

Leveraging Larkai's Technology for Remote Patient Monitoring

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DOI:10.37648/ijrmst.v17i01.001

¹Received: 03 November 2023; Accepted: 10 January 2024; Published:15 January 2023

ABSTRACT

Primarily in the treatment of chronic illnesses, the rapidly developing discipline of remote patient monitoring (RPM) has the potential to completely transform the way healthcare is delivered. With an emphasis on cardiac and respiratory health, this study intended to assess the usefulness and efficacy of Larkai Healthcare's RPM system in improving disease monitoring practices.

To comprehensively assess the Larkai RPM system, we conducted a comparative analysis of its performance against conventional clinical monitoring methods across a diverse patient population. With Larkai's RPM devices, key vitals like ECG, blood pressure, heart rate, respiration rate, and SpO₂ were continually monitored, allowing for early diagnosis and treatment of heart and lung illnesses. Our investigation focused on the interactions among treatment adherence, user experience, and technological integration, as well as how these relationships affect patient outcomes.

The findings of this study unequivocally support the efficacy of Larkai's RPM technology in real-world scenarios. We observed a significant improvement in the identification of early cardiopulmonary complications, which could lead to improved patient prognoses. Moreover, the study explored the impact of this technology on healthcare delivery patterns, revealing reductions in hospital visit frequency and associated costs. In conclusion, this study positions Larkai's RPM technology as a transformative tool in the healthcare landscape, providing compelling evidence for its ability to optimize healthcare processes and elevate patient care. Our findings pave the way for a future where remote monitoring becomes an integral component of disease management and prevention, advocating for the widespread adoption of RPM solutions within healthcare systems.

Keywords: *Remote Patient Monitoring; Larkai Healthcare; Chronic Disease Management; Cardiac Health; Respiratory Health; Early Diagnosis; Treatment Adherence; Healthcare Delivery; Cost-Effectiveness.*

INTRODUCTION

Cardiovascular disease is a pressing global health concern that necessitates innovative strategies for early detection and proactive intervention, particularly for asymptomatic individuals. Cardiovascular diseases (CVD) constitute a leading cause of premature mortality costing millions of lives annually, indicating the significant worldwide burden of cardiac illnesses. Conventional clinic-based models often fall short in providing continuous monitoring and timely action. Through portable devices, remote patient monitoring (RPM) has become a game-changing strategy that allows for continuous data gathering and individualized therapy. Larkai Healthcare is leading this change with its state-of-the-art technology, which includes both software and hardware solutions. Our mission extends beyond device development with a focus on raising public awareness about the insidious nature of heart disease and encourage proactive engagement in preventive measures, regardless of symptom presence.

¹ How to cite the article: Dhalla P., Agrawal A.; (January 2024); Leveraging Larkai's Technology for Remote Patient Monitoring; *International Journal of Research in Medical Sciences and Technology*; Vol 17, 1-5, DOI: <http://doi.org/10.37648/ijrmst.v17i01.001>

This research evaluates the multifaceted impact of Larkai's RPM solutions through diverse pilot projects. The study presents data from WREN's deployment in clinical trials, ambulance settings, elderly care programs, and maternity wards. By meticulously analyzing user experience and efficacy across these varied patient populations, the research aims to uncover the comprehensive potential of RPM in revolutionizing cardiac health management. The outcomes of this study hope to inform future healthcare practices, empower individuals to proactively protect their cardiovascular health, and potentially pave the way for wider RPM adoption as a cornerstone of preventive medicine.

METHODS

During 1990 and 2022, the number of deaths worldwide attributable to CVD climbed from 12.4 million to 19.8 million. Global population expansion, aging, and the contributions of avoidable metabolic, environmental, and behavioral risks are some of the causes contributing to this trend.

As the primary cause of CVD mortality worldwide, ischemic heart disease has an age-standardized death rate of 108.8 per 100,000 persons. This emphasizes how serious ischemic heart disease is in relation to cardiovascular health globally.

Remote Patient Monitoring (RPM), an implementation of technological advances used for tracking and analyzing information regarding patient health outside of typical healthcare settings involve acquiring health-related data, such as multi vital signs, and communicating it to healthcare specialists for evaluation and appropriate action.

A survey found that in 2019, 60% of Indian villages lacked a functioning subcenter. This indicates that many people living in rural areas do not have easy access to essential healthcare services such as immunizations, prenatal care, and treatment for minor illnesses. The survey also discovered that, even in villages with subcenters, problems with staffing shortages, poor infrastructure, and a lack of necessary equipment were frequently encountered ².

In India, both public and private providers offer primary healthcare. However, underserved populations—such as rural and distant regions and low-income families—lack access to primary healthcare of high quality. Although the government offers comprehensive primary healthcare programs, their quality and scope are limited by stagnating investments. While they are restricted in scope and geographic reach, a number of primary healthcare providers, both for-profit and nonprofit, simultaneously fill the need. Additionally, they frequently struggle to offer complete basic healthcare at a reasonable cost.

Due to financial constraints, 28% of illnesses in rural areas were left untreated in 2004 (compared to 15% in 1995–96). Similarly, in cities, 20% of illnesses went untreated in 2004 because of financial constraints, up from 10% in 1995–96³.

A survey found that "laziness" and "lack of time" were the two most prevalent reasons people avoided going for routine checkups (46% and 45.2%, respectively). "Health concern" accounted for the most frequent factor influencing their practice (77.5%), which was followed by "worry about chronic or serious illness" (32.4%) ⁴.

A. *The importance of RPM in healthcare is varied:*

- RPM enables early identification and handling of poor health issues, allowing for rapid intervention.
- It provides crucial health monitoring facilities for patients regardless of their physical location, which is especially useful for individuals living in distant places.
- Promotes patients' active participation in their own health care management.

² Sahoo, P. M., & Rout, H. S. (2023). Analysis of public health-care facilities in rural India. *Facilities*, 41(13/14), 910–926. <https://doi.org/10.1108/f-07-2022-0098>

³ Kumar AS, Chen LC, Choudhury M, Ganju S, Mahajan V, Sinha A, Sen A. (2011). Financing health care for all: challenges and opportunities. *The Lancet* [Internet], 377(9766), 0140-6736. [https://doi.org/10.1016/S0140-6736\(10\)61884-3](https://doi.org/10.1016/S0140-6736(10)61884-3)

⁴ Al-Kahil, A. B., Khawaja, R. A., Kadri, A. Y., Abbarh, M. S. M., Alakhras, J. T., & Jaganathan, P. P. (2019). Knowledge and practices toward routine medical checkup among Middle-Aged and Elderly people of Riyadh. *Journal of Patient Experience*, 7(6), 1310–1315. <https://doi.org/10.1177/2374373519851003>

B. *The Development of Products from Larkai Healthcare in Relation to RPM:*

Larkai's primary research was pivotal around measurement of ECG in quick and hassle-free manner. Thus, with the Cardiomate, which solely measured ECG at first, Larkai Healthcare concentrated on cardiac health. However, with the onset on Covid, team Larkai spotted the loopholes of portable healthcare devices and the need of making monitoring accessible. Parallely, Larkai apprehended the need of monitoring multi health-vitals along with ECG for a strengthened and reliable diagnosis thereby fulfilling the purpose of smooth remote monitoring. Thus, Larkai created a multi-parameter health monitoring device that measures ECG, SpO₂, NIBP, respiration rate, and body temperature in order to provide a more complete RPM solution because we considered the limitations of relying solely on ECG monitoring.

According to latest research⁵, the median delay duration for patients admitted with acute heart failure was 134 hours (5.6 days). Living in a rural area and waiting for symptoms to subside were two factors that affected the delay. Larkai Healthcare's vision extends beyond the development of innovative RPM products. The company aims to spread awareness about the importance of early heart disease detection and the benefits of RPM, particularly in regions lacking adequate healthcare infrastructure. By acknowledging the challenges and limitations of traditional based ECG testing, Larkai Healthcare seeks to promote the use of portable devices for early diagnosis and treatment. The company's ultimate goal is to use RPM to transform healthcare delivery, enhancing patient outcomes and quality of life while cutting costs.

C. *'Wren' The Multi-Parameter Monitoring System is one portable solution having attributes as below :*

- 5.5-inch LCD capacitive touchscreen, high-definition display, and Wi-Fi connectivity for real-time data transmission characterize this lightweight gadget.
- Superior Monitoring Skills: incorporating a 5-lead ECG, continuous body temperature monitoring, non-invasive blood pressure monitoring, pulse oximetry, SpO₂, and respiration rate.
- Data management: Equipped with cloud storage capabilities, API integration for custom software solutions, and the Wren app for real-time recording, storing, and viewing of patient data.

D. *Implementation and Gathering of Data:*

Clinical Trials and Real-World Implementation: Assessing Wren's application in a range of settings, including as maternity monitoring, in-patient transport systems like ambulances, and senior care.

Compliance and Data Security-Ensuring that patient data is maintained and safeguarded in accordance with regulatory regulations, as well as building software adapted to customer needs.

CASE STUDIES AND PROJECTS**E. *Clinical Trial with Heartmate Institute, Cuttack:***

At the onset and during the early stages of research and development, Larkai conducted heart health check-ups in a critical clinical experiment at the Heartmate Institute, Cuttack, with 512 volunteers to aid in early detection and diagnosis of heart problems. The experiment found that many asymptomatic people had unidentified cardiac issues. At the same time, there was no official diagnosis for others displaying traditional symptoms like chest pain. Vital cardiac indicators including blood pressure, SpO₂, and ECG were continuously and thoroughly monitored by the system, which helped identify heart issues that conventional diagnostic techniques had overlooked. Furthermore, the portability played a significant role in allowing the Doctors to comfortably carry the device from one volunteer to the other during such mass analysis.

F. *Wren's Installation in Patient transportation including ambulances:*

Larkai noted the scarcity in patient transportation system during the epidemic and also in general in interior areas. Remote monitoring and patient transportation have been transformed by the introduction of the Wren monitoring system to different patient transporting verticals such as ambulances. Real-time data transfer to hospital doctors is made possible by the system's integration through an API, guaranteeing ongoing patient monitoring while in transit. Wren's compact size and featherweight design make it easy to attach to any bed or stand, increasing its versatility in a range of transit scenarios. With a longer battery life of 6–8 hours, continuous functioning is guaranteed. Notable advantages of

⁵ Dutta, M., Mohan, P., Mohan, S. B., Ponnappan, V., & Satyavageeswaran, P. (2020). Financing primary healthcare for rural areas. *Journal of family medicine and primary care*, 9(11), 5516–5522. https://doi.org/10.4103/jfmpc.jfmpc_1131_20

this integration include better patient safety, better clinical decision-making in real time, and a smooth transfer of care from ambulance to hospital, all of which optimize emergency healthcare services.

G. Remote patient monitoring in Elderly homes:

Larkai understood the hassle that elderly patients face in visiting clinics for regular health checkups thereby often eventually leading to gaps in necessary checkups or diagnosis.

Larkai planned to conduct case studies with old-age Home wherein number of elderly people shall be available and also such homes frequently encounter obstacles in providing continuous and complete health monitoring. Conventional techniques may include manual blood pressure checks, pulse assessments, and simple questionnaires, offering only a limited amount of data on the health of the residents. WREN improved patient care and early health issue detection by introducing portable ECG equipment to health camps at an elderly home.

During temporary camps, elderly care frequently struggles to provide complete health monitoring, depending mainly on condensed pictures from conventional approaches. This study investigates the impact of WREN, portable ECG devices, at an elderly care facility's health camp.

H. Wren Implementation and Maternity Camps:

Larkai marked out the discomfort and struggle of women during maternity and post-natal period to carry themselves for regular health checkups.

Using the Wren monitoring system, Larkai Healthcare organized focused maternity camps in a number of places to raise awareness and provide prompt diagnosis for maternal health. Wren's multi-parameter functionality provided a novel approach to maternal care by assisting with the general health evaluation of pregnant mothers. The program improved early diagnosis of possible problems and showed Wren's efficacy and convenience for pregnant women. The analysis and success achieved in such camps paved the way for an upcoming collaboration with Ministry of Family Welfare and Health (MOFWH) with Wren to support the welfare of expectant mothers and their children, demonstrating the organization's commitment to improving mother and child healthcare.

CONCLUSION

Larkai's study and approach towards RPM is primarily two folds. Firstly, making people in general aware of the necessity of diagnosis and secondly, to solve the said purpose, making diagnosis convenient and accessible to people for them to actually able to follow.

This study has conducted an in-depth examination of the developments in Remote Patient Monitoring (RPM) technology, through Larkai's portable health monitoring devices. The report emphasizes how important RPM is to changing the way healthcare is delivered, particularly in places that have historically been underserved by traditional medical services. Wren's effectiveness and versatility are demonstrated by its use in a variety of contexts, including clinical studies at the Heartmate Institute in Cuttack, patient transportation networks, senior care, and maternity health camps. These case studies demonstrate how Wren can help with patient safety, improve early health issue diagnosis, and aid in more effective clinical decision-making. The system's effectiveness in a variety of environments demonstrates how RPM technologies may narrow the accessibility gap in healthcare. The study comes to the conclusion that RPM, as demonstrated by Wren, is a major advancement in healthcare that provides a more coordinated, effective, and patient-centered strategy. This technology is leading the way in a paradigm change that will see universal access to continuous, all-encompassing healthcare, regardless of physical or geographic limitations.

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