

Meta Analysis: Application of Health Belief Model on the Tertiary Prevention of Type 2 Diabetes Mellitus

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ABSTRACT

Background: Diabetes Mellitus Type 2 is a hyperglycemic disease due to insensitivity of cells to insulin. Insulin levels may decrease slightly or be in the normal range. The level of adherence of type 2 diabetes patients is lower than type 1 diabetes. Compliance with medication and taking medication in DM patients has a very important role in controlling blood sugar levels. HBM is a model that describes a person's knowledge of health threats and understanding of recommended behaviors to prevent or treat health problems based on an assessment of feasibility and benefits compared to costs. This study aimed to estimate the effect of HBM, especially the severity and self-efficacy constructs.

Subjects and Method: This study was conducted using a systematic review and meta-analysis study design using PICO. Population: type-2 diabetic patients. Intervention: high severity perception and high self-efficacy. Comparison: low severity perception, and low self-efficacy. Outcome: tertiary prevention behaviors. The articles used in this study came from 4 databases, namely Google Scholar, Pubmed, Science Direct and Proquest. The article keywords are "health belief model" OR "perceived severity" OR "self-efficacy" AND "type 2 diabetes". The articles included in this study are full paper articles, cross-sectional study designs, 2012-2021 and the size of the relationship between Adj Odds Ratio. Article selection is done using PRISMA. Articles were analyzed using the Review Manager 5.3 application.

Results: A total of 12 cross-sectional studies were reviewed in this study. A meta-analysis of 7 cross-sectional studies showed that strong perceived severity increased the likelihood of implementing tertiary prevention behaviors in type 2 diabetes patients by 4.69 times (aOR= 4.69; 95% CI= 1.92 to 11.47; p= 0.007). A meta-analysis of 9 cross-sectional studies showed that slightly stronger perceived self-efficacy increased the likelihood of implementing tertiary prevention behaviors in type 2 diabetes patients by 1.68 times (aOR= 1.68; 95% CI= 1.03 to 2.74; p= 0.040).

Conclusion: Severity perception and self-efficacy are predictors for tertiary prevention of type 2 Diabetes Mellitus.

Keywords: predictors, tertiary prevention, type-2 diabetes mellitus, health belief model.

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BACKGROUND

Diabetes mellitus is a serious chronic disease that occurs when the pancreas does not

produce enough insulin or when the body cannot use insulin effectively. Diabetes is an important public health problem, dia-

betes is one of the four priority non-communicable diseases targeted for action by world leaders (WHO global report, 2016).

Diabetes Mellitus Type 2 is a metabolic disorder disease characterized by an increase in blood sugar due to a decrease in insulin secretion by pancreatic beta cells and or impaired insulin function (insulin resistance). Insulin levels may be slightly decreased or within the normal range. Because insulin is still produced by pancreatic beta cells, type 2 diabetes mellitus is considered as non-insulin dependent diabetes mellitus (Fatimah NR, 2015).

The International Diabetes Federation (IDF) states that the prevalence of Diabetes Mellitus in the world is 1.9% and has made DM the seventh leading cause of death in the world, while in 2012 the incidence of diabetes mellitus in the world was 371 million people, where the proportion of type 2 diabetes mellitus was 95% of the world population suffers from diabetes mellitus (Infodatin, 2020).

The results of Basic Health Research in 2008, showed that the prevalence of DM in Indonesia had increased to 57%, in 2012 the incidence of diabetes mellitus in the world was 371 million people, where the proportion of the incidence of type 2 diabetes mellitus was 95% of the world population suffering from diabetes mellitus and only 5% of that number suffer from type 1 diabetes mellitus (Risksedas, 2018).

Non-adherence to diabetes treatment is still a big problem that is quite important in the management of diabetes. The level of adherence of type 2 diabetes patients is lower than type 1 diabetes can be caused by the therapeutic regimen which is generally more complex and polypharmacy, as well as drug side effects that arise during treatment. Compliance with medication and taking medication in DM patients has a very

important role in controlling blood sugar levels (Ulum et al, 2015).

Health Belief Model is a model that explains a person's knowledge of health threats and understanding of the recommended behavior to prevent or overcome health problems based on the assessment of feasibility and benefits compared to costs (Sulaeman, 2016). HBM includes six main elements, namely: (1) perceived susceptibility, (2) perceived severity, (3) perceived threats, (4) individual perceptions of the benefits and barriers (perceived benefits and barriers), (5) the existence of trigger factors to accept or reject alternative actions (cues to action). (6) self-efficacy.

This study aims to estimate the effect of health belief models, especially on the construct of severity perception, and self-efficacy with a meta-analysis.

SUBJECTS AND METHOD

1. Study Design

The articles used are articles published from 2012 to 2021. The selection of articles uses a flow chart, namely the PRISMA Flow Diagram. The keywords used in the article search were "health belief model" OR "perceived severity" OR "self-efficacy" AND "type 2 diabetes".

2. Inclusion Criteria

The inclusion criteria used in this study were full-text articles with a cross-sectional design. The article was published in English from 2012 to 2021. Analysis of perceived severity and perceived self-efficacy up to the end of the study was reported using adjusted odds ratio (aOR).

3. Exclusion Criteria

In this study, the exclusion criteria were articles that had been meta-analyzed, which did not use a cross-sectional design, the final results of the study were not reported using the adjusted odds ratio (aOR), and the sample was <100 participants.

4. Operational Definition of Variables

An article search was conducted to consider the eligibility criteria determined using the PICO model. Population: Type-2 diabetic Patients, Intervention: I: high severity perception, high self-efficacy. Comparison: low severity perception, low self-efficacy. Outcome: tertiary prevention behavior in type 2 diabetes patients.

Severity perception is a person's belief in predicting the severity of a disease.

Self-efficacy is the belief in one's own ability to do something.

5. Instruments

The instrument in this study is the PRISMA Flow diagram using a research quality assessment using predetermined criteria, namely using the Critical Appraisal Checklist.

6. Data Analysis

From the articles that have been collected, data processing is carried out using the Review Manager application (RevMan 5.3) issued by the Cochrane Collaboraton. Data processing is done by calculating the value of effect size and heterogeneity.

RESULTS

In the process of searching for articles to be synthesized, meta-analysis is carried out by searching several journal databases including Google Scholar, Pubmed, Science Direct and Proquest. In the process of reviewing and selecting articles, it can be seen using the PRISMA FLOW flowchart shown in Figure 1.

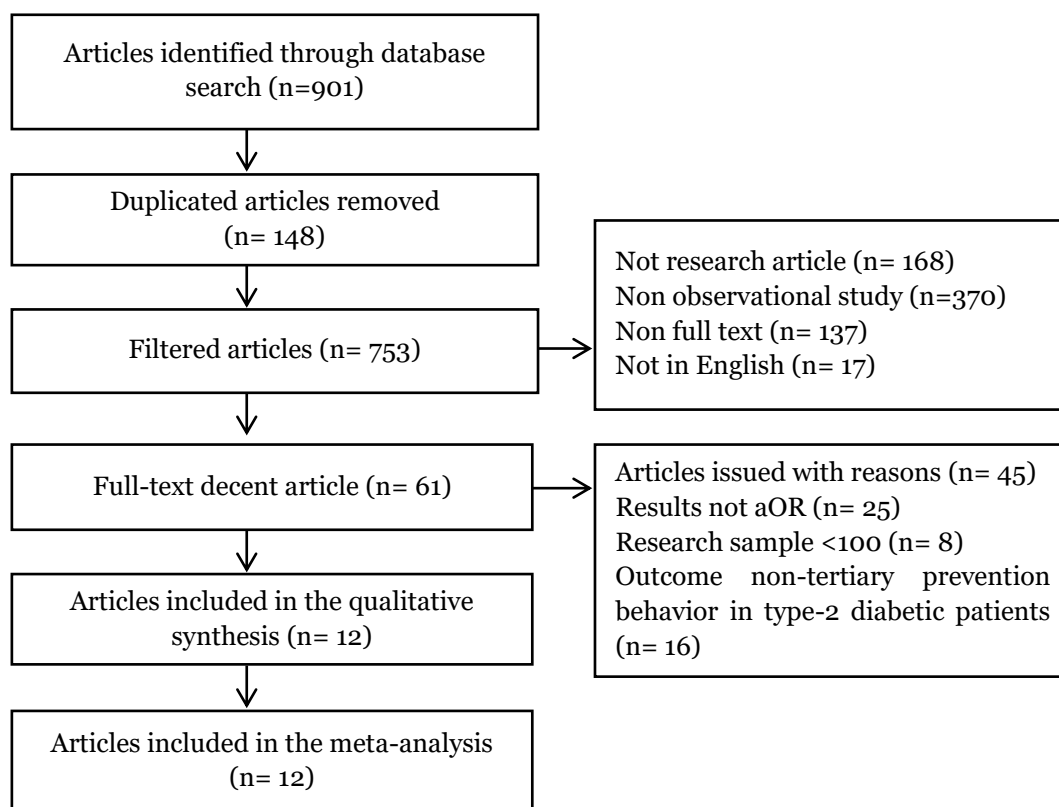


Figure 1. Results of Prisma Flow Diagrams

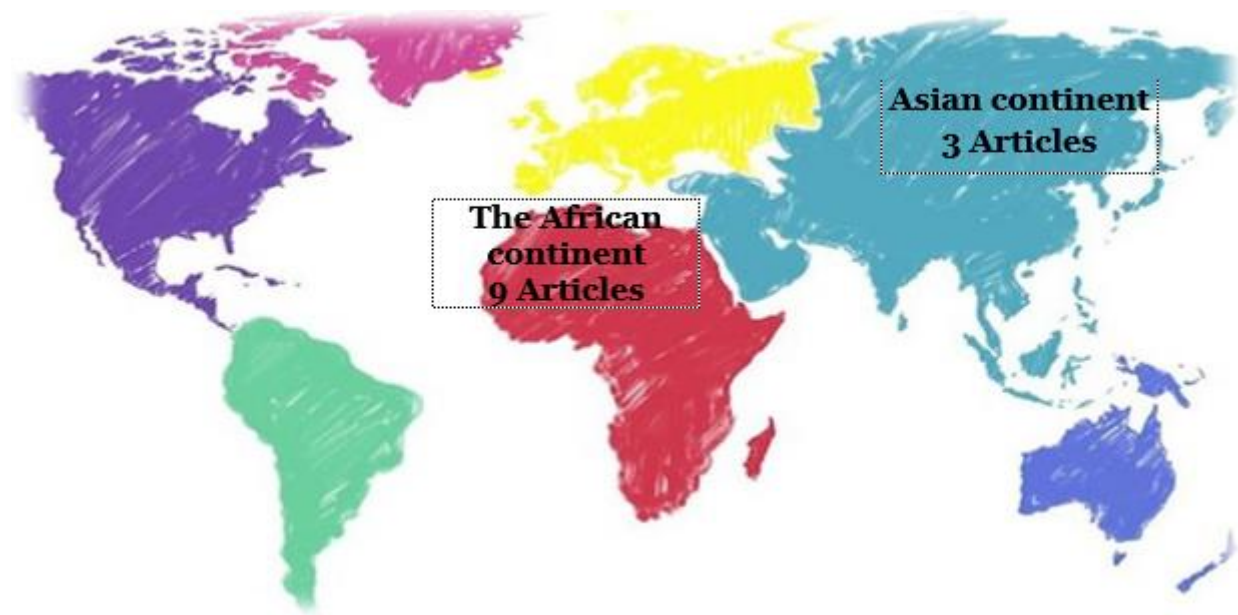


Figure 2. Research Distribution Map

Research related to Risk Factors associated with Application of Health Belief Model to Prevention of Tertiary Diabetes Mellitus Type-2 of 12 articles from the initial search process yielding 901. After deleting the duplication of articles, 753 articles were produced, then after the process of removing the duplication of articles, the next step was to check the relevance of the title and the study design used to produce 61 articles. After that, the articles were checked according to the inclusion criteria and the exclusion criteria were obtained as many as 12 articles.

From the filtered articles, an assessment of the quality of the research was carried out, it was found that 12 articles met

the assessment of research quality which would be included in the quantitative synthesis using meta-analysis.

Based on Figure 2, it can be seen that the research came from two continents, namely Asia and Africa. There are 9 articles from the African continent, namely from Ethiopia, and 3 articles from the Asian continent, namely from China and Vietnam.

Table 1 shows the results of the research quality assessment process. Table 2 shows that of the 12 articles, there were 12 articles with Cross-sectional research designs showing Application of Health Belief Model to Prevention of Tertiary Diabetes Mellitus Type 2.

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

No	Research Question	Article (Author and Year)					
		Mengiste et al. (2021)	Gurmu et al. (2018)	Gizaw at al. (2017)	Ghimire et al. (2017)	Yao et al. (2019)	Oluma et al (2020)
1	Did the study address a clearly focuswd question/ issue?	2	2	2	2	2	2
2	Is the research method (study design) appropriate for answering the research question?	2	2	2	2	2	2
3	Is the method of selection of the subjects (employees, teams, divisions, organizations) clearly described?	2	2	2	2	2	2
4	Could the way the sample was obtained introduce (selection) bias?	2	2	2	2	2	1
5	Was the sample of subjects representative with regard to the population to which the findings will be referred?	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
7	Was a satisfactory response rate achieved?	2	2	2	2	2	1
8	Are the measurements (questionnaires) likely to be valid and reliable?	2	2	2	2	1	2
9	Was the statistical significance assessed?	2	2	2	2	2	2
10	Are confidence intervals given for the main results?	2	2	2	2	2	2
11	Could there be confounding factors that haven't been accounted for?	2	2	2	2	2	2
12	Can the results be applied to your organization?	2	2	2	2	2	2
Total		24	24	24	24	23	22

Note: Answer 0= No, 1= can't tell, 2= Yes

Table 1. Continue

No	Research Question	Article (Author and Year)					
		Tamira et al. (2014)	Ayele et al. (2012)	Prakash at al. (2021)	Melkamu et al. (2021)	Nguyen et al. (2021)	Chali et al (2018)
1	Did the study address a clearly focuswd question/ issue?	2	2	2	2	2	2
2	Is the research method (study design) appropriate for answering the research question?	2	2	2	2	2	2
3	Is the method of selection of the subjects (employees, teams, divisions, organiza-tions) clearly described?	2	2	2	2	2	2
4	Could the way the sample was obtained introduce (selection) bias?	2	2	2	2	2	2
5	Was the sample of subjects represent-tative with regard to the population to which the findings will be referred?	2	2	1	1	2	2
6	Was the sample size based on pre-study considerations of statistical power?	2	2	2	2	2	2
7	Was a satisfactory response rate achi-eved?	2	1	2	1	2	2
8	Are the measurements (questionnaires) likely to be valid and reliable?	2	1	2	2	1	2
9	Was the statistical significance assessed?	2	2	2	2	2	2
10	Are confidence intervals given for the main results?	2	2	2	2	2	2
11	Could there be confounding factors that haven't been accounted for?	2	2	2	2	2	2
12	Can the results be applied to your organization?	2	2	2	2	1	2
	Total	24	22	23	22	22	24

Note: Answer 0= No, 1= can't tell, 2= Yes

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

No	Author (Year)	Country	Study Design	Sampel	P (Population)	I (Intervention)	C (Comparison)	O (Outcome)	aOR (95% CI)
1	Tamirat et al (2014)	Ethiopia	Cross-sectional	322	All patients with type 2 diabetes mellitus who came to the diabetes mellitus polyclinic at Jimma University Hospital	High severity perception and self-efficacy	Low severity perception and self-efficacy	Tertiary preventive behavior in type 2 diabetes patients	1) 7.30 (0.19 to 2.80) 2) 5.90 (0.64 to 0.96)
2	Ayele et al (2012)	Eastern-Ethiopia	Cross-sectional	222	All patients with type 2 diabetes mellitus were enrolled in a follow-up diabetes management clinic at three hospitals located in the state of Harari, Ethiopia.	High severity perception and self-efficacy	Low severity perception and self-efficacy	Tertiary preventive behavior in type 2 diabetes patients	12.30 (1.19 to 126.25)
3	Prakash (2021)	Southern-Ethiopia	Cross-sectional	276	Patients suffering from Type 2 Diabetes Mellitus who are at Nigist Eleni Mohammad Memorial Hospital aged 20-79 years.	High severity perception and self-efficacy	Low severity perception and self-efficacy	Tertiary preventive behavior in type 2 diabetes patients	8.30 (1.19 to 16.25)
4	Melkamu et al (2021)	Northwest - Ethiopia	Cross-sectional	396	Outpatient Diabetes Mellitus type 2 who is at the Special Hospital of the University of Gondar.	High severity perception and self-efficacy	Low severity perception and self-efficacy	Tertiary preventive behavior in type 2 diabetes patients	1) 4.57 (2.11 to 9.93) 2) 9.12 (2.28-9.93)
5	Gurmu (2018)	Ethiopia	Cross-sectional	257	DM patients who were in 4 hospitals in the West Shoa zone were >18 years old.	High self-efficacy	Low self-efficacy	TPB in type 2 diabetes patients.	3.30 (1.64 to 6.62)

Table 2. Continue

No	Author (Year)	Country	Study Design	Sampel	P (Population)	I (Intervention)	C (Comparison)	O (Outcome)	aOR (95% CI)
6	Nguyen et al (2021)	Vietnam	Cross-sectional	1238	People with Type 2 Diabetes Mellitus living in two rural districts in Thai Binh Province, Vietnam.	Low severity perception and self-efficacy	Low severity perception and self-efficacy	Tertiary preventive behavior in type 2 diabetes patients	4.71 (2.84 to 7.80)
7	Mengiste (2021)	Northwest-Rthiopia	Cross-sectional	423	Diabetes Mellitus Patient at Debre Markos Referral Hospital.	Low severity perception and self-efficacy	Low severity perception and self-efficacy	Tertiary preventive behavior in type 2 diabetes patients	1) 2.07 (0.42 to 10.14) 2) 0.43 (0.41 to 1.69)
8	Ghimire (2017)		Cross-sectional	197	Outpatients with Type 2 Diabetes Mellitus at the Outpatient Department Center Kupondolo City.	High severity perception and self-efficacy	Low severity perception and self-efficacy	TPB in type 2 diabetes patients	1) 0.64 (0.32 to 1.25) 2) 0.30 (0.05 to 1.64)
9	Yao et al (2019)		Cross-sectional	2166	Type 2 Diabetes Mellitus patient residing in Shandong Province.	High self-efficacy	Low self-efficacy	Tertiary preventive behavior in type 2 diabetes patients	1.06 (1.04 to 1.08)
10	Chali et al (2018)		Cross-sectional	383	Diabetes patients who underwent follow-up at Benishangul Gumuz Hospital were >18 years.	High self-efficacy	Low self-efficacy	TPB in type 2 diabetes patients	3.00 (1.76 to 5.11)
11	Oluma et al (2020)		Cross-sectional	423	Outpatients in 4 public hospitals in Western Ethiopia.	High self-efficacy	Low self-efficacy	TPB in type 2 patients	10.32 (5.65 to 18.82)
12	Ghizaw et al. (2017)	Ethiopia	Cross-sectional	423	Diabetes Mellitus Patient at Debre Markos Referral Hospital.	High self-efficacy	Low self-efficacy	Tertiary preventive behavior in type 2 diabetes patients	1.33 (1.12 to 1.57)

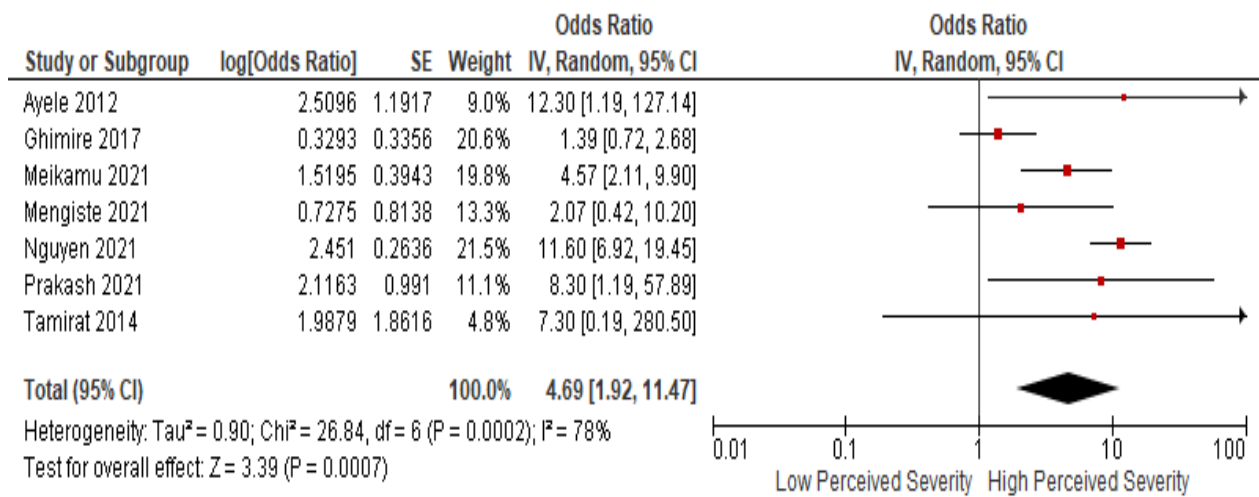


Figure 5. Forest Plot Perceived Severity to Tertiary preventive behavior in type 2 diabetes patients

Based on Figure 3, individuals with a high perception of severity can increase tertiary prevention behavior by 4.69 times compared to individuals with a low perception

of severity, and this result is significant (aOR= 4.69; 95% CI= 1.92 to 11.47; p= 0.007) .

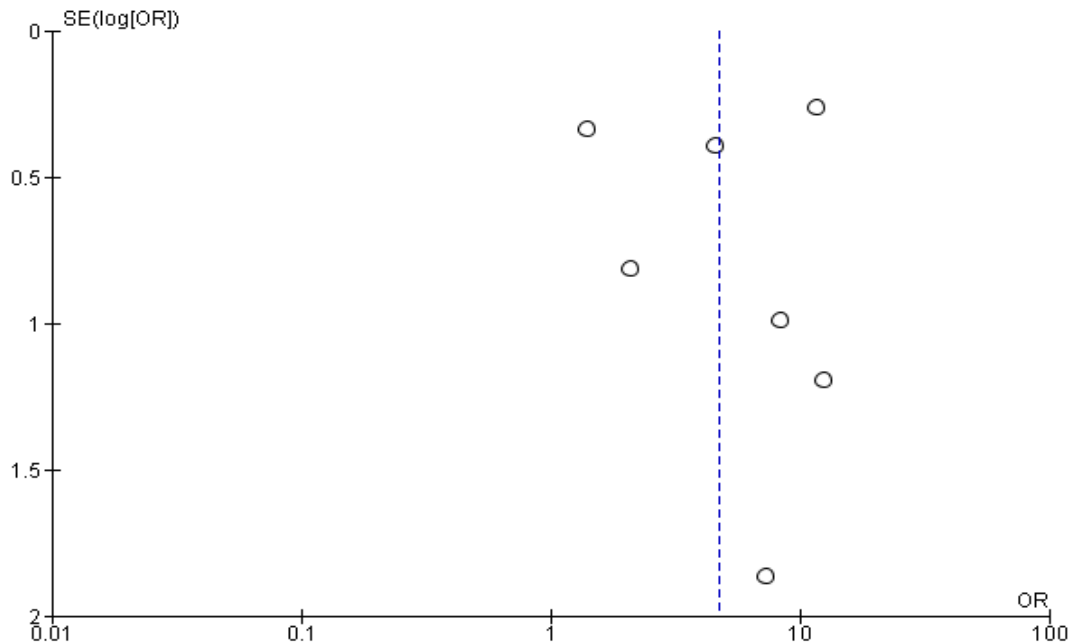


Figure 4. Funnel Plot of Perceived Severity to Tertiary preventive behavior in type 2 diabetes patients

Based on Figure 4, it can be concluded that there is a publication bias marked by plot asymmetry. On the left side of the diagram

there are 3 plots with standard errors between 0 and 1. On the right side there are 4 plots with standard errors between 0 and 2.

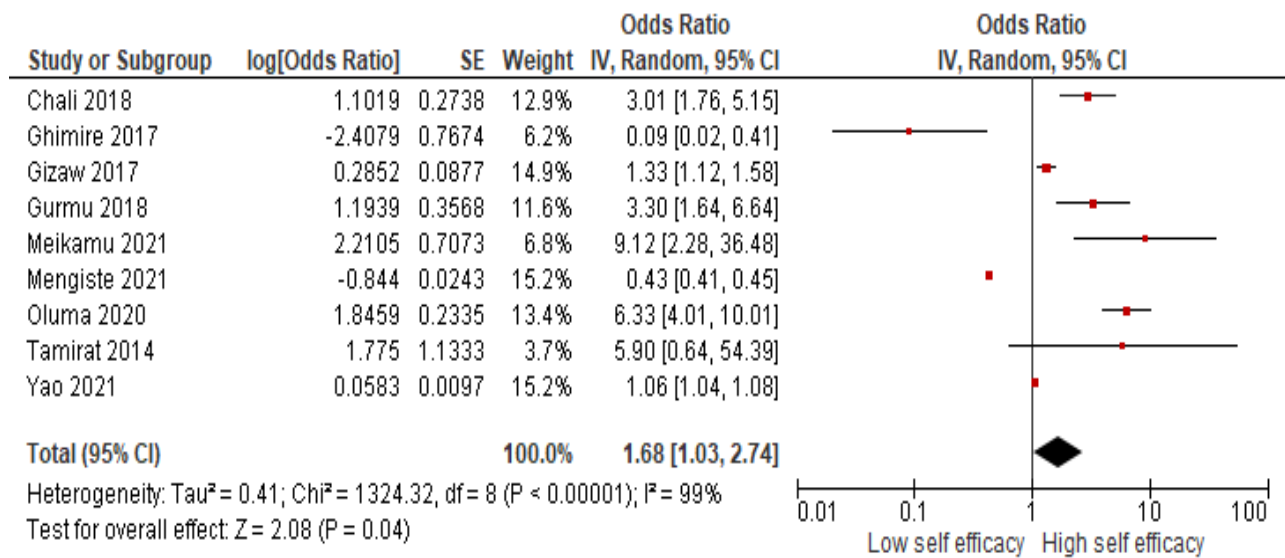


Figure 5. Forest Plot of self-efficacy to Tertiary preventive behavior in type 2 diabetes patients

Based on Figure 5 individuals with a high self-efficacy can increase tertiary prevention behavior by 1.68 times compared to

individuals with a low self-efficacy, and this result is statistically significant (aOR= 1.68; 95% CI= 1.03 to 2.74; p= 0.040) .

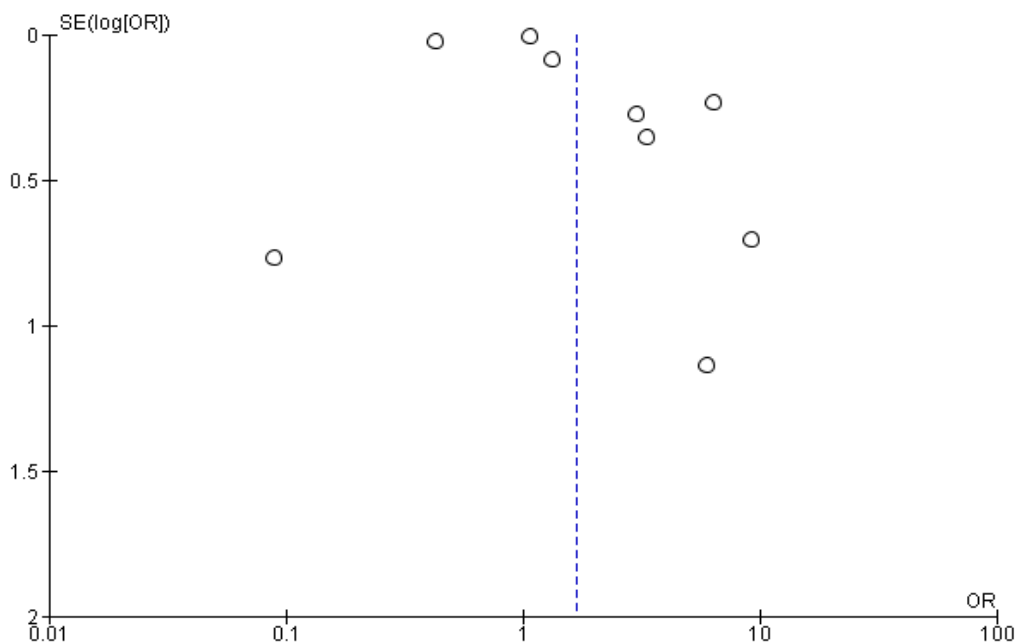


Figure 6. Funnel Plot of self-efficacy to Tertiary preventive behavior in type 2 diabetes patients

Based on Figure 6, it can be concluded that there is a publication bias marked by plot asymmetry. On the left side of the diag-

ram there are 4 plots with standard errors between 0 and 1. On the right side there are 5 plots with standard errors between 0 and

1.5. Bias can also be inferred from the disproportionate distance between studies on both the right and left sides.

DISCUSSION

The design of this study uses a meta-analysis research design, and takes the theme, namely the application of the Health Belief Model in tertiary prevention of type 2 Diabetes Mellitus patients. efficacy) in performing certain tasks for better health status.

This study uses aOR statistical results from multivariate analysis, aiming to control for confounding factors that can cause research results to affect relationships or affect the population studied (Anulus et al., 2019). It is processed using the Revman 5.3 application, while the results of a systematic study of meta-analytical data are presented in forest plots and funnel plots.

1. Application of perceived severity in tertiary prevention of type 2 DM patients.

This study shows that the application of perceived severity has a high probability of tertiary prevention of type 2 DM, which is 4.69 times, and is significant with the result $p=0.007$. The results of this study are in line with the research of Karimy et al. (2015) who stated that perceived severity could influence tertiary prevention practices for Type 2 Diabetes Mellitus. Sabhibi et al. (2017) also stated that the perceived severity was statistically significant ($p<0.001$).

In the research of Tamarat et al. (2014) explained that individuals with high disease severity and complications were 7.3 times more likely to take tertiary prevention ($p=0.002$).

The individual's view of the seriousness of a particular condition and its own consequences is called the severity perceived by the individual (Mohammadi et al, 2018). The severity felt by type 2 Diabetes

Mellitus patients makes these patients more obedient to prevent complications, therefore the perceived severity of the disease helps for the possibility of tertiary prevention itself (Karimy et al, 2015).

The perceived severity for the possibility of increasing the patient's tertiary prevention in this study is one predictor of improving health status for type 2 DM patients to cope with complications (Tafti et al, 2015). Previous studies have shown that understanding symptom severity and susceptibility to type 2 DM can lead to higher self-care improvements among type 2 DM patients (Jalilian et al, 2014).

2. Application of perceived self-efficacy in tertiary prevention of type 2 DM patients.

The results of this study were slightly stronger self-efficacy increasing the possibility of implementing tertiary prevention behavior in type 2 diabetes patients by 1.68 times and the results were not significant ($p=0.004$). This is in line with research by Ghimire (2014) which states that slightly stronger self-efficacy increases the likelihood of implementing tertiary prevention behaviors in type 2 DM by 0.90 times. Another study explains that strong self-efficacy increases the possibility of implementing tertiary prevention behavior for type 2 DM 5.9 times and significantly with p -value = 0.002 (Tamarat, 2014).

Individuals are advised to make plans that are achievable by the individual and of course realistic to build self-confidence and are more likely to be effective in changing behavior patterns, because the early stages of adapting behavior are important to increase self-efficacy. Lack of energy or stamina, and individual health problems are some of the barriers that affect self-efficacy (Ghimire, 2014).

In the study of Mohammadi et al (2018), there was a significant increase in

knowledge ($p < 0.001$) after receiving a tertiary prevention education intervention for type 2 DM, the first step in preventing and reducing disease complications was education that was effective in increasing patient self-efficacy. One of the causes of patients experiencing difficulties in controlling a healthy lifestyle is the lack of awareness to implement healthy living behaviors.

Another study, namely Karimy et al. (2015) found that self-efficacy ($r = 0.44$) had a negative relationship with perceived barriers ($r = 0.38$). Based on the Health Belief Model, barriers are potential negative aspects of certain health behaviors. Perceived barriers can act as barriers to performing the recommended behavior. One of the weaknesses of this study is that we have not included barriers to intervention

AUTHOR CONTRIBUTION

Etanaulia Marsim and Fara Aristya Prisma 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.

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