

Effectiveness of digital patient decision aids in patients with COPD: A system review and meta-analysis

Shuya Chen, Li Yang, Jiacheng Su, Musen Hua, Jiaoyue Li, Yan Dong

Submitted to: Journal of Medical Internet Research
on: April 02, 2025

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Abstract

Background: Chronic Obstructive Pulmonary Disease (COPD) patients face complex decision - making in long - term health management, yet the patient - centered shared decision - making model is insufficient.

Objective: Our aim is to expound and analyze the current situation and effectiveness of digital patient decision aids for patients with COPD.

Methods: Method: We conducted a systematic review and meta - analysis on digital patient decision aids (PADs) for COPD patients. We searched PubMed, Embase, Web of Science, and Cochrane for studies published until Feb 17, 2025, excluding qualitative, conference, protocol, review, and meta - analysis works. Chi - square test estimated study heterogeneity (I^2) and Q value judged the significance of random - effects model estimates. Results: Initially, 662 articles were retrieved. After removing duplicates and applying criteria, 56 full - texts were reviewed, and 5 articles (324 patients) were included. Results showed digital PADs had positive impacts: reducing decision - making conflicts (ES = -14.97, 95% CI: -16.66 to -13.27), improving health status (SMD = 0.03, 95% CI: -0.28 to 0.35), and enhancing self - efficacy (SMD = -0.15, 95% CI: -0.39 to 0.09). However, their impacts on knowledge acquisition and quality of life exhibit pronounced heterogeneity. Conclusions: Digital patient decision aids (PADs) have shown the potential to alleviate decision conflicts among COPD patients, while also enhancing their health status and self - efficacy. Nevertheless, the efficacy of PADs in patient education and their impact on patients' quality of life remain to be fully validated. Presently, the body of research on digital PADs for COPD patients is scarce. Owing to varying research design aims, a marked heterogeneity exists in the validity of the study results. In future, international standards should assess PADs' effectiveness on COPD outcome indicators to advance this field.

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(JMIR Preprints 02/04/2025:75360)

DOI: <https://doi.org/10.2196/preprints.75360>

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Effectiveness of digital patient decision aids in patients with COPD: A system review and meta-analysis

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Abstract:

Background: Chronic Obstructive Pulmonary Disease (COPD) patients face complex decision-making in long-term health management, yet the patient-centered shared decision-making model is insufficient.

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Keywords □ chronic obstructive pulmonary disease; shared decision-making; patient decision aids; systematic review; meta-analysis

1. Introduction □

In the context of having chronic diseases, patients are confronted with the arduous tasks of long - term disease management and the transformation of health - related behaviors. Without thorough understanding of the care and the necessary changes, patients will be incapable of effectively managing their own health conditions.^[1, 2] The patient involvement in clinical decision-making has shifted significantly since the 21st century, evolving from a paternalistic model of physician-dominated decision-making to a collaborative Shared Decision-Making (SDM) framework. The adoption of SDM represents a significant milestone in the journey towards a more patient - centric and collaborative healthcare ecosystem^[3]. This approach entails clinicians providing the requisite support to enable patients to comprehensively deliberate on the available alternatives^[4]. In this context, the role of clinicians is to elicit patients' understanding, values, or reasoning, and act as partners in decision - making to improve patients' decision - making quality, knowledge, and perception of risks^[5]. Patient Decision Aids (PADs) are a crucial part of SDM. As specifically designed tools, they enable patients to engage in healthcare decision - making. By providing structured information, PADs help patients make well - informed choices, fostering a more collaborative patient - provider relationship^[6]. PADs can be disseminated through multiple media, such as mobile applications, online bots (autonomous user - interacting computer programs), and printed brochures^[7, 8]. What's more, PADs can ensure the standardized delivery of information to patients, present it in a culturally congruent manner, and employ language and visuals to guarantee patient comprehension^[9]. The International Patient Decision Aids Standards Collaboration (IPDAS) was established in 2003 to ensure the design quality and standards of PADs,. It collaborated to develop standards that can be used by both PADs developers and users to evaluate the quality of PADs^[10].

Chronic Obstructive Pulmonary Diseases (COPD) is characterized by persistent airflow limitation and respiratory symptoms. The airflow limitation progresses gradually, originating from airway and/or alveolar abnormalities, mostly caused by chronic inflammation and lung damage due to long - term exposure to harmful particles or gases^[11]. Since COPD subjects patients to continuous and progressive airflow limitation, it is a lifelong disease with a high recurrence rate, usually imposing a huge burden and distress^[12]. The elderly tend to play a more passive role in decision - making, relying on the expertise of healthcare providers, which increases the difficulty and pressure of disease management^[3, 13]. Due to the generally low educational level of COPD patients, as well as the long disease course and recurrent nature of the illness, patients need more help when facing various decision - making challenges^[14].

Data shows that many recommendations for the disease management of COPD patients have not been effectively implemented. For example, 52% of the recommendations for improving the rehabilitation environment have not been carried out, 79% of COPD patients have failed to complete

the home exercise program, and 30 ~ 55% of patients do not use home oxygen^[15]. Within one year, over 60% of patients hospitalized for acute exacerbation of COPD are readmitted. Patients with recurrently deteriorating COPD typically endure a suboptimal quality of life, often reporting dyspnea, pain, anxiety, social isolation, loneliness, and infrequently engaging in healthcare - related activities^[14]. Moreover, due to the unpredictable health condition, COPD patients often express concerns about their illness^[16]. Many COPD patients misuse inhalers and incorrectly attribute systemic side effects to the devices, leading to premature therapy discontinuation^[17]. Decision conflicts arise when patients lack knowledge, value comprehension, and sufficient decision - making participation. It refers to an individual's state of uncertainty in action when confronted with choices involving risks or unknown outcomes, manifested as verbal expressions of uncertainty, worry about adverse results, distress, or nervousness^[18-20]. Some studies have shown that encouraging patients to participate in decision - making can improve their expectations of the prognosis and actively engage them in behavior change plans^[21].

To enable COPD patients to more effectively engage in disease - management decision - making, a variety of interventions grounded in PADs have been devised. These interventions span a wide range of topics, such as the selection of inhalers^[22], medication adherence^[23], determining when to seek medical attention, choosing pulmonary rehabilitation programs, and even addressing end - of - life care in the advanced stages of the disease^[24]. In the current era of rapid technological development, there is burgeoning interest in the potential application of intelligent technologies in elderly care^[25]. Compared with traditional methods, digital - technology - based PADs may have more potential advantages. For example, digital PADs are easy to update and have a lower dissemination cost^[26]. At present, many digital PADs are available, providing a wide range of content to support decision - making. Nevertheless, no study has reviewed digital decision aids or described the impact of these tools on COPD patients^[10, 19]. Evaluating and reviewing decision aids is vital for assisting COPD patients in making daily - life decisions and enhancing their quality of life. This review synthesizes the impact of digital PADs on COPD patients, with the aim of enabling both patients and professionals to better recognize the significance of decision - aid utilization.

2. Method□

Systematic reviews and meta - analyses were reported following the Preferred Reporting Items for Systematic Reviews and Meta - Analyses (PRISMA) guidelines^[27]. This study was registered on the International Prospective Register of Systematic Reviews (Registration No.: CRD42024601445).

2.1 Search strategy

Between the initiation and October 15, 2024, searches were conducted across multiple databases: PubMed, Web of Science, Cochrane, and Embase. The search queries integrated diverse terms related to the Internet, decision aids, and COPD. These terms were formulated by combining free - text keywords and subject headings, along with the Boolean operators OR and AND. The specific search strategy details are as follows: (("Decision Support Techniques" OR "Decision Support Model" OR "Decision Analysis" OR "Patient Decision Aid" OR "interactive decision aid" OR "Shared decision making") AND ("Pulmonary Disease, Chronic Obstructive" OR "Chronic Airflow Obstruction" OR "Chronic Obstructive Lung Disease" OR "COPD") AND ("web - based interactive tool" OR "interactive decision aid" OR "Telemedicine" OR "e - health")). Grey literature was excluded from the search scope.

2.2 Inclusion and exclusion criteria

2.2.1 Inclusion criteria:

a) A study was considered eligible if its research background was a trial conducted among COPD patients. b) In the absence of a control group, a study with outcome indicators meeting the requirements could also be included in the analysis as a self - controlled before - and - after trial. c) The study must report the results of outcomes related to the quality of life or decision - making of patients. d) Eligible randomized controlled trials must be available in English and provide the full text.

2.2.2 Exclusion criteria:

Studies were excluded if they did not use digital devices or Internet - based interventions, or if they were interventions targeting other populations. We did not impose any restrictions on the sociodemographic characteristics of the participants or the publication date.

2.3 Data Extraction

Shuya Chen and Jiacheng Su will independently screen the titles and abstracts of studies retrieved via the search strategy and from other sources to identify potentially eligible ones, remaining blinded to each other's decisions. Duplicate literature will be removed using Zotero. Preliminary screening based on titles and abstracts will exclude clearly irrelevant works. Full - texts of potentially eligible studies will be obtained. The primary outcomes are variables related to decision - making and knowledge, while secondary outcomes include quality of life, self - efficacy,

and health status. When multiple measurement methods exist, data extraction priority is: (1) validated questionnaires, (2) COPD - related questionnaires, (3) single - item analysis of other rating scales. In case of disagreements between the two reviewers on study inclusion, a third author, Yan Dong, will resolve it through discussion. The selection process is illustrated in the PRISMA flow diagram (FIGURE 1).

A data extraction form developed by the research team was employed to manage the ultimately included literature. Data extraction was performed by Shuya Chen and double - checked by Jiaoyue Li. From the included studies, the following data were retrieved: study authors, country of origin, study year, subject baseline characteristics, study design, intervention and control details, study withdrawals, and outcome variables. To mitigate bias from missing data, data from imputation models or estimated data in robust multilevel analyses were extracted.

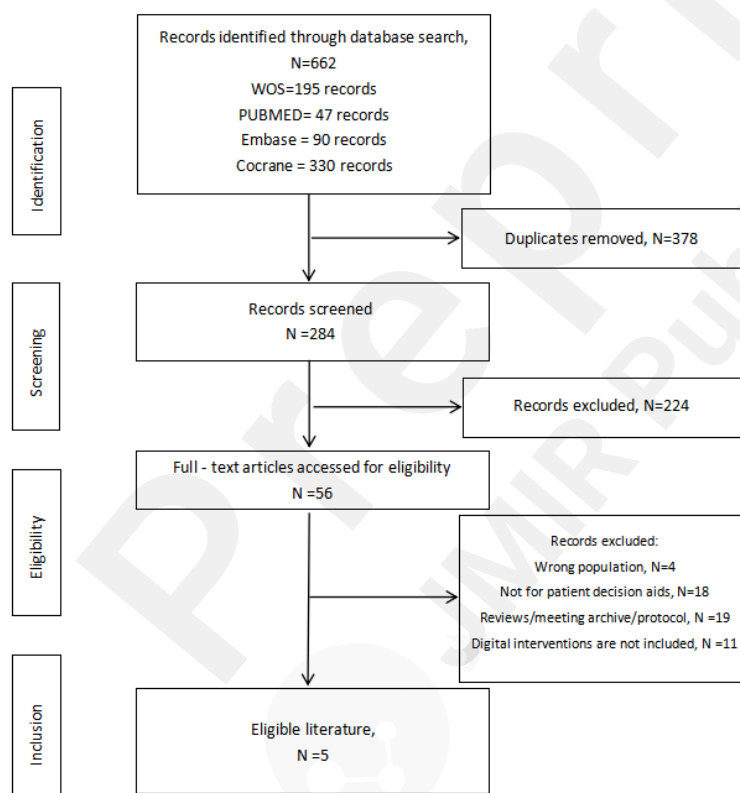


FIGURE1. Flow chart of study identification, screening,eligibility,and inclusion.

2.4 Risk of Bias and Quality of Evidence

Two review authors, Shuya Chen and Musen Hua, will independently evaluate the risk of bias in the included studies using the Cochrane Risk of Bias (ROB) tool. In case of disagreements about the risk of bias in particular studies, they will resolve them through discussion. If needed, a third author, Li Yang, will be invited to join the discussion^[28]. In the final published review, the risk - of - bias levels across different domains for each study will be tabulated separately. The quality of evidence

for primary outcomes will be appraised using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE). The GRADE evaluation encompasses risk of bias, inconsistency, indirect evidence, imprecise estimates, and outcome - level publication bias^[29]. For RCTs, the Cochrane risk - of - bias assessment tool encompasses seven criteria: random sequence generation, allocation concealment, blinding of participants and personnel, outcome - assessment blinding, outcome data completeness, selective reporting, and other bias sources. Each criterion is categorized as low, high, or unclear in terms of risk^[28].

2.5 Statistical Analysis

We conducted a random - effects meta - analysis of the primary outcomes after the intervention. We used Stata 14 and R 4.3.3 software to combine and analyze the extracted data. For randomized controlled trials, we analyzed them using standardized mean differences (SMDs) along with their respective 95% confidence intervals (CIs)^[30]. The SMD represents the between - group effect of the mean change relative to the baseline, which is standardized by the pooled standard deviation (SD) at baseline. For single - arm trials, we used the effect size (ES) and its corresponding 95% CI for analysis. The ES is an analysis method for single - arm trials, calculated using the mean and standard error. To determine the heterogeneity of the trial results' effects, we performed statistical analysis using I^2 ^[31]. The I^2 value is used to measure heterogeneity. When $I^2 < 50\%$, it implies no significant heterogeneity or heterogeneity within an acceptable range among studies, and a fixed - effect model is applied to pool effect sizes. Conversely, when $I^2 > 50\%$, significant heterogeneity exists, and a random - effect model is considered. The fixed - effect model assumes a common underlying effect across all studies and weights larger studies more. In contrast, the random - effect model assumes studies estimate different yet related effects, accounting for both within - and between - study variability. We calculate and report the pooled effect size with its 95% confidence interval. I^2 values of 25%, 50%, and 75% denote low, moderate, and high heterogeneity respectively. Given $I^2 < 50\%$ indicating no significant heterogeneity, a fixed - effect model was utilized. Additionally, subgroup and sensitivity analyses were performed on heterogeneous results.^[32] In the sensitivity analysis, the leave - one - out method was employed to evaluate the influence of each individual study on the overall risk estimate^[29]. Subgroup and sensitivity analyses were solely performed for post - intervention effects. Wherever feasible, publication bias tests were carried out on the results.

Author	Country	Age at baseline, mean (SD), y	Total No. at baseline (male, %)	Interventions (duration)	Control condition	Measure of outcomes	Dropout rate, %	
							C	T
Elie et al ^[33]	United States	69 (7.2)	8(62.5)	Design web pages based on the Ottawa Decision Support Framework and evidence - based practices;Patient - selected decision - making model;inhaled steroid therapy;(/)	/	Decision conflict;knowledge;	/	/
Walters at al ^[34]	Australia	68.2 (7.9)	182(52.7)	Community nurses undergo 12 - hour intervention training;psychological advice and skills training at home;Telephone health mentoring;Regular telephone follow - up; (12 months)	Regular monthly phone calls	Quality of life;self-management capacity;knowledge;anxiety;depression;satisfaction	10(10.9)	5(5.6)
Basile et al ^[35]	United States	66.6 (10.0)	38(50.0)	Clinicians receive 30 minutes of face - to - face training on the use of PAD;A Web-based decision aid [InformedTogether];Patients receive visits and learning materials at the outpatient clinic;pulmonary rehabilitation;(1 month)	/	Decision conflict; knowledge; acceptability; communication; motivation	/	8(21.1)
Tabak et al ^[36]	The Netherlands	64.1(9.0)	24(50.0)	Web-based self-management of COPD exacerbation;Set reminders on sensors and smartphones[Remote consultation;(9 months)	Usual care	Physical Activity;exercise tolerance;health status; dyspnea; quality of life	12(85.7)	5[33.3]
Jiang et al ^[37]	China	73.4(6.9)	72[93.1]	Pulmonary rehabilitation based on WeChat Official Accounts;A 2 - minute video introduction to the PR project for patients;Distribute digital rehabilitation diaries;Provide 5 - minute dietary and medication guidance through videos;A problem prompt sheet was created;(3 months)	In-person interventions	Quality of life; PR adherence;dyspnea symptoms; exercise self-efficacy; knowledge; decision-related outcomes.	6(16.7)	6(16.7)

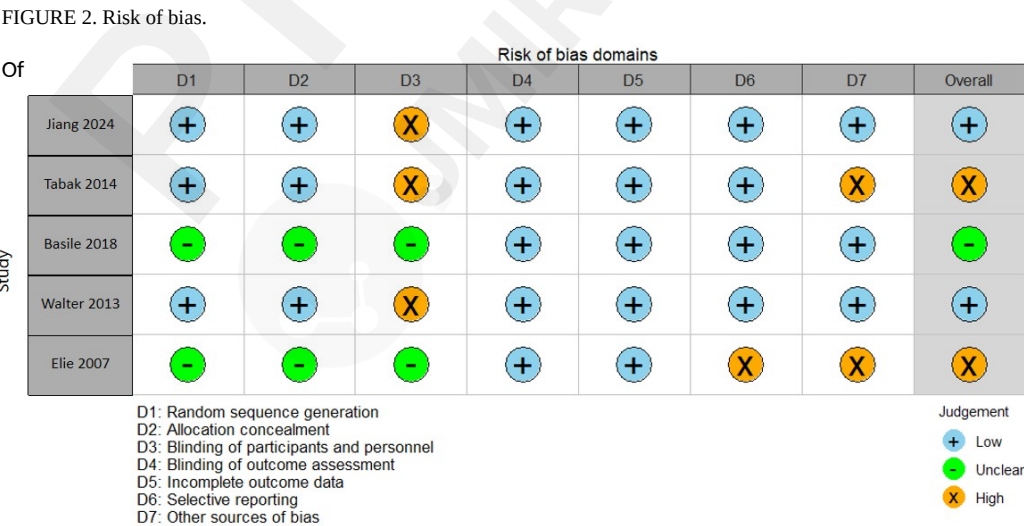
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3. Results

3.1 Selection, Inclusion, and Study Characteristics

We identified 622 records for screening. A total of 5 studies were included in the analysis, mainly from China, the United States, Australia, and the Netherlands. Among the included studies, there were 324 baseline participants; 62.3% were male; the pooled mean age was 68.88 (8.47) years old. The dropout rate in the control group spanned from 10.9% to 85.7%, compared to 5.6% - 33.3% in the experimental group, with the former being higher. Table 1 summarizes the included studies, all of which were published between 2007 and 2024. Three interventions were designed for pulmonary rehabilitation{Jiang, 2024 #11}{Jiang, 2024 #11}^[37], medication management^[33], and pulmonary ventilation treatment^[35], and two interventions were designed to improve patients' self - management ability^[34, 36]. All interventions were based on digital devices, including telephones, telemedicine, computers, and the Internet.

3.2 Risk of Bias



We analyzed the final screened literature according to the Cochrane risk assessment tool, and the results are shown in Figure 2^[28]. Since the trials by Basile

and Elie were self - controlled before - and - after trials, the generation of random sequences, allocation concealment, and the results of participant blinding were unclear^[33, 35]. Most of the trial personnel were clinical doctors or nurses, and most of the outcomes were presented in the form of self - reports. It was unlikely to blind the researchers and participants, so the blinding of personnel was at high risk^[34, 36, 37]. The study by Tabak did not report all the pre - set outcome indicators, increasing the risk of selective reporting bias^[36]. In the study by Tabak, there was a remarkably elevated dropout rate reaching 85.7% in the control group, which might cause certain information bias in the result analysis due to measurement errors^[36]. The study by Elie had a small sample size, which might introduce other bias risks^[33]. The GRADE grading manual was used to rate the overall risk. Finally, 2 studies were at low risk, 2 were at high risk, and 1 had an unknown risk.

3.3 Primary outcomes

3.3.1 Decision conflict

Effect size/standard error (ES) analysis was conducted on the three studies that reported decision conflict. The results showed large heterogeneity, with an ES of -9.77 ($I^2 = 99.2\%$; $P \leq .001$), indicating significant heterogeneity among the studies. In the post - hoc sensitivity analysis, after excluding one trial that used a different decision conflict scale^[33], the heterogeneity decreased to 0.0%; $P = .71$. The heterogeneity might stem from the large differences in the scoring methods used in the sample size of this trial and the relatively small sample size it included. Its results might have high volatility and uncertainty. The remaining trials all showed a significant effect of digital PADs in reducing patients' decision conflict, with an ES of -14.97 (95% CI, -16.66 to -13.27).

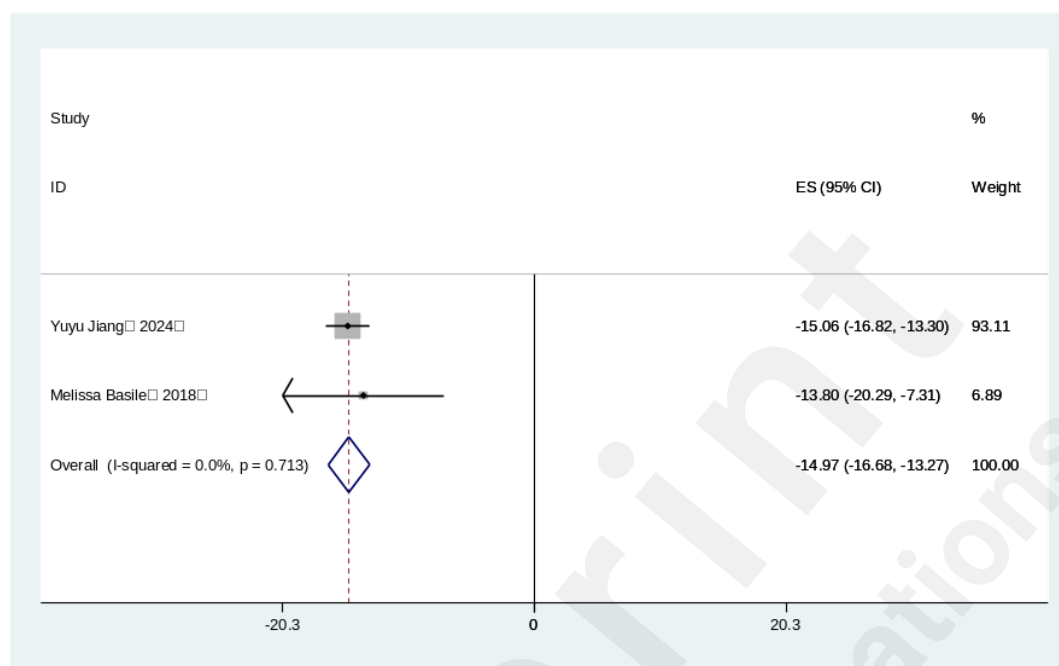


FIGURE 3. Changes in decision conflict after using PADs in single-arm trials.

3.

The analysis results show that there is a large heterogeneity in patients' knowledge among the trials. The random - effect $I^2 = 94.1\%$ ($P \leq .001$). Through subgroup analysis of whether there is an experimental group, randomized controlled trials were analyzed using the mean standard deviation, and single - arm trials were analyzed using the effect size. The heterogeneity decreased to 54.9% ($P = 0.14$), and the ES was 3.02 (95%CI, 1.94 to 4.10). Although heterogeneity was shown, $P \geq .05$. This may be due to the small sample size of the included trials, and the test power is insufficient to detect clear heterogeneity. In addition, since the purposes of the included trials are highly related to the knowledge content under investigation, and the purposes of the included experiments are not identical, this is also a possible source of heterogeneity. For example, the knowledge scale regarding inhaled steroids in 2007 was devised by the researchers themselves, which might be a contributing factor to the heterogeneity^[33].

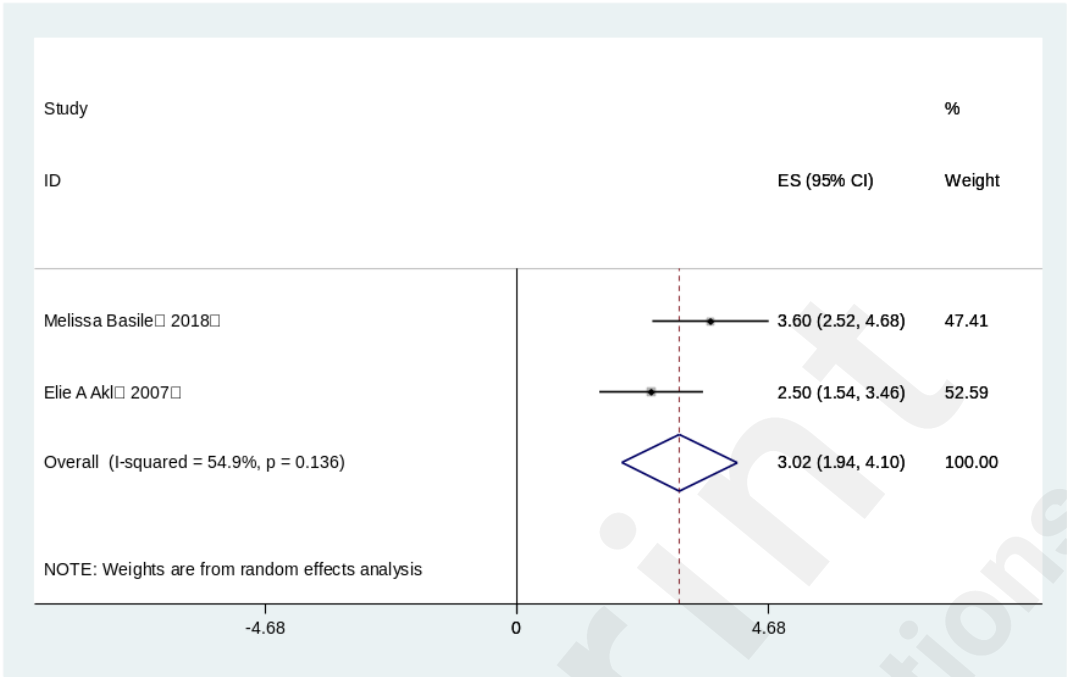
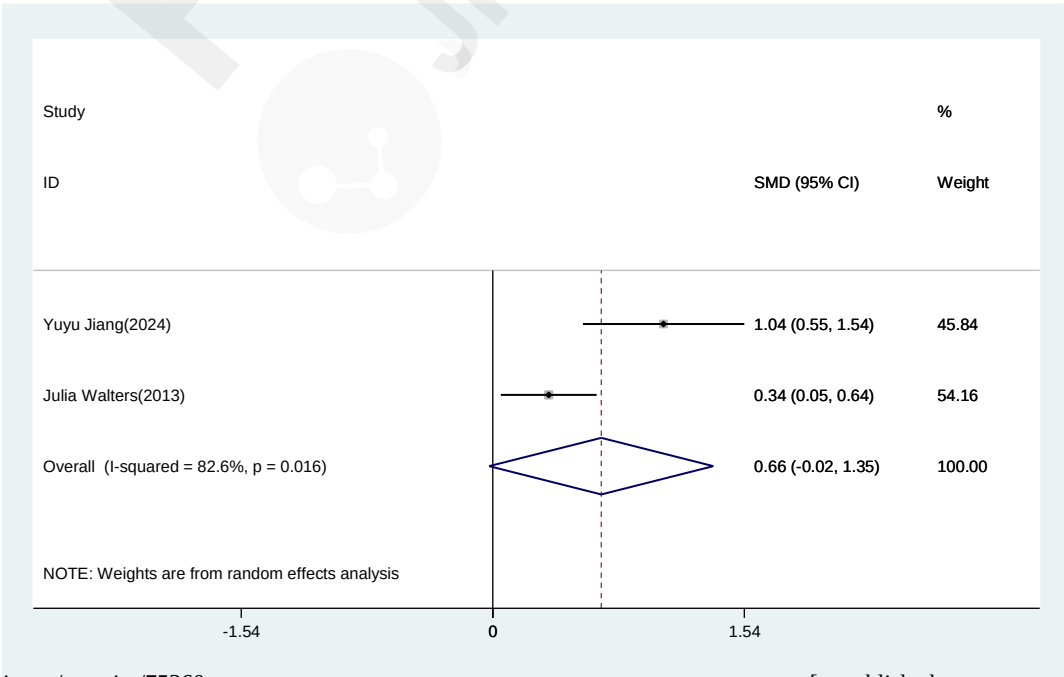


FIGURE 4. Changes in knowledge after using PADs in single-arm trails.

The results of the randomized controlled trial group showed a high degree of heterogeneity, with $I^2 = 82.6\%$ ($P \leq .05$) and an SMD of 0.66 (95%CI, -0.002 to 1.35). The main source of heterogeneity may be the different research objectives, which also targeted different areas of knowledge improvement. Other sources of heterogeneity may include targeting patients at different stages. For instance, Walters et al.^[34] conducted their study within the community population. Community - dwelling



COPD patients, being in a stable phase, may exhibit differences in cooperation and enthusiasm compared to in - hospital patients. Moreover, Jiang et al.^[37] employed an intervention integrating online and offline methods for 3 months, whereas another study had a 12 - month intervention. The varying trial duration could also contribute to heterogeneity.

3.4 Secondary Outcomes

3.4.1 Quality of life

The scores for quality of life are reverse - scored, with lower values being more favorable. The heterogeneity among the three trials with quality - of - life outcomes remained high after analysis using the random - effects model, with $I^2 = 73.9\%$ ($P = .02$), indicating significant heterogeneity among the studies. We conducted a

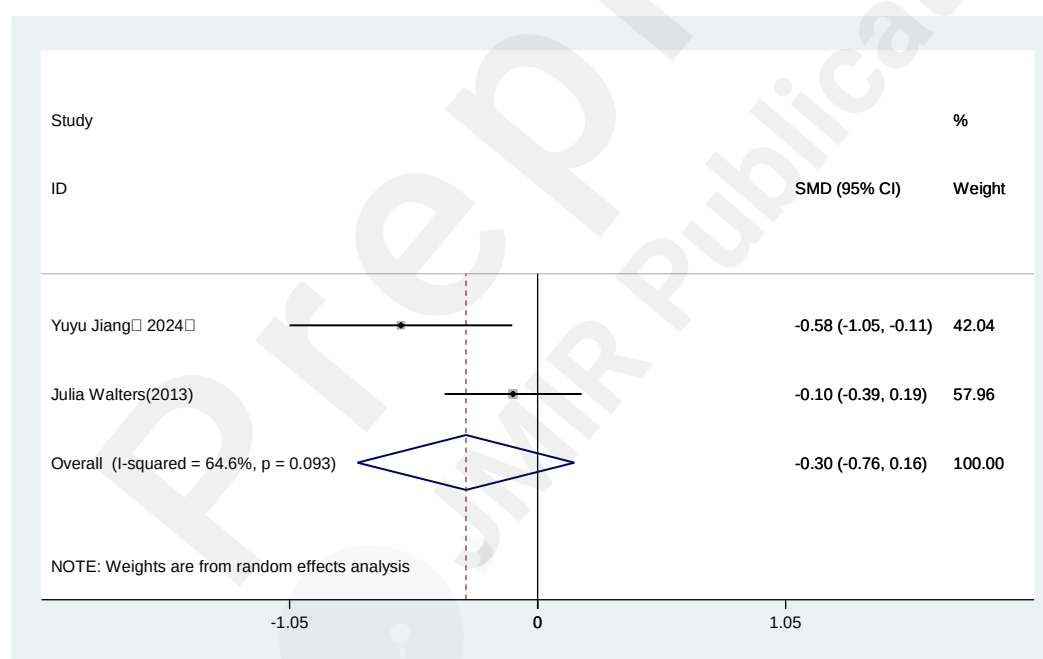


FIGURE 6. Changes in quality of life versus comparison groups.

sensitivity analysis using the leave - one - out method. After excluding a trial with a high dropout rate in the control group, the heterogeneity decreased to 64.6%, but $P \geq .05$. The seemingly paradoxical outcome could stem from the limited quantity of trials incorporated in this analysis. As a consequence, there is inadequate statistical power when conducting the heterogeneity test^[36]. There may actually be some differences among the studies, but due to the extremely small sample size, the result of $P \geq .05$ was obtained, and the heterogeneity test may not be able to accurately detect the existence of heterogeneity. In addition, the two trials had different objectives and used different scales. The participants in the study by Walters et al.^[34] were community - based, and their disease condition was likely more favorable than that of in - hospital patients.

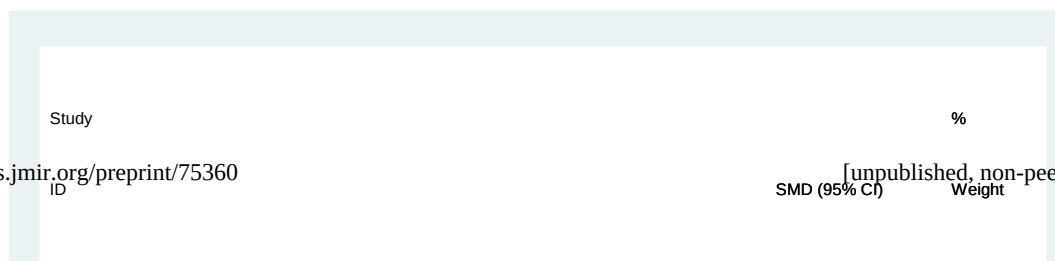
3.4.2 Self-efficiency

The analysis results of all the trials reporting self - efficacy show relatively low heterogeneity ($I^2 = 31.4\%$; $P = 0.22$), indicating an improvement in the self - efficacy of the experimental group. However, the results show that the improvement effect is minimal, with an SMD of 0.03 (95%CI, -0.28 to 0.35).

3.4.3 Health status

The health status of COPD patients was mainly evaluated based on the St. George's Respiratory Questionnaire and the Clinical COPD Questionnaire(CCQ). The health - status measurement scales used were all reverse - scored, meaning that the smaller the value, the more favorable the health condition of the patients. The reported health status had a low degree of heterogeneity, with $I^2 = 12.1\%$ ($P = 0.32$). The results showed that the SMD was -0.15 (95% CI, - 0.39 to 0.09), a negative value, indicating that digital PADs can improve adverse symptoms such as dyspnea.

FIGURE 7. Changes in self - efficiency versus comparison groups.



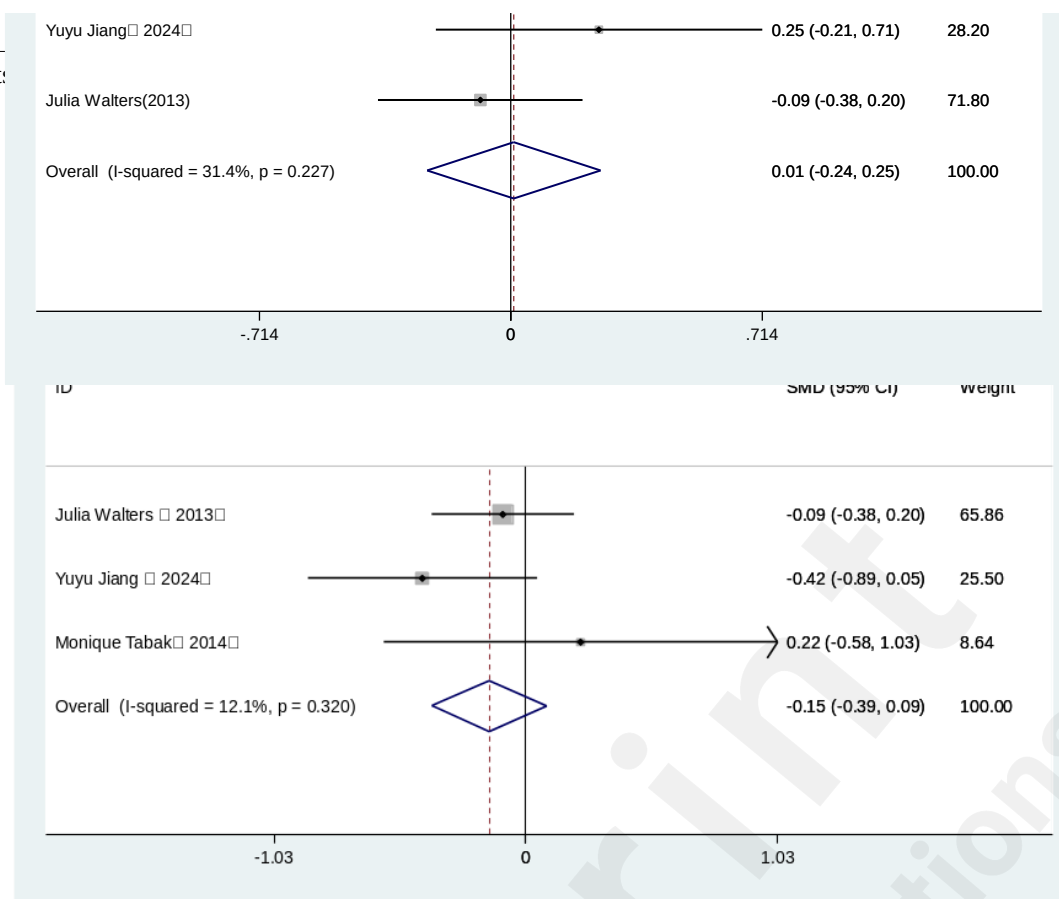


FIGURE 8. Changes in health status versus comparison groups.

4. Discussion

This meta - analysis identified and incorporated 5 trials. Available data suggest that the development and application of digital PADs for COPD patients are scarce and highly heterogeneous. Additionally, even among decision - support tools with comparable objectives, the research designs and measurement results of the included evaluation studies vary substantially. Most of the trials did not provide quality evaluation results based on international standards.

4.1 Main Findings

In the field of medical decision - making, digital PADs have demonstrated unique value. The results of the meta - analysis indicate that they have significant benefits in reducing decision - making conflicts. The results of two studies show that the effect size (ES) of digital PADs in reducing decision - making conflicts is - 14.97 (95% CI, - 16.66 to - 13.27). These two studies were designed for pulmonary rehabilitation^[37] and mechanical ventilation^[35] respectively. As time goes by, the

reduction in decision - making conflicts regarding pulmonary rehabilitation is statistically significant. No significant difference in decision-making conflicts was observed between the PDA and control groups during the first two months, but a notable reduction emerged by the third month^[37]. The results of assisted pulmonary ventilation show that most participants indicated that with the help of digital PADs, they would choose intubation and felt comforted, which further increased their initiative and motivation to participate in medical decision - making ^[35].

However, there are also some heterogeneities in the results of the meta - analysis. In terms of knowledge improvement, there are significant inconsistencies in the degree of patients' knowledge enhancement among different research projects. A significant number of participants made errors while answering questions related to the disease. In addition, patients and their healthcare providers also face many difficulties in the process of discussing the trade - off between benefits and harms, and it is often difficult to make decisions that are in line with patients' values and preferences. In terms of quality of life, although there are differences, the p - value is > 0.05 . The differences still need to be further discussed. Furthermore, variations in the severity of subjects' conditions may influence the improvement of quality of life. Community - based subjects typically have milder conditions than in - hospital or outpatient patients, so the intervention - induced quality - of - life improvement may be less evident.

Nevertheless, it can also play a positive role in improving patients' health conditions and enhancing self - efficacy. The analysis results show that the self - efficacy of COPD patients who received digital PADs has improved, with a standardized mean difference (SMD) of 0.03 (95% CI, - 0.28 to 0.35). The patients' health conditions have also improved, with an SMD of - 0.15 (95% CI, - 0.39 to 0.09). However, due to the relatively slight improvement, the research results need to be treated with caution.

4.2 Extra Findings

Receiving digital PADs assistance can reduce the occurrence of COPD - related

readmissions and the average length of re - hospitalization for patients, and to some extent, can improve the medical costs borne by both patients and hospitals^[34, 36, 37]. In this analysis, two trials investigated the impact of PADs on the readmission rate. The readmission rates in the intervention groups were 5.4% and 5.6% respectively, which were lower than the readmission rates of 12.2% and 8.3% in the control groups, and the research results were statistically significant^[34, 37]. Monique et al.^[36] counted the impact of digital PDAs on the number of patient readmissions and the length of re - hospitalization. The findings indicated that following a nine - month intervention, the experimental group experienced a total of four COPD - related hospitalizations, with a median duration of 5.5 days. In contrast, the control group had a total of five COPD - related hospitalizations, with a median duration of 7.0 days^[36].

In this analysis, the research results of Basile et al.^[35] indicated that the communication and interaction between patients, doctors, and family members increased significantly. Even advanced - stage patients could receive support through PADs, which was consistent with the previous research findings^[7, 38]. Among them, as high as 96% of the doctors clearly stated that after using the tool, they became more accustomed to using decision - aid tools, and the quality of communication with patients was significantly improved.

With the help of PADs, the doctor - patient communication is well ensured, and patients can also maintain a high level of compliance. During the trial, the proportion of patients with high compliance in the control group demonstrated a statistically significant reduction (from 58.3% to 33.3%, $P = 0.004$). Additionally, at the trial's conclusion, the proportion of patients with high compliance was significantly higher in the experimental group than in the control group ($P = 0.03$)^[37].

In addition, many trials have developed models to improve patient decision - making based on PADs. In this analysis, Jiang et al.^[37] devised a hybrid model combining face-to-face and virtual approaches for home-based pulmonary rehabilitation (PR) services targeting elderly COPD patients. In terms of enhancing the ability of medication management, Elie et al.^[33] used computer - interactive PADs to help patients choose

inhaled steroids. The PDAs in this study combined four models and the entire decision - aid process was divided into two parts. The first part introduced detailed knowledge to patients, and the second part guided patients in making decisions by clarifying values and preferences. Through the establishment of these models, patients can be more systematically assisted in handling potential decision - making difficulties, providing guidance for future research directions.

4.3 Challenges and implications

Currently, researches on PADs have achieved certain results in fields such as oncology, diabetes, and chronic kidney disease^[38], but the researches on the application of patient assistive tools among COPD patients are relatively scarce and confronted with many challenges and limitations at present. Firstly, the acceptance of PADs still needs to be further improved for that many patients have doubts about or are unfamiliar with digital tools, resulting in certain difficulties and resistance when using them. Secondly, patients with advanced - stage COPD are more likely to encounter more complex health issues. The use of decision - making aids may impose an additional burden and cause psychological stress. In a related study, it was found that as high as 74% of patients with advanced COPD gave up pulmonary ventilation treatment after learning about their condition with the help of decision-making aids^[24]. Therefore, when promoting and applying PADs, it is necessary to fully consider the patients' conditions and psychological states and adopt more personalized and humanized measures.

4.4 Limitations

Firstly, among the included studies, due to significant differences in the objectives of each study and the small number of studies, the outcomes that are not relevant to this theme could not be evaluated in a fully consistent manner. Secondly, although there is not a large difference in the age of COPD patients, other aspects such as the duration of the trials, the trial locations, and the trial contents may all be sources of heterogeneity. However, due to the small number of included studies, an

ideal subgroup analysis could not be conducted. Finally, in terms of research methods and data, as the number of available articles on COPD patients is currently limited, a comprehensive publication bias test cannot be carried out. Therefore, there may be a certain degree of publication bias. The above deficiencies may affect our judgment of the accuracy and reliability of the research results, and it is necessary to improve and perfect them in future studies.

5. Conclusion

Digital patient decision aids (PADs) demonstrate superiority over traditional tools in COPD management by enhancing disease control efficiency, patient engagement, and health outcomes while mitigating decision-making conflicts. However, current evidence remains limited by small-scale studies with substantial heterogeneity, predominantly focusing on health outcomes rather than systematically evaluating improvements in decision-making capacity and health literacy. Future research should prioritize large-scale, high-quality trials to comprehensively assess the clinical efficacy of digital PADs and establish evidence-based guidelines for optimizing COPD care practices.

AUTHOR CONTRIBUTIONS

Shuya Chen and Li Yang designed this study. The screening of literatures, quality assessment, and data extraction were completed by Shuya Chen, Jiacheng Su, Musen Hua, Jiaoyue Li and Yan Dong. Shuya Chen drafted the manuscript, while Li Yang reviewed and edited it. All authors contributed to the study and consented to submit this manuscript version.

CONFLICT OF INTEREST STATEMENT

All authors have no conflicts of interest related to the article.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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