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ORIGINAL ARTICLE

Role of Telemedicine in Rural Areas for Providing Doorstep Medical Treatment to the Elderly and Chronic Disease Patients

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ABSTRACT

Background: Telemedicine has evidently proven to have substantial effect in areas of underserved rural population and can serve as an alternate for the treatment of the chronic disease patients.
Aim: To assess the role of telemedicine in rural areas for providing doorstep medical treatment to the elderly and chronic disease patients.
Study Design: Prospective study
Place and Duration of Study: Ziauddin University, Karachi from 1st July 2024 to 31st December 2024.
Methodology: This was performed in the rural far-flung areas of Sindh (Tharparkar, Dadu and Khairpur Mir's) where not even a rural health care center was provided for a larger catchment population. A total of 1200 elderly cases diagnosed with chronic diseases including diabetes, hypertension as well as cardiovascular diseases and age between 55-75 years were enrolled. They were divided in two groups; each comprised 600 cases (200 from each district). One was considered as control (Group 1) while the other was the experimental group (Group 2).
Results: The mean age of the patients in the group 1 and 2 was measured as 61±9.1 and 63±10 years respectively. The majority of the patients in both groups were hypertensive at baseline clinical measurements followed by diabetic and cardiovascular patients. Both groups consolidated results were compared and it was observed that treatment success rate as well as patients stability were not significantly variant within group 1 and 2 (p value 0.87) while there was a significant increase in patients satisfaction in group 2 though telemedicine's counselling and education.
Conclusion: Telemedicine is a transformative solution for chronic disease management in resource-limited rural setting. It demonstrates that remote healthcare interventions can enhance treatment adherence, improve quality of life and address critical access issues.
Keywords: Telemedicine, Rural area, Doorstep, Chronic disease

INTRODUCTION

Telemedicine is succinctly defined as the application of information and communication technologies (ICT) within the field of medicine. While it is often associated primarily with remote patient monitoring or diagnosis, its scope extends further to include a variety of services such as e-learning used to provide remote education for both healthcare professionals and patients and tele-consultation, which may involve medical professionals consulting with one another or directly with patients via digital platforms (e.g., video conferencing tools like Skype, Face time, intranet systems, or the Internet). This form of consultation contrasts with traditional face-to-face interactions, as it depends entirely on digital connectivity to facilitate communication[1,2].

From an economic perspective, the telemedicine sector has seen substantial growth. Globally, the combined telephone and telemedicine market reached approximately US$13.8 billion in 2012, increasing to US$16.3 billion in 2013 and US$19.2 billion in 2014. Projections indicated continued growth, with expectations of reaching US$35.1 billion in 2018 and US$43.4 billion in 2019, representing a compound annual growth rate (CAGR) of 17.7%[3-5]. Telemedicine has emerged as a transformative force in developing countries, offering healthcare access to populations in remote regions while simultaneously fostering the development of localized medical knowledge[6]. Globally, it has evolved into a rapidly expanding industry with a valuation in the billions. Its growing prominence is largely attributed to its capacity to overcome traditional barriers to healthcare access, such as geographic isolation, shortages of healthcare professionals in rural settings, and the cumulative costs associated with in-person medical consultations - including travel expenses, lost income due to work absence, and consultation fees[7,8].

The potential of telemedicine lies in its ability to connect patients residing in geographically distant or underserved areas with qualified healthcare providers based in urban centers. Countries like Pakistan face significant healthcare challenges similar to other emerging economies. These challenges stem from a rapidly growing population and a fragmented healthcare infrastructure, resulting in a disproportionate distribution of medical personnel. In 2012, the physician-to-population ratio in Pakistan was just 0.8 doctors per 1,000 individuals[9]. Furthermore, healthcare has historically been underfunded, with only 0.9% of the nation's GDP allocated to the sector in 2014, the lowest percentage recorded across Asia. With around 61% of its population living in rural regions, the healthcare divide is particularly stark[10].

Recognizing the transformative potential of telemedicine, several governments across emerging markets including India, Bangladesh, Kenya, and Uganda have implemented initiatives that deliver healthcare services through a range of digital modalities, such as voice and video calls, SMS messaging, and mobile health applications[5-7]. The present study was designed to assess the role of telemedicine in underprivileged rural areas for treating and managing chronic health disease.

MATERIALS AND METHODS

This prospective study was conducted at Ziauddin University, Clifton Campus Karachi from 1st July 2024 to 31st December 2024. The current study was performed in the rural far-flung areas of Sindh (Tharparkar, Dadu and Khairpur Mir's) where not even a rural health care center where not even a rural health care center was provided for a larger catchment population. A total of 1200 elderly cases diagnosed with chronic diseases including diabetes, hypertension as well as cardiovascular diseases were included. They were divided in two groups; each comprised 600 cases (200 from each district).One was considered as control (Group 1) while the other was the experimental group (Group 2).The patients were selected based on underprivileged community settings. The sample size was generated through WHO sample size calculator using the prevalence of chronic diseases identified among the underserved community populates. A power of test was applied as 80% while 95% confidence of interval and 5% margin of error was used for the sample size generation. A written informed consent was read in the local languages to the enrolled patients and their verbal acceptance followed by thumb impression was taken before initiation of the research. The research was additionally approved from ethical review committee of the Sindh University prior the initiation of the research. Those patients who were having latent stages of their chronic disease and required hospitalization were not included. The control group received standardized primary health care services while the experimental group was provided medical assistance through telemedicine services. Clinical baseline data which included the health-related quality of the life clinical markers including glucose levels, the blood pressure reading measurements as well as the other clinical history information linked with cardiovascular disease were documented through a well-structured questionnaire. These analyses were done personally before data was collected. The telemedicine program consisted of weekly remote consultation through a digital service provided at the house where in community health workers visited the house of the enrolled patient and brought a digital set and the doctor provided the consultation through the telemedicines services. The lady health worker was trained in responding to the telemedicines services before the initiation of the research the remote monitoring was done through digital glucometer and the digital blood pressure machines and the consultancy was provided through the digital services of telemedicine with follow up sessions also under taken, Medication adherences (HRQoL), the life style modification was recommended and awareness about health were also delivered to the patients in group 2. Data was collected and consolidated from all households/patients results and interpreted by using SPSS-26.0 through Chi square and 't' tests. P value <0.05 was considered as significant.

RESULTS

The mean age of the patients in the group 1 and 2 was measured as 61±9.1 and 63±10 years respectively. The majority of the patients in both groups were hypertensive at baseline clinical measurements followed by diabetic. There were 24% vs 28% cardiovascular patients within group 1 and group 2 (Table 1).

Both groups consolidated results were compared and it was observed that the treatment success rate as well as patients stability were not significantly variant within group 1 and 2 (P=0.87) while there was a significant increase in patients satisfaction in group 2 though telemedicine's counselling and education (Fig. 1).

The outcomes of the telemedicine and general hospital counselling in terms of health check, exercise and opting healthy routine by monitoring blood pressure or glucose levels were also assessed within group 1 and 2. It was found that there were significantly higher number patients under group 2 who started healthy lifestyle routine in comparison to group 1 (p<0.001) [Fig. 2].

The role of telemedicine was further elaborated through the positive outcomes observed in the 50 patients were given telemedicinal services. The medication adherence rate increased to 89% from 64% baseline while there was a significant increase in the HRQoL score (P<0.001) from mean 51±8.2 to 73±6.1 respectively. There was a substantial reduction in blood pressure as well as glucose levels among group 2 patients (Table 2).

Table 1: Demographic and clinical features of the patients at enrolment (n=100)

Characteristic	Group 1 (n=600)	Group 2 (n=600)	P value
Age	61±9.1	63±10	0.98
Gender			
Male	240 (40%)	264 (44%)	0.002
Female	180 (60%)	336 (56%)	
Clinical features			
Diabetes	216 (36%)	204 (34%)	0.87
Hypertension	240 (40%)	228 (38%)	0.99
Cardiovascular disease	144 (24%)	168 (28%)	0.79

Table 2: Positive role of telemedicine applications

Outcome Measure	Baseline	Post-Telemedicine
Medication adherence rate	64%	90%
HRQoL score	51±8.2	73±6.1
Blood pressure reduction (mmHg)	–	-15±4.2
Blood glucose reduction (mg/dL)	–	-26±8.3

Fig. 1: Comparison within patients' outcomes in group 1 and group 2

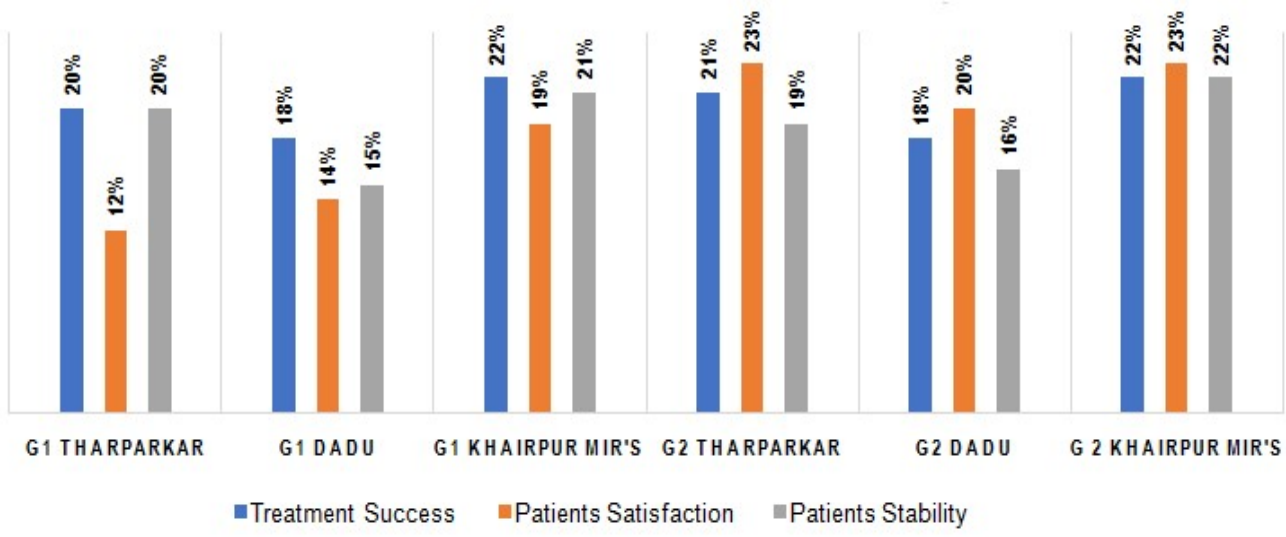
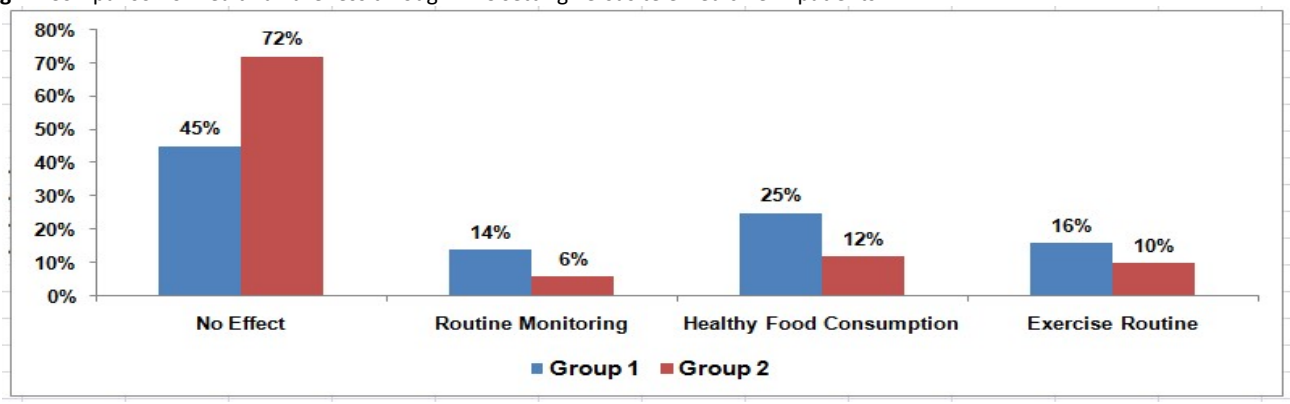


Fig. 2: Comparison of health awareness through PHC setting versus telemedicine in patients



DISCUSSION

The present study highlights telemedicine as a practical and efficacious approach for managing chronic illnesses within rural populations. It led to marked improvements in medication adherence, health-related quality of life (HRQoL), and overall clinical indicators[11-13] These outcomes are consistent with the existing body of research, which consistently demonstrates the role of telemedicine in addressing disparities in healthcare access, especially in underserved regions. The rise in medication adherence from 64% to 90% reinforces the idea that remote care delivery reduces logistical barriers and promotes sustained patient-provider interaction. This enhanced adherence was associated with significant clinical improvements, including reductions in both blood pressure and blood glucose levels - key metrics in the management of conditions like hypertension and diabetes.

The findings are in line with the work of Kwak et al[14], who observed a 1.76-fold improvement in adherence and notable enhancements in HRQoL among patients utilizing a collaborative physician-nurse telemedicine model in isolated rural areas. These parallels suggest that telemedicine interventions can be effectively adapted to various geographic and socioeconomic environments. Similarly, Sahu et al[15] underscored the role of telemedicine in narrowing healthcare disparities and improving health outcomes in marginalized communities where challenges such as limited transportation and inadequate healthcare infrastructure remain prevalent. Collectively, these studies strengthen the current findings, showcasing the reliability of telemedicine in chronic disease management[16].

The study relied on self-reported measures of medication adherence and HRQoL, which may introduce bias or subjectivity. Future investigations could benefit from integrating objective data sources, such as wearable devices or remote biometric monitoring systems, to enhance the robustness of data collection. Furthermore, although improvements in blood pressure and glucose levels were statistically significant, individual variability in these outcomes may reflect differences in disease severity and adherence to self-care protocols. Customized telemedicine strategies that account for these differences could optimize patient outcomes further[17-20].

Through the use of telemedicine, the study illustrates a scalable model for overcoming geographic barriers, thereby promoting healthcare equity. However, the relatively short intervention period may limit conclusions regarding the long-term sustainability of these improvements. Extended follow-up studies are warranted to assess the durability of outcomes and the potential for integrating telemedicine into comprehensive chronic care systems.

CONCLUSION

This study contributes to the expanding evidence base supporting telemedicine as a transformative solution for chronic disease management in resource-limited rural settings. It demonstrates that remote healthcare interventions can enhance treatment adherence, improve quality of life, and address critical access issues.

DECELARATION

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We would Like to Acknowledge our collegues and paramedical staff of hospital for supporting us for data collection and making current study possible.

Authors contribution: Each author of this article fulfilled following Criteria of Authorship:

1. Conception and design of or acquisition of data or analysis and interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
3. Final approval of the version for publication.

All authors agree to be responsible for all aspects of their research work.

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Data availability
The data that support the fndings of this study are available from the corresponding author, upon reasonable request.

Ethics approval
This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by Ethics Committee of Ziauddin University, Karachi.

Consent to participate
Informed consent was obtained from all individual participants included in the study.

Competing interests
The authors declare that the research was conducted in the absence of any commercial or fnancial relationships that could be construed as a potential confict of interest.

Conflict of interest
The authors declared no conflict of interest.

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