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Meta analysis

Prevalence of Hand Hygiene and Its Risk to Hand Eczema: A Meta-Analysis

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ABSTRACT

Background: Hand eczema is an inflammation of the skin that is limited to the hands and/or wrists. Since the pandemic began, washing hands is one of the actions that can be taken as an effort to prevent the spread of COVID-19. With the increasing frequency of hand washing by health workers during the pandemic, it is important to evaluate the risk of developing hand eczema in health personnel.

Subjects and Method: Meta-analysis was carried out according to the PRISMA flow chart and the PICO model (Population: health workers, Intervention: high frequency of hand washing, Comparison: low frequency of hand washing, Outcome: Hand eczema). The databases used are Google Scholar, PubMed, Scopus, Proquest, and Science Direct. Keywords used (hand hygiene) OR (frequency hand washing) AND (hand eczema). There were 17 cross-sectional studies published in 2018 to 2022 that met the inclusion criteria. Analysis was performed with Revman 5.3.

Results: A meta-analysis was performed on 17 cross-sectional studies from China, Turkey, India, Thailand, Denmark, Sweden, Bulgaria and Ethiopia. The total sample size is 31,154. A meta-analysis of 10 cross-sectional studies concluded that hand hygiene with a frequency of 8 to 10 times per day has a 1.46 times the risk of having hand eczema compared to hand hygiene with a frequency of <8 times per day (aOR=1.46; 95% CI 1.46 to 1.80; p<0.001). A meta-analysis of 10 cross-sectional studies concluded that hand hygiene with a frequency of 15 to 20 times per day has a 1.58 times the risk of experiencing hand hygiene compared to a frequency of <15 times per day (aOR=1.58; 95% CI 1.43 to 1.74; p<0.001).

Conclusion: The higher the frequency of hand hygiene, the higher the risk of hand eczema.

Keywords: hand hygiene, risk of hand eczema, health personnel

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BACKGROUND

Hand eczema is an inflammation of the skin that is limited to the hands and/or wrists. It is a common condition, with a lifetime prevalence of up to 14.5% in the general population (Quaade et al., 2021). This condition is often debilitating and causes a decrease in the quality of life of patients who are risk factors for hand eczema, with endogenous and exogenous factors known to play the most significant role (Mortz et al., 2014). While exogenous factors include contact allergies and exposure to irritants (Meding, 1990). Wet work activities and hand washing have also been implicated as risk factors for hand eczema, but other studies have found no association (Bryld et al., 2003).

During the COVID-19 pandemic, hand hygiene, which includes washing hands with soap and using hand sanitizers that use alco-

hol, has been recommended to reduce the spread of the virus. One way to maintain hand hygiene is to wash your hands. Hand washing is an act of cleaning hands using ordinary soap or antimicrobial soap and water (WHO, 2017). Hand washing is one of the actions that can be taken as an effort to prevent the spread of COVID-19. The use of hand washing products that contain detergents or alcohol and improper hand washing procedures can cause skin disorders such as dermatitis (Abtahi-Naeini, 2020).

Research on the relationship between handwashing and hand eczema in workers in health care settings reported that there were 21% of cases in one year. Every day, 30% of eczema cases in workers in health care settings are caused by washing hands with soap more than 20 times, 45% of cases are caused by using hand sanitizers more than 50 times and 54% of cases are caused by using gloves for more than 2 hours (Hamnerius et al., 2018).

Subsequent research on contact dermatitis and the risk of developing skin disorders stated that based on the experience of workers in health care facilities in Wuhan, out of 376 total workers, 74% of them had skin disorders. The most frequently reported skin disorders were desquamation with a prevalence rate of 68.6%, and papules or erythema with a prevalence rate of 60.4% (Balato et al., 2020).

In the study of Stoeva et al., 2019, high frequency of handwashing was associated with self-reported work-related skin symptoms in dental students in a previous study (OR 2.42, 95% CI: 1.06 to 5.52), when adjusting for other factors in the regression model logistically, the impact of frequent hand washing increased, even hand washing ≥8 times per day was significantly associated with work-related skin symptoms (aOR1.41, 95%CI: 1.11-1.80).

With the increasing frequency of hand washing carried out by health workers in the pandemic era, it is important to evaluate the risk of developing hand eczema in health workers by suggesting guidelines on proper hand washing, use of hand sanitizers or hand sanitize and the use of personal protective equipment in the form of gloves to avoid an increase in the risk of hand eczema which can reduce comfort at work. Therefore, this meta-analytic review aims to present an overview of the relationship between habitual hand hygiene (hand washing frequency) and the risk of hand eczema. These conditions prompted the authors to conduct research on the prevalence of hand hygiene with the risk of hand eczema among health workers.

SUBJECTS AND METHOD

1. Study Design

The meta-analysis was carried out with the PRISMA flowchart using Google Scholar, PubMed, Scopus, and Science Direct databases. Keywords used (hand hygiene) OR (frequency hand washing) AND (hand eczema). There were 17 studies with a cross-sectional study design published in 2018-2022 that met the inclusion criteria. Analysis was performed with Revman 5.3.)

2. Steps of Meta-Analysis

Meta-analysis is carried out through 5 steps as follows:

1) Formulate research questions using the PICO model (PICO as follows Population= population aged ≥18 years. Intervention=Vaccination. Comparison= Not vaccinated. Outcome= COVID-19 infection).
2) Search primary study research articles from electronic databases and libraries, such as PubMed, Science Direct, and Google Scholar.
3) Conduct screening and quality assessment of primary research articles.

4) Extracting and analyzing data into the RevMan 5.3 application.
5) Interpret results and draw conclusions.

3. Inclusion Criteria

Full-text paper article using a cross-sectional study. The relationship measure used by HR. The analysis used was multivariate with adjusted odds ratio (aOR). The research subjects were health workers. One of the interventions is hand hygiene, namely the frequency of hand washing. English articles. Outcome is hand eczema.

4. Exclusion Criteria

Articles with research subjects of more than 4 years, do not have a hand eczema variable and the articles are not written in English.

5. Operational Definition of Variables

Articles in this study are adapted to PICO. Article search was carried out according to the criteria according to the PICO model. There is a PICO in this study, the population is health workers, the intervenetion is hand hygiene (frequency of hand washing), and hand eczema as an outcome.

A health personnel is any person who devotes himself in the health sector who has knowledge and/or skills in the health sector which for certain types require authority to carry out health efforts.

Hand hygiene is an activity related to cleaning hands, seen from the aspect of hand washing frequency > 10 times and > 20 times per day.

Hand eczema is an inflammatory disorder of the epidermis characterized by the presence of small elastic glands filled with fluid on the palms of the hands.

6. Study Instruments

Quality assessment in this study used a critical appraisal checklist for cross-sectional studies published by the Joanna Briggs Institute.

7. Data Analysis

The articles in this study were collected according to the PRISMA flowchart and analyzed using the Review Manager 5.3 application. The analysis was carried out by calculating the effect size and heterogeneity consistency value (I^2) of the selected research results. The results of data analysis are in the form of forest plots and funnel plots.

RESULTS

The results of the article search were obtainned from the meta-analysis process using the PRISMA flowchart in Figure 2.

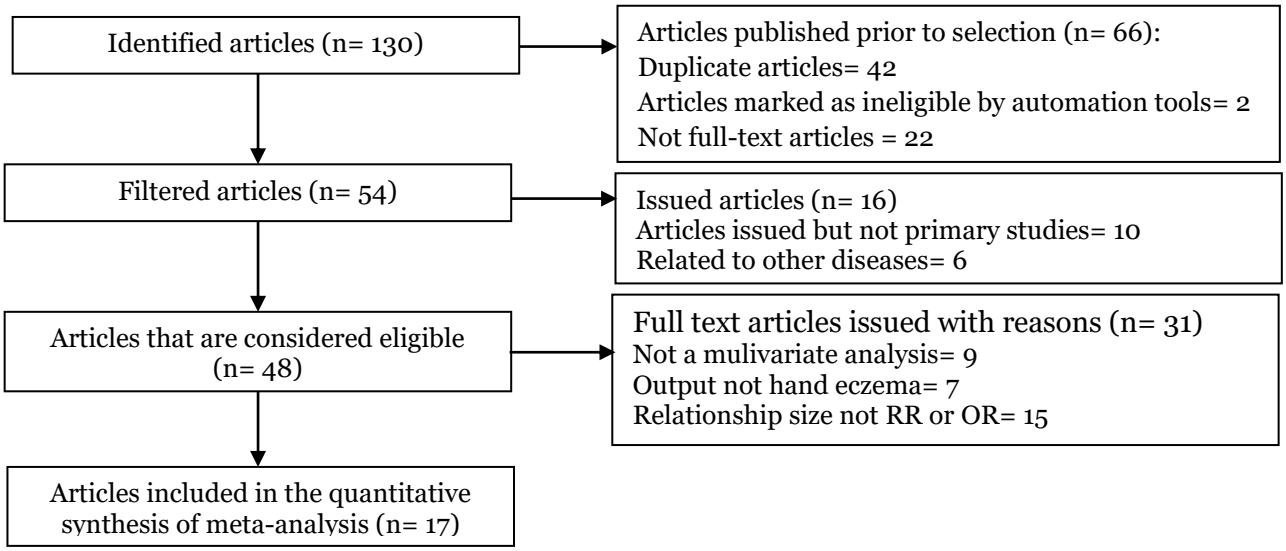

Figure 1. PRISMA diagram search for hand eczeme articles in health workers because of hand hygiene

Figure 2. Map of the Research Area

n this study related to the prevalence of hand hygiene with the risk of hand eczema in health workers from 17 articles originating from four continents, namely Asia, Africa and Europe. There were 11 studies originating from the continent of Asia, 5 studies from the continent of Europe and 1 study from the continent of Africa. Assessment of study quality was carried out quantitatively and qualitatively, this study used a critical appraisal checklist for cross-sectional studies (Moola et al., 2017). Critical appraisal which consists of 11 questions. Each "yes" answer was given a score of 2, "unclear" answer was given a score of 1 and "no" answer was given a score of 0. The assessment of the quality of the study is shown in Table 1. Based on the answers from the quality assessment, the total score of the answers ranged from 13 to 16 scores. it shows that the quality of the article is feasible for meta-analysis.

Table 1. Assessment of article quality with a cross-sectional study design

Article (Year)	question criteria								Total
	1	2	3	4	5	6	7	8	
Huang et al. (2020)	2	2	1	1	2	2	2	2	14
Lan et al. (2020)	2	2	2	2	1	2	2	2	15
Zhu (2020)	2	2	2	2	2	2	2	2	16
Metin et al. (2020)	2	1	2	1	2	2	2	0	13
Altunistik et al. (2020)	2	2	2	2	2	1	2	2	16
Jindal et al. (2020)	2	2	1	2	2	2	2	2	15
Erdem et al. (2020)	2	2	2	1	2	2	1	2	14
Falay Gur et al. (2021)	2	2	2	2	2	2	2	2	16
Papitchaya et al. (2022)	2	1	2	2	1	2	2	1	13
Techasatian et al. (2021)	2	2	2	2	2	2	2	2	16
Zhang et al. (2017)	2	2	2	2	2	2	2	0	14
Yuksel et al. (2020)	2	2	1	2	2	2	2	2	15
Hamnerius et al. (2018)	2	1	2	2	2	1	2	1	13
Hamnerius et al. (2021)	2	2	2	2	2	2	2	2	16
Stoeva et al. (2019)	2	2	1	2	2	2	2	2	15
Stoeva (2018)	2	2	2	2	1	2	2	2	15
Mekonnen et al. (2019)	2	1	2	2	2	1	2	2	14

Description of the question criteria:

1 = Are the criteria for inclusion in the sample clearly defined?
2 = Are the research subjects and settings explained in detail?
3 = Is exposure measured in a valid and reliable way?
4 = What are the standard criteria used for measuring objective conditions?
5 = Were confounding factors identified?
6 = Was a strategy to deal with confounding factors stated
7 = Are the results measured in a valid and reliable way?
8 = Has a proper statistical analysis been carried out?

Answer score description:

0 = No
1 = Can't tell
2 = Yes

Table 2. Description of the primary cross-sectional hand hygiene study with hand eczema with each PICO

Author (Year)	Country	Total Sample	P	I	C	O
Huang et al. (2020)	China	34	Health personnel	Frequency of hand washing 8-10/day & 15-20/day	Frequency of hand washing <8/day & <15 times/day	*Hand eczema*
Lan et al. (2020)	China	542	Health personnel	Frequency of hand washing 8-10 / day	Frequency of hand washing < 8 / day	*Hand eczema*
Zhu et al. (2021)	China	376	Health personnel	Frequency of hand washing 8-10 / day	Frequency of hand washing < 8 / day	*Hand eczema*
Metin et al. (2020)	Turkey	526	Health personnel	Frequency of hand washing 8-10 / day	Frequency of hand washing < 8 / day	*Hand eczema*
Altunistik et al. (2020)	Turkey	276	Health personnel	Frequency of hand washing 8-10 / day	Frequency of hand washing < 8 / day	*Hand eczema*
Jindal et al. (2020)	India	160	Health personnel	Frequency of hand washing 8-10 / day	Frequency of hand washing < 8 / day	*Hand eczema*
Erdem et al. (2020)	Turkey	170	Health personnel	Frequency of hand washing 15 – 20 / day	Frequency of hand washing <15/day	*Hand eczema*
Falay Gur et al. (2021)	Turkey	601	Health personnel	Frequency of hand washing 15 – 20 / day	Frequency of hand washing <15/day	*Hand eczema*
Papitchaya et al. (2022)	Thailand	333	Health personnel	Frequency of hand washing 15 – 20 / day	Frequency of hand washing <15/day	*Hand eczema*
Techasatian et al. (2021)	Thailand	805	Health personnel	Frequency of hand washing 15 – 20 / day	Frequency of hand washing <15/day	*Hand eczema*
Zhang et al. (2017)	China	954	Health personnel	Frequency of hand washing 15 – 20 / day	Frequency of hand washing <15/day	*Hand eczema*
Yuksel et al. (2020)	Denmark	954	Health personnel	Frequency of hand washing 8-10 / day	Frequency of hand washing < 8 / day	*Hand eczema*
Hamnerius et al. (2018)	Sweden	9,051	Health personnel	Frequency of hand washing 15 – 20 / day	Frequency of hand washing <15/day	*Hand eczema*
Hamnerius et al. (2021)	Sweden	6,886	Health personnel	Frequency of hand washing 8-10/day & 15-20/day	Frequency of hand washing <8/day & <15 times/day	*Hand eczema*

Author (Year)	Country	Total Sample	P	I	C	O
Stoeva et al. (2019)	Bulgaria	467	Health personnel	Frequency of hand washing 8-10/day & 15-20/day	Frequency of hand washing <8/day & <15 times/day	*Hand eczema*
Stoeva (2018)	Bulgaria	4,675	Health personnel	Frequency of hand washing 15 – 20 / day	Frequency of hand washing <15/day	*Hand eczema*
Mekonnen et al. (2019)	Ethiopia	422	Health personnel	Frequency of hand washing 8-10 / day	Frequency of hand washing < 8 / day	*Hand eczema*

Table 3 Data on Adjusted Odds Ratio Prevalence of Hand Hygiene (frequency of hand washing 8-10 times per day) with Hand Eczema

Author	Year	aOR	95%Cl	
			Lower Limit	Upper Limit
Huang *et al*	2020	0.54	0.25	1.18
Lan *et al*	2020	2.17	1.38	3.42
Zhu *et al*	2021	1.68	0.98	1.38
Metin *et al*	2020	3.57	1.67	7.82
Altunistik *et al*	2020	1.27	0.98	1.38
Jindal *et al*	2020	1.19	0.92	1.53
Yuksel *et al*	2020	1.73	1.26	2.73
Hamnerius *et al*	2021	1.16	0.98	1.38
Stoeva *et al*	2019	1.44	0.72	2.88
Mekonnen *et al*	2019	1.80	1.10	3.10

Table 4 Data on Adjusted Odd Ratio Prevalence of Hand Hygiene (frequency of hand washing 15-20 times per day) with Hand Eczema

Author	Year	aOR	95%Cl	
			Lower Limit	Upper Limit
Huang *et al*	2020	1.13	0.47	2.73
Erdem *et al*	2020	3.28	1.00	10.81
Falay-Gur *et al*	2021	1.39	1.20	1.62
Papitchaya *et al*	2022	2.01	1.24	3.24
Techasatian *et al*	2021	1.55	1.09	2.21
Zhang *et al*	2017	1.66	1.08	2.36
Hamneriusn *et al*	2018	1.43	1.12	1.83
Hamnerius *et al*	2021	1.78	1.43	2.21
Stoeva *et al*	2019	2.42	1.06	5.52
Stoeva *et al*	2018	1.78	1.39	2.27

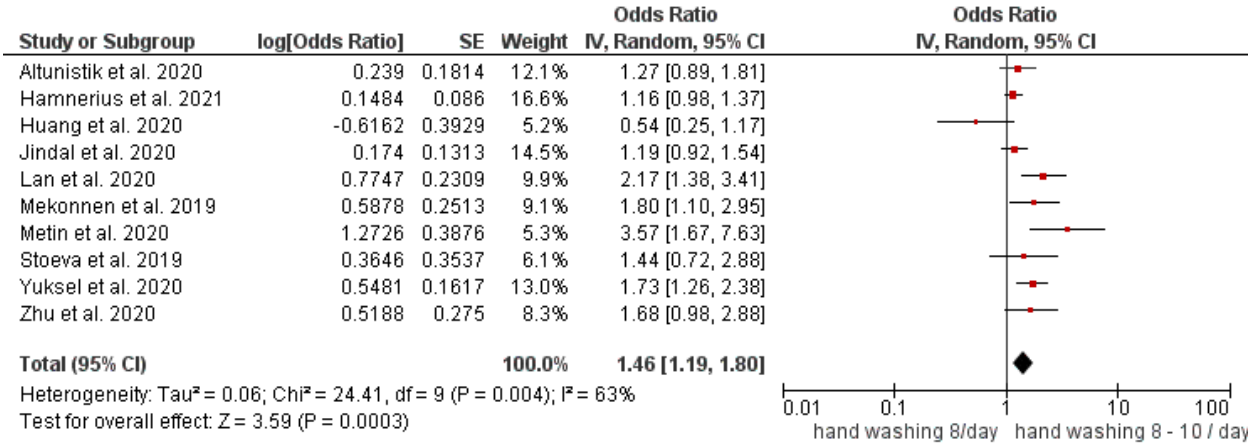

Figure 3. Forest plot of hand eczema based on the frequency of hand washing 8 to 10 times per day

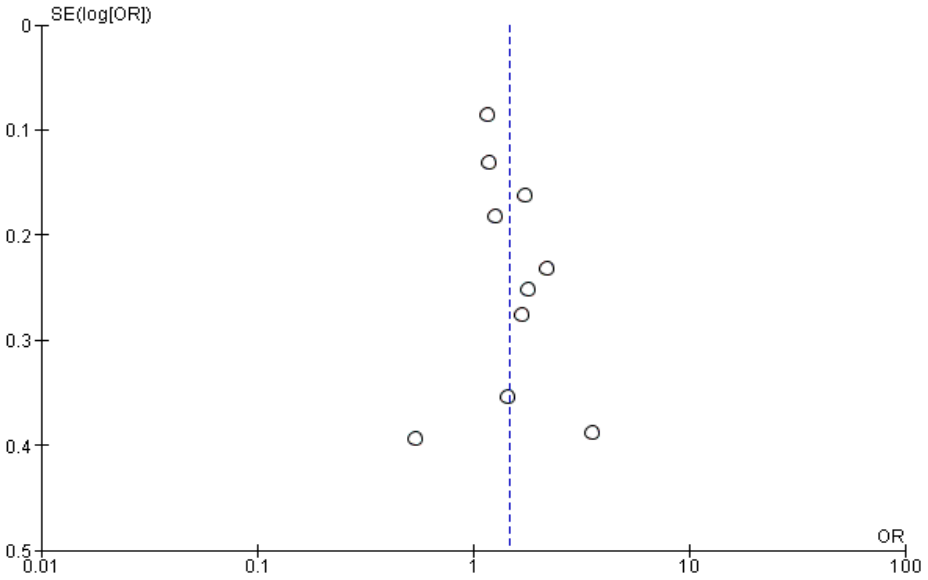

Figure 4. Funnel Plot of Hand Eczema Mortality Based on the Frequency of Handwashing 8 to 10 Times Per Day

Interpretation of the results of the meta—analysis process can be seen through the Forest plot. The forest plot in Figure 3 shows that there is a relationship between hand hygiene and the risk of hand eczema in health workers. Health workers with a frequency of washing hands 8 to 10 times per day have a risk of developing hand eczema by 1.46 times compared to those with a frequency of washing hands <8 times per day and the relationship is statistically significant (aOR= 1.46; 95% CI=1.19 to 1.80; p<0.001). The forest plots also show the estimated effect between primary studies that were investigated in the meta-analysis assessing large or heterogeneous variation with I2 = 63% (p= 0.004). Calculation of the estimated effect is done with a random effect model approach.

The funnel plot in Figure 4 shows that in a cross-sectional study, there is no publication bias as indicated by the symmetrical distribution of the right and left plots.

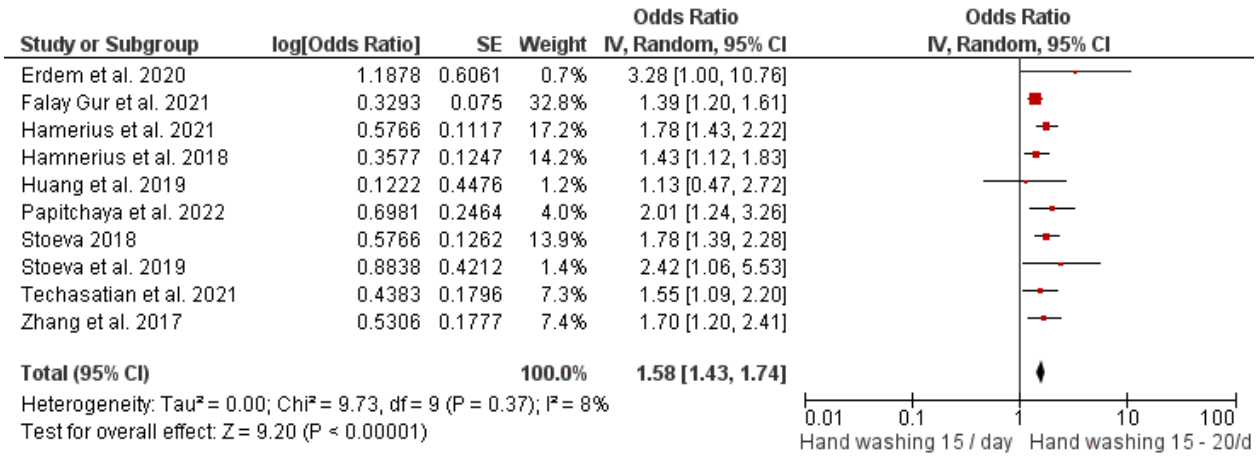

Figure 5. Forest plot of hand eczema based on the frequency of hand washing 15 to 20 times per day

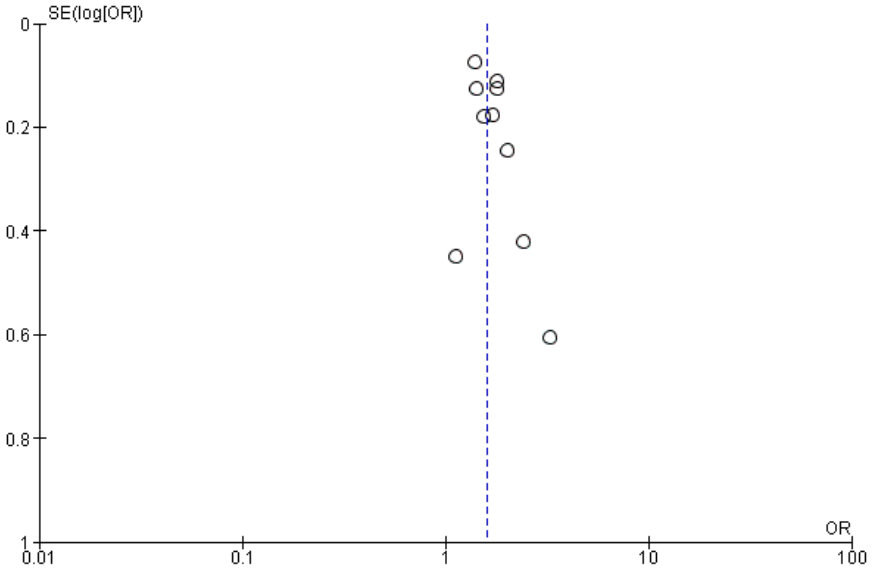

Figure 6. Hand eczema funnel based on the frequency of hand washing 15 to 20 times per day

Interpretation of the results of the meta-analysis process can be seen through the Forest plot. The funnel plot in Figure 6 shows that there is a relationship between hand hygiene and the risk of hand eczema in health workers. Health workers who have a frequency of hand washing 15 to 20 times per day have a risk of hand eczema as much as 1.58 times compared to a frequency of hand washing <15 times per day and the relationship is statistically significant (aOR=1.58; 95% CI 1.43 to 1.74; p<0.001). The forest plots also show the estimated effect between primary studies that were investigated in the meta-analysis assessing small or homogeneous variation at I^2 = 8% (p= 0.370). Thus, the calculation of the estimated effect is carried out using the random effect model approach.

The funnel plot in Figure 6 shows that the distribution of effects is more to the right of the estimated average vertical

line than to the left, indicating publication bias. The location of the distribution of effect estimates is more to the right of the estimated average vertical line, while the location of the average estimate in the forest plot also shows the results to the right of the vertical hypothesis 0, so the publication bias exaggerates the effect of the actual risk of hand eczema (over-estimated).

DISCUSSION

This systematic review research and meta-analysis discusses the risk prevalence of hand hygiene for hand eczema. The independent variable analyzed was hand hygiene, which included washing hands 8 to 10 times a day and 15 to 20 times a day. The dependent variable studied was the risk of Hand eczema among health workers.

Given the associated risks of hand eczema, there is a need to advocate for proper hand care advice even for washing hands less than 8-10 times a day. It is recommended to use a moisturizer, several times per day and especially after washing hands, to keep the skin hydrated (Beiu et al., 2020).

The results of the primary study conducted by meta-analysis showed an epidemiological study design with a larger sample, different demographic characteristics in both developed and developing countries, thus providing a basis for concluding that hand hygiene affects the risk of developing hand eczema in health workers (Riedel et al. al., 2019).

The results of the meta-analysis showed that 8 to 10 times washing hands daily is enough to cause a significantly higher risk of hand eczema than someone who rarely washes their hands. On the other hand, no significant association has been established between the use of alcohol hand rub and hand eczema, however, healthcare workers often perceive alcohol disinfection to be more damaging to the skin than hand washing. although alcohol-based hand rubbing was found to cause less skin irritation than hand washing in skin hydration tests, erythema and transepidermal water loss (Loffler et al., 2007).

This study explains again that alcohol can be a viable substitute for washing hands with soap because it is just as effective in reducing hand bacterial contamination without a significant risk of hand eczema (Girou, 2020).

Information on the prevalence of hand eczema is essential to guide intervention and primary prevention of the condition developing in healthcare workers at risk for exposure to hand eczema. There have been various reports of the high prevalence of hand eczema related to hand hygiene recommendations during the COVID-19 pandemic. Research in Denmark in 2021 reported that 28.6% of Danish children experienced incidents of hand eczema after returning to child care and frequent application of hand washing in the child care (Simonsen et al., 2021).

Hand hygiene is very important in protecting against exposure to the transmission of the COVID-19 virus, it has been shown that frequent hand washing increases hand eczema (Guertler et al., 2020).

A cross-sectional study in Turkey, health professionals reported that the prevalence of hand eczema increased from 23.1% before the COVID-19 outbreak, to 72.5% after 1 month of the COVID-19 pandemic outbreak (Metin et al., 2020). This meta-analytic study used articles that had controlled for confounding factors or confounding factors which could be seen from the previous primary study inclusion criteria used, namely the results of multivariate analysis in the form of adjusted odds ratio (aOR).

Confounding factor is a combination of estimation of the relationship between expo-

sure and the disease under study, by other factors that have a relationship, either with disease or with exposure. This confounding factor influences the relationship or effect of exposure to the occurrence of disease which is estimated by the study to be not the same as the actual relationship or effect that occurs in the target population, in other words, the study results are incurrect (Murti, 2008).

In this study there were 17 articles regarding the prevalence of hand hygiene with the risk of hand eczema in health workers processed using the Revman 5.3 application.

The results of forest plots with research articles with a cross-sectional design show that hand hygiene with a frequency of washing hands 8 to 10 times per day has a 1.47 times risk of experiencing hand eczema compared to hand hygiene washing hands less than 8 times per day and is statistically significant (aOR =1.46;95% CI=1.19 to 1.80; p<0.004). Hand hygiene frequency of washing hands 15 to 20 times per day has a risk of 1.58 times experiencing Hand eczema compared to Hand hygiene washing hands <15 times per day and statistically significant (aOR=1.58; 95% CI=1.43 to 1.74; p<0.001). In the analysis, the cross-sectional study design found by the researchers is a cross-sectional design in all primary studies. The strength of this study is that it can confirm that a temporal relationship to exposure precedes disease.

The limitation of this study is the existence of publication bias shown in the funnel plot and language bias because in this study only articles published in English were used, thus ignoring articles published in other languages. In this study there are limitations in the search for articles. Not many articles have been analyzed for hand eczema and hand hygiene variables, because there are still few studies on hand eczema using multivariate analysis. The retrospective study study used in the systematic review and meta-analysis itself had several limitations including the availability, quality, and completeness of the data in the notes included in the primary study.

AUTHOR CONTRIBUTION

Lely Tri Pangesti as a researcher who selects topics, searches for and collects research data. Bhisma Murti and Burhannudin Ichsan conducted a critical appraisal and review related to the process of writing this article.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

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