

Driving Factors in The Implementation of Telemedicine During Pandemic Covid-19: A Systematics Review

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ABSTRACT

Novel coronavirus disease (COVID-19) has become a major health challenge worldwide. The telemedicine become preferred approach for health care delivery in this pandemic era. Telemedicine may turn out to be the cheapest and fastest way to bridge the rural-urban health divide in developing country, like Indonesia. Despite several benefits which telemedicine application offer to patient and physicians, the adoption of telemedicine health services still in its initial stages. The aim of this study is to determine the factors that influence the implementation of telemedicine for COVID-19 pandemic. This systematic review study was identified by searching Pub-Med and Google Scholar database (2020-2022). Only cross sectional studies included. Telemedicine for COVID-19 was selected as the main focus. Then, the factor influences the telemedicine implementation were adding. One author searched online relevant article and review all titles. The Cochran seven step model was used to perform the review. Criteria used to assess the methodological quality based on the British Medical Journal appraisal tool for cross sectional study. The extracted data included author, year publication, country publication, design, participant number, data collection method, outcome factors, main results, and limitation of the study. The article searched identified 70 citations. Of these, 30 title appeared relevant and were retrieved. Eight cross sectional articles selected for review. In all study included, all have high quality assessment based on British Medical Journal Appraisal Tool for cross sectional study. Included study total enrolled 97.711 subject age > 18 years live with COVID-19 pandemic. This current systematic review shows information quality, system quality, services quality, performance expectancy, effort expectancy, effort expectancy, social influence, facilitating condition, perceived vulnerability, perceived severity, and response efficacy has strong relationship to telemedicine implementation. Examining the role of demographic characteristic, patient and clinician associated factors, and technology learning provide insight into the success and failures of telemedicine. This current systematic review shows the demographic characteristic, patient and clinician associated factors, and technology learning influence the success and failures of telemedicine. Specific factor like information quality, system quality, services quality, performance expectancy, effort expectancy, effort expectancy, social influence, facilitating condition, perceived vulnerability, perceived severity, and response efficacy has strong relationship to telemedicine implementation.

Keywords: COVID-19, Telemedicine, Influence Factors

INTRODUCTION

Novel coronavirus disease (COVID-19) has become a major health challenge worldwide. For the past of 2 years, people have lived with COVID-19 since become the global pandemic. Until Mei 2022, there was 525.264.369 cases and 6.295.379 deaths by COVID-19 in worldwide. The way reducing the death ratio and active case ratio become a priority. The telemedicine become preferred approach for health care delivery in this pandemic era. WHO describes telemedicine as the delivery of

health care services using information and communication technologies for the exchange of valid information for the diagnosis, treatment, and prevention of disease and injuries, research and evaluation, and for the continuing education for health care providers. Telemedicine become the solution for the obstacles to reach patient during this pandemic.^{1,2}

Telemedicine can increase access and improve the quality of care in remote areas. Telemedicine may turn out to be the cheapest and fastest way to bridge the rural-urban health divide in developing country, like Indonesia. The diffusion of innovation theory provides an appropriate framework to understand the adoption of telemedicine. There 5 factors affecting the rate of adoption the telemedicine^{2,3} :

- Relative advantage: the degree to which an innovation is perceived as being better than the ideas that is superseded
- Compatibility: the degree to which an innovation is perceived as consistent with decision makers' existing values, past experiences, and needs of potential adopters
- Trialability: the degree to which an innovation may be tried to limited basis. Trialability is more important in the early stages of adoption
- Observability: the degree to which the benefits of the innovation are visible to decision makers
- Complexity: the degree to which an innovation is perceived as relatively difficult to understand or use

Despite several benefits which telemedicine application offer to patient and physicians, the adoption of telemedicine health services still in its initial stages. The literature on health information system revealed that telemedicine project failure rate is 75% worldwide an increase into 90% in developing countries. Thys, the current research fills the research gap by investigating factors which influence on patient behavior towards the adoption of telemedicine health services.³

MATERIALS & METHODS

The purpose of this systematic review was to determine the factors that influence the implementation of telemedicine for COVID-19 pandemic. One author (SS) searched online relevant article and review all titles. The structural questions constructed based on PICO (Patient, Intervention, Comparison, Outcome) criteria

- P : Patient age > 18 years living with COVID-19
- I : Use of telemedicine to deliver health care services
- C : Conservational method to deliver health care services
- O : factors influences the telemedicine implementation

The exclusion criteria were non-cross sectional study, study not focused for telemedicine implementation, study with no full text available, the main outcome of the study other than factor influences the implementation.

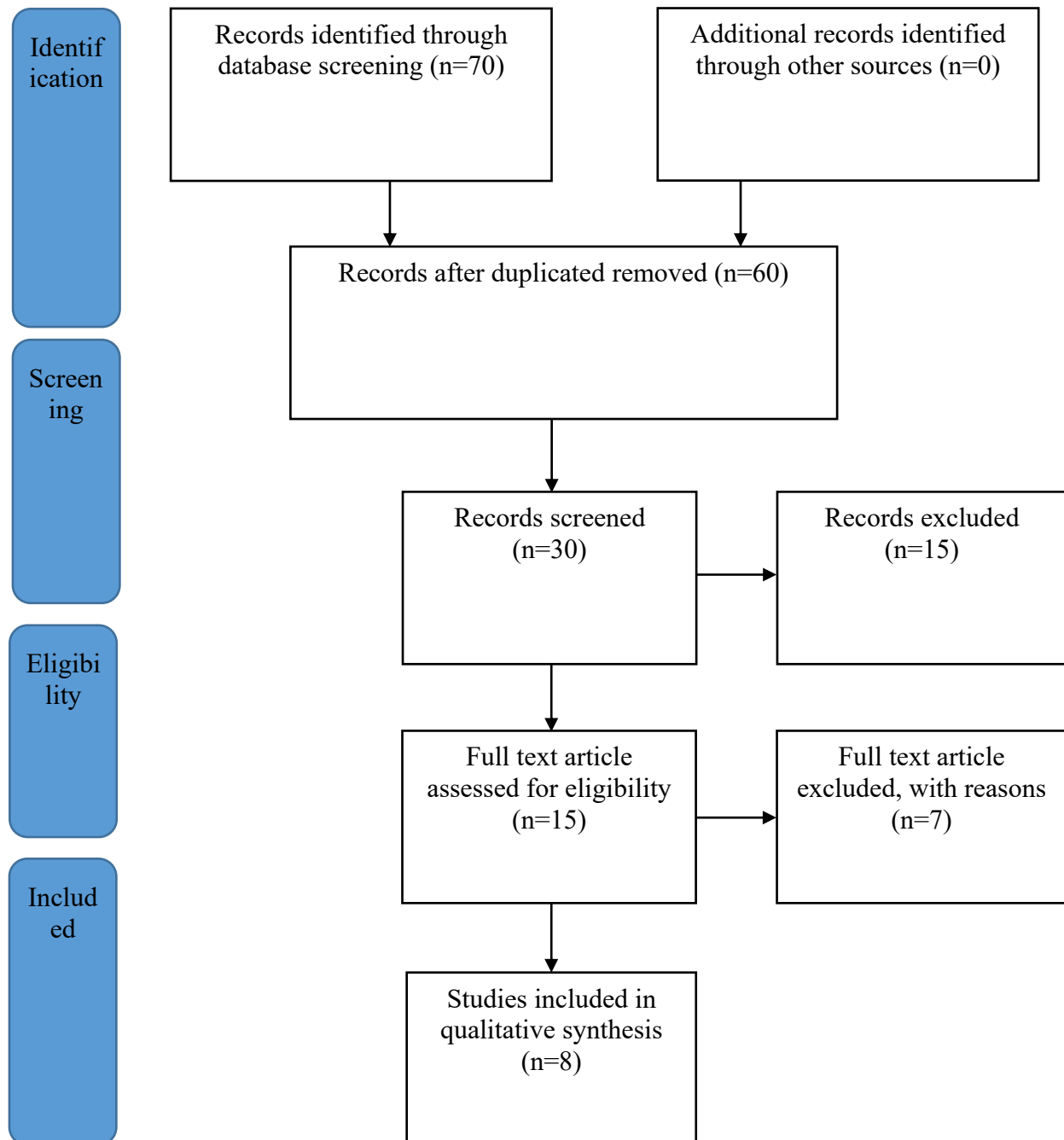
Article published between 2020-2022 were identified by searching Pub-Med and Google Scholar database. Keywords were telemedicine in COVID-19, factor influences in telemedicine implementation, factor contributes in telemedicine implementation. Telemedicine defined by the delivery of health care services using information and communication technologies for the exchange of valid information for the diagnosis, treatment, and prevention of disease and injuries, research and evaluation, and for the continuing education for health care providers. The Cochran seven step model was used to perform the review as follow

- Step 1 : Specifying the year
- Step 2 : Determining inclusion criteria. Article must publish in English or Indonesia. The design of study selected were only cross-sectional study. The study must have the availability of full text.
- Step 3 : Study selection. Telemedicine for COVID-19 was selected as the main focus. Then, the factor influences the telemedicine implementation were adding. The influence factor measured with Likert scale (1-5). The steps for selecting article are summarized in figure 1
- Step 4 : Assessment of study quality. In this step, only full text of the papers was studied. Criteria used to assess the methodological quality based on the British Medical Journal

appraisal tool for cross sectional study (range 1-19). Category of quality assessment: high (score 13-19), moderate (7-12), low (0-6)

	Indicator	Score
Internal Validity	Aim/objective of the study clear	1
	Study design appropriate for the states aim	1
	Sample size justified	1
	Target/reference population clearly defined	1
	The sample frame taken form an appropriate population base	1
	The subject/participant were representative of the target population	1
	The measure undertaken to address and categories non-responders	1
	Risk factors and outcome variable measured appropriate to the aim of the study	1
	Risk factor and outcome variable measures correctly using instrument/measurement that had been trialed, piloted, or published previously	1
	Use determines statistical significance and/or precision estimates	1
	The methods sufficiently described to enable them to be repeated	1
Results	The basic data adequately described	1
	Response rate raise concerns about non-response bias	1
	Information about non-responders described	1
	The results internally consistent	1
	The result presented for the analysis described in the methods	1
External Validity	The authors discussion and conclusion justified by the results	1
	The limitation of the study discussed	1
	The results can be applied in our institution	1
Total		18

- Step 5 : Data extraction. The extracted data included author, year publication, country publication, design, participant number, data collection method, outcome factors, main results, and limitation of the study.
- Step 6 : Data analysis. Data from the review of the studies are presented in Table 1.
- Step 7 : Presentation of results

Figure 1. Flow Chart of Study

RESULT

Results of literature search

The review flow is presented in **Figure 1**. The article searched identified 70 citations. Of these, 30 titles appeared relevant and were retrieved. Of these, 15 articles appeared relevant and were retrieved. Eight cross-sectional articles were selected for review. The exclusion reasons are study not focused in analyze factor influence the telemedicine implementation, study not cross sectional design, and no full text available.

Study characteristics

Details of characteristic of the study included presented in **Table 1**. All study had cross sectional design with online survey questionnaire measurement with Likert scale. Included study total enrolled 97.711 subject age > 18 years live with COVID-19 pandemic. Two studies (Mackwood et al and Crotty et al) have large scale of population subject (>10.000 subject), and only one study has <100 subject (Mishra et al). Most population of each study had subject from single center, except study from Crotty et al (from 6 continental area). Studies established in multiple country. One study use conservative health care approach as comparison (Taha et al).. All study included factors influence in telemedicine or telehealth implementation as main outcome. All study uses appropriate analytical statistic, except study from Dubin et al only use descriptive analysis. In all study included, all have high quality assessment based on Britih Medical Journal Appraisal Tool for cross sectional study. The full quality assessment of studies included show in **Table 2**.

Table 1. Description of included study

Author (year published and country)	Study design and participant	Data collection method, Scale	Outcome measure	factor	Summary of findings	p value
Mishra et al (2020), India²	Cross Sectional, 43 participant age 35-65 years	Online Survey Questionnaire, Likert Scale	Relative advantage, Compatibility, Trialability, Observability, Complexity		There strong relationship between adoption of telemedicine with perceive beneficial use, more fit for use, more open to trying, observed more benefit, and less complex to use of telemedicine	p =0,025
Rahi et al (2020), Malaysia³	Cross sectional, 351 participants age 18-65 years	Online Survey Questionnaire, Likert Scale	Performance expectancy, effort expectancy, social influence, facilitating condition and intention, perceived vulnerability, perceived severity, information quality, service quality, system quality, response efficacy and attitude		There strong relationship between attitude is jointly predicted by information quality, system quality, service quality, performance expectancy, effort expectancy, social influence, facilitating condition, perceived vulnerability, perceived severity, and response efficacy.	P<0,000
Taha et al (2022), Abu Dhabi⁴	Cross sectional, 515 participants age 18-65 years	Online Survey Questionnaire, Likert Scale	Easy to book appointment, clearly during consultation, provide same care as in-person consultation		The use of telemedicine was significantly associated with ease of booking telemedicine appointment, perception of similarity of quality of care between telemedicine consultation and in person visit, and preference for using telemedicine application over in person visit during the COVID pandemic	P<0,001
Mackwood et al (2022), North England⁵	Cross sectional, 19.280 participants age > 18 years	Online Survey Questionnaire, Likert Scale	Pandemic time, patient acuity, patient ease of talking with physician over the telemedicine		Early in the pandemic/lockdown, higher acuity (reflected by higher occurrence of surgery, chemotherapy, hospital visit, etc) related with higher use of telemedicine. No significance in telemedicine satisfaction in ease of	P<0,001

				communication.	
Crotty et al (2021), USA⁶	Cross sectional, 75,947 participants age > 18 years	Online Survey Questionnaire, Likert Scale	Patient income, high speed internet availability, clinical information, patient factor (perception about technology, information about type of device use)	Patient income and technology use (tablet or laptop) associated with successful telemedicine. Lower comfort with technology and using the non-integrated video visit solution associated with lower use of telemedicine. Patient factors were dominantly and systematically associated with telemedicine visit.	P value not mentioned OR > 1 (95% CI encompass 1)
Almatar et al, (2022), Kuwait⁶	Cross sectional, 484 participants age > 18 years	Online Survey Questionnaire, Likert Scale	General population familiarity and experience with virtual provision of health care	Participant with high comfort score perceived equal equality and positive perception of care received from telemedicine	P=0,0008
Dubin et al (2020), USA⁸	Cross sectional, 620 urologist	Online Survey Questionnaire, Likert Scale	Interest in telemedicine usage, barriers to telemedicine usage, usability score	The top three reasons for barrier to telemedicine were lack of technology comprehension, patient lack of access to required technology, and reimbursement concern. Another barrier was lack of administrative support No difference in usefulness, ease of use and learnability, interface quality, interaction quality, and reliability of different telemedicine platform	Not mentioned
An et al (2022), South Korea⁹	Cross sectional, 471 participant age > 30 years	Online Survey Questionnaire, Likert Scale	Increase accessibility, enhanced care, perceived usefulness, privacy, perceived ease of use, anxiety about COVID-19, attitude toward telehealth	The increase accessibility, enhanced care, and ease of telehealth use had positive effect on its perceived usefulness. Perceived usefulness, ease, and privacy significantly impacted the acceptance of telehealth.	P<0,001

Factors in Implementing Telemedicine in COVID-19 pandemic era

Cross sectional study from Mishra et al (2020), show there strong relationship between adoption of telemedicine with perceive beneficial use (relative advantage factor), more fit for use (compatibility factor), more open to trying (trialability factor), observed more benefit (observability factor), and less complex to use of telemedicine (complexity factor), with p value 0.025.² Cross sectional study from Rahi et al (2020) indicates that there causal relationship between attitude towards adoption of telemedicine health services with information quality, system quality, and service quality. Factor technology, performance expectancy, social influence and facilitating condition had shown positive influence in predicting patient behavior towards. the adoption of telemedicine health services.³

Same result shows in cross sectional study from An et al, that show the increase accessibility, enhanced care, and ease of telehealth use had positive effect on its perceived usefulness. Perceived usefulness, ease, and privacy significantly impacted the acceptance of telehealth.⁸

Cross sectional study from Taha et al (2022) show the use of telemedicine was significantly associated with ease of booking telemedicine appointment, perception of similarity of quality of care between telemedicine consultation and in person visit, and preference for using telemedicine application over in person visit during the COVID pandemic ($p < 0.01$).⁴ Cross sectional study from Crotty et al (2021) show that patient income and technology use (tablet or laptop) associated with successful telemedicine. Lower comfort with technology and using the non-integrated video visit solution associated with lower use of telemedicine. Patient factors were dominantly and systematically associated with telemedicine visit. The Odds Ratio for positive outcome were 1.41 (95% CI 1.14-1.74). This study has high level of quality assessment.⁶

Cross sectional study from Dubin et al (2020) with urologist participant, the top three reasons for barrier to telemedicine were lack of technology comprehension, patient lack of access to required technology, and reimbursement concern. Another barrier was lack of administrative support. No difference in usefulness, ease of use and learnability, interface quality, interaction quality, and reliability of different telemedicine platform

Table 2. Quality Assessment of Study Included

Study	Quality Assessment			Total Score	Level of evidence
	Internal Validity	Results	External Validity		
Mishra et al (2020)	10	3	2	15	High
Rahi et al (2020)	10	3	2	15	High
Taha et al (2020)	10	6	3	19	High
Mackwood et al (2020)	10	5	2	17	High
Crotty et al (2021)	10	4	3	17	Hugh
Almatar et al (2020)	9	3	3	15	High
Dubin et al (2020)	9	3	2	14	High
An et al (2021)	10	3	3	16	High

DISCUSSION

Discuss findings of your study with relevant reasoning along with proper citations/references. In COVID-19 pandemic and post COVID-19 pandemic era, the witness major changes in the way health-care services are delivered. This current systematic review shows information quality, system quality, services quality, performance expectancy, effort expectancy, effort expectancy, social influence, facilitating condition, perceived vulnerability, perceived severity, and response efficacy has strong relationship to telemedicine implementation. Systematic review from Riyanto et al show there 4 factors influence the telemedicine, there are organization law and regulation, financial issue, infrastructure technology, and pandemic covid-19 itself.¹⁰ Using mobile health application associated with increase ease of booking telemedicine appointment, The care via telemedicine has the same quality as the hospital physical consultation and patient preferred telemedicine consults over in-person visits during COVID-19 pandemic.^{4,10}

Cross sectional study from Dubin et al (2020) show the top three reasons for barrier to telemedicine were lack of technology comprehension, patient lack of access to required technology, and reimbursement concern. Another barrier was lack of administrative support. No difference in usefulness, ease of use and learnability, interface quality, interaction quality, and reliability of different telemedicine platform.⁸ Systematic review from Khosrounejad et al also show technology acceptance and user adoption, concerns about the adequacy and accuracy of subjective patient assessment, and technical issue were the most frequent barriers for telemedicine use.¹¹

Examining the role of demographic characteristic, patient and clinician associated factors, and technology learning provide insight into the success and failures of telemedicine. Sociodemographic characters include internet connectivity, technology literacy, educational level, and technology support also critical for the success of telemedicine.⁶ Systematic review form Monaghesh et al show telemedicine is certainly appropriate in minimizing risk of COVID-19 transmission. Telemedicine has potential to prevent any sort of direct physical contact, provide continuous care to the community, and finally reduced morbidity and mortality in COVID-19 outbreak.¹²

The limitation of this systematic review study is no longitudinal assessment in long period of time because only included cross sectional design, the data was self-reported by subject and potential in recall bias, and the survey was self-administered which risk of self-selection bias because selected only by the investigators.

CONCLUSION

This current systematic review shows the demographic characteristic, patient and clinician associated factors, and technology learning influence the success and failures of telemedicine. Specific factor like information quality, system quality, services quality, performance expectancy, effort expectancy, effort expectancy, social influence, facilitating condition, perceived vulnerability, perceived severity, and response efficacy has strong relationship to telemedicine implementation.

REFERENCES

1. Permadi D, Indrajit RE, Santoso H, Dazki E. The Service Quality of Telemedicine in Indonesia During COVID-19 : A Survey within Jakarta Area. *Jurnal Teknologi Komputer and Sistem Informasi*. 2022;5(1);22-25. ISSN : 2620-3022
2. Mishra V. Factor affecting the Adoption of Telemedicine during COVID-19. *Indian Journal of Public Health*. 2020. DOI : http://dx.doi.org/10.4103/ijph.IJPH_480_20
3. Rahi S, Khan MM, Alghizzawi M. Factor influencing the adoption of telemedicine health services during COVID-19 pandemic crisis : an integrative research model. *Enterprise Information System*. 2020;1-10. DOI : <http://dx.doi.org/10.1080/17517575.2020.1850872>
4. Taha AR, Shehadeh M, Alshehhi A, Altamimi T, Housser E, Simsekler MC, et al. The Integration of mHealth technologies in telemedicine during the COVID-19 era : A cross sectional study. *PLOS ONE*. 2022;1-13. DOI <https://doi.org/10.1371/journal.pone.0264436>
5. Mackwood MB, Tosteson TD, Teaster AT, Curtis KM, Lowry ML, Snide JA, et al. Factors Influencing Telemedicine Use at a Northern New England Cancer Center During the COVID-19 Pandemic. *American Society of Clinical Oncology*. 2022;1-14. DOI : 10.1200/OP.21.00750 *JCO*

6. Crotty BH, Hyun N, Polovneff A. Analysis of clinician and patient factors and completion of telemedicine appointment using video. JAMA Network. 2021;1-11. DOI : 10.1001/jamanetworkopen.2021.32917
7. Almatar R, Haqan AA, Abdullah I, Waheedi S. Population perceptions of health care services provided virtually (telehealth) : a cross sectional study. Journal of Public Health. 2022. DOI : <https://doi.org/10.1093/pubmed/fdac056>
8. Dubin JM, Wyant WA, Balaji NC, Ong WK, Kettache RH, Haffaf M, et al. Telemedicine Usage Among Urologist During the COVID-19 Pandemic : Cross Sectional Study. J Med Internet Res. 2020;22(11);1-9. DOI : <https://doi.org/10.2196/21875>
9. An MH, You SC, Park RW, Lee S. Using an Extended Technology Acceptance Model to Understand the Factors Influencing Telehealth Utilization After Flattening the COVID-19 Curve in South Korea : Cross Sectional Survey Study. JMIR Med Inform. 2021;9(1);1-10. DOI : <https://doi.org/10.2196/25435>
10. Riyanto A. Faktor-faktor yang mempengaruhi pelaksanaan telemedicine (systematic review). Jurnal Manajemen Informasi Kesehatan Indonesia. 2021;9(2);165-175. DOI : 10.33560/jmiki.v9i2.337
11. Khoshounejad F, Hamednia M, Mehrjerd A, Pichaghsaz S, Jamalirad H, Sargolzaei M. Telehealth-Based Services During the COVID-19 Pandemic : A Systematic Review of Features and Challenges. Front Public Health. 2021. DOI : <https://doi.org/10.3389/fpubh.2021.711762>
12. Monaghesh E, Hajizadeh A. The role of telehealth during COVID-19 outbreaks : a systematic review based on current evidence. BMC Public Health. 2020;20(1193);1-10. DOI : <https://doi.org/10.1186/s12889-020-09301-4>
