

The Impact of Cyberbullying on Self-Harming Behavior and Suicidal Thoughts among Adolescents: A Meta-Analysis

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ABSTRACT

Background: Online bullying often occurs among teenagers. This is an important risk factor for self-injurious behavior and suicidal ideation. This study aimed to analyze and estimate the magnitude of the effect of online bullying on self-injurious behavior and suicidal ideation in adolescents.

Subjects and Method: This research is a systematic review and meta-analysis using the PICO model. Population: Adolescents, Intervention: Online bullying, Comparison: No online bullying, Outcome: Self-injurious behavior and suicidal ideation. The research data used was obtained through Google Scholar, Science Direct, BMC Public Health, and Scopus with the keywords ("Cyberbullying") AND ("Self-harm") AND ("Suicidal Ideation") AND ("Mental Health") AND ("Cross-sectional"). Inclusion criteria were cross-sectional articles in English published from 2014 to 2024. Data analysis was carried out using the Review Manager 5.3 application.

Results: Meta-analysis was conducted on 8 primary studies with outcomes for self-harm behavior and 9 primary studies with outcomes for suicidal ideation. These primary studies come from Singapore, Vietnam, Taiwan, China, South Korea, Iran, Australia and America. The sample size was 47,708 adolescents for self-injurious behavior outcomes and 63,173 adolescents for suicidal ideation outcomes. Adolescents with online bullying are 3.64 times more likely to have self-injurious behavior (aOR= 3.64; 95% CI= 3.14 to 4.22; $p < 0.001$) and 2.64 times more likely to have suicidal ideation (aOR= 2.64; 95% CI= 1.94 to 3.60; $p < 0.001$) compared to adolescents without online bullying. The funnel plot indicates the existence of publication bias which tends to reduce the true effect (underestimate) on the outcome of suicidal ideation.

Conclusion: Online bullying statistically significantly increases the risk of self-injurious behavior and suicidal ideation in adolescents.

Keywords: cyberbullying, suicidal ideation, self-harm, adolescents.

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BACKGROUND

The Internet has significantly changed the dynamics of interpersonal relationships,

with both positive and negative impacts, especially among the younger generation. One negative impact that needs to be

considered is the misuse of the internet to carry out bullying (Felipe-castaño et al., 2019). According to Marengo et al. (2021) common examples of online bullying include actions such as sending harassing messages or posting inappropriate images of others. This bullying can be spread widely through various communication media, including text messages, emails, chat platforms, as well as various existing social media platforms. Even though the act occurs online, it still has similar characteristics to traditional bullying.

Online bullying is also an alarming phenomenon throughout the world with a high global prevalence rate. Research conducted by Calvete et al. (2016) in Spain found that 52.5% of teenagers admitted to having been victims. Mallik (2020) also reported that the prevalence of online bullying in Bangladesh reached 31.9%, indicating a fairly significant level of the phenomenon in the country. A meta-analysis of 46 studies in Australia documented that 1 in 7 teenagers had been a victim of bullying in the last 12 months. Recent research estimates that approximately 29% of Australian youth aged 13 to 17 years are victims (Islam et al., 2022).

The negative effects of online bullying affect various aspects of the victim's life, posing serious challenges in maintaining mental and emotional balance. Teenagers who are victims of online bullying have a higher risk of experiencing various adverse psychosocial consequences (Eyuboglu et al., 2021). Online bullying can disrupt mental and emotional balance and disrupt various aspects of their daily lives (Carvalho et al., 2021). Several studies state that adolescents who are victims tend to face various psychological problems, including suicidal thoughts (Nikolaou, 2017; Nixon, 2014). Online bullying is also associated with an increased risk of self-injurious behavior in

children and adolescents, indicating that the experience can have serious impacts on mental and physical well-being (Beauroy-eustache and Mishara, 2021). The research results of Bai et al. (2021) indicate that online bullying is a form of trauma that damages a person's beliefs about a just world. This then causes thoughts of harming yourself and even committing suicide. High psychological pressure due to online bullying can also cause thoughts of committing suicide (Kee et al., 2024).

In the field of mental health, online bullying has become an increasingly relevant issue with potentially serious impacts on the individual who is the victim. Although there is increasing attention to the psychological impact of online bullying, research specifically focusing on its influence on self-harm behavior and suicidal ideation remains scarce. Therefore, meta-analysis research is needed that unites and systematically analyzes the findings of existing research to gain an understanding of the influence of online bullying on self-injurious behavior and suicidal ideation in adolescents. This research aims to determine the influence of online bullying on self-injurious behavior and suicidal ideation in teenagers.

SUBJECTS AND METHOD

1. Study Design

This study is a systematic review and meta-analysis guided by the PRISMA flow diagram. The research data used was obtained via Google Scholar, Science Direct, BMC Public Health, and Scopus. The keywords used are (“Cyberbullying”) AND (“Self-harm”) AND (“Suicidal Ideation”) AND (“Mental Health”) AND (“Cross-sectional”).

2. Step of Meta-Analysis

The meta-analysis was carried out in five steps as follows:

- 1) Formulate research questions in Population, Intervention, Comparison, and Outcome (PICO).
- 2) Search for primary study articles from various electronic and non-electronic databases.
- 3) Conduct screening and critical assessment of primary research articles.
- 4) Perform data extraction and synthesize effect estimates into RevMan 5.3.
- 5) Interpret and conclude the results.

3. Inclusion Criteria

The inclusion criteria used in this study were articles with a cross-sectional study design, using multivariate analysis with research results using adjusted odds ratio (aOR), and published in English from 2014 to 2024. The research subjects were teenagers.

4. Exclusion Criteria

The exclusion criteria in this study were RCT studies (randomized controlled trials), quasi-experiments, research protocols, non-full text articles, non-English articles, and articles carried out only through bivariate analysis.

5. Operational Definition of Variables

Online bullying is a form of bullying that occurs through digital technology, such as cell phones, computers, or tablets, and involves behaviors such as online aggression, harassment, and electronic attacks against individuals.

Self-injurious behavior is behavior that causes pain to the body such as cutting, scratching, burning or other forms of injury.

Suicidal ideation is the desire to attempt suicide caused by a combination of unbearable psychological pain and hopelessness.

6. Instruments

The instrument in this study was the PRISMA Flow Diagram using primary study quality assessment for a cross-sectional meta-analysis research design.

7. Data analysis

Articles were collected and data processing was carried out using the Review Manager application (RevMan 5.3) to analyze and estimate the effect of online bullying on self-injurious behavior and suicidal ideation in adolescents. Data processing was presented in the form of forest plots and funnel plots.

RESULTS

The process of searching for articles to be synthesized and the process of reviewing and selecting articles using the PRISMA Flow Diagram are presented in Figure 1. The initial search process resulted in 1,420 articles. After removing articles duplication, 400 articles were generated, subsequently, after the process of eliminating article duplication, the next step was to check the relevance of the title and the study design used to generate 400 articles. After checking articles according to inclusion criteria and exclusion criteria, 51 articles were obtained, and in the end 11 articles were included in this meta-analysis.

1. Characteristics of study data

Figure 2 showed the observed 11 study articles that come from the Asia continent (China, Vietnam, Iran, Singapore, and Taiwan), Australia continent (Australia), and America continent (United states).

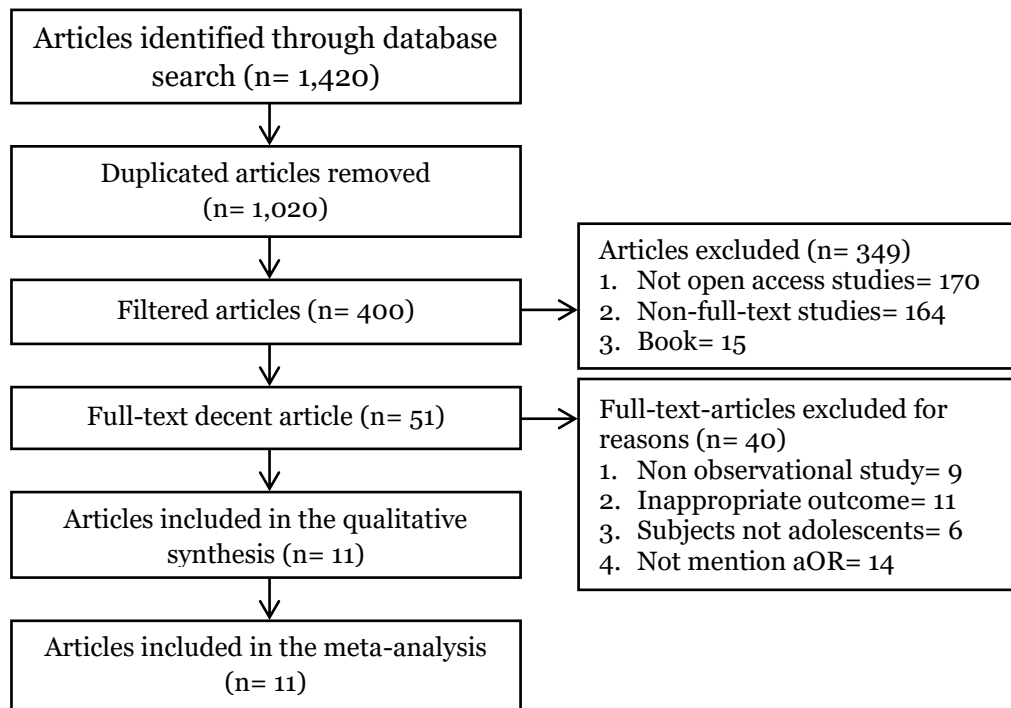


Figure 1. PRISMA Flow diagrams the impact of cyberbullying on self-harming behavior and suicidal thoughts among adolescents



Figure 2. Research distribution map the impact of cyberbullying on self-harming behavior and suicidal thoughts among adolescents

Table 1. The quality assessment result the impact of cyberbullying on self-harming behavior and suicidal thoughts among adolescents with a cross-sectional study.

Primary Study	Criteria												Total			
	1				2				3		4	5		6		7
	a	b	c	d	a	b	a	b	a	b						
Elgar et al. (2014)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	26	
Alhajji et al. (2019)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	26	
Peng et al. (2019)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	26	
Nguyen et al. (2020)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	26	

Primary Study	Criteria												Total
	1			2		3		4	5	6		7	
	a	b	c	d	a	b	a			b	a		
Azami et al. (2020)	2	2	2	2	2	2	2	2	2	2	2	2	26
Ong et al. (2020)	2	2	2	2	2	2	2	2	2	2	2	2	26
Islam et al. (2020)	2	2	2	2	2	2	2	2	2	2	2	2	26
Yang et al. (2021)	2	2	2	2	2	2	2	2	2	2	2	2	26
Lee et al. (2021)	2	2	2	2	2	2	2	2	2	2	2	2	26
Lan et al. (2022)	2	2	2	2	2	2	2	2	2	2	2	2	26
Jin et al. (2023)	2	2	2	2	2	2	2	2	2	2	2	2	26

Table 1 showed quality assessment result of articles with a cross-sectional study included in meta-analysis.

Description of the question criteria:

1. Formulation of research questions in PICO acronym:
 - a. What is the population in the study primary is the same as the population in PICO meta-analysis?
 - b. What is the operational definition of intervention (intervention), namely the status of exposure (exposed) in primary studies is the same as that definition intended in meta-analysis?
 - c. What is the comparison (comparison), namely status not exposed (unexposed) is used Primary studies are the same as that definition intended in meta-analysis?
 - d. What is the outcome variable being studied? in primary studies is the same as that definition intended in meta-analysis?
2. Method for selecting research subjects:
 - a. Descriptive cross-sectional study (prevalence): Is the sample randomly selected?
 - b. Analytical cross-sectional study: Are samples randomly or purposively selected?
3. Methods for measuring comparisons (intervention) and outcome variables:
 - a. Are both exposure or intervention and outcome variables measured with the same instruments in all primary studies?

- b. If variables are measured on a categorical scale, are the cut-offs used the same across primary studies?
4. Bias of the design:
 - a. How much is the response rate?
 - b. Is non-response related to outcomes?
5. Methods to control confounding:
 - a. Is there any confusion in the results or conclusions of the primary study?
 - b. Have primary study researchers used appropriate methods to control the effects of confounding?
6. Method of statistical analysis:
 - a. In the cross-sectional study, is multivariate analysis performed?
 - b. Multivariate analysis includes multiple linear regression analysis, multiple logistic regression analysis, Cox regression analysis.
7. Is there a conflict of interest with the research sponsor?

Description of scoring:

0= No; 1= Hesitate; 2= Yes.

Table 2 describes a summary of primary research of the impact of cyberbullying on self-harming behavior and suicidal thoughts among adolescents, a meta-analysis was carried out on 11 articles originating from the country of United States, China, Vietnam, Iran, Singapore, Australia, South Korea, and Taiwan).

Table 2. Description of the impact of cyberbullying on self-harming behavior and suicidal thoughts among adolescents (cross-sectional study).

Author (years)	Country	Sample	P	I	C	O
Elgar et al. (2014)	United State	18,834	Adolescents aged 12-18 years	Cyberbullying victimization	No cyberbullying victimization	1. Self-harm 2. Suicidal ideation
Alhajji et al. (2019)	United State	15,465	Students in grades 9-12	Cyberbullying victimization	No cyberbullying victimization	Suicidal ideation
Peng et al. (2019)	China	2,647	Students in grades 7-9	Cyberbullying victimization	No cyberbullying victimization	1. Self-harm 2. Suicidal ideation
Nguyen et al. (2020)	Vietnam	648	Grade 6 students	Cyberbullying victimization	No cyberbullying victimization	1. Self-harm 2. Suicidal ideation
Azami et al. (2020)	Iran	400	High school students	Cyberbullying victimization	No cyberbullying victimization	Self-harm
Ong et al. (2020)	Singapore	3,319	Adolescents aged 12-17 years	Cyberbullying victimization	No cyberbullying victimization	1. Self-harm 2. Suicidal ideation
Islam et al. (2020)	Australia	2,166	Adolescents aged 12-17 years	Cyberbullying victimization	No cyberbullying victimization	1. Self-harm 2. Suicidal ideation
Yang et al. (2021)	China	11,248	Students in grades 5-12	Cyberbullying victimization	No cyberbullying victimization	1. Self-harm 2. Suicidal ideation
Lee et al. (2021)	South Korea	7,333	Middle and high school students	Cyberbullying victimization	No cyberbullying victimization	Suicidal ideation
Lan et al. (2022)	Taiwan	8,448	Adolescents aged 10-18 years	Cyberbullying victimization	No cyberbullying victimization	Self-harm
Jin et al. (2023)	China	8,098	Adolescents aged 17 years	Cyberbullying victimization	No cyberbullying victimization	Suicidal ideation

2. Correlation of online bullying with self-injurious behavior

Table 3. aOR and 95% CI data of online bullying and self-injurious behavior.

(Author, year)	aOR	95% CI	
		Lower Limit	Upper Limit
Elgar et al. (2014)	3.7	2.31	5.82
Peng et al. (2019)	3.30	2.38	4.58
Nguyen et al. (2020)	4.70	1.70	13.00
Azami et al. (2020)	2.97	1.32	6.68
Ong et al. (2020)	3.34	1.80	6.20
Islam et al. (2020)	3.60	2.70	4.80
Yang et al. (2021)	3.88	2.58	5.83
Lan et al. (2022)	3.90	2.95	5.16

Table 3 showed the effect sizes of the primary studies used in the meta-analysis about the impact of online bullying and

self-injurious behavior, with largest adjusted odd ratio (aOR) conducted by Peng et

al. (2019) is 4.70, and the lowest aOR conducted by Nguyen et al. (2020) is 2.97.

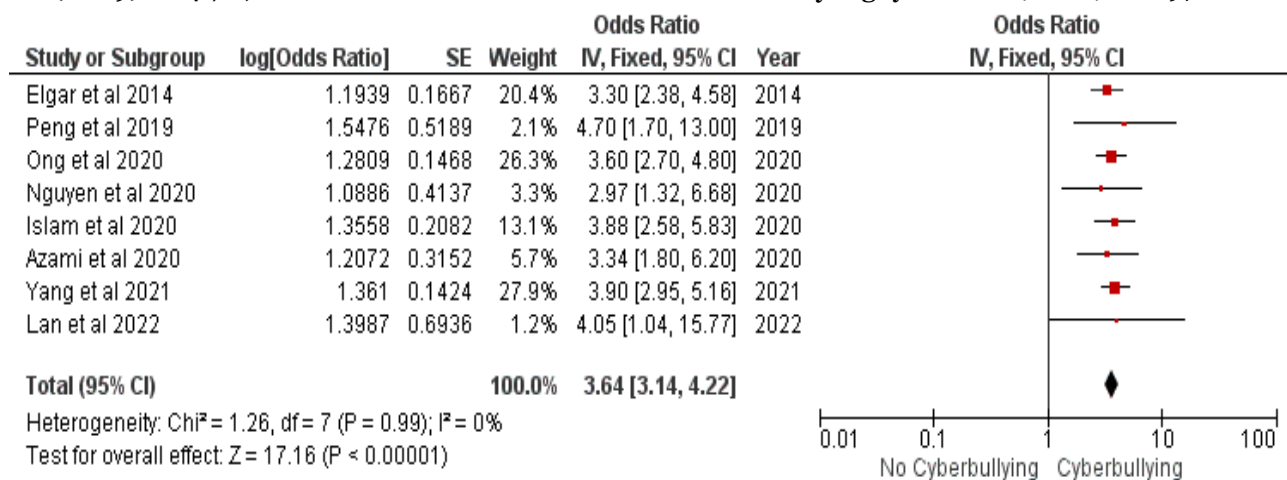


Figure 3. Forest plot of the effect of online bullying on self-harm behavior

The forest plot in figure 3 the influence of online bullying on the risk of self-injurious behavior in adolescents. The forest plot shows that teenagers who are victims of online bullying are 3.64 times more likely to have self-injurious behavior compared to teenagers who are not victims of online bullying (aOR= 3.64; 95% CI= 3.14 to 4.22;

p< 0.001). The forest plot also shows low heterogeneity of effect estimates between primary studies (I²= 0%), which means that effect estimates between primary studies in this meta-analysis do not vary. Therefore, the calculation of the average estimated effect is carried out using a fixed effect model approach.

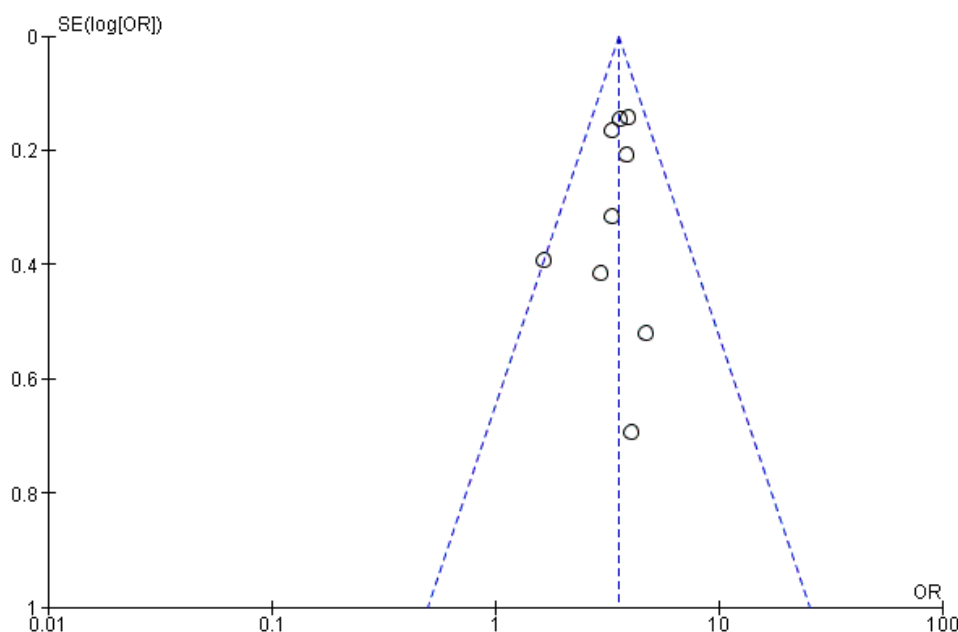


Figure 4. Forest plot of the effect of online bullying on self-harm behavior

Figure 4 show a funnel plot of the estimated distribution of the effect of online bullying

on the risk of self-injurious behavior. The funnel plot shows that the distribution of

estimated effects is balanced to the right and left of the vertical line of the mean.

Thus, the funnel plot does not show any publication bias.

3. Correlation of online bullying with suicidal ideation

Table 4. aOR and 95% CI data of online bullying and suicidal ideation.

(Author, year)	aOR	95% CI	
		Lower Limit	Upper Limit
Elgar et al. (2014)	2.97	2.03	4.35
Peng et al. (2019)	2.70	1.80	4.05
Nguyen et al. (2020)	2.10	0.90	4.90
Alhajji et al. (2019)	1.60	1.40	1.83
Ong et al. (2020)	4.30	3.20	5.78
Islam et al. (2020)	8.42	5.29	13.40
Yang et al. (2021)	1.83	1.46	2.29
Lee et al. (2021)	1.35	0.55	3.31
Jin et al. (2023)	2.18	1.84	2.59

Table 4 showed the effect sizes the impact of online bullying on suicidal ideation, with largest adjusted odd ratio conducted by

Islam et al. (2020) is 8.42, and the lowest aOR conducted by Lee et al. (2021) is 1.35.

Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio		Year
				IV, Random, 95% CI	Year	
Elgar et al 2014	1.0886	0.1941	11.6%	2.97 [2.03, 4.35]	2014	
Peng et al 2019	0.9933	0.2069	11.4%	2.70 [1.80, 4.05]	2019	
Alhajji et al 2019	0.47	0.0681	13.8%	1.60 [1.40, 1.83]	2019	
Islam et al 2020	2.1306	0.2371	10.7%	8.42 [5.29, 13.40]	2020	
Nguyen et al 2020	0.7419	0.4323	6.9%	2.10 [0.90, 4.90]	2020	
Ong et al 2020	1.4586	0.1507	12.5%	4.30 [3.20, 5.78]	2020	
Yang et al 2021	0.6043	0.1152	13.1%	1.83 [1.46, 2.29]	2021	
Lee et al 2021	0.3001	0.4581	6.4%	1.35 [0.55, 3.31]	2021	
Jin et al 2023	0.7798	0.0876	13.5%	2.18 [1.84, 2.59]	2023	
Total (95% CI)			100.0%	2.64 [1.94, 3.60]		

Heterogeneity: Tau² = 0.18; Chi² = 80.03, df = 8 (P < 0.00001); I² = 90%
 Test for overall effect: Z = 6.15 (P < 0.00001)

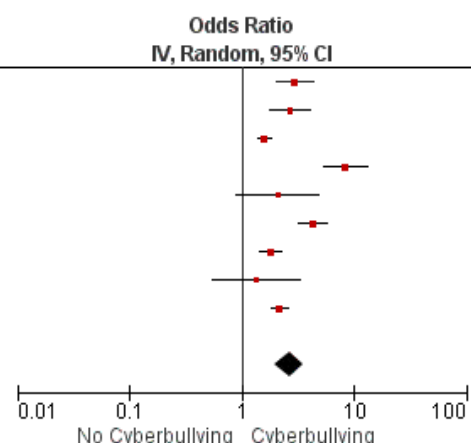


Figure 5. Forest plot of the effect of online bullying on suicidal ideation

Figure 5 shows that adolescents who are victims of online bullying are 2.64 times more likely to have suicidal ideation compared to adolescents without online bullying (aOR= 2.64; 95% CI= 1.94 to 3.60; p< 0.001). The forest plot also shows high heterogeneity in effect estimates between primary studies (I²= 90%), which means that effect estimates between primary studies in this meta-analysis vary.

Figure 6 shows a funnel plot of the estimated distribution of the effect of online

bullying on the risk of suicidal ideation. The funnel plot shows that the distribution of effect estimates across studies tends to the left rather than the right of the vertical line of the mean. Thus, the funnel plot indicates publication bias because the distribution of estimated effects lies in the opposite direction to the location of the diamonds in the forest plot, so this bias tends to reduce the true effect (underestimate).

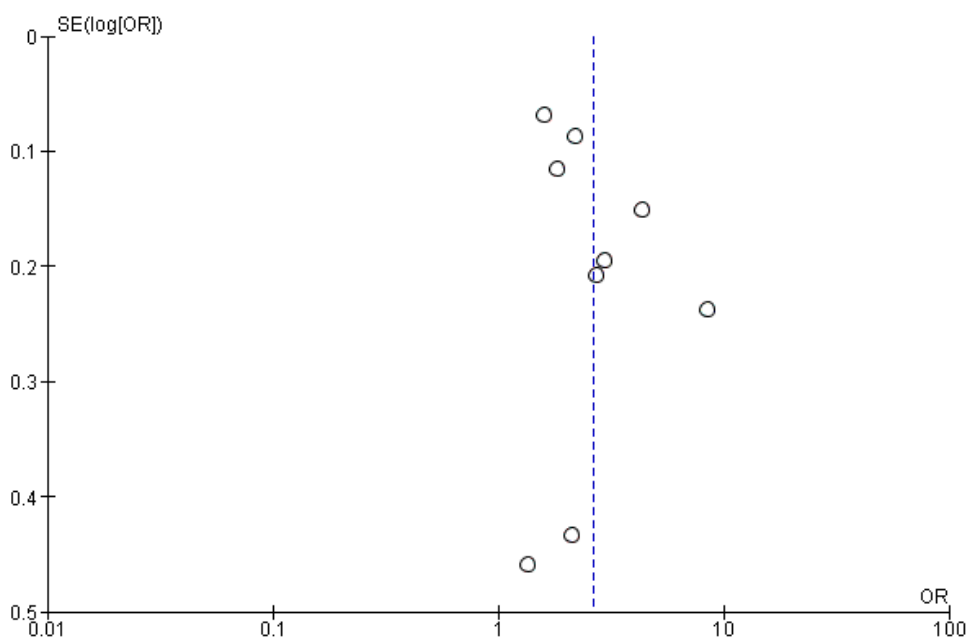


Figure 6. Funnel plot of the effect of online bullying on suicidal ideation.

DISCUSSION

1. Online bullying with self-injurious behavior

There are 8 articles from several countries that are used to measure the magnitude of the influence of online bullying on self-injurious behavior. All articles used a cross-sectional study design. This research shows the strong influence of online bullying on self-injurious behavior. Research data shows that teenagers who are victims of online bullying have a significantly higher risk of engaging in self-injurious behavior compared to teenagers who are not victims of online bullying. The results of this study show that adolescents who are victims of online bullying are 3.64 times more likely to have self-injurious behavior compared to adolescents who are not victims of online bullying (aOR= 3.64; 95% CI= 3.14 to 4.22; $p < 0.001$).

Research conducted in Canada found that online bullying is a major problem that affects the psychological condition of adolescents (Hébert et al., 2016). The results of this study are in line with other research

which states that teenagers who are victims of online bullying are 2.35 times more likely to engage in self-harming behavior than teenagers who are not victims of online bullying (John et al., 2018). Other research also states that online bullying can have long-term consequences for the victim, such as depression, anxiety, low self-esteem, and even self-injurious behavior (Myklestad and Straiton, 2021).

The association between online bullying and self-injurious behavior is associated with significant psychological distress and deep emotional pain. This is because online bullying can cause feelings of helplessness, hopelessness and worthlessness, which are risk factors for self-harm. Victims of online bullying may also experience persistent and pervasive negative thoughts about themselves, leading to an increased risk of developing self-injurious behavior as a maladaptive coping mechanism (Beauroy-eustache and Mishara, 2021; Memon et al., 2018).

Previous research conducted in Yogyakarta and Surakarta also stated that bullying can increase the risk of depression,

anxiety, negative self-concept and social interaction disorders in adolescents (Privetera et al., 2020; Sudrajat et al., 2020). Adolescents who are victims of bullying are 2.43 times more likely to experience depression compared to adolescents who are not victims of bullying (Fitriah et al., 2021). This depression will then worsen the teenager's mental condition, which in the end will give rise to self-harming behavior, even at a severe level it can give rise to suicidal ideas in teenagers.

2. Online bullying with suicidal ideation

There are 9 articles from several countries used to measure the magnitude of the influence of online bullying on suicidal ideation. All articles used a cross-sectional study design. The results of this study show that there is a fairly strong influence of online bullying on suicidal ideation. Research data shows that teenagers who are victims of online bullying have a significantly higher risk of having suicidal ideation compared to teenagers who are not victims of online bullying. The results of this study show that adolescents who are victims of online bullying are 2.64 times more likely to have suicidal ideation compared to adolescents without online bullying (aOR= 2.64; 95% CI= 1.94 to 3.60; $p < 0.001$).

The results of this study are in line with previous research which shows a significant relationship between online bullying victims and suicidal ideation among teenagers. Adolescents who are victims of online bullying are more likely to report suicidal thoughts than adolescents who do not experience online bullying (Bai et al., 2021; Peprah et al., 2023). Research with a cohort study design conducted over three years in India also stated that there was a longitudinal relationship between the experience of being a victim of online bully-

ing and thoughts of suicide in adolescents. This research also confirms that this has a lasting impact (Maurya et al., 2022).

Online bullying can increase suicidal thoughts among teenagers, mainly due to psychological stress including feelings of helplessness, hopelessness and worthlessness. This condition is exacerbated by the sense of dehumanization felt by the victim, as well as the public impact and permanent digital footprint of online bullying which causes shame and social isolation. All of these factors together increase the risk of suicidal ideation (Bai et al., 2021; Peprah et al., 2023). Apart from that, previous research also shows that low emotional intelligence can increase the risk of suicidal thoughts in teenagers who are victims of online bullying (Extremera et al., 2018).

Based on the explanation above, from the 11 cross-sectional primary studies included in this meta-analysis, it can be concluded that the risk of developing self-injurious behavior and suicidal ideation increases in adolescents who have been victims of online bullying. The results of this meta-analysis support previous primary studies regarding various factors that influence the emergence of self-injurious behavior and suicidal ideation in adolescents. Considering the many risks that can arise from online bullying, further meta-analysis is needed to determine other risks that can occur.

AUTHOR CONTRIBUTION

Amalia Khurotul Mahzunah is the main author who chose the research topic, searched for research data, and checked the writing of the article; Ica Yuniar Sari played a role in data processing and interpretation of results; Berti Vega Paradela played a role in the interpretation of the results and preparation of the article.

FUNDING AND SPONSORSHIP

This study is self-funded.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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