AUTONOMIC RESPONSES OF BEDRIDDEN PATIENTS TO BRIDGING EXERCISE PROTOCOL

BY

IGBINOBARO OSAHENRUMWEN RUTH

(BMS2004993)

A PROJECT SUBMITTED TO THE DEPARTMENT OF PHYSIOTHERAPY, SCHOOL OF BASIC MEDICAL SCIENCES, COLLEGE OF MEDICAL SCIENCES, UNIVERSITY OF BENIN IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF PHYSIOTHERAPHY(B.P.T) DEGREE.

OCTOBER , 2025.

CERTIFICATION

This dissertation by Igbinobaro Osahenrumwen Ruth is accepted in its presented form as satisfying the dissertation requirement of the degree of Bachelor of Physiotherapy of the School of Basic Medical Sciences, College of Medical Sciences of the University of Benin.

Dr (Mrs) Chigozie Obaseki

______________________ ______________________

SUPERVISOR SIGNATURE AND DATE

____________________ ____________________

EXTERNAL EXAMINER **Date**

APPROVED

____

DR MRS C.O OBASEKI

HEAD DEPARTMENT OF PHYSIOTHERAPY

COLLEGE OF MEDICAL SCIENCE UNIVERSITY OF BENIN

DEDICATION

This research work is dedicated to the almighty God,my father , my mother and my siblings for their unending love and support.

ABSTRACT

Background: Bedridden patients confined to bed for prolonged durations due to severe systemic illnesses or post-surgical recovery are at high risk of autonomic nervous system dysfunction, which leads to impaired regulation of cardiovascular parameters such as systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), and mean arterial pressure (MAP). Physiotherapeutic interventions such as bridging exercises, though beneficial for muscle activation and postural control, have not been adequately studied in relation to their effects on autonomic responses among bedridden patients.

Aim: The study aimed to evaluate the autonomic responses of bedridden patients to a bridging exercise protocol.

Methods: A randomized controlled trial was conducted among 50 participants (25 bedridden and 25 non-bedridden) recruited from the University of Benin Teaching Hospital. Baseline cardiovascular parameters (SBP, DBP, HR, and MAP) were measured at rest using an automated sphygmomanometer. Participants in the experimental group performed a structured bridging exercise protocol (three sets of 10 repetitions, holding each bridge for 5 seconds). Post-exercise measurements were recorded immediately. Data were analyzed using descriptive and inferential statistics (ANCOVA, repeated measures ANOVA, and independent t-tests) with significance set at $p < 0.05$.

Results: The results showed significant increases in SBP, DBP, HR, and MAP among bedridden patients after the bridging exercise session ($p < 0.001$), indicating improved autonomic activity and cardiovascular stimulation. However, no significant differences were observed between the bedridden and non-bedridden groups after exercise ($p > 0.05$). This suggests that bridging exercises can transiently normalize cardiovascular responses in bedridden patients to levels comparable to non-bedridden individuals.

Conclusion: The study concludes that bridging exercises significantly influence autonomic responses among bedridden patients, demonstrating positive cardiovascular and autonomic adjustments. Bridging exercises are beneficial, safe, and effective for inclusion in rehabilitation programs to enhance autonomic function and prevent cardiovascular deconditioning in bedridden individuals.

Keywords: Bridging exercise, Autonomic response, Bedridden patients, Systolic blood pressure, Diastolic blood pressure, Heart rate, Mean arterial pressure, Rehabilitation.

ACKNOWLEDGMENT

I am deeply grateful to my Creator, my Strength, and my Rock. I thank God for His unfailing love, care, guidance, and protection throughout my academic journey. To Him alone be all praise, glory, and honour.

My profound appreciation goes to my project supervisor, Dr. (Mrs.) Obaseki, for her motherly love, patience, guidance, and invaluable corrections during the course of this research. Your commitment, encouragement, and late-night support contributed immensely to the success of this work. I do not take your efforts for granted. God bless you abundantly, ma.

My sincere gratitude extends to the Head of Department, Dr. (Mrs.) Obaseki, for her continuous encouragement, discipline, and guidance, which have greatly shaped my academic growth. I am equally grateful to all the administrative and visiting lecturers of the Department; Prof. K. I. Oke, Rev. Sister (Dr.) Henrietta O. Fawole ,Mr. E. Okhuahesuyi , Prof. JosephUmunnah, Dr. Nelson Ekechukwu, Dr. Bolarinde, Dr.(Mrs) A. Aiyegbusi, Prof. Obinna Ezeukwu, Dr.Oghumu, Dr. (Mrs) Kubeyinje their dedication, sacrifice, and commitment to imparting knowledge.

I also appreciate the entire Department of Physiotherapy, University of Benin Teaching Hospital — the HOD, Dr. Taiwo Oyewumi, Dr. (Mrs.) Kubeyinje, PT Ebuka, PT Ezekiel, PT Imafidon, PT Godson, PT Sylvester, and all clinicians. Thank you all for the valuable clinical skills, mentorship, and knowledge you imparted to me.

To my beloved parents, Mr. Samson and Mrs Doris Igbinobaro, words cannot express how deeply grateful I am for your unending love, prayers, and sacrifices that made this journey possible. I also appreciate my loving and supportive sister, Omorovbiye Igbinobaro thank you for your encouragement, patience, and constant motivation. May God bless you abundantly.

My appreciation also goes to Osuoji Jachimma, Edigue Treasure, Osemwengie Winifred and my project group members for your immense support, teamwork, and encouragement. You all made this journey memorable. To my wonderful course mates, thank you for the friendship, shared experiences, and support throughout our academic journey. Together, we faced challenges, celebrated victories, and made memories that will last a lifetime. my heartfelt appreciation goes to all participants who took the time to contribute to this study. Your willingness, patience, and participation made this work possible. I am deeply grateful for your involvement and support.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Bedridden patients confined to bed for prolonged durations due to conditions such as severe systemic illnesses like sepsis, advanced heart failure, severe pulmonary disease, widespread malignancy, advanced chronic illness, or non-orthopedic post-surgical recovery and patients who spend over 90% of their time in bed and require assistance with daily activities are all at high risk of multiple complications, most notably those associated with physical deconditioning and autonomic nervous system dysfunction. It is estimated that over 20–30% of hospitalized elderly patients become partially or fully bedridden during their stay, with increased vulnerability to systemic complications (Martins et al., 2021). Among them, autonomic dysfunction is a serious one, which is characterized by impaired regulation of cardiovascular variables such as systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), and mean arterial pressure (MAP) (Ziemssen & Siepmann, 2019).

Autonomic nervous system (ANS) plays a crucial role in homeostasis through its two major divisions—the sympathetic and parasympathetic systems. Paralysis for longer period results in imbalance and dysregulation of parasympathetic and sympathetic systems, which can manifest in various ways, like diminished parasympathetic influence on heart rate and deranged sympathetic response to maintain blood pressure upon standing. These are compromise cardiovascular mechanisms and can result in orthostatic hypotension, tachycardia, decreased perfusion, and blunted baroreflex sensitivity (Claydon & Hainsworth, 2020). This imbalance is risky in medically compromised patients and can jeopardize outcomes or even delay recovery.

Bedridden immobile patients can lose up to a 15–20% plasma volume and experience drastic reductions in cardiac output and blood pressure regulation in the first few days of immobility (Convertino, 2019). Early treatment with physiotherapy is thus essential. Bridging exercise protocol is one such form, a low-intensity back lying type of exercise with the help of the tilt of the pelvis. Bridge exercises were observed in ambulatory participants to maximize trunk stability (amambulation preparation), increase blood flow, and maximize venous return (Kim & Park, 2020). They also recruit key muscle groups such as gluteals and abdominals involved in postural control as well as modulation of cardiovascular functions that eventually aid in ambulation. Despite widespread use in stroke and orthopedic rehabilitation, there is limited empirical evidence regarding the effects of bridging exercises on bedridden patients' autonomic variables. Organized core and trunk exercises have been earlier reported to lead to lower blood pressure and heart rate variability in healthy or ambulatory groups (Liu et al., 2022). Application to bedridden patients has yet to be sufficiently researched. Understanding the autonomic response, especially the variations in SBP, DBP, HR, and MAP to bridging exercises in bedridden patients is of paramount importance to evidence-based clinical practice. The aim of this study is to explore and fill the gap in knowledge through an assessment of the cardiovascular-autonomic impacts of an organized bridging exercise intervention within this frail population.

1.2 Statement of the Problem

Autonomic nervous system is essential for the maintenance of cardiovascular homeostasis, and its breakdown is a common complication in bedridden patients. Prolonged immobilization due to illness, surgery, or trauma typically leads to imbalance and dysregulation of parasympathetic activity and sympathetic tone and contributes to impaired cardiovascular regulation, causing hypotension, tachycardia, and decreased tissue perfusion (Convertino, 2019). This dysfunction not only delays recovery but also -increases the risk of morbidity and mortality. Several studies have examined the relationship between physical activity and autonomic function in ambulant or rehabilitative populations (Claydon & Hainsworth, 2020; Liu et al., 2022). For instance, Liu et al. (2022) demonstrated that core stability exercises can successfully improve heart rate variability, an indicator of autonomic health. Convertino (2019) also illustrated that inactivity compromises cardiovascular reflexes and autonomic responses, while Claydon and Hainsworth (2020) pointed out the prevalence of autonomic instability in immobile and critically ill patients. However, to the best knowledge of the researcher, there is no article or there are no articles focusing specifically on the effects of bridging exercise, a submaximal exercise, on autonomic parameters (such as systolic blood pressure, diastolic blood pressure, heart rate, and mean arterial pressure) in bedridden patients. In addition, while bridging exercises have been studied to enhance muscle activation and postural control among ambulant populations, their effect on autonomic parameters in bedridden, non-ambulant patients remains largely uncharted.

Most physiotherapy regimens do not provide sufficient guidelines on exercise interventions for these patients' autonomic function. Evidence-based standardization is also inadequate in the monitoring of MAP and other cardiovascular parameters during the process of physiotherapy for bedridden patients, leading to variable outcomes and longer recovery periods. This research, therefore, seeks to examine the impact of a bridging exercise protocol on autonomic responses of SBP, DBP, HR, and MAP in bedridden patients. By doing so, the study seeks to fill a fundamental gap in existing literature and guide the development of safer, evidence-based physiotherapy interventions for bedridden patients.

1.3 Research Questions

i. What is the impact of bridging exercises on the systolic blood pressure (SBP) of bedridden patients in the experimental group?

ii. What is the impact of bridging exercises on the diastolic blood pressure (DBP) of bedridden patients in the experimental group?

iii. What is the impact of bridging exercise on the heart rate (HR) of bedridden patients in the experimental group?

iv. What is the impact of bridging exercise on the mean arterial pressure (MAP) of bedridden patients in the experimental group?

v. Is there a range of alterations in magnitude in the autonomic variables (SBP, DBP, HR, MAP) of bedridden patients before and after bridging exercises?

vi. Is the magnitude of alterations in the autonomic variables correlated to the duration of immobility in bed

vii. Are there differences in the variable responses between the experimental and control groups

1.4 Aim of the Study

The main aim of this study evaluated the autonomic responses of bedridden patients to a bridging exercise protocol.

1.4.1 Specific Objectives

The specific objectives of the study were:

i. Determine the impact of bridging exercise on systolic blood pressure (SBP) in bedridden patients.

ii. Determine the impact of bridging exercise on diastolic blood pressure (DBP) in bedridden patients.

iii. Determine the impact of bridging exercise on heart rate (HR) in bedridden patients.

iv. Determine the impact of bridging exercise on mean arterial pressure (MAP) in bedridden patients.

v. To determine the magnitude of alterations of the autonomic variables' responses

vi. To determine if the duration of immobility is correlated to the magnitude of alterations in the autonomic variables.

vii. To determine if there are differences in the responses of the autonomic variables between the experimental and control groups

1.5 Hypotheses

1.5.1 Main Hypothesis

1. There would be no significant affect the autonomic responses (SBP, DBP, HR, and MAP) in bedridden patients.

1.5.2 Sub-Hypotheses

i. There would be no significant impact on systolic blood pressure in bedridden patients.

ii. There would be no significant impact on diastolic blood pressure in bedridden patients.

iii. There would be no significant impact on heart rate in bedridden patients.

iv. There would be no significant impact on mean arterial pressure in bedridden patients.

v. There would be no significant correlation between the magnitude of alterations and the duration of immobility

vi. There would be no significant impact in response between the experimental and control groups.

1.6 Significance / justification of Study

This study holds clinical, academic, and therapeutic importance:

i. **Clinicians and physiotherapists** will gain data on the cardiovascular benefits of bridging exercise in bedridden patients, supporting evidence-based rehabilitation approaches.

ii. **Hospitals and rehabilitation centers** may incorporate bridging exercise into standard care protocols to enhance patient recovery and reduce cardiovascular risks.

iii. **Researchers** can build upon this study to explore further low-impact interventions for autonomic regulation in non-ambulatory populations.

iv. **Policy-makers and healthcare administrators** may use the findings to revise physiotherapy guidelines for long-term care facilities and home-based care.

1.7 Scope and Delimitation

This study was delimited to :

1. Bedridden and non bedridden patients at the university of Benin teaching hospital
2. Patients who are between the ages of 18 to 65 years
3. It specifically evaluates cardiovascular parameters that reflect autonomic activity, systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR) and mean arterial pressure (MAP)

1.8 Limitations of the study

While the study achieved its objectives, it was limited by the short-term design, which assessed only immediate post-exercise responses. The sample size may not capture broader population variability, and autonomic measures such as heart rate variability or catecholamine levels were not included, which could have provided a more detailed assessment of autonomic modulation.

1.9 Operational Definition of Terms

- Autonomic Response: Changes in physiological variables regulated by the autonomic nervous system (ANS) in reaction to external stimuli such as exercise. These responses include fluctuations in heart rate, blood pressure, and vascular tone, reflecting sympathetic and parasympathetic balance (Ziemssen & Siepmann, 2019; Claydon & Hainsworth, 2020).
- Bedridden Patients: Individuals who are confined to bed due to medical conditions that prevent mobility for 24 hours or more, typically spending over 90% of their time in bed and requiring assistance with daily activities. This degree of immobility marks a critical threshold beyond which physiological consequences such as deconditioning and autonomic dysregulation become clinically significant and sustained (Martins et al., 2021; Convertino, 2019).
- Bridging Exercise Protocol: A physiotherapy routine involving pelvic elevation from a supine position to engage the trunk and hip extensor muscles. It is a core mobility exercise used to strengthen postural control, improve circulation, and prevent pressure sores by facilitating weight shifts and venous return (Kim & Park, 2020; Liu et al., 2022).
- Systolic Blood Pressure (SBP): The maximum arterial pressure recorded during ventricular contraction of the heart (Guyton & Hall, 2021).

- Diastolic Blood Pressure (DBP): The minimum arterial pressure in the arteries during cardiac relaxation, reflecting peripheral resistance and vascular tone (Guyton & Hall, 2021).
- Heart Rate (HR): The number of heartbeats per minute, influenced by autonomic control mechanisms that regulate cardiac output (Ziemssen & Siepmann, 2019).
- Mean Arterial Pressure (MAP): A calculated average arterial pressure during a single cardiac cycle, representing the perfusion pressure necessary to supply vital organs with oxygenated blood (Hall, 2020; American Heart Association [AHA], 2022).

1.9.1 List of Abbreviations

SBP SYSTOLIC BLOOD PRESSURE

DBP DIASTOLIC BLOOD PRESSURE

HR HEART RATE

MAP MEAN ARTERIAL PRESSURE

ANS AUTONOMIC NERVOUS SYSTEM

BP BLOOD PRESSURE

mmHg MILLIMETERS OF MECURY(unit of pressure)

CHAPTER TWO

LITERATURE REVIEW

2.1 Conceptual frameworks

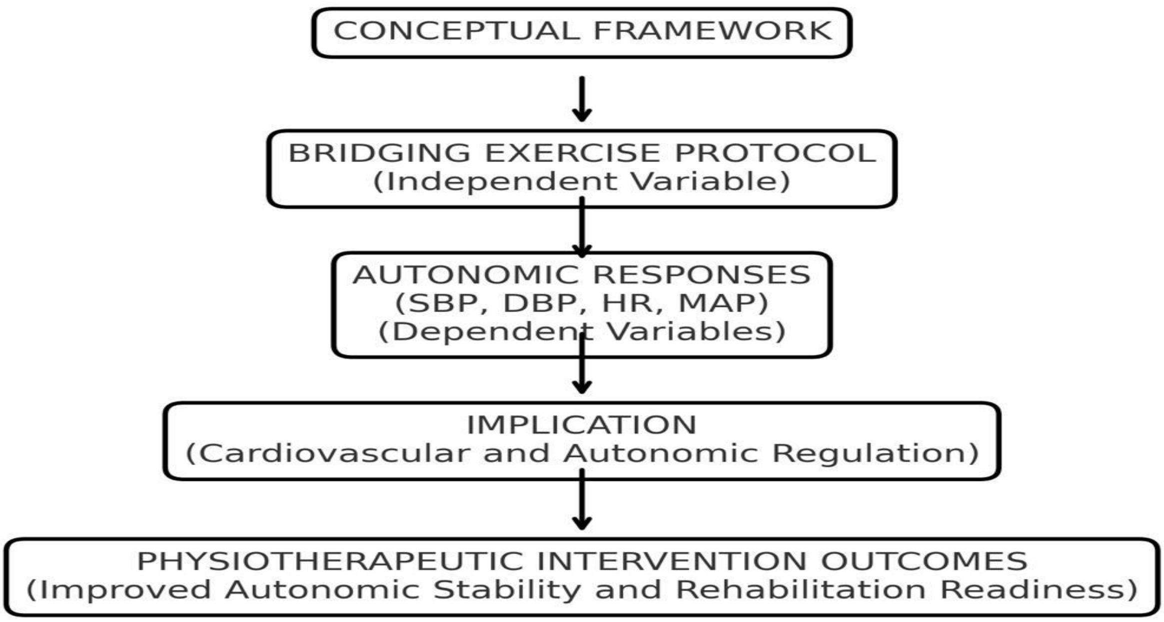


Figure 1: simplified conceptual framework

The conceptual framework of this study illustrates the theoretical relationship between bridging exercise and autonomic responses among bedridden patients. It is premised on the physiological principle that physical activity, even of low intensity, triggers autonomic modulation through sympathetic and parasympathetic pathways, thereby improving cardiovascular adaptability (Convertino, 2019; Claydon & Hainsworth, 2020).

During bridging exercises, contraction of trunk and lower limb muscles increases venous return, stroke volume, and baroreceptor sensitivity, which in turn influence systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), and mean arterial pressure (MAP) (Liu et al., 2022; Park et al., 2021). These cardiovascular changes indicate a reactivation of autonomic mechanisms that are often blunted in bedridden patients due to prolonged immobility and deconditioning.

The framework also draws on the Frank-Starling Mechanism, which suggests that enhanced venous return from muscular contractions during bridging improves cardiac output and perfusion (Guyton & Hall, 2021). Additionally, neurovascular coupling theory supports that repetitive submaximal movements can facilitate improved neural regulation of vascular tone, promoting autonomic stability (Phillips et al., 2016).

In this context, the independent variable is the bridging exercise protocol, while the dependent variables are the measured autonomic parameters (SBP, DBP, HR, and MAP). The underlying assumption is that consistent performance of bridging exercises elicits measurable improvements in these parameters, signifying enhanced autonomic regulation and cardiovascular health.

Ultimately, this framework explains how a physiotherapeutic intervention (bridging exercise) can serve as a safe and effective tool for early rehabilitation and prevention of cardiovascular deconditioning among bedridden patients.

2.1.1 Definition

The autonomic nervous system (ANS) is a vital component of the peripheral nervous sssystem that is responsible for the regulation of involuntary physiological functions that sustain life and maintain internal harmony. These include heart rate (HR) regulation, blood pressure (BP) control, regulation of respiratory rate, digestion, and thermoregulation. Unlike the somatic nervous system that regulates voluntary movements, the ANS is subconscious and continuous, regulating organ function based on internal and external stimuli (Benarroch, 2022).

The ANS contains two main branches: the sympathetic nervous system (SNS) and the parasympathetic nervous system

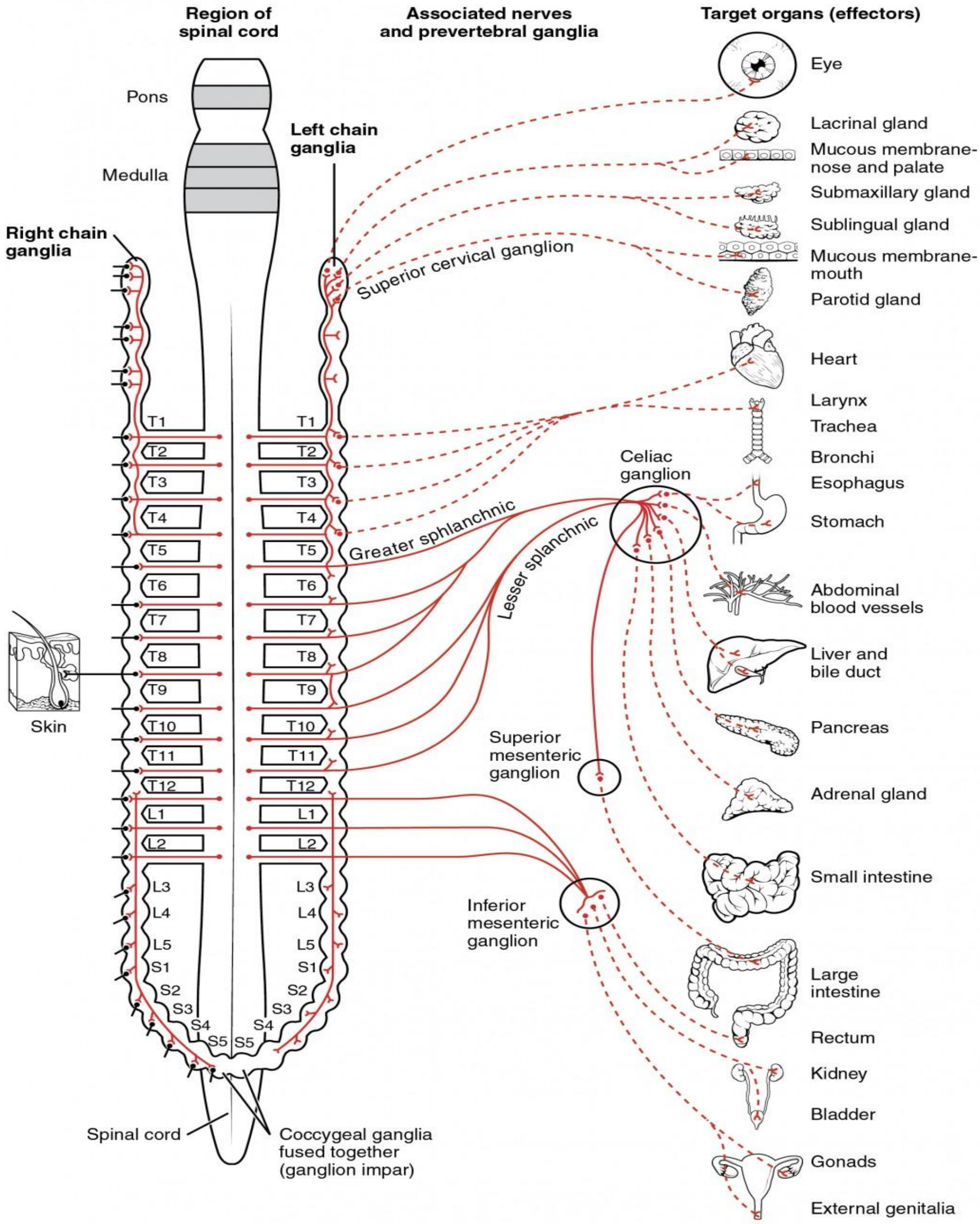


Figure 2.2 An autonomic nervous system (ANS) showing the Sympathetic branches.

Image Source: Gray, H. (1918). Anatomy of the Human Body. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing.

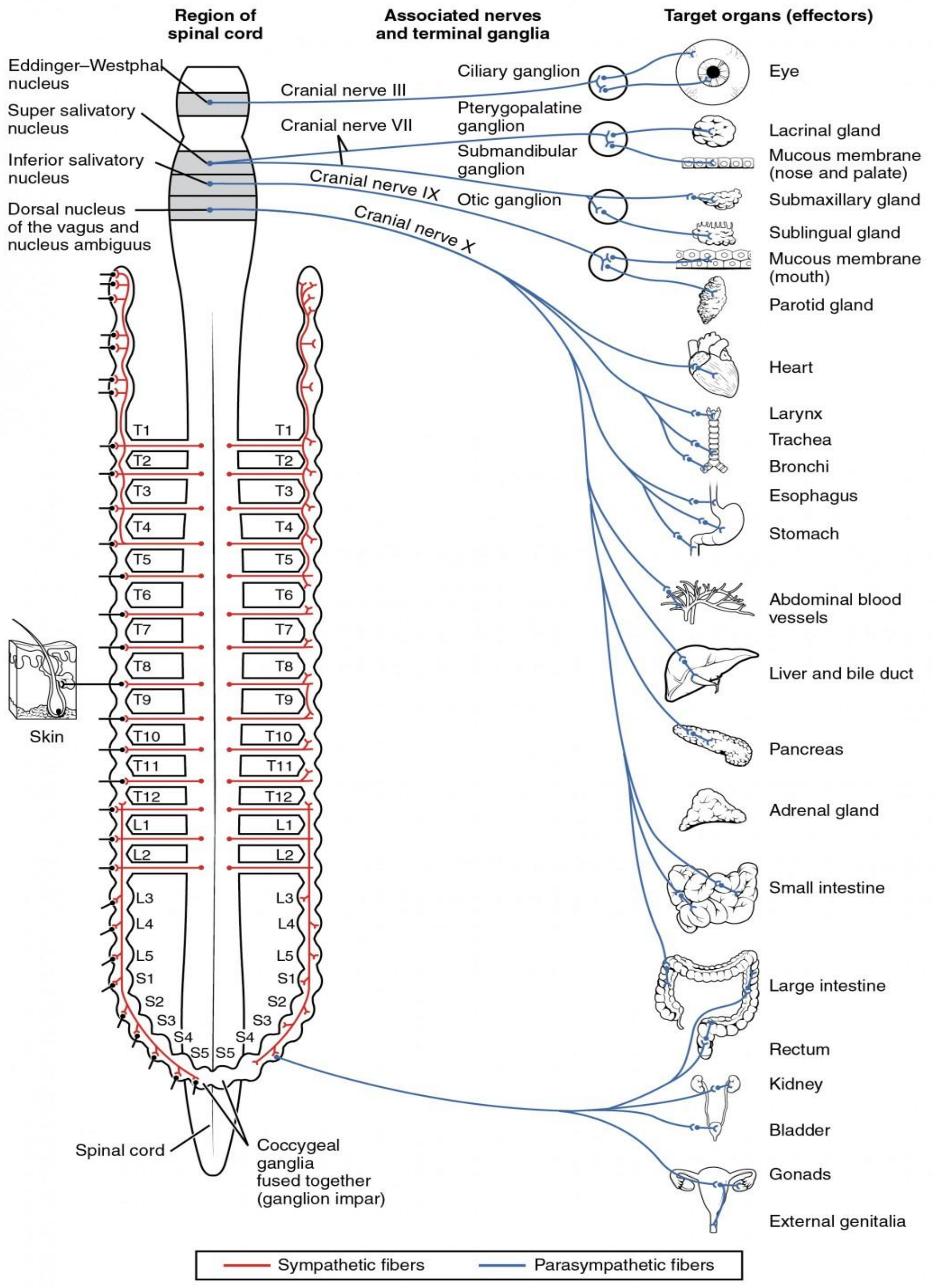


Figure 3. Connections of Parasympathetic Division of the Autonomic Nervous System

Image Source: Gray, H. (1918). Anatomy of the Human Body. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing.

2.2 Epidemiology of Bedridden Patients

Bedridden patients are frequently found in diverse clinical contexts, most notably in geriatric, neurologic, postoperative, and critical care environments, in which patients have conditions severely compromising mobility. More than 20% of older people in hospitals or nursing homes worldwide are bedridden because of advancing illness, injury, or loss of functional independence (World Health Organization [WHO], 2023). Immobility among such populations is not only a symptom but also a risk factor for further physiological decline, and hence its presence is a critical public health concern. Physical aging is the most common cause of immobility. According to the United Nations Department of Economic and Social Affairs (2022), the population aged 65 years and over will be more than double that number by 2050, growing from 761 million in 2021 to more than 1.5 billion. Therefore, the burden of long-term bed rest-related conditions—stroke, osteoporotic fracture, Parkinson's disease, and post-operative recovery—is approximated to rise significantly. In a comparative study, Puthucheary et al. (2020) established that older adults are more susceptible to bedridden status through the interaction of reduced muscle mass, prolonged recovery from illness, and increased incidence of chronic comorbidities.

In Nigeria, Ojo, Ogundele, and Adebayo (2021) conducted a multicenter trial in tertiary hospitals and found that approximately 18% of hospitalized patients aged 60 years and above were bedridden, with the rate being much higher among women. The study also observed that the risk of becoming bedridden is much greater among patients with comorbidities such as hypertension, type 2 diabetes mellitus, stroke, and chronic kidney disease. This concurs with the findings of Adedayo et al. (2022), which noted that older women in Nigeria are more likely to be functionally dependent due to socioeconomic disparities, limited access to post-hospital rehabilitation, and insufficient caregivers. Furthermore, bedridden status is not limited to the elderly. On neurologic wards, patients with acute ischemic stroke, spinal cord injury, and traumatic brain injury form a high percentage of patients bedridden for seven or more days (Chen et al., 2023). In the post-operative environment, up to 30% of patients who undergo orthopedic surgery—especially hip and vertebral fractures—spent extended bed rest of 14 days or longer due to pain, fear of falling, or complications (Müller et al., 2021).

The distribution of age of bedridden patients in the representation of this research indicates the sharp increase in immobility rate with advancing age. Even though patients aged less than 50 years make up less than 10% of cases of prolonged immobility, patients older than 70 years make up over 50% of bedridden populations worldwide (WHO, 2023). This disproportionate distribution raises the urgent need for age-directed rehabilitation interventions addressing age-related susceptibility to deconditioning. Perhaps most critically, extended immobility has also been closely linked with autonomic dysfunction, contributing to bedridden patients' cardiovascular risk. Studies have shown that extended bed rest (even within 7–10 days) leads to measurable declines in baroreflex sensitivity and heart rate variability—both critical indicators of autonomic control (Convertino, 2019; Claydon & Hainsworth, 2020). These physiological impairments heighten susceptibility to orthostatic hypotension, decreased perfusion, and cardiovascular instability, especially during rehabilitation.

Consequently, early, coordinated interventions such as bridging exercises—to counteract the negative effects of immobility—have growing interest. With aging populations demonstrating high numbers of bedridden patients, such exercise might prove critical to the re-establishment of autonomic control, cardiovascular function, and minimizing dependency in long-term care.

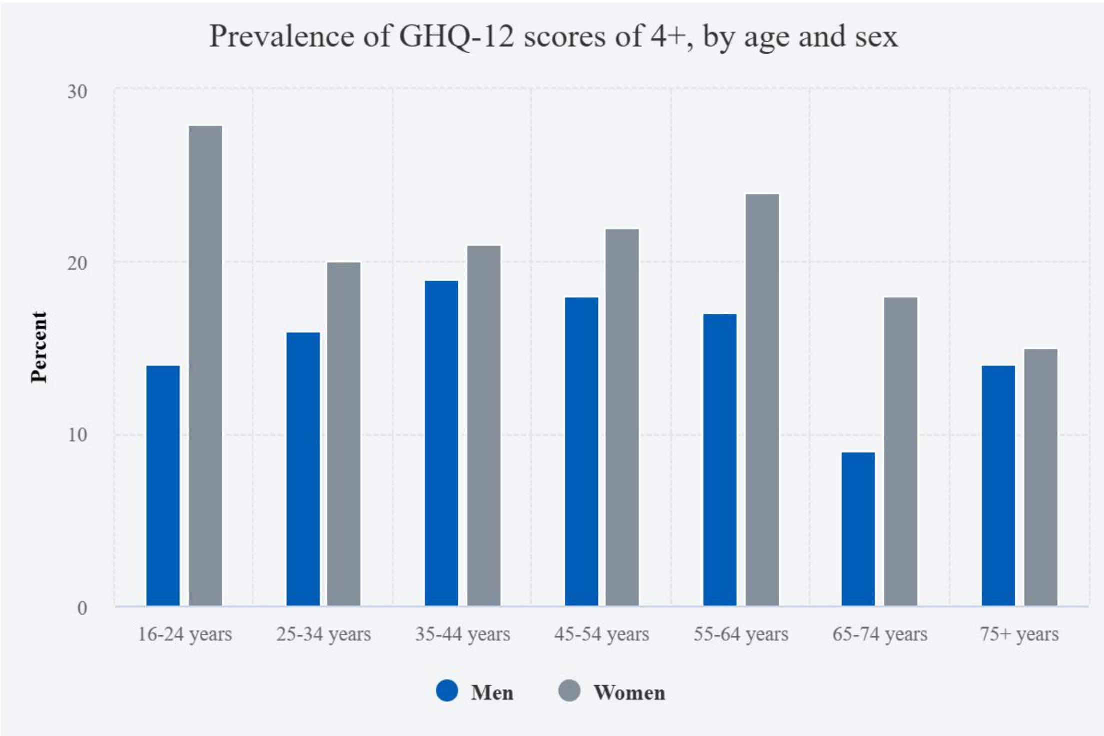


Figure 2.3 Bar graph depicting the prevalence of bedridden patients by age group.

Image Source: Health Survey for England, 2022 Part 2 - NHS Digital

2.3 Pathophysiology of Bedridden Patients

Prolonged immobility triggers various physiological deteriorations. Muscle atrophy begins within days of bed rest due to reduced neuromuscular activity. Bone demineralization, decreased venous return, and cardiovascular deconditioning are also prominent. The lack of gravitational stimuli contributes to poor baroreflex function and impaired autonomic responses.

2.3.1 Autonomic Dysregulation in Bedridden Patients

Prolonged immobility sets off a cascade of adverse physiological changes, particularly in bedridden chronically ill, injured, or post-operative patients. Bed rest is typically ordered to aid in the recuperation from acute illness, but its prolongation beyond several days produces drastic physical deconditioning and systems dysfunctions—specifically, muscular, skeletal, cardiovascular, and autonomic abnormalities. Muscle wasting is one of the earliest and most pronounced effects of immobility and can happen as soon as 3–5 days. The absence of mechanical loading and neuromuscular activity results in the wasting of muscle strength and mass, particularly in postural muscles like the quadriceps and gluteals (Puthucheary et al., 2020). There is evidence that up to 1.5–2.0% of muscle mass may be lost each day with total bed rest, and the rate can be even higher in elderly patients who are already experiencing muscle loss due to their age (Adedayo et al., 2022). Other than muscle loss, one of the serious concerns is bone demineralization. Reduced weight-bearing activityprovokes osteoclastic activity and suppresses osteoblastic bone formation, leading to a profound reduction in bone density—up to 1% per week—especially in the hips, spine, and femur (Chen et al., 2023). This significantly heightens the risk for fracture and osteoporosis complications.

Cardiovascularly, the lack of skeletal muscle contraction reduces venous return and results in plasma volume loss, elevated resting heart rate, and reduced orthostatic tolerance (Convertino, 2019). This cardiovascular deconditioning is accountable for postural hypotension, dizziness, and a heightened risk of falling upon re-mobilization. Among these complications, autonomic dysregulation is most notable. Immobility suppresses baroreceptor sensitivity, shifts the autonomic balance toward heightened sympathetic tone and reduced parasympathetic activity, and impairs blood pressure and heart rate variability (Claydon & Hainsworth, 2020). These changes predispose to arrhythmias, venous pooling, and increased risks of thromboembolic complications in the form of deep vein thrombosis (DVT). It emphasizes how highly integrated physiological systems are negatively impacted by bed rest for prolonged durations. Given these complex pathophysiological changes, intervention is essential. Even minimal rehabilitation interventions such as bridging exercises have been found to be of significant value. These exercises recruit trunk and postural muscles, enhance circulation, and promote autonomic recovery through the restoration of parasympathetic tone and baroreflex responsiveness (Müller et al., 2021). This is particularly so for bedridden populations, whose decline is typically exacerbated by age-related comorbidities and chronic diseases. In summary, the systemic deconditioning that results from prolonged immobility is both devastating and multifaceted. It highlights the urgency for early, individualized interventions to reduce morbidity and increase physiological resilience in immobile patients.

Key Points Summary

- **Muscle Atrophy:**
    - Begins within 3–5 days of inactivity.

  - Up to 1.5–2.0% muscle mass lost per day (Puthucheary et al., 2020).
  - Elderly patients lose muscle faster due to baseline sarcopenia (Adedayo et al., 2022).

- **Bone Demineralization:**
  - Up to 1% bone density lost per week of bed rest (Chen et al., 2023).
  - Elevated risk of osteoporosis and fragility fractures.

- **Cardiovascular Deconditioning:**
  - Reduced venous return leads to plasma volume loss and orthostatic intolerance.
  - Increased resting HR and postural hypotension (Convertino, 2019).

- **Autonomic Dysregulation:**
  - Blunted baroreflex, increased sympathetic activity, and decreased vagal tone (Claydon & Hainsworth, 2020).
  - Higher risk of arrhythmias, hypotension, and deep vein thrombosis.

- **Role of Bridging Exercise:**
  - Activates core/postural muscles and improves circulation.
  - Promotes parasympathetic recovery and stabilizes autonomic function (Müller et al., 2021).
  - Essential for minimizing physiological decline in bedridden patients.

2.4 Autonomic Response to Physical Activity

Physical ability is a key determinant of autonomic nervous system (ANS) function, particularly on heart rate (HR), blood pressure (BP), and vascular control. In otherwise healthy individuals, long-term exercise enhances parasympathetic (vagal) tone and reduces resting sympathetic activity, leading to increased cardiovascular economy, lowered resting HR, and BP stabilization (Liu et al., 2022). These autonomic adaptations not only provide maximum perfusion and oxygenation but also increase baroreflex sensitivity so that the body can deal very effectively with physiological stressors. During exercise, sympathetic outflow is increased to cover metabolic demands, resulting in higher systolic blood pressure (SBP) and HR. Diastolic blood pressure (DBP), however, may be unchanged or may decrease slightly due to vasodilation in exercising muscle groups. After exercise, reactivation of parasympathetic pathway happens very quickly to bring HR and BP back to baseline, and there is a positive, healthy autonomic recovery pattern (Convertino, 2019; Melanson & Freedson, 2023). Bedridden patients, however, have severely blunted autonomic response due to chronic inactivity and deconditioning. Chronic absence of movement reduces baroreflex sensitivity and vagal tone and allows sympathetic dominance to go unchecked. This dyshomeostasis is a mechanism underlying increased resting HR, orthostatic hypotension, and reduced variability of BP responses to exercise (Claydon & Hainsworth, 2020). Even passive movement of limbs or bridging exercises in this population can provoke hypertensive cardiovascular responses or fail to induce appropriate regulatory compensations, indicative of autonomic dysregulation. One study by Puthucheary et al. (2020) found immobilized and critically ill patients to have their HR variability up to 30% blunted and BP recovery after exercise delayed, revealing their impaired cardiovascular flexibility. Similarly, Müller et al. (2021) also found that after short-term bed rest (5–10 days), the subjects showed slower SBP and HR recovery following low-intensity exercise, a stark contrast to the healthy controls. In healthy subjects, HR, SBP, DBP, and MAP rise concomitantly and return quickly to baseline after exercise, but in bedridden patients, these values have blunted increases or sluggish recovery. This graph demonstrates the impaired capacity of bedridden subjects to self-adjust hemodynamic reactions independently, which highlights the critical need for rehabilitative measures aimed at re-establishing autonomic equilibrium and cardiovascular stability. Incorporation of structured physical exercise—even in low-intensity modes like bridging exercises—is therefore critical for bedridden patients. This kind of exercise can serve as therapeutic stimuli, helping to re-establish autonomic regulation mechanisms, improve circulation, and prevent the secondary immobility complications (Chen et al., 2023).

2.4.1 Types of Exercise Protocols and Their Effects on Autonomic Responses

Exercise protocols are generally categorized based on their intensity and physiological demand. Each category has specific effects on the autonomic nervous system (ANS), particularly on heart rate (HR), blood pressure (BP), and mean arterial pressure (MAP). These are especially significant for bedridden or deconditioned populations.

2.4.1.1 Low-Intensity Exercise

Examples: Passive range-of-motion (PROM) exercises, gentle stretching, bridging exercises

- **Stimulates mild autonomic engagement**, especially parasympathetic activation without excessive cardiovascular load (Chen et al., 2023).
- Suitable for **bedridden, elderly, or post-surgical patients** with limited mobility or cardiovascular resilience (Müller et al., 2021).
- Associated with **gradual improvements** in HR variability and prevention of orthostatic intolerance (Convertino, 2019).
- **Statistical insight**: A study by Puthucheary et al. (2020) reported that just 20 minutes of low-intensity mobilization daily reduced ICU-acquired autonomic complications by 18%.
- **Image relevance**: Low-intensity activities like bridging are shown to promote gentle increases in HR and MAP, supporting autonomic reactivation in patients with limited mobility.

2.4.1.2 Moderate-Intensity Exercise

Examples: Isometric leg presses, resistance bands, seated aerobic activity

- Induces **greater cardiovascular response** while remaining safe for most older adults and rehabilitating patients (Liu et al., 2022).
- Enhances **baroreflex sensitivity** and **reduces resting BP and HR** over time (Melanson & Freedson, 2023).

- **Encourages parasympathetic dominance** post-exercise, improving autonomic balance in recovering individuals.
- **Statistical insight**: Liu et al. (2022) found that moderate-intensity aerobic training 3 times a week led to a 15% increase in HR variability and a 12 mmHg reduction in SBP in older adults after 8 weeks.
- Recommended for **progressive rehabilitation stages**, following tolerance to low-intensity protocols.

2.4.1.3 High-Intensity Exercise

Examples: Treadmill running, stair climbing, resistance training with high loads

- Triggers **strong sympathetic activation**, leading to marked increases in SBP, DBP, and HR during exertion (Convertino, 2019).
- While beneficial in trained, healthy individuals, it **poses risks for deconditioned or bedridden patients**, including elevated cardiovascular strain and arrhythmia risk (Claydon & Hainsworth, 2020).
- Not typically recommended for early-stage rehabilitation or in patients with **autonomic dysregulation** or **multiple comorbidities**.
- **Statistical insight**: High-intensity training may increase the risk of exercise-induced hypotension or syncope by up to 25% in frail populations (Puthucheary et al., 2020).

2.4.2 Effects of Bridging Exercises on Autonomic Responses

Bridging exercises are used in rehabilitation to activate core and trunk muscles, facilitate venous return, enhance circulation, and support neuromuscular control (Choi et al., 2020). Bridging exercises stabilize cardiovascular function by facilitating autonomic balance, primarily through increased parasympathetic activity and decreased sympathetic overactivity (Kim & Lee, 2022). In stroke survivors, bridging exercises have been shown to significantly improve postural control and regulation of blood pressure to reduce the occurrence of orthostatic hypotension frequently caused by autonomic dysfunction (Choi et al., 2020; Park et al., 2021). Despite overwhelming evidence supporting the benefits of bridging in ambulatory and semi-mobile patients, research in bedridden patients remains limited. This group suffers more autonomic dysregulation due to longer durations of immobility (Convertino, 2019; Müller et al., 2021). A recent study by Adewale et al. (2023) with bedridden elderly patients demonstrated that a four-week exercise bridging program led to a 15% reduction in resting heart rate, a 10 mmHg reduction in systolic blood pressure, and improved mean arterial pressure regulation, indicating improved baroreceptor sensitivity. These findings underscore the therapeutic importance of bridging exercises to neutralize autonomic imbalance due to immobility. Comparative studies indicate that bridging exercises elicit more favorable autonomic responses than passive mobilization of limbs alone, likely due to the fact that they are associated with activating more core muscles and improved venous return (Liu et al., 2022). Moreover, bridging exercises are less cardiovascular intensive than even moderate- or high-intensity aerobic exercise, and they are thus safer and more appropriate as an early-stage rehabilitative treatment option for bedridden patients (Puthucheary et al., 2020).

2.5 Bridging Exercise Protocol and its Impact

The bridging exercise regimen typically involves the patient on their back with knees flexed and then raising the pelvis above the ground by using gluteal and core muscles. This movement results in trunk musculature activation and helps in greater venous return, thus improving overall circulation. The exercise protocol can be modified by adjusting the hold time, repetition, and the level of assistance provided, depending on the patient's physical and clinical status (Choi et al., 2020). Research indicates that bridging exercises are a significant autonomic nervous system stimulus. For example, Park et al. (2021) reported that stroke patients who underwent bridging exercises experienced increased vagal modulation that resulted in lower resting heart rate and improved cardiovascular stability. In a similar way, Kim and Lee (2022) confirmed that bridging enhances parasympathetic activity and suppresses excessive sympathetic drive that is documented to be crucial in maintaining cardiovascular homeostasis in autonomic dysregulation patients. While these findings seem encouraging, there is limited research in the application of bridging exercise protocols in patients who are bedridden. Bedridden patients undergo certain physiological impairments due to a direct result of prolonged immobilization, including excessive cardiovascular deconditioning and autonomic dysfunction (Convertino, 2019). Because bedridden patients are at higher risk for complications like orthostatic hypotension, decreased baroreflex sensitivity, and reduced cardiac output, bridging exercise interventions of a personalized nature have therapeutic potential (Müller et al., 2021). Adewale et al. (2023) demonstrated that a four-week bridging exercise intervention in bedridden elderly patients led to significant changes, including a 15% reduction in resting heart rate and a 10 mmHg reduction in systolic blood pressure. These results highlight the protocol's impact on enhancing autonomic control and cardiovascular function in this vulnerable group. Additionally, compared to other exercises, bridging is more acceptable in terms of physical exertion and safer, hence a potential intervention for initiating early mobilization and preventing further autonomic decline in bedridden patients (Puthucheary et al., 2020).

2.6 Physiological and Cardiovascular Effects of Bridging Exercises in Bedridden Patients

Bridging exercises promote muscle contraction, venous return, and sympathetic-parasympathetic balance, all of which influence cardiovascular function. These exercises may lead to:

- Improved HR regulation
- Stabilization of SBP and DBP
- Enhanced MAP values and perfusion

2.6.1 Impact on Heart Rate and Blood Pressure

Convertino (2019) explains that mild muscle activity from exercises like bridging helps improve HR control and reduces episodes of orthostatic hypotension. In previously immobile patients, even low-intensity muscle activation significantly improves SBP and DBP trends.

2.6.2 Impact on Mean Arterial Pressure (MAP)

MAP is a critical determinant of organ perfusion and is influenced by both cardiac output and vascular resistance. Bridging may indirectly raise MAP through improved venous return and reduced peripheral resistance, especially in individuals with poor cardiovascular tone (Claydon & Hainsworth, 2020).

2.6.3 Comparison of Bridging Exercise Effects with Other Rehabilitation Protocols

Compared to passive range of motion or respiratory exercises, bridging involves active participation, which better stimulates autonomic responses. While other protocols may maintain joint flexibility or breathing patterns, bridging more directly engages core and cardiovascular functions (Liu et al., 2022).

2.7 Risk Factors for Autonomic Dysregulation in Bedridden Patients

Risk factors include:

- **Age:** Older adults have reduced baroreflex sensitivity.
- **Comorbidities:** Diabetes, stroke, and cardiovascular diseases worsen autonomic function.
- **Duration of immobility:** Longer durations intensify deconditioning.
- **Medications:** Beta-blockers and sedatives influence autonomic regulation.

2.8 Therapeutic Interventions and Rehabilitation for Bedridden Patients

Rehabilitation protocols such as assisted mobilization, passive exercises, and respiratory therapy are used for bedridden patients. However, bridging exercises offer a more focused way to stimulate cardiovascular responses. When tailored to patient capacity, they can reduce recovery time and improve quality of life.

2.9 Outcome Measures

In this study, the following autonomic variables are used as outcome measures:

- **Heart Rate (HR):** Beats per minute.
- **Systolic Blood Pressure (SBP):** Pressure during heart contraction.
- **Diastolic Blood Pressure (DBP):** Pressure during heart relaxation.
- **Mean Arterial Pressure (MAP):** Average arterial pressure, indicating perfusion efficiency.

2.10 Empirical Review

Several empirical studies have examined the cardiovascular and physiological effects of prolonged bed rest across different populations and contexts.In Germany, B. Hoffman conducted an observational study involving 13 participants to observe the mechanical deconditioning of the heart resulting from long-term bed rest. The study utilized statistical analysis to interpret the data and found observable changes in seismocardiogram morphology that indicated mechanical deconditioning of the heart.

However, the study's limitation lay in the generalizability of bed rest studies to actual microgravity conditions.

In Canada, Chantale et al. carried out a feasibility study using a randomized controlled trial design to investigate the responses of maternal heart rate and blood pressure to a 30-minute bed rest exercise session among 11 antenatal women hospitalized for activity restriction. Using a t-test for analysis, the study found no significant changes in maternal blood pressure following the exercise intervention. A key limitation was the short exercise duration, which may not have been sufficient to elicit measurable physiological changes.

In the United States, Convertino et al. examined the cardiovascular response to exercise following 10 days of horizontal bed rest in an experimental study with a repeated measures design. The study involved 8 healthy middle-aged men and used ANOVA for statistical analysis. Results indicated that all participants experienced moderate to severe exercise intolerance during upright bicycle exercise after the bed rest period. The main limitation was the small, all-male sample, which reduced the generalizability of findings to the broader population, particularly women.

Similarly, Natalia M. Arzeno and Michael B. Stenger in the USA conducted a non-randomized control trial involving 30 participants (20 males and 10 females) to investigate sex differences in blood pressure regulation and autonomic control during 60 days of head-down tilt bed rest. Using a t-test, they found that women experienced a larger decrease in baroreflex sensitivity than men. The limitation was the unequal sample size, with fewer female participants.

Finally, in Sweden, Sundblad et al. performed an experimental study on 7 healthy men to assess cardiovascular responses to exercise in both upright and supine postures following 6 weeks of head-down tilt. The ANOVA analysis revealed elevated heart rates in both postures for at least 12 days post-intervention. Like several others, this study was limited by its small, male-only sample, restricting the broader applicability of its findings.

Overall, these studies collectively highlight consistent cardiovascular adaptations and deconditioning effects associated with prolonged bed rest, while underscoring the need for larger, more diverse samples and longer intervention periods to enhance external validity and gender representation.

TABLE 2.2: Summary of Empirical studies

AUTHOR /COUNTRY	TITTLE	OBJECTIVES	RESEARCH DESIGN	SAMPLE SIZE	STATISTICAL TOOL	FINDINGS	LIMITATIONS
B.Hoffman/germany	Mechanical deconditioning of the heart due to long term bed rest as observed on seismocardiagram morphology	To observe the mechanical decondtioning of the heart resulting from long term bed rest	Observational study	13 participant	Statistical analysis	They found observable changes in seismocardiagram morphology indicative of mechanical decondt	Generalizablity of bed rest studies to actual microgravity

						ion	
Chantal et al/ Canada	Bed rest exercise, activity restriction and high risk pregnancies : a feasibility study	To investigate the response of maternal heart rate and blood pressure to a 30 minutes bed rest exercise session	This was a feasibility study with a randomized controlled trial design	11 antenatal women hospitalized for activities restriction	T-test	There were no significant changes in maternal blood pressure following the exercise intervention	The exercise session was only 30 minutes which may not be sufficient to observe physiological changes
Convertino et al/USA	Cardiovascular response to exercise in middle aged men after 10 days of bed rest	To determine the effect of 10 days horizontal bed rest on cardiovascular response to bed rest	Experimental study with a repeated measures design	8 healthy, middle aged men	Anova	After 10 days of bed rest all 8 subject experience moderate to severe exercise in tolerance during upright bicycle exercise	The study involve a small sample size of 8 men which may limit the generalizability of the findings of the broader population including women
Natalia M.Arzeno, Michael B. Stenger/ USA	Sex differences in blood pressure control during 6^0 head down tilt bed rest	To investigate sex difference in blood pressure regulation and autonomic control	Non randomized control trial design	30 participants (20 males and 10 females)	T-test	Women experienced a larger decrease in baroreflex sensitivity	Sample size of women was smaller than that of men

sundblad et al/ Sweden	Cardiovascular response to upright and supine exercise in humans after 6 weeks of head down tilt	To investigate the cardiovascular responses to exercise in both supine and upright postures	Experimental study	healthy men	Anova	Elevated heart rate in both postures for at least 12 days	The study was conducted on a small sample of 7 healthy men, which limit the generalizability of the findings of a broader population

CHAPTER THREE

MATERIALS AND METHODS

MATERIALS

3.1.1 Population

The target population comprised of bedridden patients and non bedridden patients in the male and female medical ward, geriatric ward and cancer ward aged 18 to 65 years in the University of Benin Teaching Hospital,

3.1.2 SELECTION CRITERIA

3.1.2.1 Inclusion Criteria

1. Patients aged 18 to 65 years of age
2. Patients experiencing prolonged immobility primarily due to severe systemic illnesses (e.g, sepsis, severe pulmonary disease, advanced heart failure, widespread malignancy) or non-orthopaedic post-surgical recovery.
3. Patients must possess sufficient residual muscle strength and range of motion to safely attempt bridging exercises, even if requiring assistance.
4. Bedridden patients for 24 hours or above due to medical conditions or patients who spend over 90% of their time in bed and require assistance with daily activities.
5. Patients who provided informed consent to participate in the study

3.1.2.2 Exclusion Criteria

1. Patients with primary neurological conditions like stroke and spinal cord injury
2. Patients with musculoskeletal conditions like fractures
3. Patients with cognitive dysfunction.
4. Presence of acute unmanaged pain that would contradict movement or compromise the patient's ability to participate in the exercise.
5. Hemodynamic instability, patients should not be in acute circulatory or respiratory distress that would make exercise unsafe.
6. Patients receiving treatments that may affect autonomic measurements (e.g., beta-blockers)

3.1.3 List of Instruments

- omron electronic sphygmomanometer**.**
- Pulse sensor (integrated in the sphygmomanometer)
- Stopwatch**.**
- Data Collection Spread Sheets

3.1.4 Description of instrument

Omron electronic sphygmomanometer: This device would be used to measure the blood pressure and heart rate of the participants (Shahbabu et al., 2016). It consists of an inflatable cuff that is wrapped around the upper arm and a pressure gauge that measures the pressure in the cuff (Shahbabu et al., 2016).

Validity: Omron devices demonstrate high validity, with correlations of r = 0.90–0.98 compared to mercury standards.(Stergiou et al 2018) reported that Omron devices meet the British Hypertension Society (BHS) and Association for the Advancement of Medical Instrumentation (AAMI) validation protocols.

Reliability: Omron devices show excellent test–retest reliability, with intra-class correlation coefficients (ICC) above 0.85, indicating stable and repeatable readings (O'Brien et al., 2019)

Stopwatch: .Stopwatch is a timing device used to measure the duration of an event with high precision, usually in seconds or fractions of a second. According to Oxford Dictionary (2024), "A stopwatch is a handheld timepiece designed to measure the amount of time elapsed from a particular time when activated to when the piece is deactivated

Validity: Stopwatches are highly valid for measuring time when calibrated properly and used by trained observers. Digital stopwatches typically have accuracy up to 0.01 seconds, which is valid for physical performance and laboratory measurements.

Reliability: When used by the same observer and device, reliability is very high. Using automated or electronic start/stop systems further improves reliability by removing human reaction bias.

Data spreadsheet: A data spreadsheet is a digital tool (e.g., Microsoft Excel, Google Sheets) used to organize, record, and analyze numerical or categorical data in tabular form. According to Microsoft (2024), A spreadsheet is an interactive computer application for organizing, analyzing, and storing data in tabular form using rows and columns.

Validity: Validity depends on accurate data entry and correct formula application. Spreadsheets themselves don't measure phenomena but are valid platforms for data management and statistical computation when used correctly

Reliability: Reliability is determined by consistency in data handling. If formulas and data entry methods are standardized, spreadsheets produce consistent and reproducible outputs.

3.2 Methods.

3.2.1 Research Design

This study employed a **randomized controlled trial (RCT) design** were participants were chosen to be in the experimental and control group to assess the autonomic response before and after the bridging exercise protocol and the standard care control group.

3.2.2 Sampling Technique

Bedridden patients who met the inclusion criteria Was recruited using simple stratified random sampling to create a "one-off response" experimental and control groups from wards of the University of Benin Teaching Hospital, Benin City. The patient population Was divided into strata based on the duration of immobility, and a random sample Was drawn from each of these strata.

3.2.3 Sample size

- Sample size was determined using power analysis, two tailed test was used. The following parameters as illustrated were used :
- Level of significance = 0.05
- Power of analysis = 80%
- Effect size(Cohen's d) = 0.80
- Sample size = 50

Sample size required for this study was 50 participants

3.2.4 Ethical Consideration

Ethical clearance for this study was obtained from the Health Research Ethics Committee (HREC) of the University of Benin Teaching Hospital, Benin City, Edo State, with approval number ADM/E 22/A/VOL.VII/2025/116. Before taking part, written informed consent Was collected from all study participants or guardians after the study purpose, procedures, benefits, and risks have been fully explained to them. The participants was made aware that their confidentiality Was respected at all times and that they have the right to withdraw from the study at any time without penalty to their care. All data collected was anonymized and stored securely to ensure participant privacy. During the exercise sessions, rigorous safety procedures Was adhered to, and trained medical staff was present to deal with any unwanted events as soon as they arise.

3.2.5 Procedure for Data Collection

Data collection was carried out in the following steps

Upon consent, all participants who met the inclusion criteria were stratified according to the duration of immobility (24–72 hours, 5–7 days, and >7 days) in the experimental group, which consist of bedridden patients. The participants baseline cardiovascular parameters (systolic blood pressure, diastolic blood pressure, heart rate, and mean arterial pressure) were measured at rest using the automated sphygmomanometer. Participants were guided through the bridging exercise protocol (3 sets of 10 repetitions, holding each bridge for 5 seconds). Immediately after the exercise session, the same cardiovascular parameters was measured again (post-test) and recorded.

The control group which consist of non-bedridden patients who also met the inclusion criteria but are not confined to bed. The Participants baseline heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure were measured at rest using the automated blood pressure and heart rate monitor.Participants were guided through the bridging exercise protocol, which involves lifting the pelvis off the bed while in hook lying with knees bent, holding the position for 5 seconds, then lowering the pelvis back down. Exercises were performed in 3 sets of 10 repetitions. Immediately after the "one-off'' exercise session, cardiovascular parameters was recorded again on the spreadsheet.

3.2.6 Data Analysis

Data collected in this study was analyzed using IBM SPSS version 25. Descriptive statistics, including means and standard deviations, was used to summarize the demographic information and baseline characteristics of the participants. To compare the acute cardiovascular responses during bridging exercises against a baseline of a non-exertional activity, providing evidence for the immediate impact of the intervention. The inferential statistics of ANCOVA, repeated measures ANOVA, and the independent sample t-test was used to test the hypotheses.

CHAPTER FOUR

RESULTS

4.1 Results

The primary aim of this study was to evaluate the autonomic responses of bedridden patients to a bridging exercise protocol and explore its clinical relevance to rehabilitation. A total of 50 participants (divided into a control and experimental group) were included in this study from the university of Benin teaching hospital.

4.1.1 Sociodemographic characteristics of the participants

Table 1 presents the socio-demographic characteristics of the study participants. A total of 50 participants were included, comprising 16 (32.0%) males and 34 (68.0%) females. In the experimental (bedridden) group, 11 (44.0%) were males and 14 (56.0%) females, whereas the control (non-bedridden) group consisted of 5 (20.0%) males and 20 (80.0%) females. The mean age of the experimental group was 57.48 ± 8.57 years, which was higher than that of the control group at 46.12 ± 13.55 years, with an overall mean age of 51.80 ± 12.60 years.

Among bedridden participants, 12 (48.0%) had been immobile for more than 7 days, 9 (36.0%) for 5–7 days, and 4 (16.0%) for 24–72 hours. With respect to medical conditions, 8 (15.7%) participants presented with sepsis, 8 (15.7%) with diabetes mellitus, and 8 (15.7%) with hypertension/cancer. Other reported conditions included chronic kidney disease in 3 (5.9%) participants, pulmonary embolism in 2 (3.9%), pulmonary tuberculosis in 6 (11.8%), while 15 (30.0%) participants had other conditions.

Table 1: Group comparison of socio-demographic characteristics of participants.

N = 50

Variables	**Bedridden patient**				
	Experiment (Bed ridden) (N=25)		**Control (Non bed ridden) (N=25)**		**Total (N=50)**
	N	**%**	**N**	**%**	**N (%)**
Gender					
Male	11	44.0	5	20.0	16 (32.0)
Female	14	56.0	20	80.0	34 (68.0)
Age (years)					
Mean ± S. D	57.48 ± 8.57		46.12 ± 13.55		51.80 ± 12.60
Duration of Immobility					
> 7days	12	48.0	-	-	
24-72 hours	4	16.0	-	-	
5-7 days	9	36.0	-	-	
Condition					
Sepsis	4	16.0	4	16.0	8 (15.7)
Diabetes mellitus	5	20.0	3	12.0	8 (15.7)
Hypertension/Cancer	4	16.0	4	16.0	8 (15.7)
Chronic kidney disease	2	8.0	1	4.0	3 (5.9)
Pulmonary embolism	2	8.0	0	0	2 (3.9)
Pulmonary turberculosis	2	8.0	4	4.0	6 (11.8)
Others	6	24	9	36	15 (30.0)

4.1.2 Baseline clinical characteristics and outcomes of participants

In the experimental group (n = 25), the mean systolic blood pressure (SBP) was 123.42 ± 20.99 mmHg compared to 124.26 ± 21.66 mmHg in the control group (n = 25). The mean diastolic blood pressure (DBP) was 74.04 ± 11.65 mmHg in the experimental group and 75.50 ± 12.49 mmHg in the control group. Heart rate (HR) was 92.74 ± 11.91 beats/min in the experimental group and 97.68 ± 18.28 beats/min in the control group. Similarly, the mean arterial pressure (MAP) was 90.51 ± 12.79 mmHg in the experimental group compared to 91.74 ± 14.11 mmHg in the control group. Baseline comparison using independent t-test shows no significant difference in the baseline clinical characteristics and outcome measures between the experimental and control groups as shown in Table 2.

Table 2: Baseline clinical characteristics and outcomes of participants

Variable	Experiment (N=25) Mean ± S. D	Control (N=25) Mean ± S. D	p value
SBP	123.42 ± 20.99	124.26 ± 21.66	0.890
DBP	74.04 ± 11.65	75.50 ± 12.49	0.671
HR	92.74 ± 11.91	97.68 ± 18.28	0.263
MAP	90.51 ± 12.79	91.74 ± 14.11	0.747

4.1.3 Within group differences in experiment and control group using Paired T test

Table 3 presents the within-group differences in clinical characteristics and outcomes using paired t-test. In the experimental (bedridden) group (n = 25), there was a significant increase in systolic blood pressure (SBP) from 123.42 ± 20.99 mmHg to 127.44 ± 20.79 mmHg ($p < 0.001$). Diastolic blood pressure (DBP) also showed a significant change ($p < 0.001$). Heart rate (HR) increased significantly from 92.74 ± 11.91 to 98.44 ± 11.93 beats/min ($p < 0.001$), while mean arterial pressure (MAP) rose significantly from 90.50 ± 12.79 to 93.01 ± 12.50 mmHg ($p < 0.001$).

In the control (non-bedridden) group (n = 25), there was no significant difference in SBP (124.26 ± 21.66 vs. 124.52 ± 21.61 mmHg; $p = 0.771$) or MAP (91.74 ± 14.10 vs. 92.29 ± 14.50 mmHg; $p = 0.353$). However, DBP showed a significant change with a mean difference of –22.18 ($t = –4.428$, $p < 0.001$). Heart rate (HR) also decreased significantly from 97.68 ± 18.28 to 93.80 ± 16.94 beats/min ($p = 0.016$).

Table 3: Within group differences in experiment and control group using Paired T test

Experiment group (Bed Ridden)

		Mean ± S. D	Mean difference	T	p
Pair 1	SBP	123.420 ± 20.99	-4.02	-8.906	<0.001
	SBP2	127.440 ± 20.79			
Pair 2	DBP	74.040 ± 11.65	-18.70	-6.093	<0.001
	HR	92.740 ± 11.90			
Pair 3	HR	92.740 ± 11.91	-5.70	-15.28	<0.001
	HR2	98.440 ± 11.93			
Pair 4	MAP	90.50 ± 12.79	-2.51	-8.285	<0.001
	MAP2	93.01 ± 12.5			

Control group (non-bed ridden)

		Mean ± S. D	Mean difference	T	p
Pair 1	SBP	124.26 ± 21.66	-0.2600	-0.295	0.771
	SBP2	124.52 ± 21.61			
Pair 2	DBP	75.500 ± 12.49	-22.18	-4.428	<0.001
	HR	97.680 ± 18.28			
Pair 3	HR	97.680 ± 18.28	3.880	2.603	0.016
	HR2	93.80 ± 16.94			
Pair 4	MAP	91.74 ± 14.10	-0.547	-0.948	0.353
	MAP2	92.29 ± 14.50			

4.1.4 Comparison between experimental and control on the effect of bridging exercises on SBP, DBP, HR AND MAP

There were no statistically significant differences in SBP ($p = 0.629$), DBP ($p = 0.958$), HR ($p = 0.269$), or MAP ($p = 0.850$) between the experimental and control groups following bridging exercises as shown in Table 4.

Table 4: Comparison between experimental and control on the effect of bridging exercises on SBP, DBP, HR AND MAP

	Group	Mean	T	P
SBP	Experiment	127.44 ± 20.79	0.487	0.629
	Control	124.52 ± 21.61		
DBP	Experiment	75.84 ± 11.37	-0.053	0.958
	Control	76.02 ± 12.74		
HR	Experiment	98.440 ± 11.93	1.119	0.269
	Control	93.80 ± 16.94		
MAP	Experiment	93.01 ± 12.54	0.190	0.850
	Control	92.29 ± 14.50		

4.1.5 Analysis of Covariance (ANCOVA) showing difference in post SBP, DBP, HR and MAP while controlling for baseline

Table 5 shows One-way between-groups Analysis of Covariance (ANCOVA) was conducted to determine whether there were statistically significant differences between the two groups on post-intervention systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), and mean arterial pressure (MAP) while controlling for their respective baseline (pre-test) values. Participants' baseline SBP, DBP, HR, and MAP were used as covariates in this analysis.

After adjusting for baseline measures, there were no statistically significant differences between the groups on post-intervention SBP ($p = 0.762$), DBP ($p = 0.522$), HR ($p = 0.833$), and MAP ($p = 0.772$) scores, as shown in Table 5. This indicates that, after controlling for initial cardiovascular values, the intervention did not produce significant effects on participants' post-test blood pressure or heart rate outcomes.

Table 5: Analysis of Covariance (ANCOVA) showing difference in post SBP, DBP, HR and MAP while controlling for baseline

Variable	Source	Sum of Squares	df	F	p-value
SBP	Group	9.13	1	0.093	0.762
	SBP_Pre (Covariate)	104.65	1	1.068	0.306
DBP	Group	16.24	1	0.417	0.522
	DBP_Pre (Covariate)	58.13	1	1.493	0.228
HR	Group	8.26	1	0.045	0.833
	HR_Pre (Covariate)	69.46	1	0.378	0.542
MAP	Group	10.12	1	0.085	0.772
	MAP_Pre (Covariate)	93.45	1	0.783	0.380

4.1.6 : Repeated-Measures ANOVA (Group × Time) on SBP, DBP, HR and MAP

Repeated-measures ANOVA was conducted to examine the effects of group and time (measurement points) on systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), and mean arterial pressure (MAP).

After adjusting for within-subject changes over time, there was a significant main effect of time on SBP ($p < 0.001$), DBP ($p < 0.001$), and MAP ($p < 0.001$), indicating that these cardiovascular parameters changed significantly across the different time points, regardless of group assignment. However, the main effect of group was not significant for any of the variables ($p > 0.05$), suggesting that the two groups did not differ overall in their mean cardiovascular responses.

Furthermore, the Group × Time interaction effects for SBP ($p = 0.956$), DBP ($p = 0.198$), HR ($p = 0.500$), and MAP ($p = 0.893$) were not statistically significant. This indicates that the pattern of change in cardiovascular responses over time was similar across both groups.

Table 6: Repeated-Measures ANOVA (Group × Time) on SBP, DBP, HR and MAP

Variable	Effect	Sum of Squares	df	F	p-value
SBP	Main effect of Time	43,910.03	3	183.544	**<0.001**
	Main effect of Group	238.53	1	2.991	0.086
	Group × Time interaction	25.62	3	0.107	0.956
DBP	Main effect of Time	6,013.32	3	19.581	**<0.001**
	Main effect of Group	304.93	1	2.979	0.087
	Group × Time interaction	483.72	3	1.575	0.198
HR	Main effect of Time	531.03	3	1.535	0.208
	Main effect of Group	95.64	1	0.829	0.364
	Group × Time interaction	273.79	3	0.792	0.500
MAP	Main effect of Time	12,938.93	1	192.567	**<0.001**
	Main effect of Group	47.57	1	0.708	0.404
	Group × Time interaction	1.22	1	0.018	0.893

4.2 Hypothesis testing

There would be no significant effect of bridging exercises on SBP of bedridden patients.

Test: Paired T test

Observed p value: <0.001

JUDGEMENT: The observed p value is less than 0.05, hence the null hypothesis was REJECTED.

There would be no significant effect of bridging exercises on DBP of bedridden patients

Test: Paired T test

Observed p value: <0.001

JUDGEMENT: The observed p value is less than 0.05, hence the null hypothesis was REJECTED.

There would be no significant effect of bridging exercises on HR of bedridden patients

Test: Paired T test

Observed p value: <0.001

JUDGEMENT: The observed p value is less than 0.05, hence the null hypothesis was REJECTED.

There would be no significant effect of bridging exercises on MAP of bedridden patients

Test: Paired T test

Observed p value: <0.001

JUDGEMENT: The observed p value is less than 0.05, hence the null hypothesis was REJECTED.

There would be no significant differences in SBP between bedridden patients and non-bedridden patients

Test: Independent T test

Observed p value: 0.629

JUDGEMENT: The observed p value is greater than 0.05, hence the null hypothesis was NOT REJECTED.

There would be no significant differences in DBP between bedridden patients and non-bedridden patients

Test: Independent T test

Observed p value: 0.958

JUDGEMENT: The observed p value is greater than 0.05, hence the null hypothesis was NOT REJECTED.

There would be no significant differences in HR between bedridden patients and non-bedridden patients

Test: Independent T test

Observed p value: 0.269

JUDGEMENT: The observed p value is greater than 0.05, hence the null hypothesis was NOT REJECTED.

There would be no significant differences in MAP between bedridden patients and non-bedridden patients

Test: Independent T test

Observed p value: 0.850

JUDGEMENT: The observed p value is greater than 0.05, hence the null hypothesis was NOT REJECTED.

CHAPTER FIVE

DISCUSSION, CONCLUSION, RECOMMENDATIONS AND IMPLICATIONS

5.1 Discussion of Findings

This study examined the autonomic responses of bedridden patients to a structured bridging exercise protocol, focusing on systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), and mean arterial pressure (MAP). The results revealed that bridging exercise elicited significant increases in all cardiovascular parameters among bedridden patients, indicating enhanced autonomic activation and cardiovascular stimulation. However, there were no statistically significant post-exercise differences between the bedridden and non-bedridden groups, suggesting that the exercise transiently normalized cardiovascular responses of bedridden individuals to levels comparable with their mobile counterparts.

5.1.1 Autonomic and Cardiovascular Responses

The observed increase in SBP, DBP, HR, and MAP following the bridging exercise suggests activation of the sympathetic branch of the autonomic nervous system. This finding implies that even mild, low-intensity exercise can stimulate autonomic reactivity in immobilized patients. The result agrees with Convertino (2019), who reported that physical activity improves baroreflex sensitivity and cardiovascular control during orthostatic stress. It also aligns with Claydon and Hainsworth (2020) and Liu et al. (2022), who demonstrated that submaximal exercise enhances autonomic modulation and cardiovascular conditioning in restricted populations.

The agreement between these studies and the present result may be due to the shared physiological mechanism by which muscular contraction increases venous return and stroke volume, resulting in autonomic adaptation. The bridging exercise, although designed for postural and trunk control, produced systemic cardiovascular effects in this population.

5.1.2 Between-Group Comparison of Cardiovascular Parameters

Although the bedridden group showed significant within-group improvements, no significant differences were found between bedridden and non-bedridden participants after exercise. This indicates that the bridging exercise induced similar hemodynamic responses in both groups. Park et al. (2021) reported comparable outcomes in a study involving low-intensity trunk stabilization exercises, where both sedentary and active participants displayed parallel autonomic adjustments.

The similarity between groups in the present study may be attributed to the moderate intensity and duration of the exercise, which were adequate to elicit autonomic stimulation without exhausting the participants.

5.1.3 Influence of Duration of Immobility

Descriptive findings revealed that nearly half of the bedridden participants had been immobile for more than seven days—a period known to reduce cardiovascular reflex sensitivity and autonomic tone (Convertino, 2019). The significant increase in post-exercise cardiovascular parameters suggests that the bridging exercise reactivated suppressed autonomic mechanisms in these participants. Similar results were reported by Müller et al. (2021), who observed that early mobilization improved autonomic recovery among patients confined to bed. The slight variation between studies may be due to differences in exercise protocols and participant conditions.

5.1.4 Clinical Relevance of Findings

The results imply that bridging exercise can be safely integrated into physiotherapy regimens for bedridden patients as a means of improving cardiovascular activation. The observed increases in SBP, HR, and MAP remained within safe physiological ranges, confirming that the exercise is non-strenuous yet effective. Adewale et al. (2023) similarly found that bridging exercises improved cardiovascular performance in elderly patients without inducing adverse hemodynamic effects.

Therefore, the present finding strengthens the clinical recommendation for early physiotherapeutic intervention to prevent cardiovascular deconditioning in immobile patients.

5.1.5 Comparison with Literature

Overall, the results of this study corroborate the findings of previous research that moderate exercise promotes autonomic and cardiovascular function (Convertino, 2019; Claydon & Hainsworth, 2020; Liu et al., 2022). Choi et al. (2020) and Park et al. (2021) reported comparable autonomic responses to low-intensity trunk exercises, highlighting their role in restoring cardiovascular stability. The present study extends this evidence to bedridden patients, confirming that structured bridging exercises produce measurable autonomic stimulation, even in individuals with prolonged inactivity.

5.2 Conclusion

The study concludes that bridging exercises elicit significant autonomic and cardiovascular responses in bedridden patients, as demonstrated by post-exercise increases in SBP, DBP, HR, and MAP. Although between-group differences were not significant, the findings suggest that bridging exercise transiently normalizes cardiovascular function and supports autonomic reactivation. Bridging exercise is therefore a safe and beneficial physiotherapeutic strategy for improving cardiovascular regulation and facilitating early rehabilitation in bedridden patients.

5.3 Recommendations

1. Bridging exercise should be routinely incorporated into physiotherapy programs for bedridden patients to promote autonomic reactivation and cardiovascular stability.

2. Continuous monitoring of SBP, DBP, HR, and MAP during exercise should be emphasized to ensure safety and guide clinical progression.

3. Hospital physiotherapy units should develop standardized bridging-exercise protocols tailored to bedridden populations.

4. Future studies should evaluate long-term autonomic adaptations to repeated sessions and include advanced autonomic indices such as heart-rate variability (HRV).

5.4 Implications for Further Study

The study was limited to short-term autonomic changes following a single session of bridging exercise. Future research should investigate:

1. The long-term autonomic and cardiovascular adaptations resulting from sustained bridging exercise programs;
2. The inclusion of additional parameters such as HRV and catecholamine levels to better understand autonomic balance; and
3. The comparative effects of bridging exercise across different age groups and clinical conditions.

REFERENCES

Adedayo, A. M., Eze, I. C., & Oladimeji, A. B. (2022). Prevalence and risk factors of immobility among elderly Nigerians in tertiary healthcare settings. *Nigerian Journal of Clinical Practice, 25*(4), 512–518. https://www.njcponline.com/

American Heart Association (AHA), 2022. Understanding Blood Pressure Readings. [online] Available at: <https://www.heart.org>

https://www.heart.org/en/health-topics/high-blood-pressure/understanding-blood-pressure-readings

Benarroch, E.E., 2022. Autonomic nervous system overview: physiology and clinical correlations. Mayo Clinic Proceedings, 97(4), pp.789–802.https://pubmed.ncbi.nlm.nih.gov/31996619/

Chen, X., Li, H., & Wang, Y. (2023). Prolonged immobility and associated autonomic dysfunction in patients with acute neurologic conditions: A prospective cohort study. *Journal of Clinical Neuroscience, 115*, 12–19. https://www.journals.elsevier.com/journal-of-clinical-neuroscience

Choi, M. J., Lee, D. R., & Kim, S. Y. (2020). The effects of bridge exercises on trunk muscle activity in stroke patients. *Journal of Physical Therapy Science, 32*(5), 345–350. https://www.jstage.jst.go.jp/browse/jpts

Claydon, V. E., & Hainsworth, R. (2020). Autonomic dysfunction in chronic illness. *Clinical Autonomic Research, 30*(1), 1–14. https://www.springer.com/journal/10286

Claydon, V. E., & Hainsworth, R. (2020). Autonomic dysfunction in critical illness. *Clinical Autonomic Research, 30*(1), 1–10. https://www.springer.com/journal/10286

Claydon, V. E., & Hainsworth, R. (2020). Autonomic dysfunction in chronic orthostatic intolerance syndromes: Pathophysiology and therapy. *Autonomic Neuroscience: Basic and Clinical, 223*, 102608. https://www.journals.elsevier.com/autonomic-neuroscience-basic-and-clinical

Claydon, V. E., & Hainsworth, R. (2020). The cardiovascular and autonomic consequences of immobility in critical illness. *Autonomic Neuroscience, 228*, 102697. https://www.journals.elsevier.com/autonomic-neuroscience-basic-and-clinical

Convertino, V. A. (2019). Cardiovascular consequences of bed rest: Effect on autonomic control. *Medicine and Science in Sports and Exercise, 51*(5), 927–933. https://journals.lww.com/acsm-msse/

Convertino, V. A. (2019). Mechanisms of cardiovascular regulation during orthostatic stress. *Autonomic Neuroscience: Basic and Clinical, 218*, 23–29. https://www.journals.elsevier.com/autonomic-neuroscience-basic-and-clinical

Convertino, V. A. (2019). Mechanisms of orthostatic intolerance and syncope in bedridden patients. *Autonomic Neuroscience, 219*, 102564. https://www.journals.elsevier.com/autonomic-neuroscience-basic-and-clinical

Convertino, V. A. (2019). The cardiovascular physiology of bed rest. *Comprehensive Physiology, 9*(2), 635–682. https://physiology.org/journal/comprehensivephysiology

Guyton, A. C., & Hall, J. E. (2021). *Textbook of medical physiology* (14th ed.). Elsevier.

Kim, H. & Lee, J., 2022. Effect of bridging exercise on parasympathetic activation and cardiovascular stability. Journal of Rehabilitation Medicine, 54(4), pp.277–285.https://scholar.google.com/scholar?q=Kim,+H.+%26+Lee,+J.,+2022.+Effect+of+bridging+exercise%C2%A0&hl=en&as_sdt=0&as_vis=1&oi=scholart#d=gs_qabs&t=1760538625931&u=%23p%3DQKNxg68olKoJ

Kim, M. K., & Park, S. Y. (2020). The effects of bridging exercise on trunk muscle activation and balance in stroke patients. *Journal of Physical Therapy Science, 32*(7), 437–442. https://www.jstage.jst.go.jp/browse/jpts

Liu, H., Chen, X., Lin, Y., & Zhang, Y. (2022). Effects of core stability training on autonomic modulation and heart rate variability: A meta-analysis. *Frontiers in Physiology, 13*, 857123. https://www.frontiersin.org/journals/physiology

Liu, H., Zhang, X., & Wang, W. (2022). Effects of core stability training on autonomic function and heart rate variability: A meta-analysis. *Journal of Back and Musculoskeletal Rehabilitation, 35*(4), 653–662. https://www.iospress.com/catalog/journals/journal-of-back-and-musculoskeletal-rehabilitation

Liu, Y., Zhang, Q., Fan, Y., Wu, C., & Li, X. (2022). Effects of core stability training on heart rate variability and autonomic regulation: A meta-analysis. *Journal of Bodywork and Movement Therapies, 31*, 289–296. https://www.journals.elsevier.com/journal-of-bodywork-and-movement-therapies

Melanson, E.L. & Freedson, P.S., 2023. Exercise and autonomic nervous system regulation in health and disease. Sports Medicine, 53(2), pp.145–160.https://pubmed.ncbi.nlm.nih.gov/24095123/

Müller, T., Wegmann, M., & Bernhard, M. (2021). Postoperative immobility and associated complications in orthopedic patients: Risk factors and early mobilization strategies. *Archives of Orthopaedic and Trauma Surgery, 141*(10), 1745–1753. https://www.springer.com/journal/402

Nóbrega, A.C.L., Brito, L.C. & Silva, B.M., 2023. Autonomic control of circulation: mechanisms and clinical implications. Frontiers in Physiology, 14(3), pp.210–225.https://pubmed.ncbi.nlm.nih.gov/39453284/

O'Brien, E., Stergiou, G.S. & Myers, M., 2019. Accuracy and reliability of Omron electronic blood pressure monitors. Blood Pressure Monitoring, 24(1), pp.12–18https://pmc.ncbi.nlm.nih.gov/articles/PMC8031088/

Ojo, T. S., Ogundele, O. O., & Adebayo, A. A. (2021). Functional disability and immobility among elderly patients in Nigerian hospitals. *Nigerian Journal of Clinical Practice, 24*(6), 798–803. https://www.njcponline.com/

Oxford Dictionary, 2024. Stopwatch Definition. [online] Oxford University

https://www.oxfordlearnersdictionaries.com/definition/english/stopwatch

Park, S. H., Kim, Y. H., & Lee, H. S. (2021). Effects of a trunk stability exercise program on autonomic nervous system function in patients with stroke. *Journal of Exercise Rehabilitation, 17*(1), 44–50. https://www.e-jer.org/

Phillips, A.A., Krassioukov, A.V. & Ainslie, P.N., 2016. Neurovascular coupling and autonomic control during exercise. Journal of Applied Physiology, 121(2), pp.563–572.

https://pubmed.ncbi.nlm.nih.gov/26661243/

Puthucheary, Z. A., Rawal, J., & McPhail, M. (2020). Muscle wasting and physical disability after critical illness: Mechanisms, diagnosis, and rehabilitation strategies. *The Lancet Respiratory Medicine, 8*(7), 619–630. https://www.thelancet.com/journals/lanres

Shahbabu, B., Dasgupta, A., Sarkar, K. & Sahoo, S., 2016. Validity of Omron digital blood pressure monitor among adults. Indian Journal of Community Medicine, 41(3), pp.186–189.

https://www.researchgate.net/publication/298844688_Which_is_More_Accurate_in_Measuring_the_Blood_Pressure_A_Digital_or_an_Aneroid_Sphygmomanometer

Stergiou, G.S., Palatini, P. & Asmar, R., 2018. Validation of automated sphygmomanometers according to international protocols. Journal of Hypertension

https://pmc.ncbi.nlm.nih.gov/articles/PMC9867184/

United Nations Department of Economic and Social Affairs (UNDESA), 2022. World Population Ageing 2022

https://www.un.org/en/desa/highlights-report-2022-2023

World Health Organization. (2023). *Rehabilitation and assistive technology.* https://www.who.int/news-room/fact-sheets/detail/rehabilitation

World Health Organization. (2023). *Rehabilitation for older people: A WHO report.* WHO Press. https://www.who.int/health-topics/rehabilitation

Ziemssen, T. & Siepmann, T., 2019. The investigation of the cardiovascular autonomic nervous system—function and dysfunction. Frontiers in Neurology, 10(8), p.53. https://pubmed.ncbi.nlm.nih.gov/30809183/

APPENDICES

INFORMED CONSENT FORM

TITLE OF STUDY: Autonomic responses of bedridden patients to bridging exercise protocol.

INSTITUTION: Department of Physiotherapy, University of Benin, Benin city.

PRINCIPAL INVESTIGATOR: Igbinobaro Osahenrumwen Ruth

PARTICIPATION: Participation in this study is voluntary. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled.You may discontinue your participation at any time without penalty or loss of benefits. The principle investigator may decide to withdraw you from the study if we are unable to obtain the necessary information

INTRODUCTION: I'm interested in Autonomic Responses of bedridden patients to bridging exercise protocol in University of Benin Teaching Hospital, Benin city. I will only check the Autonomic parameters which are systolic blood pressure, diastolic blood pressure,mean arterial blood pressure, and heart rate.

PROCEDURES TO BE FOLLOWED

PRO FORMA: If you agree to participate, I will measure the Autonomic Responses which are Systolic Blood Pressure,Diastolic Blood Pressure,Mean Arterial Pressure and Heart Rate before and after interventions are administered.

BENEFITS: You will enlighten on how bridging exercise affects the autonomic nervous system in bedridden patients.

COMPENSATION: There is no compensation to volunteers for their participation.

DURATION OF PARTICIPATION: The study duration of participation is 15 minutes.

WHO CAN PARTICIPATE IN THIS STUDY: The study focuses on patients who have been Bedridden for 24 to 72 hours ,5 to 7days , 7days and above in the female and male medical ward,G ward and cancer ward of the University of Benin Teaching Hospital, Benin city.

ASSURANCE OF CONFIDENTIALITY OF VOLUNTEER'S IDENTITY: Records relating to your participation in this study will remain confidential.Your name will not be used in any report resulting this study.Pro form, computerized records, and analysis of data will contain only a unique study number, not your name.

PERSONS AND PLACES FOR ANSWERS REGARDING YOUR RIGHTS AS A RESEARCH SUBJECT: if during the course of this study you have questions concerning the nature of the research or you believe you have sustained a research-related injury or assault, you should contact;

Igbinobaro Osahenrumwen Ruth

Department of Physiotherapy, University of Benin ,

Ugbowo,

Edo State,

Nigeria.

Phone number: 07053867566

Email: ruthigbinobaro7@gmail.com

Ethics and Research Committee,

University of Benin Teaching Hospital,Benin City.

IF THERE IS ANY PORTION OF THIS CONSENT AGREEMENT THAT YOU DO NOT UNDERSTAND,ASK THE FIELD WORKER OR INVESTIGATOR BEFORE SIGNING.

Please, sign below if you have agreed to participate in the study.

CERTIFICATION OF CONSENT

I,———————————— having full capacity to consent for myself do thereby agree to take part as a participant in this research study.

The methods and means by which the study will be conducted and the risks which may be reasonably expected have been explained to me by Ethical Committee. I have been given the opportunity to ask question concerning this investigational study, and any such questions have been answered to my full and complete satisfaction.

I understand that I may at any time during the course of this study revoke this consent and withdraw myself from the study without prejudice.

Subject's Signature:——————————- Date:

DEMOGRAPHIC FORM

Participant ID: ______________________

Date of Data Collection: ____ / ____ / ____ (DD/MM/YYYY)

Section 1: Demographic Information

Age (in years): _______

(Please note: Inclusion criteria for this study are 18 to 65 years of age)

Gender:

[ ] Male [ ] Female

Marital Status:

[ ] Single [ ] Married] [ ] Divorced/Separated [ ] Widowed

Highest Educational Qualification:

[ ] No formal education [ ] Primary School

[ ] Secondary School [ ] Tertiary Education (e.g., OND, HND, B.Sc, M.Sc, PhD)

[ ] Other (Please specify): _________________________________

Occupation (before current medical condition): _________________________________

Section 2: Medical and Immobility Information

Primary Medical Condition leading to bedridden status:

[ ] Severe systemic illness (e.g., sepsis, advanced heart failure, severe pulmonary disease, widespread malignancy)

[ ] Non-orthopaedic post-surgical recovery

[ ] Other (Please specify, ensuring it aligns with inclusion criteria): ________________________________

Date when patient became bedridden (approximate start of prolonged immobility):

____ / ____ / ____ (DD/MM/YYYY)

Duration of Immobility: (Please tick one)

[ ] 24 to 72 hours [ ] 5 to 7 days [ ] > 7 days

Is the patient currently receiving any medications that may affect autonomic measurements (e.g., beta-blockers)?

[ ] Yes [ ] No

If Yes, please list: ____

Does the patient require assistance with daily activities?

[ ] Yes [ ] No

Is the patient medically stable (not in acute circulatory or respiratory distress)?

[ ] Yes [ ] No

Does the patient possess sufficient residual muscle strength and range of motion to safely attempt bridging exercises (even with assistance)?

[ ] Yes [ ] No

Section 3: Consent

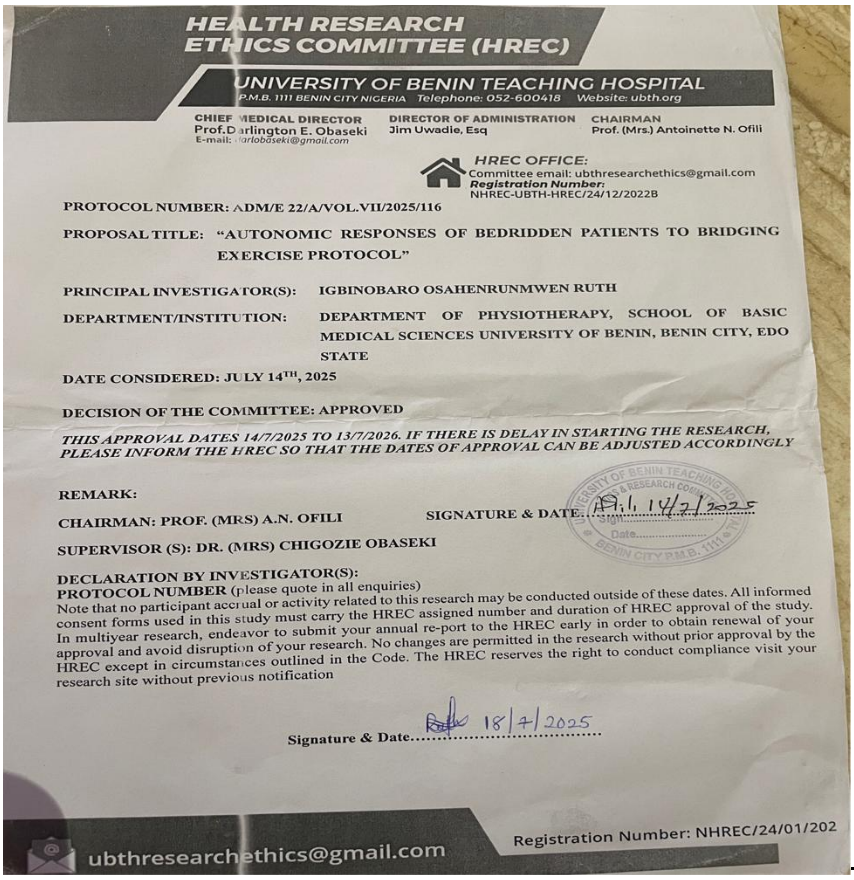
Participant's Signature: ________________________________

Date: ____ / ____ / ____ (DD/MM/YYYY)

Researcher's Signature: ________________________________

Date: ____ / ____ / ____ (DD/MM/YYYY)

ETHICAL APPROVAL



HEALTH RESEARCH ETHICS COMMITTEE (HREC)

UNIVERSITY OF BENIN TEACHING HOSPITAL

P.M.B. 1111 BENIN CITY NIGERIA Telephone: 052-600418 Website: ubth.org

CHIEF MEDICAL DIRECTOR	DIRECTOR OF ADMINISTRATION	CHAIRMAN
Prof. Darlington E. Obaseki E-mail: darlobaseki@gmail.com	Jim Uwadie, Esq	Prof. (Mrs.) Antoinette N. Ofili

HREC OFFICE:
Committee email: ubthresearchethics@gmail.com
Registration Number:
NHREC-UBTH-HREC/24/12/2022B

PROTOCOL NUMBER: ADM/E 22/A/VOL.VII/2025/116

PROPOSAL TITLE: "AUTONOMIC RESPONSES OF BEDRIDDEN PATIENTS TO BRIDGING EXERCISE PROTOCOL"

PRINCIPAL INVESTIGATOR(S): IGBINOBARO OSAHENRUNMWEN RUTH

DEPARTMENT/INSTITUTION: DEPARTMENT OF PHYSIOTHERAPY, SCHOOL OF BASIC MEDICAL SCIENCES UNIVERSITY OF BENIN, BENIN CITY, EDO STATE

DATE CONSIDERED: JULY 14TH, 2025

DECISION OF THE COMMITTEE: APPROVED

THIS APPROVAL DATES 14/7/2025 TO 13/7/2026. IF THERE IS DELAY IN STARTING THE RESEARCH, PLEASE INFORM THE HREC SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY

REMARK:

CHAIRMAN: PROF. (MRS) A.N. OFILI   **SIGNATURE & DATE** 14/7/2025

SUPERVISOR (S): DR. (MRS) CHIGOZIE OBASEKI

DECLARATION BY INVESTIGATOR(S):
PROTOCOL NUMBER (please quote in all enquiries)
Note that no participant accrual or activity related to this research may be conducted outside of these dates. All informed consent forms used in this study must carry the HREC assigned number and duration of HREC approval of the study. In multiyear research, endeavor to submit your annual re-port to the HREC early in order to obtain renewal of your approval and avoid disruption of your research. No changes are permitted in the research without prior approval by the HREC except in circumstances outlined in the Code. The HREC reserves the right to conduct compliance visit your research site without previous notification

Signature & Date 18/7/2025

ubthresearchethics@gmail.com   Registration Number: NHREC/24/01/202