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Meta-analysis

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Meta-Analysis: Correlations between Knowledge, Self-Efficacy, and Social Support on HIV testing in Homosexual

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ABSTRACT

Background: HIV is an infectious disease for which there is no cure. Homosexuals are a vulnerable group for HIV transmission. One of the HIV-AIDS control programs is to make HIV testing a standard of service in all health facilities. This study aims to analyze the influence of self-efficacy, social support, and knowledge in carrying out HIV tests on homosexuals.
Subjects and Method: This study is a systematic and meta-analysis study, with PICO as follows: Population= Homosexual. Intervention= Good knowledge, high self-efficacy, and high social support. Comparison= Poor knowledge, low self-efficacy, and low social support. Outcome= Use of HIV Testing. The articles used in this research were obtained from several databases including PubMed, Google Scholar and Scopus. These articles were collected over 2 weeks. The keywords to search for articles are as follows: "HIV Test AND Homosexual AND Knowledge AND Self Efficacy AND Social Support". The articles included in this research were full-text articles with a cross-sectional study design. Articles were collected using PRISMA flow diagrams. Articles were analyzed using Review Manager 5.3 application.
Results: A total of 12 articles were reviewed in this meta-analysis research originating from China, Guatemala, Myanmar, USA, Jamaica. The study showed that homosexuals with good knowledge (aOR= 2.02; 95% CI= 1.38 to 2.96; p= 0.003), social support high (aOR= 1.17; 95% CI= 1.03 to 1.34; p= 0.020), and high self-efficacy (aOR= 1.11; 95% CI= 1.02 to 1.22; p= 0.010) has a significant influence on the decision to test for HIV.
Conclusion: Good knowledge, high self-efficacy, and high social support can increase the willingness to carry out HIV testing among homosexuals.

Keywords: HIV testing, self-efficacy, social support, knowledge, homosexuality.

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BACKGROUND

Based on WHO data since the beginning of this epidemic, 85.6 million people have been infected by the HIV virus and around 40.4 million people have lost their lives due to HIV. Globally, by the end of 2022, it is estimated that around 39 million people are living with HIV. Estimates show that

around 33.1-45.7 million adults aged 15-49 years old worldwide are living with HIV, although the rate of spread of this disease continues to vary between countries and regions (WHO, 2023a).

One of the Government's strategies related to the HIV-AIDS and PIMS Control Program is to expand access to KTHIV services by making the HIS test a service standard in all government health facilities (FASKES) according to the epidemic status of each district/city in Indonesia. HIV testing is included in the Medical Service Standards (SPM) like other laboratory tests, according to Minister of Health Regulation No. 37 of 2012 concerning the Implementation of a Public Health Center Laboratory and its attachments (Ministry of Health of the Republic of Indonesia, 2017).

According to SIHA data from the Ministry of Health of the Republic of Indonesia, 1,907 AIDS cases were discovered for the period January-March 2022 in five provinces, namely Central Java, Bali, Papua, East Java and South Sulawesi. The 20-29 year age group is the group with the highest percentage of AIDS (31.8%) and the highest risk factors are risky sexual relations in homosexuals (30.2%), heterosexuals (12.8%) and shared use of injection needles (0.7%) (RI Ministry of Health, 2022).

Lian et al. (2022) in China found that knowledge (aOR= 1.79; 95% CI= 1.36 to 2.34) was related to the decision to carry out an HIV test (n= 1259). Pham et al. (2019) in Myanmar conducted a study on 585 MSM aged 18-24 years old. The study results stated that participants who had high self-efficacy (aOR= 7.35; 95% CI= 2.29 to 23.5) and had HIV-related knowledge (aOR= 2.20; 95% CI= 1.51 to 3.21) had a strong relationship with HIV testing.

Zhao et al. (2020) in their study conducted in China on 500 MSM showed that knowledge about HIV testing (aOR= 1.13; 95% CI= 1.05 to 1.21) was related to the decision to carry out HIV testing on participants, the study was conducted in the US South on Gay Latino, bisexual, and other MSM populations. From a total of 304 MSM in North Carolina, the study found that HIV-related social support (aOR= 1.07; 95% CI= 1.01 to 1.12) and better HIV knowledge (aOR= 1.20; 95% CI= 1.01 to 1.45) were significantly associated with an increase in the likelihood of having an HIV test (Painter et al., 2020).

Another study was conducted among young black and men transgender who had sexual intercourse with men or women transgender. A logistic regression study conducted by Weinberger et al. (2020) on 169 black men with an average age of 24 years and 8% identified as transgender. The study showed that those who had high social support was significantly associated with prior knowledge about self-testing (aOR= 1.24; 95% CI= 0.52 to 2.98) reported being more likely to undertake an HIV test (Weinberger et al., 2020).

Based on the results identified in this initial study, the researchers are interested in developing further research by conducting a systematic review and meta-analysis. A systematic review is an evaluation carried out in a structured manner with the aim of integrating findings from primary research. On the other hand, meta-analysis is one of the epidemiological research designs used to evaluate previous research with a systematic approach.

In this study design, researchers combined the findings obtained to reach quantitative conclusions. This systematic review and meta-analysis was conducted as part of an effort to achieve a comprehensive understanding by synthesizing the results of primary research involving homosexuality and the use of HIV testing.

SUBJECTS AND METHOD

1. Study Design

This study used articles published from 2010 to 2023. The selection of articles used a flow diagram, namely the PRISMA Flow Diagram. Keywords used in article searches include: "Homosexual" OR "Sexual Gender Minorities" AND "Social Support" OR "Knowledge" OR "Self-Efficacy" AND "HIV Test.

2. Step of Meta-Analysis

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

1) Formulate research questions in the PICO, including: P= Homo-sexual, I= good knowledge, high social support, high self-efficacy, C= poor knowledge, low social support, low self-efficacy, O= use of HIV test.
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

This study used criteria such as a full paper article with a cross sectional observational study, the research subject was homo-sexual, the relationship measure used was the adjusted Odds Ratio and 95% Confident Interval and the research outcome was using HIV Test.

4. Exclusion Criteria

This study used exclusion criteria, namely statistical results reported in the form of bivariate analysis, articles published in languages other than English and searching the literature.

5. Operational Definition of Variables

Knowledge is the final result of the information processing process in the brain which includes understanding and giving meaning to information.

Self-efficacy is an individual's self-confidence about his ability to organize and carry out the various types of actions necessary to achieve certain goals.

Social supports are emotional, instrumental, or informational resources provided by others in a person's social network to enhance well-being and help in coping with stress or problems.

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 determine the influence between knowledge, self-efficacy and social support and the use of HIV testing among homosexuals. Data processing was presented in the form of forest plots and funnel plots.

RESULTS

Search articles in this research through databases including PubMed, Google Scholar and Scopus. Figure 1 showed the initial search process total of 625 articles. After the process of eliminating duplicate articles (n= 25 articles), 600 articles were obtained, 225 articles met the requirements for further full text review. Finally, there were 12 articles that met the requirements for full text review.

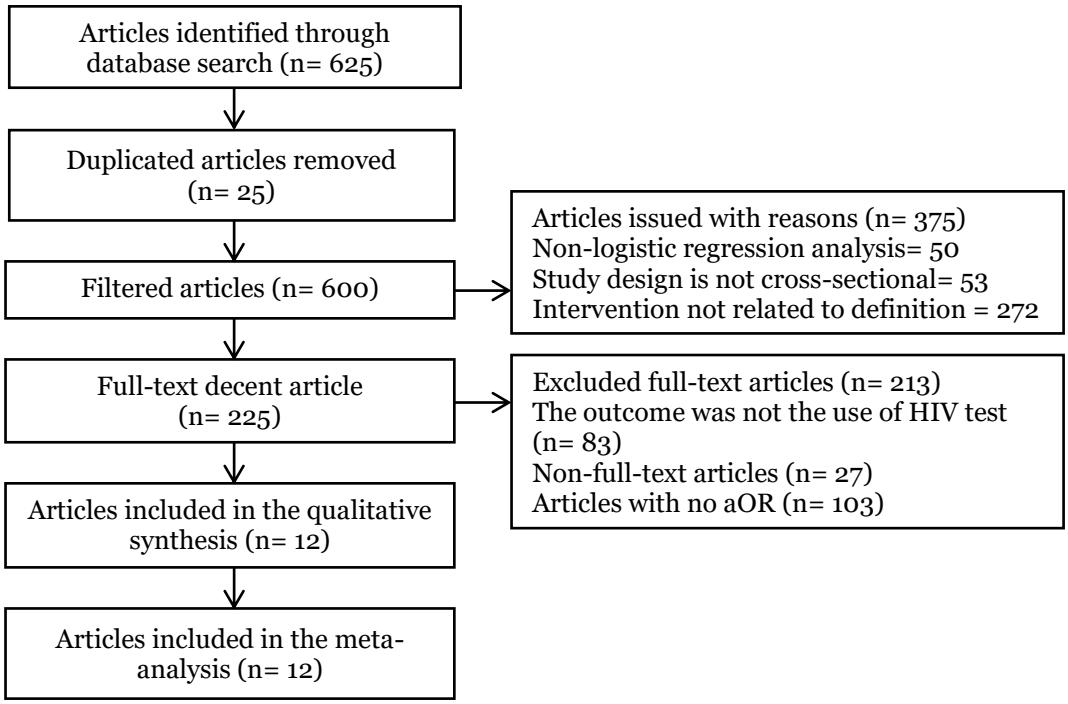

Figure 1. Results of PRISMA Flow diagrams of correlations between knowledge, self-efficacy, and social support on HIV testing

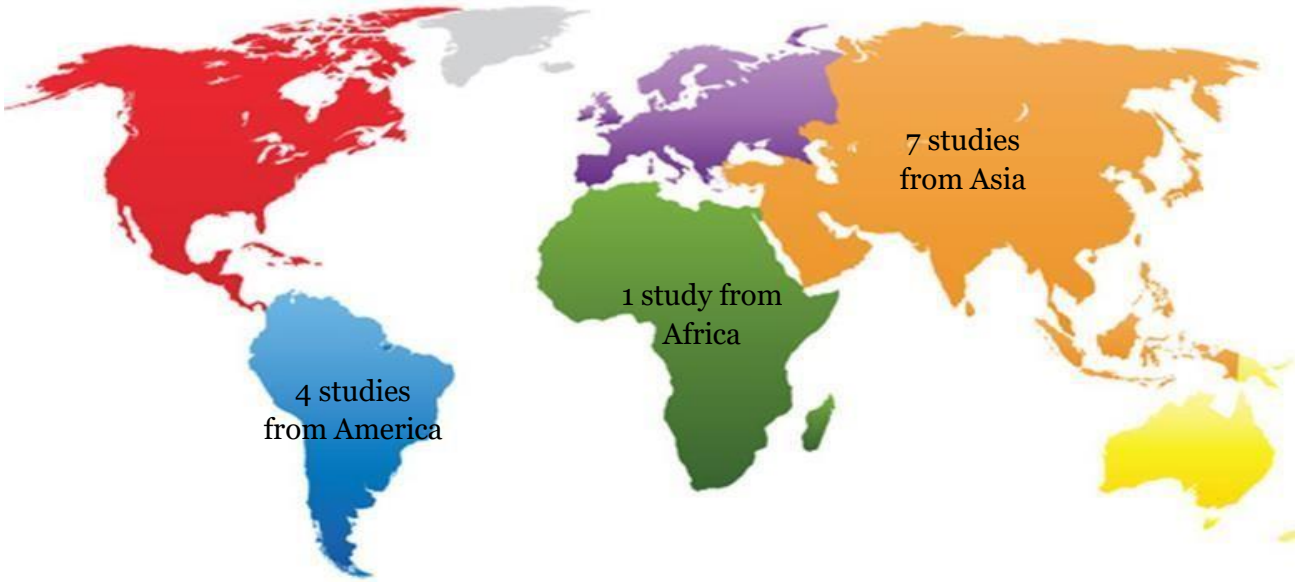

Figure 2. Research distribution map of correlations between knowledge, self-efficacy, and social support on HIV testing

Figure 2 showed a map of correlations between knowledge, self-efficacy, and social support on HIV testing in homosexual that will be included in the meta-analysis from 3 continents consisting of the Asian, Africa, and America continent. Table 1 showed quality assessment result of articles with a cross-sectional study included in meta-analysis.

Table 1. The quality assessment result of correlations between knowledge, self-efficacy, and social support on HIV testing 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		
Lian et al. (2023)	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Pham et al. (2019)	2	1	2	2	2	2	2	2	2	2	2	2	2	25
Andrinopoulus et al. (2010)	2	1	2	2	2	2	2	2	1	2	2	2	2	24
Mboussi et al. (2023)	2	1	2	2	2	2	2	2	1	2	2	2	2	24
Zhao et al. (2020)	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Li et al. (2016)	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Painter et al. (2023)	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Miranda et al. (2019)	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Wei et al. (2019)	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Tang et al. (2019)	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Scott et al. (2014)	2	1	2	2	2	2	2	2	1	2	2	2	2	24
Weinberg et al. (2020)	2	2	2	2	2	2	2	2	2	2	2	2	2	26

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 confusion?
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 correlations between knowledge, self-efficacy, and social support on HIV testing, a meta-analysis was carried out on 12 articles originating from the country of China, Myanmar, Jamaica, USA, America, and Africa.

Table 2. Description of the primary study of the influence of knowledge, self-efficacy and social support on the use of HIV testing (cross-sectional study).

Author (years)	Country	Sample	P	I	C	O
Lian et al. (2023)	China	1,259	Men Sex Men	Awareness of HIV/AIDS-Related know-ledge, Availability of social support, and High self-efficacy	No Awareness of HIV/AIDS-Related knowledge, low social support, low Self-efficacy	HIV testing
Pham et al. (2019)	Myanmar	585	Men sex men	Have good HIV-related knowledge, High self-efficacy	Not good knowledge, low self-efficacy	HIV testing status
Andrinopoulos et al. (2010)	Jamaica	298	Incarcerated Men	High knowledge of HIV, Social Support, High coping, Self-efficacy	Low knowledge of hiv, no social support, low coping & self-efficacy	HIV test acceptance
Mboussi et al. (2023)	China	935	Men sex men	Search for information on HIV testing through the web, high self-efficacy	No search informa-tion on HIV testing through the web, low self- Efficacy	HIV testing
Zhao et al. (2020)	China	500	Men Sex Men	High knowledge of HIV testing, High self-efficacy behavioral control	Low knowledge of HIV testing, Low self-efficacy behavioral control	HIV testing
Painter et al. (2023)	USA	304	Gay, bisexual, and MSM	High HIV-related knowledge, High HIV related to social support	low HIV related knowledge, low HIV related social support	HIV testing
Miranda et al. (2019)	America	444	Men sex men	Comprehensive knowledge of HIV	No comprehensive knowledge of HIV	HIV testing
Wei et al. (2019)	China	4,935	Men Sex Men	High HIV-related knowledge	Low HIV related knowledge	HIV testing
Tang et al. (2019)	China	1,219	Men Sex Men	Increased Community Engagement	Not increased Com-munity engagement	HIV testing
Scott et al. (2014)	USA	1,329	Men sex men	High Social support	Low social support	HIV testing
Li et al. (2016)	China	1,316	Men sex men	High HIV-related knowledge	Low HIV related knowledge	HIV testing
Weinberger et al. (2020)	Africa	169	Transwoman	High HIV related to social support	Low HIV related social support	HIV testing

Table 3. aOR and 95% CI data on the effect of knowledge on HIV testing

(Author, year)	aOR	95% CI	
		Lower Limit	Upper Limit
Andrinopoulus et al. (2010)	2.33	1.04	5.22
Lian et al. (2022)	1.79	1.36	2.34
Li et al. (2016)	8.27	6.19	11.07
Mboussi et al. (2023)	1.89	1.23	2.92
Miranda et al. (2019)	2.63	1.38	5.02
Painter et al. (2019)	1.20	1.01	1.45
Pham et al. (2019)	2.20	1.51	3.21
Wei et al. (2019)	1.33	1.10	1.61
Zhao et al. (2020)	1.13	1.05	1.21

Table 3 showed the effect sizes of the primary studies used in the meta-analysis, with largest adjusted odd ratio (aOR) conducted by Li et al. (2016) is 8.27, and the lowest aOR conducted by Zhao et al. (2020) is 1.13.

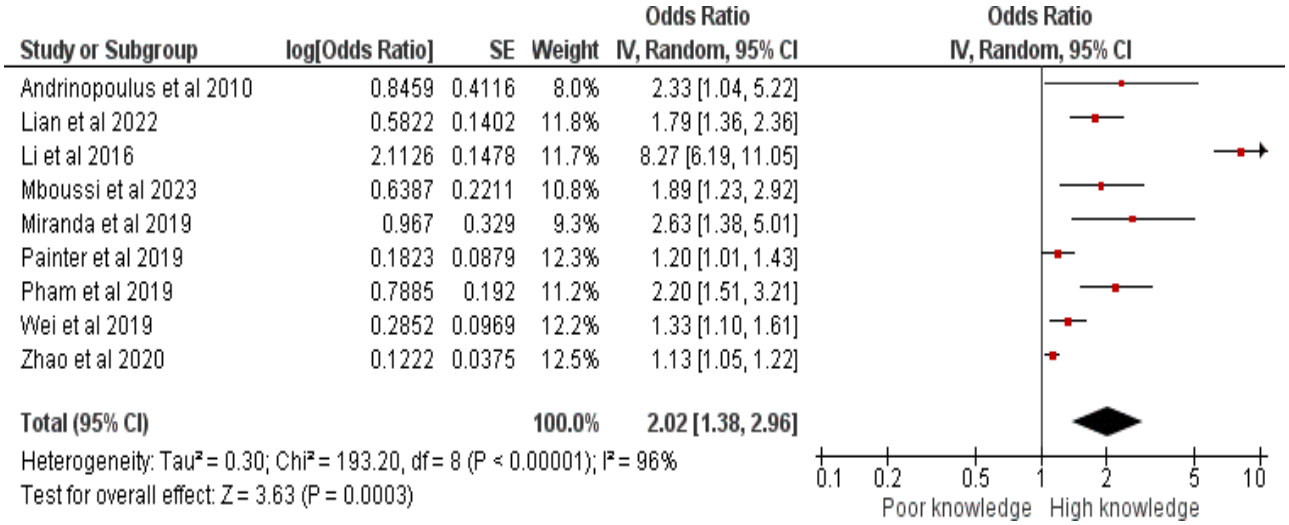

Figure 3. Forest plot on the effect of knowledge on HIV testing in homosexual.

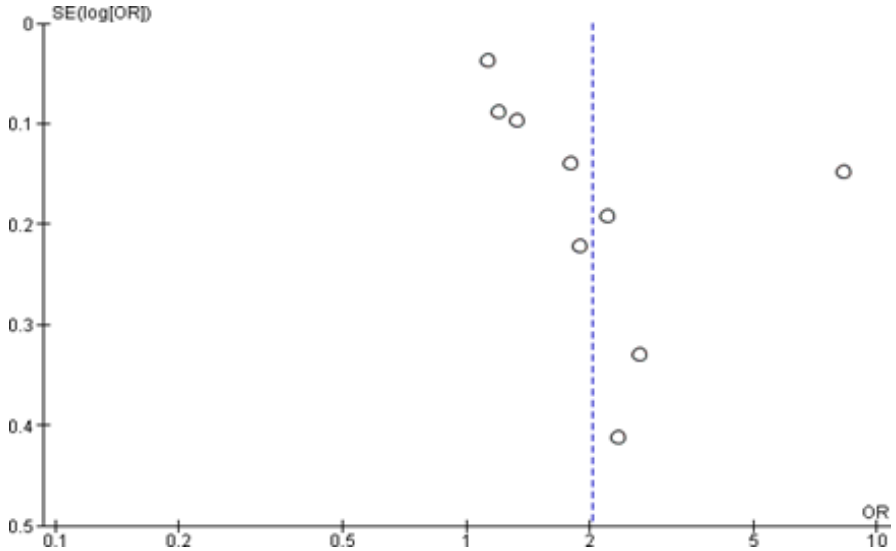

Figure 4. Funnel plot on the effect of knowledge on HIV testing in homosexual.

The forest plot in Figure 3 shows that there was an influence of high knowledge on HIV testing. Homosexual men with high knowledge were 2.02 times more likely to conduct HIV testing compared to homosexual men with low knowledge and this was statistically significant (aOR= 2.02; 95% CI= 1.38 to 2.96; p= 0.003). The forest plot also indicates high heterogeneity of effect estimates across primary studies I^2= 96%; p< 0.001. Therefore, the calculation of the average effect estimates was carried out with a random effect model approach.

Figure 4 shows the funnel plot results of the effect of knowledge on HIV testing. Figure 4 shows the distribution of estimated effects between studies which was balanced between the right and left vertical lines of the average estimate, this showed that there was no publication bias in research articles on the effect of knowledge on HIV testing.

Table 4. aOR and 95% CI data on the influence of social support on HIV testing.

(Author, year)	aOR	95% CI	
		Lower Limit	Upper Limit
Andrinopoulus et al. (2010)	2.09	1.19	3.68
Lian et al. (2022)	1.15	0.89	1.48
Painter et al. (2019)	1.07	1.01	1.12
Scott et al. (2014)	1.25	1.05	1.49
Tang et al. (2019)	1.21	0.31	4.66
Weinberger (2020)	1.24	0.52	2.98

Table 5 showed the effect sizes of the primary studies used in the meta-analysis, with largest adjusted odd ratio conducted by Andrinopoulus et al. (2010) is 2.09, and the lowest aOR conducted by Painter et al. (2019) is 1.07.

Figure 5 the forest plot of the influence of high social support on HIV testing. Homosexual men who have high social support were 1.17 times more likely to undergo HIV testing compared to homosexual men with low social support and this was statistically significant (aOR=1.17; 95% CI=1.03 to 1.34; p=0.020).

Figure 6 showed the funnel plot results of the influence of social support on HIV testing. The funnel plot shows the distribution of estimated effects between studies which was balanced between the right and left of the vertical line of the average estimate. This can be concluded that there was no publication bias in the article on the influence of social support on HIV testing. HIV testing.

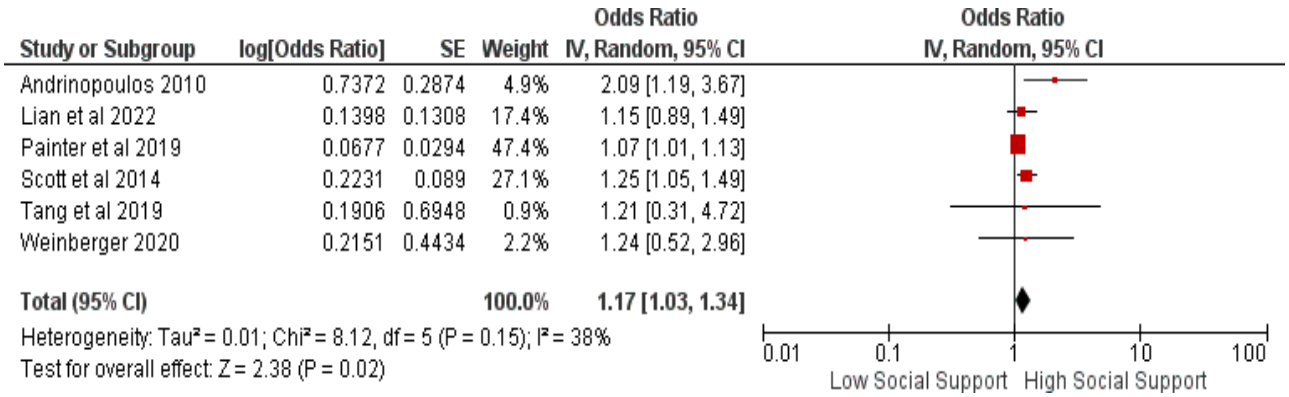

Figure 5. Forest plot on the influence of social support on HIV testing.

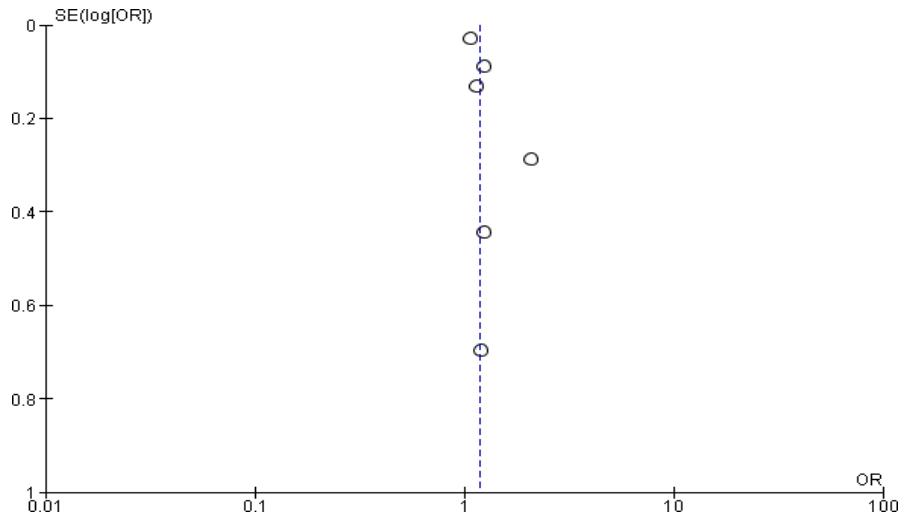

Figure 6. Funnel plot of the influence of social support on HIV testing.

Table 5. aOR and 95% CI data on the influence of self-efficacy on HIV testing.

(Author, year)	aOR	95% CI	
		Lower Limit	Upper Limit
Andrinopoulus et al. (2010)	1.86	1.24	2.78
Lian et al. (2022)	1.05	1.02	1.08
Mboussi et al. (2023)	1.09	1.04	1.14
Pham et al. (2019)	7.35	2.29	23.5
Zhao et al. (2020)	1.11	1.01	1.22

Table 7 showed the effect sizes of the primary studies the influence of self-efficacy on HIV testing used in the meta-analysis, with largest adjusted odd ratio conducted by Pham et al. (2019) is 7.35, and the lowest adjusted odd ratio conducted by Lian et al. (2022) is 1.05.

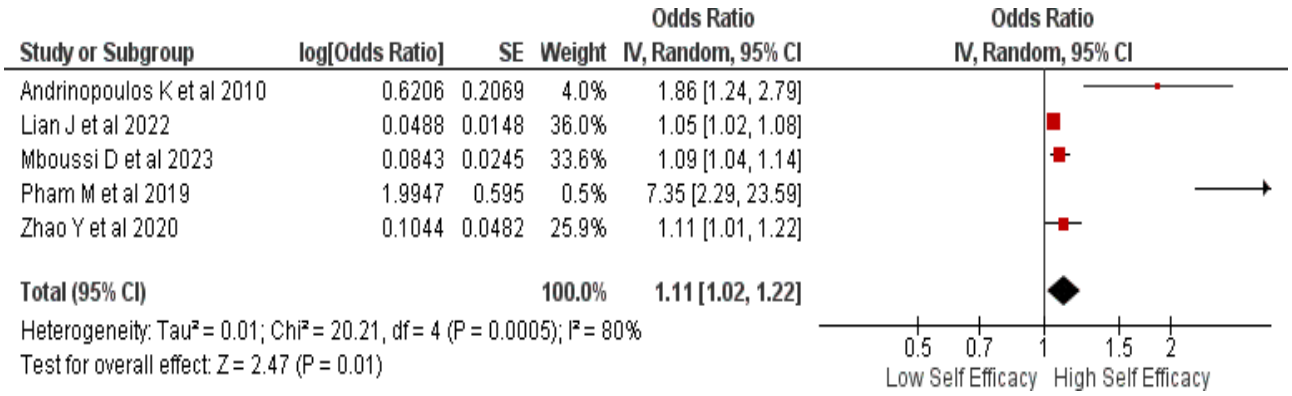

Figure 7. Forest plot on the influence of self-efficacy on HIV testing

The forest plot in Figure 5 shows that there was an influence of self-efficacy on HIV testing. Homosexual men who have high self-efficacy were 1.11 times more likely to undergo HIV testing compared to homosexual men with low self-efficacy and this was statistically significant (aOR=1.11; 95% CI=1.02 to 1.22; p=0.010).

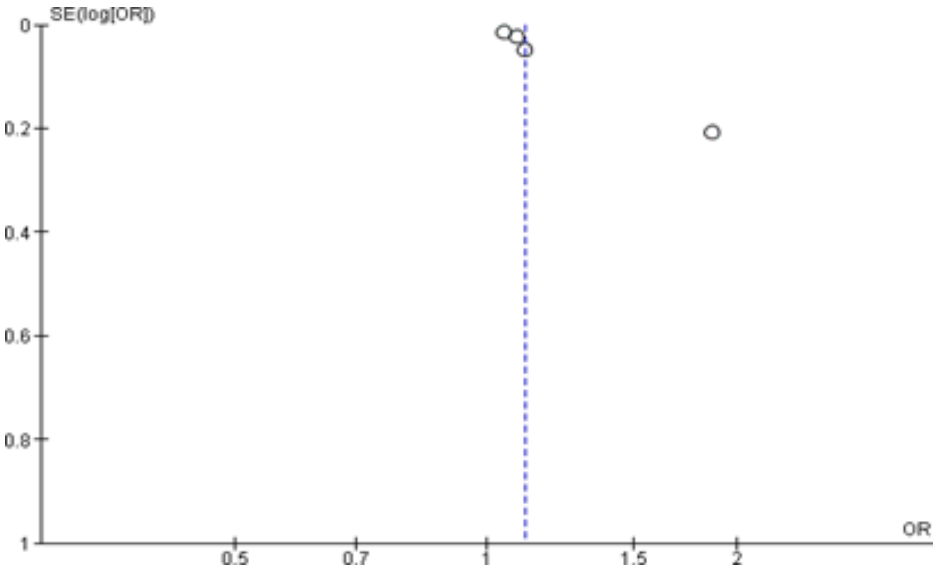

Figure 8. Funnel plot of the influence of self-efficacy on HIV testing

The funnel plot of the influence of self-efficacy on HIV testing showed in figure 6 shows that the distribution of effect estimates between studies was unequal between the right and left of the vertical line of the average estimate.

DISCUSSION

HIV (Human Immunodeficiency Virus) is a virus that attacks the human immune system, especially CD4 cells which are T cells that are important in the body's defense. AIDS (acquired immunodeficiency syndrome) is an advanced stage of HIV infection, where the body's immune system has weakened making it vulnerable to infections and other diseases (WHO, 2023).

HIV testing is an important component of HIV prevention strategies linked to treatment and care. The first goal of the PBB 90-90-90 target is that 90% of all people with HIV will be tested and know their status by 2020 (Wei et al., 2019). The Ministry of Health of the Republic of Indonesia states that several groups are vulnerable to HIV transmission, including Commercial Sex Workers (PSK), Injecting drug abusers (PLWHA), Homosexuals and Bisexuals, Transgenders, Shemale, Setodiscordance Couples (One partner is HIV positive, the other is negative), non-injecting drug use (PLWHA) (RI Ministry of Health, 2023).

The 20–29-year age group is the group with the highest percentage of AIDS (31.8%) and the highest risk factors are risky sexual relations in homosexuals (30.2%), heterosexuals (12.8%) and sharing needles (0.7%) (Ministry of Health of the Republic of Indonesia, 2022).

This systematic review and meta-analysis research created the theme entitled the influence of social support, knowledge and self-efficacy on HIV testing among homosexuals. The dependent variable analyzed was the use of HIV testing. The independent variables analyzed were social support, knowledge and self-efficacy. This study discussed the use of HIV testing on homosexuals because they were considered a vulnerable group for HIV transmission (Ministry of Health of the Republic of Indonesia, 2023).

This systematic research and meta-analysis used research methods that have controlled for confounding factors, which

can be recognized through study inclusion criteria, namely the adjusted odds ratio (aOR). Murti (2018) defines a cofounding factor as mixing estimates of the relationship between exposure and the disease being studied by others related factors, either to disease or exposure. Confounding factors can influence the relationship or impact of exposure to the occurrence of a disease that is estimated by a study that is different from the relationship or effect that actually occurs in the target population, or the results of the study are invalid (Murti, 2018).

The relationship between social support, knowledge and self-efficacy on the use of HIV testing was processed using RevMan 5.3 with the generic inverse variance method. This method is used to analyze data in the form of rate, time to event, hazard ratio, ordinal scale, adjusted estimate, difference of mean, or ratio of mean.

The results of systematic analysis and meta-analysis are presented through forest plots and funnel plots. The forest plot shows information from each study included in the meta-analysis and provides an estimate of the overall results of the study (Murti, 2018). Visualization of the forest plot shows significant variation (heterogeneity) between the results of the studies that have been investigated (Akobeng in Murti, 2018). Meanwhile, the funnel plot is a diagram in meta-analysis that is used to illustrate potential publication bias, including: (1) Showing the relationship between the study effect size and the sample size or standard error of the effect size of the various included studies; (2) Visually describes the level of variation (heterogeneity); (3) Highlight the relationship between the effect size of the study and the sample size of the included studies, which can be measured using different methods (Murti, 2018).

This study used a systematic review and meta-analysis with the aim of increasing the generalizability of the findings and formulating strong conclusions based on the results of similar studies regarding the relationship of social support, knowledge, and self-efficacy on the use of HIV testing in the homosexual population. There were 12 primary study articles that met the inclusion criteria, 6 articles from China, 1 article from Myanmar, 4 articles from the USA, and 1 article from Jamaica.

A total of 12 cross-sectional observational research articles were used as a source of meta-analysis of the relationship between social support, knowledge and self-efficacy on the use of HIV testing among homosexuals. It was found that high social support, good knowledge and high self-efficacy had an influence statistically significant impact on the decision to use HIV testing. The results of the forest plot show that homosexuals who have high social support will have 1.17 times more influence compared to homosexuals who have low social support (aOR= 1.17; 95% CI= 1.03 to 1.34; p= 0.020) low heterogeneity I2= 38%, therefore, the data distribution is declared homogeneous (fixed effect model).

Homosexual men who have high knowledge were 2.02 times more likely to perform HIV testing compared to homosexual men with low knowledge and this was statistically significant (aOR= 2.02; 95% CI= 1.38 to 2.96; p= 0.003) and homosexual men who have high self-efficacy were 1.11 times more likely to perform HIV testing compared to homosexuals' men with low self-efficacy, and this was statistically not significant (aOR=1.11; CI 95%= 1.02 to 1.22; p=0.010).

According to Painter et al. (2020) in his study conducted in South America among Gay Latino, bisexual, and other MSM populations, of 304 MSM in North

Carolina, it showed that HIV-related social support (aOR= 1.07; 95% CI= 1.01 to 1.12) and better HIV knowledge (aOR= 1.20; 95% CI= 1.01 to 1.45) were significantly associated with increased likelihood of having an HIV test. Scott et al. (2014) in his study regarding young black men who have sex with black men in the US showed that (aOR= 1.25; 95% CI= 1.05 to 1.49) young black MSM reported receiving more social support from other black MSM are less likely to delay HIV testing.

Good knowledge and high self-efficacy can increase the decision to carry out HIV testing on homosexuals. This is in accordance with the hypothesis an also in line with research conducted by Miranda et al. (2019) who conducted research on 444 MSM in Guatemala which aimed to explore factors associated with HIV testing among MSM. It was reported that 56% of participants reported an HIV test in the last 12 months. According to this study, men with comprehensive HIV knowledge (aOR= 2.63; 95% CI= 1.38 to 5.02) have a higher probability of being tested for HIV. Zhao et al. (2020) in their study conducted in China on 500 MSM showed that knowledge about HIV testing (aOR= 1.13; 95% CI= 1.05 to 1.21) was related to the decision to carry out HIV testing on participants. There was bias that arised in this study as the limitation of publication because in this study, researchers only focused on the English language articles being analyzed, resulting in neglect of articles written in other languages. There was bias in the search because this research only used databases (Pubmed, Google Scholar, and Scopus), therefore, other search sources were ignored.

AUTHOR CONTRIBUTION

Kharismatika Surya Gumilar is the main researcher who designed, conducted research and compiled the article. Bhisma Murti determined the topic and reviewed the article. Argyo Dermatoto reviewed 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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