; $p = 0.212$). Finally, results for grade repetition and school expulsion were not statistically significant (Fig. 2).

Meta-regression Analyses

Meta-regression analyses were performed for previous psychopathology, alcohol or substance use, and NOS quality of the studies included. Both psychopathology (coefficient = 0.017, $p = 0.974$, $R^2 = 0\%$) and alcohol or substance use (coefficient = 1.277, $p = 0.250$, $R^2 = 4.55\%$) had nonsignificant effects in the association between any school failure variable and suicide attempt. The quality of the included studies had also a nonsignificant effect, but it explains the 49.53% of between-study variance (coefficient = -0.370 , $p = 0.079$, $R^2 = 49.5\%$) (online supplementary material Table S2).

Population Attributable Risks (PARs)

PAR was calculated on the basis of the prevalence of suicide attempts for school failure and each form of other related conditions. All suicide attempts in adolescents and youths were attributable to (from highest to lowest) school dropout (9.9%), school failure (6.7%), low academic performance (5.1%). For grade repetition (1.3%) and school expulsion (0.3%), PAR was almost ineffective ($< 2\%$) (Table 3).

Discussion

Summary of Main Findings

According to the results of this review based on 14 articles from 13 studies, adolescents/youths who had school failure (dropping out of school and low academic performance) have a substantially higher risk of suicide attempt than those with better academic adjustment. This risk was independently associated with previous psychopathology, alcohol or substance use, and the quality of the studies. In particular, the highest risk was found among those who dropped out of school with over sixfold risk. For grade repetition and school expulsion, the data were scarce. We have also estimated that eliminating school dropout and school failure, and having higher academic performance could theoretically avoid up to 9.9%, 6.1%, and 5.7%, of suicide attempts in this age-group, respectively. Finally, we found no evidence of whether school failure, and its corresponding variables, could be a risk factor for suicide.

Strengths and Limitations

To the best of our knowledge, no previous systematic reviews or meta-analyses, including the corresponding PAR calculations, have been conducted assessing the association of suicidal behavior and school failure. Strengths of this review include: (1) study selection was conducted

with no restriction of language and publication year, using a peer-review process in the screening phase, and independent peer review in data extraction, using methods for minimizing bias; (2) we contacted authors from some studies in other languages for further information and manual and gray literature searches were also carried out; (3) we used adjusted OR extracted from the original articles; (4) the Newcastle–Ottawa Scale (NOS), recommended by the Cochrane Collaboration, was used (The Ottawa Research Institute, 2014); (5) we only included longitudinal studies in our review, thus ensuring that exposure to the factors assessed preceded the outcome. Such a decision makes our findings more relevant to establish the temporal order of events, as well as minimizing bias. However, information about exposure in case–control studies is retrospective and therefore subject to recall bias; and (6) taking into account that this systematic review only includes observational studies, only low performance showed significant, but moderate heterogeneity.

This study also presents some limitations that deserve discussion: (1) as Trim and Fill imputation method suggested, our pooled results may have been inflated; studies with statistically significant and positive results are more likely to be published than studies with negative or null findings. However, the significance was maintained after imputation; (2) only one study was identified that assessed these risk factors for suicide death, so we were unable to estimate the true magnitude of the effect. Therefore, our inferences about causality and temporality are robust only for suicide attempt.

School Failure as Risk Factor for Suicidal Behaviors

Adolescents/youths with school failure have almost twofold risk of suicide attempt than non-exposed counterparts, and this result is independently associated with previous psychopathology, alcohol or substance use, and the quality of included studies. Specifically, our results show that low academic performance and school dropout are the unique significant risk factors assessed, especially the latter which exhibits sixfold higher risks of suicide attempt than their non-exposed peers. According to previous published meta-analyses of suicidal behaviors in the same age range, school dropout (OR 6.44) showed a higher risk than previous affective disorder (OR 1.54) (Gili et al., 2018), suicide ideation (OR 3.26) (Castellvi, Lucas-Romero et al., 2017) and being exposed to child maltreatment (OR 2.25) or bullying (OR 2.39) (Castellvi, Miranda-Mendizabal et al., 2017), even previous suicide attempt (OR 5.56). So, we can consider adolescents who dropout from school as a main risk factor for future suicide attempts.

Previous literature suggests that low academic performance, school dropout, and mental health problems are

Table 2 Quality assessment of studies

Study	Representativeness of exposed cohort ^b	Selection of non-exposed cohort ^b	Ascertainment of exposure ^b	Demonstration outcome of interest not present at start of study ^b	Comparability of cohorts on the basis of design or analysis ^c	Ascertainment of outcome ^b	Adequate length of follow-up ^b	Adequacy of follow-up ^b	Total stars
<i>Cohort studies</i>									
Lewinsohn et al. (1994)	*	*	*	*	*	*	*	*	8
Fergusson and Lynskey (1995)	*	*	*	*	*	—	*	*	7
Reinherz et al. (1995)	*	*	*	*	**	—	*	*	8
Fergusson et al. (2003)	*	*	*	*	**	—	*	*	8
Rodriguez-Cano et al. (2006)	—	*	*	*	**	—	*	—	6
Sourander et al. (2009)	*	*	*	*	*	—	*	*	7
Fried et al. (2013)	*	*	*	*	**	—	—	*	7
Nrugham et al. (2015)	*	*	*	*	*	—	*	—	6
Power et al. (2015)	—	*	*	*	**	—	*	*	7
Feigelman et al. (2016)	*	*	*	*	—	—	*	—	5
Hishinuma et al. (2018)	*	*	*	—	—	—	—	*	4
Study	Case definition ^b	Representativeness of cases ^b	Selection of controls ^b	Definition of controls ^b	Comparability of cases and controls ^c	Ascertainment of exposure ^b	Same method ascertainment both groups ^b	Non-response rate ^b	Total of stars
<i>Case-control studies</i>									
Garnefski et al. (1992)	—	*	*	*	**	—	*	*	7
Lyon et al. (2000)	—	—	—	*	**	—	*	—	4
Donald et al. (2006)	*	*	*	*	**	*	—	—	7

^aHighest quality studies are awarded up to nine stars

^bA maximum of one star can be allotted in this category

^cA maximum of two stars can be allotted in this category

—None star was allotted

related. Most psychiatric disorders present symptom patterns that cause severe impairment on the emotional, cognitive, and social level, inasmuch as the student affected by a disorder may be unable to carry out his/her academic potential (Kessler, Foster, Saunders, & Stang, 1995). Thus,

adolescents who suffer from a mental disorder risk finding themselves in a downward spiral caused by the interrelation of psychological symptoms and negative school experiences that may culminate in early school dropout. In turn, school dropout without any or poor qualifications may implicate a

Fig. 2 Forest plot of school failure and each related-dimension (Grade repetition; Low academic performance; School dropout; School expulsion) as risk factor of suicide attempt in adolescents and young adults

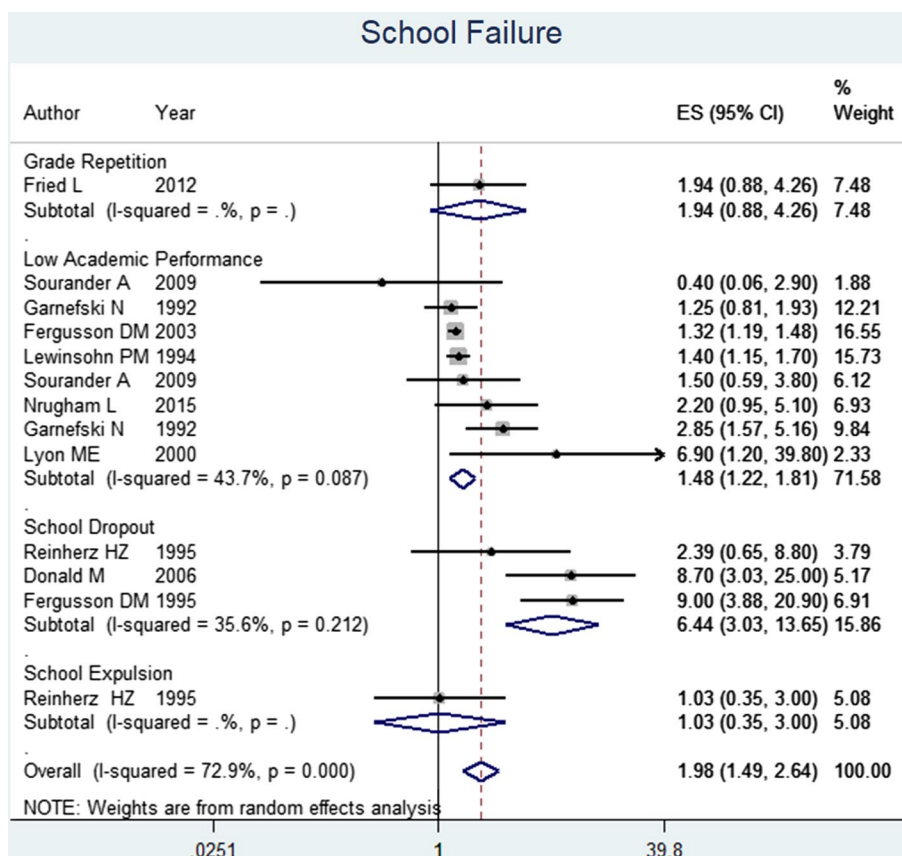


Table 3 Population attributable risk (PAR) estimates of suicide attempt for school failure

Type of academic factor exposure	Prevalence of suicide attempt (%)	P ₀ (%)	RR	PAR (%)	95% CI
School failure	20 (12–29)	7	1.656	6.7	(3.2–11.1)
Low academic performance	23 (14–33)	16	1.333	5.1	(1.0–10.4)
School dropout	7 (5–8)	3	4.664	9.9	(6.8–12.8)
School expulsion	20 (0–68)	10	1.015	0.3	(0.2–0.4)
Grade repetition	26 (25–27)	0	1.633	1.3	(1.3–1.9)

Prevalence of suicide attempt was calculated based on data from studies reporting this. P₀: prevalence of suicide attempts in people non-exposed to any risk factors

RR relative risk, PAR population attributable risk

difficult professional and social integration regarding limited educational and vocational opportunities, thus involving an increased vulnerability for developing a mental disorder and, then, a suicide attempt (Esch et al., 2014). However, unexpectedly these variables were significant independently of previous psychopathology or alcohol or substance use. To our knowledge, there are two reasons that can explain these results: (1) maybe previous mental disorders can act as confusing variable between socioeconomic disadvantages, school failure, and suicide attempts. Children with the least opportunities, arising from poverty and compounding disadvantages, are most likely to repeat grades and leave school

early. These shortcomings have meant lost opportunities for children in children’s development, life chances, and poorer health status (UNESCO, 2012). Hopelessness and depression usually develop after a few years, with consequent suicidal behaviors. As vocational opportunities are very limited and unstable for young people with low qualifications, living conditions become more precarious. These circumstances can lead to the onset of substance use, anxiety and mood disorders increasing the consequent incidence of suicidal behaviors (Esch et al., 2014), and (2) the few number of included studies in the meta-analyses that can make it difficult to generalize our results;

Our review shows that the evidence about school failure and suicide death is scarce. Only one study was identified assessing this association being significant in adolescents who were expelled from school. So, no meta-analysis could be performed. The scarcity of published literature for this research question may be due to different reasons. Unfavorable academic factors for health-related outcomes have not been historically a main interest for health researchers. In fact, only one article considered these factors as a primary variable of interest (Power et al., 2015). Also, incidence rates of suicide death are low in community population; the WHO estimated an annual global age-standardized suicide rate of 11.4 per 100,000 population, limiting the possibility of risk information. Finally, the nature of this health outcome brings some difficulties for assessing risk factors. So, it is important to conduct systematic reviews of longitudinal studies to estimate a higher evidence of the risk.

Finally, based on our PAR calculations, and assuming that eliminating the exposure would not affect other risk factors, effective interventions on adolescents and youths exposed to school failure could theoretically reduce suicide attempts by around 6.7% (by 9.9% for school dropout and 5.7% for low academic performance, specifically). For other school failure factors, not enough data can infer the reduction in suicide attempts after an effective intervention. These magnitudes point to the need to develop effective public health and educational programs to increase involvement with the school setting and to detect student groups, or individuals, with a high risk of suicidal behavior. In fact, a previous systematic review reported that school is an effective environment for the development of suicide prevention programs (Robinson et al., 2013).

Generalization of Results

As mentioned above, several limitations should be taken into consideration for the generalization of our results. First, some evidence of publication bias was found in the assessed risk factors, but after the Trim and Fill method these risks maintained their significance. Second, identified articles have overall good methodological quality which makes unlikely that reported results are due to methodological biases.

Future Research

Although a significant association has been found between suicide attempt and school failure, school dropout and low academic performance, future research is needed in several areas, especially for suicide death. In particular, more evidence is needed about the risks of suicidal behaviors associated with grade repetition and school expulsion.

In this sense, new longitudinal studies are needed to assess the outcome and moderator factors which may be involved, such as previous mental or substance use disorders. Finally, more knowledge about the role of some school factors, such as school environment or health and disciplinary policies, and schooling for promoting their mental well-being and for reducing future mental disorders and suicidal behaviors is needed. For example, a few randomized trials or natural experiments have shown that lower barriers to education and some early childhood programs have economic and health benefits (Lager & Torssander, 2012; Raver et al., 2009).

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Acknowledgements Thanks to Dave MacFarlane and Victoria Mailen Arfuch for help in management of the data extraction form and data abstraction.

Author contributions JA and PC developed the original protocol. Three investigators (PC; AM; and OP) did the literature search in October 2013 and updated it in January 2017. Twelve investigators (JA; IA; MJB; AC; RCS; AG; MG; CL; JAP; MR; JRM; TRJ; and VSS) double-screened titles, and abstracts of all studies to establish eligibility for full-text screening, and they extracted the data independently onto a data extraction form. PC identified all the articles included from the broad review, reviewed all data extracted from previous reviewers, and conducted all analyses. PC developed the article, figures, and tables. PC, AM, and OP resolved any disagreement about eligibility for inclusion in the review and discrepancies arising during data extraction. All authors read and approved the final draft of the manuscript.

Funding This work was supported by the ISCIII-FEDER (PI13/00343); Ministry of Health, Social Services and Equality, PNSD (2015I015); Instituto de Salud Carlos III (ISCIII) (Sara Borrell, CD12/00440 and CD18/00049); ISCIII (Río Hortega, CM14/00125); Ministry of Education, Culture and Sport (FPU15/05728); UJA-FEDER (R08/06/2018), Generalitat de Catalunya (2014 SGR 748 and 2017 SGR 452), and by the Spanish Ministry of Science, Innovation and Universities, the State Research Agency (AEI), and ERDF funding thanks to PSI2017-90650-REDT grant. The corresponding author (JA) confirms that he had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Compliance with Ethical Standards

Conflict of interest There are no conflicts of interest to be declared for all the authors.

References



- Breslau, J., Lane, M., Sampson, N., & Kessler, R. C. (2008). Mental disorders and subsequent educational attainment in a US national sample. *Journal of Psychiatric Research*, 42(9), 708–716. <https://doi.org/10.1016/j.jpsychires.2008.01.016>.
- Bruns, E. J., Walrath, C., Glass-Siegel, M., & Weist, M. D. (2004). School-based mental health services in Baltimore: Association with school climate and special education referrals. *Behavior*

- Modification*, 28(4), 491–512. <https://doi.org/10.1177/0145445503259524>.
- Castellvi, P., Lucas-Romero, E., Miranda-Mendizábal, A., Parés-Badell, O., Almenara, J., Alonso, I., et al. (2017a). Longitudinal association between self-injurious thoughts and behaviors and suicidal behavior in adolescents and young adults: A systematic review with meta-analysis. *Journal of Affective Disorders*. <https://doi.org/10.1016/j.jad.2017.03.035>.
- Castellvi, P., Miranda-Mendizábal, A., Pares-Badell, O., Almenara, J., Alonso, I., Blasco, M. J., et al. (2017b). Exposure to violence, a risk for suicide in youths and young adults. A meta-analysis of longitudinal studies. *Acta Psychiatrica Scandinavica*, 135(3), 195–211. <https://doi.org/10.1111/acps.12679>.
- De Ridder, K. A. A., Pape, K., Johnsen, R., Westin, S., Holmen, T. L., & Bjørngaard, J. H. (2012). School dropout: A major public health challenge: A 10-year prospective study on medical and non-medical social insurance benefits in young adulthood, the Young-HUNT 1 Study (Norway). *Journal of Epidemiology and Community Health*, 66(11), 995–1000. <https://doi.org/10.1136/jech-2011-200047>.
- Donald, M., Dower, J., Correa-Velez, I., & Jones, M. (2006). Risk and protective factors for medically serious suicide attempts: A comparison of hospital-based with population-based samples of young adults. *The Australian and New Zealand Journal of Psychiatry*, 40(1), 87–96. <https://doi.org/10.1080/j.1440-1614.2006.01747.x>.
- Duval, S., & Tweedie, R. (2000). Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*, 56(2), 455–463.
- Esch, P., Bocquet, V., Pull, C., Couffignal, S., Lehnert, T., Graas, M., et al. (2014). The downward spiral of mental disorders and educational attainment: A systematic review on early school leaving. *BMC Psychiatry*, 14, 237. <https://doi.org/10.1186/s12888-014-0237-4>.
- Evans, E., Hawton, K., Rodham, K., & Deeks, J. (2005). The prevalence of suicidal phenomena in adolescents: A systematic review of population-based studies. *Suicide & Life-Threatening Behavior*, 35(3), 239–250.
- Feigelman, W., Joiner, T., Rosen, Z., & Silva, C. (2016). Investigating correlates of suicide among male youth: Questioning the close affinity between suicide attempts and deaths. *Suicide and Life-Threatening Behavior*, 46(2), 191–205. <https://doi.org/10.1111/sltb.12183>.
- Fergusson, D. M., Beautrais, A. L., & Horwood, L. J. (2003). Vulnerability and resiliency to suicidal behaviours in young people. *Psychological Medicine*, 33(1), 61–73.
- Fergusson, D. M., & Lynskey, M. T. (1995). Childhood circumstances, adolescent adjustment, and suicide attempts in a New Zealand birth cohort. *Journal of the American Academy of Child and Adolescent Psychiatry*, 34(5), 612–622. <https://doi.org/10.1097/00004583-199505000-00013>.
- Fried, L. E., Williams, S., Cabral, H., & Hacker, K. (2013). Differences in risk factors for suicide attempts among 9th and 11th grade youth: A longitudinal perspective. *The Journal of School Nursing*, 29(2), 113–122. <https://doi.org/10.1177/1059840512461010>.
- Garnefski, N., Diekstra, R. F., & de Heus, P. (1992). A population-based survey of the characteristics of high school students with and without a history of suicidal behavior. *Acta Psychiatrica Scandinavica*, 86(3), 189–196.
- Gili, M., Castellvi, P., Vives, M., de la Torre-Luque, A., Almenara, J., Blasco, M. J., et al. (2018). Mental disorders as risk factors for suicidal behavior in young people: A meta-analysis and systematic review of longitudinal studies. *Journal of Affective Disorders*, 245, 152–162. <https://doi.org/10.1016/j.jad.2018.10.115>.
- Hishinuma, E. S., Smith, M. D., McCarthy, K., Lee, M., Goebert, D. A., Sugimoto-Matsuda, J. J., et al. (2018). Longitudinal prediction of suicide attempts for a diverse adolescent sample of Native Hawaiians, Pacific Peoples, and Asian Americans. *Archives of Suicide Research*, 22(1), 67–90. <https://doi.org/10.1080/1381118.2016.1275992>.
- Hjorth, C. F., Bilgrav, L., Frandsen, L. S., Overgaard, C., Torp-Pedersen, C., Nielsen, B., et al. (2016). Mental health and school dropout across educational levels and genders: A 4.8-year follow-up study. *BMC Public Health*, 16, 976. <https://doi.org/10.1186/s12889-016-3622-8>.
- Jamal, F., Fletcher, A., Harden, A., Wells, H., Thomas, J., & Bonell, C. (2013). The school environment and student health: A systematic review and meta-ethnography of qualitative research. *BMC Public Health*, 13, 798. <https://doi.org/10.1186/1471-2458-13-798>.
- Kessler, R., Amminger, G. P., Aguilar-Gaxiola, S., Alonso, J., Lee, S., & Ustun, T. B. (2007). Age of onset of mental disorders: A review of recent literature. *Current Opinion in Psychiatry*, 20(4), 359–364. <https://doi.org/10.1097/YCO.0b013e32816ebc8c>.
- Kessler, R. C., Foster, C. L., Saunders, W. B., & Stang, P. E. (1995). Social consequences of psychiatric disorders, I: Educational attainment. *The American Journal of Psychiatry*, 152(7), 1026–1032. <https://doi.org/10.1176/ajp.152.7.1026>.
- Lager, A. C. J., & Torssander, J. (2012). Causal effect of education on mortality in a quasi-experiment on 1.2 million Swedes. *Proceedings of the National Academy of Sciences of the United States of America*, 109(22), 8461–8466. <https://doi.org/10.1073/pnas.1105839109>.
- Levesque, R. J. R. (2011). Adolescent crisis. In R. J. R. Levesque (Ed.), *Encyclopedia of adolescence* (p. 69). New York, NY: Springer. https://doi.org/10.1007/978-1-4419-1695-2_489.
- Lewinsohn, P. M., Rohde, P., & Seeley, J. R. (1994). Psychosocial risk factors for future adolescent suicide attempts. *Journal of Consulting and Clinical Psychology*, 62(2), 297–305.
- Lyon, M. E., Benoit, M., O'Donnell, R. M., Getson, P. R., Silber, T., & Walsh, T. (2000). Assessing African American adolescents' risk for suicide attempts: Attachment theory. *Adolescence*, 35(137), 121–134.
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Grp, P. (2010). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *International Journal of Surgery*, 8(5), 336–341. <https://doi.org/10.1016/j.ijssu.2010.02.007>.
- Molla, M. T., Madans, J. H., & Wagener, D. K. (2004). Differentials in adult mortality and activity limitation by years of education in the United States at the end of the 1990s. *Population and Development Review*, 30(4), 625–646. <https://doi.org/10.1111/1j.1728-4457.2004.00035.x>.
- Nrugham, L., Holen, A., & Sund, A. M. (2015). Prognosis and psychosocial outcomes of attempted suicide by early adolescence: A 6-year follow-up of school students into early adulthood. *The Journal of Nervous and Mental Disease*, 203(4), 294–301. <https://doi.org/10.1097/NMD.0000000000000281>.
- Patton, G. C., Sawyer, S. M., Santelli, J. S., Ross, D. A., Afifi, R., Allen, N. B., et al. (2016). Our future: A Lancet commission on adolescent health and wellbeing. *Lancet (London, England)*, 387(10036), 2423–2478. [https://doi.org/10.1016/S0140-6736\(16\)00579-1](https://doi.org/10.1016/S0140-6736(16)00579-1).
- Porta, M. (2014). *A dictionary of epidemiology* (6th ed.). Oxford: Oxford University Press. <https://doi.org/10.1093/ije/15.2.277>.
- Power, E., Clarke, M., Kelleher, I., Coughlan, H., Lynch, F., Connor, D., et al. (2015). The association between economic inactivity and mental health among young people: A longitudinal study of young adults who are not in employment, education or training. *Irish Journal of Psychological Medicine*, 32(1), 155–160. <https://doi.org/10.1017/ipm.2014.85>.
- Raver, C. C., Jones, S. M., Li-Grining, C., Zhai, F., Metzger, M. W., & Solomon, B. (2009). Targeting children's behavior problems in preschool classrooms: A cluster-randomized controlled trial.

- Journal of Consulting and Clinical Psychology*, 77(2), 302–316. <https://doi.org/10.1037/a0015302>.
- Reinherz, H. Z., Giaconia, R. M., Silverman, A. B., Friedman, A., Pakiz, B., Frost, A. K., et al. (1995). Early psychosocial risks for adolescent suicidal ideation and attempts. *Journal of the American Academy of Child and Adolescent Psychiatry*, 34(5), 599–611. <https://doi.org/10.1097/00004583-199505000-00012>.
- Robinson, J., Cox, G., Malone, A., Williamson, M., Baldwin, G., Fletcher, K., et al. (2013). A systematic review of school-based interventions aimed at preventing, treating, and responding to suicide-related behavior in young people. *Crisis*, 34(3), 164–182. <https://doi.org/10.1027/0227-5910/a000168>.
- Rodriguez-Cano, T., Beato-Fernandez, L., & Llario, A. B. (2006). Body dissatisfaction as a predictor of self-reported suicide attempts in adolescents: A Spanish community prospective study. *The Journal of Adolescent Health*, 38(6), 684–688. <https://doi.org/10.1016/j.jadohealth.2005.08.003>.
- Silverman, M. M., Berman, A. L., Sanddal, N. D., O'Carroll, P. W., & Joiner, T. E. (2007). Rebuilding the tower of Babel: A revised nomenclature for the study of suicide and suicidal behaviors. Part 1: Background, rationale, and methodology. *Suicide & Life-Threatening Behavior*, 37(3), 248–263. <https://doi.org/10.1521/suli.2007.37.3.248>.
- Sourander, A., Klomek, A. B., Niemela, S., Haavisto, A., Gyllenberg, D., Helenius, H., et al. (2009). Childhood predictors of completed and severe suicide attempts: Findings from the Finnish 1981 Birth Cohort Study. *Archives of General Psychiatry*, 66(4), 398–406. <https://doi.org/10.1001/archgenpsychiatry.2009.21>.
- Stroup, D. F., Berlin, J. A., Morton, S. C., Olkin, I., Williamson, G. D., Rennie, D., et al. (2000). Meta-analysis of observational studies in epidemiology—A proposal for reporting. *JAMA*, 283(15), 2008–2012. <https://doi.org/10.1001/jama.283.15.2008>.
- The Ottawa Research Institute. (2014). Newcastle-Ottawa Scale.
- UNESCO. (2012). *Opportunities lost: The impact of grade repetition and early school leaving*. Montreal: UNESCO.
- World Health Organization. (2010). *Education and health go hand in hand*. Retrieved April 4, 2019 from https://www.who.int/dg/speeches/2010/educationandhealth_20100920/en/.
- World Health Organization (WHO). (2013). *Mental health action plan 2013–2020*. WHO Library Cataloguing-in-Publication Data-Library Cataloguing-in-Publication Data. Geneva, Switzerland. ISBN 978 92 4 150602 1.
- World Health Organization (WHO). (2014). *Preventing suicide: A global imperative*. Canadian Medical Association Journal. Geneva, Switzerland. ISBN: 978 92 4 156477 9.
- Young, R., Sweeting, H., & Ellaway, A. (2011). Do schools differ in suicide risk? The influence of school and neighbourhood on attempted suicide, suicidal ideation and self-harm among secondary school pupils. *bmc public health*, 11, 874. <https://doi.org/10.1186/1471-2458-11-874>.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Affiliations

P. Castellví^{1,2}  · A. Miranda-Mendizábal^{2,3} · I. Alayo^{2,4} · O. Parés-Badell⁵ · J. Almenara⁶ · I. Alonso⁷ · M. J. Blasco^{2,4} · A. Cebrià⁸ · A. Gabilondo^{9,10} · M. Gili^{11,12} · C. Lagares¹³ · J. A. Piqueras¹⁴ · M. Roca^{11,12} · J. Rodríguez-Marín¹⁴ · T. Rodríguez-Jimenez¹⁴ · V. Soto-Sanz¹⁴ · J. Alonso^{2,3,4} 

¹ School of Medicine, Universitat Internacional de Catalunya, C/Josep Trueta, 08195 Sant Cugat del Vallès, Barcelona, Spain

² Health Services Research Group, IMIM-Institut Hospital del Mar d'Investigacions Mèdiques, PRBB Building, Doctor Aiguader 88, 08003 Barcelona, Spain

³ Department of Health and Experimental Sciences, University Pompeu Fabra (UPF), Barcelona, Spain

⁴ CIBER Epidemiología y Salud Pública (CIBERESP), Madrid, Spain

⁵ Barcelona Public Health Agency, Barcelona, Spain

⁶ Area of Preventive Medicine and Public Health, University of Cadiz, Cádiz, Spain

⁷ Morales Meseguer Hospital, Murcia, Spain

⁸ Department of Mental Health, Corporació Sanitaria Parc Taulí, Sabadell, Spain

⁹ Outpatient Mental Health Care Network, Osakidetza-Basque Health Service, Vitoria-Gasteiz, Spain

¹⁰ Mental Health and Psychiatric Care Research Unit, BioDonosti Health Research Institute, San Sebastián, Spain

¹¹ Institut Universitari d'Investigació en Ciències de la Salut (IUNICS-IDISPA), University of Balearic Islands, Palma de Mallorca, Spain

¹² Network of Preventive Activities and Health Promotion, University of Balearic Islands, Palma de Mallorca, Spain

¹³ Department of Statistics and Operative Research, University of Cádiz, Cádiz, Spain

¹⁴ Department of Health Psychology, Miguel Hernandez University of Elche, Elche, Spain