UTILIZATION OF POINT OF CARE ULTRASONOGRAPHY (POCUS) BY HEALTH CARE PROVIDERS WORKING IN THE EMERGENCY DEPARTMENT AND CRITICAL CARE UNIT AT KENYATTA NATIONAL HOSPITAL: BENEFITS AND BARRIERS.

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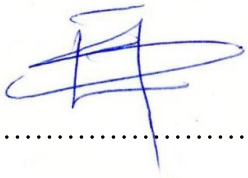
DECLARATION

I, Dr. Eunice Ndungwa Sammy, declare that the work contained herein is my original idea and has not been presented at any other university or institution of higher learning to the best of my knowledge.



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Date :10th March 2023

Approval by supervisors

This research dissertation has been submitted with my approval as a university supervisor.

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LIST OF ABBREVIATIONS

CT- Computed Tomography

DVT-Deep Venous Thrombosis

FAST- Focused Assessment with Sonography in Trauma

KNH- Kenyatta National Hospital

LMIC-Low- and Middle Income Countries.

MRI- Magnetic Resonance Imaging

MTU-Multi Targeted Ultrasound

NGO- Non-Governmental organization

POCE-Point of Care Echocardiography

POCUS- Point of Care Ultrasound

RUSH- Rapid Ultrasound for Shock and Hypotension.

STU- Single Targeted Ultrasound

WHO- World Health Organization

ABSTRACT

Background: Point of Care Ultrasound (POCUS) sometimes referred to as bedside or clinical ultrasound is the use of ultrasound at the patient's location either bedside, in an ambulance, or in a remote village, and has been gaining popularity in diverse healthcare settings due to its portability and efficiency in providing real-time imaging. POCUS enables faster and more accurate diagnosis, helps guide procedures, and generally improves patient management and outcome. There has however been reduced uptake of POCUS with the commonest barrier been lack of training, training curricula, and accreditation, and also the availability of equipment. There is limited knowledge of the use of POCUS in the local healthcare setting in Kenya.

The Purpose of the study: To determine the utility of point of care ultrasound (POCUS) by healthcare providers working in the emergency department and critical care unit at Kenyatta National Hospital, the benefits, and the barriers to uptake.

Methodology: This was a cross sectional study design conducted at the Emergency Department and Critical Care Unit at Kenyatta National Hospital. A total of 56 doctors working in the emergency department were enrolled consecutively in the study. A structured questionnaire was used to collect participants' demographic data, and also assess the utility of POCUS by assessing the frequency of use and areas where it has been utilized, any training received, the observed benefits, and also the barriers to its uptake. Data analysis was done using Statistical Package of Social Sciences (SPSS) version 26.

Results: The majority of the respondents, 71% were aware of POCUS, 62% of them had received some form of training with 71.1% receiving bedside tutorials and 28.9% had a practical course with demonstrations. Utilization of POCUS was 64% although the frequency of use was low with 52.8% using POCUS a few times a week and 25% using it a few times a year. More than half of the respondents, 58.9% were fairly competent. Majority of the respondents stated that POCUS was very useful, 76.8% in Abdominal (FAST /liver /GB/ Spleen/renal) region and it was least useful, 30.4% in regional (soft tissue/joints/thyroid/scrotal) area.

All of the respondents agreed that POCUS allows for a faster diagnosis and that it rationalizes ordering a detailed radiological investigation. Inadequate POCUS machines in emergency care, lack of training, availability of conventional ultrasound machines, and lack of a clear training curriculum on POCUS use were key barriers identified. Years worked at the emergency department (OR =1.45, 95%CI: 1.02 – 4.51, p = 0.041), working in CCU department (OR =2.51, 95%CI: 1.14 – 6.31, p =0.002), awareness of POCUS (OR = 7.58, 95%CI: 2.08 – 27.57, p =0.002), having POCUS training (OR =6.5, 95%CI:1.94 – 21.78, p = 0.003) and competency of POCUS use (OR =4.83, 95%CI:1.49 – 15.61, p =0.011) were significantly associated with increased likelihood of POCUS use.

Conclusion and recommendation: The findings have established that awareness of POCUS was high while the frequency of utilization was extremely low because of inadequate machines, and lack of training and a proper training curriculum. Thus, it is crucial to provide training and develop a standard training curriculum and accreditation bodies on POCUS as well as avail POCUS machines and incorporate POCUS in the standard operating procedures for effective utilization.

CHAPTER ONE: INTRODUCTION

1.1. Background

Ultrasound imaging involves the use of sound waves to produce images. Its use in diagnosis and medicine dates back to the year 1956 and has since evolved to newer imaging techniques like Doppler imaging, 3D imaging, and sonoelastography among others (Alter, 1988). Ultrasound has a wide range of use due to its ready availability, cost effectiveness, and does not use ionizing radiation making it safe in pregnancy and children (Enriquez & Wu, 2014).

Point of care ultrasound (POCUS) refers to the use of portable ultrasound at the patient's bedside either for a diagnostic or therapeutic purpose(Kendall et al., 2007). Whereas bedside sonography and POCUS are used interchangeably, bedside ultrasonography is an older term where sonographic assessment is usually at the medical facility at the patient's bed whereas POCUS is a broader term where the portable ultrasound can be transported to wherever the patient is located such as in an ambulance, in a remote village(Henwood, Rempell, Liteplo, Leo, et al., 2013). Other terms like clinical ultrasound also refer to the same. In POCUS the attending doctor acquires and interprets the images and uses the information together with clinical information to immediately guide patient management. (Whitson et al .,2016).

POCUS does not replace conventional ultrasound done by radiologists or sonographers but it's a precise, focused exam that should be easy to understand and perform and meant to answer a specific question at hand(Kendall et al., 2007). The application of POCUS began in the early 1990s when it was widely utilized in the emergency department but has since been extended to other departments like internal medicine , obstetrics, anesthesia, and critical care among others(Kingwill et al., 2017). This has been made possible due to the invention of portable devices either hand carried or hand held devices which can easily be accessed at the patients bedside and which are also cost effective and hence more available (Cid et al., 2020).

POCUS has proven to be an effective tool in patient management making it not just a skill of the few but its wider utilization in daily patient care (Kingwill et al., 2017). It provides faster diagnosis, confirms or changes the diagnosis, or even helps narrow down the clinical diagnosis.(Bhagra et al., 2016; Kobal et al., 2016; Yates et al., 2016). Its therefore an essential tool in initial patient management as it augments healthcare workers' ability to assess and

manage patients and it increases the healthcare provider's confidence in diagnosis and initial management. Early patient triage, diagnosis, management, and follow-up are therefore achieved and this leads to improved patient outcomes((Udrea et al., 2017). It also helps reduce delays in diagnosis and patient referral and also when used in guiding procedures it helps reduce procedure related complications((Valle Alonso et al., 2019). The patient gains more satisfaction when POCUS is performed by the primary caregiver and this leads to an improved doctor-patient relationship (Genc et al., 2016).

Despite the benefits of POCUS and the wide availability of lower-cost, smaller handheld ultrasound units, there is still reduced use of POCUS in the diagnosis and management of patients both in Kenya and the outside world(Micks et al., 2016). The primary barrier has been the lack of widespread, efficient, and affordable training solutions (Micks et al., 2016; Peh & Kang, 2018; Smallwood & Dachsel, 2018). In Kenya, most of the training is done by nongovernmental organizations (NGO) and most are short workshop trainings of which without follow up there is lack of confidence by the providers to offer POCUS((Siuba et al., 2016; Wanjiku et al., 2018). The other common barrier especially in the developing world is the lack of equipment to carry out POCUS. The cost of ultrasound machines is still prohibitive in the developing world despite many manufacturers lowering costs to produce more cost-effective machines.(Jones et al., 2020; Peh & Kang, 2018) Health care providers' attitudes also play a key role in the uptake of POCUS as many still rely on the traditional examination methods, others lack interest while others find it time consuming to undergo the training.((Wong et al., 2020)

The importance of POCUS cannot be ignored in the current management of critically ill patient((Kobal et al., 2016). It's soon going to become the "stethoscope" that every clinician needs to augment patient management. Kenyatta national hospital, been the largest referral hospital in Kenya and East Africa receives wide range patients with a wide range of diagnoses and plays a critical role in the management of an acutely ill patient. The importance of POCUS in the emergency department is key in the triage and timely management of these patients most of whom are in critical condition((Fischer et al., 2015). Trainings have been carried out by non-governmental organizations in collaboration with KNH administration targeted to various carders, especially doctors.

Therefore, this study aimed at finding out whether point of care ultrasound is been utilized by the primary caregivers at Kenyatta National hospital Accident and Emergency department and the Critical care unit and if been utilized what are some of the benefits observed from its utilization. If not been utilized the study aims to find out what are the barriers to its uptake. The findings of this study would help in reinforcing the utilization of POCUS given its proven benefits to the patients and health care providers. It also aids in addressing the challenges that contribute to its low uptake by increasing training, provision of machines, and even been incorporated into the curricula of the disciplines that require it.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction to ultrasound and POCUS

Ultrasound has been used in medicine for many years. It is a non-invasive technique that does not use ionizing radiation. In the last two decades, ultrasound machines have become more portable and low cost to even handheld devices and this has made them more readily available for use at patient's bedside (Cid et al., 2020). Real time image acquisition allows immediate interpretation of results and incorporation into the ongoing decision making and patient care. The report is available immediately for the clinician and operator and information can be stored for follow up image comparison (Kingwill et al., 2017).

Point of care ultrasound(POCUS) sometimes also referred to as “clinical” ultrasound is a bedside ultrasound performed by the treating doctor as an adjunct to clinical evaluation (Bhagra et al., 2016). A presumptive diagnosis can be confirmed by information provided using POCUS and it is an effective tool for monitoring patients and procedural guidance (Choi et al., 2020).

Kendal et al. (2007) clearly defined the characteristics of point of care ultrasound in contrast to the formal radiological ultrasound. The examination should be for a well-defined purpose geared towards improved patient outcomes. This examination should be focused and goal directed. Another characteristic of POCUS is that the examination should be easily learned, quick to perform and findings are easily recognizable. The interpretation should be simple with the endpoint of guiding immediate medical care (Kendall et al., 2007).

Traditionally, physicians relied on medical history and physical examination i.e. clinical evaluation to derive a differential diagnosis and formulate a management plan. However, clinical evaluation alone is frequently inaccurate in determining the correct diagnosis (Cid et al., 2020). The difference between POCUS and consultative ultrasonography is that the attending doctor performs the imaging, interprets, and uses the information to make clinical decisions. There is also a slight difference between POCUS and bedside ultrasound in that the latter is performed at the patient's bedside while POCUS imaging is done wherever the patient is with a portable ultrasound such as ambulance, helicopter, or emergency room (Valle Alonso et al., 2019).

2.2. Utilizationof Pocus

The application of POCUS has developed rapidly since the 1990s and has now become part of daily practices across many disciplines (Kingwill et al., 2017). The use of bedside ultrasound was pioneered by the emergency medicine discipline which led to the widespread adoption of Focused Assessment with Sonography in Trauma (FAST) as the prototype point of care ultrasound investigation (American college of emergency physicians 1991). Over the years there has been rapid development in this field and point of care ultrasound is likely to become a daily medical practice for practitioners across multiple specialties. The most common specialties that utilize POCUS include emergency medicine, anesthesia and critical care, and internal medicine (Valle Alonso et al., 2019).

2.2.1. Utilizationof Pocus in Kenya and Other Low and Middle-Income Countries

There has been a significant interest to employ POCUS in low and middle income countries(LMIC)because they are resource-limited and this technology requires less infrastructure and training unlike the other imaging modalities like CT, and MRI (Becker et al., 2016). WHO in 1985 concluded that the use of ultrasound has real advantages with overall improved patient management and care of individuals.

Kenya been among the LMIC has a limited workforce with an estimated 14 doctors per 100,000 population of whom 60% live in urban areas (WHO, 2016). In addition, radiology specialists are few with most been in the urban areas and hence limited access to radiology services in the rural setting(Wanjiku et al., 2018). Hence, there is a need to equip the healthcare providers like general physicians, clinical officers and nurses with basic ultrasound imaging skills to be able to provide services in these rural areas.

The novel POCUS training started in Kenya in the year 2013 with 81 trainees recruited from different hospitals in 38 hospitals. The participants were equipped with practical skills and refresher training was also offered. There was noted an increase in ultrasound use in the facilities with the involved participants which influenced their clinical care of patients, especially in obstetrics (Bell et al., 2016a). A follow up study in 2015 to assess the outcome of the training showed better performance for those who had more training and frequent scanning and better

image quality with 2nd and 3rd trimester obstetric ultrasound been the most performed scan (Wanjiku et al., 2018).

Jones et al. (2020) also assessed the utility of POCUS among family medicine physicians in Kenya and reported an increase in skill and confidence after a short workshop training. He noted that these physicians are well situated to utilize POCUS yet most lacked formal training (Jones et al., 2020). Other low- and moderate-income countries (LMIC) face similar challenges as Kenya. POCUS has been shown to change clinical management in these resource limited settings with major changes related to medication choice, admission, transfer to higher levels of care, and performing procedures causing a great impact on the care of these patients (Henwood, Rempell, Liteplo, Leo, et al., 2013). POCUS resulted in modification in clinical management in up to 76%0f cases(Becker et al., 2016). Kotlyar et al. (2008) in their study on the utility of ultrasound in Liberia concluded that POCUS has the potential to change management in up to two-thirds of patients who receive it showing a great impact in obstetric imaging and abdominal trauma which both only need a curvilinear probe for imaging(Kotlyar & Moore, 2008).

2.2.2. Utilizationof Pœus in the Developed World

POCUS has been widely used adopted and utilized in developed countries, been classified into single or multiple targeted ultrasound examinations (STU versus MTU)(Choi et al., 2020).In the emergency and intensive care unit, it has been used widely as POCE(point of care echocardiography) to assess pericardial effusion and tamponade, cardiac and the great vessels anatomy, and assess heart contractility and hemodynamics for preload, cardiac activity, and afterload (Kovell et al., 2018). The results provide triage and early management plans when coupled with the clinical assessment (Spencer, 2015). Other areas where STU is used is in thoracic imaging to detect pathologies like pneumothorax, consolidations, and effusions (Volpicelli et al., 2012). Deep venous thrombosis in pulmonary embolism (Blaivas et al., 2000), testicular and even ocular imaging (Choi et al., 2020).

POCUS has also been used widely in the abdomen to detect bowel trauma, biliary and urinary tracts, and also in abdominal aortic aneurysms. Given that many patients present with acute abdomen with a wide differential diagnosis, POCUS plays a major role to narrow the differential diagnosis and provide faster intervention (Spencer, 2015). Rubano et al demonstrated an increased sensitivity and specificity of up to 98% in the detection of abdominal aortic aneurysms

in symptomatic patients hence helping avoid complications of rupture in time (Rubano et al., 2013).

The use of POCUS in Ultrasound-guided procedures has also been widely applied especially for critically ill patients in emergency departments and intensive care units. It has been used in central and peripheral venous catheterization (Barr et al., 2014), especially in difficult venous access where ultrasound use showed an improved speed and patient satisfaction with fewer skin punctures and complications (Bauman et al., 2009). Other ultrasound guided procedures include thoracocentesis, paracentesis, pericardiocentesis, arthrocentesis, nerve block, abscess drainage, and foreign body removal among others (Bell et al., 2016).

Multiple targeted ultrasound examinations (MTU) are used in cases of trauma, cardiac arrest, shock, and chest pain and are usually performed by a qualified physician to determine each clinical situation (Choi et al., 2020). Ultrasound can detect cardiac motion in a pulseless patient with a negative predictive value of up to 100% which helps to determine patients with little chance of survival and stoppage of unnecessary resuscitations (Cureton et al., 2012).

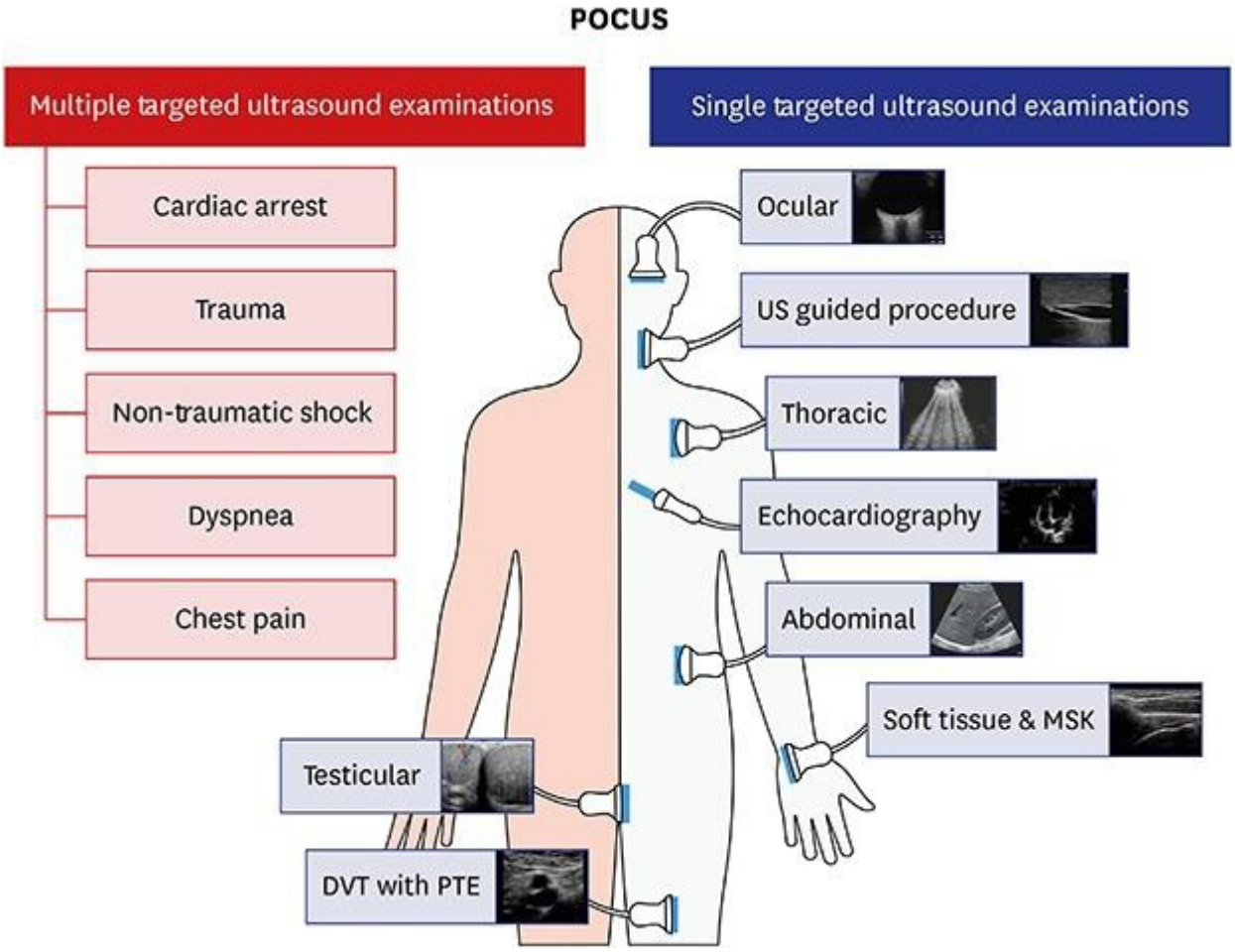

Figure 1 showing the scope of POCUS. Source Choi et al., (2020)

2.3. Benefits of POCUS

The benefits of POCUS are numerous as already mentioned in the above studies. According To to the Emergency Medicine Kenya Foundation, it augments health care provider's ability to manage a critically ill patient and increases confidence in the management. It is a powerful adjunct tool in the clinical assessment that can improve patient triage, change the primary diagnosis, reinforce the initial diagnosis and modify management plans on whether to perform a procedure, hospitalize, discharge or refer in up to 30-80% of cases depending on the clinical scenario while a multi-organ POCUS helps identify the cause of a symptom and narrow down the differential diagnosis (Bhagra et al., 2016; Kobal et al., 2016; Udrea et al., 2017; Yates et al.,

2016). POCUS helps to reduce procedure related complications. Multiple procedures performed with POCUS in a critically ill patient have shown increased success rates and reduction of complication rates. The use of POCUS in venous access has shown reduced attempts, reduced procedure time, and reduced complications compared to blind attempts(Valle Alonso et al., 2019). Barnes et al. found out that ultrasound guidance in diagnostic thoracentesis reduced the rate of pneumothorax and tube thoracotomy (Barnes et al., 2005).

POCUS has also been shown to be cost-saving. When incorporated early in patient management, especially in rural and community hospitals, it can eliminate extra costs of additional diagnostic workups directly and indirectly (Van Schaik et al., 2019). It helps reduce costs in diagnostic procedures and also reduce procedure related complications which in turn reduces the length of hospital stay associated with these complications (Bhagra et al., 2016).

POCUS also promotes interprofessional task sharing between radiologists, sonographers and other health care workers and promotes capacity building. Vinayak et al in their study on designing and implementing a training model to equip Kenyan midwives to identify risk factors in pregnancy found it to be an effective model that can increase POCUS access with proven benefits of early detection and referral of complications. There has been noted to be a more effective and sustainable extension of health care access especially to the under serviced areas with collaborative task sharing (Vinayak & Brownie, 2018).

2.4. Barriers to the uptake of POCUS.

Despite the immense benefits of POCUS, its uptake is still slow. (Taft et al). Lack of training has been cited as the major primary barrier to the use of POCUS both in low and middle-income countries and also the developed world (Jones et al., 2020; Peh & Kang, 2018; Smallwood & Dachsel, 2018). Short-term training done in Kenya by various non-governmental organizations (NGOs) has proved helpful but there has been noted to be a decline in skills and confidence after the training if no refresher courses or follow up training is done (Wanjiku et al., 2018). Lack of trainers or mentors, suitable formal training curricula, and credentialing impede the development of a training program (Peh & Kang, 2018). Unavailability of supervision and lack of quality assurance processes like archiving and review of images is also noted to be a challenge (Wong et al., 2020).

Issues of competence, certification, and credentialing have been major concerns in POCUS. Competence is the acquisition of the requisite knowledge and skills to perform POCUS, certification is the availability of a recognized body to identify that competence in POCUS while credentialing is an assessment of qualifications to practice. There has been no consensus on establishing the required competencies and certification bodies for POCUS (McCormick et al., 2018).

The second major cited barrier is the lack of ultrasound machines to carry out POCUS. Though ultrasound machines are relatively inexpensive compared to other imaging modalities, the cost is still prohibiting especially in LMICS (Jones et al., 2020). Despite most companies manufacturing more affordable machines, there still is a high initial cost incurred in the startup of POCUS due to machine acquisition and training (Peh & Kang, 2018). In Kenya, most NGOs like the emergency medicine foundation are distributing POCUS machines but still, there is no full coverage to meet the demand. Apart from the issue of cost and availability, parameters of the machines such as portability, and ability to withstand harsh conditions even in areas with no power have also been cited as barriers `, especially in rural and community settings. Difficulties with knobology with different make or models of machines have also been reported as a barrier by different users (Enriquez & Wu, 2014).

Individual and organizational attitudes are also cited as barriers to the effective adoption of POCUS. Some practitioners lack understanding of the evidence base behind this imaging modality and still overly on the traditional examination methods (Smallwood & Dachsel, 2018), others feel the length of time required in training and also the availability of time to perform the procedure is lengthy, while others lack interest and motivation in this subject (Peh & Kang, 2018).Wong et al in their study found out that most internists did not feel that POCUS examination will change their clinical judgments and their continued overreliance may make them lose their physical examination skills. The organizational environment in the provision of proper leadership, policies, economic, social, and structural infrastructure plays a major role (Wong et al., 2020). Other cited barriers include liability issues and also resistance by imaging specialists though not major barriers (Wong et al., 2020). The possibility of litigation been taken against the clinician was mentioned as a concern but it was later concluded that legal action is

more likely to be taken if one fails to perform the imaging than performing the imaging(Blaivas & Pawl, 2012; Collins et al., 2019).

2.5. StudyJustification.

POCUS has been shown to improve patient outcomes and improve providers' confidence in the diagnosis and management of patients. Worldwide, there has been an increasing intensity and enthusiasm over the last decade in the use of this modality by health care providers. Kenya has a limited number of radiologists and sonographers who may not be available to carry out some of the basic ultrasound procedures throughout the country whenever urgently needed. There has also been an increased demand for other imaging modalities which require their attention.

Many facilities also lack basic imaging modalities and this leads to delays in diagnosis and hence management of these patients. It is, therefore, necessary for healthcare providers to embrace and utilize POCUS as the primary caregivers to improve patient clinical outcomes and hasten patient management. As shown in the literature review, the importance of POCUS in management of the critically ill patient in the emergency department and critical care unit cannot be overemphasized. The emergency department is the first point of care for most patients and utilization of POCUS at this department is essential for triage, initial diagnosis, faster diagnosis, and appropriate management options. POCUS is also widely used in the critical care unit for guiding procedures like catheter insertions and continued management of patients in critical condition.

Studies done in Kenya on the utility of POCUS were for individual subspecialties which include family physicians(Jones et al., 2020), or follow-up studies in areas where training had been done to assess the impact(Wanjiku et al., 2018). Despite having some training on POCUS in KNH mostly conducted by NGOs in collaboration with the administration, it is not known whether the trained personnel utilize POCUS in the management of their patients and the benefits or challenges experienced.

This study, therefore, aims at determining the utilization of POCUS by healthcare givers at the emergency department and critical care unit of Kenyatta National Hospital and establish the benefits of this utility. If not been utilized, the study identified the barriers to the uptake of this “stethoscope of the future”.

This study is essential in reinforcing the utilization of POCUS by health care providers given its vast benefits. It also helps in identifying the challenges and realization of the gaps that contribute to its low uptake which can be addressed by lobbying for finances to avail more portable ultrasound machines, opening opportunities for the provision of more training solutions, and developing training curricula to achieve competence to learn this operator-dependent modality with overall benefit to improved patient care.

2.6. Objectives

2.6.1. Broad objective:

To determine the utilization of point of care ultrasound (POCUS) by doctors working in the emergency and critical care unit at Kenyatta National Hospital, the benefits and the barriers to uptake.

2.6.2. Specific objectives

1. To determine the utilization of POCUS by doctors working in the emergency department and critical care unit at KNH.
2. To establish the benefits of POCUS utilization in the Emergency Department and critical care unit.
3. To find out the barriers to the uptake of POCUS by the doctors in the KNH emergency department and critical care unit.

CHAPTER THREE: METHODOLOGY

3.1. Study Design

The research adopted a cross-sectional research design. The respondents were engaged during the study period to determine the utility, benefits, and barriers to POCUS utilization. A cross-sectional design is most appropriate for this content because it allows the researcher to identify the outcome (Setia, 2016). This design provides data for quantitative analysis. The benefit of the cross-sectional study is that it is a one-time data collection. It does not involve long duration and hence is quick and more financially feasible.

3.2. Study setting

The study was conducted at Kenyatta National Hospital Accident and Emergency Department and the Critical Care Unit. Kenyatta National Hospital is the largest referral hospital in East and Central Africa with a bed capacity of 1,800. The Accident and Emergency department is a busy department that attends to approximately 200-250 patients daily with a monthly average of 4000 patients. It comprises 2 units with one unit dedicated to pediatric patients known as the emergency pediatric unit and the other unit handles trauma and medical cases. There are 35 doctors and 141 nurses working in the department.

The Critical care unit has a 36-bed capacity. There are three critical care units namely the pediatric intensive care unit, the main intensive care unit that mainly admits surgical cases and medical intensive care unit that deals with adult patients. There are 22 medical officers and 6 consultants working in the CCU.

3.3. Target Population

The target population included Doctors working at the Accident and Emergency and Critical care Unit. This population has been selected because of their likelihood to use POCUS as observed in other settings in the world.

3.4. Inclusɒn Criteria

- The study included doctors working at the Kenyatta National Hospital accident and emergency department and Critical Care Unit for the last six months. The six months

were considered to be enough for new staff to fully understand the processes within the department as well as train and understand the use of POCUS in healthcare.

- Doctors who consent to participate in the study.

3.5. Exclusion criteria

- Doctors deployed at the emergency and critical care unit for less than 6 months.

3.6. Sample size

The Census method was adopted in this study. All doctors in the accident and emergency department and critical care unit were targeted. Census is essential in this context considering that the target population is small hence would be appropriate to target everyone.

Setting	Number of doctors
Accident and emergency department	35
Critical Care Unit	28
Total	63

3.6.1. Sample size determination

A complete enumeration was done where all the doctors in the accident and emergency department and Critical Care unit were targeted. A total of 56 doctors consented to participate in the study and were enrolled.

3.7. Sampling technique

The study adopted a consecutive sampling technique targeting respondents based on length of stay at the accident and emergency department and critical care unit(Taherdoost, 2018). The study sought to recruit doctors who have worked in the accident and emergency and critical care unit for more than six months. After identifying respondents who meet the inclusion criteria, the respondents were selected consecutively until the sample size was attained.

3.8. Research tool

A structured questionnaire was used in the data collection process. The questionnaire was structured based on the research problem and the objectives that are being investigated. The data collection tool was uploaded to google forms to ensure easy data collection and storage.

3.9. Research assistants

The Principal investigator employed the help of research assistants to collect information from the sample population. The research assistants who were recruited to help in data collection were medical students with experience in data collection to ensure relevancy. This was essential in ensuring that valid, reliable, and accurate data was obtained. Two research assistants were recruited to help in data collection.

3.10. Data collection procedure

The data collection process began after approval from the KNH-UoN Ethics review committee and Kenyatta National Hospital administration. After approval, the principal investigator with the help of research assistants headed to the accident and emergency and the critical care unit where they identified and recruited potential respondents. To ensure that the data collection does not interfere with the work of doctors in the department, the research assistants approached them at different intervals during short breaks in the dining rooms and resting areas which allowed easy engagement and improved understanding of the study and its objectives. The research assistants used tablets with a pre-installed questionnaire that was used in data collection. The data collection process began at 8.00 am and ended at 5.00 pm every day until the sample size was attained. The study duration was based on the number of questionnaires that are filled. Once a respondent has participated in the study, they were given a unique number which they were requested to reveal in case they are approached again during the data collection process. This was essential in controlling double data collection.

3.11. Pretest, validity, and Reliability

To check the efficacy and reliability of the data abstraction tool, a pilot test was done at KNH before the start of the actual data collection. This helped in the familiarization of the study setting, the data collection process as well as testing of the research tool. This was essential in maintaining a high level of reliability of the data questionnaire in attaining the needed outcomes. The questionnaire was also reviewed by experts in the field to assess its validity and efficacy in obtaining the needed data for analysis.

3.12. Data entry and Storage

Data collection was done using a research questionnaire based on the study objectives. Data entry was done using Epi data version 3.1. After data entry, the coded data was exported into SPSS version 26 for analysis. The available data in soft copy form was stored in a password-protected laptop only accessed by the researcher or with approval from the researcher.

3.13. Data analysis

The data analysis included descriptive analysis, which described the data obtained from the data collection tool. Categorical data was analyzed using frequencies and percentages and represented in graphs and charts. Continuous data was analyzed using mean (SD) and median (IQR). This was represented in tables. Data analysis was done using SPSS version 26 software. All comparisons were performed at 0.05 significance level. The utility of POCUS by clinicians was calculated as a proportion of clinicians who have used POCUS from the sample population sought. The benefits and barriers of POCUS utilization at Kenyatta National Hospital were presented as categorical data and analyzed using frequencies (n) and percentages (%).

3.14. Ethical Consideration

The study sought approval from the KNH-UoN Ethics committee which reviewed the ethical aspects of the study. Approval was also sought from KNH administration to ensure that there is compliance with laid down research procedures and access to the needed information within the hospital. Confidentiality, anonymity, and privacy were fully guaranteed throughout the study. All the Covid-19 prevention guidelines were observed to control cross-infection among research assistants.

The recruited clinicians into the study were required to sign consent which showed their agreement with the study protocols and processes. Those who do not consent were excluded from the study. Strict confidentiality and anonymity were observed when collecting, storing, processing data, and in handling the results. A summary of the study findings was presented to the KHN administration.

CHAPTER FOUR: RESULTS

4.1. Introduction

The study sought to determine the utilization of point of care ultrasound (POCUS) by doctors working in the emergency and critical care unit at Kenyatta National Hospital, the benefits, and the barriers to uptake. A total of 63 doctors working in the accident and emergency and critical care unit. A total of 56 respondents completed the questionnaire successfully representing a 88.9% response rate.

4.2. Demographic characteristics of doctors working in the emergency and critical care unit at Kenyatta National Hospital

More than half, 66.1% (n =37) of the respondents were male. The average age was 33(±5.9) years, and 89.3% (n =50) were medical officers. The findings also revealed that the mean years of experience among respondents was 5.89(±4.49) years. Further, 55.4% (n =31) were from the accident and emergency department and the average duration of stay in the current setting was 2.04(±0.57) years as shown in Table 1.

Table 1: Demographic characteristics of doctors working in the emergency and critical care unit at Kenyatta National Hospital

	Frequency	Percent
Gender		
Male	37	66.1
Female	19	33.9
Age (Mean)	33.07(5.9)	
Cadre		
Medical officer	50	89.3
Consultant	6	10.7
Years of work experience (Mean)	5.89(4.49)	
Department		
Accident and emergency	31	55.4
CCU	25	44.6
Years in the current setting (Mean)	2.04(0.57)	

4.3. The utilization of POCUS by doctors working in the emergency department and critical care unit at KNH

4.3.1. Awareness of POCUS among respondents

The findings showed that 71.4% (n =40) of the respondents were aware of POCUS as shown in Figure 1.

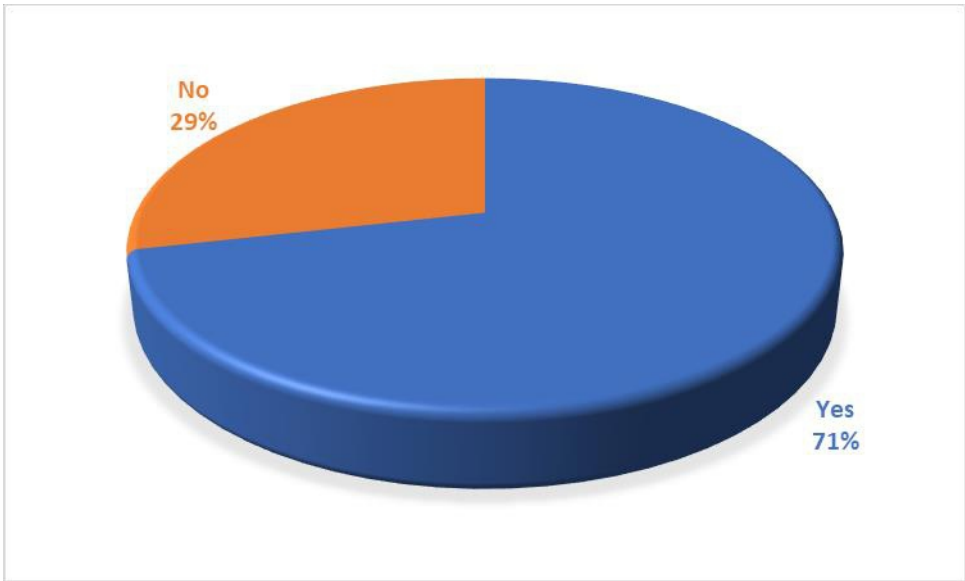

Figure 1: Awareness of POCUS

4.3.2. Use of POCUS in the current workplace

The findings revealed that 64.3%(n =36) of the respondents affirmed that they have utilized POCUS in their current workplace as shown in Figure 2.

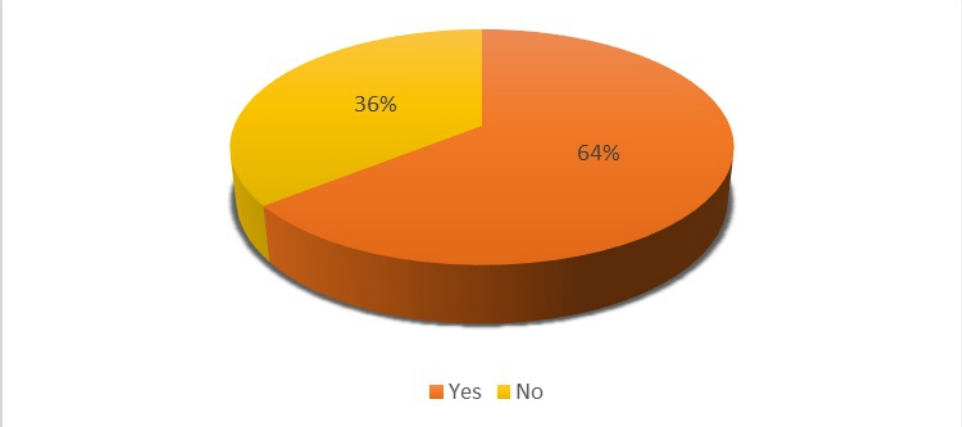

Figure 2: Use of POCUS in the current workplace

4.3.3. Frequency of POCUS Use

Among the respondents who reported the use of POCUS, 52.8%(n =19) used POCUS a few times a week, 25%(n =9) stated few times a year, and 22.2%(n =8) few times a month (Figure 3).

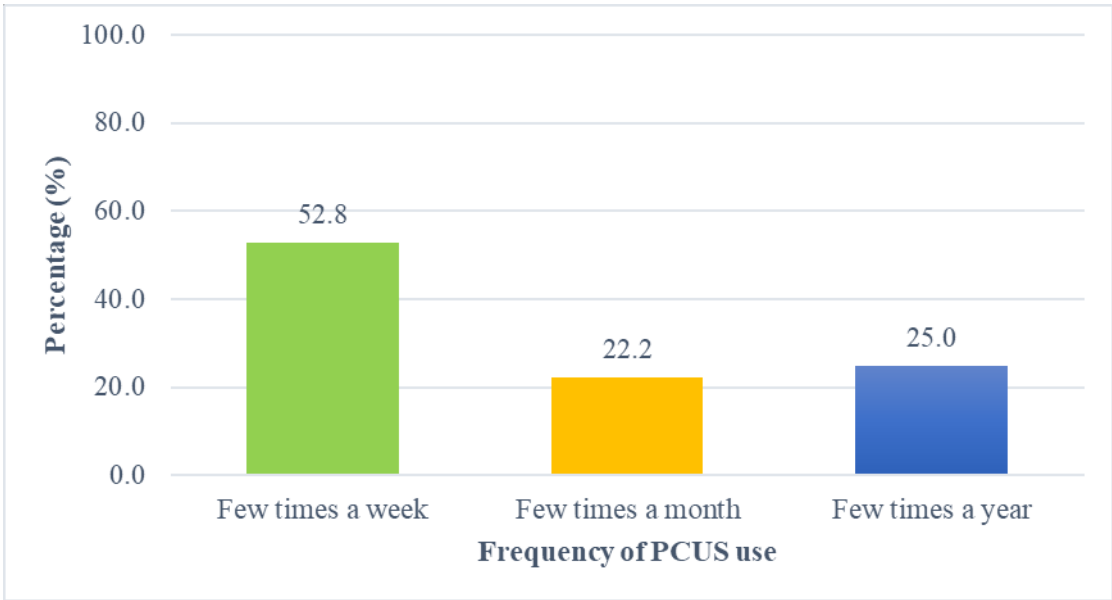

Figure 3: Frequency of POCUS Use

4.3.4. Training on POCUS use

The findings revealed that 62.5%(n =35) of the respondents stated that they have received training on the use of POCUS in emergency and critical care setting as shown in Figure 4.

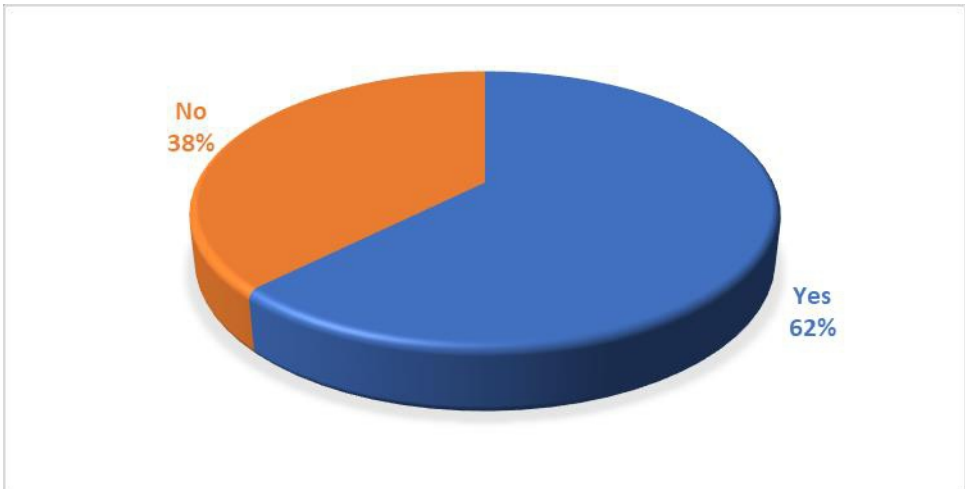

Figure 4: Training on POCUS use

4.3.5. Form of training

The findings established among those who had POCUS training, 71.1%(n =27) received bedside tutorials while 28.9%(n =11) had practical courses with demonstrations as shown in Figure 5.

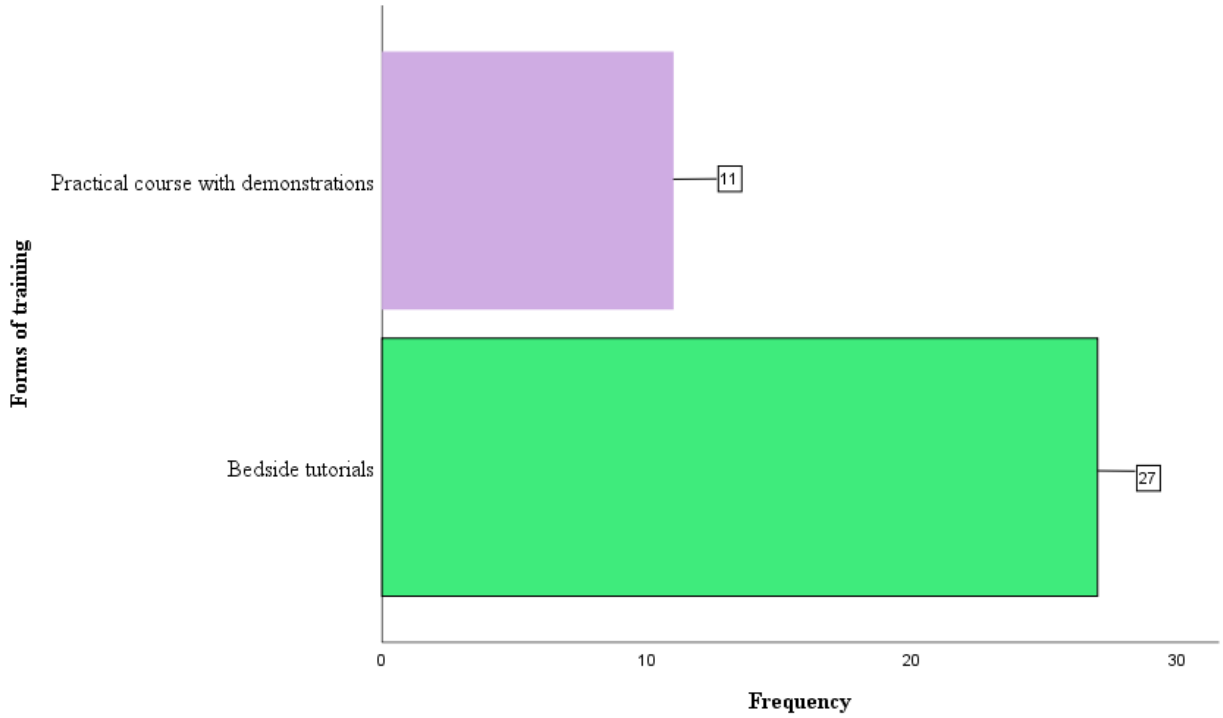

Figure 5: Form of training

4.3.6. Competency in using POCUS among respondents

More than half of the respondents, 58.9%(n =33) were fairly competent while 41.1%(n =23) were incompetent in the utilization of POCUS as shown in Figure 6.

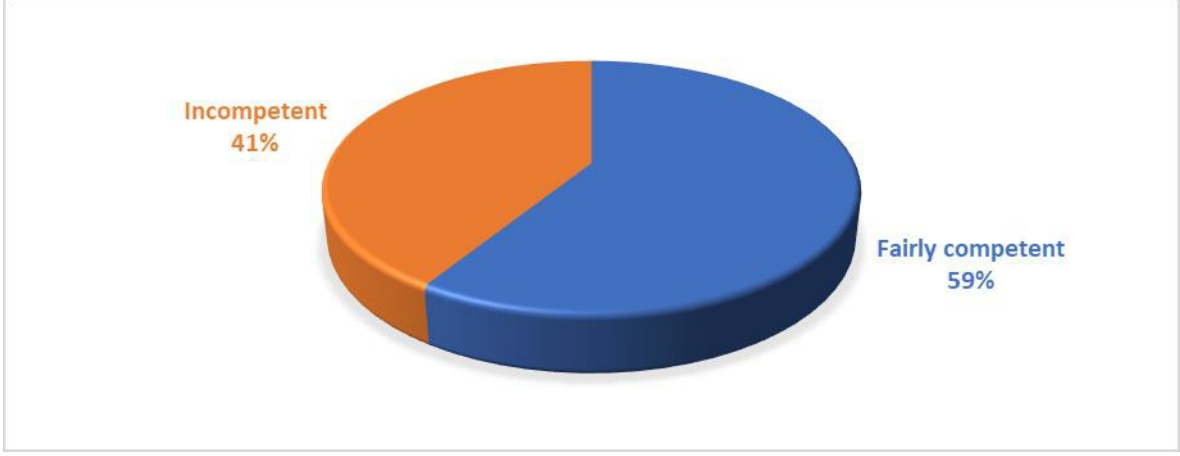

Figure 6: Competency in using POCUS among respondents

4.3.7. Systems where POCUS has been used among respondents

The results showed that 80.4% (n = 45) used POCUS in focused assessment with sonography in trauma, 71.4% (n =40) used in Deep venous thrombosis diagnosis, 62.5%(n =35) in cardiac investigation as shown in Figure 7.

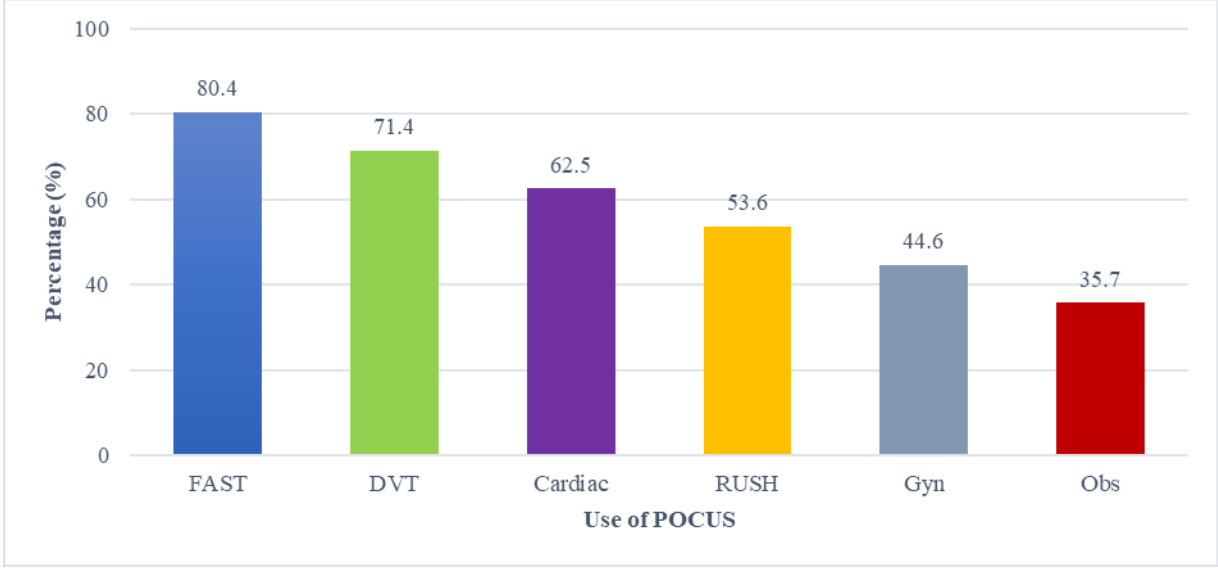

Figure 7: Systems where POCUS has been used among respondents

4.4. The benefits of POCUS utilization in the Emergency Department and critical care unit.

4.4.1. Areas where POCUS has been useful

The study also investigated the usefulness of POCUS across different areas as identified by the respondents. The respondents were required to rate the usefulness from not useful to very useful as shown in Table 2. Majority of the respondents stated that POCUS was very useful, 76.8%(n =43) in Abdominal (FAST /liver /GB/ Spleen/renal) region and it was least useful, 30.4%(n =17) in regional (soft tissue/joints/thyroid/scrotal) area.

Table 2: Areas where POCUS has been useful

Area	Not useful	Rarely	Sometimes	Fairly	Very
Catheter insertions (CVC/PICC/IV line/arterial	5(8.9)	3(5.4)	4(7.1)	20(35.7)	24(42.9)
Paracentesis/thoracentesis/pericardiocentesis/arthrocentesis	2(3.6)	4(7.1)	8(14.3)	13(23.2)	29(51.8)
Abdominal (FAST /liver /GB/ Spleen/renal)		1(1.8)	3(5.4)	9(16.1)	43(76.8)
Cardiac and lung	3(5.4)		9(16.1)	18(32.1)	26(46.4)
DVT	5(8.9)	5(8.9)	6(10.7)	18(32.1)	22(39.3)
Regional (soft tissue/joints/thyroid/scrotal	8(14.3)	8(14.3)	10(17.9)	13(23.2)	17(30.4)

4.4.2. Benefits of POCUS use in the departments

The findings revealed that all the respondents agreed that POCUS allows for a faster diagnosis. Majority agreed that it allows a procedure to be carried out more effectively and that it rationalizes ordering for a detailed radiological investigation. All the respondents also disagreed with the statement that they don't see any need for POCUS as shown in Figure 8.

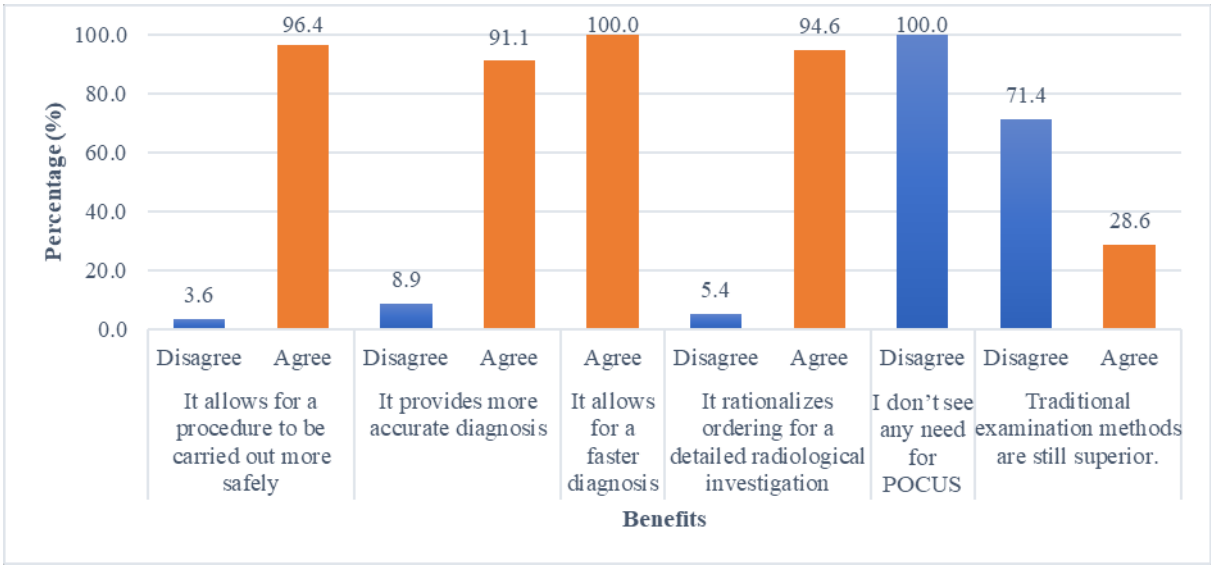

Figure 8: Benefits of POCUS use in your department

4.5. Barriers to the uptake of POCUS by the health care providers in the KNH emergency department and critical care unit

The respondents were asked to rate barriers to the uptake of POCUS in their workplace setting on a Likert scale where 1= strongly disagree, 2 =Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly agree. The majority of the respondents agreed that lack of training was a key barrier (M =4.57, SD =0.69). Many of the respondents also agreed that there is no available training curriculum (M =3.89, SD =1.19), availability of ultrasound machines (M =3.82, SD =1.39) was also identified as a key barrier as shown in Table 3.

Table 3: Barriers to POCUS utilization

Barriers	Mean	Std. Deviation
Lack of training	4.57	0.690
There is no available training curriculum	3.89	1.186
Lack of licensed bodies for accreditation.	3.68	1.341
Inadequate POCUS machines	3.82	1.390
No time to do POCUS	2.07	1.016
No time for training	2.34	1.210
Lack of interest in learning POCUS	2.23	1.265
Fear of litigation due to inaccurate results	2.80	1.471
Conflict with radiology specialists	2.73	1.483
Lack of mentors/expert support	3.75	1.391
Preference for traditional examination methods and blind procedures	2.80	1.393

4.6. Factors associated with POCUS use among respondents

Binary logistic regression was used to investigate factors associated with POCUS use among respondents as shown in Table 4. The findings revealed that years worked at the emergency department (OR =1.45, 95%CI: 1.02 – 4.51, p = 0.041), working in CCU department (OR =2.51, 95%CI: 1.14 – 6.31, p =0.002), awareness of POCUS (OR = 7.58, 95%CI: 2.08 – 27.57, p =0.002), having POCUS training (OR =6.5, 95%CI:1.94 – 21.78, p = 0.003) and competency of POCUS use (OR =4.83, 95%CI:1.49 – 15.61, p =0.011) were significantly associated with increased likelihood of POCUS use among the respondents.

Table 4: Factors associated with POCUS use among respondents

	POCUS use			
	Yes	No	OR(95%CI)	P-value
Age of respondent				
≤30 years	14(38.9)	8(40)	Ref	
>30 years	22(61.1)	12(60)	0.96(0.31 - 2.92)	0.578
Gender				
Male	23(63.9)	14(70)	0.76(0.24 - 2.45)	0.437
Female	13(36.1)	6(30)	Ref	
Cadre				
Medical officer	31(86.1)	19(95)	0.33(0.04 - 3.01)	0.292
Consultant	5(13.9)	1(5)	Ref	
Years of experience				
<5 years	15(41.7)	10(50)	Ref	
≥5 years	21(58.3)	10(50)	0.71(0.24 - 2.14)	0.374
Years worked at the department				
<5 years	2(5.6)	6(30)	Ref	
1 - 5 years	27(75)	11(55)	1.45(1.02 - 4.51)	0.041
>5 years	7(19.4)	3(15)	0.51(0.22 - 2.01)	0.231
Department				
Accident and emergency	14(38.9)	17(85)	Ref	
CCU	22(61.1)	3(15)	2.51(1.14 - 6.31)	0.002
Aware of POCUS				
Yes	31(86.1)	9(45)	7.58(2.08 - 27.57)	0.002
No	5(13.9)	11(55)	Ref	
POCUS training				
Yes	28(77.8)	7(35)	6.5(1.94 - 21.78)	0.003
No	8(22.2)	13(65)	Ref	
Competency of POCUS use				
Fairly competent	26(72.2)	7(35)	4.83(1.49 - 15.61)	0.011
Incompetent	10(27.8)	13(65)	Ref	

CHAPTER FIVE: DISCUSSION

The present study sought to investigate the utilization of POCUS, its benefits, and barriers in the emergency department and critical care units at Kenyatta National Hospital, Kenya. Majority of the respondents were male. These findings are consistent with studies done that showed despite having equal numbers of males and females in the United States and United Kingdom medical schools, the number of emergency medicine female physicians is at 27% (Agrawal et al.,2019) while intensive care medicine had only 22% of females (Chadwick et al., 2019). The higher proportion of male physicians in these specialties as compared to women has been associated with varied factors. Institutional policies related to promotion or advancement may inherently disadvantage women. (Agrawal et al 2019) and may be exacerbated by implicit bias and stereotyping (Chadwick et al.,2019). There are an insufficient number of women in current leadership positions, resulting in fewer mentors and role models for women early in their careers (Leigh et al., 2019). Long and inflexible working hours with the high pressure associated with these specialties have also been cited as a major contributor (Leigh et al.,2019). Women receive fewer opportunities to get started in academia, such as presenting at grand rounds. Policies around parental leave, emergency childcare, and breastfeeding affect women disproportionately. Unfortunately, sexual harassment is also still widely documented in emergency medicine and has a major impact on career advancement and attrition (Chang et al., 2021). (Sheppard et al 2021)

The average age of the participants was 33 years with 60.7% of the respondents aged above 30 years. These findings are comparable to a study conducted in Canada which revealed that the majority of the physicians in the emergency department were aged between 30 and 40 years (Sheppard et al., 2021). These findings show that the focus on emergency and critical care medicine among younger is influenced by varied factors including many opportunities for research. There are several levels to maintain this motivation and transform it into commitment in the academic course (Douillet et al., 2018).

The high awareness of POCUS from this study compared with a study conducted in Slovenia which found that most emergency physicians and intensivists knew POCUS (Homar et al., 2020). POCUS in emergency and critical care units is needed due to the urgency required to rapidly integrate the results in the initial and ongoing patient management (Whitson et al,2016).

There was a high rate of POCUS utilization from the study due to its great impact on the management of acutely ill patients in A/E and CCU departments compared to other departments. Most developed countries have widely adopted POCUS use in the management of critical patients since the 1990s (Whitson et al.,2016) unlike developing countries. Peh and Kang et al (2018) found out that among the interviewed internists, those doctors who had worked in CCU and A/E had higher knowledge and performance of POCUS. However, our findings have also established that the frequency of use is not regular considering that slightly more than half (52.8%) use POCUS a few times a week. This is, in contrast, to a study done in Canada that showed most doctors use POCUS daily or most times a week. (Shepperd et al., 2021).

The increased frequency has continued to rise as shown by a study conducted in France which revealed that POCUS availability in the emergency department was as high as 52% in 2011 which has increased to 71% in 2016 (Bobbia et al., 2018). Additionally, in more than 80% of the Danish emergency departments, POCUS has been available to emergency physicians (Nielsen et al., 2015).

These findings are lower compared to a prospective study conducted in Australia which revealed that the use of POCUS in emergency care was common both as a diagnostic tool and for procedural guidance. The findings from their study revealed that 88.2% of the POCUS conducted were for diagnosis while 11.8% were for procedural guidance (Pouryahya et al., 2019). The difference observed in the utilization of POCUS in their setting and our setting is mainly due to the lack of its integration as a standard of care in our setting compared to the Australian healthcare context. Implementation of POCUS has been majorly done in the last decade. However, despite implementation across the world, its utility varies. Regular utilization of POCUS has been found to vary across Europe ranging between 40 percent in Germany to less than one percent in Catalonia, Austria, Sweden, and Denmark (Mengel-Jørgensen & Jensen, 2016). This increase in POCUS availability and use was not limited to Europe and North America. In China, more than half of emergency department physicians have reported having access to POCUS, with 43% reporting using it in their clinical work (Shi et al., 2018). Another study found that POCUS was available in all surveyed emergency departments of South Korea, with 82.7% of respondents using POCUS daily on adult patients (Ahn et al., 2015).

More than half of the participants (62.5%) had received some form of training and reported to be fairly competent. The training was mainly in form of bedside tutorials while only a few had a practical course with demonstrations. This is consistent with Jones et al(2020) findings that showed that short workshop training help increase confidence but there is a decline in competence if follow up training is not done ,also explained by Wanjiku et al.(2018). Unlike the underdeveloped world, comprehensive training in POCUS has been made mandatory in emergency medicine training in North America and parts of Europe. (Whitson et al.,2016). Shepherd et al (2021) in their study demonstrated that all their participants had formal training on POCUS offered by professional bodies and therefore most of the participants had a high level of confidence to acquire, interpret images and operate the ultrasound device.

Our findings of Focused assessment with Sonography in trauma (FAST) been the most common performed examination by the participants (80.4%) was consistent with many findings in the literature since FAST was the prototype examination done when POCUS was developed in the 1990s. (American college of emergency physicians., 1991) and it's the most widespread ultrasound protocol used in emergency medicine and the most common form of POCUS used in trauma care. With FAST, one can rapidly generate images to rule in or out the presence of intraperitoneal fluid, hemothorax, and pericardial effusion in a patient with penetrating or blunt trauma which is life-threatening in an unstable patient. (Gleeson et al., 2018). There is however overwhelming evidence that the limitations of FAST in blunt trauma patients and the increasing availability of CT scans may in the future limit its utilization. (Smallwood et al., 2018).

There was reported a significant usage of cardiac imaging in POCUS. Point of care echocardiography (POCE) has been widely used in the intensive care unit (Kovell et al., 2018) with the ability to effectively determine cardiac motion in a pulseless patient and avoid unnecessary resuscitations. (Cureton et al., 2012, Whitson et al 2016).

The high usage of POCUS in DVT contradicts most studies. DVT was part of the extended POCUS scope in 2009 by the Canadian Association of Emergency Physicians (CAEP) hence there has been delayed integration into POCUS use. Sheppard et al (2021) in his study noted that the participants were less confident in diagnosing DVT though this could be explained by the fact that most of the participants were family medicine physicians with few emergency

physicians. POCUS has a major role in the diagnosis of acute proximal DVT, especially in the emergency and critical care setting but there still exists significant heterogeneity in the standardization of protocol in this area ((Varrias et al., 2021). The low usage of POCUS in obstetrics and gynaecology is mainly because the study area was not in the specialties for the above despite POCUS having wide usage in pregnancy and gynaecologic emergency conditions. (Vinayak et al.,2018, Collins et al.,2019)

The present findings established that majority of respondents reported POCUS to be useful in abdominal imaging, guiding procedures, and cardiac. These findings are comparable to a study conducted in Rwanda which revealed that 51% of physicians used POCUS where abdominal ultrasound was the most frequently performed examination and this greatly changed the patients management.((Henwood, Rempell, Liteplo, Murray, et al., 2013). In the abdomen, despite the wide use of POCUS in abdominal trauma, it is also needed in the monitoring of abdominal aortic aneurysms and abdominal emergencies like appendicitis, renal colic, and biliary diseases. (Smallwood et al, Hashim et al 2021). The use of ultrasound in guiding procedures and catheter insertions is of great importance. (Barr et al.,2014) .Bauman et al (2009) noted improved speed and patient satisfaction with a reduction in complications when ultrasound is used. Musculoskeletal, male genital, and pediatric scans were rarely performed tests but ranked as of the scans physicians most wanted to learn (Yoo et al., 2021).

Our present findings established that POCUS in the emergency department and Critical care unit is highly beneficial, especially in making a faster diagnosis, allowing procedures to be carried out more safely, and rationalizing ordering detailed radiological investigations. All the respondents in our study agreed that POCUS is fundamental in emergency care and should be incorporated into standard procedures of care. These findings are comparable to a study by Bhagra et al. (2016) who asserted that POCUS is a powerful adjunct tool in clinical assessment which improves primary diagnosis and fastens the patients' management process. Kobal et al. (2016) also stressed that POCUS reduces procedure-related complications as well as controls the likelihood of making an error in judgment. The fact that the patient is not required to be taken in the imaging room presents a major basis for efficacy in care delivery, especially in emergency settings. (Hashim et al., 2021)

In our findings, POCUS was not associated with a reduction in the cost of care as illustrated by Van Schaik et al., (2019) who maintained that the use of POCUS is associated with reduced length of hospital stay and cost of care. This difference could be attributed to the fact that the benefits of POCUS that were being assessed in the present study were mainly physician-related and not patient related hence the respondents were providing benefits based on their personal experience and perspective. Similarly, Vinayak and Brownie (2018) stated that POCUS has been essential in the provision of sustainable healthcare access through collaborative task sharing and improved patient engagement. However, in our present findings, utilization of POCUS has been interfered with by varied factors such as limited resources which make it difficult to make such conclusions.

Our findings established that utilization of POCUS in emergency and critical care settings in our local Kenyan context has been hindered by varied factors with the main factor been lack of training, training curriculum, and accreditation bodies coupled with inadequate POCUS machines in emergency and critical units. These findings are comparable to the many of past studies assessing the utilization of POCUS in the emergency setting (Jones et al., 2020; Peh & Kang, 2018; Smallwood & Dachsel, 2018). Wanjiku et al. (2018) identified that there is limited training on POCUS use in Kenya with only Non-Governmental Organizations (NGOs) being actively involved in the provision of skills to health care providers to incorporate POCUS in their delivery of care although this has also been hindered by lack of ultrasound machines in public hospitals. Peh and Kang (2018) also maintained that lack of trainers or mentors, as well as suitable curricula, have limited the utilization of POCUS in most settings. Wong et al. (2020) also found that inadequate supervision and lack of quality assurance have created a difficult setting where POCUS can be relied upon fully as a standard procedure. Jones et al. (2020) established that the lack of POCUS machines has created a major gap in the implementation of POCUS. This could explain why in our present study, none of the respondents was using POCUS regularly in their patient care.

Most developed countries especially America and Europe have widely adopted POCUS due to its immense benefits in patient care. Most medical schools in the USA have integrated ultrasound education as part of the curriculum right from the undergraduate to the residency programs. (Lee et al.,2020). There have been concerted efforts by professional bodies like the American College

of emergency physicians(ACEP) and the Society for acute medicine in the UK to determine the scope, and the required training curricula and develop protocols to streamline this emerging field.(Smallwood et al,2018 , Whitson et al .,2016).

The current study also revealed that years of experience in the emergency department (p = 0.041), working specifically in CCU(p=0.002) awareness of POCUS(p=0.002), training(p=0.003), and the level of competency(p=0.011) were associated with increased utilization of POCUS in emergency and critical care among respondents. Years worked in an emergency setting could influence the probability of having received some training on care of emergency and critical patients which includes the adoption of flexible care approaches such as POCUS (Peh & Kang, 2020; Jones et al., 2020). Awareness of POCUS increases individual knowledge of various ways that POCUS can be adopted in the care environment. McCormick et al., (2018) stated that awareness and formal training were significantly associated with utilization of POCUS. Current findings have established that working in CCU was associated with a higher likelihood of POCUS use. CCU is a more critical environment where patients require urgent and prompt management. POCUS is a key adjunct in overcoming diagnostic uncertainty and guiding the prognosis of these patients. (Lau et al.,2022)

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

The findings from the study established that majority of the respondents were aware of POCUS, with more than half having received some form of training mainly in form of bedside tutorials.. The results also revealed that there was high utilization of in the sampled departments although the frequency of use was low with only half of them using POCUS a few times a week. More than half of the respondents felt they were fairly competent in POCUS.

Most of the respondents used POCUS in focused assessment with sonography in trauma followed by Deep venous thrombosis and cardiac investigation. POCUS was reported to be highly useful in abdominal imaging and it was least useful in regional areas like the joints, soft tissues and other small parts.

All of the respondents agreed that POCUS allows for a faster diagnosis and majority agreed that it allows a procedure to be carried out more safely, and that it rationalizes ordering a detailed radiological investigation. Lack of training, training curriculum with accreditation bodies, and inadequate POCUS machines in the emergency and critical care units were key barriers identified.

The findings also found out that years of experience in the emergency department, working specifically in CCU, awareness of POCUS, training, and the level of competency were associated with increased utilization of POCUS in emergency and critical care among respondents.

6.2. Recommendations

- Develop a standardized training curriculum and accreditation bodies on the use of POCUS.
- Provide structured POCUS training to health care providers working in emergency and critical care departments to improve competency with overall benefit to improved patient care.
- To improve the availability of POCUS machines in emergency care settings as an alternative to conventional ultrasound machines, especially for severely ill patients who require immediate care.
- To develop a standard operational procedure in the utilization of POCUS in an emergency care setting to improve the level of quality care.

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APPENDIX A: PARTICIPANT INFORMATION AND CONSENT FORM

Study title: Utilization of point of care ultrasound (POCUS) by doctors working in the Emergency department and Critical care units of Kenyatta national hospital: benefits and barriers

Principal Investigator: DR EUNICE NDUNGWA SAMMY

Co-Investigator: DR ANGELINE AYWAK

Introduction

I would like to tell you about a study being conducted by Dr. Eunice Sammy, a medical Registrar at the department of Radiology, University of Nairobi. The purpose of this consent form is to give you the information you will need to help you decide whether or not to be a participant in the study. Feel free to ask any questions about the purpose of the research, what happens if you participate in the study, the possible risks and benefits, your rights as a volunteer,

and anything else about the research or this form that is not clear. When we have answered all your questions to your satisfaction, you may decide to be in the study or not. This process is called 'informed consent'. Once you understand and agree to be in the study, I will request you to sign your name on this form. You should understand the general principles which apply to all participants in a medical research: i) Your decision to participate is entirely voluntary ii) You may withdraw from the study at any time without necessarily giving a reason for your withdrawal iii) Refusal to participate in the research will not affect the services you are entitled to in this health facility or other facilities.

Study purpose

The purpose of the study is to find out the utilization of POCUS by health care providers working in the emergency department and critical care unit at Kenyatta national hospital, the benefits and barriers to uptake.

Study procedure

A structured questionnaire which will be uploaded into google forms will be used to collect data .You will be engaged and requested to participate in the study by one of the two research assistants who will be assisting in data collection.

Potential benefits

By participating in the study, you will help in generating information on whether POCUS is been utilized at the emergency department and critical care unit, what benefits have been obtained from its utilization and if not been utilized what are the barriers to its uptake. This will help in enhancing more uptake of POCUS by the department and also other departments with overall benefit of improved patient management. The principal investigator will share study findings and any recommendations emanating from the study with the chairpersons of the Radiology, emergency departments and critical care unit and also the KNH administration to enhance POCUS utilization in the department and also other departments

Risks, harms and discomforts

A potential risk of the study may be concerns regarding the privacy of information you share in which case you can be assured that every case will be kept as confidential as possible with a code number being the only identifier in a password protected computer database.

Reimbursement

You will not receive any monetary compensation for participating in this study

Confidentiality

No name or any other personal identifier will be used in any report or publications arising from this study. The data collected will be stored into a computer which will only be accessible to principal investigator, supervisors and statistician.

Voluntarism

Your decision to participate in research is voluntary. You are free to decline participation in the study and you can withdraw from the study at any time without injustice or loss of any benefits.

Additional information

If you have any further questions or concerns about participating in this study that have not been answered above , please call or send a text message to the study staff at the number provided at the bottom of this page.

For more information about your rights as a research participant you may contact the Secretary/Chairperson, Kenyatta National Hospital-University of Nairobi Ethics and Research Committee Telephone No. 2726300 Ext. 44102 email uonknh_erc@uonbi.ac.ke.

STATEMENT OF CONSENT

Participant's statement

I have read this consent form. I have had my questions answered in a language that I understand. The risks and benefits have been explained to me. I understand that my participation in this study is voluntary and that I may choose to withdraw any time. I freely agree to participate in this research study. I understand that all efforts will be made to keep information regarding my personal identity confidential.

By signing this consent form, I have not given up any of the legal rights that I have as a participant in a research study.

I agree to participate in this research study: Yes No

Participant's signature _____ Date _____

Researcher's statement

I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and has willingly and freely given his/her consent.

Researcher's Name: DR EUNICE N. SAMMY Date: _____

Signature_____

Contacts: 254727656901

Email: eunicesammy8@gmail.com

APPENDIX B: DATA COLLECTION FORM

QUESTIONNAIRE

I. DEMOGRAPHIC DATA

1. Age

2. Gender ☐ Male ☐ female

3. Cadre ☐ medical officer ☐ consultant

4. Years of practice in your profession.

5. How long have you worked in emergency department/CCU

<I YEAR ☐ 1 YR-5YRS ☐ >5 YRS ☐

II. UTILIZATION OF POCUS (POINT OF CARE ULTRASOUND)/ BEDSIDE ULTRASOUND

1. Are you aware of POCUS? ☐ YES ☐ NO

2 .Have you witnessed or performed POCUS?

☐ Witnessed ☐ performed

3 .How frequently do you use POCUS in your work?

☐ Never

☐ Daily

☐ Few times a week

☐ Few times a month

☐ Few times a year

7. a. Have you ever undergone any form of training /education in performing POCUS?

☐ Yes ☐ no

b. if yes, what form of training

☐ bedside tutorials

☐ practical course with demonstrations

☐ lectures

☐ online resources

5.How competent are you in practicing POCUS?

☐

Very competent

☐ Fairly competent

☐ Incompetent

6. In what system have you practiced POCUS?

Cardiac ☐

Obs ☐

FAST ☐

RUSH ☐

DVT ☐

Gyn ☐

Any other ……..

*FAST-focused assessment with sonography in trauma

*RUSH-rapid ultrasound for shock and hypotension

*DVT-Deep venous thrombosis

BENEFITS OF POCUS

1.Using a Likert scale of 1-5, In what area have you found POCUS very useful in the department

Not useful	rarely useful	sometimes useful	fairly useful	very useful

Catheter insertions (CVC/PICC/IV line/arterial) ☐ ☐ ☐ ☐ ☐

Paracentesis/thoracocentesis/pericardiocentesis/arthrocentesis ☐ ☐ ☐ ☐ ☐

Abdominal (FAST /liver /GB/ Spleen/renal) ☐ ☐ ☐ ☐ ☐

Cardiac and lung ☐ ☐ ☐ ☐ ☐

DVT ☐ ☐ ☐ ☐ ☐

Regional (soft tissue/joints/thyroid/scrotal, ☐ ☐ ☐ ☐ ☐

other region(specify)

2. What are your observed benefits for POCUS use in your department

	Strongly Disagree	disagree	neutral	agree	strongly agree
a. it allows for a procedure to be carried out more safely	☐	☐	☐	☐	☐
b. it provides more accurate diagnosis	☐	☐	☐	☐	☐
c.it allows for a faster diagnosis	☐	☐	☐	☐	☐
d.it rationalizes ordering for a detailed radiological investigation	☐	☐	☐	☐	☐
e. I don't see any need for POCUS	☐	☐	☐	☐	☐
f. Traditional examination methods are still superior.	☐	☐	☐	☐	☐

g. Any other benefits of POCUS that you have experienced ?

_____

_____

BARRIERS TO POCUS UPTAKE

1.What are your main barriers to utilization of POCUS in the emergency department

	Not a Barrier	minor barrier	moderately barrier	large barrier	severe barrier
i.Lack of training	☐	☐	☐	☐	☐
ii. There is no available training curriculum	☐	☐	☐	☐	☐
iii. Lack of licensed bodies for accreditation.	☐	☐	☐	☐	☐
iv. Availability of ultrasound machines	☐	☐	☐	☐	☐
v. No time to do POCUS	☐	☐	☐	☐	☐
vi. No time for training	☐	☐	☐	☐	☐
vii. Lack of interest in learning POCUS	☐	☐	☐	☐	☐
viii. Fear of litigation due to inaccurate results	☐	☐	☐	☐	☐
ix. Conflict with radiology specialists	☐	☐	☐	☐	☐
x. Lack of mentors/expert support	☐	☐	☐	☐	☐
xi. Preference of traditional examination methods and blind procedures to POCUS.	☐	☐	☐	☐	☐

xii. .Any other barriers to POCUS that you have experienced?

_____

2 Based on your stated barriers above what would you recommend to improve POCUS utilization in your department?

_____
_____
_____
_____

APPENDIX C:TIMELINE OF RESEARCH STUDY

	March-2021	April-2021	May-2021	July-2021	Aug-2021	Oct-2021	Nov-Jan 2021	Feb-april 2021
Proposal write up	*	*	*					
Correction of supervisor's input				*				
1st submission to KNH-ERC					*			
2nd submission & corrections						*		
Final submission & expected approval							*	
Data collection							*	
Data entry							*	
Data analysis							*	
Report witting								*
Dissertation submission								*

APPENDIX D: BUDGET

BUDGET AND BUDGET JUSTIFICATION

ITEM	QUANTITY	COST PER UNIT	TOTAL COST
A4 Printing paper	3 reams	1000	3000
Pens	1 box	1000	1000
Document folders	10	200	2000
Ethics board fees	-	-	2000
Printing	-	-	3000
Statistician services	-	-	30000
Internet cost	6 months	3000/month	18000
Printing and binding (draft, proposal and final report)	-	-	25000
TOTAL			84,000

APPENDIX E: PLAGIARISM REPORT

UTILITY OF POINT OF CARE ULTRASONOGRAPHY (POCUS) BY HEALTH CARE PROVIDERS WORKING IN THE EMERGENCY DEPARTMENT AND CRITICAL CARE UNIT AT KENYATTA NATIONAL HOSPITAL: BENEFITS AND BARRIERS.

ORIGINALITY REPORT

5%	%	%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Excelsior College Student Paper	3%
2	Submitted to Mount Kenya University Student Paper	1%
3	Submitted to Saint George's University Student Paper	<1%
4	Submitted to Laureate Higher Education Group Student Paper	<1%
5	Submitted to University of Washington Student Paper	<1%

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Chairman

Signature .....

Supervisor

Signature: _____