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Meta-Analysis

Meta Analysis: Application of Health Belief Model Theory on Pap Smear Screening Uptake in Women of Reproductive Age

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ABSTRACT

Background: Cervical cancer is the fourth cancer in the world that attacks women and causes death. Until now, cervical cancer causes high morbidity and mortality. Regular cervical cancer screening with the Papanicolaou (Pap) smear test remains an effective public health intervention in the prevention and subsequent reduction of the incidence, morbidity and mortality of cervical cancer. Health Belief Model (HBM) is a model developed to help understand human behavior in seeking health services and explain why people do not engage in behavior for disease prevention or early detection.
Subjects and Method: This was a systematic review and meta-analysis. Data collection was obtained from 3 databases, namely: Google Scholar, PubMed, and Science Direct. Analysis of this research using software RevMan 5.3. The inclusion criteria used were full English paper with cross sectional design in 2012-2022. The keywords used were "Pap Smear" OR "Cervical Cancer Screening" AND "Health Belief Model" OR "Health Belief" AND "Cervical Cancer".
Results: A total of 15 cross-sectional study articles from Indonesia, Malaysia, Turkey, Nepal, Lebanon, South Korea, Iran, South Africa, Ethiopia, the United States, and Italy were reviewed in the meta-analysis. Based on the results of the analysis, it was found that the perception of high susceptibility had an effect on the possibility of using Pap smear services 1.13 times compared to the perception of low susceptibility (aOR= 1.13; 95% CI= 1.03 to 1.07; p < 0.001), and the results were statistically significant. The perception of low barriers affects the possibility of using Pap smear services 0.91 times compared to perceptions of high barriers (aOR = 0.91; 95% CI = 0.86 to 0.97; p <0.001), and the results are statistically significant.
Conclusion: Perceptions of high susceptibility and perceptions of low barriers affect the possibility of using pap smear services.

Keywords: health belief model, cervical cancer, pap smear.

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BACKGROUND

Cervical cancer is the fourth cancer in the world that attacks women and causes death. In the Human Development Index (HDI), cervical cancer ranks second in the incidence of death. In addition, cervical cancer is a cancer that often occurs in 28 countries and is the main cause of death in

42 countries (Nyamhunga et al., 2020). Globally, the average age at diagnosis for cervical cancer is 53 years. Ranging from 44 years (Vanuatu) to 68 years (Singapore). The global median age of death from cervical cancer is 59 years. Ranging from 45 years (Vanuatu) to 76 years (matinique). Cervical cancer is ranked in the top three cancers that attack women under 45 years of age in 146 countries (79%) from 185 countries (Arbyn et al., 2020).

Until now, cervical cancer causes high morbidity and mortality. In developed countries, the incidence of cervical cancer is 4% of all cancers in women, while in developing countries, for example in South Asia and Southeast Asia, the figure reaches above 15% (Oktaviani et al., 2018). The main risk factor for cervical cancer is infection with the human papillomavirus (HPV). Cervical cancer can be prevented or at least diagnosed at an early stage. The cervix is an organ that is easily accessible and can be evaluated clinically. Death from cervical cancer can be prevented if precancerous lesions are diagnosed and treated. Cervical intraepithelial neoplasia (CIN) 1 takes about 10-15 to develop into cervical cancer stage (Nkwabong et al., 2019).

Screening aims to detect precancerous changes, which if left untreated, can lead to cancer. Women who are found to have abnormalities on screening need follow-up, diagnosis and treatment, to prevent the development of cancer or to treat cancer in its early stages. WHO has reviewed the evidence regarding possible modalities for cervical cancer screening and has concluded that: screening should be performed at least once for every woman in the target age group (30-49 years); HPV test, cytology in the form of Pap smear or liquid based cytology and visual inspection with acetic acid (IVA) are recommended screening tests (Hu et al., 2021).

The Pap smear is an effective and widely available cervical cancer screening tool that is performed by examining the cytological components of the cervix using Papanicolaou stain. Pap smears have been implemented as a form of population-based screening for several years in the UK, USA, Australia and New Zealand, leading to a reduction in cervical cancer incidence and mortality (Nwabichie et.al., 2018). Regular cervical cancer screening with the Papanicolaou (Pap) smear test remains an effective public health intervention in the prevention and subsequent reduction of the incidence, morbidity and mortality of cervical cancer (Okunowo et al., 2018).

Although the screening modality may be an organized mass screening program or an opportunistic screening, it has been shown that mass screening targeting all women at risk is known to be effective. Over the past 40 years, this population-based screening method has drastically reduced the incidence and mortality of cervical cancer by 65% in developed countries. However, this opportunistic screening is not widely available. However, when opportunistic screening is available, this service is underutilized. From several studies that have been carried out, the utilization of pap smears is very low even in areas where pap smear services are available. This study also shows a level of knowledge and awareness about cancer and the Pap smear screening test. About 50-90% of women die from cervical cancer and have never had a Pap smear screening. Even most women do not know what a Pap smear screening test is (Okunowo et al., 2018).

The Health Belief Model (HBM) is a model developed in the early 1950s by Rosenstock to help understand human

behavior in seeking health services and explain why people do not engage in behavior for the prevention or early detection of disease (Shobeiri et al., 2018). The Health Belief Model (HBM) focuses on the determinants of health-related behavior, with determinants consisting of perceived susceptibility and severity of health problems, perceived benefits and barriers to performing health-related behaviors, cues to action, and sociodemographic factors. other. Researchers used a systematic review approach to relevant studies by conducting a meta-analysis to clearly identify the magnitude of the influence of the health belief model with the use of Pap smear screening services in women of childbearing age.

SUBJECTS AND METHOD

1. Study Design

This research is a systematic review and meta-analysis. Data collection was obtained from 3 databases, namely: Google Scholar, PubMed, and Science Direct. The analysis of this research was carried out using RevMan 5.3 software. The keywords used were "Pap Smear" OR "Cervical Cancer Screening" AND "Health Belief Model" OR "Health Belief" AND "Cervical Cancer".

2. Inclusion Criteria

The inclusion criteria used are full English papers with a cross sectional design in 2012 to 2022, the relationship measure used is the adjusted Odds Ratio (aOR), the research subjects are women of childbearing age who have the intention to carry out Pap smear screening services, the outcome of the study is the use of Pap Smear services.

3. Exclusion Criteria

Exclusion criteria in this study were articles published in languages other than English, statistical results reported in the form of bivariate analysis, and articles published before 2010.

4. Operational Definition of Variables

The search for articles was carried out by considering the eligibility criteria determined using the PICO model. The population of this study is women of childbearing age, the intervention used is the perception of high vulnerability and low perception of barriers. The comparison criteria are the perception of low vulnerability and the perception of high barriers. The outcome of this research is the use of Pap smear services.

Health belief model developed to help understand human behavior in seeking health services and explain why people do not engage in behavior for the prevention or early detection of disease.

Pap smear is one part of the annual gynecological examination, and is relatively fast.

5. Study Instruments

The instrument used in this research is the Critical Appraisal Checklist Center for Evidence Based Management (CEBMa).

The following are indicators in critical assessment:

a. Do the research objectives clearly address the focus/problem of the research?
b. Is the research method (research design) suitable for answering the research question?
c. Is the research subject selection method clearly written?
d. Does the sampling method give rise to bias (selection)?
e. Does the research sample take represent the designated population?
f. Was the sample size based on pre-study considerations?
g. Is the measurement method achievable?
h. Are the research instruments valid and reliable?
i. Was statistical significance assessed?
j. Was a confidence interval given for the main outcome?

k. Are there any confounding factors that have not been taken into account?
l. Are the results applicable to your research?

6. Data Analysis

The collected articles were then processed using the Review Manager (RevMan 5.3). Data processing is done by calculating aOR. Forest plots and funnel plots are used to determine the size of the relationship and the heterogeneity of the data.

RESULTS

Process of searching article wascarried out by searching several journal databases Pub-Med, Google Schoolar, and Science Direct it can be seen using the PRISMA FLOW flow-chart shown in Figure 1.

The initial search process resulted in a total of 2,957 articles, after deleting the duplicated articles, 1,237 articles were found, of which 39 articles were eligible for a full text review. A total of 16 articles that meet the criteria according to the quanti-tative synthesis meta-analysis.

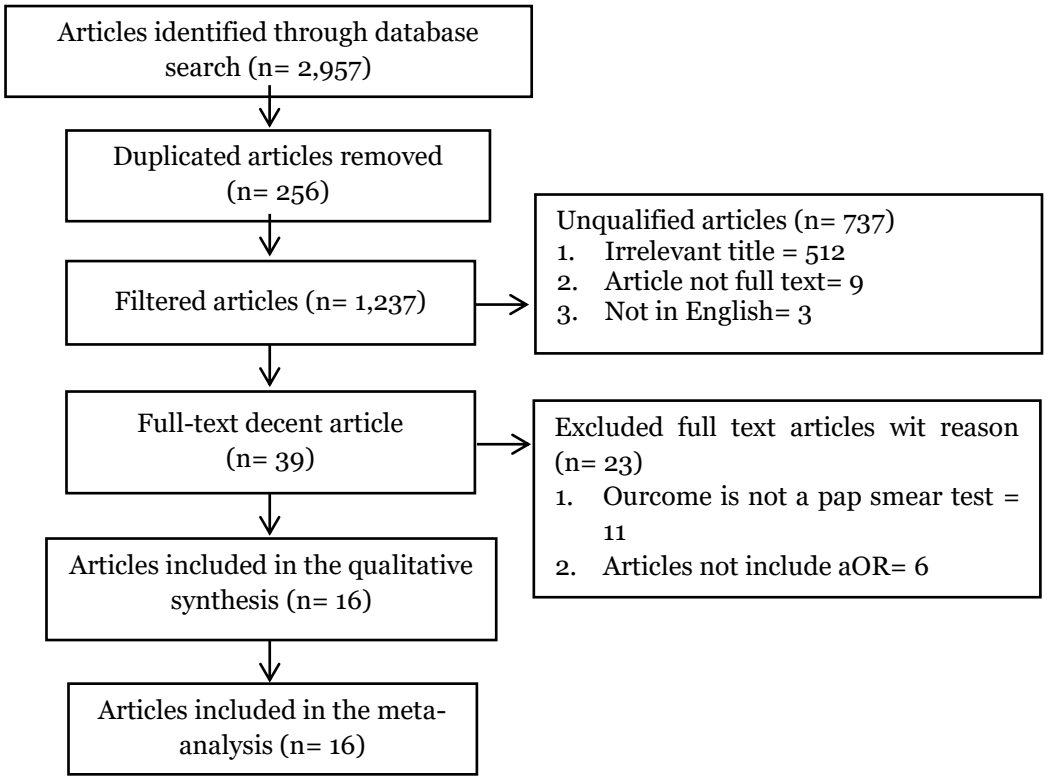

Figure 1. Results of Prisma Flow Diagrams

Figure 2. Resarch Distribution Map

It can be seen in Figure 2 that the research articles come from fourth continents such as Asia, Africa, South America, and North America.

An assessment of the quality of the articles with case-control study design used in this study can be seen in table 1, and quality of the articles with cohort study it can be seen in table 2.

Then Table 1 showed about the details of the articles provide perceived susceptibility in using pap smear services. Then table 2 showed the study quality assessment using CEBM.

Table 3 it can be seen about the details of the articles provide perceived barrier sources in the use of pap smear services. Then table 4 showed the study quality assessment of each article.

a. Forest plot relationship between high perceived susceptibility and the possibility of using Pap Smear services

Women of childbearing age with a high perception of vulnerability were more likely to use Pap smear services (aOR= 1.13; 95% CI= 1.03 to 1.22).

b. Funnel plot the relationship between high perceived susceptibility and the possibility of using Pap Smear services

This study shows an indication of publication bias that overestimates the true effect, which is characterized by an asymmetric distribution between the right and left plots. The plot on the right has 4, then the plot on the left has 2, and 3 plots touch the vertical line.

c. Forest Plot relationship between low perceived barrier & possible use of Pap Smear services.

Women of childbearing age with high susceptibility reduce the use of pap smear services (aOR= 0.91; 95% CI= 0.86 to 0.97; p= 0.005).

d. Funnel Plot relationship between low perceived barrier & possible use of Pap Smear services.

This study shows an indication of publication bias that underestimates the true effect, which is characterized by an asymmetric distribution between the right and left plots. The plot on the right has 2, then the plot on the left has 3, and 4 plots touch the vertical line.

Table 1. Summary of Articles Sources of Perceived Susceptibility in Using Pap Smear Services.

Author (Year)	Country	Study Design	Sample	Population	Intervention	Comparison	Outcome	aOR (CI 95%)
Nigussie et al. (2019)	Ethiopia	Cross-sectional	737	Women who are 30 to 49 years old	High Vulnerability Perception	Low Vulnerability Perception	Use of Pap Smear Service	3.02 (1.64 to 5.56)
Bayu et al. (2016)	Ethiopia	Cross-sectional	1286	Women of childbearing age	High Vulnerability Perception	Low Vulnerability Perception	Use of Pap Smear Service	2.22 (1.31 to 3.79)
Babazadeh et al. (2018)	Iran	Cross-sectional	280	Housewife	Vulnerability Perception	Vulnerability Perception	Pap Service Usage	1.01 (0.95 to 1.08)
Lambert et al. (2015)	USA	Cross-sectional	267	Women aged 18 years and over	High Vulnerability Perception	Low Vulnerability Perception	Use of Pap Smear Service	1.09 (1.00 to 1.18)
Babazadeh et al. (2019)	Iran	Cross-sectional	220	Women of childbearing age	High Vulnerability Perception	Low Vulnerability Perception	Use of Pap Smear Service	0.98 (0.93 to 1.04)
Lai et al. (2017)	USA	Cross-sectional	206	Women aged 21 years and over	High Vulnerability Perception	Low Vulnerability Perception	Use of Pap Smear Service	3.21 (1.24 to 8.92)
Maharjan et al. (2020)	Nepal	Cross-sectional	510	Women aged 20 to 65	High Vulnerability Perception	Low Vulnerability Perception	Use of Pap Smear Service	1.12 (1.02 to 1.23)
Bou-Orm et al. (2017)	Lebanon	Cross-sectional	2255	Women aged 18 to 65	High Vulnerability Perception	Low Vulnerability Perception	Use of Pap Smear Service	1.07 (1.04 to 1.10)
Restivo et al. (2018)	Italia	Cross-sectional	365	Women aged 25 to 65	High Vulnerability Perception	Low Vulnerability Perception	Use of Pap Smear Service	3.24 (1.92 to 5.48)

Table 2. Critical Appraisal Checklist Center for Evidence Based Management (CEBMa) for Perceived susceptibility in the Use of Pap Smear Services.

Primary Study	Criteria												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
Nigussie et al. (2019)	2	2	2	2	2	2	2	2	2	2	2	2	24
Bayu et al. (2016)	2	2	2	2	2	2	2	2	2	2	2	2	24
Babazadeh et al. (2018)	2	2	2	2	2	2	2	2	2	2	2	2	24
Lambert et al. (2015)	2	2	2	2	2	2	2	2	2	2	2	2	24
Babazadeh et al. (2019)	2	2	2	2	2	2	2	2	2	2	2	2	24
Lai et al. (2017)	2	2	2	2	2	2	2	2	2	2	2	2	24
Maharjan et al. (2020)	2	2	2	2	2	2	2	2	2	2	2	2	24
Bou-Orm et al. (2017)	2	2	2	2	2	2	2	2	2	2	1	2	23
Restivo et al. (2018)	2	2	2	2	2	2	2	2	2	2	2	2	24

Table 3. Summary of Articles on Perceived Barrier Sources in the Use of Pap Smear Services.

Author (Year)	Country	Study Design	Sample	Population	Intervention	Comparison	Outcome	aOR (CI 95%)
Sumarmi et al. (2021)	Indonesia	Cross-sectional	687	Married woman	Low Perception Barriers	High Barrier Perception	Use of Pap Smear Service	0.97 (0.95 to 0.98)
Mabotja et al. (2021)	South Africa	Cross-sectional	280	Women aged 30 years and over	Low Perception Barriers	High Barrier Perception	Use of Pap Smear Service	0.40 (0.30 to 0.50)
Kim (2016)	South Korea	Cross-sectional	1581	Female aged 13 to 18 years	Low Perception Barriers	High Barrier Perception	Use of Pap Smear Service	1.47 (1.03 to 2.11)
Karimy et al. (2017)	Iran	Cross-sectional	305	Married woman	Low Perception Barriers	High Barrier Perception	Use of Pap Smear Service	0.22 (0.12 to 1.10)
Yunus et al. (2018)	Malaysia	Cross-sectional	316	Women aged 20 to 65	Low Perception Barriers	High Barrier Perception	Use of Pap Smear Service	1.00 (0.95 to 1.05)
Nigussie et al. (2019)	Ethiopia	Cross-sectional	737	Women who are 30 to 49 years	Low Perception Barriers	High Barrier Perception	Use of Pap Smear Service	0.79 (0.38 to 1.63)
Babazadeh et al. (2018)	Iran	Cross-sectional	280	Housewife	Low Perception Barriers	High Barrier Perception	Use of Pap Smear Service	0.91 (0.87 to 0.96)

Author (Year)	Country	Study Design	Sample	Population	Intervention	Comparison	Outcome	aOR (CI 95%)
Sook et al. (2019)	South Korea	Cross-sectional	196	Married woman	Low Perception Barriers	High Barrier Perception	Use of Pap Smear Service	1.00 (0.95 to 1.05)
Maharjan et al. (2020)	Nepal	Cross-sectional	510	Women aged 20 to 65	Low Perception Barriers	High Barrier Perception	Use of Pap Smear Service	1.51 (0.42 to 5.46)
Bou-Orm, et al. (2017)	Lebanon	Cross-sectional	2255	Women aged 18 to 65 years (2255)	Low Perception Barriers	High Barrier Perception	Use of Pap Smear Service	0.87 (0.85 to 0.90)
Lambert, et al. (2015)	USA	Cross-sectional	267	Women aged 18 years and over	Low Perception Barriers	High Barrier Perception	Use of Pap Smear Service	0.93 (0.90 to 0.97)

Table 4. Critical Appraisal Checklist Center for Evidence Based Management (CEBMa) for perceived barriers in the use of Pap Smear Services.

Primary Study	Criteria												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
Sumarmi et al. (2021)	2	2	2	2	2	2	2	2	2	2	2	2	24
Mabotja et al. (2021)	2	2	2	2	2	2	2	2	2	2	2	2	24
Kim (2016)	2	2	2	2	2	2	2	2	2	2	2	2	24
Karimy et al. (2017)	2	2	2	2	2	2	2	2	2	2	2	2	24
Yunus et al. (2018)	2	2	2	2	2	2	2	2	2	2	2	2	24
Nigussie et al. (2019)	2	2	2	2	2	2	2	2	1	2	2	2	23
Babazadeh et al. (2018)	2	2	2	2	2	2	2	2	2	2	2	2	24
Cinar et al. (2019)	2	2	2	2	2	2	2	2	2	2	2	2	24
Maharjan et al. (2020)	2	2	2	1	2	2	2	2	2	2	2	2	23
Bou-Orm et al. (2017)	2	2	2	2	2	2	2	2	2	2	2	2	24
Lambert et al. (2015)	2	2	2	2	2	2	2	2	2	2	2	2	24

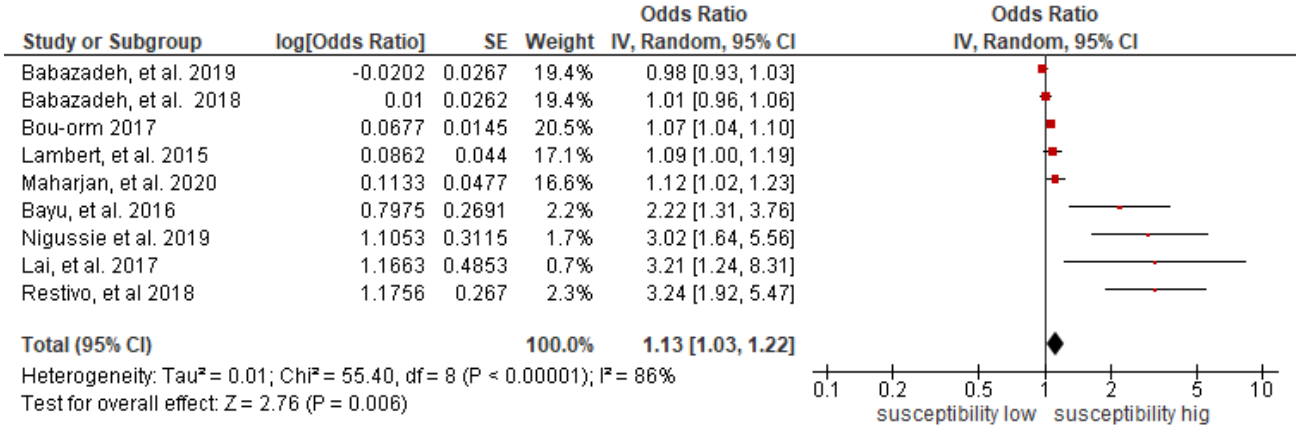

Figure 3. Forest Plot relationship between high perceived susceptibility and the possibility of using Pap Smear services

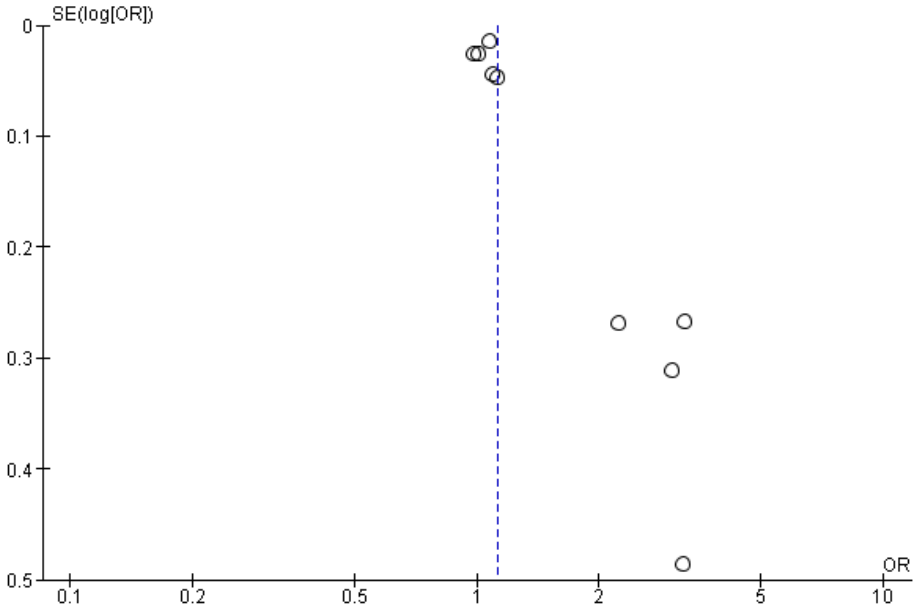

Figure 4. Funnel Plot relationship between high perceived susceptibility and the possibility of using Pap Smear services

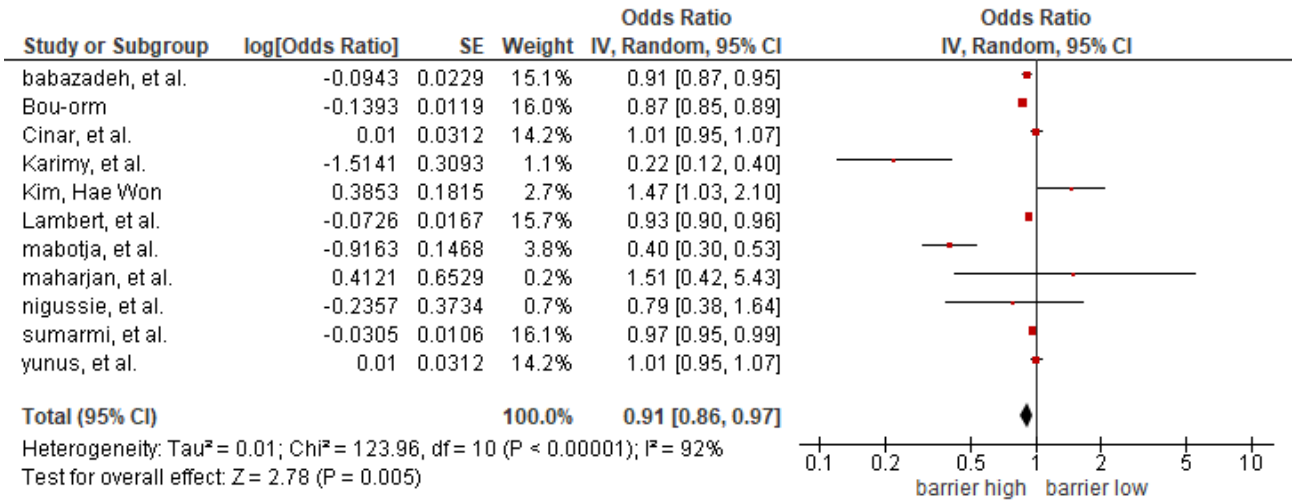

Figure 5. Forest Plot relationship between low perceived barrier and possible use of Pap Smear services

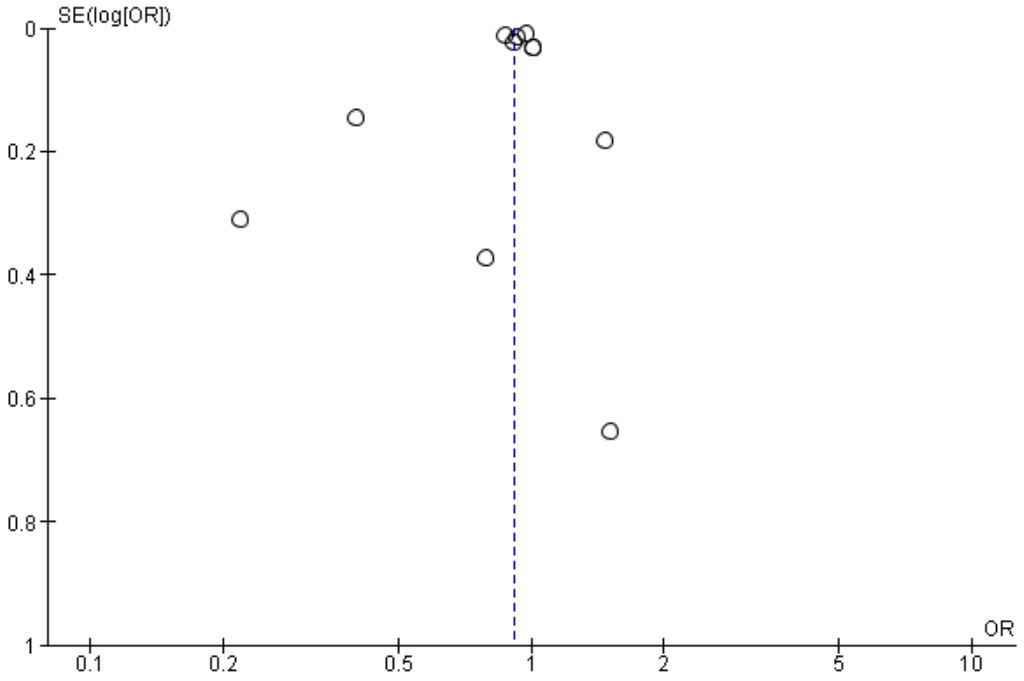

Figure 6. Forest Plot relationship between low perceived barrier and possible use of Pap Smear services

DISCUSSION

This study is based on a systematic review and meta-analysis investigating the effect of health belief models on the use of Pap smear services in women of childbearing age with a sample size of 9,415 individuals from 15 cross-sectional studies conducted in Asia, Africa, America, and Europe. Cervical cancer is a preventable disease when proper screening, treatment and follow-up is done. The Papanicolaou (Pap) smear test, which has the ability to detect cervical cancer at a pre-invasive stage.

The United States National Cancer Institute reports that women who have not been screened for cervical cancer are three

to ten times more likely to develop invasive cervical cancer. (Yunus, et al. 2018). Intention to undergo cervical cancer screening refers to women who are willing to be involved in cervical cancer screening. Research has found that women who have a higher intention to do a Pap smear test will have a more regular Pap smear test (Sumarmi, et al. 2021).

The HBM describes an individual's belief about the likelihood of experiencing a condition or disease that can affect their health (perceived susceptibility), an individual's interpretation of the severity of the disease (perceived severity), a person's belief that using preventive services will benefit the individual (perceived benefit), and other factors. perceived to hinder a person's healthy behavior (perceived barriers). Two other constructs were added later to the HBM cues of action (cues or triggers that encourage one's involvement in a health-promoting behavior and self-efficacy (perceived belief in one's ability to adopt a behavior that leads to the desired desired outcome) (Mabotja, et al. .2020)

The results of the 15 relevant studies can be measured based on the reported statistical values. The statistical value is the adjusted odds ratio (aOR) which in these studies controls for confounding factors. The adjusted odds ratio value is the statistical result of the Odds Ratio (OR) value generated in the multivariate analysis. Confounding factor is the influence of the relationship or effect of exposure on the occurrence of diseases that have been predicted by research that is not the same as the relationship or effect that actually occurs in the target population or can be declared invalid results (Murti, 2018).

1. **Perceived Susceptibility in Using Pap Smear Services**

Forest plot Figure 3 of this study shows that there is an effect of perceived vulnerability on the possibility of using Pap smear services. Women of childbearing age with a high perception of vulnerability were more likely to use Pap smear services (aOR= 1.13; 95% CI= 1.03 to 1.22). Figure 3 also shows I2=86% meaning that the estimated effect of all primary studies conducted in this meta-analysis showed high heterogeneity. Thus, the calculation of the average estimated effect of all primary studies uses a random effect model approach. The funnel plot in Figure 4 of this study shows an indication of publication bias that overestimates the true effect, which is characterized by an asymmetric distribution between the right and left plots. The plot on the right has 4, then the plot on the left has 2, and 3 plots touch the vertical line.

This study was supported by Restivo et al. (2018) showed that fertile women with a high perception of susceptibility 3.24 times increased the use of Pap smear services compared to fertile women who did not receive Pap smear services. (aOR= 3.24; 95% CI= 1.92 to 5.48). In this research study, it was found that women of childbearing age who did not want to do Pap smear services had the perception that no one felt pain in their bodies. Another study from Maharjan et al. (2020) reported that cervical cancer screening would reduce the chances of dying from cervical cancer. Likewise, women in mountainous and terai areas want to know about health problems early. More than half of the responses in both regions stated that Pap smear screening is the best way to diagnose cervical cancer in its early stages. The result of the perceived vulnerability value is aOR= 1.12; 95% CI= 0.01 to 1.12)

2. **Perceived Barrier in the Use of Pap Smear Services**

Forest plot Figure 5 shows the effect of perceived barriers on the possibility of using Pap smear services. Women of child-

bearing age with low perceived barriers to use were more likely to use Pap smear services (aOR= 0.91; 95% CI= 0.86 to 0.97). Figure 5 also shows I2=92% meaning that the estimated effect of all primary studies conducted in this meta-analysis showed high heterogeneity. Thus, the calculation of the average estimated effect of all primary studies uses a random effect model approach. The funnel plot in Figure 6 shows that the distribution of effect estimates from all studies is more or less balanced to the right and left of the mean vertical line. Thus, the funnel plot does not identify the absence of publication bias.

The results of this study are supported by Mabotja et al. (2021) women who do pap smear services have lower barriers and are more aware of cervical cancer. In this study, it was shown that women with low perceived barriers had a score of 0.40 times for Pap smear services compared to women who did not (aOR= 0.40; 95% CI= 0.30 to 0.50). In this study, it was found that there were many barriers for women to perform Pap smear services, such as being afraid of the results of the examination, being embarrassed to do the examination, the examination taking a long time and the examination process being painful. Another study from Sumarmi et al. (2021) revealed that women who have a perception of cervical cancer as severe disease have a low perception of barriers to doing Pap smear services.

Women with low perceived barriers were 0.97 times compared with women with high barriers (aOR= 0.97; 95% CI= 0.95 to 1.00). Women with low perception of barriers have high motivation and knowledge about cervical cancer. The limitation in this study is language bias because in this study only articles in English were used, thus ignoring articles in other languages. In addition, publication bias is shown in the funnel plot results.

AUTHOR CONTRIBUTION

Syndia Puspitasari is the main researcher who selects the topic, searches for and collects research data. Bhisma Murti and Hanung Prasetya analyzed the data and reviewed research documents.

FUNDING AND SPONSORSHIP

This study is self-funded.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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