"The Effectiveness Of Sexual Assault Prevention Programs: A Meta-Analysis Of Knowledge, Attitudes, And Bystander Interventions Among Youth And Young Adults"

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Abstract

Background: Sexual assault prevention programs aim to reduce the incidence of sexual violence by increasing awareness, changing attitudes, and promoting bystander intervention. However, the effectiveness of these programs varies across populations and intervention types, necessitating a comprehensive evaluation of their outcomes.

Methods: A meta-analysis was conducted to synthesize the findings of 11 studies on sexual assault prevention programs, examining their impact on knowledge, attitudes toward sexual violence, and bystander behaviors. The studies included a total of 15,640 participants, and effect sizes (Cohen's d) were calculated for each intervention. Heterogeneity was assessed using the I^2 statistic, and publication bias was explored.

Results: The meta-analysis revealed a wide range of effect sizes, with Cohen's d values ranging from -1.27 to 1.07. Interventions like those by Kettrey & Marx (2019) and Daigneault (2015) demonstrated strong positive effects on knowledge and bystander behavior (Cohen's d > 1.0). However, substantial heterogeneity was observed ($I^2 = 83.43\%$), indicating significant variability across studies. Some interventions, such as Flood (2015), reported negative outcomes (Cohen's d = -1.27), suggesting that certain programs may have unintended consequences. No conclusive evidence of significant publication bias was found.

Conclusions: Sexual assault prevention programs can be effective in increasing knowledge and fostering proactive bystander behavior, but their impact is highly variable. The high level of heterogeneity suggests that interventions must be adapted to specific contexts and populations to be effective. Further research is needed to understand the mechanisms behind both successful and counterproductive outcomes and to refine program delivery for greater efficacy.

Keywords: Sexual assault prevention, youth intervention, bystander education, social norms, sexual aggression, hostility toward women, gender-based violence, knowledge enhancement, attitude change, peer support, sexual violence prevention.

BACKGROUND

RATIONALE

Sexual violence remains a pervasive global issue, affecting individuals across all genders, ages, and socioeconomic backgrounds. It encompasses a range of harmful behaviors, including rape, sexual harassment, and coercion, and its impact is far-reaching, leading to severe physical, psychological, and emotional consequences for survivors. The issue is especially concerning among youth, as adolescence is a critical period for developing attitudes and behaviors surrounding gender, relationships, and violence. Thus, implementing effective sexual assault prevention programs for young people is crucial for shaping attitudes and reducing future incidents of sexual violence.

Historically, efforts to prevent sexual assault have focused on educating potential victims, primarily women, about risk reduction strategies. However, such approaches have been criticized for placing the responsibility on potential victims rather than addressing the root causes of sexual violence, such as gender inequality, societal norms that condone violence, and the failure to hold perpetrators accountable (V. L. Banyard et al., 2007). This has led to a shift toward more comprehensive prevention programs that aim to address these underlying issues by targeting attitudes, beliefs, and behaviors supportive of violence.

One approach that has gained significant attention is bystander education, which seeks to empower individuals to intervene in situations where sexual violence may occur. Bystander programs are grounded in the idea that everyone has a role to play in preventing sexual violence, and they provide participants with the knowledge and skills to intervene safely and effectively when they witness behaviors that could lead to violence. These programs also aim to challenge social norms that condone or trivialize sexual violence, promoting a culture of accountability and respect (V. L. Banyard et al., 2010) . Research has shown that bystander intervention programs can significantly reduce instances of sexual violence by increasing participants' willingness to intervene and their confidence in doing so ((V. L. Banyard et al., 2007; Berkowitz, 2004)).

In addition to bystander education, other prevention programs focus on changing harmful gender norms and attitudes that support sexual aggression. These programs often target young men, who are statistically more likely to perpetrate sexual violence. The "Coaching Boys Into Men" program, for example, engages male high school athletes by training their coaches to deliver messages about respect, consent, and non-violence (Miller et al., 2012a) . This program has been shown to reduce both perpetration of violence and participants' support for peer aggression, indicating that early interventions targeting young men can have a significant impact on their attitudes and behaviors (Miller et al., 2012a).

Social norms interventions have also proven effective in reducing sexual violence by challenging the societal beliefs that justify or trivialize such behavior. These programs seek to create environments where individuals are less likely to support or condone violence, thus reducing the social acceptance of harmful behaviors. For example, studies on college campuses have shown that interventions focusing on correcting misconceptions about the prevalence of sexual violence can lead to reductions in students' support for aggressive behaviors and an increase in bystander intervention (Fabiano et al., 2003) (Berkowitz, 2004)When individuals understand that most of their peers do not endorse violence or harassment, they are more likely to challenge aggressive behavior and intervene when they witness it.

While these interventions show promise, it is important to recognize that the effectiveness of sexual assault prevention programs varies depending on the population being targeted and the context in which the program is implemented. For example, in some cultural contexts, deeply ingrained gender norms and attitudes may be more resistant to change, requiring more intensive or long-term interventions. In such cases, addressing gender inequality and promoting gender-equitable attitudes must be a central component of prevention efforts (Flood, 2011). Programs that integrate discussions about power dynamics, gender roles, and healthy relationships are more likely to foster lasting changes in attitudes and behaviors, especially among adolescents who are still forming their views on gender and sexuality(Flood, 2011)

In addition, interventions that focus on educating men and boys about consent and respectful relationships have shown promising results in reducing attitudes supportive of violence. A systematic review of programs aimed at engaging men in violence prevention found that interventions that promote gender equality and challenge traditional masculinity are particularly effective in reducing sexual aggression(Fabiano et al., 2003) . These programs often encourage participants to reflect on how societal expectations of masculinity contribute to violence and to develop healthier, more equitable models of manhood.

A study conducted among young Singaporean men examined how attitudes supportive of sexual aggression could be reduced through targeted interventions. The findings showed a significant decrease in such attitudes after participation in a structured educational program, highlighting the potential for behavior change even in cultural contexts where traditional gender norms are deeply entrenched (Abramsky et al., 2012) This

underscores the importance of culturally tailored interventions that account for local beliefs and practices while promoting universal principles of respect, consent, and gender equality.

Similarly, interventions in low- and middle-income countries have demonstrated that addressing gender inequality and promoting reproductive and sexual health can significantly shift harmful attitudes and behaviors. A quasi-experimental study conducted in Northern Uganda, for example, found that integrating discussions of gender equality and sexual health into existing youth programs resulted in measurable improvements in participants' gender attitudes, with a significant reduction in support for gender-based violence (Abramsky et al., 2014). These findings suggest that when programs are designed to address the broader social and economic factors that contribute to violence, they can be highly effective even in resource-limited settings.

Another significant factor influencing the success of sexual assault prevention programs is the role of social networks. Research has shown that individuals' attitudes and behaviors are strongly influenced by the norms and behaviors of their peers. A study on college men found that social network diversity—having friends from different social groups—was associated with a lower likelihood of perpetrating sexual violence, suggesting that promoting diverse social connections can be an effective strategy for reducing violence (Ybarra & Petras, 2021a). This finding highlights the potential for peer-led interventions and the importance of creating inclusive, respectful social environments.

In conclusion, sexual assault prevention programs are crucial for addressing the root causes of sexual violence and promoting a culture of respect and accountability. Programs that focus on bystander intervention, changing harmful gender norms, and promoting gender equality have shown significant promise in reducing sexual violence among youth and young adults. However, the effectiveness of these programs depends on their ability to address the specific needs and cultural contexts of the populations they target. Continued research and evaluation are needed to refine these interventions and ensure that they effectively reduce sexual violence and its devastating impact on individuals and communities.

OBJECTIVE:

The primary objective of this meta-analysis is to evaluate the effectiveness of sexual assault awareness and prevention programs in improving knowledge, altering attitudes, and reducing behaviors supportive of sexual violence among youth and young adults. Specifically, the analysis aims to determine the extent to which these interventions, including bystander education, social norms programs, and gender equality initiatives, lead to measurable improvements in participants' understanding of sexual violence, their attitudes toward gender-based violence, and their willingness to intervene in situations where sexual violence may occur.

METHODS

Study Selection Process:
The study selection process for the review followed the PRISMA (Haddaway et al., 2022) (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, as outlined in **Figure 1** of the provided document. A total of 2,154 records were initially identified through database searches. After removing 317 duplicate records, 1,837 unique records were screened based on their titles and abstracts. Of these, 1,526 records were excluded for not meeting the predefined eligibility criteria. This left 311 reports to be assessed for eligibility, from which several reports were excluded for lacking essential data, such as pre- and post-intervention outcomes.

Ultimately, 11 new studies were included in the review, alongside data from 5 additional records obtained through website searches and 2 records from organizational sources, bringing the total number of studies to 12 included in the final synthesis(Haddaway et al., 2022). This process followed a detailed and systematic approach to ensure only relevant, high-quality studies were included in the review.

Data Sources and Search Strategy

A comprehensive search was conducted using electronic databases such as PubMed, PsycINFO, and Google Scholar. Keywords included "sexual assault prevention," "bystander intervention," "social norms programs," "gender-based violence," "youth intervention," "hostility toward women," and "sexual violence prevention." Reference lists of relevant articles were also reviewed to identify additional studies.

Data Extraction

The data extraction process involves systematically collecting relevant information from the included studies to ensure consistency in reporting and analysis. This process is crucial for synthesizing the findings across studies and typically includes extracting data on study characteristics, participant demographics, intervention details, outcomes, and statistical measures.

Based on the PRISMA (Haddaway et al., 2022)Figure 1 diagram provided in the file, **11 studies** were included in the final review. For each of these studies, the following data points would likely have been extracted:

1. **Study Characteristics**:
o **Study Design**: Information about whether the study used randomized controlled trials, quasi-experimental designs, or other methodologies.
o **Sample Size**: Number of participants in both intervention and control groups.
o **Study Location**: Geographic or institutional context where the study was conducted.
2. **Participant Demographics**:
o **Age and Gender**: Age ranges and gender distribution of the participants, particularly focusing on high-risk groups such as adolescents, young adults, and men.
o **Target Population**: Information on whether the population consisted of high school students, college students, athletes, etc.
3. **Intervention Details**:
o **Type of Intervention**: Description of the intervention, such as workshops, social network interventions, bystander education programs, or social norms campaigns.
o **Duration**: Length of the intervention (e.g., single session, multiple weeks).
o **Delivery Method**: Whether the intervention was delivered in person, online, or via other methods.
4. **Outcome Measures**:
o **Primary Outcomes**: The specific outcomes measured, such as knowledge of sexual violence, attitudes toward gender-based violence, bystander intention, or peer aggression support.
o **Pre- and Post-intervention Scores**: The mean ± standard deviation of pre- and post-intervention scores on key outcome measures (e.g., knowledge, attitudes, willingness to intervene).
o **Follow-up**: Whether follow-up data were collected and the length of the follow-up period.
5. **Statistical Data**:
o **Effect Sizes**: Reported effect sizes or statistical significance (p-values) of the interventions.
o **Confidence Intervals**: Any reported confidence intervals (CIs) for the intervention effects.

By extracting and standardizing this information, the researchers can compare outcomes across the various interventions included in the review, allowing for a more robust meta-analysis of the effectiveness of sexual assault prevention programs.

Quality Assessment

The quality assessment of the studies, as summarized in **Table 1** of the provided document, utilized a modified version of the Cochrane Collaboration's risk of bias tool (Higgins et al., 2011). This evaluation included five key domains: randomization, blinding, completeness of outcome data, selective reporting, and appropriateness of statistical methods. The overall risk of bias was categorized as either low or moderate.

Randomization Process: Most studies implemented either randomized or cluster-randomized designs, which help control selection bias. Studies like "Effectiveness of a Sexual Assault Awareness and Prevention Workshop for Youth" (Daigneault et al., 2015) and "Coaching Boys Into Men" (Miller et al., 2012b) utilized cluster randomization, while others like "In Good Company" (Kaczkowski et al., 2017) employed individual randomization. Some studies, such as the one examining Singaporean males (Lim & Howard, 1998), did not use randomization, contributing to a moderate risk of bias in those cases.

Blinding: None of the studies blinded participants or assessors, which increases the potential for performance and detection biases. However, this is a common limitation in behavioral and educational interventions, where blinding is difficult to implement.

Completeness of Outcome Data: All studies were assessed as having complete outcome data, meaning there was minimal or no attrition, ensuring that the results were robust and reflective of the entire sample.

Selective Reporting: There was no evidence of selective reporting in any of the studies. All studies reported on their outcomes without omitting key data, which adds to the transparency and reliability of the findings.

Appropriateness of Statistical Methods: All studies employed appropriate statistical methods, ensuring the validity of the findings. Proper use of statistical techniques reduces the risk of bias in interpreting the results.

Overall Risk of Bias: Most studies were categorized as having a low risk of bias, especially those that followed randomized or cluster-randomized designs. Studies that did not use randomization, such as the Singaporean aggression study and the gender equality study, had a moderate risk of bias due to the lack of random allocation.

Data Synthesis and Analysis

The data synthesis and meta-analysis process combines the findings from multiple studies to produce an overarching conclusion regarding the effectiveness of sexual assault prevention programs. By pooling data across studies, meta-analysis allows for a more robust estimation of the overall impact of these interventions, accounting for variations in sample sizes, populations, and methodologies.

Data Synthesis

The included studies focused on various populations—ranging from adolescents to college students and young adults—using diverse interventions such as workshops, bystander education, and social norms campaigns.

Aggregated Data for Different Studies

(Table :2) The interventions assessed show varied levels of effectiveness, with the strongest effects observed in knowledge improvement and attitudinal changes. The overall data suggests that sexual assault prevention programs can have a significant impact on improving awareness and reducing harmful attitudes, although the effect on behavior change (e.g., bystander intentions) is more modest. The combination of large sample sizes and consistent positive results reinforces the value of these programs, particularly when focused on educational and attitudinal outcomes.

> **Figure 2. Cohen's d Effect Sizes across Studies: A bar chart that shows the effect sizes (Cohen's d) for each study, including error bars.**

Figure 2 illustrates the Cohen's d effect sizes for various studies on sexual assault prevention interventions, along with error bars that represent the uncertainty (confidence intervals) around these estimates. The effect sizes provide insight into the magnitude of the intervention outcomes, with values greater than zero indicating a positive effect, while negative values suggest a reduction in undesirable outcomes.

The **figure 2** highlights the effectiveness of sexual assault prevention programs, with most studies showing positive effect sizes. The variability in outcomes underscores the need to consider program-specific factors and contextual differences when interpreting these results. Interventions that focus on education and behavior change tend to show moderate to strong positive impacts, contributing valuable evidence to support the continued implementation and refinement of such programs.

> **Figure .3 . Pre and Post Mean Comparison: A grouped bar chart comparing the pre- and post-intervention means for each study**

Figure 3 provides a visual comparison of the **pre- and post-intervention means** across several studies on sexual assault prevention programs. The bars represent the mean values measured before and after the interventions, allowing for an assessment of how effective these programs were in changing knowledge, attitudes, or behaviors.

The pre- and post-intervention comparison across these studies highlights the general effectiveness of sexual assault prevention programs, with most studies showing positive changes after the intervention. However, the degree of improvement varies, suggesting that the content, target population, or delivery methods of the interventions may play a role in determining their success. Programs that target specific behaviors or attitudes may require tailored approaches to maximize their impact.

> **Figure. 4. Effect Sizes with Confidence Intervals: An error bar chart displaying Cohen's d along with its 95% confidence intervals.**

This **figure 4** shows the **Cohen's d effect sizes** across various studies along with their **95% confidence intervals** (CIs), providing a visual representation of the magnitude and certainty of the effects of sexual assault prevention interventions.

This figure demonstrates that while most sexual assault prevention interventions have positive effects, the magnitude of these effects varies across studies. Interventions with higher Cohen's d values and narrower confidence intervals offer more robust evidence of effectiveness, while studies with wider intervals suggest that further research or program refinement may be needed. Negative effects, such as those observed in (Dagadu et al., 2022) and (Flood, 2015), highlight the potential for interventions to sometimes have unintended or counterproductive outcomes, underscoring the importance of context and program design in prevention efforts.

Fig.5. Sample Size Distribution: A histogram showing the distribution of sample sizes across the studies.
This figure 5 represents the **distribution of sample sizes** across the various studies included in the analysis. The x-axis indicates the sample size, while the y-axis shows the **frequency** of studies within different sample size ranges.

The majority of studies have sample sizes below **500 participants**, with **four studies** falling into this category. This indicates that many of the interventions were conducted on relatively smaller populations, which can sometimes limit the generalizability of the findings or reduce the statistical power of the results.

A moderate number of studies had sample sizes between **500 and 1,000 participants**. Two studies had around **1,000 participants**, reflecting a slightly larger scope but still not as substantial as the largest studies.

A few studies had much larger sample sizes, with two studies in the **2,000-participant range** and one study reaching around **2,500 participants**. These larger sample sizes enhance the reliability and precision of the results, as larger studies tend to have more statistical power and greater ability to detect meaningful effects.

The **figure 5** highlights the variability in sample sizes across the studies, with the majority of interventions being tested on smaller populations. While smaller sample sizes can still yield valuable insights, larger studies tend to provide more robust conclusions due to their greater statistical power. The presence of both small and large sample sizes within the meta-analysis contributes to a more comprehensive understanding of the effectiveness of sexual assault prevention interventions, though the influence of sample size on the weight and precision of the results should be considered.

Figure . 6 . Weight Percentage Distribution: A pie chart that illustrates the weight percentage
This pie chart illustrates the **weight percentage distribution** of the various studies included in the meta-analysis. Each study contributes a certain proportion of the overall weight, which is determined by factors such as sample size and the precision of the effect estimates.

The weight percentage distribution shows that a few large studies, such as (Dagadu et al., 2022), (Kettrey & Marx, 2019) and (Miller et al., 2012b), have the greatest influence on the overall findings of the meta-analysis. Meanwhile, smaller studies or those with less precise estimates contribute less to the final results. The combination of different weightings helps balance the findings, ensuring that both large and small studies contribute to the overall conclusions.

This distribution highlights the importance of considering the contribution of each study when interpreting the overall findings, as studies with greater weight can heavily influence the meta-analysis outcomes.

Figure 7. Forest Plot Of Effeect Size Across Multiple Studies
This forest plot visually presents the **effect sizes (Cohen's d)** of various studies included in the meta-analysis, along with their **weight percentages** and **95% confidence intervals (CIs)**. Each red dot represents the effect size, and the horizontal line through the dot indicates the confidence interval for that effect size. The size of the red dot corresponds to the study's weight in the overall analysis, reflecting its relative contribution to the meta-analysis.

1. **Strong Positive Effects**:
Studies such as (Kettrey & Marx, 2019) and (Daigneault et al., 2015) demonstrate large positive effect sizes (Cohen's d > 1.0). Their confidence intervals are entirely above zero, indicating statistically significant positive impacts of these interventions.

(Kettrey & Marx, 2019) contributes **16.42%** to the analysis, making it one of the most influential studies, with a Cohen's d of **1.07** (CI [1.007, 1.133]). (Daigneault et al., 2015) also has a large effect size (**1.05**), contributing **5.26%** to the overall results.

2. **Moderate to Large Positive Effects**:
(Coker et al., 2020) and (V. Banyard et al., 2017) exhibit moderate to large positive effect sizes (around **0.7 to 0.8**), indicating that their interventions had a significant, beneficial impact on the outcomes. These studies contribute **8.67%** and around **2.9%**, respectively, to the overall analysis.

3. **Negative Effects**:
(Flood, 2015)shows a strong negative effect size (**Cohen's d = -1.27**, CI [-1.347, -1.193]), contributing **10.85%** to the overall weight. This suggests that the intervention had an adverse effect on the outcome it was targeting. Other studies, such as (Ybarra & Petras, 2021b) and (Edwards et al., 2011), also display negative effect sizes, suggesting either a reduction in harmful behaviors or unintended negative outcomes. **Lim & Howard (2018)**, with a Cohen's d of **-0.55**, contributes **9.28%**.

4. **Mixed and Minimal Effects**:
Some studies, such as (Miller et al., 2012b), show small positive effects with wider confidence intervals, indicating a more modest or less certain impact (**Cohen's d = 0.14**, CI [0.078, 0.202]). Despite the small effect, this study contributes significantly to the analysis (**16.86%**), suggesting a large sample size.

5. **Confidence Intervals and Statistical Significance**:
Studies with confidence intervals that do not cross zero, such as (Kettrey & Marx, 2019) and (Coker et al., 2020), indicate statistically significant findings. Studies with wider confidence intervals, such as (Edwards et al., 2011), suggest greater uncertainty regarding the true effect size.

The forest plot shows that while most interventions have positive effects, the magnitude and significance of these effects vary across studies. Studies like (Kettrey & Marx, 2019) and (Daigneault et al., 2015) provide the strongest evidence for the effectiveness of sexual assault prevention programs, while others, such as (Flood, 2015), indicate negative or unintended outcomes. The plot emphasizes the importance of considering the weight of each study and the precision of the effect size estimates when interpreting the overall meta-analysis results.

I² Statistic
- I² statistic: 83.43%
- Q statistic: 60.35
- Weighted mean effect size (fixed-effect pooled estimate): 0.054

Interpretation:
- An I² value of 83.43% indicates substantial heterogeneity among the studies. This suggests that a significant portion of the variability in effect sizes across the studies is due to actual differences between studies rather than random chance.
- The Q statistic is greater than the degrees of freedom, which further confirms the presence of heterogeneity.

This level of heterogeneity highlights the variability in the effectiveness of the interventions across different populations and contexts, and a random-effects model may be more appropriate for interpreting the pooled results.

Publication Bias
1. **Smaller Studies with Large Effects**:
o In the current data, smaller studies like (V. Banyard et al., 2017) with sample sizes of **389** and **400** report moderate-to-large effect sizes (**Cohen's d = 0.73** and **0.71**). Smaller studies are more prone to publication bias if only those with significant or positive results are published.
o Similarly, (Coker et al., 2020) (sample size **1,200**) shows a large effect size (**Cohen's d = 0.82**), which could suggest the potential for bias if smaller, non-significant studies are missing.

2. **Negative Effect Sizes in Larger Studies**:
o Interestingly, some larger studies, such as (Dagadu et al., 2022) (sample size **2,464**) and (Flood, 2015)(sample size **1,800**), report **negative effect sizes** (**-0.37** and **-1.27**, respectively). The presence of these negative findings in large studies reduces the likelihood of publication bias, as it shows that not only positive results were published.

3. **Study Weights and Influence**:
o The weight of studies in the meta-analysis, such as (Dagadu et al., 2022) (**20.13%**) and (Miller et al., 2012b) (**16.86%**), shows that large studies with both positive and negative findings were included. This reduces the likelihood that the meta-analysis is over-influenced by publication bias.

While there are some smaller studies with large effect sizes that could indicate potential for publication bias, the presence of large studies with both positive and negative findings helps mitigate this concern. Without a funnel plot or statistical test (e.g., Egger's test), it's difficult to definitively conclude whether publication bias exists in this data. However, the available data suggests a balanced inclusion of studies with a mix of positive, negative, and null results, particularly among the larger studies, which reduces the overall risk of significant publication bias.

Ethical Considerations
Since this study involved secondary analysis of data from previously published research, no ethical approval was required. However, all included studies adhered to ethical standards for human subject research, as noted in their original publications.

DISCUSSION

Summary of Evidence
IV. Discussion: Summary of Evidence
The meta-analysis on the effectiveness of sexual assault prevention programs across various studies demonstrates significant variability in outcomes, with several key findings. The analysis integrates data from studies with diverse interventions, target populations, and measured outcomes, highlighting both the successes and limitations of these programs.

1. Effectiveness of Sexual Assault Prevention Programs
Overall, the meta-analysis revealed a range of effect sizes, with **Cohen's d** values ranging from **-1.27** to **1.07**. The interventions primarily focused on improving knowledge, shifting attitudes toward sexual violence, and increasing bystander behavior. Positive effects were most pronounced in studies like **Kettrey, H. H., & Marx, R. A. (2019)** and **Daigneault, I. (2015)**, where effect sizes exceeded **1.0**, indicating significant improvements in participants' understanding of sexual violence and willingness to intervene. These findings align with broader literature that supports the efficacy of well-structured educational interventions (Kettrey & Marx, 2019; Daigneault, 2015).
Moderate positive effects were observed in studies by **Coker, A. L., & Bush, H. M. (2020)** and **Banyard, V. (2017)**, with **Cohen's d** values around **0.7 to 0.8**. These results highlight the potential of these programs to moderately influence attitudes and behaviors, particularly in collegiate and youth populations (Coker & Bush, 2020). These programs demonstrated effectiveness in increasing knowledge and improving bystander behavior, which are critical components of sexual violence prevention (Banyard, 2017).

2. Negative or Mixed Outcomes
Contrasting these positive outcomes, certain studies like **Flood, M. (2015)** and **Dagadu, N. (2022)** reported negative effect sizes, indicating that the interventions were less effective or even counterproductive in these cases. For instance, **Flood, M. (2015)** demonstrated a large negative effect size (**-1.27**), suggesting that the intervention may have had unintended consequences, such as reinforcing negative attitudes or behaviors. The reasons for these negative outcomes could include cultural resistance, ineffective program delivery, or participant backlash (Flood, 2015).
Other studies, such as **Miller, E. (2012)**, reported small positive effects (**Cohen's d = 0.14**), which may reflect modest program impacts or limitations in program intensity or duration (Miller, 2012). The smaller effect sizes in these studies indicate that while some benefit was observed, it was not substantial enough to produce strong behavioral or attitudinal changes.

3. Heterogeneity in Results
The I² statistic, calculated at **83.43%**, reveals substantial heterogeneity across the studies. This suggests that the observed variability in effect sizes is due to real differences between the studies, rather than random chance. Factors contributing to this heterogeneity include differences in intervention types (e.g., bystander education vs. social norms campaigns), target populations (e.g., college students, high school athletes), and contextual variables such as cultural attitudes toward gender and sexual violence **(Lim & Howard, 2018).** The significant heterogeneity underscores the need for tailored approaches to sexual assault prevention, as one-size-fits-all programs may not be equally effective across different populations.

4. Publication Bias
While a formal analysis using a funnel plot or Egger's test was not conducted, the presence of both large positive and negative effect sizes in studies with significant weights (e.g., **Dagadu, N. (2022)** and **Flood, M. (2015)**) suggests that publication bias may be minimal. The inclusion of negative findings reduces the likelihood of overrepresentation of positive outcomes, which is often a hallmark of publication bias (Dagadu, 2022). However, further analysis using techniques such as the **trim-and-fill method** would be necessary to definitively rule out publication bias.

5. Implications for Future Research and Practice

The findings of this meta-analysis have important implications for future sexual assault prevention efforts. Programs that show strong positive effects, such as bystander interventions and social norms campaigns, should be further refined and adapted to different cultural and institutional contexts to maximize their effectiveness (Kettrey & Marx, 2019). Additionally, more attention should be given to understanding why certain interventions produce negative outcomes, and how these can be mitigated through better program design and delivery (Flood, 2015).

In summary, sexual assault prevention programs show potential for significant positive impact, particularly in increasing knowledge and bystander intervention behaviors. However, the variability in effect sizes and the substantial heterogeneity observed in the meta-analysis indicate that interventions must be carefully designed and adapted to specific populations to ensure effectiveness. The presence of both positive and negative findings highlights the complexity of sexual violence prevention and the need for ongoing research to refine these programs.

Conclusion

This meta-analysis synthesizes evidence from multiple studies examining the effectiveness of sexual assault prevention programs, focusing on outcomes such as knowledge improvement, attitudinal shifts, and bystander intervention behaviors. The results indicate that these programs can produce significant positive changes, but their effectiveness is highly variable across different contexts and populations.

1. **Positive Impact on Knowledge and Bystander Behavior**: The analysis shows that sexual assault prevention programs, particularly those emphasizing bystander education and social norms interventions, are effective in improving participants' knowledge about sexual violence and increasing their willingness to intervene in problematic situations. Studies such as **Kettrey, H. H., & Marx, R. A. (2019)** and **Daigneault, I. (2015)** demonstrate strong positive effect sizes, indicating that these programs can significantly influence attitudes and behaviors when well-implemented.

2. **Variability in Effectiveness**: Despite the overall positive findings, the heterogeneity across studies is substantial ($I^2 = $ **83.43%**). This suggests that the effectiveness of these programs depends heavily on contextual factors such as the population being targeted, the specific intervention used, and cultural or institutional settings. For instance, while some studies show strong positive outcomes, others, like **Flood, M. (2015)** and **Dagadu, N. (2022)**, report negative or counterproductive effects, highlighting the need for tailored approaches to different populations.

3. **Challenges and Negative Findings**: The presence of negative outcomes in some studies, such as **Flood, M. (2015)**, underscores the complexity of sexual assault prevention efforts. In some cases, interventions may inadvertently reinforce harmful attitudes or face resistance, particularly in settings where cultural or social norms are deeply entrenched. These findings highlight the importance of careful program design and evaluation to avoid unintended consequences.

4. **Need for Adaptation and Further Research**: Given the mixed results, there is a clear need for continued refinement of sexual assault prevention programs. Interventions must be adapted to the specific cultural and institutional contexts in which they are implemented. Further research should focus on identifying the mechanisms that contribute to both the success and failure of these programs, as well as exploring how to enhance their effectiveness in diverse settings.

5. **Publication Bias and Study Quality**: While the data do not provide conclusive evidence of significant publication bias, the variability in study outcomes and the overrepresentation of smaller studies with positive results suggest that caution is warranted when interpreting the overall effect sizes. Larger, more robust studies are needed to confirm the findings and provide more definitive conclusions about the effectiveness of these programs.

In conclusion, sexual assault prevention programs hold promise for addressing the pervasive issue of sexual violence, particularly through knowledge enhancement and fostering proactive bystander behaviours. However, the variability in program effectiveness across different settings and populations, along with the presence of both positive and negative findings, indicates that these programs are not universally successful. The high degree of heterogeneity calls for further research and program refinement, ensuring that interventions are contextually appropriate and able to effectively address the specific needs of their target populations.

To maximize the impact of sexual assault prevention efforts, it is essential to adapt these interventions to the unique cultural, social, and institutional contexts in which they are applied, while continuously evaluating and improving program delivery.

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