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A Multifaceted Intervention Program for Improving Heart Health in Elderly Care Homes: A Clinical Trial

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ABSTRACT

This clinical research addresses the critical need for enhanced healthcare practices in geriatric care facilities, where cardiovascular diseases (CVDs) constitute a major risk to the aging population. With CVDs being the primary cause of death among people over 65, the study sought to assess the cardiovascular and pulmonary health of senior residents in care facilities. A pilot study with 7 patients over the age of 65 was undertaken using non-invasive monitoring devices, specifically Cardiomate and WREN. The entire method comprised participant recruiting, medical history gathering, and physiological evaluations.

Notably, the trial revealed a substantial lack of regular monitoring and health checkups in elderly care homes, exacerbated by concerns related to invasive procedures. The participants' restricted willingness to undergo ECG procedures (1:3 ratio) highlighted the importance of patient-friendly monitoring systems. Uncovering hidden health concerns and diseases underlined the significance of complete health evaluations, emphasizing the supposedly asymptomatic character of some ailments.

The study found a significant frequency of cardiovascular and respiratory disorders in geriatric care facilities, highlighting the need for specialized healthcare interventions. Mobility constraints and limited access to routine hospital visits emphasized the need for novel solutions. As a result, the paper calls for the integration of real-time monitoring technologies to bridge existing healthcare gaps in aged care, ensuring continuous surveillance and timely interventions.

The statistical study included descriptive statistics, correlation analyses, and frequency distributions. These studies shed light on physiological parameters, medical history, and diseases, providing important insights for personalized healthcare solutions. Overall, the findings highlight the critical need for multimodal healthcare measures to improve the quality of life and health outcomes for the most vulnerable elderly people in care facilities.

KEYWORDS: Geriatric care, Cardiovascular diseases, Elderly health, Non-invasive monitoring, Respiratory diseases, Real-time monitoring, Healthcare interventions, Patient-friendly monitoring, Aging population, Quality of life, Health outcomes.

ARTICLE DETAILS

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I. INTRODUCTION

Cardiovascular diseases (CVDs) are the major cause of death for people over 65. They have a large impact on death rates as well as significant morbidity and disability, particularly in community settings (Global Burden of Disease Study 2010). The World Health Organization's 2015 pronouncement that the growth in chronic illnesses among the elderly population is a global epidemic, indicating a serious public health concern, serves to emphasize this even more. Due to the increase in prevalence of the co-existence of numerous chronic conditions—the aging population—which is expected to reach 2 billion people over 60 by 2050—introduces additional challenges.

After an in-depth review of the Global Burden of Disease (GBD) 2010 data, it was determined that 30.3% of all diseases in individuals over the age of 60 years are related to cardiovascular diseases, which is followed by 15.1% of malignant neoplasms ,9.5% of chronic respiratory

diseases,7.5% of musculoskeletal diseases, and 6.6% of neurological and mental disorders. This situation is especially worrisome in senior care facilities in view of the fact that patients frequently reside away from their relatives and are not routinely monitored or examined for health issues.

This initiative, led by Good Heart, the social arm of Larkai Healthcare, focuses on promoting preventative care, ensuring easy access to screenings, and fostering a sense of well-being. We aim to address these challenges by bridging the gap between diagnostic and treatment in elderly care homes. Our approach is tailored to make healthcare accessible and continuously monitored, thereby enhancing the quality of life and health outcomes for this vulnerable segment of the population.

II. OBJECTIVES

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A. Primary

To evaluate the cardiovascular and pulmonary well-being of elderly individuals with the primary goal of advancing healthcare interventions tailored to enhance their overall health outcomes.

B. Secondary

The secondary objective of the clinical trial was to investigate the living conditions of older individuals residing in institutional settings and to ascertain whether systematic monitoring of various physiological parameters among subjects reveals additional correlations with cardiovascular and respiratory disorders.

III. METHODS

A. Study Design

The clinical trial employed a pilot study, encompassing 7 participants aged over 65, with the primary objective of assessing cardiac and lung health in individuals residing in care facilities. Prior to the initiation of the study, all participants provided informed consent, inclusive of permission for data utilisation in the research.

B. Participant Recruitment and Information Gathering

The study commenced with a comprehensive approach, encompassing the establishment of rapport with participants, collection of medical histories, and acquisition of basic demographic details, including age and gender. Initially met with hesitancy due to apprehensions associated with traditional invasive check-ups, potential subjects were reassured through a demonstration of the testing procedure on the research team members. Subsequently, participants willingly engaged in the examinations.

C. Vital Signs Measurement and Physical Examination

Out of the two products developed by Larkai, namely Cardiomate, which serves as a monitoring device offering graphical analyses of cardiac and pulmonary functions, including real-time display of lung and heart sounds, and WREN, a multi-parameter monitor capable of simultaneous measurement of Electrocardiogram (ECG), Oxygen Saturation (SpO2), Body Temperature, Blood Pressure, and Respiratory Rate, the decision was made to proceed with WREN for the clinical trial as it demonstrated greater alignment with our research objectives and requirements.

Physiological assessments included blood pressure measurements on the left arm, oxygen saturation and pulse rate measurements on the right-hand index finger using a pulse oximeter, body temperature measurements under the right arm, and ECG measurements through electrode placement on the chest. Self-reports were utilized for ascertaining cardiovascular and lung risk factors. Normal blood pressure is defined as systolic pressure below 120 mm Hg and a diastolic pressure below 80 mm Hg. Hypertension is identified as systolic blood pressure of 140 mm Hg or higher, or diastolic blood pressure of 90 mm Hg or higher. Conversely, hypotension is characterized by significantly lower than anticipated blood pressure readings (less than 90/60 mm Hg).

Upon completion of assessments, personalized results, including identified risk factors and prescribed interventions, were communicated to participants and their caretakers. Customized prescriptions were provided, and a duplicate copy was retained for research records.

D. Interventions

***Management of Cardiovascular and Respiratory Risk Factors*:** In the intervention group, Cardiovascular and Respiratory risk factors and possible interventions were evaluated and suggested by cardiologists in the study.

Participants in the intervention group were provided with information on the importance of reducing risk factors, guidance on lifestyle changes and prescribing treatment if necessary by the cardiologists.

Participants in the intervention group also received a multifaceted approach, incorporating physical activity, dietary modifications, regular monitoring, check-ups, and education on the importance of reducing risk factors.

1. Physical Activity:

- Tailored moderate exercise regimens were recommended, accounting for individual capabilities and limitations.
- Activities such as walking, gentle stretching exercises, or participation in structured exercise programs were encouraged under professional supervision.
- Emphasis was placed on integrating physical activity into daily routines to enhance cardiovascular health, muscle strength, mobility, and weight management.

2. Dietary Modifications:

- Participants were advised to maintain a balanced diet including fruits, vegetables, whole grains, lean proteins, and healthy fats. Dietary modifications targeted specific needs, such as reducing sodium intake for those with high blood pressure and increasing it for those with low blood pressure.
- Guidance included limiting saturated fats, cholesterol, and controlling portion sizes to manage blood pressure, cholesterol levels, and blood sugar.

3. Regular Monitoring and Check-ups:

- Subjects were encouraged to schedule regular follow-up appointments with healthcare providers for vital sign assessments and overall health evaluations.
- Periodic assessments of blood pressure, pulse rate, oxygen saturation, and blood sugar levels were conducted to track progress and detect potential complications.
- Comprehensive medical evaluations, including screenings for cardiovascular risk factors and respiratory function, aimed to identify health issues promptly.

4. Education and Awareness:

- Awareness campaigns were initiated to educate participants about signs and symptoms of cardiovascular and respiratory diseases.
- Health literacy was promoted, emphasizing the distinction between normal and abnormal vital signs.
- Participants were empowered through education on medical conditions, treatment options, and self-care strategies.

IV. FINDINGS & OUTCOMES

A. Monitoring and Healthcare Deficiencies in Elderly Residents of Old Age Homes

Our investigation revealed a notable absence of regular monitoring and health checkups among elderly individuals residing in old age homes. A prevalent obstacle regarding invasive and painful procedures during health assessments was identified as a significant barrier to voluntary participation. Remarkably, only a limited subset of subjects, in a ratio of 1:3, expressed willingness to undergo Electrocardiogram (ECG) procedures, demonstrating a discernible trust in our non-invasive monitoring device.

B. Hidden Health Concerns and Underlying Diseases

A significant observation emerged, indicating that a subset of subjects, though appearing physiologically and psychologically well externally, harboured undisclosed underlying health issues. The lack of awareness about these conditions among the elderly population was evident. This finding underscores the imperative of comprehensive health assessments to uncover latent health concerns in seemingly asymptomatic individuals.

C. Prevalence of Cardiovascular and Respiratory Diseases

A significant revelation from our study was the high prevalence of cardiovascular and respiratory diseases among elderly individuals in geriatric care facilities. The absence of proper health checkups and routine management practices in these settings contributes to the heightened prevalence of these conditions. The primary focus of old age homes on the residents' living arrangements, while neglecting medical checkups and well-being, accentuates the urgency for targeted healthcare interventions.

D. Limited Mobility and Accessibility Challenges

Our investigation highlighted the constrained mobility of subjects, with a noteworthy number rarely leaving the confines of the old age home. Frequent visits to hospitals for routine checkups were deemed impractical due to these mobility limitations. This poses a considerable challenge to ensuring regular healthcare monitoring and timely medical interventions for this population.

E. Need for Technological Innovation

The identified challenges underscored the pressing need for innovative solutions in healthcare delivery for elderly individuals in old age homes. Recognizing the limitations imposed by restricted mobility, the imperative for real-time monitoring technologies that transcend geographical barriers became evident. The development of technologies enabling remote monitoring, ensuring continuous healthcare surveillance from any location to the hospital, emerged as a critical requirement to bridge the existing healthcare gap in this demographic.

V. STATISTICAL ANALYSIS

A. Correlation Analysis

In the particular section, we delve into the intricate relationships between physiological measurements across various patient demographics. A correlation table is presented to scrutinise the associations between key vitals such as blood pressure, age, SPO2, pulse rate, and temperature. The focus is particularly directed towards unravelling potential correlations, providing a nuanced understanding of how these vital parameters interact within different patient groups.

Subject	Age	SPO2	Pulse	Temp	BP	Medical History	Possible ailments
A	78	95	82	99	135/65	Partial hearing loss, Diabetic	● Abnormal decrease in systemic arterial blood pressure. ● Possible inadequate perfusion and oxygen delivery to tissues. ● Structural and functional abnormalities in the heart and blood vessels ● Possible impairment in circulatory function and contributing to various cardiovascular diseases.
B	71	96	69	99.7	160/90	High BP, severe angerissues, gradual loss of memory, mental stress.	● Persistent elevation of systemic arterial blood pressure. ● Possible structural and functional changes in blood vessels and the heart, contributing to various cardiovascular complications.
C	91	90	55	95	135/90	Upper body half paralysis, Diabetic	● Abnormal decrease in systemic arterial blood pressure ● Possible inadequate perfusion and oxygen delivery to tissues. ● Possible potentially decreased cardiac output and associated symptoms. ● Insufficient oxygen levels in the bloodstream, ● Possible impaired gas exchange in the lungs ● Possible decreased oxygen delivery to tissues and potential systemic consequences. ● Possible Aberrations in the structure or function of the respiratory system, encompassing the airways, lungs, and associated components.
D	73	93	70	98	145/61	Diabetic, back problem, joints pain	● Persistent elevation of systemic arterial blood pressure This condition may lead to structural and functional changes in blood vessels and the heart, contributing to various cardiovascular complications. ● Possible abnormalities in the heart's structure or function resulting in tissue damage and impaired organ function. ● Possible Aberrations in the structure or function of the respiratory system, encompassing the airways, lungs, and associated components. ● Possible Increased susceptibility to microbial pathogens due to factors such as compromised immune responses, underlying health conditions.
E	82	98	58	97	151/75	Heart stroke, diabetic	● Persistent elevation of systemic arterial blood pressure ● Possible structural and functional changes in blood vessels and the heart, contributing to various cardiovascular complications. ● Possible potentially decreased cardiac output and associated symptoms. ● Possible interruption of blood flow to a part of the heart muscle & subsequent tissue damage.
F	76	93	68	96	145/95	Hearing problem, knee arthritis	● Persistent elevation of systemic arterial blood pressure ● Possible structural and functional changes in blood vessels and the heart. ● Possible abnormalities in the heart's structure or function. ● Possible tissue damage and impaired organ function. ● Possible Aberrations in the structure or function of the respiratory system, encompassing the airways, lungs, and associated components.
G	68	91	100	98	128/59	Partial hearing loss, Partially sighted, mental stress	● Possible inadequate perfusion and oxygen delivery to tissues. ● Possible impaired gas exchange in the lungs ● Possible decreased oxygen delivery to tissues and potential systemic consequences. ● Possible Structural and functional abnormalities in the heart and blood vessels ● Possible impairment in circulatory function and contributing to various cardiovascular diseases. ● Possible Aberrations in the structure or function of the respiratory system, encompassing the airways, lungs, and associated components. ● Possible breathing difficulties.

Analysing the prevalence of specific medical conditions and their potential correlation with physiological measurements revealed distinct patterns of potential ailments for each individual. Subjects show differences in systemic arterial blood pressure, cardiac and vascular structure and function, possible cardiac output anomalies, and respiratory system aberrations. Notably, persons with elevated blood pressure levels may encounter cardiovascular difficulties, whilst those with low blood pressure may experience insufficient oxygen delivery and associated respiratory problems. These findings highlight the complexity of the participants' physiological circumstances, emphasising the need for personalised healthcare approaches to address various cardiovascular and respiratory issues.

Figure 1

Figure 1, Representing Distribution Pattern of Different Vitals

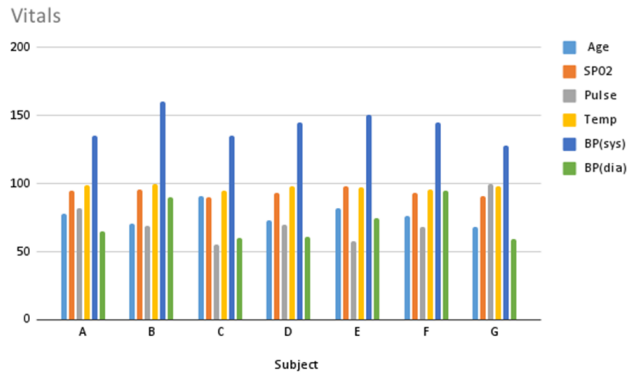
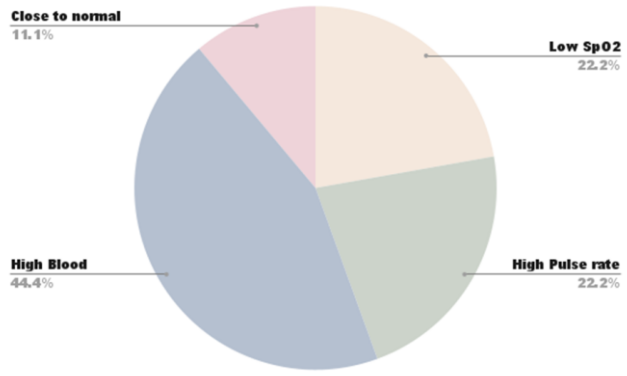


Figure 2

Figure 2, Representing Cardiovascular and Respiratory Health Profile.



B. Descriptive Statistics

This section conducts a thorough examination of key physiological parameters, including SPO2, Pulse, Temperature, and Blood Pressure, by calculating descriptive statistics such as mean, median, and standard deviation. The aim is to provide a comprehensive summary of the central tendency and variability within each set of physiological measurements, offering valuable insights into the overall distribution of the data.

Mean ($\bar{x}$) = $\sum x/n$

Median For Odd Numbers = $(X(n+1))/2$

Median For Even Numbers = $(X\ n/2 + X\ n/2 + 1)/2$

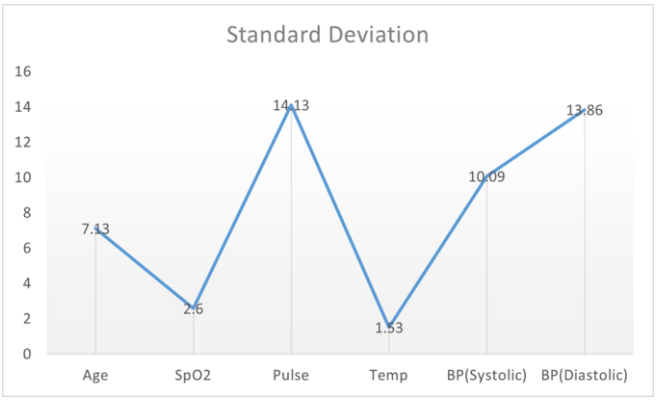
Standard deviation $\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$.

Margin of Error $\sigma\bar{x} = \sigma \sqrt{N}$

Vitals	Mean	Median	Standard Deviation	Margin of Error (At 95% Confidence Level)
Age	77	76	7.13	77 ±5.283 (±6.86%)
SpO2	93.71	93	2.6	93.7143 ±1.928 (±2.06%)
Pulse	71.71	69	14.13	71.7143 ±10.467 (±14.60%)
Temp	97.52	98	1.53	97.5286 ±1.132 (±1.16%)
BP(Sys)	142.71	145	10.09	142.7143 ±7.479 (±5.24%)
BP(Dia)	72.14	65	13.86	72.1429 ±10.268 (±14.23%)

Figure 3

Figure 3, Representing Variability in Distribution of Different Vitals



The complete examination of major physiological indicators across a dataset of seven subjects provided useful insights into the primary patterns and variability of these vital signs. The mean values are used as typical measures, highlighting averages such as age 77, SPO2 levels of 93.71, and systolic blood pressure of 142.71. The closely aligned median values reflect symmetrical distributions, demonstrating the dataset's robustness and dependability. Notably, standard deviations provide a measure of variability, with heart rate and body temperature showing greater fluctuation. This variability highlights the diversity of individual responses within the group. The computed margin of error, at a 95% confidence level, emphasises the precision of these estimates, increasing trust in the measured physiological parameters' trustworthiness. These findings

help to provide a more comprehensive understanding of the overall distribution of physiological data, allowing for more informed interpretations and implications for healthcare treatments in the clinical trial setting.

CONCLUSIONS

In conclusion, our clinical trial has illuminated critical insights into the healthcare challenges faced by elderly residents in care facilities, particularly concerning cardiovascular and respiratory health. The inadequacies in routine monitoring and health checks that have been observed highlight the need for innovative solutions to improve the delivery of healthcare for this vulnerable population. The occurrence of unreported health issues in patients who appear to be asymptomatic emphasises the need for comprehensive health assessments.

Targeted interventions are necessary to bridge the gaps in routine management practices since cardiovascular and respiratory illnesses are highly prevalent in senior care facilities. Immobility exacerbates the difficulties in maintaining timely medical interventions and routine healthcare monitoring. Recognizing these challenges, our study advocates for technological innovation in healthcare delivery.

Furthermore, our commitment to addressing these challenges has led to the launch of a groundbreaking product, WREN REALTIME. This innovative solution facilitates live streaming of patients' vital signs directly from the WREN device to hospitals and healthcare professionals. WREN REALTIME provides continuous healthcare surveillance and enables prompt actions regardless of geographic boundaries, addressing the limits created by mobility limitations. This revolutionary innovation is a significant advance towards bridging the existing healthcare gap in elderly care homes.

The multimodal intervention program, together with the launch of WREN REALTIME, not only improves the quality of life and health outcomes for the elderly, but also establishes a new benchmark for remote healthcare monitoring. This combination of technical innovation and scientific understanding has the potential to transform geriatric healthcare practices, thereby contributing to the well-being of the ageing population.

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