

## Telemedicine, Cost Effectiveness, and Patients Satisfaction: A Systematic Review

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### ABSTRACT

**Background:** Telemedicine has been practiced since 1960. The objective of telemedicine was to establish feasible interactive telecommunication for medical diagnosis and treatment of patients at remote sites. Nowadays, with healthcare costs on the rise, telemedicine is increasingly being seen as a strategy for healthcare organizations to make cost-saving. This study aimed to explore the opportunity of telemedicine utilization in cost savings to patients and the health care system.

**Subjects and Method:** A systematic review was conducted by searching the published articles from PubMed, MEDLINE, EMBASE, CINAHL, and Science Direct databases. Keywords for this study were “telemedicine” AND “patient satisfaction”, “telemedicine” AND “cost-utility and cost-effectiveness”, and “telemedicine” AND “systematic review”. The data were analyzed by PRISMA flow diagram.

**Results:** 8 articles were selected for this study. These studies reported that telemedicine utilization in dermatology, radiology, pediatrics, and intensive care unit (ICU) rooms reduced health

cost by 56% and patients travel cost to health care by 94%. Telemedicine advantages for patients were reduced transportation time or cost, eliminated time off of work, on-demand option, and reduced time in the waiting room, so that it can increase patient’s satisfaction. A study reported that telemedicine utilization at the pediatrics department increased hospital’s revenue by USD 101,744 per year.

**Conclusion:** Telemedicine is an alternative health care to generate cost savings for patient and hospital and it can increase patient’s satisfaction.

**Keywords:** telemedicine, cost effectiveness, patient satisfaction

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### BACKGROUND

Telemedicine is the use of medical information exchanged from one site to another through electronic communication to improve the clinical health status of patients (American Telemedicine Association, 2016). Telemedicine can be a value-added service that utilizes the development of communica-

tion technology. The development of internet and telecommunications facilities can play an important role in providing medical facilities in remote areas where modern health facilities are very limited especially in rural areas (De La Torre-Diéz et al., 2015).

Telemedicine can be a cheaper and easier way to disseminate services and medi-

cal facilities to communities in remote areas using limited resources (Chavula, 2013). Several countries in Asia have used telemedicine in their health services including Bangladesh and Japan.

Telemedicine has been expected to simultaneously increase costs, quality, and access to health care. There are more than 20 systematic reviews conclusively reporting that telemedicine is effective in areas such as mental health and management of chronic diseases including diabetes, heart failure, and elderly care (Ekeland et al, 2010; Akiyama et al, 2016).

However, previous systematic reviews of telemedicine economic evaluations, based on study populations in the US, UK, and Australia, show no conclusive evidence that telemedicine interventions can save health costs compared to conventional health care (Wade et al., 2010; Mistry, 2012; Mistry, Garnvwa and Oppong, 2014; De La Torre-Díez et al., 2015).

Telemedicine programs in Japan are indicated to have a favorable level of economic efficiency (Akiyama and Yoo, 2016), in addition to that telemedicine services introduced in Bangladesh can also be considered as cost-effective and time-saving health care solutions for improving health care facilities in remote rural areas (Sorwar et al., 2016).

In addition to economic factors, patient satisfaction is also one factor that needs to be considered because patient satisfaction is the key to developing a telemedicine program and patient satisfaction is an indicator of how well the telemedicine modality meets patient expectations. (Kruse et al., 2017).

Cost savings are needed in the era of health insurance so that the government does not suffer losses, without neglecting patient satisfaction and healing. So that researchers are interested in reviewing telemedicine opportunities in increasing the effectiveness of treatment costs and patient satisfaction.

## SUBJECTS AND METHOD

### 1. Study Design

A systematic review was conducted on June 1 - July 20 2019 by reading various articles through PubMed, MEDLINE, EMBASE, CINAHL, and Science Direct databases. Keywords used include: telemedicine AND patient satisfaction, telemedicine AND cost effectiveness, telemedicine.

### 2. Inclusion and Exclusion Criteria

Criteria for articles included in this review are randomized controlled trials, retrospective, observational studies, case studies, and reviews. Non-English and unpublished articles were excluded.

### 3. Data Extraction

Searches on electronic databases were filtered to identify studies that include relevance for reference. Then the data was made into a structured table i.e. PRISMA flowchart of Systematic Review.

## RESULTS

Based on Preferred Reporting Items for Systematic Review and Meta-Analysis/ Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA).

A total of 234 articles were identified during the initial search of the entire database. After eliminating the duplication and applying the selection of 8 articles will be further analyzed.

### 1. Telemedicine and cost effectiveness

Previous studies have reported that the use of telemedicine in various countries has benefits in reducing the cost of care or personal costs of patients.

Based on a study by Sorwar et al., (2016) in Bangladesh, reported that the time spent by a patient to access health services through telemedicine introduced was reduced by 56% (226 minutes to 99 minutes) compared to similar traditional health services. Similarly, the average maintenance costs were reduced by 94%. So it can be

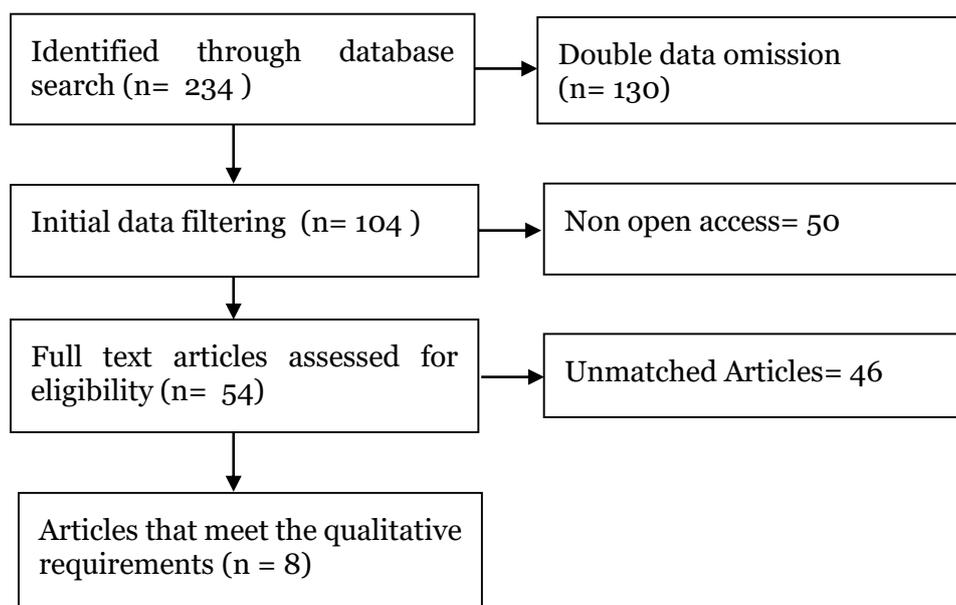
concluded that telemedicine services are more cost effective and time efficient for rural communities in accessing their health services.

A study by Akiyama and Yoo (2016), also reported on the cost effectiveness of telemedicine in Japan. Telemedicine services can reduce the frequency of doctor visits from twice a week to once. Savings in the cost of palliative care at home with telemedicine are estimated at \$ 5,000 per person per year compared to conventional care.

Other studies also report medical expenses that can be saved by tele-homecare that connects nurses with elderly people who have chronic diseases in one region showing that the treatment period is shortened by telemedicine services. Estimates about redu-

cing medical expenses range from \$ 148 to \$ 629 per case per year for lifestyle-related illnesses. However, tele-homecare input costs are not shown in this study (Ito et al., 2003; Akematsu and Tsuji, 2009).

A research team measures the willingness-to-pay of a patient's WTP for a tele-homecare system that combines monitoring of vital signs and consulting a doctor. Estimated WTP are \$ 288, \$ 480, and \$ 520 per case per year, depending on analytical methods. There is only one study conducted in urban areas to estimate the user's WTP for home tele-health monitoring. This study, published in 2012, shows WTP as low as \$ 109 per patient per year (Akematsu and Tsuji, 2009; Peeters et al., 2012).



**Figure 1. Flow Diagram**

## 2. Telemedicine and patient satisfaction

A study by Sorwar et al., (2016) showed studies in patients accessing health care services through the telemedicine system in Bangladesh resulted in diverse levels of satisfaction, namely 51% of satisfied patients, 11% were quite satisfied, and 38% of service

recipients showed that they were very satisfied with telemedicine services.

The benefits of telemedicine services are also felt by elderly patients and also patients who live far from the hospital, (Jacobs et al., 2016) report high levels of satisfaction in island residents and elderly studies with

tele-consultation services, especially in terms of technical and interpersonal aspects.

High satisfaction is also demonstrated by telemedicine services that are used to diagnose and treat non-acute headaches. Patients are satisfied with the video and sound quality in this service (Bradbury et al., 2016; Kruse et al., 2017).

## DISCUSSION

This systematic review shows that telemedicine services significantly reduce the cost of care for users to access needed health services. The majority of patients only require half the conventional stature for telemedicine services, this is because they do not need to come to the hospital and incur transportation costs (Sorwar et al., 2016).

Based on a study by Akiyama and Yoo (2016) in Japan, the most economically efficient telemedicine service is emergency radiotherapy consultation related to malignant spinal cord compression services. Telemedicine can reduce patient transfer costs and shorten treatment decision times (Fitzpatrick et al., 2012). Telemedicine also saves costs in hospital services including teledermatology consultations which can save \$ 17,160 per case per year (Akiyama and Yoo, 2016).

In addition, telemedicine provides satisfaction to patients with various parameters including: can improve health service outcomes, ease of use, low cost, or cost savings, can improve communication, cut travel time to the hospital, increase access, increase self-awareness, no need to wait long to get service, save transportation costs, reduce the frequency of direct visits, increase self-efficacy, increase compliance and reduce readmissions (Kruse et al., 2017).

Overall, it has been proven that telemedicine can have a positive impact in reducing health costs, increasing satisfaction and expanding services to remote areas without

having to move resources. So that the users and provision of telemedicine services widely in various countries need attention.

## AUTHOR CONTRIBUTION

Joko Tri Atmojo, Wahyu Tri Sudaryanto, Aris Widiyanto, Ernawati, Dewi Arrandini, collected, examined the articles, and wrote the systematic review.

## CONFLICT OF INTEREST

We declare that there was no conflict of interest in this study.

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## REFERENCE

- Akematsu Y, Tsuji M (2009). An empirical analysis of the reduction in medical expenditure by e-health users. *Journal of Telemedicine and Telecare*. 15(3): 109-11. <https://doi.org/10.1258/jtt.2009.003001>
- Akiyama M, Yoo BK (2016). A systematic review of the economic evaluation of telemedicine in Japan. *Journal of Preventive Medicine and Public Health*, 49(4): 183–196. <https://doi.org/10.3961/jpmph.16.043>.
- American Telemedicine Association (2016) About Telemedicine, FAQs.
- Bradbury A, Patrick-Miller L, Harris D, Stevens E, Egleston B, Smith K, Mueller R, Brandt A, et al. (2016). Utilizing remote real-time videoconferencing to expand access to cancer genetic services in community practices: A multicenter feasibility study. *Journal of Medical Internet Research*. 18(2):e23. <https://doi.org/10.2196/jmir.4564>.
- Chavula HK (2013). Telecommunications development and economic growth in Africa. *Information Technology for*

- Development. 19(1): 5-23. <https://doi.org/10.1080/02681102.2012.694794>.
- Demiris G, Hensel BK (2008). Technologies for an aging society: A systematic review of “smart home” applications. *Yearbook of medical informatics*. 33-40. PMID: 18660873
- Ekeland AG, Bowes A, Flottorp S (2010). Effectiveness of telemedicine: A systematic review of reviews. *International Journal of Medical Informatics*. 79 (11): 736-71.
- Fitzpatrick D, Grabarz D, Wang L, Bezjak A, Fehlings MG, Fosker C, Rampersaud R, Wong RK (2012). How effective is a virtual consultation process in facilitating multidisciplinary decision-making for malignant epidural spinal cord compression? *International Journal of Radiation Oncology Biology Physics*. 84(2):e167-72. <https://doi.org/10.1016/j.ijrobp.2012.03.057>
- Ito Y, Suzuki W, Tsuji S, Kamata H, Taoka F, Osaka HV (2003). Regional Comparative Study of Home Health Care: Based on a Survey on Kamaishi City and Nishiaizu Town. *Japan Journal of Medical Informatics*. 23(4): 313-323. <https://doi.org/10.14948/jami.23.313>
- Jacobs JJWM, Ekkelboom R, Jacobs JPAM, van der Molen T, Sanderman R (2016). Patient satisfaction with a teleradiology service in general practice. *BMC Family Practice*. 17: 17. <https://doi.org/10.1186/s12875-016-0418-y>.
- Kruse C S, Krowski N, Rodriguez B, Tran L, Vela J, Brooks M, et al. (2017). Telehealth and patient satisfaction: A systematic review and narrative analysis. *BMJ Open*, 7(8): 1–12. <https://doi.org/10.1136/bmjopen-2017-016242>.
- De La Torre-Diéz I, López-Coronado M, Vaca C, Aguado JS, De Castro C (2015). Cost-utility and cost-effectiveness studies of telemedicine, electronic, and mobile health systems in the literature: A systematic review. *Telemedicine and e-Health*, 21(2): 81–85. <https://doi.org/10.1089/tmj.2014.0053>.
- Mistry H (2012). Systematic review of studies of the cost-effectiveness of telemedicine and telecare. Changes in the economic evidence over twenty years. *Journal of Telemedicine and Telecare*. 18(1): 1-6. <https://doi.org/10.1258/jtt.2011.1105-05>.
- Mistry H, Garnvwa H, Oppong R (2014). Critical appraisal of published systematic reviews assessing the cost-effectiveness of telemedicine studies. *Telemedicine and e-Health*. 20(7): 609-18. <https://doi.org/10.1089/tmj.2013-0259>
- Peeters JM, De Veer Anke JE, Van der Hoek L, Francke AL (2012). Factors influencing the adoption of home telecare by elderly or chronically ill people: A national survey. *Journal of Clinical Nursing*. 21(21-22):3183-93. <https://doi.org/10.1111/j.1365-2702.2012.04173.x>.
- Sorwar G, Rahamn MM, Uddin RH, Rakibul (2016). Cost and time effectiveness analysis of a telemedicine service in Bangladesh. *Studies in Health Technology and Informatics*, 231: 127–134.
- Wade VA, Karnon J, Elshaug AG, Hiller JE (2010). A systematic review of economic analyses of telehealth services using real time video communication. *BMC Health Serv Res*. 10, 233 (2010) <https://doi.org/10.1186/1472-6963-10-233>.