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Masters Program in Public Health, Universitas Sebelas Maret

Meta-Analysis

The Effectiveness of Wearing Mask and Physical Distancing in Preventing the COVID-19 Transmission

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ABSTRACT

Background: Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). The increase in the number of cases was rapid, and spread to various countries in a short time. Based on epidemiological and virological studies, it has been proven that COVID-19 is transmitted from symptomatic (symptomatic) people to other people who are in close proximity through droplets and aerosols. The application of health protocols is very effective in preventing transmission. Wearing masks, keeping a distance and washing hands are very important in preventing the spread of COVID-19.
Subjects and Method: This study is a meta-analysis using the PICO model. The population is the general public (adults over 18 years), the intervention is to wear masks properly and keep a distance. The comparison is not wearing a mask properly and not keeping a distance. The outcome is prevention of the spread of COVID-19. The articles used in this study were obtained from three databases, namely Google Scholar, PubMed, and Science Direct. The keywords to search for articles were "mask" AND "covid transmission" "physical distancing" AND "cross sectional study", from 2019 to 2021. The selection of articles was carried out using the PRISMA flow diagram. Articles were analyzed using the Review Manager 5.3 application.
Results: A total of 9 case studies from the African, American and Asian continents were selected for systematic review and meta-analysis. The results showed that the use of masks was 2.10 times effective in preventing transmission of COVID-19 and was statistically significant (aOR= 2.10; 95% CI= 1.54 to 2.85; p<0.001). Maintaining an effective distance of 2.35 times in preventing transmission of COVID-19 and statistically significant (Aor= 2.35; 95% CI= 1.44 to 3.83; p<0.001).
Conclusion: Wearing a mask and keeping a distance is effective in preventing the spread of COVID-19.

Keywords: mask, physical distancing, covid transmission

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BACKGROUND

Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). SARS-CoV is a new type of coronavirus that has never been previously identified in humans (Ministry of Health, 2020; Wang et al., 2020; WHO, 2020). It belongs to the coronavirus family, is a positive single-strain RNA virus, encapsulated and not segmented.

The increase in the number of cases took place quite quickly, and spread to various countries in a short time. As of February 11, 2022, the World Health Organization (WHO) reported 408,706,743 total confirmed cases with 5,820,136 deaths worldwide (Case Fatality Rate/CFR 0.14%), Asia 107,194,945 total confirmed cases with 1,316,138 deaths (CFR 0.12%), Indonesia 4,708.043 total confirmed cases with 144,958 deaths (CFR 0.30%), globally ranked -13th and ranked 3rd in Asia under India and Turkey (WHO, 2022). Indonesia reported its first case on March 2, 2020 (Ministry of Health, 2020). Based on epidemiological and virological studies, it has been proven that COVID-19 is transmitted from symptomatic (symptomatic) people to other people who are in close proximity through droplets and aerosols.

Some people who are infected with COVID-19 do not show any symptoms and still feel healthy. Common signs and symptoms of COVID-19 infection include symptoms of acute respiratory distress such as fever, cough and shortness of breath. The average incubation period is 5-6 days with the longest incubation period being 14 days. In severe cases of COVID-19, it can cause pneumonia, acute respiratory syndrome, kidney failure, and even death. The most common symptoms are fever, tiredness, and dry cough, pain, nasal congestion, runny nose, headache, conjunctivitis, sore throat, diarrhea, loss of smell and smell or skin rash (Ministry of Health, 2020; Burhan et al., 2022). Patients experiencing symptoms at the beginning of the disease are fever (98%), cough (76%), and myalgia or fatigue (44%); sputum production (28%), headache (8%), and diarrhea (3%) (Huang et al., 2020). In some patients, symptoms of anxiety can appear mainly in people who live in urban areas (Fresna et al., 2021).

The community has an important role in breaking the chain of transmission of COVID-19 so as not to cause new sources of transmission. The use of masks is very important in preventing the spread of COVID-19. Some countries have even implemented mandatory use of face masks indoors and outdoors during the COVID-19 pandemic, in addition to hand hygiene and social distancing (CDC, 2020b; Soriano et al., 2020). Communities with reported use of masks and physical distancing had the highest probability of controlling transmission (Sánchez et al., 2021; Rader et al., 2021).

Good knowledge of COVID-19 is associated with an optimistic attitude, useful for encouraging optimistic attitudes and perceptions so that they will carry out safe and correct ways of wearing masks (Mboowa et al., 2021). Wearing a mask properly covering the nose and mouth can prevent the spread of COVID-19 (Cohen et al., 2021). Preventative measures such as regular hand washing, social distancing, and wearing a face mask are highly recommended. Critically, interpersonal distance, interpersonal dystancing (IPD) depends on the affective dimension of social interaction, which may be influenced by the current COVID-19 context. Its use should be accompanied by an emphasis on social distancing to prevent adverse health consequences (Cartaud et al., 2020; Bundgaard et al., 2021).

SUBJECTS AND METHOD

1. Study Design

This is a systematic research and meta-analysis. The articles used in this study were obtained from several databases, namely Google Scholar, PubMed, and Science Direct between 2019 and 2021. The selection of articles was carried out using the PRISMA flow chart. The keywords to search

for articles are as follows: “mask AND covid transmission”, “physical distancing AND covid transmission”, “mask AND physical distancing AND covid transmission”.

2. Inclusion Criteria

The inclusion criteria in this research article are: The article must be a full paper, with an appropriate title, and related to the use of masks, social distancing and COVID -19. The article uses a cross-sectional study design in English. The intervention provided was wearing a mask correctly and keeping a distance, the research subject was the general public, aged over 18 years, the outcome was the prevention of COVID-19 transmission.

3. Exclusion Criteria

Exclusion criteria for articles include: Articles that do not include adjusted Odds Ratio (aOR), articles that conduct research on certain groups, such as hemodialysis patients.

4. Operational Definition of Variables

The search for articles was carried out by considering the eligibility criteria determined using the PICO model. The PICO in this study are: Population: the general public (adults over 18 years). Intervention: wearing masks properly and keeping a distance. Comparison: not wearing masks properly and not keeping a distance. Outcome: preventing the transmission of COVID-19.

Correct use of mask: Wearing a mask with the nose, mouth and chin fully covered, the colored part of the mask in front, and the white part that sticks to the face and tie tightly to minimize gaps between the face and the mask.

Keeping the distance: maintain a physical distance from each other at least 6 feet or 1m – 2m. continuous data in meters, then categorized to keep the distance or not. If the distance is less than 1 meter, it is categorized as not keeping the distance.

Prevention of the spread of COVID-19: Actions taken to prevent the spread of COVID-19.

5. Study Instruments

The research is guided by the PRISMA flow chart and quality assessment using Critical Appraisal. Table 1 The researchers conducted an assessment of the quality of the research using the critical appraisal tools Checklist for Cross-sectional Study published by CEBM University of Oxford 2014. The 12 questions used in the check list are as follows:

a. Does this objective clearly address the research focus/problem?
b. Is the research method (research design) suitable to answer the research question?
c. Is the research subject selection method clearly written?
d. Can the sampling method lead to bias (selection)?
e. Does the research sample taken represent the designated population?
f. Was the sample size based on pre-study considerations?
g. Was a satisfactory response achieved?
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 data in the study were analyzed using the Review Manager application (RevMan 5.3). Forest plots and funnel plots were used to measure the relationship and heterogeneity of the data. The fixed effects model is used for homogeneous data, while the random effects model is used for heterogeneous data across studies.

RESULTS

The article search process is carried out through several journal databases, including Google Scholar, PubMed, and Science Direct. The review process for related articles can be seen in the PRISMA flowchart in chart 1. The initial search process resulted in 1,336 articles, after the process of deleting duplicate articles, 1,140 articles were found, with 67 of them eligible for further full-text review. Articles that met the exclusion criteria were excluded. The results of the articles that met the qualitative requirements were reviewed again and only 9 articles that met the quantitative requirements.

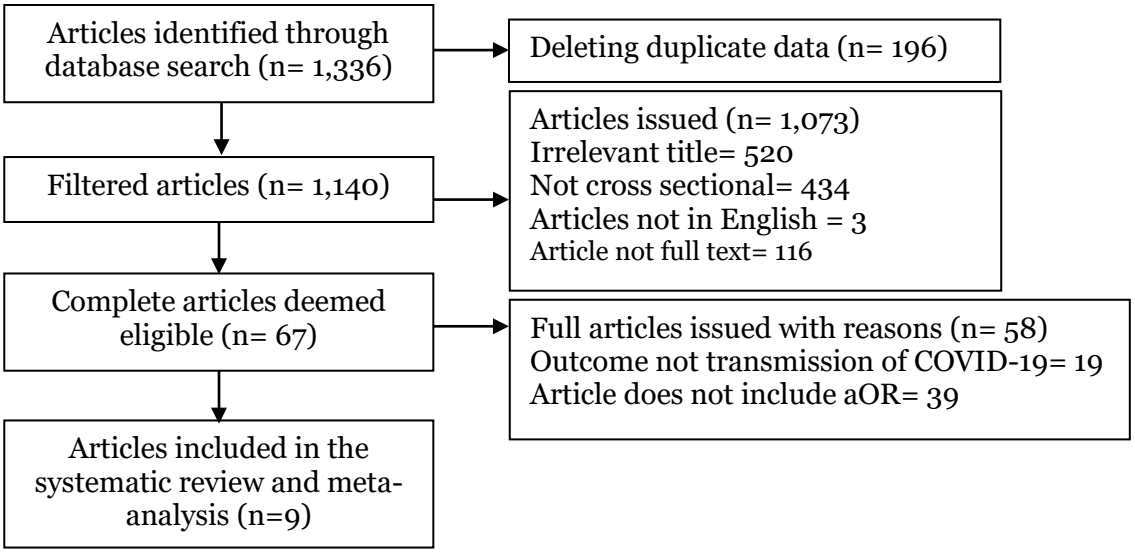

Figure 1. PRISMA Flowchart

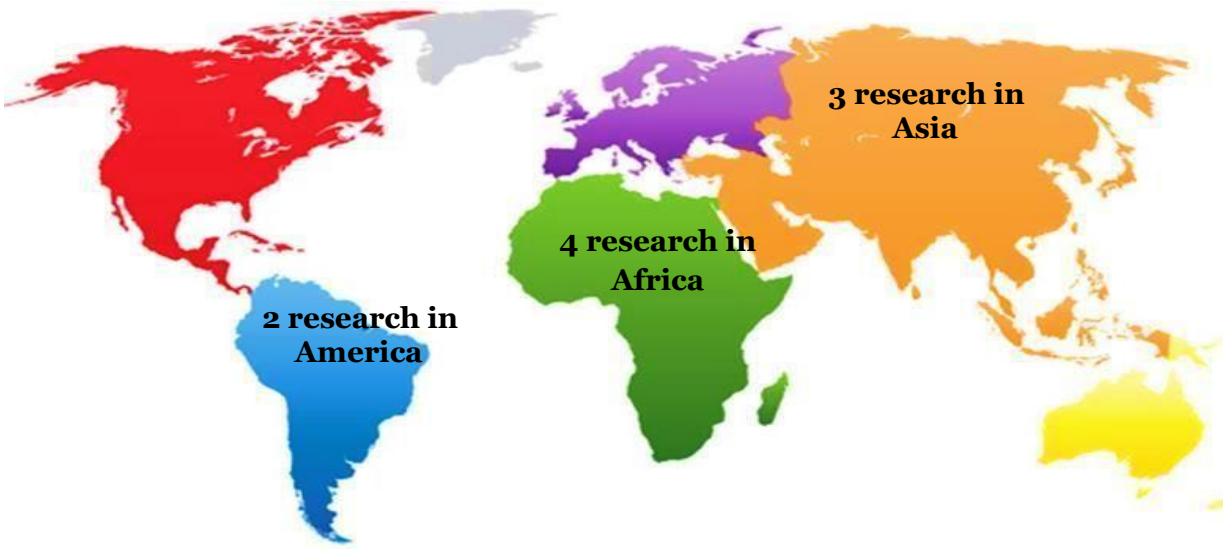

Figure 2. Map of study area

Table 1. Assessment of study quality using the Critical Appraisal Checklist for Cross-sectional published by Checklist for Cross-sectional Study published (CEBM)

No	Indicators	Authors (Year)								
		Mboowa et al. (2021)	Rader et al. (2021)	Cohen et al. (2021)	Sikakulya et al. (2021)	Sharif et al. (2021)	Deressa et al. (2021)	Apanga and Kumbeni (2021)	Ranjan et al. (2020)	Bo et al. (2020)
1	Does this objective clearly address the research focus/problem?	2	2	2	2	2	2	2	2	2
2	Is the research method (research design) suitable to answer the research question?	2	2	2	2	2	2	2	2	2
3	Is the research subject selection method clearly written?	2	2	2	2	2	2	2	2	2
4	Can the sampling method lead to bias (selection)?	2	2	2	2	2	2	2	2	2
5	Does the research sample taken represent the designated population?	2	2	2	2	2	2	2	2	2
6	Was the sample size based on pre-study considerations?	1	1	1	2	2	2	2	1	2
7	Was a satisfactory response achieved?	2	2	2	2	2	2	2	2	2
8	Are the research instruments 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	Are there any confounding factors that have not been taken into account?	2	2	2	2	2	2	2	2	2
12	Are the results applicable to your research?	2	2	2	2	2	2	2	2	2
	Total	**23**	**23**	**23**	**24**	**24**	**24**	**24**	**23**	**24**

Note: 2: Yes; 1: Can't tell; 0: No

Table 2. Description of primary studies included in the meta-analysis of the effectiveness of wearing masks in preventing transmission of COVID-19

Author (Year)	Country	Study Design	Sample Size		P (Population)	I (Intervention)	C (Comparison)	O (Outcome)	aOR (95%CI)
			Total	Wearing masks					
Mboowa, et al. (2021)	Ugdanan	Cross sectional Study	659	644	General public/risk groups	Providing information and how to use the correct mask	Did not get the information and how to use the correct mask	Prevention of the spread of COVID-19	2.01 (1.26 to 3.21)
Rader et al. (2021)	USA	Cross sectional study	378,207	319,980	The general public is at risk	Using masks the right way	Not wearing a mask properly	Prevention of the spread of COVID-19	3,53 (2.03 to 6·43)
Sikakulya et al. (2021)	Ugdanan	Cross-sectional study	1,114	1,114	The general public is at risk	Use masks properly	Not wearing a mask properly	Prevention of the spread of COVID-19	2.60 (1.42 to 4.67)
Sharif et al. (2021)	Bangladesh	Cross-sectional study	1,690	1,690	The general public is at risk	Use masks properly	Not wearing a mask properly	Prevention of the spread of COVID-19	1.02 (1.01 to 1.03)
Deressa et al. (2021)	Ethiopia	Cross sectional study	1,710	1.573	General public government employees	Use of masks	Not wearing a mask	Prevention of the spread of COVID-19	1.41 (1.22 to 1.63)
Apanga and Kumbeni (2021)	Ghana	Cross sectional study	556	527	General public/ pregnant women	Use of masks	Not wearing a mask	Prevention of the spread of COVID-19	1.92 (1.01 to 3.62)
Bo et al. (2020)	China	Cross sectional study	1,908,197	1,908,197	General public	Use of masks	Not wearing a mask	Prevention of transmission of COVID-19	15.14 (7.93 to 28.90)
Ranjan et al. (2020)	India	Cross Sectional study	388	379	General public	Use of masks	Not wearing a mask	Prevention of the spread of COVID-19	1.35 (1.18 to 1.54)

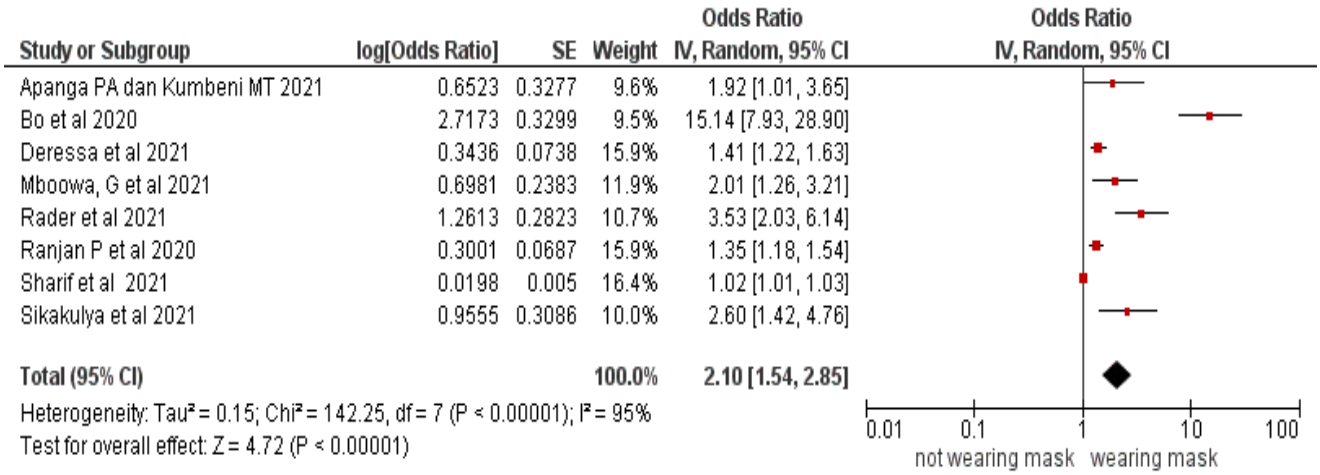

Figure 3. Forest plot effect of mask wear to prevent COVID-19 transmission

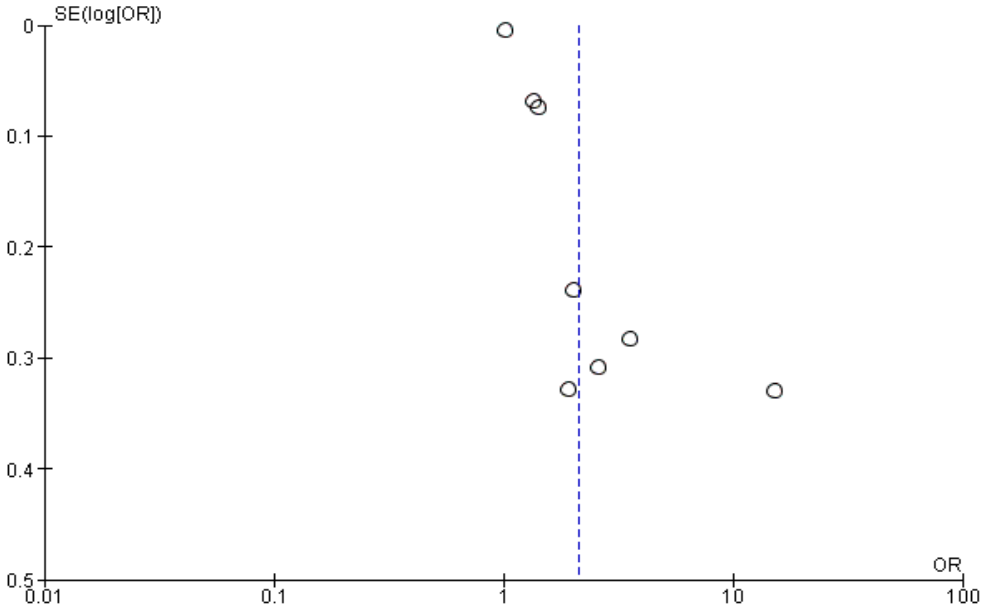

Figure 4. Funnel plot effect of mask wear to prevent COVID-19 transmission

Figure 3 shows that wearing a mask is effective in preventing the transmission of COVID-19 compared to without wearing a mask. Wearing an effective mask increased the odds by 2.10 times in preventing transmission of COVID-19 and was statistically significant (aOR= 2.10; 95% CI= 1.54 to 2.85; p<0.001). The heterogeneity of the research data shows I^2= 95% so that the distribution of the data is declared heterogeneous (random effect model).

Figure 4 shows that there is a publication bias which is indicated by the asymmetry of the right and left plots where 3 plots are on the right and 3 plots are on the left, and 2 plots are attached to the vertical line. The plot on the right of the graph appears to have a standard error (SE) between 0.2 and 0.4. The plot on the left of the graph appears to have a standard error (SE) between 0.0 and 0.1. And those that stick to the vertical line have a standard error (SE) between 0.2 and 0.4. Bias also occurs from the imbalance between the distances between studies on both the right and left sides of the funnel plot.

Table 3. Description of the primary studies included in the meta-analysis The effectiveness of social distancing in preventing transmission of COVID-19

Author (Year)	Country	Study Design	Sample Size		P (Population)	I (Inter-vention)	C (Compa-rison)	O (Outcome)	aOR (95%CI)
			Total	Physical Distancing					
Rader et al. (2021)	USA	Cross sectional study	378,207	319,980	The general public is at risk	Keep the distance	Not keeping distance	Prevention of the spread of COVID-19	1.42 (1.16 to 1.74)
Cohen et al. (2021)	Philadelpia	Cross sectional study	4,606	4,606	The general public is at risk	Keep the distance	Not keeping distance	Prevention of the spread of COVID-19	1.13 (0.17 to 7.51)
Sharif et al. (2021)	Bangladesh	Cross-sectional study	1,690	1,690	The general public is at risk	Keep the distance	Not keeping distance	Prevention of the spread of COVID-19	1.04 (1.01 to 1.07)
Deressa et al. (2021)	Ethiopia	Cross sectional study	1,710	1,573	General public government employees	Keep the distance	Not keeping distance	Prevention of the spread of COVID-19	1.10 (0.31 to 3.93)
Apanga and Kumbeni (2021)	Ghana	Cross sectional study	527	556	General public/pregnant women	Keep the distance	Not keeping distance	Prevention of the spread of COVID-19	15.27 (1.87 to 124.69)
Bo et al. (2020)	China	Cross sectional study	1,908,197	1,908,197	General public	Keep the distance	Not keeping distance	Prevention of spread of COVID-19	23.00 (17.22 to 30.72)
Ranjan et al. (2020)	India	Cross Sectional Study	388	379	General public	Keep the distance	Not keeping distance	Prevention of the spread of COVID-19	1.15 (1.07 to 1.24)

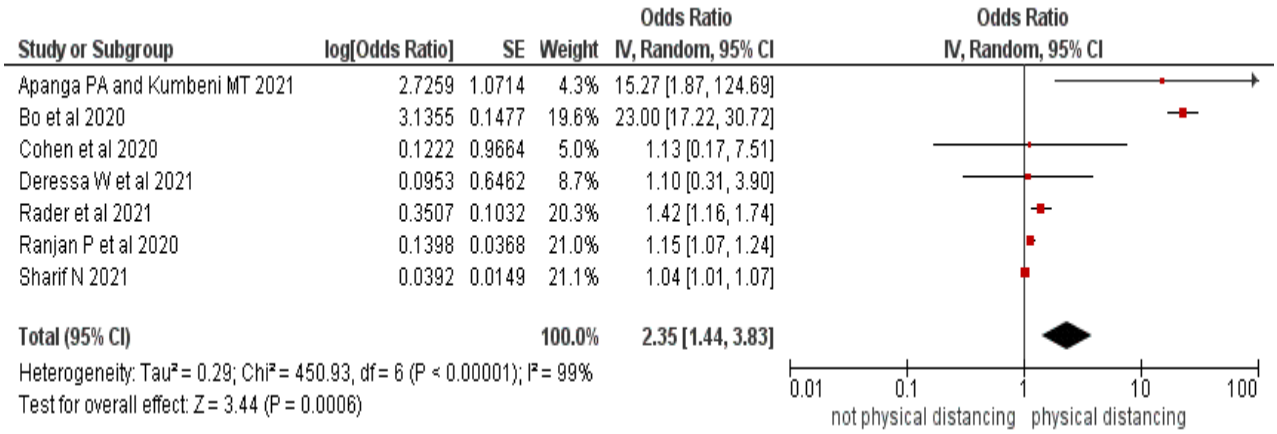

Figure 5. Forest plot effect of physical distancing in prevention of COVID-19 transmission

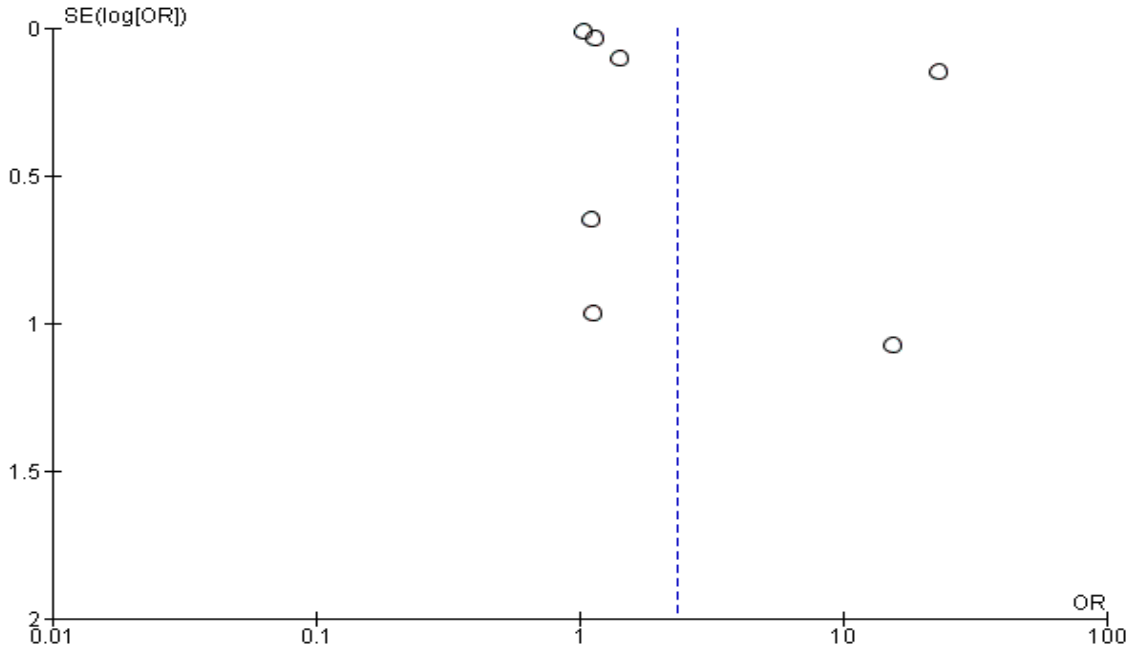

Figure 6. Funnel plot effectiveness of physical distancing in prevention of COVID-19 transmission

Figure 5 shows that maintaining a distance is effective in preventing the transmission of COVID-19 compared to not maintaining a distance. Maintaining effective distance increased the odds by 2.35 times in preventing transmission of COVID-19 and was statistically significant (aOR= 2.35; 95%CI= 1.44 to 3.83; p<0.001). The heterogeneity of the research data shows I^2= 99% so that the distribution of the data is declared heterogeneous (random effect model).

Figure 6 shows that there is a publication bias which is indicated by the asymmetry of the right and left plots where 2 plots are on the right and 5 plots are on the left. The plot on the right of the graph appears to have a standard error (SE) between 0.0 and 1.5. The plot on the left of the graph appears to have a standard error (SE) between 0.0 and 1.0. It could also occur from an imbalance between the

distances between studies on both the right and left sides of the funnel plot.

DISCUSSION

The effectiveness of wearing masks in preventing the transmission of COVID-19

From this study, it was found that the use of masks that were truly effective in preventing the transmission of COVID-19 compared to without wearing the correct masks. Wearing an effective mask increased the odds by 2.10 times in preventing transmission of COVID-19 and was statistically significant (aOR= 2.10; 95% CI= 1.54 to 2.85: p<0.001). The heterogeneity of the research data shows I^2= 95% so that the distribution of the data is declared heterogeneous (random effect model).

Deressa et al. (2021) stated that it is important to apply the use of masks in preventing the transmission of COVID-19. The government must enforce these precautions and the public must properly apply the use of masks, wash their hands frequently, and maintain social distance as a comprehensive package of COVID-19 prevention and control strategies. This is also in line with Ranjan et al. (2020) that preventive practices are important to reduce the spread of the COVID-19 pandemic. This opinion is in accordance with the results of research by Apanga PA and Kumbeni MT (2021) that knowledge about the symptoms of COVID-19, understanding transmission and prevention measures by wearing masks can play an important role in the practice of preventing transmission of COVID-19.

The effectiveness of maintaining distance in preventing the transmission of COVID-19

From this study, it was found that maintaining a distance is effective in preventing the transmission of COVID-19 compared to not keeping a distance. Maintaining an effective distance increased the odds by 2.35 times in preventing transmission of COVID-19 and was statistically significant (aOR= 2.35, 95% CI= 1.44 to 3.83; p <0.001). The heterogeneity of the research data shows I^2= 99% so that the distribution of the data is declared heterogeneous (random effect model).

The results of this study are in line with Kwon et al., (2021), which found that the relationship between social distancing at the community level reduces the predicted risk of COVID-19 transmission (WHO, 2020). The call to keep this distance does not only apply in public places, but also applies to all households and families. Because not all family members are safe from the corona virus (Widyaningrum and Putri, 2020).

Other studies are also in accordance with this study conducted by Deressa et al. (2021) stated that social distancing is a strategy to prevent and control COVID-19. This is in line with research conducted by Ranjan et al. (2020) that the preventive practice of keeping a distance is important to reduce the spread of the COVID-19 pandemic. This opinion is in accordance with the results of research by Apanga and Kumbeni (2021) that understanding transmission and preventive measures by keeping a distance can play an important role in the practice of preventive measures against COVID-19.

AUTHOR CONTRIBUTION

Tri Nyantosani Widyawardani is the main researcher who selects topics, explores and collects data. Eti Poncorini Pamungkasari and Bhisma Murti played a role in analyzing data and reviewing research documents.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

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