Meta Analysis the Effectiveness of Internet-Based Self-Management for Asthma Control Monitoring

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ABSTRACT

Background: The high incidence and mortality of asthma is caused by a lack of asthma control and the independence of patients and families in doing good self-management. So far, self-management has been carried out in various ways, one of which is using internet-based self-management. The aim of this study was to estimate the effectiveness of Internet-based self-management on asthma control by meta-analysis.

Subjects and Method: This research is a meta-analysis study using PRISMA flowchart guidelines. The article search process was carried out between 2011-2022 using databases from PubMed, Google Scholar, ProQuest, Science Direct and Scopus. The PICO formula used is P= patients with asthma. I= using internet-based self-management. C= without using internet-based self-management. O= asthma control. Article searches were performed using the keywords "mhealth" OR "mobile health" OR "telemedicine" AND "self management" AND "asthma control" OR "asthma treatment" AND "asthma control". The inclusion criteria were full paper articles with randomized controlled trial study design, articles using English, the intervention provided was the application of internet-based self-management, and the outcome was asthma control. Based on the database, there were 9 articles that met the inclusion criteria. The analysis was carried out using Revman 5.3 software.

Results: A total of 9 articles spread across 4 continents, namely Asia, Europe, Australia, and America. The articles reviewed in the meta-analysis showed that the use of Internet-based self-management in asthmatics was effective in changing asthma control by 1.25 times compared with no Internet-based self-management, and was statistically significant (OR= 1.25; 95% CI= 1.09 to 1.44; p= 0.002).

Conclusion: Internet-based self-management is effective in improving asthma control compared to no Internet-based self-management.

Keywords: asthma control, internet-based self-management, asthma patients

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BACKGROUND

Asthma is a type of disease in which the airways become inflamed and then swell and produce excess mucus, causing the patient to have difficulty breathing (Ferrante et al., 2021). WHO research states that there are approximately 300 million people suffering from asthma and it is estimated that by 2025 people with asthma will increase to 400 million people. Adolescents with persistent

asthma experience impaired health and quality of life due to complications. In addition, the mortality rate due to asthma is also quite high, reaching 250,000 people per year (Gina, 2018).

The high incidence and mortality rate in asthmatics is due to a lack of asthma control and the independence of patients and families in doing good self-management. Although there is no cure for asthma completely, effective self-management strategies can help patients to control their disease and prevent worse symptoms. Self-management of asthma is a behavior that is carried out independently by sufferers to manage and control asthma symptoms and prevent exacerbations. The main goal of asthma management is to improve and maintain the quality of life so that people with asthma can live a normal life without obstacles in carrying out daily activities.

Self-management will work effectively if there are objects or media that can guide and remind these activities. One of the media that can be used is the internet and other digital media that take advantage of the use of health information technology. The availability of media in the form of the internet and other digital media is an effort to support the implementation of self-management so that it can improve the ability of families to manage asthma patients independently (Morrison et al., 2014). Based on research conducted by Jan et al (2020) which stated that telemonitoring at home for respiratory conditions showed a decrease in the patient's condition and symptom control. Meanwhile, research conducted in Taiwan shows that internet-based asthma telemonitoring programs are reported to improve self-management skills and improve asthma outcomes and become an effective technology for treatment that is well received by patients (Jan et al., 2017).

Based on this background description, the researcher is interested in conducting a study with the aim of investigating relevant primary studies to assess the effectiveness of Internet-based self-management on asthma control. Researchers conducted research with a systematic review approach to relevant studies using meta-analysis. The purpose of this study was to determine the level of effectiveness of the use of internet-based self-management on asthma control in asthmatics.

SUBJECTS AND METHOD

a. Study Design

This study uses a meta-analysis research design. This research article was obtained from several online databases such as Google Schoolar, Medline/PubMed, Science Direct and Spinger Link. Article searches were conducted using the keywords "m-health" OR "mobile health" OR "tele-medicine" AND "self management" AND "asthma control" OR "asthma treatment" AND "quality of life". Article searches were also carried out by formulating problems using PICO (Population, Intervention, Comparison and Outcome).

b. Inclusion Criteria

The inclusion criteria used in this study are full text articles published between 2011-2022, using a Randomized Controlled Trial study design, using English and the final results of the study reported using the Odds Ratio (OR).

c. Exclusion Criteria

The exclusion criteria used are articles published before 2011, are full tests and are in a language other than English.

d. Study Variables

There are two variables used in this study, namely the dependent variable and the independent variable. The independent variable in this study is internet-based self-

management. While the dependent variable is asthma control.

e. Operational Definition of Variables

criteria using the following PICO model: Population= Asthmatic patients. Intervention= Internet-based self-management. Comparison= without internet-based self-management. Outcome= asthma control.

Internet-based self-management is the use of health information technology that is used to facilitate the implementation of patient and family self-management.

Asthma control is the control of the manifestations of asthma.

f. Study Instruments

This research is guided by the PRISMA flow diagram and the assessment of the quality of research articles using the Critical Appraisal Skills Program (CASP) for Randomized Controlled Trials. The 11 questions used are as follows:

a. Does the experiment clearly address the clinical problem?

b. Was the intervention given to participants at random?

c. Were all patients included in the study properly accounted for in the conclusions? Were all patients analyzed according to the randomized study groups?

d. Are patients, health workers and researchers blinded?

The articles included in this study were PICO-adjusted. The search for articles was carried out by considering the eligibility e. Were the study groups similar at the start of the study?

f. Outside of the intervention studied, were the study groups treated equally?

g. Data analysis

The collected articles are processed using the Review Manager application (RevMan 5.3). Data processing is carried out by calculating the effect size and heterogeneity values to determine the research combination model and form the final results of the meta-analysis in the form of forest plots and funnel plots..

RESULTS

The article review in this study used the PRISMA flow diagram which can be seen in Figure 1. The total articles obtained were 9 articles spread across continents, namely the Asian continent, the American continent, the European continent and the Australian continent. The following is the process of reviewing the articles used in this research. The following are the results of the quality assessment of the Randomized Controlled Study on the effectiveness of internet-based self-management research on asthma control.
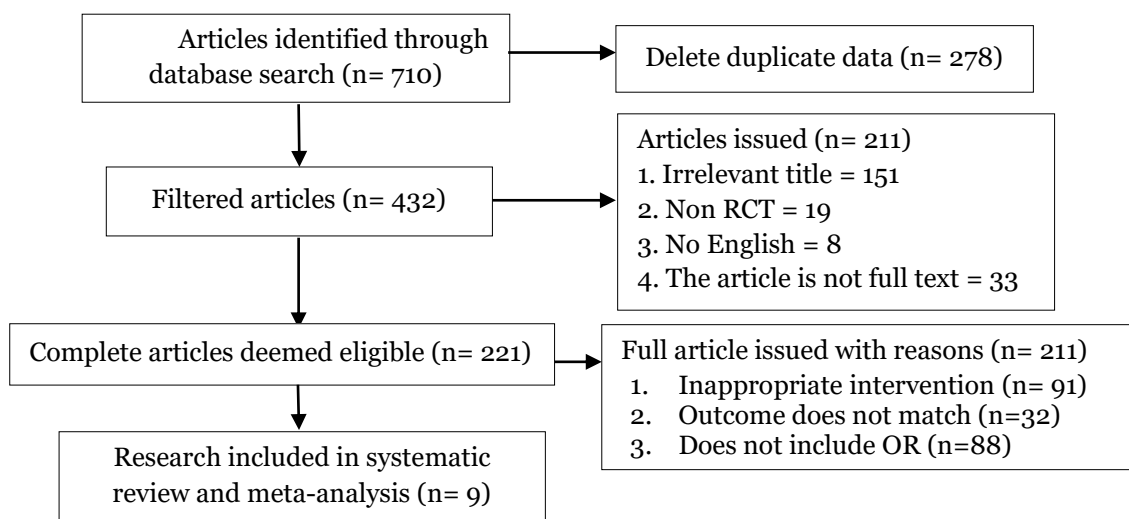

Figure 1. Article search results with PRISMA flow diagram

Figure 2. Map of the research area

Table 1. Results of quality assessment of randomized controlled studies

Primary Study	Criteria											Total
	1	2	3	4	5	6	7	8	9	10	11	
Ahmed et al. (2011)	1	1	1	1	1	1	1	1	1	1	1	11
Gaalen et al. (2013)	1	1	1	1	1	1	1	1	1	1	1	11
Khusial et al. (2020)	1	1	1	1	1	1	1	1	1	1	1	11
Liu et al. (2011)	1	1	1	1	1	1	1	1	1	1	1	11
Meer et al. (2021)	1	1	1	1	1	1	1	1	1	1	1	11
Mutsaerts et al. (2012)	1	1	1	1	1	1	1	1	1	1	1	11
Ryan et al. (2012)	1	1	1	1	1	1	1	1	1	1	1	11
Yanhua et al. (2012)	1	1	1	1	1	1	1	1	1	1	1	11
Zairina et al. (2016)	1	1	1	1	1	1	1	1	1	1	1	11

a. Forest plot

The forest plot in the figure shows that the use of Internet-based self-management in asthmatics is effective in changing asthma control as much as 1.25 times compared to without using Internet-based self-management and the results are statistically significant (OR= 1.25; 95% CI= 1.09 to 1.44; p= 0.002). The heterogeneity value in the forest plot shows $I2 = 5\%$, so that the data analysis in the forest plot uses the fixed effect model.

b. Funnel plot

The funnel plot presented in Figure 4 shows that there is a potential for publication bias which is indicated by an overestimated effect. This is indicated by the asymmetry of the plots on the right and left sides where the left plot is 2 and the right plot is 6. The left plot has a standard error of 0 to 0.5, while the right plot has a standard error of 0 to 1.
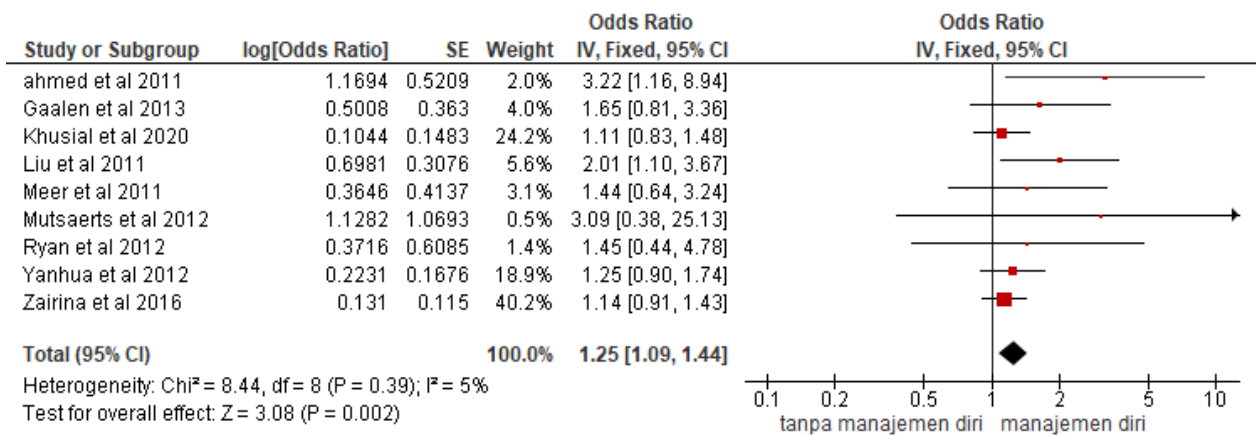
Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Fixed, 95% CI
ahmed et al 2011	1.1694	0.5209	2.0%	3.22 [1.16, 8.94]
Gaalen et al 2013	0.5008	0.363	4.0%	1.65 [0.81, 3.36]
Khusial et al 2020	0.1044	0.1483	24.2%	1.11 [0.83, 1.48]
Liu et al 2011	0.6981	0.3076	5.6%	2.01 [1.10, 3.67]
Meer et al 2011	0.3646	0.4137	3.1%	1.44 [0.64, 3.24]
Mutsaerts et al 2012	1.1282	1.0693	0.5%	3.09 [0.38, 25.13]
Ryan et al 2012	0.3716	0.6085	1.4%	1.45 [0.44, 4.78]
Yanhua et al 2012	0.2231	0.1676	18.9%	1.25 [0.90, 1.74]
Zairina et al 2016	0.131	0.115	40.2%	1.14 [0.91, 1.43]
Total (95% CI)			**100.0%**	**1.25 [1.09, 1.44]**

Heterogeneity: Chi² = 8.44, df = 8 (P = 0.39); I² = 5%
Test for overall effect: Z = 3.08 (P = 0.002)

Figure 3. Forest plot of internet-based self-management on asthma control
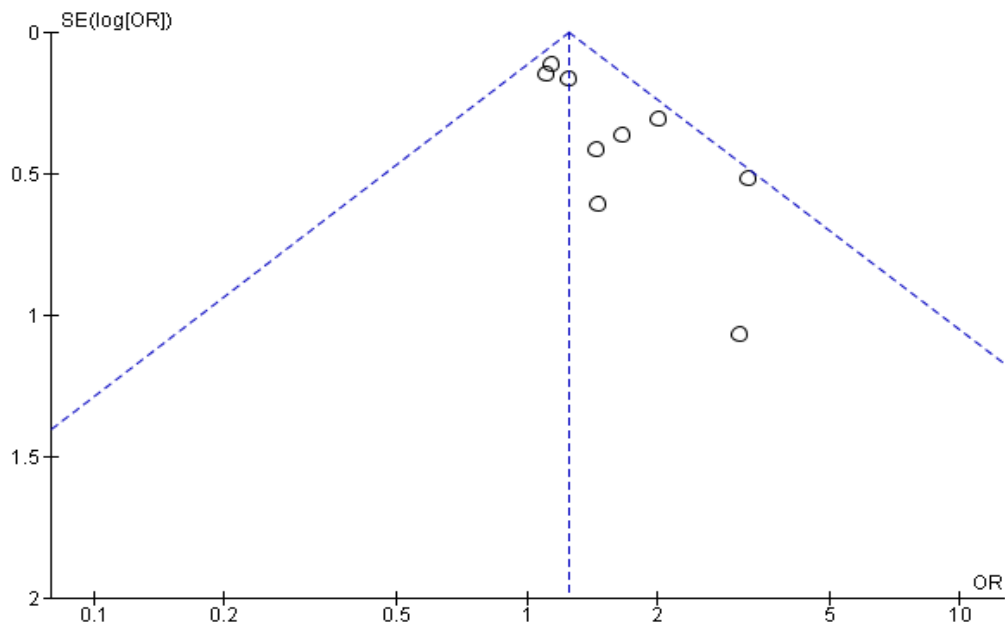

Figure 4. Funnel plot of the effectiveness of internet-based self-management on asthma control

Table 2. Description of the primary studies included in the meta-analysis

Author (year)	Country	Study Design	Sample	P Population	I Intervention	C Comparison	O Outcome	OR (CI95%)
Ahmed et al. (2011)	Canada	Randomized Clinical Trial	80	Asthma patients aged 18-69 years	Web-based self-management (My Asthma Portal)	Not using web-based self-management (My Asthma Portal)	Asthma control	3.22 (1.16 to 8.9)
Gaalen et al. (2013)	Netherland	Randomized Clinical Trial	200	Adult patient	Internet-based self-management	Do not use Internet-based self-management	Asthma control	1.65 (0.81 to 3.36)
Khusial et al. (2020)	Amerika Serikat	Randomized Clinical Trial	82	Asthma patients aged 18 years or older	MyAirCoach (internet-based self-management)	Not using MyAirCoach (internet based self-management)	Asthma control	1.11 (0.83 to 1.48)
Liu et al. (2011)	Spanyol	Randomized Controlled Trial	120	Outpatient asthma patient	Internet-based self-management	Do not use Internet-based self-management	Asthma control	2.01 (1.10 to 3.67)
Meer et al. (2011)	Netherland	Randomized Controlled Trial	200	Inpatient asthma	Internet-based self-management	Do not use Internet-based self-management	Asthma control	1.44 (0.64 to 1.24)
Rikkers-Mutsaerts et al. (2012)	Belanda	Randomized Controlled Trial	688	Asthma patients aged 12-18 years	Internet-based self-management	Do not use Internet-based self-management	Asthma control	3.09 (0.38 to 25.11)
Ryan et al. (2012)	Inggris	Randomized Controlled Trial	288	Teen patient	Internet-based self-management	Do not use Internet-based self-management	Asthma control	1.45 (0.44 to 78)
Yanhua et al. (2012)	China	Randomized Controlled Trial	150	Asthma patients aged 18 years and over	Internet-based self-management	Do not use Internet-based self-management	Asthma control	1.25 (0.90 to 1.74)
Zairina et al. (2016)	Australia	Randomized Controlled Trial	72	Asthma patients in pregnant women	Telehealth	Not using telehealth	Asthma control	1.14 (0.91 to 1.43)

DISCUSSION

In a research with a systematic review study design and a meta-analysis that has been carried out with the theme of the effect of unsafe action, workload and work experience on the incidence of needlestick injuries in health workers in hospitals. The independent variables used in the analysis of this research are unsafe action, workload and work experience. This research is important because it strengthens the evidence for finding the cause of work accidents in health workers, especially related to NSI where NSI is at high risk for exposure to infectious blood or body fluids from patients to health workers.

The number of relevant studies published and accessible is quite a lot, but most of the statistical results reported and published are still in the form of percent and the results of the analysis are still in the form of Odds Ratio where the research does not control for confounding factors. These confounding factors affect the relationship or effect of exposure to the studied output (Murti, 2018).

In this study, there were 14 studies identified worldwide from 2011 to 2021. This study analyzed articles that used the adjusted odds ratio (aOR) relationship measure. The results of the Systematic Review and meta-analysis are presented in the form of forest plots and funnel plots. Forest plots are diagrams that interpret information from the studied studies in a meta-analysis and provide estimates of overall results. In addition, the forest plot also displays the magnitude of variation (heterogeneity) between research results (Murti, 2018).

There are 14 research articles with an observational study design as a source of synthesis of meta-analysis of the effect of unsafe action on the incidence of Needlestick Injury (NSI) work accidents. The results of the forest plot illustrate that unsafe action has an effect on increasing the incidence of Needlestick Injury (NSI) in health workers in hospitals by 2.79 times higher than health workers who behave safely (safe action) and significantly (aOR= 2.79; 95% CI= 2.18 to 3.67, p < 0.001). The results of this meta-analysis prove that unsafe action is very influential on events. Needlestick Injury (NSI). Unsafe actions identified in this study were in the form of recapping syringes, rushing, not using PPE and not according to standard procedures.

This result is in accordance with the results of previous research conducted by Putra et al (2020) conducted in Indonesia which stated that in a multivariate analysis it was shown that unsafe action affects the incidence of Needlestick Injury (NSI). In this study, it was stated that nurses who performed activities that were dangerous (unsafe action) were 4 (four) times more likely to experience NSI than nurses who worked with names (safe action).

In addition, Bekele et al. (2015) research conducted in Ethiopia at 4 hospitals with a total of 362 samples of health workers stated that the main cause of accidents due to needle stick injuries (NSI) experienced by 69.8% of the total sample was the practice of recapping needles or closing syringes. Returned after 12 months of use (aOR = 3.23, 95% CI: 1.78 to 5.84). In that study, 1 in 5 respondents had experienced NSI. Recapping needle / unsafe action is the main behavior that can be carried out by the NSI incident prevention program. Hospital management must develop health policies and strategies to improve occupational health and safety and the compliance of health wor-kers with occupational safety. Liyew et al. (2020) stated that one of the causes of NSI is recapping after use (aOR = 1.78, 95% CI 1.03 to 3.09).

Causes of Needlestick Injury (NSI) based on data from a systematic review

conducted by Motaarefi et al. (2016) the results of the analysis show that the highest incidence that occurs in nurses in the form of NSI is caused by age, education level, number of shifts per month, history of recapping needle training. The highest incidence of NSI occurred during instrument preparation and needle recapping activities. Based on the Centers for Disease Control and Prevention (CDC, 2021) research has shown that most injuries due to NSI are caused by not using a needle that is designed safely or by using it incorrectly (not according to the procedure), recapping the needle or re-closing the needle. used syringes, when transferring body fluids between containers, do not throw used syringes into puncture-resistant sharps containers.

There are 9 research articles with an observational study design as a source of meta-analysis of the effect of work experience on the incidence of Needlestick Injury (NSI) work accidents. The results of the forest plot illustrate that work experience < 5 years has an effect on increasing the incidence of Needlestick Injury (NSI) in health workers in hospitals by 1.97 times higher than health workers who have work experience > 5 years and significantly (aOR= 1.97; 95% CI= 1.16 to 3.34; p= 0.010). The results of this meta-analysis prove that work experience <5 years greatly influences the incidence of Needlestick Injury (NSI).

These results are in accordance with Beker and Bamlie (2015) on 170 samples of nurses stating that this study identified that work experience was significantly related to the incidence of Needlestick Injury.

AUTHOR CONTRIBUTION

Bhre Diansyah Dinda Khalifatulloh is the main researcher who chooses the topic, looks for data and collects research data. Didik Gunawan Tamtomo and Bhisma Murti as supervisors in data analysis and compilation of publications.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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