PUBLIC PERCEPTION AND AWARENESS OF ULTRASOUND AS A DIAGNOSTIC TOOL BEYOND PREGNANCY AMONG STUDENTS OF SOME SELECTED FACULTIES IN UNIVERSITY OF BENIN

BY

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BMS2005191

DEPARTMENT OF RADIOGRAPHY

SCHOOL OF BASIC MEDICAL SCIENCES

UNIVERSITY OF BENIN

BENIN CITY

OCTOBER, 2025

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A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF RADIOGRAPHY IN PARTIAL FUFILMENT FOR THE REQUIREMENTS OF THE AWARD OF BACHELOR DEGREE IN RADIOGRAPHY (B.RAD), UNIVERSITY OF BENIN, BENIN CITY, NIGERIA.

OCTOBER, 2025

CERTIFICATION

This is to certify that this project work was carried out by **IMAGBEGHIAN OMOFEBA** with the matriculation number **BMS2005191** under the supervision of **MR MBIAKU V.** in Partial fulfilment for the award of Bachelor of Radiography (B.RAD) Degree of the Department of Radiography, School of Basic Medical Sciences, College of Medical Sciences, University of Benin, Benin City, Edo State.

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DEDICATION

This project work is dedicated to God Almighty for His guidance, wisdom and strength and for making my academic journey a huge success.

ACKNOWLEDGEMENT

First and foremost, I return all glory and thanks to God Almighty for His unending grace, strength, and faithfulness throughout this project and my academic journey so far. Without Him, this would not have been possible.

I am deeply grateful to my wonderful parents Mr and Mrs Williams Ehighasumen and my siblings for their constant love, support, and prayers. Your encouragement gave me the strength to keep pushing even when things got tough.

I would like to express my sincere appreciation to my supervisor, Mr. Mbaiku V., for his guidance, patience, and valuable contributions during the course of this research work. His insightful suggestions and support played a vital role in shaping this project.

My heartfelt thanks also go to the entire Department of Radiography, University of Benin, for their dedication and the knowledge they have imparted over the years.

I am also thankful to my senior radiographers at the University of Benin Teaching Hospital (UBTH), and Raytouch Diagnostics, who contributed to my practical training experience

A special thank you to my friends, Funmi and Bimbo, for standing by me, offering words of encouragement, and cheering me on every step of the way.

I also appreciate Access to Success (A2S) for supporting and impacting me throughout this journey and also for the opportunities they have exposed me to. I am truly grateful.

To everyone who supported me in one way or another, whether through prayers, motivation, or assistance with this project, thank you. Your contributions mean a lot to me.

God bless you all.

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ABSTRACT

This study assessed the public perception and awareness of ultrasound as a diagnostic tool beyond pregnancy among undergraduate students in the University of Benin, Ugbowo campus. Although ultrasound is widely recognized for its use in obstetric imaging, its broader diagnostic applications remain underappreciated by the public. A descriptive cross-sectional survey design was adopted, targeting students from the Faculties of Arts, Life Sciences, and Basic Medical Sciences. Using a stratified random sampling method, a total of 327 questionnaires were distributed and completed. Data were collected through a structured self-administered questionnaire and analyzed using descriptive and inferential statistics with the Statistical Package for the Social Sciences (SPSS) software. Findings revealed that 60.24% of respondents were female, while the majority (53.21%) were between 20 and 23 years old. Most respondents (40.37%) were from the Faculty of Arts, with the 300-level students contributing the largest group (24.46%). The study showed that although most students were aware of ultrasound as a tool for pregnancy monitoring, their knowledge of its use in other diagnostic areas such as abdominal, cardiac, and musculoskeletal examinations was limited. Despite this, respondents generally perceived ultrasound positively, describing it as safe, affordable, and advantageous compared to other imaging modalities like CT and MRI. The study concludes that while awareness of ultrasound beyond pregnancy remains inadequate, students hold favorable attitudes toward its diagnostic potential. It recommends strengthening health education initiatives, integrating basic diagnostic imaging information into university health programs, and organizing awareness campaigns to broaden public understanding of ultrasound's diverse clinical applications.

Keywords: Ultrasound, Awareness, Perception, Diagnostic tool, Non-obstetric ultrasound, University students

CHAPTER ONE

INTRODUCTION

1.1 Background of study

Diagnostic imaging is crucial in healthcare, playing an essential role in prompt diagnosis, disease staging, management, treatment selection, planning, guidance, and follow-up. Among the various imaging techniques, ultrasound stands out as an affordable and highly interactive tool, offering clinicians real-time insights. Its portability and cost-effectiveness make it ideal for point-of-care imaging in settings like hospitals, emergency rooms, rural clinics, and developing countries (Van Sloun et al., 2020).

Ultrasound (US) is a highly valuable diagnostic imaging technique widely used by healthcare professionals in numerous applications. It is preferred over other imaging methods due to its safety, affordability, and accuracy (Adam et al., 2021).

Ultrasound imaging operates by utilizing high-frequency sound waves. In physics, ultrasound refers to sound waves with frequencies above 20kHz. Diagnostic ultrasound typically uses sound waves ranging from 2MHz to 15MHz. The transducer generates sound pulses, which are transmitted into the body and travel through tissues, with gradual attenuation through absorption and reflection (Dodgeon & Harrison, 2023).

Ultrasound has long been recognized as a vital diagnostic imaging tool, particularly in the field of obstetrics, where it plays a central role in monitoring fetal development during pregnancy (Recker et al., 2024). However, advances in medical technology have expanded the application of ultrasound far beyond pregnancy-related care. Today, ultrasound is used across a broad range of clinical specialties including abdominal imaging, musculoskeletal assessments, cardiac

evaluations (echocardiography), breast examinations, and vascular studies. Its real-time imaging capability, lack of ionizing radiation, and relative affordability make it a preferred choice for both clinicians and patients.

Despite these developments, public perception and awareness of ultrasound as a diagnostic tool beyond pregnancy remain limited (Kumsa & Haile, 2023), even among young adults and university students. Some studies have examined perception of obstetrics ultrasound among women In many communities, including those in Nigeria, but there has been no similar survey of perception and awareness of non obstetric ultrasound among university students.

University students, as young adults transitioning into full independence, are an important demographic when it comes to health education and awareness. An understanding of healthseeking behavior of students in the university community is important if a healthy community is to be maintained (Afolabi et al., 2013). Their health-seeking behaviors, beliefs about medical technology, and willingness to utilize diagnostic services are shaped by both personal experiences and prevailing social narratives. Unfortunately, limited exposure to accurate health information and the underutilization of routine diagnostic services can hinder early detection and proper management of various health conditions in this group. Their understanding of available medical diagnostics shapes their decisions when seeking care. A study by Olumide et al.,(2016) conducted internationally among medical students have shown overwhelmingly positive perceptions of early ultrasound exposure in enhancing anatomy knowledge, clinical decision-making, and confidence . While these findings are based on medical students, they signal broader relevance: early, hands-on ultrasound engagement boosts familiarity and breaks stereotypes tied to pregnancy only.

In academic settings such as the University of Benin (UNIBEN), where access to basic health services and medical education may be available, it becomes essential to assess how students perceive and understand the role of ultrasound in healthcare beyond pregnancy. Their attitudes and knowledge could influence not only their personal health choices but also shape future societal attitudes, especially considering that university graduates often become influential voices in their families and communities.

This study therefore seeks to explore the level of public perception and awareness among university students regarding the use of ultrasound as a diagnostic tool beyond pregnancy. By identifying gaps in knowledge and understanding the reasons behind prevailing perceptions, the findings of this research can help guide more targeted health education campaigns, influence university health policies, and ultimately contribute to improved health outcomes among young adults.

1.2 Statement of problem

Over the years, ultrasound has gained popularity, but predominantly as a tool for monitoring pregnancy and fetal development. This has led to a narrow perception and limited understanding of its role in healthcare. Many individuals in the general public may not know that ultrasound can be used to diagnose liver diseases, kidney stones, heart problems, breast lumps, thyroid abnormalities, and guide procedures like biopsies.

This limited understanding can negatively affect healthcare decisions. People may not request or consent to ultrasound examinations for non-pregnancy-related conditions due to ignorance or misconceptions. There is therefore a need to assess the current level of awareness and perception among the public concerning the broader diagnostic uses of ultrasound.

1.3 Research questions

1. What is the level of public awareness regarding ultrasound uses beyond pregnancy among students in the university of Benin?

2. What are the perceptions of these students about the importance of ultrasound for non-pregnancy conditions?

3. What are the common medical conditions for which ultrasound is used apart from obstetric scanning?

4. What factors influence the awareness and use of ultrasound among the public?

1.4 Hypothesis 1

H_1: There is a significant relationship between the level of public awareness and the use of ultrasound for non-pregnancy-related diagnostic purposes.

H_0: There is no significant relationship between the level of public awareness and the use of ultrasound for non-pregnancy-related diagnostic purposes.

Hypothesis 2

H_1: There is a significant relationship between the perception of the importance of ultrasound and the use of ultrasound for non-pregnancy-related diagnostic purposes.

H_0: There is no significant relationship between the perception of the importance of ultrasound and the use of ultrasound for non-pregnancy-related diagnostic purposes.

1.5 Aim of study

To assess the public perception and awareness of ultrasound as a diagnostic tool beyond pregnancy among students in the Universityy of Benin.

1.6 Objectives of study

1. To determine the level of awareness of ultrasound uses beyond pregnancy among students of the University of Benin.

2. To evaluate students' perceptions of ultrasound in non-obstetric conditions.

3. To identify factors influencing awareness and perception of ultrasound.

4. To suggest strategies for improving public understanding of ultrasound beyond pregnancy.

1.7 Significance of the Study

This study will be of great importance in several ways:

It will help healthcare professionals understand the level of public knowledge about ultrasound beyond pregnancy.

The findings will guide awareness campaigns and educational programs aimed at improving the public's understanding of ultrasound's full diagnostic potential.

It will assist policymakers in designing health communication strategies that correct misconceptions and promote appropriate use of ultrasound services.

Radiographers, sonographers, and other imaging professionals can use the study results to educate patients during their clinical practice.

1.8 Scope of the Study

This study focuses on assessing the level of public perception and awareness of ultrasound as a diagnostic tool beyond its common use in pregnancy among students of the University of Benin (UNIBEN). The research will examine students' with the aim of exploring their knowledge, beliefs, and attitudes toward the use of ultrasound in non-obstetric cases.

The study will be targeted to undergraduate students across selected faculties within UNIBEN. It will explore their sources of information, depth of knowledge, and any misconceptions they

may have regarding ultrasound. Additionally, the study will consider factors such as age, gender, course of study, and level of education to understand their influence on awareness levels. This research will be done over a period of five months.

1.9 Operational definition of Terms

Ultrasound: A medical imaging technique that uses high-frequency sound waves to create images of internal body structures for diagnosis and monitoring of health conditions.

Awareness: The degree to which students have knowledge or understanding of ultrasound applications beyond pregnancy.

Perception: Students' opinions, beliefs, and attitudes about the importance and effectiveness of ultrasound in diagnosing conditions other than pregnancy.

Diagnostic Tool: Any method or instrument used to detect, confirm, or monitor diseases or medical conditions.

Beyond Pregnancy: Refers to non-obstetric uses of ultrasound, including abdominal, breast, cardiac, musculoskeletal, thyroid, and vascular scans.

CHAPTER TWO

LITERATURE REVIEW

Medical imaging is essential for effective medical practice, encompassing various imaging techniques, with ultrasonography, or ultrasound, being one of the key modalities (Cumber & Nchanji, 2017). Ultrasound (US) is a crucial, cost-effective tool for quick diagnoses and the examination of a wide range of medical conditions (Poggi & Palavecino, 2024).

Ultrasonography, a widely used diagnostic tool, has experienced significant proliferation in Nigeria's healthcare landscape. (Abayomi et al., 2024). It ranks second in terms of utilization after traditional X-ray radiography, is one of the most significant diagnostic technologies by the 2000s. Current ultrasound scanners generate real-time color images of blood flow and detailed grayscale images of anatomical features(Gilbert et al., 2024). Ultrasound is a non-ionizing form of radiation that utilizes high-frequency sound waves to create images of the body. As a real-time imaging method, ultrasound enables the assessment of moving structures and allows for the measurement of blood flow velocity and direction within vessels (Powles et al., 2018).

This literature review explores the public perception and awareness of ultrasound as a diagnostic tool, especially its use beyond pregnancy. While ultrasound is widely recognized for its role in monitoring pregnancies, its application in diagnosing a range of medical conditions such as tumors, organ abnormalities, and vascular diseases remains underutilized in many communities. A deep understanding of how the general public perceives ultrasound technology, especially outside the context of pregnancy, is crucial for promoting broader use and increasing health outcomes.

Ultrasound imaging, due to its non-invasive nature and relatively low cost, holds significant potential for improving diagnostic processes. However, public awareness of its uses beyond pregnancy,remains limited. This review synthesizes existing literature on perceptions, awareness, and barriers to ultrasound utilization beyond pregnancy, focusing on individuals' knowledge of its diagnostic power and attitudes toward its broader use.

The importance of this review lies in identifying the gaps and misconceptions in the public's understanding of ultrasound, as these can influence both the decision to seek medical care and the willingness to undergo screenings. Furthermore, this review will evaluate theoretical models, including the Health Belief Model and Theory of Planned Behavior, to examine how perceptions and attitudes about ultrasound impact its use. This synthesis of literature will guide health interventions designed to increase ultrasound adoption and enhance its potential for early diagnosis, especially in resource-limited settings.

2.1 Conceptual Review

Understanding Ultrasound Technology

This section provides a comprehensive overview of ultrasound imaging, explaining it's fundamental principles and diverse applications. By examining the definition and mechanism of ultrasound, exploring various clinical applications beyond obstetrics, and tracing the historical evolution of this diagnostic modality

2.1.1 Brief History of Ultrasound

The history of ultrasonography dates back to the early 1800s when Swiss physicist Jean-Daniel Colladon accurately measured the speed of sound in water. In the late 1800s, Pierre and Jacques Curie discovered the relationship between voltage and pressure in crystals, now known as the

piezoelectric effect. This discovery paved the way for the development of the modern ultrasound transducer (Law & Macbeth, 2011). Over the past 60 years, ultrasound has evolved into an essential diagnostic tool in medicine. In the 1930s and 1940s, Theodore Dussik and his brother Friederich became the first to use ultrasound to detect a brain tumor. Today, ultrasound is used in various medical applications, including disease detection, biopsy guidance, monitoring diagnosed conditions, and pregnancy assessment. However, many people remain unaware of ultrasound's important role in women's health beyond pregnancy evaluation (Kumsa et al., 2024). Introduced for medical diagnosis in the 1950s, ultrasound technology has seen remarkable advancements since then.

Ultrasound has made significant advancements as a medical imaging tool since it was first introduced in the mid-20th century. Initially, equipment was based on analog signals and operated at a single element or line level (A-mode). Over time, technology evolved to allow for real-time two-dimensional (B-mode) scanning. With the development of digital signal processing capable of handling high-bandwidth data, 3D imaging became possible with useful frame rates. Today's ultrasound systems rely on a complex signal processing chain, which includes amplifying, digitizing, beamforming, filtering, and mapping echo signals from the transducer to display both 2D and 3D images.(Wang et al., 2020).

2.1.2 Basic Principles of Ultrasound Technology

Ultrasound refers to sound waves with a frequency higher than 20,000 Hertz (Hz), which are beyond the detection range of the human ear (Patey & Corcoran, 2021). Unlike X-ray energy, ultrasound is not a form of electromagnetic radiation. It is similar to audible sound, but with a much higher frequency. Ultrasound is a type of energy that travels in waves, with vibrations of neighboring molecules in a medium facilitating its propagation (Dodgeon & Harrison, 2023).

Ultrasound serves as an important technique for identifying the form, dimensions, and surfaces of structures, as well as their positions and how they relate to one another. A solid grasp of ultrasound's basic principles is crucial for producing high-quality diagnostic images and ensuring safe operation. ("AIUM Curriculum for Fundamentals," 2019).

A device called a transducer that is placed on the skin sends the soundwaves into the body and records the echoes as they bounce back, thus defining the size, shapeand mass of soft tissues and organs.(Rashid, 2017). Ultrasonography operates on the piezoelectric effect, where quartz crystals are electrically stimulated, causing them to change shape and generate sound waves. When sound waves are reflected back to the crystals, they produce electrical signals, which are used to create an image. The generation of this image depends on the differences in impedance between various tissues, which causes the ultrasound waves to reflect off tissue boundaries, creating echoes. These echoes, along with the physical properties of ultrasonic beams like reflection, refraction, and attenuation, contribute to the objects seen in ultrasound images. The ultrasound computer measures the time it takes for the reflected waves to return and calculates the distance to the reflective surface. These signals are processed together to form a two-dimensional, real-time image displayed on the screen. During a typical ultrasound, millions of pulses and echoes are transmitted and received every second. The probe is placed on the skin and moved to capture different angles. Ultrasound waves pass through fluids and soft tissues with ease, but cannot penetrate bone or gas, limiting its use in areas surrounded by bone or containing air. Despite this, ultrasound is a valuable tool for examining most parts of the body. Understanding these interactions is crucial for making accurate clinical diagnoses.(Law & Macbeth 2011).

2.1.3 Modes of Ultrasound

A-mode (Amplitude Mode): The earliest ultrasound technique, A-mode displays echoes as vertical spikes on a one-dimensional graph. Though limited in spatial detail, it is useful for measuring organ depth or size and is still occasionally used in ophthalmology (Subedi, 2019).

B-mode (Brightness Mode): This is the most commonly used mode, producing 2D grayscale images. Multiple transducer elements generate echoes that appear as dots of varying brightness. It offers clear structural imaging, though less effective for fast-moving or 3D structures (Rashid, 2017).

M-mode (Motion Mode): M-mode ultrasonography is commonly used due to its superior axial and temporal resolution. In this technique, a single ultrasound scan line is transmitted, received, and displayed as a graph. Its high temporal resolution makes it especially valuable for tracking the movement of fast-moving structures and determining their timing, such as in relation to the phases of the cardiac cycle (Carroll et al., 2024).

Doppler Mode: Based on the Doppler effect, this mode evaluates blood flow by detecting frequency shifts in sound waves reflected by moving blood cells. It provides functional data, especially in cardiac and vascular assessments, and is widely used in echocardiography (Subedi, 2019).

2.1.4 Advantages and Challenges of Using Ultrasound Beyond Pregnancy

Diagnostic ultrasound has become an indispensable tool across medical specialties due to its unique advantages. However, its expanding role also brings forth challenges that must be addressed to ensure optimal and equitable utilization.

Advantages

1. Non-Invasiveness and Safety: One of ultrasound's most prominent benefits is its non-ionizing nature, which makes it a safe modality for repeated use across patient populations. Unlike computed tomography (CT) or radiography, ultrasound does not expose patients to ionizing radiation, making it ideal for pediatric, reproductive, and critically ill populations (Schnobrich et al., 2020).

2. Portability and Real-Time Imaging: The compact nature of modern ultrasound devices, including handheld units, allows for bedside assessments, especially in emergency and critical care environments. This portability enhances point-of-care diagnostics, enabling rapid clinical decisions in dynamic settings such as intensive care units and rural clinics (Eke et al., 2021; Yau et al., 2021).

3. Cost-Effectiveness: Compared to MRI and CT, ultrasound is considerably less expensive and requires minimal infrastructural investment. This has made it especially valuable in low- and middle-income countries where healthcare resources are constrained (Eke et al., 2021).

4. Versatility Across Specialties: Ultrasound serves a wide range of applications—from echocardiography and abdominal imaging to musculoskeletal, vascular, and breast evaluations. Recent innovations have enabled even greater utility, including the integration of elastography and Doppler techniques for functional assessments (Zhou et al., 2020).

5. Integration with Artificial Intelligence (AI): AI-enhanced ultrasound systems are improving diagnostic precision and reducing operator dependency. For instance, in breast cancer screening, AI-supported handheld ultrasound devices have shown promising results in enhancing lesion detection and reducing interpretation errors (Bunnell et al., 2024).

Challenges

1. Operator Dependency and Variability: Ultrasound is inherently user-dependent; image acquisition and interpretation quality often vary with operator skill. This variability can lead to misdiagnosis or incomplete assessments, especially among inexperienced practitioners (Schnobrich et al., 2020).

2. Limited Penetration and Image Quality: In patients with high body mass index (BMI) or significant bowel gas, ultrasound's effectiveness diminishes. The modality also struggles to penetrate bone or air-filled structures, limiting its applicability in certain anatomical regions (Zhou et al., 2020).

3. Training and Education Gaps: While ultrasound has become more accessible, adequate training remains a barrier. The proliferation of point-of-care ultrasound (POCUS) has outpaced the standardization of training curricula, particularly in resource-limited settings (Eke et al., 2021). Moreover, maintaining proficiency requires consistent practice and feedback.

4. Technology Access and Cost in Low-Resource Areas: Although ultrasound is more affordable than many other imaging techniques, access to modern devices and AI-integrated tools remains limited in some underserved regions. Infrastructure, maintenance, and device calibration also pose logistical challenges (Eke et al., 2021).

5. Ethical and Legal Concerns: As non-radiologists increasingly adopt ultrasound in clinical practice, concerns about diagnostic accuracy and medico-legal liability have grown. The absence of formal credentialing frameworks in some settings adds to this ambiguity, raising questions about scope of practice and patient safety (Schnobrich et al., 2020).

2.1.5 Applications of Ultrasound Beyond Pregnancy

1. **Abdominal imaging**

Imaging has a very important role in evaluating abdominal pathology. Ultrasound, which on its own can lead to an accurate diagnosis, plays a pivotal role in the management of abdominal pathology. (Caraini et al., 2020). Most people, aside from women when they hear ultrasound, associate it with pregnancy and how it is used in monitoring the development of a baby in the womb. However, ultrasound can be used to diagnose and help in the treatment of many health issues beyond pregnancy. Abdominal ultrasound imaging is performed to evaluate kidneys, liver, gallbladder, bile ducts, pancreas, spleen, and abdominal aorta and other blood vessels of the abdomen.Ultrasound is used to help diagnose a variety of conditions, such as abdominal pain or distention, assessment of liver condition, gall stones, enlarged abdominal organ and kidney problems (Kumsa & Haile, 2023).

2. Pelvic imaging

Pelvic sonography is often the first imaging method used to investigate suspected pelvic issues following a clinical examination. It acts as an important extension of the physical exam, allowing detailed assessment of structures like the uterus, ovaries, fallopian tubes, pouch of Douglas, prostate and bladder (Karena & Mehta, 2023). Over time, it has become a crucial step before initiating treatment for many pelvic conditions. Ultrasound offers several advantages: it avoids radiation exposure, provides real-time imaging, enables dynamic blood flow studies, and now includes advanced three-dimensional and four-dimensional imaging capabilities (Karena & Mehta, 2023). These strengths have made pelvic sonography a preferred option over many other diagnostic techniques. It is commonly performed using transabdominal, transvaginal,

transperineal, or endosonographic approaches. To optimize imaging, a gel is placed on the skin above the bladder during a transabdominal scan, while a urine-filled bladder helps displace bowel loops, creating a clear acoustic window and minimizing image distortion caused by bowel gas (Dobaria et al., 2025). The ultrasound beam passes easily through the fluid-filled bladder, allowing clear visualization of pelvic structures (Dobaria et al., 2025). Advanced methods like sonohysterosalpingography, Doppler ultrasound, and 3D/4D sonography have further expanded the clinical applications of pelvic ultrasound, enhancing its role in both diagnostic and treatment planning processes (Karena & Mehta, 2023).

3. Musculoskeletal imaging

Ultrasonography (US) has become an essential imaging tool for examining the musculoskeletal system. It provides crucial diagnostic insights and is also valuable in evaluating disease activity and monitoring treatment outcomes (Dinescu et al., 2023). Among various imaging methods, musculoskeletal (MSK) ultrasound has gained significant attention as a reliable diagnostic tool for a wide array of disorders. MSK ultrasound offers a non-invasive, radiation-free, and real-time imaging approach, making it an effective option for diagnosing and tracking conditions such as tendon injuries, ligament tears, arthritis, and soft tissue abnormalities (Getzmann et al., 2024).

4. Cardiac imaging (Echocardiography)

Cardiac ultrasound, commonly known as echocardiography, has become a key tool in the functional evaluation of cardiovascular disease (Aly et al., 2021). It is used to evaluate heart disease by examining the geometry and function of the heart with its high spatial and temporal resolution (Liu et al., 2022). Despite being a relatively simple imaging technique, it provides extensive information about the heart's structures and function. In fact, its simplicity is what makes it so widely used. Echocardiography is one of the primary imaging methods for cardiac

evaluation. It works by using sound waves, with their frequency described to produce images. Echocardiography has become the preferred method for initial cardiac disease assessment because it is non-invasive, easy to perform, and delivers high-resolution images with real-time results (Aly et al., 2021).

5. Breast imaging

Breast cancer is the most commonly diagnosed cancer and the leading cause of cancer-related deaths among women worldwide (Arnold et al., 2020). Early detection and accurate evaluation of breast lesions are key objectives of various imaging techniques. As a traditional medical imaging tool, ultrasound (US) has played a vital role in detecting breast cancer, guiding biopsies, and diagnosing lymph nodes for many years. Ultrasound is capable of evaluating the morphology, orientation, internal structure, and boundaries of lesions from multiple angles with high resolution, whether in fatty or dense glandular breast tissue. The technology includes ultrasound elastography, contrast-enhanced ultrasound, 3D ultrasound, automatic breast ultrasound, and computer-aided detection for breast ultrasound (Guo et al., 2019).

6. Vascular ultrasound

Vascular ultrasound is used to image arteries and veins in the upper and lower extremities, the head and neck, and the abdomen, with the aim to diagnose vascular abnormalities and guide treatment. Currently applied vascular ultrasound modalities in clinical practice include two-dimensional (2D) grayscale B(brightness)-mode imaging for assessment of tissue morphology and echogenicity, colour-flow imaging for assessment of flow patterns and identification of regions of disturbed flow (such as in stenoses), and spectral Doppler for measurement of blood velocities and velocity-derived indices (such as degrees of stenosis) at specific regions within the vessel lumen. (Golemati et al., 2022).

7. Ultrasound In Emergency Medicine

Diagnostic tools in emergency medicine have been widely studied. As a non-invasive and quick tool, ultrasound plays a role in the field of emergency medicine. (Wang et al., 2021). The use of ultrasound (US) in emergency departments (ED) has become widespread. This includes both traditional US scans performed by radiology departments as well as point-of-care US (POCUS) performed by bedside clinicians. (Lentz et al., 2021). Point-of-care ultrasound (POCUS) is a bedside imaging technique that allows healthcare providers to evaluate patients accurately and efficiently, supporting the diagnosis of a wide range of medical conditions (Sethi et al., 2024).

Point-of-care ultrasound (PoCUS) has become an indispensable standard in emergency medicine. Emergency medicine ultrasound (EMUS) is the application of bedside PoCUS by the attending emergency physician to assist in the diagnosis and management of many time-sensitive health emergencies. (Osterwalder et al., 2023).

8. Interventional procedures

Interventional ultrasound refers to the use of ultrasound imaging to guide various diagnostic and therapeutic procedures, such as fluid aspiration, local injections (e.g., corticosteroids, botulinum toxin), biopsies , and minimally invasive surgeries like carpal tunnel release. It offers real-time visualization, improves precision, reduces radiation exposure compared to fluoroscopy, and is becoming increasingly important in orthopaedics, rheumatology, and emergency medicine (Apard, 2019).

2.1.6 Public Awareness of Ultrasound as a Diagnostic Tool

Public awareness refers to the extent to which people are informed about the uses, safety, and benefits of ultrasound in clinical care. While ultrasound is widely acknowledged for monitoring

pregnancies, knowledge about its broader diagnostic utility remains inconsistent and, in many regions, limited.

Access to accurate health information, educational level, and interactions with healthcare providers greatly influence awareness (Kuyinu et al., 2020). Those with prior healthcare exposure tend to know more about the wide applications of ultrasound, especially in academic environments.

Nevertheless, a gap remains suggesting a need for structured public enlightenment through community health talks, student health fairs, and mass media campaigns Raising awareness is crucial because it encourages early medical intervention. For instance, someone aware of ultrasound's role in detecting kidney stones is more likely to seek care early, avoiding complications.

2.1.7 Perception of Ultrasound as a Tool For Medical Diagnosis

Perception involves beliefs, attitudes, and assumptions people hold about the usefulness and reliability of ultrasound. Many individuals regard ultrasound as a safe and painless diagnostic method, especially since it does not use ionizing radiation like X-rays or CT scans (Schnobrich et al., 2020).

Despite this, perceptions vary with exposure and cultural context. In several Nigerian communities, ultrasound is sometimes seen as unnecessary unless a pregnancy is involved. This has been reinforced by the fact that most routine scans in public hospitals are antenatal (Sidi et al., 2021). This misconception can delay early diagnosis and intervention in non-obstetric conditions that could otherwise be identified using ultrasound. Delays or refusal in seeking and obtaining proper diagnosis and treatment can allow for a greater probability of adverse

sequelae.(Afolabi et al., 2013). A positive perception promotes higher acceptance, better compliance with clinical advice, and improved outcomes. However, for perception to change, awareness and accessibility must improve simultaneously.

2.2 Empirical Review

Understanding how the public perceives and utilizes ultrasound for purposes beyond pregnancy is vital, especially in academic environments where access to health information is expected to be higher. Despite advances in imaging technology, many people continue to associate ultrasound almost exclusively with pregnancy care, leaving a gap in knowledge about its broader diagnostic capabilities.

2.2.1 Public Awareness of Diagnostic Ultrasound

A recent study by (Jamwal & Kaushal, 2025), explored how much the public knows about various imaging tools, from ultrasound to PET scans. The study revealed that while 82% of respondents correctly identified ultrasound as useful during pregnancy. The authors concluded that the general population is poorly informed about the diverse uses of medical imaging, particularly non-obstetric ultrasound. This study reinforces the need for targeted education—especially among young adults in academic institutions—about modern imaging tools.

Similarly, Klein and Anderson (2021) found that misconceptions about medical ultrasound persist even in more developed settings. Their study showed that many people equate ultrasound strictly with prenatal checkups and are unaware of its applications in diagnosing gallstones, breast lumps, or vascular conditions. This global trend aligns with patterns observed in Nigeria, where ultrasound services are often perceived as limited to obstetrics.

2.2.2 Utilization and Misconceptions

In Nigeria, these misconceptions are particularly widespread. A study by Ighodaro and Isara (2017) in Benin City found that only 29.9% of women considered transvaginal ultrasound safe, with cultural concerns and lack of proper information contributing to the skepticism. Despite the wide availability of ultrasound in some urban hospitals, many patients remain unaware of its non-pregnancy-related diagnostic roles.

Further emphasizing this point, Sidi et al. (2021) examined the state of ultrasound practice in Kano and found that healthcare providers themselves sometimes lacked awareness of the full diagnostic spectrum of ultrasound, using it less often for non-obstetric purposes. This professional gap could influence how much patients—and by extension, the public, know about the technology.

2.2.3 Students' Awareness and Utilization of Ultrasound

Although there is no direct study on students awareness and utilization of ultrasound, Studies on student's utilization of medical services exist. Gerald et al. (2024) assessed the awareness and use of medical services among University of Calabar students and found that while most students knew about the campus health center, only few actually utilized the medical services provided.

Tran & Silvestri-Elmore (2021) conducted a comprehensive review of studies exploring healthcare-seeking behaviours among college students and young adults across various regions, including Africa, Asia, and the United States. They reviewed 28 studies and their findings showed that students underutilize medical services, especially for preventive care—only about 32% of students used campus health services annually. The authors emphasized the need for targeted interventions to promote awareness, reduce stigma, and increase students' engagement with available health services.

This gap between awareness and utilization of medical services among students may also extend to ultrasound, especially when it is not related to pregnancy. The low engagement with general health services suggests that students might similarly underutilize ultrasound imaging, even when it is available and medically necessary.

2.2.4 Research Gap

These studies collectively indicate that while awareness of ultrasound's role in pregnancy is high, knowledge of its broader diagnostic use remains limited—even among educated young adults. However, there is a scarcity of empirical studies that specifically explore awareness and perceptions among university students in Nigeria, particularly at institutions like the University of Benin (UNIBEN). This gap highlights the importance of investigating how well students understand the scope of ultrasound beyond pregnancy, which this study aims to address.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Setting

The study will be conducted at the Ugbowo campus of the University of Benin (UNIBEN), located in Benin City, Edo State, Nigeria. The campus comprises various faculties, departments, and student hostels and is known for its academic, social, and health-related activities. The setting provides a diverse population of students suitable for a study assessing awareness and perception of medical imaging tools like ultrasound.

3.2 Research Study Design

This study will adopt a descriptive cross-sectional survey design. This design will be used because it enables the collection of data at a single point in time and is suitable for assessing the current level of perception and awareness among students. The study focuses on both qualitative and quantitative data. A structured questionnaire will be used to gather data from respondents without manipulating any variables.

3.3 Target Population

The target population comprised undergraduate students of the University of Benin, Ugbowo campus.

Inclusion criteria :

Undergraduate students in faculty of Arts, Faculty of Life sciences, and School of Basic medical sciences.

Students across all levels in selected faculties

Exclusion criteria:

Students in Other faculties

Staff in the university of Benin

3.4 Sampling Technique and Sample Size

A proportionate sampling technique will be used in this study to ensure fair representation of students from the selected faculties within the University of Benin. The faculties chosen are Life Sciences, Arts, and Basic Medical Sciences. Each faculty will serve as a stratum, and the number of students selected from each one will be based on its proportion in the total student population. This approach will help avoid bias and ensure that responses reflect views from all the selected faculties according to their population size.

The sample size will be determined using the Yamane (1967) formula, which is suitable for a known and finite population. The formula is stated as:

$n = N/1+N(e)^2$

Where:

n= sample size

N= total population size (estimated at 1,800 students across selected faculties)

e= margin of error (set at 0.05 for a 95% confidence level)

Substituting the values:

$n = 1800/1 + 1800(0.05)^2 = 1800/1 + 4.5 = 1800/5.5= 327$

Based on this calculation, a total of 327 students will be selected as the sample for the study. The number of respondents chosen from each faculty will be determined proportionately, based on the size of the faculty. This will ensure that larger faculties contribute more respondents than smaller ones, while maintaining balanced representation across the three faculties.

3.5 Instrument for Data Collection

Data will be collected using a structured, self-administered questionnaire adapted from previous studies and modified to fit the study objectives. The questionnaire will be divided into four sections:

Section A: Demographic data (e.g., age, sex, faculty, year of study)

Section B: Awareness of ultrasound use beyond pregnancy (e.g., sources of information, knowledge of diagnostic use)

Section C: Perception of ultrasound as a diagnostic tool (e.g., usefulness, safety, accuracy)

Section D: Attitudes towards using ultrasound for non-pregnancy-related conditions

The questions will be both closed and open-ended to allow detailed and objective responses.

3.6 Validity of the Instrument

To ensure that the instrument measures what it is intended to measure, content and face validity will be established. The draft questionnaire will be reviewed by experts in radiography, public health, and research methodology to evaluate its clarity, relevance, and comprehensiveness. Their feedback will guide revisions to improve the language, structure, and coverage of key areas related to awareness and perception of ultrasound. Additionally, a pilot study will be conducted among 10–15 students from faculties not included in the main study. The pilot will help identify vague or unclear items and assess the general flow of the questionnaire. Based on the feedback obtained, necessary adjustments will be made before the final data collection. This process ensures that the instrument is clear, relevant, and accurately aligned with the study objectives.

3.7 Reliability of the Instrument

The reliability of the instrument will be tested using Cronbach's Alpha to assess internal consistency. A reliability coefficient of 0.70 or higher is considered acceptable, indicating that the items in the questionnaire consistently measure the intended variables.

3.8 Method of Data Collection

Data collection was carried out over a period of eight weeks. Questionnaires will be distributed online and physically to selected respondents across selected faculties on the Ugbowo campus. Respondents will be briefed about the study, and informed consent will be obtained before participation.

3.9 Method of Data Analysis

Data obtained from the completed questionnaires will be coded and analyzed using the Statistical Package for Social Sciences (SPSS) version 27. Descriptive statistics such as frequencies and percentages will be used to summarize demographic information and responses on awareness, perception, and attitude. Inferential statistics will be performed using Spearman's Rank Correlation Test to determine the strength and direction of the relationship between variables (for example, between awareness and perception or between awareness and use of ultrasound). The results will be presented using tables, charts, and graphs for clarity and ease of interpretation.

3.10 Ethical Consideration

Ethical approval for this study will be obtained from the University of Benin Ethics Committee. All participants will be informed about the purpose of the study. Participation will be voluntary, and confidentiality will be assured. Respondents will be informed of their right to withdraw from the study at any time without any consequences. All data collected will be used strictly for academic purposes, with no identifying information disclosed.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION

4.1 DATA PRESENTATION

4.1.1 Introduction

This chapter presents the results of the analysis of the data collected from 327 undergraduate students of selected faculties in the University of Benin. The faculties include the Faculty of Basic Medical Sciences (BMS), the Faculty of Arts (ARTS), and the Faculty of Life Sciences (LSC). We selected, examined, and presented questionnaire responses that were most relevant to obtaining correct study results.

The analysis is organized in accordance with the objectives of the study as stated below:

1. To determine the level of public awareness of other uses of ultrasound beyond pregnancy among students in the University of Benin.

2. To assess the perception of ultrasound examinations in non-obstetric conditions among students in the university of Benin.

3. To identify factors influencing public awareness and perception of ultrasound.

4. To recommend strategies for improving public knowledge about ultrasound.

4.1.2 Demographic Information of Respondents

Table 4.1 illustrates the demographic information of the participants of the study. The findings show that majority of the respondent were females with a total of 197 (60.24%) out of the 327

participants included in the study. 174 (53.21%) of the respondents were also aged between 20-23 years and only 6 (1.83) of them were aged 28 years and above. The study level with the most respondents was 300 level with a total of 80 (24.46%) students spanning across the 3 faculties involved in the study, followed by 200 level (73; 22.32%) and 100 level (71; 21.71%), 500 level had the least amount of participants with just 51 (15.60%) participants. Majority of the respondents were from the faculty of Arts with a total of 132 (40.37%) participants.

Table 4.1: Demographic Information of Respondents (N=327)

Variable	Category	Frequency	Percentage (%)
Sex	Male	130	39.76
	Female	197	60.24
Age	16 - 19 years	102	31.19
	20-23 years	174	53.21
	24-27 years	45	13.76
	28 years and above	6	1.83
Level of study	100L	71	21.71
	200L	73	22.32
	300L	80	24.46
	400L	52	15.90
	500L	51	15.60
Faculty	ARTS	132	40.37

	BMS	109	33.33
	LSC	86	26.30

4.1.3 Respondents' Awareness of Ultrasound Use Beyond Pregnancy.

Table 4.2: Responses on Awareness of the concept of ultrasound. (N=327)

Questions	Responses (Frequency %)	
	Yes	**No**
Have you ever heard of an ultrasound scan (Sonography)?	290 (88.69%)	37 (11.31%)

Table 4.2 presents the responses of the participants on their awareness of the concept "Ultrasound scan" or "Sonography" and the finding show a generally high level of awareness with 290 (88.69%) of the respondents reporting to have heard of the concept.

Table 4.3: Responses on the primary use of ultrasound. (N=327)

Questions	Responses (Frequency %)			
	To monitor pregnancy	**To diagnose other medical conditions**	**Both of the above**	**I don't know**
To the best of your knowledge, what is the primary use of an ultrasound scan?	123 (37.61%)	22 (6.73%)	153 (46.79%)	29 (8.87%)

The result has shown that although almost half of the respondents identified ultrasound accurately as applicable in monitoring pregnancy and in treating other medical diseases, a significant number of them still considered ultrasound to be more of a pregnancy monitoring tool. The overall fact that a number of respondents especially non-science respondents like the Arts students did not even know the primary purpose of ultrasound indicates a significant gap in knowledge and thus possibly the necessity to educate the masses on wider understanding of the diagnostic capabilities of ultrasound.

Analysis of Section B Item 3: Besides pregnancy, which of the following conditions do you know can be diagnosed using an ultrasound scan?

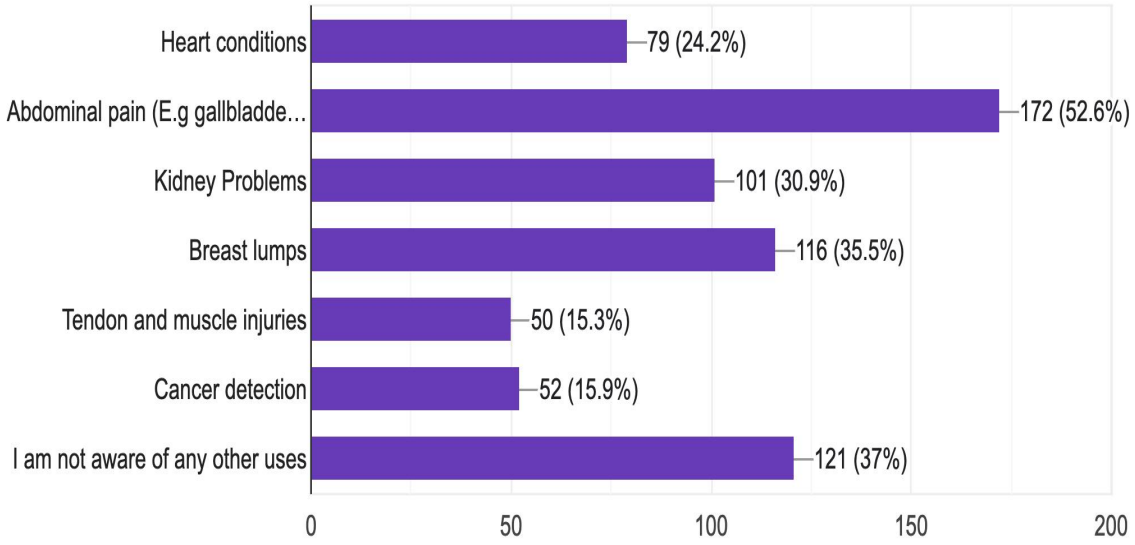

Fig 4.1 Distribution of Conditions which could be diagnosed with ultrasound

Fig 4.1 shows the distribution of the participants' responses on other conditions asides pregnancy which could be diagnosed using ultrasound scan. The general awareness of ultrasound had

moderate results among the respondents, with abdominal related diseases being the most prevalent. Nevertheless, comparatively not so many people have become aware of its usefulness to identify diseases like cancer, heart diseases or musculoskeletal injuries. The observation that 37% of the respondents were not aware of any non-pregnancy application is an indicator that they have poor insights on the full diagnostic potential of ultrasound and emphasizes the use of health education campaigns to increase their awareness.

Analysis of Section B Item 4: On a scale of 1 to 5, where 1 is "Very unaware" and 5 is "Very aware," how would you rate your general awareness of ultrasound uses beyond pregnancy?

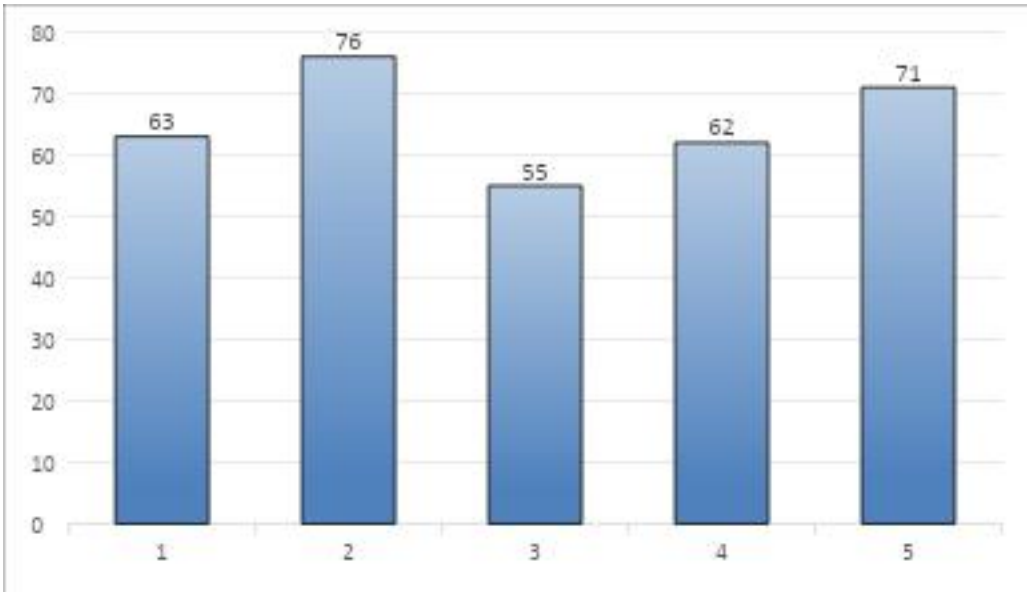

Fig 4.2 Distribution of respondents' awareness scale

The findings show that respondents have varying levels of understanding about the broader applications of ultrasonography. The awareness scale findings show a moderate degree of social awareness. Although some percentage of the respondents described themselves as highly aware, almost the same percentage of respondents described themselves as very unaware or as just somewhat aware. Such a broad range of variation indicates the lack of consistency in the

dissemination of information about the broader clinical use of ultrasound and indicates the possibility of specific awareness campaigns to address this gap in the knowledge base.

4.1.4 Respondents' Perception of Ultrasound as a Diagnostic Tool.

Table 4.4: Responses on the importance of ultrasound as a diagnostic tool for non-pregnancy related conditions. (N=327)

Questions	Responses (Frequency %)				
	Very important	**Important**	**Neutral**	**Not important**	**Not important at all**
How important do you think ultrasound is as a diagnostic tool for non-pregnancy related conditions?	133 (40.67%)	91 (27.83%)	94 (28.75%)	6 (1.83%)	3 (0.92%)

Table 4.4 presents the participants responses on the importance of ultrasound as a diagnostic tool for non-pregnancy related conditions. The majority of respondents regarded ultrasound as a significant or highly significant diagnostic instrument outside pregnancy care, which suggests awareness of the medical utility of ultrasound. The proportion of people who were unsure or did

not seem to be interested in it, however, was almost one-third, which represents a part of the population that might not be fully familiar with the diagnostic potential of ultrasound beyond obstetric applications. This shows the importance of better communication on its applicability to different specialties in medicine.

Table 4.5: Responses on the level of agreement of ultrasound as a diagnostic tool for non-pregnancy related conditions. (N=327)

Questions	SA	A	N	D	SD
Ultrasound is a safe diagnostic tool	**169**	**90**	**66**	**1**	**1**
Ultrasound is affordable compared to other imaging modalities (CT, MRI)	**90**	**88**	**142**	**7**	**0**
Ultrasound provides quick results	**107**	**115**	**91**	**13**	**1**
Ultrasound can diagnose a wide range of conditions	**92**	**102**	**124**	**9**	**0**
Ultrasound should be used more widely beyond pregnancy	**115**	**104**	**102**	**1**	**5**

Table 4.6: Arithmetic mean scale and its interpretation

Strongly disagree	Disgree	Neutal	Agree	Strongly agree
1-1.80	1.81-2.60	2.61-3.4	3.41-4.20	4.21-5

Table 4.7: Mean Scores on the level of agreement of ultrasound as a diagnostic tool for non-pregnancy related conditions. (Likert Scale 1–5)

Perception item	Mean score	S.D	Rank	Remark
Ultrasound is a safe diagnostic tool	4.30	0.82	1	Strongly agree
Ultrasound is affordable compared to other imaging modalities (CT, MRI)	3.80	0.87	5	Agree
Ultrasound provides quick results	3.96	0.89	3	Agree
Ultrasound can diagnose a wide range of conditions	3.85	0.87	4	Agree
Ultrasound should be used more widely beyond pregnancy	3.99	0.90	2	Agree

Table 4.6 and Table 4.7 shows the responses and mean scores (Likert Scale 1–5) of the respondents' level of agreement of ultrasound as a diagnostic tool for non-pregnancy related

conditions. The respondents were keen to express their opinion that ultrasound is safe, accessible, and effective in diagnosing different conditions. The fact that the mean score of safety is high indicates the level of confidence in its fact that it is not an ionizing procedure, whereas the level of agreement on affordability is relatively low, which may indicate that there are financial barriers or that people may see a difference between the cost of this type of imaging and other types. In general, the perception of ultrasound was good, and it supports the idea that this method is widely accepted as a diagnostic tool.

Analysis of Section C Item 7: "In your opinion, what are the main advantages of using ultrasound for diagnosis?". The responses to the open ended questions were filtered and similar responses were grouped into seven different major themes as show in the table below.

4.1.5 Factors Influencing Respondents' Awareness and Use of Ultrasound.

The most frequently recognized benefits were safety, accuracy, and accessibility, as they focused on the fact that people appreciated the non-invasive nature of ultrasound and the absence of radiation. However, the significant percentage of the interviewees who cited only pregnancy-related applications or said that they were not sure enough is an indicator that the myths about the diagnostic scope of ultrasound are still being perpetuated. This highlights the need to do educational outreach to advance a more comprehensive knowledge of its medical uses.

Table 4.8: Responses on the advantages of using ultrasound for diagnosis (N=327).

Theme	Description	Example Responses	Frequency (n)	Perecentage
Safety and Non-invasiveness	Emphasized that ultrasound is safe, non-invasive tool which is also radiation-free.	"It's safe", "No radiation", "Non-invasive", "Safe for pregnant women".	68	20.8%

Diagnostic Value and Accuracy	Highlighted Ultrasound usefulness for detecting or diagnosing diseases and internal problems.	"Helps detect diseases", "Accurate diagnosis", "Early detection".	61	18.7%
Cost and Accessibility	Mentioned affordability, cost-effectiveness, or availability.	"It is affordable", "Cheap", "Widely available".	41	12.5%
Quick and Reliable Results	Focused on speed, quick diagnosis, or fast results.	"Quick results", "Fast and reliable", "Immediate feedback".	36	11.0%
Versatility and Broad Use	Recognized its application beyond pregnancy and in multiple conditions.	"Can diagnose a wide range of conditions", "Used for many diseases".	27	8.3%
Pregnancy-Related Use	Mentioned only pregnancy monitoring, baby gender, or fetal well-being.	"Monitoring pregnancy", "To check baby", "Pregnancy test".	48	14.7%
Limited Knowledge / No Response	Stated uncertainty, lack of awareness, or left blank.	"No idea", "Nil", "0", "I don't know".	46	14.1%

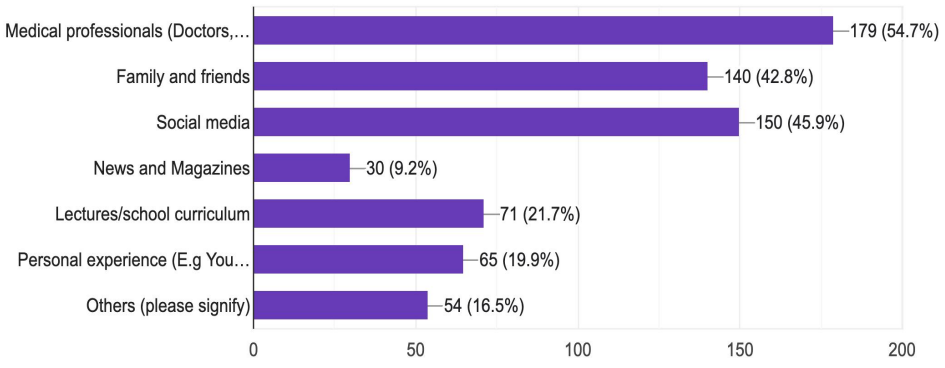

Fig 4.3 Distribution of respondents' information sources on diagnostic tools like ultrasound

Fig 4.3 shows the results of the possible information sources/channels where the respondents are made aware of Ultrasound as a medical diagnostic tool. Majority of the respondents reported Medical professionals, social media and Family and friends as their most common information sources with a frequency of 179 (54.7%),150 (45.9%) and 140(42.8%) respectively. The respondents reported News and Magazines as the least common information source.

Table 4.9: Responses on history of family member ever having an ultrasound scan for a non-pregnancy related condition. (N=327)

Questions	Responses (Frequency %)		
	Yes	No	I'm not sure
Have you or a family member ever had an ultrasound scan for a non-pregnancy related condition?	129 (39.45%)	83 (25.38%)	115 (35.17%)

Table 4.9 shows the participants' responses when asked whether they or a family member had ever undergone an ultrasound examination for a non-pregnancy-related condition. Moderate exposure to the extended diagnostic capabilities of ultrasound was demonstrated by almost 40% of respondents or people in their families who had some ultrasound use, but not during pregnancy. Nonetheless, the fact that the percentage of the respondents not knowing the reason behind undergoing ultrasound was high, perhaps because of the lack of communication between caregivers and patients. The results of this study support the importance of more explanations in the medical imaging process to improve awareness and active participation in health.

Table 4.10: Responses on major factors that influence participants' decision to use an ultrasound scan for diagnosis. (N=327)

Questions	Responses		
	1 (Most influencing)	2	3 (Least influencing)
Cost	196	113	18
Recommendation from a doctor	262	55	10
Personal knowledge about its uses	114	182	31
Availability of equipment	135	161	31
Fear or anxiety about the procedure	82	178	67

Table 4.11: Arithmetic mean scale and its interpretation

Most influencing	Moderately influencing	Least influencing
1-1.66	**1.67-2.33**	**2.34-3**

Table 4.12: Mean score on major factors that influence participants' decision to use an ultrasound scan for diagnosis. (scale 1-3)

influence items	Mean score	S.D	Rank	Remark
Cost	1.46	0.60	4	Most influencing
Recommendation from a doctor	1.23	0.49	5	Most influencing
Personal knowledge about its uses	1.75	0.62	2	Moderately influencing

Availability of equipment	1.68	0.64	3	Moderately influencing
Fear or anxiety about the procedure	1.95	0.67	1	Moderately influencing

Table 4.12 shows the mean score on major factors that influence participants' decision to use an ultrasound scan for diagnosis. According to the table, the two most important factors influencing participants' decisions to use ultrasound for diagnosis were cost (mean = 1.46 ± 0.60) and doctor's recommendation (mean = 1.23 ± 0.49). The following factors had a moderate impact: personal knowledge about Ultrasound uses (1.75 ± 0.62), equipment availability (1.68 ± 0.64), and procedure-related dread or anxiety (1.95 ± 0.67). Overall, the results indicate that the two factors that influence participants' use of ultrasonography the most are cost and medical advice.

Analysis of section D item 8: Six primary barriers to the use of ultrasonography for diseases unrelated to pregnancy were identified by analysis of the 327 open-ended replies. Lack of information or awareness was the most frequently mentioned obstacle (31.8%), followed by cost/financial constraints (15.0%). Non-responses or uninformative tokens made up a significant number of the entries (39.1%), which suggests either inquiry fatigue or a high level of ambiguity over the subject. Misconceptions that ultrasonography is solely used for pregnancy (4.0%), lack of equipment or skilled personnel (2.4%), and fear/anxiety (5.8%) were mentioned by smaller percentages.

Table 4.13: Responses on the major barriers that prevent people from using ultrasound for non-pregnancy related issues (N=327).

Theme	Description	Example Responses	Frequency (n)	Perecentage
Lack of Knowledge / Awareness	Ignorance, low awareness, unawareness, or statements showing people don't know ultrasound's uses beyond pregnancy.	"Ignorance", "Lack of knowledge", "People think ultrasound is only for pregnancy", "Unawareness of its importance".	104	31.8%
Cost / Financial Constraints	Cost, financial hardship, lack of funds, or affordability concerns.	"Cost", "Too expensive", "No money", "Financial restraint".	49	15.0%
Fear / Anxiety / Skepticism	Fear of procedure, fear of false results, anxiety about outcome, or distrust.	"Fear", "Anxiety", "Fear of false diagnosis", "Fear of the unknown".	19	5.8%
Unavailability / Accessibility	Mention of lack of ultrasound machines, limited access, or shortage of trained staff.	"Non-availability of equipment", "Limited access", "Shortage of skilled personnel".	8	2.4%
Misconceptions / Pregnancy-only belief	Stereotypes, social or cultural beliefs that ultrasound is for women or pregnancy only.	"People think it's for women", "Stereotype that ultrasound is for pregnant women", "Illiteracy".	13	4.0%
Concern about Diagnostic Accuracy	Concerns about the accuracy of the ultrasound as a diagnostic tool compared to other diagnostic tools.	"incorrect diagnosis", "inconsistent results".	6	1.8%
No Response / Blank / Nil	"Nil", blank rows, "No idea", "No opinion", "I don't know", meaningless symbols (e.g., 0, T, Y, U).	"Nil", "No idea", blank cells, "0".	128	1.2%

4.1.6 Hypothesis Testing

Hypotheses

1. Null Hypothesis ($H_{0\ 1}$): There is no significant relationship between the level of public awareness and the use of ultrasound for non-pregnancy-related diagnostic purposes.
2. Null Hypothesis ($H_{0\ 2}$): There is no significant relationship between the perception of the importance of ultrasound and the use of ultrasound for non-pregnancy-related diagnostic purposes.

Test of Hypothesis 1 using Spearman's Rank Correlation

Variables/ items used

1. Public awareness: This was derived from responses to section B item 4; "On a scale of 1 to 5, where 1 is "Very unaware" and 5 is "Very aware," how would you rate your general awareness of ultrasound uses beyond pregnancy?"

2. Ultrasound use: This was derived from responses to section D item 2; "Have you or a family member ever had an ultrasound scan for a non-pregnancy related condition?"

NOTE: The "I'm not sure" responses (n = 115) were excluded from the analysis to ensure that only definitive responses ("Yes" or "No") were used in the Spearman's correlation tests. This reduced the valid sample size for hypothesis testing to n = 212.

Table 4.14: Spearman's Correlation between public awareness and ultrasound use.

Variable	ρ (Spearman's rho)	p-value	N	Decision
Public awareness vs ultrasound use	0.374	1.96E-08	212	significant

Null Hypothesis ($H_{0\ 1}$): *There is no significant relationship between the level of public awareness and the use of ultrasound for non-pregnancy-related diagnostic purposes. Spearman's Correlation Result: ρ = 0.374 p =1.96E-08 (0.0000000196); Since p = 0.0000000196 is lesser than 0.05, we reject the null hypothesis* ($H_{0\ 1}$).

Conclusion: There is a moderate positive and statistically significant relationship between the students' public awareness of ultrasound and their use of ultrasound for non-pregnancy-related diagnostic purposes. This implies that respondents with higher awareness were more likely to have used ultrasonography or had family members who used it.

Test of Hypothesis 2 using Spearman's Rank Correlation

Variables/ items used

1. Perception of importance: This was derived from responses to section C item 1; "How important do you think ultrasound is as a diagnostic tool for non-pregnancy related conditions?"

2. Ultrasound use: This was derived from responses to section D item 2; "Have you or a family member ever had an ultrasound scan for a non-pregnancy related condition?"

Table 4.15: Spearman's Correlation between perception of importance and ultrasound use.

Variable	ρ (Spearman's rho)	p-value	N	Decision
perception of importance vs ultrasound use	0.561	5.87E-19	212	significant

Null Hypothesis ($H_{0\ 1}$): *There is no significant relationship between the level of public awareness and the use of ultrasound for non-pregnancy-related diagnostic purposes. Spearman's Correlation Result: ρ = 0.561 p=5.87E-19 (0.000000000000000000561); Since p= 0.000000000000000000561 is lesser than 0.05, we reject the null hypothesis* ($H_{0\ 2}$).

Conclusion: There is a strong positive and statistically significant relationship between the students' perception of the importance of ultrasound and their use of ultrasound for non-

pregnancy-related diagnostic purposes. This suggests that participants with a more favorable perception of ultrasound's importance were more likely to have used it for diagnostic purposes beyond pregnancy.

SUMMARY OF IMPORTANT TRENDS

- Most respondents remain largely unaware of the wider diagnostic applications of ultrasound still identifying it primarily with pregnancy monitoring.
- There is awareness of the use of ultrasound in non-pregnancy situations (e.g., abdominal, breast, or renal diseases) and it is unevenly spread across the various health problems.
- Awareness was reported subjectively, with the majority of the participants being somewhat aware and some being highly or very lowly aware.
- The majority of the respondents considered ultrasound to be a valuable diagnostic instrument but a considerable proportion of them displayed no knowledge or remained neutral showing an incomplete understanding.
- The strongest agreement among the participants was that ultrasound is safe and non-invasive, and the attitude towards its affordability was relatively lower.
- The most mentioned advantages were safety, diagnostic accuracy, and accessibility, although there were still those associating ultrasound only with pregnancy use.
- Approximately 40 per cent had experience with ultrasound in non-pregnancy conditions either personally or in their family, but many were unaware, meaning that there was little understanding of the purpose of ultrasound diagnosis.

- All in all, the results reveal that there is inconsistent awareness and an ongoing misconception that there is a need to educate people and create awareness campaigns on the broader medical uses of ultrasound.

4.2 DISCUSSION

This study accessed the public and awareness of ultrasound as a diagnostic tool beyond pregnancy among students of some selected faculties in University of Benin. The faculties involved in this study were the Faculty of Arts, Faculty of Basic Medical Sciences and the Faculty of Life Sciences. The main aim of the study was to assess the public perception and awareness of ultrasound as a diagnostic tool beyond pregnancy among students in the university of Benin.

Questionnaires were prepared and disseminated to students in the faculties involved and a total of 327 students spanning across the 3 different faculties attempted the questionnaire. The results indicate that, of the 327 participants in the survey, 197 (60.24%) were female respondents, making up the majority. Just 6 (1.83) of the respondents were older than 28, whereas 174 (53.21%) of the respondents were likewise in the 20–23 age range. With a total of 80 (24.46%) students from all three faculties participating in the survey, the 300 level had the most respondents. The 200 level (73; 22.32%) and 100 level (71; 21.71%) had the fewest participants, with only 51 (15.60%). With 132 participants (40.37%), the majority of respondents came from the faculty of arts.

According to study conducted by Nassar et al. (2024) on the perception, knowledge, indications, and future prospects of point-of-care ultrasound among medical students in Saudi Arabia. According to the findings of the study, the majority of respondents were female (57.9%) which is

quite similar to the demographic data of our study with the females being the majority (60.24%), while the age category with the highest percentage of respondents was those under 24 (83.6%). 75% of the students were from the Central region of Saudi Arabia. Respondents' ultrasound training varied; 23.4% took informal courses (median duration: four hours) and 31.5% took official courses (median duration: two hours). 17.3% of participants engaged in POCUS self-teaching, with a median time of four hours. 3.6% of them were officially accredited by POCUS. For a variety of reasons, a staggering 82.2% never employed POCUS in their affiliated hospital. Students' self-taught POCUS and their perceived difficulties doing an ultrasound examination for patients in their daily practice were positively correlated, according to multi-variable logistic binary regression analysis.

The qualitative findings of our study showed that the students found ultrasound to be very advantageous compared to with reference to other imaging modalities such as CT and MRI. This is somewhat similar to the findings of a a mixed method study conducted by Ng et al. (2024) on the knowledge, attitude, practices, and perceived barriers to using point-of-care ultrasound by Asian primary care physicians. The survey was completed by 330 people, and the interviews were conducted by 14. 22.5% of respondents reported utilizing point-of-care ultrasonography. The mean score for perceived knowledge was 1.9 out of 4, with a standard deviation of 0.6. The majority of the attitudes were favorable (mean score: 3.0 out of 4; SD: 0.5). According to the majority, training (90.9%), proficiency in point-of-care ultrasound abilities (90.2%), and clinical support (89.5%) were the main obstacles to using point-of-care ultrasound. The majority of participants viewed point-of-care ultrasonography to be helpful, according to qualitative data; nevertheless, they believed that their ability to use it was restricted by their clinical practice and point-of-care ultrasound proficiency.

CHAPTER FIVE

CONCLUSION, RECOMMENDATIONS, LIMITATIONS AND SUGGESTIONS FOR FURTHER STUDIES

5.1 Conclusion

This study examined the public perception and awareness of ultrasound as a diagnostic tool beyond pregnancy among students of selected faculties in the University of Benin. The results showed that although the students were reasonably knowledgeable of the various uses of ultrasound, they had a very high opinion of its significance. The results of the data analysis showed a high positive correlation between ultrasound perception and use for non-pregnancy-related objectives, and a somewhat positive correlation between awareness and use. These results imply that students are more likely to use ultrasound after pregnancy if they are more aware of it and have more positive opinions of it. Students generally have a positive opinion of ultrasonography, but focused education and sensitization campaigns are needed to increase knowledge of its wider uses.

5.2 Recommendations

1. There is a need for universities and health educators to organize seminars and outreach programs to increase students' awareness of the various diagnostic uses of ultrasound beyond pregnancy.
2. There is need for basic knowledge of medical imaging, including ultrasound applications, to be incorporated into general health or science courses to build early awareness among students.

3. To refute the myth that ultrasound is primarily used for pregnancy-related objectives, health organizations and the media should step up their public education campaigns.
4. To promote broader use for diagnosis unrelated to pregnancy, healthcare facilities should make sure that ultrasound services are accessible and reasonably priced.

5.3 Limitations

1. The research did not conduct a study on all the students in the University of Benin; hence, the limited sample of students in the specific faculties of the University does not fully represent the student population in the University and in general.
2. Self-reported questionnaires may also have caused bias on the part of the respondent or impacted on social desirability or even misunderstanding of some questions, which in turn might have compromised the accuracy and reliability of the gathered data.
3. The cross-sectional research design poses awareness and perceptions of the participants at one point, and thus, there is no possibility to develop any causal relationship or trace any changes.
4. The restricted representation of students of the non-health-related faculties might have limited the amount of diversity of opinions and understanding that the study takes into account.
5. Medical education or media influences were not considered in the study, and this could have influenced the awareness and perception of the respondents.

5.4 Suggestions for further studies

1. The sample of the studies should be more diversified and bigger, with students of different institutions or regions involved in future studies to enhance the level of representativeness and generalizability.

2. Focus group discussions and semi-structured interviews should be used as qualitative approaches to find out more about the beliefs, attitudes, and misconceptions of the students on ultrasound.
3. Comparative researches need to be conducted to identify the variation in the level of awareness and perception of the medical students and non-medical students as well as the practicing healthcare professionals.
4. They could carry out longitudinal studies to determine the change in awareness and perception of ultrasound over time especially following specific health education or public awareness intervention.
5. Studies on the effects of media exposure, level of education, and clinical practice on the knowledge of ultrasound as a diagnostic tool by the people should also be conducted in the future.

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APPENDIX I

QUESTIONNAIRE

This questionnaire is designed to assess the awareness and perception of ultrasound use beyond pregnancy among university students. All responses will remain confidential and are for academic purposes only.

Indicates required question

Section A: Demographic Information

1 What is your Faculty?

Mark only one oval.

□Faculty of Arts

□Faculty of Basic medical sciences

□Faculty of Life sciences

2 What is your current level of study?

Mark only one oval.
□100 level
□ 200 level
□300 level
□400 level
□500 level

3 **What is your gender?**

Mark only one oval.

□Male

□Female

4. What is your age

Mark only one oval.

□16 - 19 years

□20 - 23 years

□24 - 27 years

□28 years and above

Section B: Awareness of Ultrasound Use Beyond Pregnancy

5 Have you ever heard of an ultrasound scan (Sonography)?

Mark only one oval.

□Yes

□No

6. To the best of your knowledge, what is the primary use of an ultrasound scan?

Mark only one oval.

□To monitor pregnancy

□To diagnose other medical conditions

□Both of the above

□I don't know

7. Besides pregnancy, which of the following conditions do you know can be diagnosed using an ultrasound scan? (Select all that apply)

Check all that apply.

□Heart conditions

□Abdominal pain (E.g gallbladder stones, liver issues)

□Kidney Problems

□Breast lumps

□Tendon and muscle injuries

□Cancer detection

□I am not aware of any other uses

8 On a scale of 1 to 5, where 1 is "Very unaware" and 5 is "Very aware," how would you rate your general awareness of ultrasound uses beyond pregnancy?

Mark only one oval.

Very Unaware

1 2 3 4 5

_____

Very □ □□□□ aware

Section C: Perception of Ultrasound as a Diagnostic Tool

9. How important do you think ultrasound is as a diagnostic tool for non-pregnancy related conditions?

Mark only one oval.

□Very important

□Important

□Neutral

□Not important

□Not important at all

10. Please indicate your level of agreement with the following statements about ultrasound as a diagnostic tool for non-pregnancy related conditions.

Mark only one oval per row.

	Strongly Agree	agree	Neutral	Disagree	Strongly disagree
Ultrasound is a safe diagnostic tool	□	□	□	□	□
Ultrasound is affordable compared to other imaging modalities (CT, MRI)	□	□	□	□	□
Ultrasound Provides Quick results	□	□	□	□	□
Ultrasound can diagnose a wide range of conditions	□	□	□	□	□
Ultrasound should be					

used more widely beyond pregnancy	□	□	□	□	□

11 In your opinion, what are the main advantages of using ultrasound for diagnosis? *

Section D: Factors Influencing Awareness and Use

Check all that apply.

□Medical professionals (Doctors, Nurses, Radiographers, etc.)

□Family and friends

□Social media

□News and Magazines

□Lectures/school curriculum

□Personal experience (E.g You or a loved one had a scan)

□Others (please signify)

13. Have you or a family member ever had an ultrasound scan for a non-pregnancy related condition?

Mark only one oval.

□Yes

□No

□I'm not sure

14 Where do you get most of your information about medical diagnostic tools like ultrasound? (Select all that apply)

Mark only one oval per row.

Which of the following factors do you think most influence a person's decision to use an ultrasound scan for diagnosis? (Rank from 1 to 3, where 1 is the most influential)

	1 (Most influencing)	2	3
Cost			
Recommendation from a doctor			

_____

Personal
knowledge about
it's uses

_____

Availability of the
Equipment

_____

Fear or anxiety
about the
procedure

_____

15 In your opinion, what are the major barriers that prevent people from using ultrasound for non-pregnancy related issues, even if they need it?

_____

_____

_____

APPENDIX II

RESEARCH ETHICS COMMITTEE
COLLEGE OF MEDICAL SCIENCES
UNIVERSITY OF BENIN, BENIN CITY, NIGERIA.

Chairman: Prof. F. A Imarhiagbe
MBChb, FMCP
Cert Clin Res and ethics (NIH), MD.
0803449092

P.M.B 1154, BENIN CITY
Email: researchethics.cms@gmail.com

Our Ref: CMS/REC/01/VOL.2/803 **Date:** 9th October, 2025

Re: PUBLIC PERCEPTION AND AWARENESS OF ULTRASOUND AS A DIAGNOSTIC TOOL BEYOND PREGNANCY AMONG STUDENTS OF SOME SELECTED FACULTIES IN UNIBEN

Name of Principal Investigator: **IMAGBEGHIAN OMOFEBA**
Department Of Radiography,
School of Basic Medical Science
College of Medical Sciences,
University of Benin

REC Approval No: CMS/REC/2025/803

This is to inform you that the research described in the submitted proposal, the Informed Consent Forms and other participant information materials have been reviewed and approved by the College Research Ethics Committee, University of Benin.

This approval dates from **9th October, 2025 to 10th October, 2025.** In multi-year research, Endeavour to submit your annual report to the REC early in order to obtain renewal of your approval and avoid disruption of your research.

The National Code of Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations and with the tenets of the code including ensuring that all adverse events are reported promptly to the REC. No, changes are permitted in the research without prior approval by REC except in circumstances outlined in the code. REC reserves the right to conduct compliance visit to your research site without prior notice. Thank you.

PROF. F.A IMARHIAGBE
Chairman, REC

Promoting best ethical & scientific standard for research in Nigeria