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ORIGINAL ARTICLE

The Effect of Motivational Interviewing on Smoking Cessation of University Students: A Meta-Analysis

Feyza Dereli[1], Melike Tekindal[1], Mustafa Agah Tekindal[2]

[1]İzmir Katip Çelebi University Faculty of Health Sciences, Izmir, Türkiye
[2]İzmir Katip Çelebi University Faculty of Medicine, Izmir, Türkiye

ORCID iDs of the authors: F.D. 0000-0002-9066-4884, M.T. 0000-0002-3453-3273, M.A.T. 0000-0002-4060-7048.

Main Points

- As a result of the meta-analysis, the mean effect size (Tau) for MI was 1.190 and was statistically significant ($p < .001$).
- In the world, motivational interviewing is effective in smoking cessation among university students.
- The study with the highest weight and the highest consistency with other studies in the meta-analysis is Harris et al. (2010), and the study with the lowest weight and the lowest consistency with other studies is Yıldız (2023).

Abstract

Various strategies are used in the fight against tobacco, including quitlines, education campaigns, motivational interviewing, mobile applications, and smoke-free campuses. This study aims to analyze the impact of motivational interviewing on smoking cessation among university students through a meta-analysis. The meta-analysis was conducted following PRISMA statement. We searched multiple databases (PubMed, CINAHL, Web of Science, Cochrane Library, Google Scholar) to find relevant studies. We identified randomized controlled trials (RCTs) that used motivational interviewing for smoking cessation in university students and reported cessation rates. Two authors independently selected and assessed the quality of the studies, while the third author performed the final data analysis. After the literature search, we found 21 studies with randomized experimental – control groups that used motivational interviewing for smoking cessation in university students. Seven studies were excluded after data extraction, leaving 14 studies for meta-analysis. The studies with the highest weight and agreement with other publications in the meta-analysis were Harris et al. (2010), McCambridge et al. (2011), Prokhorov et al. (2008), and McCambridge et al. (2008). The estimated effect size for motivational interviewing (MI) was 0.741, indicating a positive association with smoking cessation.

Keywords: Meta-Analysis, Motivational İnterviewing, Randomized, Smoking Cessation, University Students

Corresponding Author:
Feyza Dereli
E-mail:
dfeyza@gmail.com

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Introduction

Tobacco use is a major public health issue and is considered the leading preventable cause of death. In order to protect and improve public health, governments, institutions, and organizations have implemented various practices to prevent tobacco initiation and encourage cessation. These include smoke-free airspace policies, cessation clinics, telephone quitlines, educational campaigns, motivational interviewing (MI), mobile applications, and smoke-free campuses. Despite these efforts, smoking continues to be responsible for over eight million deaths worldwide every year (Arslan et al., 2021; Nian et al., 2023; Turan et al., 2022; World Health Organization, 2023). Psychological and behavioral interventions, as well as drug treatments, are used to help students, who are a primary target of the tobacco industry, quit smoking. University students tend to prefer cognitive-behavioral interventions, motivational interviews, and telephone applications as quitting methods. Universities are ideal places to carry out smoking cessation programs, as well as preventive studies (Jorayeva et al., 2017; Setchoduk

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et al., 2023). However, when examining the literature, there are limited studies with strong evidence regarding the effectiveness of motivational interviewing (MI) among different methods in cessation programs for university students. This meta-analysis aims to synthesize whether motivational interviewing has any effect on smoking cessation among university students, with the goal of proving its effectiveness to practitioners who will use MI in cessation programs for university students.

Methods

The study utilized the meta-analysis method, which involves combining the results of similar studies for statistical synthesis (Siddaway et al., 2019). The aim of the study was to determine the effect of motivational interviewing on smoking cessation among university students worldwide, through a meta-analysis of relevant studies. The study was conducted in line with the Preferred Reporting Items for Meta-Analyses (PRISMA) statement (Page et al., 2021). To be included in the analysis, each study followed the PICO key terms, with all words being based on medical subject headings (MeSH):

- Population (P): students, university students.
- Intervention (s) (I): motivational interviewing.
- Comparator (s) (C): experimental, control group.
- Outcomes (O): smoking cessation, tobacco usage cessation.

Data Collection

In line with the PRISMA statement, the criteria for studies to be included in the meta-analysis were determined as follows: having a population comprising university students; using a motivational interviewing method of smoking cessation intervention; being randomized and with the experimental-control group; being a published article or completed postgraduate thesis; and being published in English. The process is presented below (Figure 1):

The first search was conducted by the researchers on September 02, 2023, by considering the inclusion criteria in the first

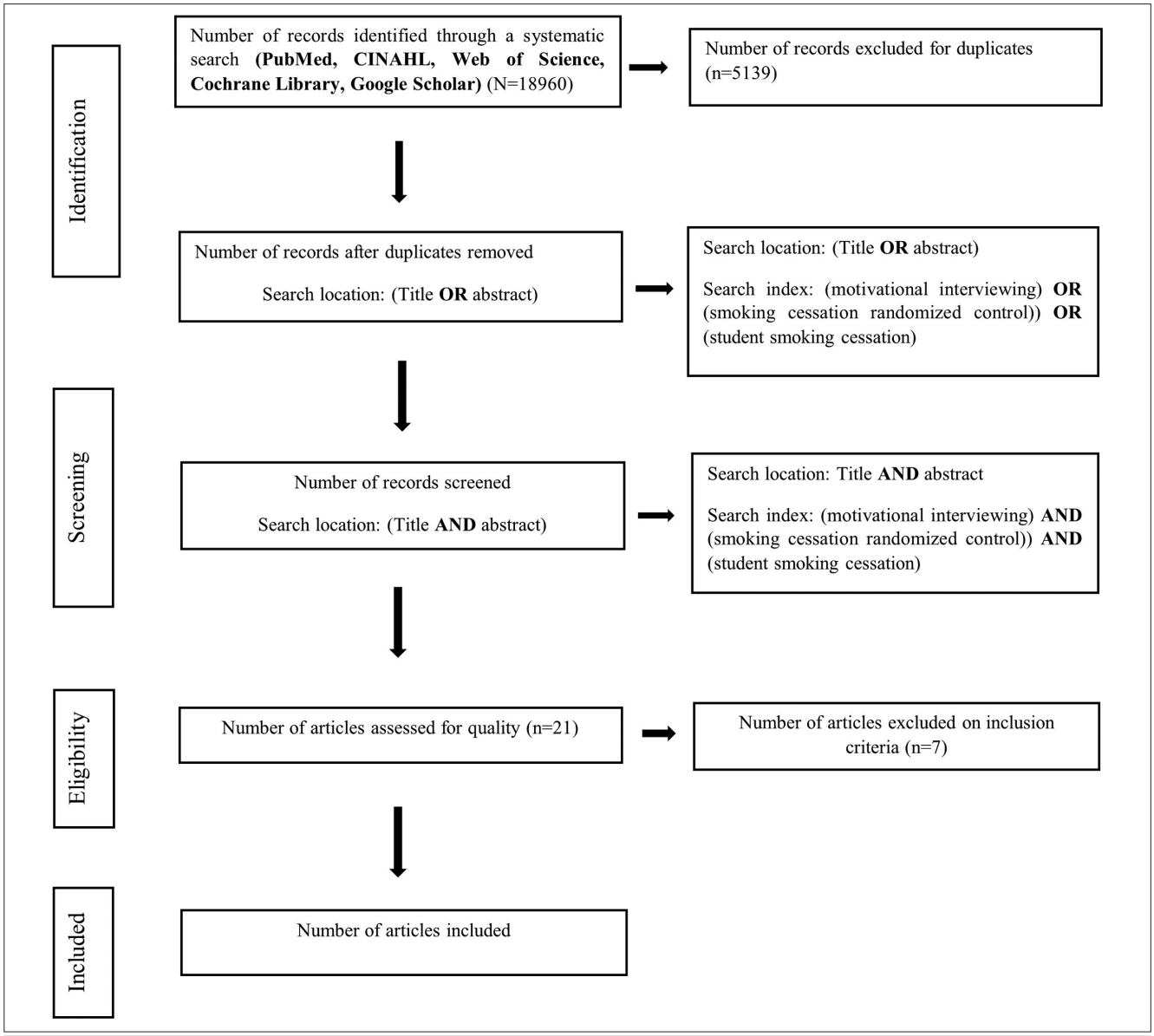

Figure 1. PRISMA flowchart of study selection.

stage. A total of 18960 publications were identified by searching PubMed, Cochrane Library, Web of Science, CINAHL, and Google Scholar databases with the keywords "motivational interviewing OR smoking cessation randomized control OR student smoking cessation" in "all fields." After removing duplicate publications (5139), 13,821 records were identified.

In the second stage, "motivational interviewing OR smoking cessation randomized control OR student smoking cessation" was searched again in "title or abstract" as the search location. As a result of the search, 11,251 publications were excluded and 2570 publications were accessed. In the third stage, when 2549 publications were searched with the search words "motivational interviewing AND smoking cessation randomized control AND student smoking cessation" in the "title and abstract," 21 publications were identified.

In the last stage, two researchers (F.D. and M.T.) examined the studies independently. Differing opinions were reviewed by a third researcher (M.A.T.). The retrieved literature was deduplicated via Mendeley software. Afterwards, two authors screened studies that might meet the criteria by reading titles and abstracts. The full texts were then reviewed. In the content evaluation, seven articles were excluded from the analysis due to inappropriate methodology, lack of motivational interviewing for cessation, the inclusion of alcohol and substance users, and comparison of cessation interventions (Baldwin et al., 2013; Conway et.al., 2017; Hyndman et.al., 2019; Koerber et.al., 2003; McNamara et al., 2015; Mounsey et al., 2006; Tevyaw et.al. 2009). As a result of detailed reviews of the studies by three authors, 14 studies within PICOS were identified for analysis (Bolger et al., 2010; Dereli, 2022; Gray et al, 2005; Herman & Fahnlander, 2003; Joveini et al., 2020; Kelly & Lapworth, 2006; Krigel et al., 2017; McCambridge et al., 2008; McCambridge et al., 2011; O'Neill et al., 2000; Pardavila-Belio et al., 2015; Prokhorov et al., 2008; Yıldız, 2023). Since the number of smokers who quit smoking was not clearly stated in the findings of one study (Yıldız, 2023), the results were requested from the author via e-mail. Study tables were designed using Microsoft Excel 2019 software and the first author's name, publication year, country, methodology, interventions, and smoking cessation results of the experimental-control groups were determined. Data analysis was performed by MAT. Since this study is a meta-analysis, it is not subject to ethics committee permission.

Data Analysis

In the method part of the study, Egger's linear regression test was used to evaluate the linearity of effect sizes and standard errors in the studies in which meta-analysis was performed. To correct for publication bias, the common exposure value was recalculated using the Trim and Fill method of Duval and Tweedie (2000). Random-effects model (Paule – Mandel method) was preferred to determine the variance within the study and the variance between the studies. Cochrane's Q statistic with $(k-1)$ degrees of freedom was used to evaluate the heterogeneity regarding effect sizes across studies, I^2 statistic was used to determine the level of heterogeneity, and τ^2 statistic was used to detect the true variance between studies. Fail-safe N analysis was performed to evaluate publication bias and small sampling effect. Rank correlation test was used to examine funnel plot asymmetry, and regression test was preferred to statistically evaluate funnel plot asymmetry. Analyses of the study were carried out using the JAMOVI program (The Jamovi project, 2023. Jamovi (Version 2.3) [Computer Software]).

Results

Descriptive information about the studies included in the meta-analysis, summary statistics of publication bias, the random effects model, and forest and funnel plot analyses are presented in this section.

Fourteen meta-analyzed randomized controlled trials with experimental control groups were conducted in six different countries (Australia, United States, UK, Türkiye, Iran, and Spain) with a total of 2476 university students, and the total number of dropouts was 880. In addition, MI was administered with different duration and frequency (Table 1).

Fail-safe N analysis shows how robust the results are if insignificant findings are not included in the meta-analysis. A higher fail-safe N value indicates that the results are more reliable (Orwin, 1983). According to Table 2, the meta-analysis with MI was reliable ($p < .001$).

The rank correlation test for funnel plot asymmetry is used to assess the asymmetry on the scatter plot of the meta-analysis. Kendall's Tau coefficient is a statistical measure of asymmetry (Begg & Mazumdar, 1994; Viechtbauer, 2010). It is determined that MI (0.385) has a statistically significant asymmetry.

According to Table 2, the studies included in this meta-analysis study were heterogeneous due to the p-value less than .05 and the Q value greater than the corresponding df value, according to the result of the heterogeneity test. Since I^2 statistical values were determined above 50%, there was a moderate level of bias in the study. Therefore, the random effects model was selected. At the end of the meta-analysis, the average effect size (Tau) for MI was 1.190 and was found to be statistically significant ($p < .001$).

While analyzing Table 3, we determined the effect size as MI (0.741) <0.05. It can be said that the methods have a significant effect between the specified periods (2000 – 2023). According to the table, based on the results of the analysis using the random-effects model (empirical Bayes), the estimated effect sizes for MI are given. For MI, the estimated effect size (Intercept) is 0.741 and is statistically significant ($p < .040$). The 95% CI lies between 0.036 and 1.447 (Table 3). This suggests that the TP53 gene has a positive association with the condition under study.

The random-effects model makes estimates taking into account heterogeneity across studies (Borenstein, et al., 2010). As a result, the estimated effect size for MI indicates that MI has a positive association with the condition under study. However, the overall results should be interpreted with caution, taking heterogeneity into account.

According to Figure 2, the studies with the highest weight in the meta-analysis and the highest consistency with other studies are Harris et al. (2010), McCambridge et al. (2011), Prokhorov et al.

Table 1.
Distribution of Studies Included in the Meta-analysis (n = 14)

Author/Year	Country	Number of Experiment/Control	Method Motivational Interview (MI)	Number of releases Experiment/Control
O'Neill, Gillispie, & Slobin, 2000	United States	31/34	Initially—3 times with 2 week intervals afterwards	9/10
Herman & Fahnlander 2003	United States	20/22	Initially	3/0
Gray et al., 2005	England	59/103	Initially	27/28
Kelly & Lapworth, 2006	Australia	30/26	first, third and sixth months	7/4
McCambridge, Slym, & Strang, 2008	England	164/162	Initially—3 – 6 months	26/30
Prokhorov et.al., 2008	United States	158/168	Initially—2 – 4 months	45/41
Harris et.al 2010	United States	245/207	Initially, then 4 times every 2 weeks	77/58
Bolger et al., 2010	United States	20/20	Initially—after 1 week	4/4
McCambridge, Hunt, Jenkins, & Strang, 2011	England	206/210	Initially—3 – 12 months	65/52
Pardavila-Belio et al, 2015	Spain	133/122	Initially—2 – 4 months	28/8
Krigel et al., 2017	England	41/41	Initially	6/6
Joveini et al., 2020	Iran	71/67	Initially—1 week apart 3 times	19/6
Dereli 2022	Türkiye	32/32	Initially—2 – 4 months	12/3
Yıldız 2023	Türkiye	26/26	First, second, third, fourth, fifth, and sixth month	5/0
Total		1236/1240 = 2476		333/547 = 880

Table 2.
Publication Bias Summary Statistic

	Fail-Safe N Analysis (File Drawer Analysis)		Rank Correlation Test for Funnel Plot Asymmetry		Regression Test for Funnel Plot Asymmetry		Heterogeneity Statistics						
	Fail-safe *N*	*p*	Kendall's *Tau*	p	*Z*	*p*	τ	τ^2	I^2	H^2	*df*		*p*
MI	123.000	<.001	0.385	.062	3.003	.003	1.190	1.4152 (SE = 0.7121)	% 90.44	10.463	13.000	35.796	<.001

(2008) and McCambridge et al. (2008), respectively. The study with the lowest weight and the lowest consistency with other studies is Yıldız (2023).

According to Figure 3, the studies are concentrated at the top of the graph. This concentration at the top indicates that the studies on MI included in the meta-analysis are high-powered. Each point represents one study, and the effect of publication bias can be reduced by excluding studies outside the CIs from the meta-analysis.

Discussion and Conclusion

The aim of this meta-analysis study was to examine the effect of motivational interviewing (MI) on smoking cessation rates among university students worldwide. Out of the fourteen studies that met the inclusion criteria, 333 individuals quit smoking out of the 1276 people in the experimental group who underwent MI. It was observed that different MI practices may cause different cessation rates due to the diversity of tobacco policies, living conditions, and cultures in the countries included in the study.

Table 3.
Statistical values for the Random-Effects Model

		Random-Effects Model					
		Estimate	SE	*Z*	*p*	CI Lower Bound	CI Upper Bound
MI	Intercept	0.741	0.360	2.06	.040	0.036	1.447

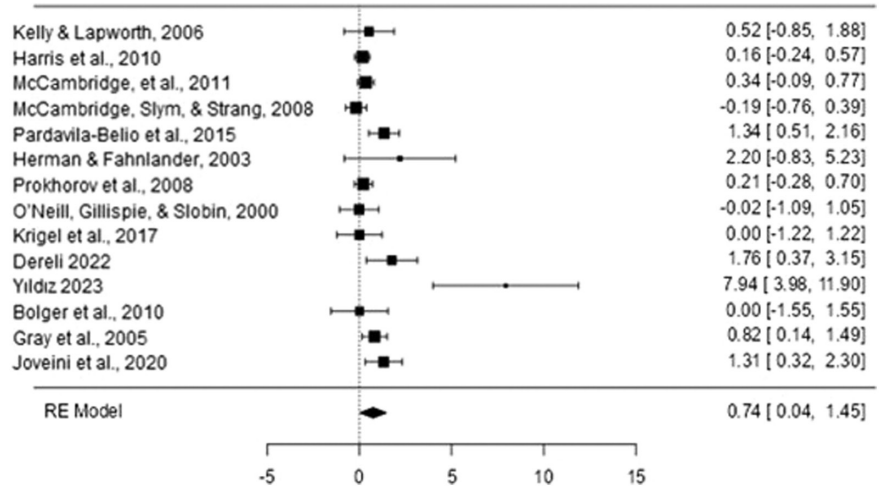

Figure 2. Forest plot for MI effect size (ES) and 95% CI of studies on the impact of MI. MI = motivational interviewing.

Tobacco use rates among young people have been increasing rapidly in recent years, and various treatment programs are being used to help university students quit smoking. Studies have shown that MI, one of the smoking cessation treatments, is effective in young people (Baldwin et al., 2013; Hyndman et al., 2019; Jorayeva, 2017; Melnick et al., 2021). Setchoduk et al. (2023) conducted a systematic review and meta-analysis study to compare various methods to change students' smoking cessation behavior in tobacco cessation programs for university students. The study concluded that technology-based and motivational interviewing interventions greatly affect smoking cessation, but a single intervention alone is not effective in quitting. This study confirms that MI is effective in the smoking cessation behavior of university students.

Study heterogeneity was observed as a result of the analysis of the studies included in the meta-analysis. This heterogeneity may introduce study bias. The publications that increased the bias value of the study were Herman & Fahnlander (2003) and Yıldız (2023). Meanwhile, the studies with the highest weight in the meta-analysis and the highest consistency with other studies are Harris et al. 2010, McCambridge et al., 2011, Prokhorov et al., 2008, and McCambridge et al., 2008. In MI method studies for smoking cessation, the methodology of the relevant studies should be taken into consideration.

One of the strengths of this study is the inclusion of randomized controlled trials to prove the effect of MI. The heterogeneity of the studies indicates that the studies were influenced by environmental factors. The validation of the effect size of the results was determined by using the Empirical Bayes method, one of the meta-analysis estimation methods. The heterogeneity of the studies may have been caused by randomization errors, the duration of MI, and differences in interventions, such as frequency and content (Petitti, 2001). The differences in the studies are that Gray et al. (2005), Krigel et al. (2017) and Herman and Fahnlander (2003) conducted a single session MI in the experimental group interventions, while more than one MI was conducted in other studies.

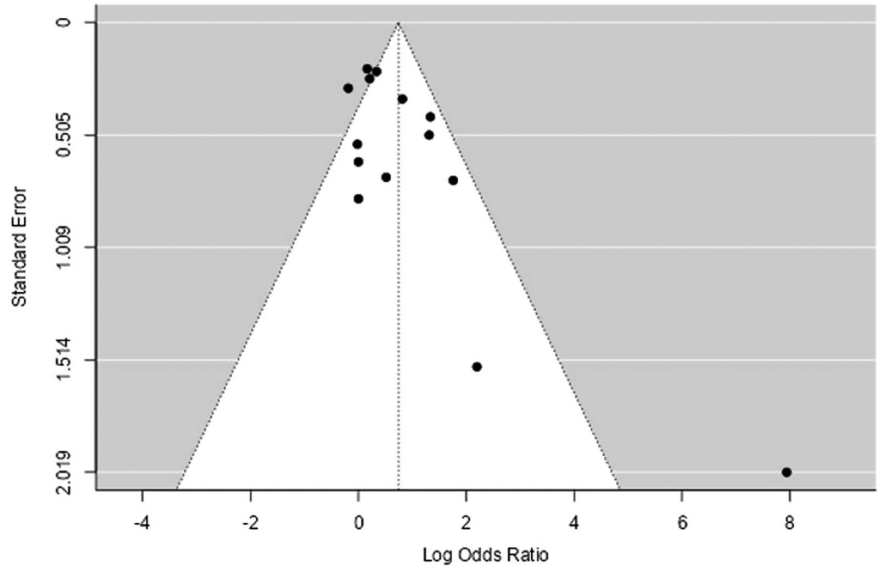

Figure 3. Funnel plot for motivational interviewing.

Research has shown that 6-month interventions are effective in behavioral change for smoking cessation programs. Motivational interviews emphasize the importance of client-oriented, collaborative, and responsible approaches, which support the person's efforts and strengths, respect their personal preferences and decisions, and are empathic, supportive, sincere, and respectful (Lindson-Hawley et al., 2015; Ögel & Şimşek, 2021). Harris et al. (2010) conducted a randomized controlled trial with college students, where they were given four sessions of individual 20- to 30-minute motivational interviewing every 2 weeks. The study's randomization, MI duration, frequency, and content intervention increased the quality of the study.

Yıldız (2023) conducted a single-blind randomized controlled study on nursing students, which showed that face-to-face MI was administered to the experimental group during the first month, online for the second and third months, and face-to-face again for the fourth, fifth, and sixth months, with an average duration of 45 – 50 minutes. The study's sample size, randomization, face-to-face interviews with students in groups according to their grades (6, 8, 12 students), and single session MI with the participation of all grades (26 students) in the online interview affected the study results.

The studies included in the meta-analysis were randomized and controlled, and located in the upper region of the funnel plot, which reveals the high power of the studies. Studies outside and at the bottom of the funnel plot were excluded. Although Yıldız's study was outside the funnel plot, it was not excluded because it is an example of what should be considered in the content planning of future studies, and the publication bias value of meta-analysis is low.

In conclusion, this meta-analysis examined the effect of motivational interviewing on smoking cessation in university students worldwide, and determined that MI is positively effective in smoking cessation.

Limitations and Future Directions

In future meta-analysis studies, the most effective motivational interviewing program should be determined by adding MI to the inclusion criteria in terms of duration, frequency, and content. One limitation was the scarcity of publications included in the meta-analysis because the MI method was not used frequently and alone in randomized controlled studies. Another limitation of the study is that the studies were heterogeneous and biased and the search was conducted in a single language (English). Meta-analysis studies investigating the effectiveness of MI in different groups should be conducted.

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