SYSTEMATIC REVIEW

The application of digital health as a nursing solution for leprosy patients during the COVID-19 pandemic: A systematic review

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Abstract

Objective: To analyse the effect of using digital health technology on leprosy control programmes.

Method: The systematic review comprised search on PubMed, Scopus, ScienceDirect, SAGE and ProQuest databases for interventional studies published in English language from 2013 to 2021 which used digital health technology for leprosy contact tracing, active leprosy detection, monitoring of multi-drug therapy and treatment management during the corona virus disease-2019 pandemic A standard risk of bias tool was used to evaluate bias in the studies, and the Joanna Briggs Institute protocol was used to assess the quality of the studies analysed.

Results: Of the 205 studies initially identified, 15(7.3%) were analysed in detail. Quasi-experimental studies had a low risk of bias compared to the rest. The e-leprosy framework was being used along with applications based on smartphones and artificial intelligence Digital health technology was found to be practical, accessible and effective in leprosy control programmes.

Conclusion: Studies reported favourable findings regarding the use of digital health technology in services related to leprosy patients.

Keywords: Prophylaxis, Leprosy, COVID-19, Nursing. (JPMA 73: S-170 [Suppl. 2]; 2023)

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Introduction

Leprosy, also known as Morbus Hansen (MH), is a contagious and chronic infectious disease caused by mycobacterium (M.) leprae. Early detection and treatment can cure leprosy and prevent disability. The World Health Organisation (WHO) noted that there were 12,558 new cases of leprosy detected globally in 2020, and there were 129,389 cases on treatment. The Indonesian Ministry of Health reported that there were 16,704 cases of leprosy and the proportion of new cases of leprosy in children in Indonesia had reached 9.14%.[1,2]

The impact of the coronovirus disease-2019 (COVID-19) pandemic in 2020-21 resulted in a decrease in the implementation of treatment programmes, and leprosy case discovery fell by 37% from the year before the pandemic.[1] Leprosy patients who are supposed to make regular visits to public health centres had to go through complicated procedures due to the increasing number of COVID-19 cases. The symptoms of leprosy are white or red patches on the skin. The patches are not itchy or painful, but numb. Because they don't feel pain or itching, the patients tend to be indifferent towards the treatment, which has the potential to transmit and cause disability.[3]

Short message reminders are proven to be effective in increasing the punctuality of taking medication (21%) and attendance at public health centres (14.6%) for leprosy patients. Mobile-phone-based health (M-Health) delivery has been proven to be effective in preventing stigma and exclusion from families and communities towards people with leprosy, and health technology is taken as a tool to make it easier for leprosy patients to undergo treatment protocols.[4,9]

The COVID-19 pandemic disrupted health services, thus opening up opportunities for the application of health digital technology in diagnosing, referring, monitoring and training health staff, providing treatment and managing disabilities.[1]

The current systematic review was planned to analyse the effect of using digital health on leprosy control programmes.

Materials and Methods

The systematic review comprised search on PubMed, Scopus, ScienceDirect, SAGE and ProQuest databases for interventional studies published in English language from 2013 to 2021 which used digital health technology for leprosy contact tracing, active leprosy detection, monitoring of multi-drug therapy (MDT) and treatment management during the COVID-19 pandemic.

The search protocol was based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The search strategy was in

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line with the Population-Intervention-Comparison-Outcomes-Time (PICOT) framework (Table 1), and key words used included pandemic, COVID-19, digital health, technology, and leprosy. Descriptive and quasi-experimental studies whose full texts were available were included.

A standard risk of bias tool was used to evaluate bias in the studies, and the Joanna Briggs Institute (JBI) protocol was used to assess the quality of the studies analysed.

Results

Of the 205 studies initially identified, 15(7.3%) were analysed in detail (Figure 1).[3-12,14,16-17,19-20]

Overall, quasi-experimental studies had a low risk of bias (Figure 2).

The e-leprosy framework was being used to send messages repeatedly to patients, their relatives and the relavent leprosy surveillance officers (LSOs) every month regarding the due date for multi-drug therapy at the appropriate public health center.[4] Every day across the duration of the treatment, the patient was being sent a reminder message to take medication.[5] Also used for the purpose was the Mh-Mobile application.[2] Health workers used artificial intelligence (AI) applications to screen leprosy.[6] Use and development of RehApp, a digital tool for field force working with people with disabilities, and global positioning system (GPS) tracking devices to track mobility, to assess health-seeking behaviour and support contact tracing were also in use (Table 2).[19]

Table-1: Population-Intervention-Comparison-Outcomes-Time (PICOT) framework.

PICOT Framework	Inclusion and Exclusion Criteria
Population	Leprosy patient
Intervention	Application of digital health technology
Comparison	No comparison intervention
Outcomes	Leprosy contact tracing, active case finding, post-exposure prophylaxis, multi-drug therapy monitoring
Time	2013 – 2021
Study Design	Descriptive study, quasi-experiments
Language	English
Exclusion criteria	The article does not discuss digital health technology for leprosy patients during the Covid-19 pandemic, articles without full text and abstract without intervention details, dated before 2021, and research conducted other than English, as well as descriptive study design studies and quasi-experiments.

Table-2: Characteristics of the studies analysed.

No	Author	Country	Methods	Samples	Duration and Frequency	Research Purpose	Interventions	Results
1	(Aditya R.S. et al., 2021)[3]	Turkey	Quasi-Experiment	70 participants	6 months	The Mh Mobile application is expected to increase knowledge, compliance with treatment programs for people with leprosy and assist families and nurses in providing good service.	The intervention was carried out in the treatment group using an android application. To measure knowledge and compliance using a validated questionnaire.	The results of statistical tests show that there is a significant effect of the Mh Mobile android application on knowledge and adherence to treatment of leprosy patients (p-value = 0.000), so that it can be used as an effective means of education during the Covid-19 pandemic.
2	(da Cunha et al., 2022)[8]	Switzerland	Descriptive Study	306,000 participants	January 2001-December 2020	The application of the ARIMA model is aimed at detecting cases of leprosy and assisting surveillance actions as well as helping health managers make decisions during a pandemic.	Application of ARIMA (Autoregressive Integrated Moving Average) Model is used to predict new cases of leprosy.	Based on the results of statistical tests, ARIMA Model is the best model and most appropriate to the data to test and derive predictions of leprosy cases with AIC = 431.30 and BIC = 462.28.
3	(Rachmani et al., 2020)[5]	Indonesia	Descriptive Study	101 patients	July 2014 to June 2016	The application of e-leprosy is used to describe the success and failure of treatment for leprosy patients and the implementation by health workers of the patient's timely attendance at the public health center.	This study uses an e-leprosy framework by involving leprosy surveillance officers (LSO), patients and relatives of patients to support the leprosy control programme..	The e-leprosy framework has been proven to have a significant relationship and can increase the involvement of LSO, patients and their relatives in supporting the leprosy control program as indicated by the fluency of computers and the internet (r=0.48, p<0.05) and age (r=0.621). p<0.01).

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No	Author	Country	Methods	Samples	Duration and Frequency	Research Purpose	Interventions	Results
4	(Paul & Kumar, 2020)[11]	India	Descriptive Study	6 participants	6 months	This study aims to assess the usefulness and convenience of M-Health to the needs and challenges faced by leprosy patients.	The intervention carried out in this study was health promotion using text messages via mobile phones with toll-free numbers to contact health workers.	M-Health is proven to be effective in preventing stigma and exclusion from families, communities for people with leprosy who are undergoing treatment programs.
5	(Steinmann et al., 2020)[17]	Switzerland	Descriptive Study	144 participants	Between 2016 and 2018	The use of digital technology is an innovative and comprehensive development to reduce transmission, the incidence of leprosy, disability and discrimination.	Establishment of a Global Partnership for Zero Leprosy which is committed to achieving the elimination of leprosy from the WHO programme by 2023.	Research on the development of a zero leprosy agenda is the best step forward for people with leprosy and for the next step, high-quality implementation is needed in order to realize the leprosy elimination programme.
6	(Warne & Mukhier, 2021)[19]	Swiss	Descriptive Study	165 participants	September 2020	Digital technology is used as a new means for improving leprosy services and overcoming problems caused if someone suffers from leprosy.	In this study, periodic conferences were held by the International Federation of Anti-Leprosy Associations (ILEP) to work together in dealing with the problem of leprosy.	The results of this study 85% use technology to improve their services, 75% they get information and 82% are interested in listening to recordings.
7	(Rachmani et al., 2019)[5]	Indonesia	Quasi Experiment	188 registered patients	19 months	This study is to evaluate the use of the e-leprosy framework in increasing the attendance and timely completion of treatment for leprosy patients.	This research uses an e-leprosy framework for basic services for people with leprosy.	The e-leprosy framework with short message service (message reminder) has proven to be effective in increasing timely completion of treatment programmes.
8	(Kumar, Paul & Siva, 2021)[7]	India	Descriptive Study	3 Computer-Aided Design (CAD) software SOLIDWORKS	2021	The lightweight disassembly device is designed as a tool to analyze and assess patient compliance levels without compromising efficacy	The tool used to design a 3-dimensional model of the lightweight demolition device is the Computer Aided Design (CAD) SOLIDWORKS software.	The results of this study demonstrate the efficacy of a new computer design for lowering foot load and improving compliance.
9	(De Souza et al., 2021)[6]	Brazil	Descriptive Study	174,871 cases	Period 2014-2018	This study aims to develop an artificial intelligence (AI)-based platform application to increase the ease of classifying leprosy and those who are far from health services.	To predict the type of leprosy PB or MB using a random forest algorithm while the SINAN data are used to build an artificial intelligence (AI) decision model.	The use of artificial intelligence models has been proven to detect as many as 21,047 leprosy classification data that are not in accordance with their clinical form with a sensitivity value of 93.97% and specificity of 87.09% from the AI model.
10	(Raza et al., 2022)[14]	Pakistan	Descriptive Study	1000 cases	2021	The dynamic analysis of the stochastic leprosy epidemic model will be described in this study	The dynamic analysis of this stochastic model is studied using a mathematical model where each population is divided into four groups.	The use of the stochastic model is found to be efficient, low cost and can be a feasible model for all the desired objectives
11	(Zhang et al., 2020)[20]	China	Descriptive Study	30 participants	April 2018-May 2019	The purpose of this research is to design, develop and test the use of mobile applications for use in field practice on disability and rehabilitation as well as function classification.	The development of this Android Mobile Application goes through stages, including being designed, developed and then tested for validity by rehabilitation professionals.	This android mobile application has been successfully developed and meets the requirements, it is easy and convenient to use in rehabilitation practice.
12	(Cheng et al., 2018)[10]	China	Descriptive Study	112 leprosy patients	January-March 2018	This study aims to assess the sensitivity and specificity of using quantitative polymerase chain reaction (qPCR) and droplet digital quantitative polymerase (ddPCR) in PB leprosy patients.	Sensitivity and specificity assessment was carried out on two DNA targets using qPCR and ddPCR in detecting M. leprae	The results of the ddPCR test on the sensitivity to detect M. leprae DNA were greater than qPCR by 79.5% and 36.4%, respectively, while the sensitivity test for both were the same (100%) in MB patients.

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Table-2: *continued from previous page*

No	Author	Country	Methods	Samples	Duration and Frequency	Research Purpose	Interventions	Results
13	(Maia et al., 2016)[12]	Brazil	Descriptive Study	8 patients	November 2014-February 2015	Analyzing the influence of technology in assisting self-care of patients with leprosy sequelae.	There are two categories, namely devices for self-care and taste sensations for the instruments used.	The results of interviews and observations showed that both verbal and non-verbal categories were very meaningful to the stigma of individuals and families related to leprosy.
14	(Schoenmakers et al., 2021)[16]	Ethiopia, Mozambique and Tanzania	Descriptive Study	30,000 participants	2019-2020	The PEP4LEP study aims to screen people at risk of leprosy and break the chain of transmission by administering prophylactic treatment.	Community-based and community-based interventions using skin camps per patient as well as patient's family for leprosy screening and the use of m-Health Skin Apps by health workers in skin examinations.	The results of the study show an increase in case finding and skin screening in leprosy patients and their families.
15	(Paula Vaz Cardoso et al., 2013)[9]	Brazil	Descriptive Study	441 participants	2006-2012	Develop rapid tests to diagnose, determine the prognosis, classification and treatment of leprosy in breaking the chain of transmission	The Enzyme-linked Immunosorbent Assay (ELISA) examination combines two rapid tests namely NDO-LID with a new mobile-based test reader platform (Smart Reader).	The test results showed that the rapid test was greater than the laboratory-based ELISA test with an increase from 83.3% of the MB type and 15.4% of the PB type to 87% of the MB type and 21.2% of the PB type.

[MH: Morbus Hansen, ARIMA: Autoregressive integrated moving average, qPCR: Quantitative polymerase chain reaction, ddPCR: Droplet digital polymerase chain reaction, PEP4LEP: Post-exposure prophylaxis-leprosy exposure prophylaxis, ELISA: Enzyme-linked immunosorbent assay, PGL: Phenolic glycolipid, NDO-LID: Natural disaccharide octyl-leprosy IDRI diagnostic, MB: Multibacillary, PB: Paucibacillary, AI: Artificial intelligence, GPZL: Global Partnership for Zero Leprosy, CAD: Computer-aided design, LSOs: Leprosy surveillance officers, mApp: Mobile application, SMS: Short message service.]

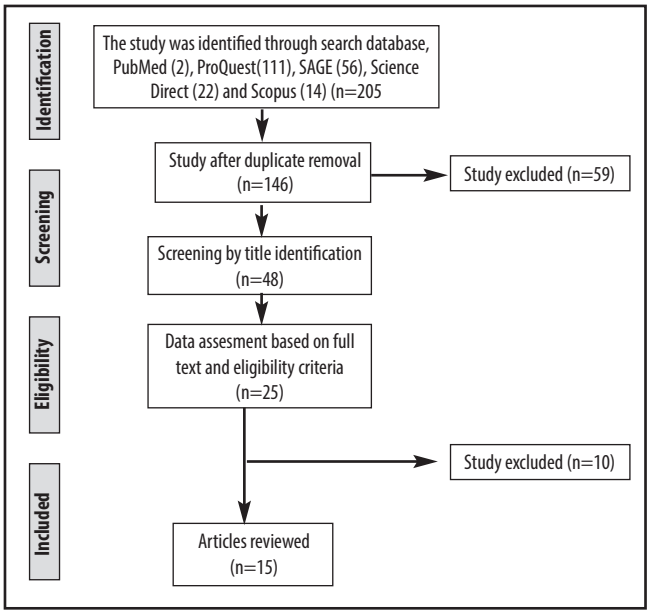

Figure-1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Flowchart

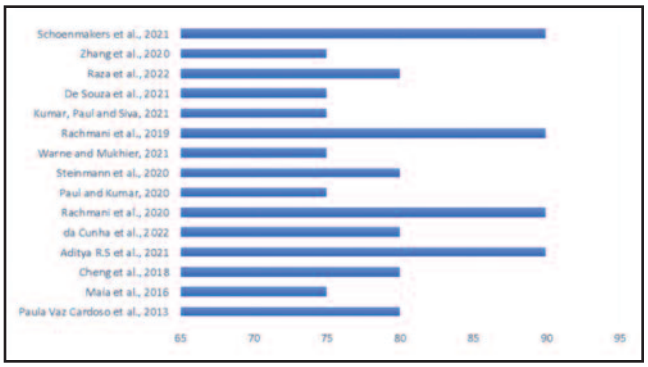

Figure-2: Risk of bias in the studies reviewed.

Discussion

The WHO has developed an e-learning module aimed at improving the knowledge and skills of staff at all levels on topics ranging from referral and suspected diagnosis to leprosy treatment and disability management.[1] People with leprosy may experience permanent disabilities related because of the involvement of skin, peripheral nerves, limbs and eyes, if they do not carry out the treatment programme.[1]

Studies [3-5,7-8,16,19-20] found that digital health technology is very effective in helping early detection of leprosy contacts, finding active cases and disabilities, and even increasing adherence to medication among leprosy patients.

One study[7] demonstrated the efficacy of a new computer design for lowering foot-load and improving compliance, while another[9] reported that leprosy diagnostic tests through smartphone technology were faster than laboratory tests.

According to Cheng et al.[10] the sensitivity of digital polymerase chain reaction (dPCR) test for detecting M.

leprae deoxyribonucleic acid (DNA) was greater than quantitative PCR (qPCR), while Paul et al.[11] reported that M-Health was effective in preventing stigma and exclusion of leprosy patients undergoing treatment, and Raza et al.[14] found that the stochastic model was efficient, low-cost and feasible for leprosy management.

The current review was not registered with the international prospective register of systematic reviews (PROSPERO), which is a limitation.

Conclusion

Literature reported favourable findings regarding the use of digital health technology in services related to leprosy patients.

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