Journal of Health Promotion and Behavior (2021), 06(04): 327-338
Masters Program in Public Health, Universitas Sebelas Maret

Meta-Analysis

Health Belief Model Application in Encouraging Colorectal Cancer Screening in Adults: Meta-analysis

Audria Ersananda[1)], Aulia Siti Nur Rahmah[2)]

[1)]Catholic School of Health Sciences, St.Vincentius A Paulo, Surabaya, East Java
[2)]Faculty of Public Health, Universitas Muhammadiyah Surakarta, Central Java

ABSTRACT

Background: Colorectal cancer is one of the cancers caused by the growth of malignant abnormal cells in the large intestine and rectum which are part of the gastrointestinal system. Screening has the potential to reduce the burden of colorectal cancer with the support of scientific literature showing a reduction in colorectal cancer mortality ranging from 18% to 57% (depending on the screening test used). The Health Belief Model is a health behavior model that can predict a person's interest in screening for colorectal cancer. This study aims to estimate the effect of the Health Belief Model in colorectal cancer screening by meta-analysis.
Subjects and Method: Meta-analyses were performed by searching articles from the PubMed, Google Scholar, and ScienceDirect databases. The keywords and Boolean operators used are Health Belief Model OR perceived susceptibilty OR perceived risk OR risk perception OR perception of risk AND screening colorectal OR colonoscopy OR faecal occult blood test OR sigmoidoscopy. The inclusion criteria in this study were full-text articles with a cross-sectional design. The articles were published in English from 2012 to 2022. The population used in this study were both male and female adults. Analysis of perceived susceptibility to final study results was reported using the adjusted odds ratio (aOR). Article analysis using RevMan 5.3 software.
Results: A total of 9 articles were used. The results showed that a person's perception of being vulnerable or at high risk will increase colorectal cancer screening by 1.81 times compared to someone who has a low perception of susceptibility to colorectal cancer screening (aOR= 1.81; 95% CI= 1.58 to 2.07) and the results are significant. statistically ($p < 0.001$).
Conclusion: Perceived susceptibility is statistically significant in predicting someone to be screened for colorectal cancer.

Keywords: health belief model, susceptibility perception, colorectal cancer screening.

Correspondence:
Aulia Siti Nur Rahmah. Catholic School of Health Sciences, St.Vincentius A Paulo, Surabaya, East Java, Indonesia. Email: rahmaaulia500@gmail.com. Mobile: +6281233511180.

Cite this as:
Ersananda A, Rahmah ASN (2021). Health Belief Model Application in Encouraging Colorectal Cancer Screening in Adults: Meta-analysis. J Health Promot Behav. 06(04): 327-338. https://doi.org/10.26911-/thejhpb.2021.06.04.07.

BACKGROUND

Colorectal cancer is one of the cancers caused by the growth of malignant abnormal cells in the large intestine and rectum which are part of the gastrointestinal system. Before colorectal cancer develops, usually polyps will form on the walls of the colon or rectum. Polyps are benign tumors that can develop into cancer over time. Most colorectal cancers develop slowly from adenomatous polyps or adenomas (Aran, 2016).

According to WHO (2020), colorectal cancer is a common cancer that can occur

in all sexes, both men and women. Globally, colorectal cancer ranks second after lung cancer with an incidence of 4.4% and a mortality of 3.7%. In Indonesia, colorectal cancer is ranked third with an incidence of 8.6% and a mortality of 7.9% (WHO, 2020).

Several risk factors can cause colorectal cancer, both modifiable and non-modifiable risk factors. Family history is a non-modifiable risk factor indicating that inherited DNA contributes to the cause of colorectal cancer (Cho, Oh., 2019). Although colorectal cancer can occur in early to middle adulthood, especially in people with a history of congenital malformations, most cancers occur in people who are considered average risk, and age is the most significant risk factor. The likelihood of developing colorectal cancer increases markedly after the age of 50, with 90% of new cases and 94% of colorectal cancer-related deaths occurring in those aged 50 years (Simon, 2016).

Modifiable risk factors such as lifestyle factors also contribute to colorectal cancer such as obesity, cigarette consumption, alcohol consumption, high intake of red meat, and lack of physical activity (Siegel, 2022). Obesity and physical activity are behaviors that contribute significantly to colorectal cancer. Studies have found that people who regularly engage in physical activity have a 25% lower chance of developing colorectal cancer. Meanwhile, people who sit the most have a 50% higher risk of developing colorectal cancer (Rawla, 2019). In addition, a study conducted by (Mena, 2018), that smoking is associated with a worse colorectal cancer prognosis than someone who does not smoke. Alcohol consumption also plays a role in colorectal cancer. A study conducted by (Cai, 2014), that alcohol consumption has a positive role in colorectal cancer mortality.

Screening has the potential to reduce the burden of colorectal cancer with the support of scientific literature showing a reduction in colorectal cancer mortality ranging from 18% to 57% depending on the screening test used. The application of screening tests is carried out as an effort to prevent colorectal cancer from time to time (Gini, 2020).

Screening can prevent colorectal cancer through removal of precancerous adenomatous polyps, and reduce mortality through early detection and treatment of cancer. The United States Preventive Services Task Force recommends several screening tests, including the guaiac Based Fecal Occult Blood Test, Fecal Immunochemical Test, multi-target fecal DNA testing, colonoscopy, CT colonography, and flexible sigmoidoscopy with or without the Fecal Immunochemical Test (Miftahussurur, 2021). Most guidelines recommend starting colorectal cancer screening for average risk individuals at age 50. This is based on the increase in the incidence of colorectal cancer starting at the age of 50 years (Kemenkes RI, 2016).

This study uses the Health Belief Model theory because this model can overcome problems in healthy behavior and can increase individual attention to health (Wong, 2013). One of the most important components in behavior change according to the Health Belief Model theory is the perception of vulnerability. Perceived susceptibility is a person's belief that they are vulnerable and at risk for diseases such as colorectal cancer. Perceived susceptibility is a key component of decisions regarding colorectal cancer screening and prevention behaviors (Dashdebi, 2016)

A study conducted by (Taheri Kharameh, 2016), in Iran, stated that the perception of susceptibility showed a significant predictor of colorectal cancer screening

adherence indicating that participants, perceive colorectal cancer as a serious disease or that it will affect the participants' lives. In another study conducted by (Bujang, 2021), in Malaysia, good knowledge of risk factors, perception of susceptibility, and doctor's recommendations can positively influence the desire to undergo iFOBT screening.

This study aims to estimate the effect of the Health Belief Model, especially the construct of perceived susceptibility in the practice of colorectal cancer screening with a meta-analysis.

SUBJECTS AND METHOD

1. Study Design

This research was conducted using a meta-analysis study design. This study was conducted by searching articles obtained from the PubMed, Google Scholar, and ScienceDirect databases. The selection of articles was carried out using the PRISMA flow chart. Article search strategy using keywords and Boolean operators namely Health Belief Model OR perceived susceptibilty OR perceived risk OR risk perception OR perception of risk AND screening colorectal OR colonoscopy OR faecal occult blood test OR sigmoidoscopy.

2. Inclusion Criteria

The inclusion criteria in this study were full-text articles with a cross-sectional design. The articles were published in English from 2012 to 2022. The population used in this study were both male and female adults. Analysis of perceived susceptibility to final study results was reported using the adjusted odds ratio (aOR).

3. Exclusion Criteria

In this study, the exclusion criteria were articles that had been meta-analyzed, duplicate articles, published articles only in the abstract, and the number of research samples was less than 100.

4. Operational Definition of Variables

The search for articles was carried out by considering the eligibility criteria determined using the PICO model. Population: adults. Intervention: perception of vulnerability is high. Comparison: perception of low vulnerability. Outcome: colorectal cancer screening.

Colorectal Cancer Screening is Colorectal cancer screening is a secondary preventive measure by finding adenoma polyps and finding cancer at an early stage. Various types of colorectal cancer screening such as Colonoscopy, Faecal Occult Blood Test, CT Colonography, Fecal Immunochemical Test, multi-target stool DNA examination, and Flexible Sigmoidoscopy are performed by adults, both male and female as an effort to prevent colorectal cancer.

Vulnerability Perception is a person's belief that they have susceptibility and have a risk for colorectal cancer, so that person is encouraged to do colorectal cancer screening.

5. Data Analysis

The data in this study were analyzed using the Review Manager application (RevMan 5.3). Forest plots and funnel plots were used to determine the size of the relationship and the heterogeneity of the data. The fixed effect model is used when the data is homogeneous, while the random effect model is used when the data is heterogeneous.

RESULTS

Process of searching article wascarried out by searching several journal databases including Google Scholar, Pubmed, and Science Direct, it can be seen using the PRISMA FLOW flowchart shown in Figure 1.

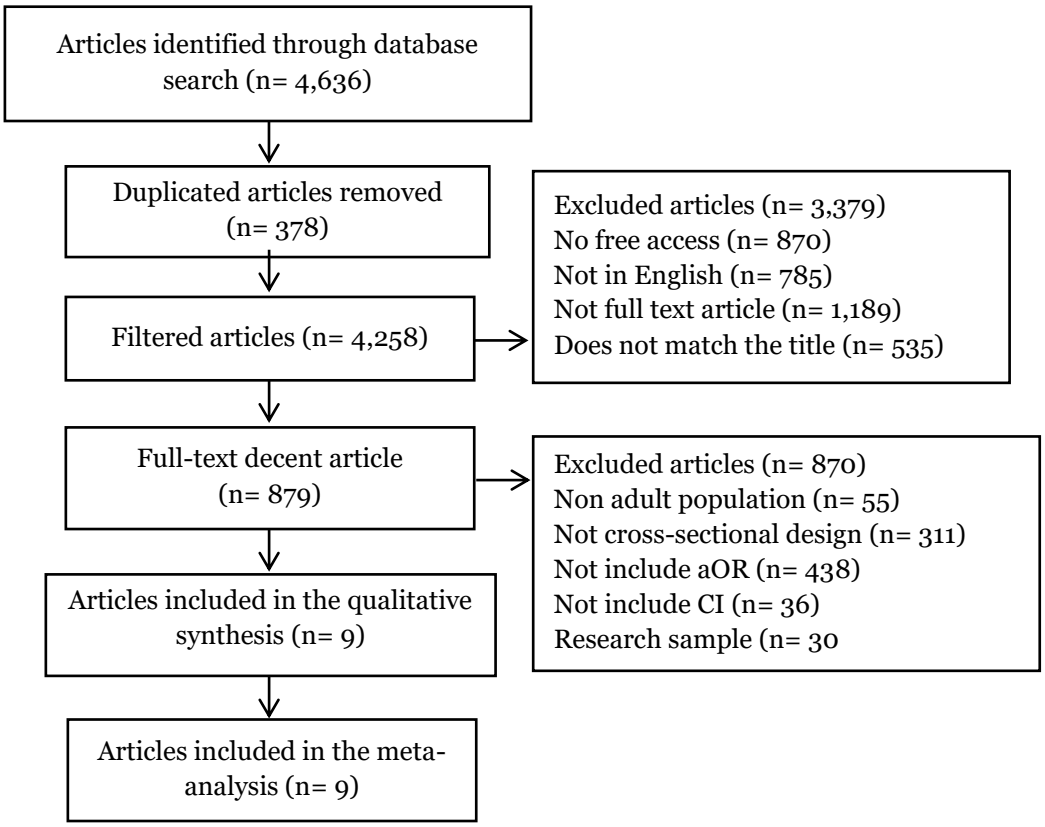

Figure 1. Results of Prisma Flow Diagrams

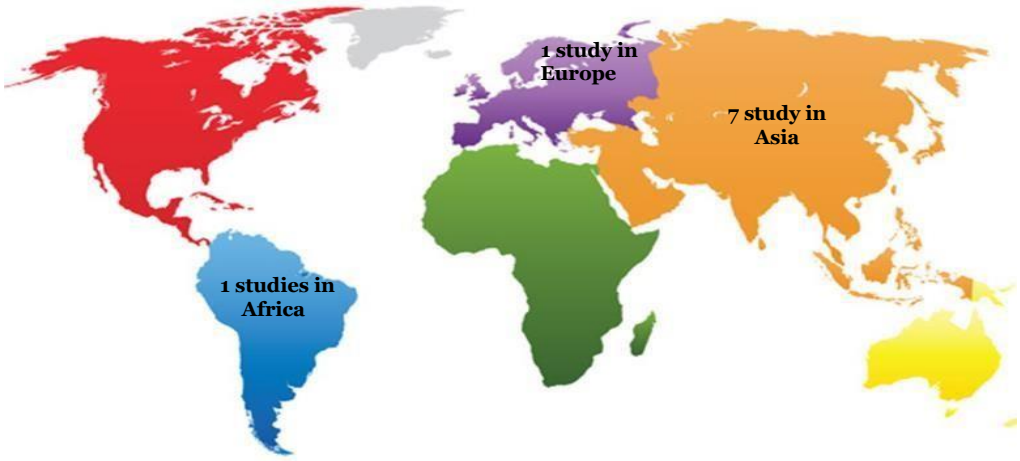

Figure 2. Research Distribution Map

Research related to exclusive breast-feeding in mothers who visited antenatal care consisted of 9 articles from the initial search process yielding 4,636 articles, after the deletion process, articles were published with 879 requirements for full-text review more carry on. A total of 9 articles that met the quality assessment were included in the quantitative synthesis using a meta-analysis.

It can be seen in Figure 2 that the research used in this study amounted to 9 studies, which came from 3 continents, namely Asia, North America, and Europe.

Table 1. Assessment of study quality published by the Centre for Evidence-Based Medicine

No	Indicator	Publication (Author and Year)								
		Tsoh et al. (2018)	Bujang et al. (2021)	Bae et al. (2014)	Hadley et al. (2020)	Choi et al. (2018)	Lianos et al. (2015)	Huang et al. (2021)	Menon et al. (2014)	Taheri-Kharameh et al. (2016)
1	Does the study address clearly focused questions/problems?	2	2	2	2	2	2	2	2	2
2	Is the research method (research design appropriate) to answer the research question?	2	2	2	2	2	2	2	2	2
3	Is the method according to the subject (employee, team, division, organization) clearly explained?	2	2	2	2	2	2	2	2	2
4	Does the way the sample is obtained can lead to bias (selection)?	2	2	2	2	2	2	2	2	2
5	Is the sample of subjects representative of the population to which the findings will be referred?	2	2	2	2	2	2	2	2	2
6	Was the sample size based on pre-study considerations of statistical power?	2	2	2	2	2	2	2	2	2
7	Was a satisfactory response rate achieved?	2	2	2	2	2	2	2	2	2
8	Is the measurement (questionnaire) possible valid and reliable?	2	2	2	2	2	2	2	2	2
9	Was statistical significance assessed?	2	2	2	2	2	2	2	2	2
10	Was a confidence interval given for the main outcome?	2	2	2	2	2	2	2	2	2
11	Could there be a confounding factor that has not been taken into account?	2	2	2	2	2	2	2	2	2
12	Can the results be applied to your organization?	2	2	2	2	2	2	2	2	2
	Total	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**

Table 2. Description of Primary Research included in the Meta-Analysis

No	Author (Year)	Country	Study Design	Sample	Population (P)	Intervention (I)	Comparison (C)	Outcome (O)	aOR (CI 95%)
1	Tsoh *et al.*, (2018)	Asian America	Cross Sectional	504	Adults 50-75 years old	High vulnerability perception	Low vulnerability perception	Perceived susceptibility shows a significant correlation to colorectal cancer screening	2.05 (1.08 to 2.70)
2	Bujang *et al.*, (2021)	Malaysia	Cross Sectional	508	Adults >50 years old	Feeling at risk for colorectal cancer	Do not feel at risk of colorectal cancer	Perceived susceptibility shows an association with increased willingness to screen for colorectal cancer	1.70 (1.08 to 2.70)
3	Bae *et al.*, (2014)	Korea	Cross Sectional	237	Adults who are 50 years old	High vulnerability perception	Low vulnerability perception	Perceived susceptibility showed a significant effect on adherence to colorectal cancer screening	1.829 (1.07 to 3.12)
4	Hadley *et al.*, (2020)	United Kingdom (UK)	Cross Sectional	176	Adults aged 18-87	High vulnerability perception	Low vulnerability perception	Perceived susceptibility showed a significant predictor in the use of colonoscopy	1.99 to 1.14 to 3.47)
5	Choi *et al.*, (2018)	Korea	Cross Sectional	2.154	Adults who are 50 years old	High vulnerability perception	Low vulnerability perception	Perceived susceptibility shows association to increased colorectal cancer screening	1.61 (1.21 to 2.15)

No	Author (Year)	Country	Study Design	Sample	Population (P)	Intervention (I)	Comparison (C)	Outcome (O)	aOR (CI 95%)
6	Llanos *et al.*, (2015)	United States	Cross Sectional	275	Adults 51-75 years old	High vulnerability perception	Low vulnerability perception	Perceived susceptibility shows strong association with colorectal cancer screening	3.49 (2.19 to 5.56)
7	Huang et al., (2021)	Hongkong	Cross Sectional	7,200	Adults aged 61-70 years	Feeling at risk for colorectal cancer	Do not feel at risk of colorectal cancer	Perceived susceptibility shows positive association to colorectal cancer screening	1.32 (1.05 to 1.65)
8	Menon et al., (2014)	United States	Cross Sectional	275	Adults 50-64 years old	High vulnerability perception	Low vulnerability perception	The perception of susceptibility showed significantly to colorectal cancer screening through endoscopy.	8.9 (1.10 to 17.70)
9	Taheri-Kharameh et al., (2016)	Iran	Cross Sectional	200	Adults who are 50 years old	High vulnerability perception	Low vulnerability perception	Perceived susceptibility is a significant predictor of colorectal cancer screening adherence	2.99 (1.23 to 5.45)

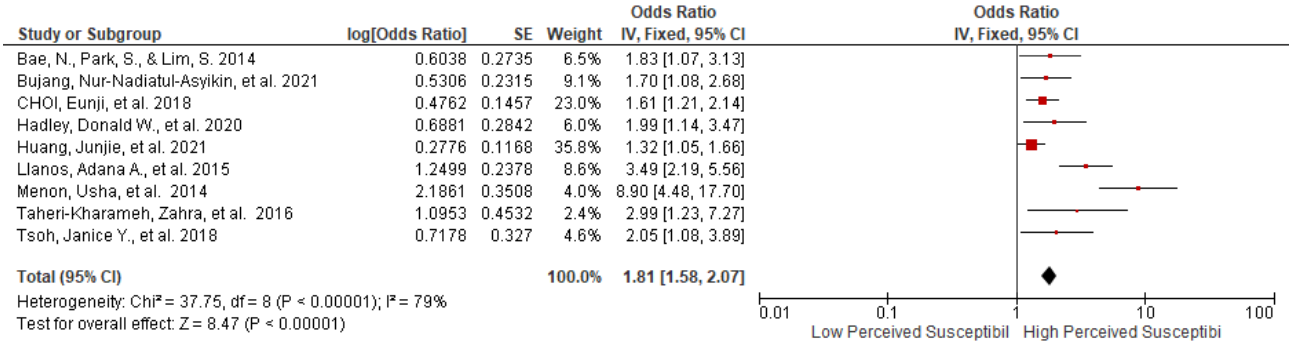

Figure 4. Forest plot of the application of vulnerability perception in the implementation of colorectal cancer screening

The Forest Plot in Figure 3 shows that there is an application of perceived vulnerability in the implementation of colorectal cancer screening by 1.81 times compared to someone who has a low perception of susceptibility to colorectal cancer screening (aOR = 1.81 ; 95% CI= 1.58-2.07) and the results are statistically significant (p<0.001).

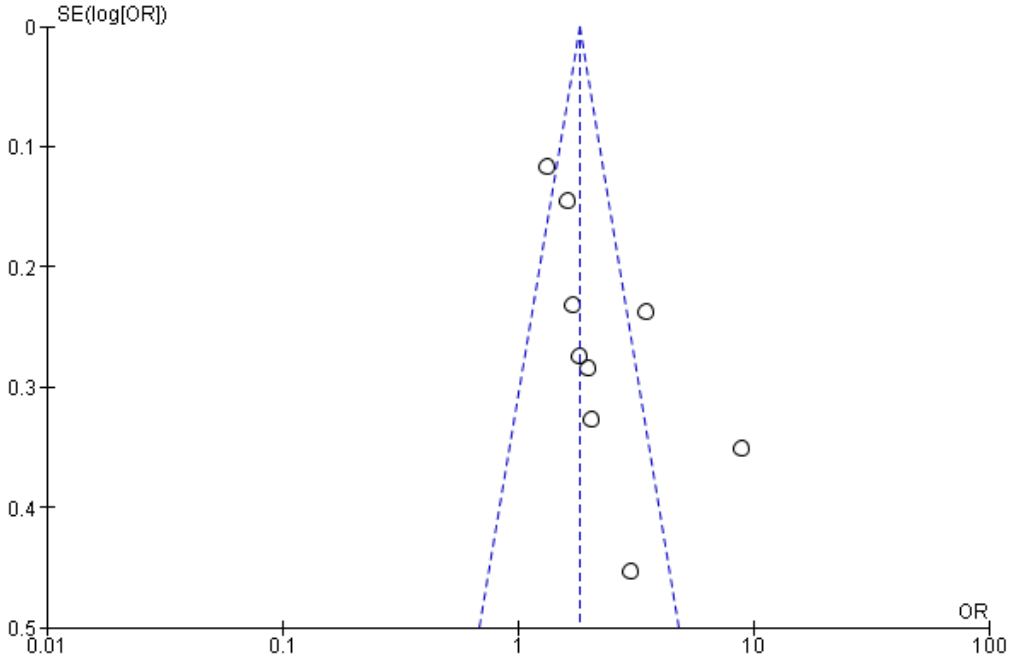

Figure 4. Funnel Plot of the application of vulnerability perception in the implementation of colorectal cancer screening

The funnel plot in Figure 4 shows an asymmetric distribution of primary outcome estimates, weight to the right of the vertical line, which has a publication bias that exceeds the real (Overestimated.) There are five plots on the right, three plots on the left, and one plot vertical line drawing. The plot on the right side of the graph has a standard error (SE) between 0 and 0.5. The plot on the left side of the graph has a standard error (SE) between 0 and 0.3.

DISCUSSION

analysis in this study took the theme of applying the Health Belief Model theory to colorectal cancer screening. The indepen-

dent variable of this study is the perception of perceived vulnerability. The dependent variable of this study was colorectal cancer screening. This study discusses one of the constructs of the Health Belief Model, namely the perception of vulnerability which is one of the determining factors in a person to predict health behavior, especially the use of health services to implement and encourage prevention including colorectal cancer screening.

The results of this study indicate that a person's perception of himself as vulnerable or at high risk will increase colorectal cancer screening by 1.81 times compared to someone who has a low perception of susceptibility to colorectal cancer screening (aOR= 1.81 ; 95% CI = 1.58 to 2.07) and the results were statistically significant ($p < 0.001$). The results of this study are in line with research conducted by (Gilfoyle, 2020), which stated that the perception of susceptibility showed a positive relationship to colorectal cancer screening (aOR= 1.97; 95% CI = 1.52 to 2.55).

There are several indicators that can influence someone who thinks that they have susceptibility and are at risk for colorectal cancer, such as lower knowledge, lack of participation in colorectal cancer prevention programs or screening through seminars and counseling related to colorectal cancer. This allows people who initially they did not know for sure about the risk of developing colorectal cancer and after being informed about the estimated risks that could occur, so that the person perceives himself as having susceptibility and increases the likelihood for them to participate in colorectal cancer screening (Wong , 2013).

According to (Huang, 2021), several other factors that can influence a person's perceived susceptibility to colorectal cancer such as lower income levels and those who work as farmers have poorer awareness. Furthermore, those who do not have health insurance and have never visited a doctor will have a lower perception of colorectal cancer risk so there is a possibility that they will not be encouraged to undergo colorectal cancer screening.

Perceived susceptibility is a person's perceived vulnerability that they have susceptibility and have a risk for colorectal cancer, so that person is encouraged to do colorectal cancer screening. Perceived susceptibility based on this study may increase the likelihood of getting colorectal cancer screening. A person's susceptibility to colorectal cancer is influenced by emotional reactions to cancer itself and the perceived risk is influenced by subjective awareness. The existence of emotional feelings towards risk factors as a response to one's own feelings greatly affects a person's feeling of having a susceptibility to getting colorectal cancer. Based on research conducted by (Choi, 2018), perceived susceptibility to developing colorectal cancer is independently related to absorption of colorectal cancer screening and is expected to motivate individuals to engage in cancer screening with feelings of increased susceptibility.

As a result, someone who has a perception of susceptibility to colorectal cancer will influence someone to act in prevention by carrying out colorectal cancer screening. The strategy for increasing awareness and screening for colorectal cancer is with the government taking the initiative to carry out appropriate and effective campaigns or counseling on target. In addition, health workers must be trained to play an active role in increasing public awareness, perception, and behavior about colorectal cancer screening. The limitations of this study are that there is a language bias because it only uses English articles, a publication bias shown in the funnel plot results, and a

search bias because it only uses three databases.

AUTHOR CONTRIBUTION

Audria Ersananda & Aulia Siti Nur Rahmah as the main researchers, designed this study, collected articles from electronic journal databases and analyzed the data.

FUNDING AND SPONSORSHIP

This study is self-funded.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

ACKNOWLEDGMENT

The authors would like to thank the database providers PubMed, Google Scholar, and ScienceDirect.

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