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## RESEARCH IN FIJI

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**SPECIAL EDITION**  
MEDICAL INTERN RESEARCH IN FIJI

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## EDITORIAL COMMENTS

The research emerging from Fiji's major referral centres, Colonial War Memorial Hospital in Suva, Lautoka Hospital in the Western Division, and Labasa Hospital in the Northern Division, reflects a strengthening culture of locally driven inquiry within the national health system. Of note is the collaborative model through which this work has been undertaken, with medical interns working closely alongside consultants, senior colleagues, and multidisciplinary teams within demanding clinical environments.

Pacific health research is most meaningful when it is grounded in place, practice, and relationships. The studies highlighted here arise directly from the realities of everyday clinical care in Fiji, shaped by high patient loads, constrained resources, and diverse population needs. Medical interns, as frontline clinicians, are uniquely positioned to identify gaps in care and opportunities for service improvement. Their active engagement in research, supported by consultant mentorship, represents both a contribution to the evidence base and an investment in the future clinical and academic workforce of Fiji and the wider Pacific.

The inclusion of multiple sites across the country strengthens the relevance and credibility of this work. Colonial War Memorial Hospital provides insight into complex and tertiary-level care at the national referral centre, while Lautoka Hospital reflects the pressures and strengths of a busy divisional hub serving a large and diverse population. Labasa Hospital offers an essential perspective from the Northern Division, where geography and access continue to shape health service delivery. Together, these hospitals provide a more comprehensive and representative picture of health and healthcare in Fiji, reflecting Pacific values of collective effort and shared learning.

Importantly, this research moves beyond dependence on international data, generating evidence that is specific to Fiji's social, cultural, and health system context. Such locally produced knowledge is critical for informing clinical practice, service development, and policy in ways that are realistic and sustainable. While challenges such as limited time, competing service demands, and data constraints are acknowledged, these realities underscore the commitment required to undertake research in Pacific clinical settings rather than diminishing the value of the work.

### Acknowledgements

Respectful acknowledgement is extended to the Fiji Human Health Research Ethics Committee for its oversight in ensuring ethical, culturally appropriate, and responsible conduct of the research. The contribution of the Editorial Committee is also gratefully recognised for its role in supporting Pacific-led scholarship and providing a platform for the dissemination of locally relevant health research.

In bringing together interns, consultants, and colleagues across three major hospitals, this body of work demonstrates the potential of collaborative, practice-based research to strengthen Pacific health systems. It contributes meaningfully to Pacific health dialogue by building local evidence, nurturing future leaders, and affirming that high-quality research can and should be led from within the Pacific.

Dr Vineet Chand

Chair of Fiji Human Health Research Ethics Committee

Ministry of Health and Medical Services

## A Cross-Sectional Study Of Coagulase- Negative Staphylococci Isolated From Adult Blood Cultures At Cwm Hospital From 1st January 2024 To 1st July 2024

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### Abstract:

**Introduction:** Coagulase-negative staphylococci (CoNS) are the most frequently isolated blood culture contaminants. There are several negative effects of blood culture contamination, therefore, an analysis of factors contributing to the contamination of blood cultures was needed.

**Aims:** To calculate the prevalence of CoNS isolated from adult blood cultures sampled between 1st January 2024 to 1st July 2024, at CWM Hospital, Suva, Fiji. To assess the availability of procedural equipment, and to assess the quality of blood culture ordering and sampling at CWM hospital.

**Materials and Methods:** For this six-month cross-sectional study, information was obtained from the CWMH Laboratory Information Management System (LIS) database and to calculate prevalence of CoNS isolated. A random manual audit of procedural equipment was conducted at CWMH wards and Emergency Department, and a KAP (Knowledge, Attitude, Practice) Survey was distributed online for physicians.

**Results:** The prevalence of CoNS isolated from 3683 blood cultures sampled at CWM hospital was 16.86%. For the ward audit on procedural equipment, most wards were well equipped except Sukuna ward, Physio Isolation ward, Paru Isolation Ward, and Antenatal ward which did not stock sufficient blood culture bottles and had unavailability of Betadine, and Acute Medical Ward which did not have any blood culture bottles available or cotton swabs. For the KAP survey, the response rate was 12.77%. 100% of participants indicated that guidelines for BC sampling were not well known and that there was a need for improvement in BC sampling practices in Fiji.

**Conclusion:** This study shows a high prevalence of CoNS isolated from adult blood cultures sampled at CWM hospital. It recommends that it would be useful if a National, evidence-based guideline on blood culture ordering and sampling was adopted in Fiji, and that alcoholic chlorhexidine would be a suitable substitute for skin antiseptics during betadine shortages.

### Introduction

Sepsis is a life-threatening consequence of bacteraemia. In 2017, it was estimated that sepsis affected 49 million people worldwide, with a mortality of 11 million, accounting for 20% of all global deaths [1]. Up to 85% of sepsis cases and sepsis-related deaths occurred in low and middle-income countries [1]. Blood culture sampling is an important diagnostic tool for bloodstream infections as it allows pathogen identification, and guides treatment by antibiotic susceptibility testing [2,3,4]. Several guidelines are available on Blood culture sampling, including CDC guidelines and WHO Phlebotomy guidelines [4]. Many countries have also adopted National guidelines for blood culture sampling. Fiji, however, does not currently have such a guideline in place.

The optimization of blood culture sampling depends on several parameters such as the concentration of

bacteria in the blood, the volume of blood sampled, the number of times samples are taken and the risk of contamination [5]. Coagulase-negative staphylococci (CoNS) are the most frequently isolated contaminants of blood cultures [6]. CoNS are common human normal skin microbiota [7]. CoNS are an expanding group of species under the genus *Staphylococcus* united by their lack of virulence factor coagulase, and since 2019, there have been 53 identified species under the CoNS group [8]. CoNS comprises all other staphylococcal species except *Staphylococcus aureus* and *Staphylococcus hyicus-intermedius* group that are coagulase positive [7]. Among cases where CoNS has been isolated from blood cultures, significant infection is seen in 12-25% of cases whereas the rest are contaminants [6]. CoNS as a true pathogen are the most common cause of nosocomial bloodstream infections, accounting for 30-40% of cases [9]. Most CoNS bacteraemia is secondary to infected Intravenous (IV) catheters. For short-term catheters,

CoNS spreads from patients' skin along the cutaneous surface of the catheter to gain bloodstream entry, whereas, for long-term IV catheters, hub colonization and migration of bacteria through the luminal surface occurs. To diagnose CoNS as the true cause of bloodstream infection, two separate blood cultures must be taken, and one of them must be taken through the indwelling catheter [9]. CoNS are also the most common cause of vascular graft infections, whereby infra inguinal grafts have the highest rates of infection, and aortic graft infections have significant mortality rates of 50% and morbidity rates of 21% [9]. Prosthetic valve endocarditis, though uncommon, is frequently caused by CoNS, namely *S. epidermidis*. In comparison, native valve endocarditis caused by CNS is rare, occurring in 5-8% of all endocarditis cases [9]. Cardiac pacemaker infections, orthopaedic/prosthetic joint infections, central nervous system shunt infections, and surgical site infections are other examples of infections that harbour a source of seeding for CoNS to cause true bacteraemia [9].

The contamination of blood cultures has several negative effects [3,10,11]. Repeated blood cultures are warranted, increasing invasive procedures for patients and leading to additional laboratory testing. The specification of antibiotic treatment is delayed which contributes to antimicrobial resistance. These factors increase patient hospital stay, use more resources, and reduce the quality of patient care [3,10,11]. Therefore, an analysis of factors contributing to the contamination of blood cultures was needed.

### Materials And Methods:

This six-month cross-sectional study was conducted at the Colonial War Memorial Hospital, a Tertiary Hospital in Suva, Fiji from January 1 2024 to July 1 2024. Adult patients ( $\geq 18$  years old) with blood culture isolates of CoNS were included in the study. Informed consent from patients was not needed as isolated CoNS species and clinical details were obtained from information systems only, namely, CWMH Laboratory Information Management System (LIS) and Patient Information System (PATIS).

Raw data from the LIS database had 31218 entries logged for all blood cultures processed at the

CWMH Microbiology Laboratory from January 1, 2024, to July 1, 2024. Each processed blood culture sample had multiple data entries in five aspects. These were direct smear results, incubation data, culture data, antimicrobial testing data, and conclusion entries for data validation. Additionally, blood cultures sampled from outer centres, quality control/sheep blood samples, and paediatric blood cultures were present in the initial data obtained. Data was sorted using Microsoft Excel. The following Inclusion and exclusion criteria were applied:

**Inclusion criteria:** Adult patients ( $\geq 18$  years of age) who isolated CoNS in blood cultures sampled between January 1, 2024, to July 1, 2024, at CWM Hospital.

**Exclusion Criteria:** 1.) Paediatric blood cultures ( $<18$  years old). 2.) Blood cultures sampled outside of CWM Hospital. 3.) Internal or Quality Control samples.

A summary of data sorting is presented in Figure 1.

Secondly, an audit of procedural equipment required to sample blood cultures was conducted at the CWMH wards and Emergency Department from 23 September to 26 September. This was done by manual counting of equipment stocked at procedure trolleys and stored within stock cupboards. The audit was limited to the availability of equipment needed to sample cultures for at least 20% of the ward capacity- rounded off to the upper bound. Any shortages that could be compensated with other available equipment were accounted for.

Lastly, a KAP (Knowledge, Attitude, Practice)-Survey was conducted. The questionnaire used was adopted from Rapuch-Rosin Study [20] which included 52 questions about the ordering and practical sampling of blood cultures, as well as, about the knowledge of relevant Blood culture sampling guidelines and professional attitudes towards these guidelines. The questionnaire was delivered online via Google forms to interns, registrars and consultants working in CWM hospital. The questionnaire was distributed to 165 first- and second-year interns individually via Viber platform and distributed to the Viber work groups/forums of Internal Medicine, Surgery, Obstetrics and Gynaecology and Emergency Medicine departments. The Population size of all medical interns, registrars

and consultants at CWMH was approximately at 220. At a confidence interval of 95% with a margin error of 5%, the sample size of the survey was calculated at 141. Response rates were calculated appropriately.

**Results:**

**i. Prevalence of CoNS Isolated**

The total number of adult blood cultures sampled and processed at CWMH over the six-month study period was 3683 (Figure 1). 2636 samples (71.57%) showed no growth whereas 1047 (28.43%) were positive blood cultures. Of the 1047 positive blood cultures, 621(16.86% of the total) isolated CoNS. Hence, the prevalence (%) of CoNS isolated from total blood cultures sampled at CWM hospital during the study period is 16.86.

The highest proportion of CoNS isolated from blood cultures sampled at various wards (Figure 2) was for the following wards respectively, Sukuna Ward (25.71), ICU (23.83), Paying Ward which includes samples from ANZ and Beqa ward (20.19), Acute Surgical ward (19.34), Emergency department (18.05), and Women’s medical ward (16.95).

The highest proportion of CoNS isolated by month (Figure 4) were seen between March to May, that coincided with the period of betadine unavailability at CWMH.

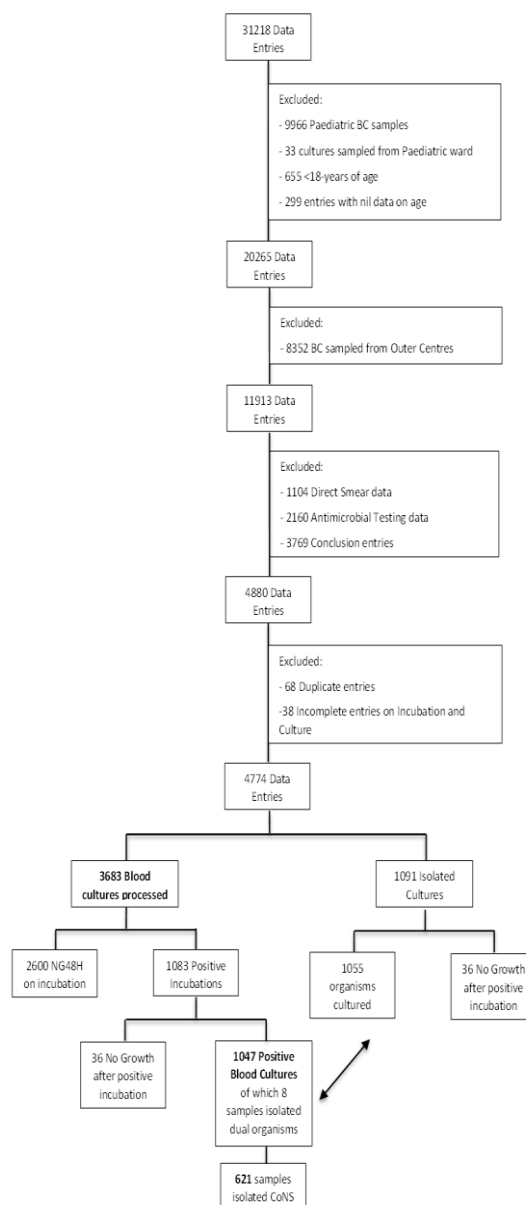


Figure 1. Summary of Data Sorting.

The total number of adult blood cultures sampled and processed was 3683. 2636 samples (71.57%) showed no growth whereas 1047 (28.43%) were positive blood cultures. Of the 1047 positive blood cultures, 621(16.86% of the total) isolated CoNS.

CWMH WARD	Prevalence of CoNS		
	CoNS Isolated	Total BC Sampled	(%)
Emergency Department	356	1972	18.05
Acute Medical Ward	29	209	13.88
Acute Surgical Ward	35	181	19.34
CCU	11	66	16.67
ICU	51	214	23.83
PARU	1	33	3.03
SOPD	3	36	8.33
ANTENATAL WARD	8	49	16.33
Morrisons Maternity			
Unit	1	16	6.25
Birthing Unit	1	7	14.29
Labour Ward	18	166	10.84
Post Natal Ward	4	30	13.33
MICU	8	59	13.56
Lancaster Ward	19	140	13.57
New Surgical			
Ward/TNW	23	165	13.94
Mens Medical Ward	8	69	11.59
Womens Medical Ward	10	59	16.95
PARU Isolation	1	12	8.33
Physio Isolation	4	43	9.3
Paying Ward	21	104	20.19
Sukuna Ward	9	35	25.71

Figure 2 Proportion of CoNS isolated per CWMH ward.

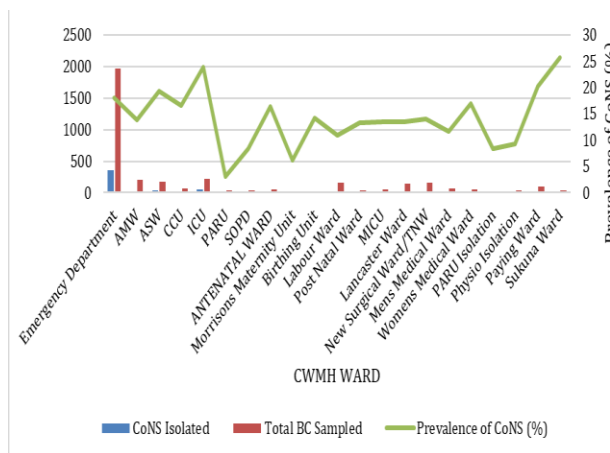


Figure 3 Trends of prevalence of CoNS

Trends in Prevalence of CoNS Isolated showed that the highest total number of blood cultures were sampled from Emergency Department (Figure 3). The highest proportion of CoNS isolated were sampled from Sukuna Ward (25.71), ICU (23.83), Paying Ward which includes samples from ANZ and Beqa ward (20.19), Acute Surgical ward (19.34), Emergency department (18.05), and Women’s medical ward (16.95).

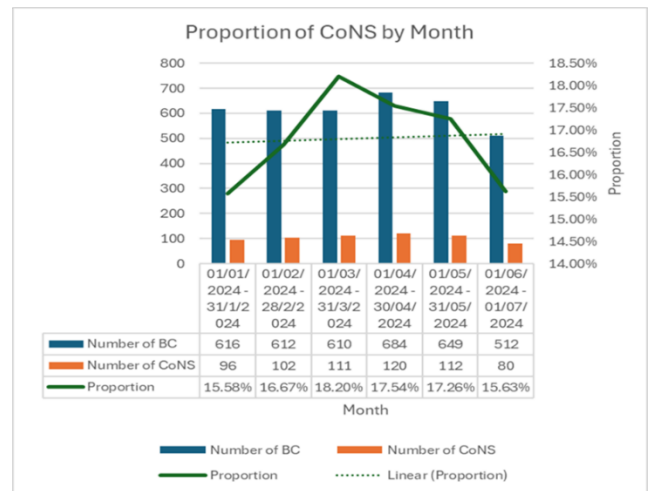


Figure 4 The highest proportion of CoNS isolated from blood cultures was seen between March- May of 2024

ii. **Audit of Equipment for Blood Culture Sampling at CWM Wards**

The manual audit of procedural equipment required to perform cultures for at least 20% of the ward capacity showed that CCU, the Emergency Department, New surgical ward, and Labour ward were the best equipped. Men’s medical ward, Women’s medical ward, and Paying ward were well-equipped in all aspects except the availability of betadine. During the period of this audit, Betadine was low in stock at CWM Hospital hence the East wing wards were prioritized over the West wing wards. The Acute Surgical Ward, ICU, Antenatal ward, Birthing Unit, Morrisons Maternity Unit, Lancaster and MICU were not stocked with sufficient blood culture bottles, however, were well equipped in other aspects. The audit also revealed that MICU had stocked 3 expired aerobic bottles and 3 expired anaerobic bottles, and the Birthing Unit had stocked 1 expired anaerobic bottle, which was excluded from the audit results. Sukuna ward, Physio Isolation ward, Paru Isolation Ward and Antenatal ward were not stocked with sufficient blood culture bottles and had unavailability of Betadine. Shortage of one size of syringes was compensated by the availability of sufficient other-sized syringes. The Acute Medical Ward did not have any blood culture bottles and swabs available during this audit, nor any sterile IV pack to compensate for the shortage.

CCU, the Emergency Department, New surgical ward, and Labour ward were the best equipped in all aspects. Betadine was unavailable in the west wing wards (Sukuna, Men’s Medical Ward, Women’s Medical Ward, Physio Isolation ward, Post Natal Ward.) The five least well-equipped wards were Sukuna ward, Physio Isolation ward, Paru Isolation Ward, Postnatal ward and Acute Medical Ward.

**iii. KAP (Knowledge, Attitude, Practice) Survey**

The Population size of all medical interns, registrars and consultants at CWMH was approximately 220. At a confidence interval of 95% with a margin error of 5%, the sample size of the survey was calculated at 141. The response rate was 12.77% as 18 physicians participated in the study.

**a. Blood culture ordering practice.**

Only 50% of the respondents would have initiated BC sampling in all the three constructed case studies for which BC testing is recommended (Figure 4). A majority (100%) of the respondents reported that they would have taken BCs in the case of a patient with a central venous catheter who has two temperature spikes, and the same was true for the case of an elderly lady with hypothermia and suspicion of pneumonia (94.4%).

When asked to indicate which three clinical criteria for BC sampling they apply most often in their own clinical practice, study participants mentioned most often fever above 38.5 °C (94.4%), clinical suspicion of infection (77.8%), and a rise in temperature (50%).

A minority of participants (27.8%) acknowledged that despite an existing indication for BC sampling, antibiotic therapy is often initiated first.

22.2% thought that far too many and (38.9%) thought that too many blood cultures were sampled in Fiji. However, 33.3% of physicians thought that sufficient blood cultures were sampled.

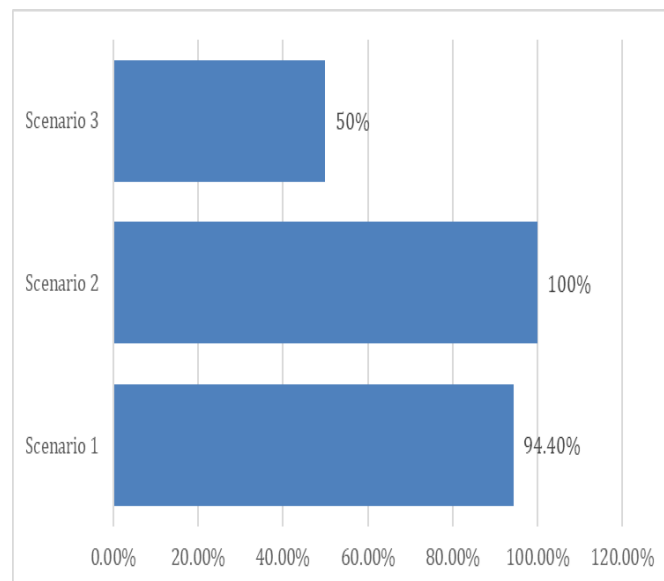


Figure 5 Percentages of participants

Those participants who would have ordered blood cultures for each scenario (n = 18). Only 50% of respondents would sample BC for all three scenarios for which BC is indicated as per Figure 5. (Scenario 1: Bedridden, elderly woman with suspicion of pneumonia and hypothermia. Scenario 2: Patient with central-venous catheter and two spikes. Scenario 3: 32-years old female outpatient with dysuria and shivering.)

**b. Blood culture sampling practice**

Most participants (88.3%) reported taking only one BC set at a time for clinical suspicion of sepsis, and only a minority (11.1%) followed evidence-based recommendations to obtain at least two BC sets.

Only 38.9% of the participants stated that they filled each BC bottle with at least 8–10 ml of blood as recommended by guidelines and manufacturers (FIG 4.1). 38.9% of the participants stated filling 5-8mls and 16.7% to filling less than 5mls.

Hygiene measures aiming at a reduction of contamination risks were implemented well by the participants. 83.33% performed hand disinfection before the procedure (38.89% always performed hand disinfection and 44.45% performed hand disinfection at least 75% of the time before the procedure). Similarly, 83.33% indicated using sterile gloves (33.33% of participants always used sterile gloves for the procedure and 50% of participants used sterile gloves at least 75% of the time). Moreover, 55.56% indicated never using non-sterile

gloves for the procedure. 50% of the participants indicated always performing skin disinfection of the patient whereas another 50% did this at least 75% of the time. 61.11% of the participants indicated self-disinfecting kidney dishes before use due to the unavailability of sterile IV packs. A majority 66.67% indicated never disinfecting the diaphragm of the blood culture bottles before inoculation which is the recommended practice.

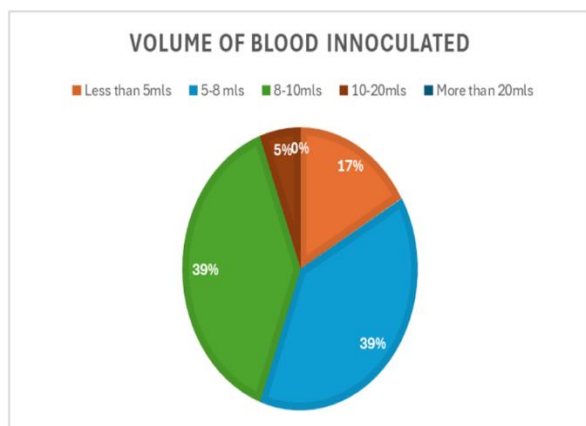


Figure 6. The Volume of blood inoculated for Blood culture Sampling.

Only 39% of the participants stated that they filled each BC bottle with at least 8–10 ml of blood shown in Figure 6, as recommended by guidelines and manufacturers.

**c. Attitude towards blood culture diagnostics**

88.9% of the study participants considered BC sampling to be a very important diagnostic tool and 11.1 % found it to be an important diagnostic tool for sepsis. The vast majority (88.9 %) felt very responsible for guideline BC sampling however (11.1%) felt only a bit responsible for guideline-based BC sampling.

A majority (88.9%) of the participants reported that guidelines for BC ordering and sampling existed in their hospital on some administrative level and 50% reported its presence at the ward level.

Only 5.6% of participants stated to always follow recommended guidelines for blood culture sampling (Figure 4.2). A third (33.3%) stated to follow existing guidelines in at least 75% of the cases, whereas 22.2% of all participants stated to follow existing guidelines in about 25% of the cases. 16.7% of participants admitted to never following

guidelines and 11.1% of participants indicated not knowing the guidelines.

A majority of participants (72.23%) did not feel that blood culture sampling was a time-consuming effort, however, 27.78% of the participants thought that blood cultures are often negative and therefore not helpful.

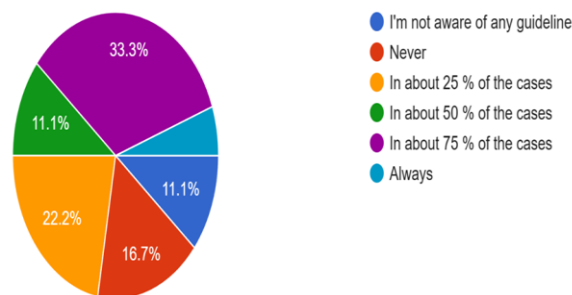


Figure 7. Adherence to guidelines for blood culture sampling.

Only 5.6% of participants stated to always follow recommended guidelines for blood culture sampling 16.7% of participants admitted to never following guidelines and 11.1% of participants indicated they did not know the guidelines as shown in Figure 7.

**d. Potential for improvement**

All (100%) of the participants indicated that there was a general need to improve blood culture ordering and sampling at CWM Hospital.

Most of the surveyed physicians (88.89%) stated that the unavailability of a local guideline in place for blood culture sampling was an important issue to address. Similarly, 100% of the participants indicated that other recommended guidelines for BC sampling were not well known.

55.56% of the participants indicated that there was not enough time to implement guidelines into practice and another 55.56% indicated that due to economic reasons and resource limitations, guidelines were not being put into practice. A majority (61.11%) considered improved communication on the value of BC sampling to be very helpful in ensuring guideline-based BC sampling, and 55.56% of the participants indicated regular training and further education on guidelines as helpful for its implementation.

**Discussion:**

The prevalence of CoNS isolated from adult Blood cultures sampled at CWM Hospital over the six-month study period was 16.86%. Al-Mazroea (2009) found a prevalence of 5.05% of CoNS isolated from blood cultures at Ohud Hospital, Saudi Arabia over sixteen months [12].

Similarly, Van Hal et al. (2008) found a prevalence of 2.6% of CoNS isolated from blood cultures over a six-month study at St. Vincent's Hospital, Sydney, Australia [13]. In comparison with other studies, the prevalence of CoNS isolated from blood cultures at CWM hospital is markedly high. A limitation of this present study was the inability to ascertain CoNS as a contaminant versus a true pathogen for the data available.

Differentiating between CoNS as a blood culture contaminant or a true pathogen involves the assessment of several parameters. Clinically, risk factors for true CoNS bacteriemia should be identified such as IV catheters or indwelling foreign devices/implants, post-surgical infections, immunocompromised status, patients undergoing haemodialysis, and patients with prolonged hospital stay [2,14]. Despite the availability of several guidelines to differentiate contaminants from true pathogens, a "gold standard" is not yet established [15]. Generally, contamination is presumed if only one of two blood cultures is CoNS-positive, whereas true bacteraemia is considered if two CoNS-positive blood cultures are present [2,15].

In this study, the inability to ascertain CoNS as a contaminant versus true pathogen for the data available was due to two main reasons: Firstly, to determine CoNS as a contaminant versus true pathogen, clinical data is needed, including information on risk factors for CoNS bacteraemia which includes ICS status, and duration and type of antimicrobial therapy the patients receive in-patient [2,15]. This clinical information is not provided in Patient

Information Systems at CWM Hospital as evolving patient clinical data is not computerized. Hence, the only way to obtain this information would be by locating patient folders for each of the 621 cases of CoNS isolated and investigating each case individually. Secondly, information on CoNS data

was obtained as a whole set for the study period and particularly late (in September) from LIS systems.

Epidemiologically, among cases where CoNS have been isolated from blood cultures, significant infection is seen in 12-25% of cases whereas the rest are contaminants [6].

The highest proportion of CoNS isolated from blood cultures sampled at various wards of CWM Hospital were for the following wards respectively, Sukuna Ward (25.71%), ICU (23.83%), Paying ward which includes samples from ANZ and Beqa ward (20.19%), Acute Surgical ward (19.34%), Emergency department (18.05%), and Women's medical ward (16.95%).

These values do not holistically reflect the quality of blood cultures sampled at the ICU as a proportion of the cases may be accounted for by True CoNS infections since patients admitted to the ICU have a higher risk of nosocomial infection than other hospitalized patients [16]. Whereas general medical/surgical ward patients have a 6% overall risk of acquiring an infection during their hospital stay, critically ill patients in the ICU have an 18% risk (P greater than 0.001) [16]. Hurley (2019) conducted a meta-analysis of CoNS bacteraemia in ICU patients and found that among observational studies which did versus did not specify stringent ( $\geq 2$  positive blood cultures) diagnostic criteria, the mean CoNS bacteraemia incidence per 100 patients (and 95% CI; n) was 1.3 (0.9–2.0; n = 23) versus 3.6 (1.8–6.9; n = 8), respectively, giving an overall benchmark of 1.8 (1.2–2.4; n = 31) [17]. Patient mortality before the second blood culture taken in ICU settings also requires further consideration.

Sukuna Ward had the highest proportion of CoNS isolated from blood cultures (25.71%), and this was consistent with the findings of the ward audit, whereby Sukuna Ward was among the five least well-equipped wards for procedural equipment. In comparison, the other wards that had the highest proportion of CoNS isolated were well equipped otherwise.

During the period of this study, Betadine was low in stock at the CWM Pharmacy stores from March 2024. Hence, the East Wing Wards were prioritized over the West Wing Wards, which resulted in complete betadine unavailability in most of the West

Wing Wards. However, SVM (70% Methylated spirit/ Denatured ethanol) was available in all wards. The highest proportion of CoNS isolated was between the months of March- May which coincides with the period of Betadine shortage. Poor skin antisepsis before drawing blood is the most common cause of blood culture contamination [18]. Caldeira et al. (2010) conducted a systematic review with a meta-analysis of RCTs on skin disinfection before blood culture sampling which demonstrated that alcoholic chlorhexidine was better than non-alcoholic povidone-iodine (RR: 0.33; 95% CI: 0.24e0.46) in 4757 blood cultures from two trials. Alcoholic solutions were better than non-alcoholic products (0.53; 0.31e0.90) in 21300 blood cultures from four studies and alcohol alone was not inferior to iodinated products for prevention of contamination in venous sampling of blood cultures [19].

For the KAP study, the response rate was poor at 12.77%.

Out of the total participant responses, only 5.6% noted always following recommended guidelines for BC sampling, whereas 16.7% indicated never following guidelines and 11.1% indicated not knowing any available guidelines. Furthermore, 27.78% of respondents believed that blood cultures are often negative and not helpful. These suggest deficits in knowledge and attitude. Furthermore, 50% of participants did not choose to take blood cultures in the scenario of a young female with UTI and chills which was an indication for BC sampling. A majority (61.1%) of participants believed that too many blood cultures were sampled in their setting.

A majority of participants (88.3%) reported taking only one BC set at a time for clinical suspicion of sepsis, and only a minority (11.1%) followed evidence-based recommendations to obtain at least two BC sets. Washington (1996) conducted a study on 80 bacteraemia patients who had at least 3 blood cultures taken within 24 hours [18,20]. 80% of bacteraemic episodes were detected in the first culture, followed by 89% and 99% in the second and third cultures. Similarly, Weinstein et al. (1996) [18,21] documented similar findings and Roberts (1993) [18,22] found that a second blood culture was the only positive culture in 12.5% of cases. No newer studies have been conducted on this topic.

Only 38.9% of the KAP survey participants stated that they filled each BC bottle with at least 8–10 ml

of blood. Several studies [18,23-26] have found a direct relationship between the volume of blood sampled for blood cultures and the diagnostic yield of the culture. Cockerill et al. (2004) found that the diagnostic yield of bacteria was 29.8% higher in 20mls (10mls in each flask) than in 10mls, and 47.2% higher in 30mls than in 10mls of blood collected [23].

Furthermore, all (100%) of the participants indicated that guidelines for BC sampling were not well known and that there was a need for improvement in BC sampling practices in Fiji.

The non-response rate was high for this KAP survey, at 87.23%, hence, due to the high non-response bias, the results obtained for this KAP study may not fairly reflect the Knowledge, Attitude and Practise of physicians at CWM Hospital on blood culture ordering and sampling.

Nevertheless, from this research, we recommend that it would be useful if a National, evidence-based guideline on blood culture sampling and ordering was established in Fiji.

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## Clinical Outcomes Of STEMI In Lautoka Hospital Over A Six-Month Period

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### Abstract

**Aim:** To identify the determinants, outcomes and mortality rate of STEMI at Lautoka hospital between July to December 2023

**Method:** This was a retrospective observational study, carried out in Lautoka Hospital and included patients above the age of 18 years, diagnosed with STEMI admitted to the emergency department, Critical care unit and medical wards between July to December 2023.

**Results:** Study population included 56 patients predominantly male (73.2%). Majority of the patients (85%) were Fijian of Indian Descent and were between the ages of 51-60. 66% of patients presented within 12 hours of onset of chest pain. The average time from onset of chest pain to presentation was 17 hours. 20 patients (68.97%) were within the ideal door to needle time of 1 hour. The average door to needle time was 66 minutes. Out of the 29 patients who were thrombolysed with streptokinase, 66% had nil adverse effects while 34% suffered from hypotension. Most patients (44.64%) were discharged without any complications while 19.6% (n=11) had cardiac related death. Of the remaining 45 patients, 25 (57.78%) are awaiting ECHO/angiogram while attending SOPD clinics while 5 patients (11.11% have had a coronary artery bypass done. The mortality rate was 19.6%.

**Conclusion:** This study has helped better identify the determinants of patients that were diagnosed with STEMI in Lautoka Hospital from July to December in 2023. Indian ethnicity, male gender and age group of more than 50 had much higher probability of developing STEMI. Majority of the patients were discharged and were henceforth followed up in medical clinics. Additionally, the mortality rate of 19.6% can be attributed to an increase in modifiable risk factors, The average door-to-needle time was found to be 66 minutes. This study demonstrates a need for public education and more efficient referral pathways to assist in reducing the time of presentation to the hospital and the door-to-needle time; hence reducing the overall probability of the morbidity and mortality associated with STEMI.

### Introduction

An acute ST-elevation myocardial infarction (STEMI) is an event in which there is transmural myocardial ischemia resulting in myocardial injury or necrosis. The current 2018 clinical definition of Myocardial Infarction (MI) requires the confirmation of the myocardial ischemic injury seen as elevated cardiac biomarkers. It is a clinical syndrome involving myocardial ischemia, ECG changes and chest pain.

This ischemic heart disease carries a high burden of morbidity and mortality especially in the Pacific. The Centers for Disease Control and Prevention (CDC) have reported that Native Hawaiians and Pacific Islander adults have a higher rate of coronary heart disease, angina, and history of heart attack than white persons (6.0% vs 5.4%, respectively). Looking at Fiji's health report in 2017, there was an increasing trend of cardiac related hospital

admissions from 35 to 59 per 1000 admissions. The increase in cardiovascular disease was due to improved diagnostics, referrals, and cardiovascular interventions e.g. angiograms. The leading cause of hospital admissions for cardiovascular diseases was an acute sub endocardial myocardial infarction.

An ST-elevation myocardial infarction occurs from occlusion of one or more of the coronary arteries that supply the heart with blood. The cause of this abrupt disruption of blood flow may be due to plaque rupture, erosion, fissuring or dissection of coronary arteries that results in an obstructing thrombus. The major risk factors for STEMI are dyslipidemia, diabetes mellitus, hypertension, smoking, and family history of coronary artery disease, all of which are prevalent in Fiji.

The symptoms for a typical MI include dull chest pain that radiates down the left arm and is associated with shortness of breath, diaphoresis and nausea/

vomiting. However, there can also be atypical symptoms such as epigastric pain, back pain, pain radiating to jaw or pain that is described as sharp and burning nature. This can lead to misdiagnosis, for example as gastritis, and ultimately lead to patients either coming in with MI complications or in worst case scenarios, sudden cardiac death.

According to the Journal of American Heart Association, women are more likely to get “atypical” symptoms, therefore be misdiagnosed and have poorer outcomes compared to men. Mirzaei et al found that another factor contributing to women's less timely reperfusion was longer prehospital delay compared with men. This finding is concerning because ECGs are frequently not obtained within the recommended 10 minutes of arrival, and in one study, women with ischemic-type symptoms had a mean time of 53 minutes from presentation to ECG.

An important factor in the management of STEMI with favorable outcomes is early recognition and reperfusion therapy hence the gold standard treatment for this is Percutaneous Coronary Intervention (PCI). An alternative treatment option for this is thrombolytic therapy with medications such as streptokinase (STK). Prompt thrombolysis with early CCU care would translate to smaller infarct sizes. The GREAT trial showed that patients receiving prehospital thrombolysis (101 minutes after onset of symptoms) had up to a 50% risk reduction in annual mortality compared to patients receiving in-hospital thrombolysis (240 minutes from onset of symptoms). This benefit was consistent at the 5 years follow up. Another meta-analysis consisting of six randomized trials involving 6,434 patients showed a significant reduction in all-cause mortality in prehospital thrombolysis compared to in-hospital thrombolysis. This shows that a shorter door to needle time is associated with better outcomes and lower mortality rates. While there aren't trained personnel and equipment available for PCI in government hospitals in Fiji, thrombolysis with STK is available provided the thrombolysis criteria is met.

When looking at other factors that influence STEMI outcomes, a study done in Barcelona found that the low-socioeconomic patients with STEMI were younger, had worse clinical profiles due to multiple other comorbidities such as Diabetes Mellitus and had longer revascularization delays. Despite that, their 30-day and 1-year outcomes were comparable

to those of the higher-income patients (Helena Marcos, 2022).

Education also plays an important role in the outcomes as patients need to be able to recognize their symptoms to get to the hospital in time. A study done in 2011 showed that one-year mortality was inversely related to years of education and was 5-fold higher in patients with 8 years compared with those with 16 years of education (17.5% vs. 3.5%,  $p < 0.0001$ ). The strength of the relationship between education and mortality varied among different countries; however, years of education remained an independent correlate of mortality at day 7 (Rajendra, 2011)

Despite advancements in the medical field regarding this topic, there continues to be an increasing trend of morbidity and mortality related to MI in the country. When looking at data available from Fiji in this context, there were only 2 articles found. One was published in 1973 by the Medical Journal of Australia, and it gave a mortality rate of 24.1%. The other study was carried out between 1964-1965 and it found that an acute MI was much more common amongst Fijians of Indian descent compared to Itaukei due to comorbidities such as diabetes, hypertension and hypercholesterolemia.

## **Methodology**

### **2.1 Study type/ design**

This was a retrospective observational study to evaluate the outcome of STEMI and rates of mortality in Lautoka hospital from 1st July to 31st December 2023.

### **2.2 Study Setting**

The study was set in Lautoka Hospital specifically focusing on the Emergency department, critical care units, men's medical ward and women's medical ward.

### **2.3 Study Population/ Sample Size**

The study was based on patients who presented to the emergency department in Lautoka hospital and had suffered from a ST elevation myocardial infarction, whereby they had been admitted to the coronary care unit (CCU), the medical wards or had succumbed.

**2.4 Inclusion Criteria**

All patients above the age of 18 years old admitted to Lautoka Hospital with STEMI

**2.5 Exclusion Criteria**

- Patients with ACS who do not meet the criteria for STEMI
- Patients admitted to the wards with STEMI who signed out against medical advice during admission
- Patients with STEMI who refused admission from ED and signed out against medical advice
- Patients referred from sub divisional hospitals diagnosed with STEMI

**2.6 Sampling and Power of Study**

All patients that are over the age of 18, admitted in CCU and other medical wards over a period of 6 months, between July and December 2023. These patients were then segregated using the inclusion and exclusion criteria.

**2.7 Method of Recruitment of Participants**

Tamanu, ED and CCU admission registers were accessed to identify patients admitted with STEMI.

**2.8 Data Management and Storage**

- Data Collection & Capturing:
  - Data from Lautoka Hospital’s records including Tamanu/ ED Registers/ CCU registers
- Managing & Collaboration
  - Results of data analysis e.g statistical tables

Our major tool for data storage was via google drive which allowed access to the research partners working on this project. The data collected was further annotated and tabulated for easier apprehension.

**Results**

**3.1 Sociodemographic Characteristics**

The study population consisted of 56 patients from the hospital registries, with 73.2% being male and

26.8 % female. The majority (32 %) of patients were aged between 51-60. It is important to note however that the second most common age group was 41-50 which highlights the shift towards younger people. Among the patients, the majority (85 %) were Fijian of Indian descent, followed by those of Itaukei (12 %). Most patients had 2 or 3 comorbidities (48%) while dyslipidemia and smoking alone carried a risk of 7%. Most of the patients (44%) had a positive family history of cardiac disease while it was unknown in 25% of patients. 39% of patients had blue collar jobs while 17.8% had white collar jobs.

Table 1. Sociodemographic characteristic

Gender	Total (56)	Percentage
● Male	41	73.2
● Female	15	26.8
Age		
● 31-40	5	8.9
● 41-50	14	25
● 51-60	18	32
● 61-70	12	21
● 71-80	4	7
● 81+	3	5
Ethnicity		
● FID	48	85
● I-taukei	7	12
● Others	1	1.7
Comorbidities		
● Dyslipidemia	4	7
● Smoker	4	7
● Hypertension	1	1.7
● Dual (DM+HTN)	4	7
● 2-3	27	48
● 4+	16	28
Family History		
● Positive	25	44
● Negative	17	30
● Unknown	14	25
Occupation		
● Retired	7	12
● Domestic duties	9	16
● White collar	10	17.8
● Blue collar	22	39
● Unknown	8	14

**3.2 Time from onset of chest pain to presentation to ED**

More than a third of the patients (35.7%) presented within 1-6 hours of onset of chest pain while 17.8% presented within 30 minutes. A few patients (5.3%) presented at 1 week. The average time from onset of chest pain to presentation was 17 hours.

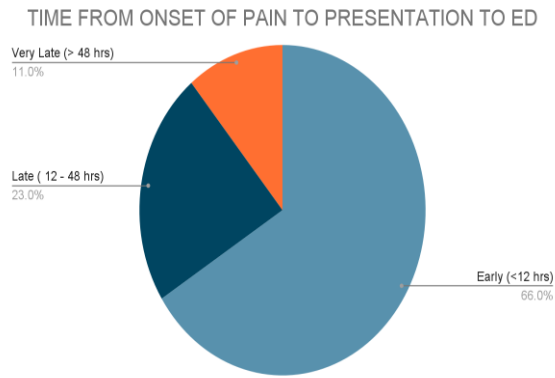


Figure 1. Time to ED presentation

Most of the patients (66%) had presented within the 12-hour mark and thus were eligible for thrombolysis provided they did not have any contraindications as shown in Figure 1.

**3.3 Number of patients thrombolysed**

51.8% of patients further went on to receive thrombolysis with streptokinase while 48.2% did not as shown in Figure 2.

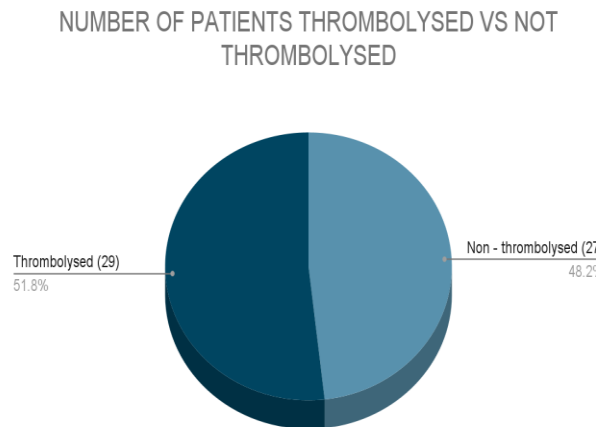


Figure 2. Number of patients thrombolysed vs not thrombolysed

**3.4 Door to needle time**

Majority of the patients (37.9%) received streptokinase within 1 hour since presentation to ED while 31% received it within 30 minutes. In total, almost 69% were within the ideal door to needle time of 1 hour. The average door to needle time was 66 minutes as shown in Figure 3.

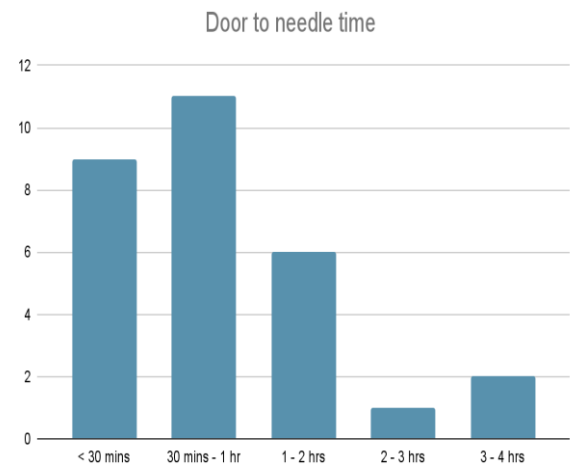


Figure 3. Door to needle time

**3.5 Adverse Effects of thrombolysis**

66% of patients had no adverse effects while 34% suffered from hypotension which was either treated with IVF boluses or intropic support. None of the patients had any bleeding manifestations, arrhythmias or allergic reaction.

**3.6 Primary Outcome**

Of the 56 admitted patients as per Figure 4, 25 (44.6%) were discharged without complications while 11 patients (19.6%) died. 12.5% of patients developed failure symptoms, 10.7% developed APO while 83.9% went into cardiogenic shock. Only 1 patient had a recurrent MI.

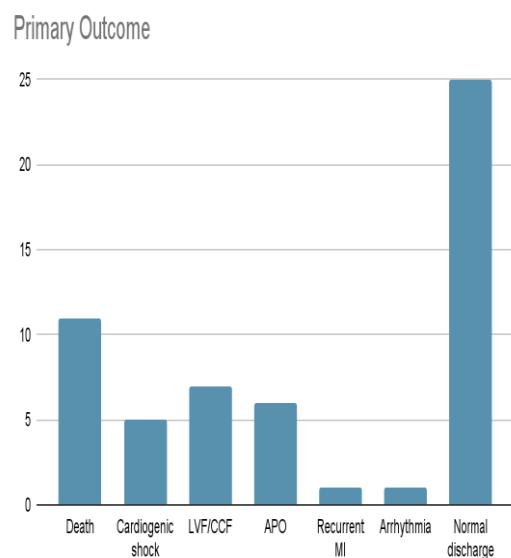


Figure 4 Primary outcomes

### 3.7 Secondary Outcome

Majority of the patients (57.8%) are currently attending SOPD clinics while awaiting ECHO/angiogram. 8.9% died due to non-cardiac related causes, 11.1% had coronary artery bypass done, 8.9% had an angiogram done privately and 8.9% were re-hospitalised within 6 months for either NSTEMI or Unstable Angina. These proportions are shown in Figure 5.

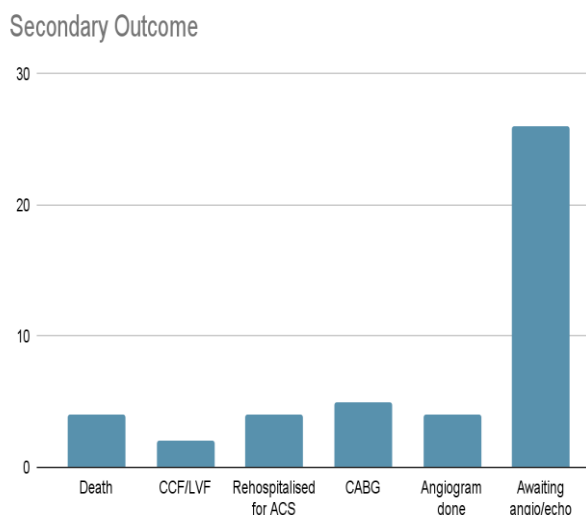


Figure 5 Secondary Outcomes

### Discussion

This study showed a high incidence of STEMI cases in the 51-60 age group population (32%), predominantly males (73%). Most of these patients were of Fijian of Indian Descent (85%) which may contribute to one of the socio-economic determinants; comparison of health seeking behavior between different ethnicities.

STEMI prevailed largely in patients who had multiple risk factors (including dyslipidemia, DM and HTN) and a positive family history of cardiovascular event (44%) hence creating awareness and educating the public on primordial and primary prevention becomes fundamental at an individual and community level. Furthermore, timely and effective SOPD follow-ups to prevent STEMI as a complication is imperative.

STEMI being more prevalent in the domestic duties and “blue-collar” job profiles beg the question of ‘education; is it a major determinant of this disease?’

Majority patients (66%) had presented to ED in  $\leq 12$  hours of onset of symptom(s) however the median time was increased to 17 hours. This can be attributed to “delay in deciding” to seek medical care or “delay in reaching” the health care facility. Even though the majority were residing in Lautoka, further comments on the economic and geographical factors of these patients cannot be made as this information were limited.

Out of the 29 patients (52%) who received thrombolysis with streptokinase, 20 (69%) had been successfully thrombolysed within 1 hour of presentation with the median door-to-needle time averaging to 66 mins. This provides room for discussion for the third delay; “delay in receiving treatment”. One of the reasons for the delay in diagnosis was found to be a delay in retrieving old folders to compare ECGs. There was also a delay in conducting a few of the serial ECGs which led to either missing important changes or were recognized too late. There was also a case whereby there was a late discussion with superiors from nursing practitioners to Interns- Registrars- Consultants to discourse on thrombolysis between the Emergency and Medical team.

Of the adverse effects of streptokinase, 10 (34%) developed hypotension as the major adverse effect. These cases were adequately treated with intravenous normal saline boluses while 1 patient had required inotropic support (dobutamine infusion) but had completed STK successfully.

On the contrary, out of the 27 (48%) who were not thrombolysed, 20 (74%) had surpassed the thrombolysis period, 4 (14%) were missed STEMI, 2 had absolute contraindications (recent history of eye surgery and history of ischemic stroke on Clexane) while 1 patient was not thrombolysed upon discussion with the medical consultant on call as there were more risks than benefits.

The primary outcome focused on major adverse cardiac events (MACE) within the 2 weeks of presentation. In this study, most of the patients (45%, n=25) were discharged without complications. The major cardiovascular events that preceded were LVF/CCF (12.5%), APO (10.7%) and cardiogenic shock (8.9%) respectively. The mortality rate, on the other hand, was 19.6%.

Moreover, the secondary outcome delved into MACE past 2 weeks till 6 months post-discharge.

Majority i.e 26 patients (58%) were awaiting outpatient Angiogram/ ECHO, while 8.9% had it done privately.

### Limitations

Some of the limitations of our study were that our study depended on the availability of data on admission notes and a few of our patients had incomplete documentation. On the same note, this was retrospective research hence there was unavailability of certain information such as economical and geographical status. Patients were also excluded if they were referred from peripheral settings, which means that critical cases were not included in the research. This study is single centred and conducted retrospectively thus limiting exploration of additional associations.

### Conclusion

This study has helped better identify the determinants of patients that were diagnosed with STEMI in Lautoka Hospital from July to December in 2023. Indian ethnicity, male gender and age group of more than 50 had much higher probability of developing STEMI. Majority of the patients were discharged and were henceforth followed up in medical clinics. Additionally, the mortality rate of 19.6% can be attributed to increase in modifiable risk factors, and an average door to needle time of 66 minutes with the overall delay being delay in serial ECGs or delay in diagnosis. This study demonstrates a need for public education and more efficient referral pathways to assist in reducing the time of presentation to the hospital and the DON time; hence reducing the overall probability of the morbidity and mortality associated with STEMI.

### Recommendation

One of the imperative measures to assist in reducing the burden of STEMI on Lautoka hospital is health promotion and disease prevention. This can be better cemented by promoting better general health such as lifestyle or behavioral modifications and nutritional interventions. In-hospital early detection measures can be improved by recording all ECGs in a timely manner, possibly every 15 minutes, with quick and efficient referrals or discussions with senior medical officers to further reduce the door to needle time.

Furthermore, developing a cardiac catheterization laboratory in Lautoka Hospital will change the dynamics of inpatient care and help improve the statistics that have been seen for the better.

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## Efficacy Of Fine Needle Aspiration In The Diagnosis Of Breast Cancer In Women In Lautoka Hospital From 1st January 2023 To 1st January 2024

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### Abstract

**Background:** Breast cancer is the most common cancer among women worldwide, accounting for about 12.5% of new cancer cases annually [1]. Its global burden is expected to rise to over 3 million new cases and more than 1 million deaths each year. Due to its high prevalence and mortality, accurate and timely diagnosis is essential.

**Objective:** This study reviews all breast lump FNAs performed at Lautoka Hospital from January 2023 to January 2024 to assess how effective FNA is in diagnosing breast cancer, identify which lesions are most detectable by FNA, and evaluate procedure complications and long-term outcomes in affected patients.

**Methodology:** This retrospective study at Lautoka Hospital reviewed breast lump FNA biopsies from 1st January 2023 to 1st January 2024. It assessed the accuracy of initial FNA diagnoses, the need for re-biopsy, and long-term outcomes, with all data securely recorded.

**Results:** Out of 227 FNA samples, 217 were included. Initial results showed 32% benign, 24% malignant and 38% inconclusive cases. Thirty-five patients had re-biopsy, with 49% malignant, 42% benign and 9% still inconclusive. Malignancies were most common in women aged 56–66, while benign lesions were more common in those under 35. Twelve patients died, with 5 having malignant FNAs. FNA sensitivity for malignancy was 75%.

**Conclusion:** FNA is a valuable, minimally invasive tool for evaluating breast lumps, particularly in resource-limited settings. However, its limitations, such as inconclusive samples and follow-up issues, emphasize the need for additional diagnostic methods and improved follow-up protocols.

### Introduction

A breast lump is an abnormal mass within the breast tissue, which can result from conditions like cysts, fibroadenomas, or breast cancer. Breast cancer is a malignant tumor originating in the milk ducts or lobules, marked by uncontrolled cell growth. In 2022, there were 2.3 million new breast cancer cases globally, with 670,000 deaths [2]. In Fiji, breast cancer was the most common cancer that year, with 289 new cases and 182 deaths [3].

Several factors increase the risk of breast cancer, including age over 65, atypical hyperplasia, inherited genetic mutations (e.g., BRCA1/2), family history of early ovarian cancer, and prior exposure to ionizing radiation. Other common risk factors include postmenopausal status, high endogenous estrogen, late first pregnancy, early menarche, dense breasts, and a history of benign breast disease. Diagnosis involves clinical evaluation, radiological assessment, tissue diagnosis through techniques like FNA, tru-cut biopsy, and excisional biopsies. The

goal of these tests are to determine if the lesion is benign or malignant, guiding the subsequent treatment approach.

Fine-needle aspiration (FNA) is a minimally invasive procedure where a thin needle extracts a tissue or fluid sample for microscopic examination. A Tru-cut biopsy, or core needle biopsy, also minimally invasive, removes a 2mm thick tissue sample from a lump or mass. FNA is quicker, less painful, and can be done in an outpatient setting, without needing an incision, making it advantageous over open biopsies. The main difference between incisional and excisional biopsies lies in the amount of tissue removed: an incisional biopsy removes a tissue sample, while an excisional biopsy removes the entire lump or suspicious area, often used for melanoma.

To effectively reduce breast cancer mortality in Fiji, early diagnosis and accessible diagnostic tools like FNA and Tru-cut biopsies are crucial, especially in

resource-limited settings. Early detection enables timely treatment and better management of the disease. Improving public health awareness, encouraging self-examinations, and ensuring adequate follow-up care are key to reducing late-stage diagnoses. Strengthening healthcare infrastructure, providing affordable diagnostic services and promoting regular screening will significantly improve patient outcomes and decrease mortality rates.

### Methodology

**Study design:** This study is a retrospective study design.

**Study setting:** The Surgical Department of Lautoka Hospital, Fiji from 1<sup>st</sup> January 2023 to 1<sup>st</sup> January 2024.

**Study Sample:** All breast lump FNAs performed between 1<sup>st</sup> January 2023 and 1<sup>st</sup> January 2024 were identified through the pathology register, and the results were reviewed. The study determined the percentage of breast cancer cases confirmed by the first FNA and those requiring a second FNA or alternative biopsy. The most commonly detected breast lesions by FNA were also identified and patient records were reviewed to assess outcomes.

**Methods / Sampling, sample size and power of study:** A total of 227 FNA samples were identified, but 217 were included in the study after 10 patients were excluded based on the criteria.

**Inclusion criteria** - All FNA performed for breast lump in Lautoka Hospital from 1<sup>st</sup> January 2023 to 1<sup>st</sup> January 2024.

#### Exclusion criteria:

- Male
- Not a Fiji Citizen
- FNAs that had an incomplete record of results.
- Patients with lost folders / details.
- Patients with NHN Issues.
- Patients with recurrent malignancies.

- Patients with past / current chemotherapeutic or prevention treatment.

### Data Collection, Management and Analysis

Data collection began after ethical approval, with access to the pathology lab register for all FNAs performed on breast lumps between 1<sup>st</sup> January 2023 and 1<sup>st</sup> January 2024. Patient records were de-identified using a coding system to maintain confidentiality and stored in a password-protected Excel spreadsheet on Google Sheets, with restricted access to the research team to maintain the confidentiality.

The histopathological results were reviewed to identify breast cancer diagnoses and inconclusive cases. Patient folders were retrieved using National Hospital Numbers (NHN) and via Tamanu (Electronic Health Record) and reviewed for long-term outcomes and complications. The effectiveness of FNA in diagnosing breast cancer was assessed through qualitative coding and data visualization (pie charts and graphs). The result were used to assess the sensitivity of FNA in detecting malignant breast lumps, measuring its accuracy in identifying cancer when present.

### Results

In 2023, a total of 227 breast FNAs were conducted at Lautoka Hospital, but 217 were included in the study. Ten cases were excluded due to inaccessible patient folders or male gender, based on the exclusion criteria. Data was collected and analyzed, focusing on demographics, malignant breast cancer, benign breast disease, follow-up clinics and the age distribution of patients with various pathologies.

**1.0 Demography of Lesions of FNA biopsy**

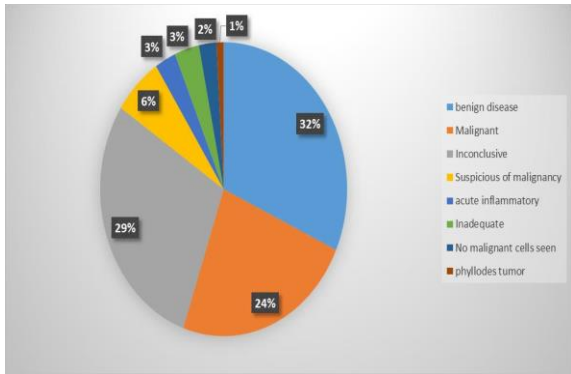


Figure 1: Types of breast lesions diagnosed by FNA

According to Figure 1, of the 217 FNA samples, 32% were diagnosed with benign breast diseases, with fibroadenoma being the most common. Malignant lesions accounted for 24%, while 38% (84 cases) had indefinite results, 6% were suspicious of malignancy, 3% were inadequate and 29% were inconclusive, requiring further workup such as re-biopsy or additional imaging. Uncommon pathologies included acute inflammation (3%) and phyllodes tumor (1%), while 2% had clear results, showing no malignant cells.

**2.0 Demographics of age distribution**

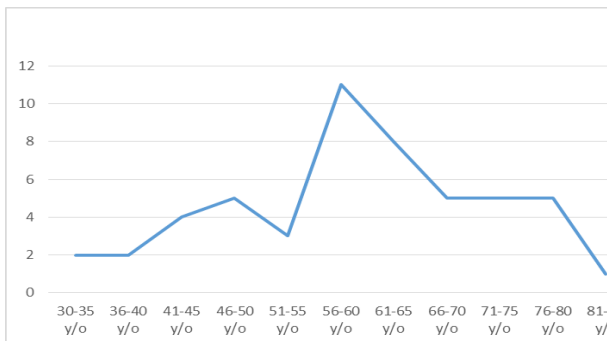


Figure 2: Age distribution of patients with malignant breast cancer

In Figure 2, most malignant breast cancers detected by FNA were in patients over 55, particularly between ages 56-65, likely due to increased estrogen exposure with age. The youngest malignant patient was 32, and the oldest was 80. Five patients with malignant breast cancer died from metastasis, with the youngest being 32.

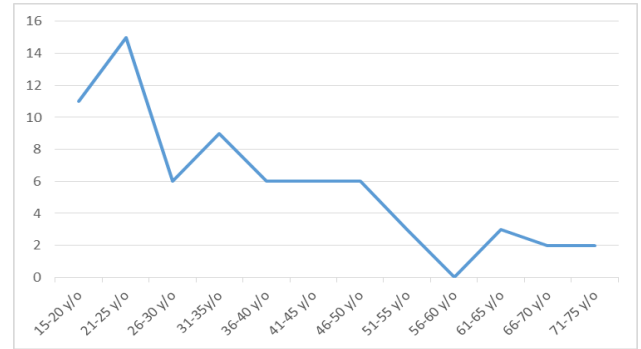


Figure 3: Age distribution of patients with benign breast disease

The Figure 3 shows that benign breast diseases detected by FNA were most common in patients under 35, with only one death reported in this group.

**3.0 Analysis of Indefinite FNA results**

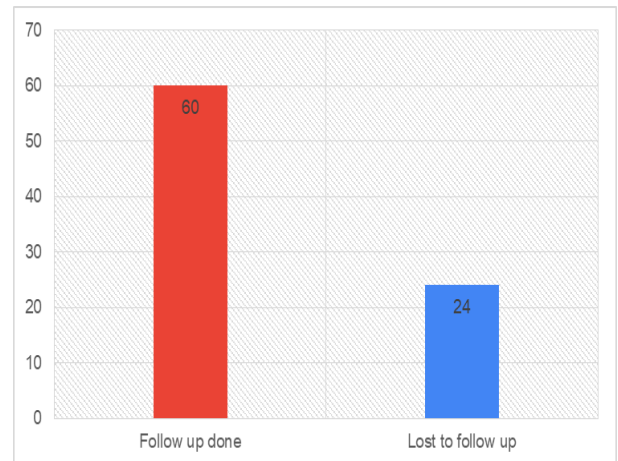


Figure 4: Follow up clinics vs lost to follow-up of indefinite FNA biopsies

Moreover, as per Figure 4, 84 patients had inconclusive, inadequate, or suspicious FNA results. Of these, 71% were followed up in the clinic, while 29% were lost to follow-up. Six deaths occurred among these patients, with three having inconclusive results and three suspicious of malignancy. Treatment outcomes included 13 mastectomies, 15 discharges, 16 ongoing clinic visits with mammogram and self-examination reviews, and 3 on a waiting list. Some patients either had re-biopsies or were lost to follow-up or refused further interventions. Two patients who were diagnosed with malignancy but lost to follow-up were contacted: one refused treatment for herbal therapy, while the other agreed to surgical intervention.

#### 4.0 Re-biopsy and Sensitivity

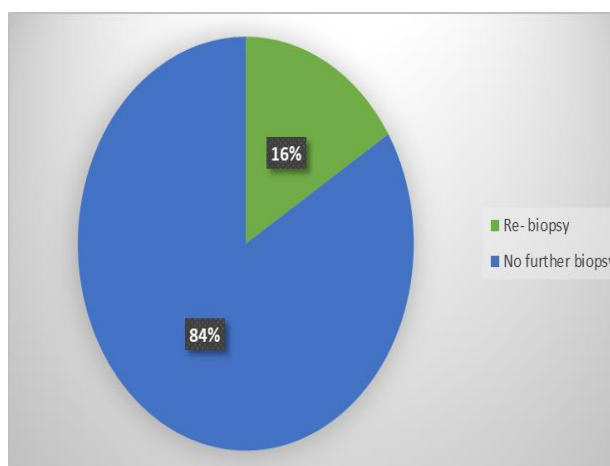


Figure 5 Re-biopsy rates

	True Positive	False Negative	Sensitivity
<b>Malignant</b>	51	17	75%

$$\text{Sensitivity} = \left[ \frac{\text{True Positive}}{\text{True Positive} + \text{False Negative}} \right] \times 100$$

$$= \left[ \frac{51}{51 + 17} \right] \times 100 = 75\%$$

Figure 6: Sensitivity of FNA in diagnosing malignant breast cancer

As shown in Figure 5, of all the FNAs that were done, 35 patients had a re-biopsy (16%), 182 patients did not need further biopsy (84%). Among these 35 patients that had re-biopsy, malignant cancers were detected in 49% (17 patients), benign breast disease in 42% (15 patients) and 9% were inconclusive (3 patients).

The sensitivity of FNA in diagnosing malignancy was calculated to be 75%, using the results of **True Positives** (malignant cases identified in the first FNA) and **False Negatives** (malignant cases found in re-biopsy) as shown in Figure 6.

#### Discussion

This study evaluated the diagnostic efficacy of Fine Needle Aspiration (FNA) for breast lumps at Lautoka Hospital, providing insights into its role in breast cancer detection in Fiji.

#### Comparison with previous studies

Among 217 FNAs reviewed, malignancy was identified in 24% and benign disease in 32%,

aligning with international findings. Agarwal et al. (2020) [5] similarly reported benign lesions as the most frequent breast pathology, reinforcing FNA's value as a first-line diagnostic tool. Despite this, 38% of cases were inconclusive, suspicious, or inadequate. This limitation is widely recognized, with Bukhari et al. (2011) [6] also reporting high rates of indeterminate results requiring further workup. In our cohort, 16% underwent re-biopsy, and nearly half were confirmed malignant. This underscores that FNA, while valuable, should not be used in isolation, particularly in cases where initial samples are equivocal.

#### Age distribution

Age distribution trends mirrored global data: malignancies were concentrated in women over 55 years, while benign disease predominated in women under 35. These findings reflect the established role of cumulative estrogen exposure in carcinogenesis. Mortality patterns were also noteworthy, with several deaths occurring in patients whose FNAs were initially inconclusive or suspicious. Furthermore, nearly one-third of such patients were lost to follow-up, highlighting the clinical consequences of diagnostic uncertainty and the urgent need for robust patient tracking systems.

#### Sensitivity

The sensitivity of FNA for detecting malignancy was 75%, consistent with global studies reporting values of 70–75% [7], [8]. While this level of accuracy supports its continued use, it also implies that up to one-quarter of cancers may be missed. By contrast, Tru-Cut biopsy demonstrates higher sensitivity and specificity [9] as it provides sufficient tissue for histological classification. However, FNA retains important advantages: it is quick, minimally invasive, inexpensive, and associated with fewer complications. These attributes make it especially suitable in Fiji, where resource constraints, accessibility, and patient acceptance are key considerations.

#### Implications of Findings

The findings suggest several important implications for improving the diagnostic process and patient outcomes in the context of fine needle aspiration (FNA):

- **Indeterminate Results:** These should prompt systematic follow-up, including

repeat testing or alternative methods (like Tru-Cut biopsy or imaging) to ensure accurate diagnosis.

- **Technical Enhancements:** Adopting ultrasound guidance during FNA can improve sample quality and diagnostic accuracy, reducing the risk of inadequate samples.
- **Standardized Reporting:** Implementing a framework like the Bethesda system for breast cytology can improve consistency in results interpretation and reduce observer variability.
- **System-Level Challenges:** A concerning 29% loss to follow-up emphasizes the need for structured recall systems, electronic reminders, and nurse-led follow-up. Patient education—especially regarding cultural beliefs and alternative therapies—can improve adherence and reduce diagnostic delays.
- **Policy and Access:** National guidelines for breast lump assessment would help standardize practices across Fiji. Multicenter collaboration could strengthen the evidence base and make findings more applicable to diverse populations across the Pacific. Expanding outreach to rural facilities would improve equity of access, particularly for women presenting late with advanced disease.
- **Integration of FNA in Diagnostic Pathways:** FNA should be part of an integrated diagnostic process, including clinical examination, imaging, and Tru-Cut biopsy when needed. It should not be used in isolation.
- **Future Research:** Prospective studies with standardized reporting and systematic documentation of complications will help strengthen the evidence supporting FNA in breast lump evaluation.

Overall, the study highlights the continued relevance of FNA, but also emphasizes the need for improvements in follow-up, technical processes, and system-level support to improve outcomes.

## Conclusion

Fine Needle Aspiration (FNA) is a valuable, minimally invasive, and cost-effective diagnostic tool for breast lump evaluation in Fiji. Its moderate sensitivity makes it particularly suited for resource-limited settings, offering rapid preliminary results that are crucial for timely decision-making. However, challenges such as inconclusive results, inadequate sampling, and patient attrition underscore the need for complementary diagnostic strategies, standardized reporting protocols, and more robust follow-up systems. Addressing these issues will not only improve diagnostic accuracy but also enhance patient outcomes and contribute to reducing the burden of breast cancer in Fiji.

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## Donor Deferrals At Colonial War Memorial Hospital, Fiji - A Retrospective Observational Study

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### Abstract

**Aim:** To identify the blood donor deferral rate and the reasons for deferral at Colonial War Memorial Hospital (CWMH) blood donor services in Fiji.

**Method:** This retrospective observational study included every individual that presented to the blood donor services at CWMH during 1/05/23 to 31/07/23. Data of individuals who were not accepted to donate due to not meeting CWMH donor criteria was collected from CWMH blood donor records.

**Results:** Of the 2787 individuals who came with an intent to donate 635 (22.8%) were deferred. Low hemoglobin (n=189, 29.7%), low blood pressure (n=124, 19.5%), menstruation (n=76, 11.9%), medication use (n=53, 8.3%), respiratory illness (n=44, 6.9%) and high blood pressure (n=44, 6.9%) were the principal documented reasons for deferral.

**Conclusion:** The blood donor deferral rate at CWMH during our study period was 22.8%, which is higher than average international rates. A revision of the CWMH blood donor criteria to meet with international recommendations could result in a significant proportion of deferrals patients being accepted.

**KEYWORDS:** blood donor, deferral rate, CWMH

### Introduction

Blood donations can save lives. It is therefore imperative to maintain a steady supply of blood products so that it can be available when needed (Organization, Blood products: Blood donation, 2022). The whole blood donation rate provides an indication for the general availability of blood in a country, with access to blood varying significantly between low- and high-income countries. The median rate in high-income countries is 31.5 per 1000 people, compared with 16.4 in upper-middle-income countries, 6.6 in lower-middle-income countries, and 5.0 in low-income countries (Organization, Global status report on blood safety and availability 2021, 2022).

The blood donor selection guideline designed by the World Health Organization (WHO) aids policy makers in national blood programs and assists blood transfusion services to improve and strengthen selection of blood donors. In addition, it serves to highlight those that need to be deferred temporarily or permanently depending on their health circumstances (Organization, Blood donor selection: guidelines on assessing donor suitability

for blood donation, 2012). In general, people between the ages of 17 and 65, who are in a good state of health and do not have any blood-borne infection, are eligible to donate (Organization, Blood products: Blood donation, 2022).

As per the Global Status Report on Blood Safety and Availability 2021, the average total deferral rate for year 2018 was 13% among the 130 countries that provided data. In addition, 110 countries provided their most common deferral reasons, which were low weight, low hemoglobin, high-risk behavior, and travel history (Organization W. H., Blood donor selection: guidelines on assessing donor suitability for blood donation, 2012).

In Fiji, about 50 pints of blood is required daily for pregnant mothers with anemia or bleeding, motor vehicle crash victims, cancer patients, and for surgical emergencies and complications (Services, 2014). The Colonial War Memorial Hospital (CWMH), the largest referral hospital in Fiji with a 500-bed capacity, has been challenged with a shortage of blood availability in the blood bank in recent years. Therefore, the aim of this study was to

determine the deferral rate at CWMH, and analyze the various reasons for deferring donors, with the hope that areas in the donor criteria could be identified to increase the donor yield at CWMH.

**Methods**

This retrospective cohort study was conducted at CWMH blood donor services, during the period of 1<sup>st</sup> May 2023 to 31<sup>st</sup> July 2023. Ethics approval was granted by the Fiji National Health Research Committee (FNHRERC Number: MI\_6\_1\_2022).

Using the CWMH blood donor standard operating procedure, donors at blood donor services are assessed for the presence of factors that may affect their eligibility to donate (Table 1). Each potential donor is advised on the procedure and requirements for blood donation and then interviewed to clarify their eligibility using a screening form that includes vital signs (heart rate, blood pressure, temperature and weight), hemoglobin level, last meal time, medical history, current medication use, previous donation history, and their general well-being and sexual practices. The standard operating procedure was issued in 27<sup>th</sup> Sept 2019 and last revised in 27<sup>th</sup> Sept 2021.

All individuals who presented to CWMH blood services during the study period with the intent to donate were included. Individuals who had their blood donation deferred as a result of not meeting the current CWMH donor criteria, had demographic and clinical data collected from the CWMH blood donor records, and the reasons for deferral were analyzed. Data was collected and analyzed was conducted using Microsoft Excel (Microsoft Corporation, Redmond, WA, USA). Descriptive analyses were used.

**Results**

A total of 2787 donors presented to CWMH blood services during the 3-month study period, of which 635 (22.7%) were deferred for not meeting the current CWMH donor criteria.

The mean age of deferred individuals was 34.9 years (SD 11.7), with an overall male predominance of 51.3%. Table 2 outlines the age spread of deferred donors.

Overall, the most common reasons for deferral were low hemoglobin (n=189, 29.7%), low blood

pressure (n=124, 19.5%), menstruation (n=76, 11.9%), medications (n=53, 8.3%), respiratory disease (n=44, 6.9%) and high blood pressure (n=44, 6.9%). Table 1 outlines the reasons for deferral in detail.

Of the 635 patients deferred from blood donation, 189 (29.7%) were deferred due to 'low hemoglobin'; 152 females, 37 males. Of those deferred due to low hemoglobin, 31 females (20.4%) and 11 males (29.7%) met the minimum required hemoglobin of 12.5 g/dl, and were therefore incorrectly deferred.

**Table 1. Stated reasons for blood donor deferral**

Stated Reasons for Deferral		
Deferral reasons	Number	Percentage
<b>Low Hemoglobin</b>	<b>189</b>	<b>29.8%</b>
Hb < 12.5 g/dl	147	23.1%
Hb ≥ 12.5 g/dl	42	6.6%
<b>Low Blood Pressure</b>	<b>124</b>	<b>19.5%</b>
< 100/60 mmHg	60	9.4%
≥ 100/60 mmHg	64	10.1%
<b>Menstruation</b>	<b>76</b>	<b>12.0%</b>
Currently having menses	21	3.3%
Menses completed > 1 day ago	20	3.1%
Expecting menses soon	26	4.1%
Irregular menses	9	1.4%
<b>Medications</b>	<b>53</b>	<b>8.3%</b>
NSAIDS	14	2.2%
Antibiotics	6	0.9%
Scabies treatment	5	0.8%
Cardiac	5	0.8%

Anticoagulant	1	0.2%
Diabetic medication	1	0.2%
Anti-seizure medication	1	0.2%
Not indicated	20	3.1%
<b>Respiratory disease</b>	<b>44</b>	<b>6.9%</b>
Upper Respiratory Tract Infection	38	6.0%
Asthma	6	0.9%
<b>High Blood Pressure</b>	<b>44</b>	<b>6.9%</b>
Elevated (systolic 120-129 and diastolic < 80)	0	0
Stage 1 (systolic 130-139 or diastolic 80-89)	0	0
Stage 2 (systolic 140-179 or diastolic 90-119)	32	5.0%
Crisis (systolic > 180 or diastolic > 120)	12	1.9%
<b>Skin lesions</b>	<b>17</b>	<b>2.7%</b>
<b>Tattoo</b>	<b>14</b>	<b>2.2%</b>
<b>Other co-morbidities</b>	<b>11</b>	<b>1.7%</b>
<b>Substance use</b>	<b>9</b>	<b>1.4%</b>
<b>Last donation &lt; 3 months</b>	<b>9</b>	<b>1.4%</b>
<b>Kava</b>	<b>2</b>	<b>0.3%</b>
<b>Others*</b>	<b>38</b>	<b>6.0%</b>
<b>Reason not documented</b>	<b>21</b>	<b>3.3%</b>
*Others included weight < 50 kg, age above or below accepted limits, pregnancy, breastfeeding, fear and individual reporting not feeling well		

Low blood pressure (BP) was the second most common reason for deferral in 124 individuals (19.5%). Of these, 60 (48%) had BP <100/60, 41 (33%) had BP equal to 100/60, and 23 (18.5%) had BP >100/60. Conversely, 44 individuals (6.9%) were deferred due to high BP readings of >140/90. Of these, 32 (73%) had BP readings between 140/90 to 180/100, and the remaining 12 individuals (27%) had BP more than 180/100.

Of the total donors deferred, 76 individuals (11.9%) were deferred due to either menstruating at the time of intended donation (n=21, 27.6%), having recently ended their menstruation or nearing their menstrual period date (n=46, 60.5%), or due to irregular menstrual cycle (n=9, 11.9%).

Fifty-three individuals (8.3%) were deferred due to ineligible medication use. Of these, 14 (26.4%) had taken non-steroidal anti-inflammatory medications, 6 (11.3%) were on antibiotics, 5 (9.4%) were on scabies therapy, 5 (9.4%) were on a cardiac medication, 1 (1.9%) was on an anticoagulant, 1 (1.9%) was on a hypoglycemic agent, and 1 (1.9%) on an antiseizure medication. The remaining 20 individuals (37.7%) did not specify the class of medication they were taking.

### Discussion

This study was the first of its kind that was conducted at our facility and found that of the 2787 people who came to CWMH to donate blood, 635 (22.8 %) were deferred compared to the median global deferral rate of 12% (Surendra Koju, 2022). Our study, therefore, highlights that the deferral rate at CWMH is comparatively high, with the most common reasons being low hemoglobin, hypotension, menstruation, medication use, and hypertension.

Analysis of the deferred population is important as it not only guides local guideline development but also aids in increasing donor awareness and improving education material. To increase the donor pool, whilst upholding the safety of each donor, it is essential that the reason for deferral with relevance to their safety is explained well to the individual, along with recommendations to improve their health and provide motivation to return for donation after the expiry of the deferral period. While each deferral causes loss of at least one

donation, the resulting impact may be multiplied as many may feel demotivated to attempt another donation in the future (Mast, 2014). As such, the following expands on the most common reasons for deferral identified and offers recommendations for donors and CWMH, in an effort to safely increase the number of prospective blood donors.

#### Low Hemoglobin

The most common reason for deferral in our cohort was low hemoglobin (29.7%). The CWMH policy requires a hemoglobin greater than 12.5 g/dl for both men and women. This is largely in line with the American Red Cross, WHO Guidelines and Association for the Advancement of Blood and Biotherapies, whose recommended minimum hemoglobin requirement for blood donation is 12.5 g/dl for women and 13 g/dl for men. Notably though, of the 189 patients deferred in our cohort due to low hemoglobin, a total of 42 individuals were deferred incorrectly despite meeting these minimum requirements (31 females and 11 males).

The threshold for anemia, as defined by the WHO Global Database on Anemia, is 12.0 g/dl for women and 13.0 g/dl for men. Therefore, additional donations may potentially be accepted if the CWMH hemoglobin target was lowered to 12.0 g/dl for non-pregnant women. However, donation-induced iron deficiency is a concern, particularly for women of childbearing age, (Spencer, 2022) with a donation of one unit of blood potentially leading to a depletion of most or all of iron reserves and could precipitate a negative iron balance. Recognizing that a hemoglobin between 12.0 to 12.5 g/dl is still within the normal range for women, the Department of Health and Human Services, under the United States Food and Drug Administration, states that blood donation can be allowed “from female allogeneic donors who have a hemoglobin level between 12.0 and 12.5 g/dl, or a hematocrit value between 36 and 38%, provided that the establishment take additional steps to ensure that this alternative standard is adequate to ensure that the health of the donor will not be adversely affected due to the donation” (Administration, 2015). These steps include iron supplementation, deworming and prolonging donation interval, which have been proposed in other developing countries such as India and Nepal (Sheetal Malhotra, 2023).

#### Low blood pressure

Low BP was the second most common reason for deferral (19.5%) despite the current CWMH policy not specifying the lower limit of acceptable blood pressure. According to WHO, suggested limits of systolic BP for blood donation is between 100-140 mmHg, and diastolic of 60–90 mmHg (Organization, Blood donor selection: guidelines on assessing donor suitability for blood donation, 2012). In our study 64 individuals were deferred for low BP despite having a BP equal or greater than 100/60. Indeed, a healthy adult can donate 500 ml of blood without any effect on the blood pressure (LibreTexts, 2022). As such, a personalized approach towards the patient’s overall health, alongside the cut-off for blood pressure, could help decrease the number of deferrals. World Health Organization recommends blood services to provide 500 ml of drinking water to donors prior to donation to lessen the chances of vasovagal reactions (Organization W. H., Blood donor selection: guidelines on assessing donor suitability for blood donation, 2012).

#### Menstruation

Of the total donors deferred, 76 individuals (11.9%) were deferred due to menstruation. Hemoglobin levels for this group of donors were not tested. These deferrals are despite the current CWMH policy not specifying that menstruation should result in ineligibility. WHO guidelines for donor selection state that menstruation itself should not be a cause of donor deferral. Pan American Health Organization, a specialized health agency under WHO, explains that menstruating females should not be deferred if they feel well at the time of donation and fulfil all other criteria (Organization P. A., 2009). A review of the local guidelines regarding this eligibility criteria and proper awareness of blood donation during menses could therefore increase the number of female donors significantly.

One of the major factors limiting regular blood donation by menstruating females is the depletion of body iron stores. Most healthy women lose about 40-80ml of blood during their menses and 40 ml of menstrual blood yields an average loss of 1.6 mg of iron (Mary-Jane N. Ofojekwu, 2013). As such, examining the risk factors of developing iron deficiency is important, and oral iron replacement

could be recommended. In a double-blind study done in menstruating female donors, it was found that a minimal daily iron supplementation was beneficial in improving the hemoglobin and iron storage by 88% after blood donation within the first 8 weeks (Ritchard G. Cable, 2016). Similarly, multiple studies show that taking oral iron tablets daily for 2 months is adequate to replace the iron lost from donation. A recent study done regarding the benefits of iron supplementation following blood donation, reveal that hemoglobin can recover as early as at 4-5 weeks in those taking iron supplements as compared to 11-23 weeks in those not taking iron (Alan E Mast, 2020).

### High Blood Pressure

CWMH donor criteria currently only accepts donors with SBP of <140 mmHg. Although WHO guidelines accept donor systolic BP between 100-140, more recent international guidelines such as American Red Cross and American Heart Association however defines the blood donation eligibility cut off as BP<180/100 on the day of donation. Similarly, Up-to-Date recommends a set of acceptable donor blood pressure reading that ranges from 100/50 mmHg to 180/100 mmHg (Steven Kleinman, 2022). A systematic review comprised of 16 studies conducted in people who donated blood with elevated blood pressures, concluded that there was no evidence found to suggest an increased risk of adverse effects for donors with an elevated baseline systolic blood pressure of up to 200 mm Hg or to those treated for hypertension (D Stainsby, 2010). In our cohort, of the 32 prospective donors deferred due to high blood pressure had BP lower than 180/100 mmHg and could have been accepted if CWMH criteria were brought in line with the latest evidence.

### **Limitations**

The main limitation identified during this study was regarding recent medication use. Unfortunately, there was no detailed information available in the deferral forms regarding the type, duration and dosage of medication that was taken, thus hindering our ability to further investigate if the medications constituted substantial ground for deferral.

### **Conclusion**

Our study revealed a blood donor deferral rate of 22.8% at CWMH, which is relatively high when

compared to international rates. Low hemoglobin, low blood pressure and menstruation constituted the major reasons for deferral. If international guidelines were considered, potentially up to 33.7% (n=214) of the deferrals during our study period could have donated, which approximates to about an additional 850 donors per year. While having stringent criteria for donor selection in order to keep blood donor and recipient's safety is paramount, having criteria that is supported by evidence is also key in order to prevent unnecessary deferrals, especially as studies have shown a negative implication on donor return post deferrals.

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## Incidence Of *Pseudomonas Aeruginosa* At Labasa Divisional Hospital From January 2019 To December 2023

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### Abstract

*Pseudomonas aeruginosa* is a gram-negative bacterium and is one of the leading causes of healthcare associated infections. This highly resistant bacterium presents a formidable challenge within contemporary medicine. This is a retrospective study to ascertain the incidence of *P. aeruginosa* infections at Labasa Divisional Hospital within a five-year period. Out of 36,233 blood cultures, 6,847 (18.9%) were positive and *Pseudomonas* was responsible for 26 (0.4%). A total of 1,131 indwelling medical devices (IMD) were cultured and 1,024 (90.5%) had a positive result, out of which 205 (20.0%) were *Pseudomonas*.

### Introduction and Literature Review

*Pseudomonas aeruginosa* is a gram-negative, non-spore-forming rod that is capable of inducing a wide spectrum of infections in both immunocompetent and immunocompromised hosts. As an opportunistic pathogen, it is among the most frequent causes of healthcare-associated infections (HAIs), although community-acquired cases also occur (Reynolds & Kollef, 2021). The organism thrives in moist environments and can be found in water, soil, and vegetation. In hospital settings, reservoirs include sinks, taps, bathrooms, and various medical devices such as urinary catheters, endotracheal tubes, central lines, and endoscopes. Its optimal growth temperature is approximately 37°C.

*P. aeruginosa* exhibits a diverse range of virulence factors that promote survival in hostile environments. These include intrinsic resistance mechanisms such as decreased membrane permeability, efflux pumps that expel toxic substances and antibiotics, and the production of  $\beta$ -lactamases and extended-spectrum  $\beta$ -lactamases (ESBLs). Notably, the organism has the ability to rapidly alter its genotype, transitioning from non-mucoid to mucoid forms capable of biofilm production, which provides protection against antimicrobial agents and host defenses (Reynolds & Kollef, 2021). This adaptability facilitates the emergence of new, drug-resistant strains.

Although predominantly responsible for healthcare-associated infections, *P. aeruginosa* can also cause community-acquired infections such as infected puncture wounds, burns, and chronic otitis media. Within healthcare facilities, it is commonly

associated with pneumonia (including ventilator-associated pneumonia), surgical site infections, urinary tract infections, and bacteraemia. Patients at particular risk include those with indwelling devices, those on parenteral nutrition, ventilated patients, and immunocompromised individuals, such as those with diabetes mellitus, malignancies, AIDS, or chronic infections.

Globally, *P. aeruginosa* infections have been a growing concern due to their antimicrobial resistance and persistence. A point-prevalence study conducted at the Colonial War Memorial Hospital (CWMH) in Fiji reported an HAI prevalence of 8.7% over five consecutive days, with *P. aeruginosa* responsible for 3 out of 21 confirmed cases (Loftus et al., 2020). Another study from 2011–2012 investigating nosocomial infections in the adult intensive care unit at CWMH found that 114 out of 663 patients developed HAIs, yielding 437 isolates. Of these, 72 (16.2%) were *Pseudomonas*, primarily associated with surgical site and respiratory infections (Naidu et al., 2014). While this suggests a slight reduction to 14.2% in 2020, the difference is not substantial, indicating ongoing challenges in infection control despite improved hospital infrastructure and protocols.

Internationally, similar patterns have been observed. A national surveillance review of the National Health Service (NHS) acute trusts in England between August 2020 and February 2021 revealed an increase in *P. aeruginosa* incidence from 4.9 to 6.2 per 100,000 bed days, with hospital-acquired cases rising from 34.6% to 49.5%, most commonly manifesting as urinary tract infections (Sloot et al., 2022). Globally, antimicrobial resistance

surveillance through the Antimicrobial Testing Leadership and Surveillance (ATLAS) program from 2017–2019 reported a rising trend in carbapenem resistance, with *P. aeruginosa* showing one of the highest rates among the major bacterial pathogens (Gales et al., 2023).

Collectively, these findings highlight a persistent and possibly increasing prevalence of *P. aeruginosa* infections worldwide. The organism’s adaptive resistance mechanisms and biofilm-forming capabilities underscore the need for continuous surveillance, rigorous infection control measures, and prudent antibiotic stewardship to mitigate its clinical and public health impact.

**Method**

This is a retrospective audit of all *Pseudomonas aeruginosa* positive blood cultures and indwelling medical device cultures at Labasa Divisional Hospital between 1st January 2019 to 31st December 2023. The study also looks at certain patient factors including age and gender. All data was collected from the microbiology laboratory records, infection prevention and control records, ward admissions registers, Patient Information System (PATIS) and admissions records from the records department. Collected data included date and location of sample collection, age of patient, organism isolated and the resistance and sensitivity of the organism. All data was entered manually into and analysed electronically using Microsoft Excel Spreadsheet. The data is represented using graphs and tables.

Inclusion Criteria

1. All positive blood cultures for *Pseudomonas aeruginosa* only
2. All positive indwelling medical device cultures for *Pseudomonas* only
3. Cultures done only in wards

Exclusion Criteria

1. Cultures growing multiple organisms
2. Cultures with *Pseudomonas* and Coagulase Negative Staphylococcus
3. Cultures done in ED
4. Referred cases from peripheries with cultures done outside of Labasa Divisional Hospital

**Results**

Blood culture

During the five-year period from January 2019 to December 2023, a total of **36,233** blood cultures were processed at Labasa Divisional Hospital. Of these, **6,847 (18.9%)** yielded positive results. The highest number of positive blood cultures was recorded in **2023 (1,905; 27.8%)**, showing a steady increase across most years: **2019 (18.0%)**, **2020 (14.4%)**, **2021 (16.2%)**, **2022 (21.8%)**, and **2023 (27.8%)**. (Figure 1)

Table 1. Number of blood cultures done

*Pseudomonas* Positive Blood cultures

Year	Total Cultures	Positive	PAE		CNS	
			M	F		
2019	7527	1356	5	3	2	426
2020	6408	989	5	2	3	365
2021	6305	1108	9	4	5	357
2022	7895	1489	3	2	1	542
2023	8098	1905	4	4	0	667

Table 1 shows the total number of blood cultures done each year and the total for positive cultures and also shows the number of PAE and CNS isolates per year.

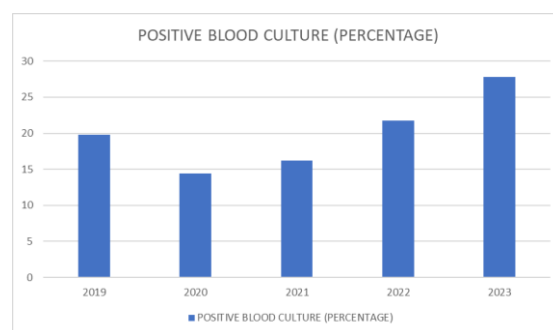


Figure 1: Shows the trend of positive blood cultures in the 5-year period.

*Pseudomonas aeruginosa* accounted for **26 (0.4%)** of all positive blood cultures, with the following yearly distribution: **2019 (0.4%)**, **2020 (0.5%)**, **2021 (0.8%)**, **2022 (0.2%)**, and **2023 (0.2%)**. Of these, **15 (58%)** were males and **11 (42%)** females. The majority of isolates were from patients aged **>55 years (7 cases; 26.9%)**, followed by **35–54 years (6 cases; 23.1%)**, **15–34 years (5 cases; 19.2%)**, **1–14 years (4 cases; 15.4%)**, and **<1 year (3 cases; 11.5%)**. (Figure 3)

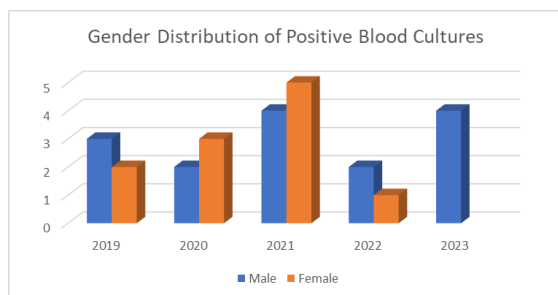


Figure 2: Gender distribution of positive blood cultures

In the five-year period, patients >55 years of age were noted to have the highest number of Pseudomonas blood culture isolates, followed by 35-54 years (6), 15-34 years (5), 1-14 years (4), with the least number of isolates (3) in patients less than 1 year old. (Table 3)

Table 1: Age distribution of positive blood cultures

Age	Year					Grand Total
	2019	2020	2021	2022	2023	
< 1 year	1	1			1	3
1 to 14 years	1	1	1	1		4
15 to 34 years			4	1		5
35 to 54 years	2	1	2	1		6
> 55 years	1	1	2		3	7
Grand Total	5	4	9	3	4	25

Pseudomonas Positive IMD cultures

A total of 1,131 IMD cultures were processed during the same period, with 1,024 (90.5%) yielding positive results. The positivity rate was highest in 2022 (93.7%). P. aeruginosa accounted for 205 (20.0%) of all positive IMD cultures, showing a general upward trend: 2019 (9.3%), 2020 (14.3%), 2021 (24.2%), 2022 (30.6%), and 2023 (22.5%).

Gender distribution was nearly equal, with 105 males (51%) and 100 females (49%). Patients aged >55 years recorded the highest number of Pseudomonas-positive central line and IDC tip cultures (26 and 48 respectively), while those aged 15-34 years had the highest number of positive ETT tip cultures (17). (Table 2)

Table 3. Pseudomonas positive blood cultures

Year	Cultures	Positives	PAE			CNS
			M	F		
2019	214	194	18	11	7	43
2020	269	252	36	24	12	38
2021	234	211	51	22	29	34
2022	240	216	66	34	32	21
2023	174	151	34	14	20	35

Table 2 shows the total number of IMD cultures done per year and the positive results including a breakdown of the positive PAE and CNS cultures.

Pseudomonas aeruginosa accounted for 20% of all positive cultures isolated. Results showed an increasing trend of positive Pseudomonas cultures, starting with 9.3% in 2019, 14.3% in 2020, 24.2% in 2021 to 30.6% in 2022. It dropped to 22.5% in 2023. (Figure 2)

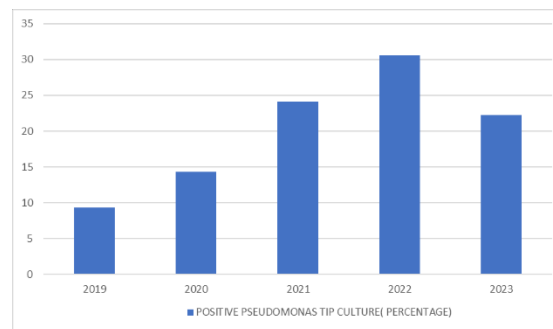


Figure 3: Shows the trend of Pseudomonas isolates in the IMD cultures.

A total of 105 males and 100 females had positive Pseudomonas aeruginosa over the 5-year interval (51% and 49% respectively). (Figure 4)

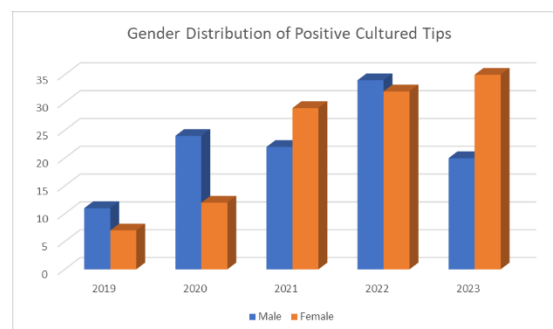


Figure 4: Gender distribution of positive IMDs

Patients more than 55 years of age had the highest number of Pseudomonas isolated in central line tips (26) and IDC tips (48). Ages 15-34 had the highest Pseudomonas positive ETT tip cultures (17). (Table 4)

Table 4. Age distribution of IMDs cultures

Count of Name	Year Cultured	Year					Grand Total
		2019	2020	2021	2022	2023	
<b>Specimen Type</b>	<b>Category</b>						
Central line tip	15 to 34 years	2	1	3	4	3	13
	35 to 54 years		6	2	4	4	16
	> 55 years	2	7	5	8	4	26
<b>Central line tip Total</b>		4	14	10	16	11	55
ETT tip	< 1 year	1	1	3	12	6	23
	1 to 14 years	1	3	1	2	1	8
	15 to 34 years	2	6	4	4	1	17
	35 to 54 years			3	4	4	11
	> 55 years	3	1	2	5	1	12
<b>ETT tip Total</b>		7	11	13	27	13	71
IDC Tip	< 1 year		2				2
	1 to 14 years		1	1	1	3	6
	15 to 34 years	1		4	3	2	10
	35 to 54 years		1	4	3	5	13
	> 55 years	6	14	14	11	3	48
<b>IDC Tip Total</b>		7	18	23	18	13	79
Trachea tube	> 55 years				2		2
Trachea tube					2		2
<b>Total</b>							
Vascath Line	15 to 34 years					1	1
Vascath Line						1	1
<b>Grand Total</b>		18	43	46	63	38	208

**Sensitivity Pattern**

Antimicrobial susceptibility testing for *Pseudomonas aeruginosa* isolates obtained from both blood and indwelling medical device (IMD) cultures was performed using the Kirby–Bauer disk diffusion method, in accordance with Clinical and Laboratory Standards Institute (CLSI, 2023) guidelines. The results demonstrated variable sensitivity and resistance profiles across different antibiotic classes.

**Blood Culture Isolates:**

Analysis of *Pseudomonas aeruginosa* from blood cultures revealed that **Ceftazidime, Amikacin, Chloramphenicol, Co-trimoxazole, and Piperacillin–Tazobactam** maintained 100% susceptibility in the tested isolates. **Gentamicin (75%), Piperacillin–Tazobactam (71.4%), and Ciprofloxacin (60%)** showed moderate sensitivity, while **Meropenem** exhibited markedly reduced efficacy, with **only 16.7% sensitivity and 83.3% resistance**. **Cephalexin** and **Tobramycin** were completely resistant (100%). (Table 5)

Table 5: Antibiotic Sensitivity Pattern of *Pseudomonas aeruginosa* — Blood Culture Isolates (2019–2023)

Antibiotic	Sensitive (%)	Resistant (%)
Ceftazidime (CAZ)	100.0	0.0
Amikacin (AM)	100.0	0.0
Chloramphenicol (C)	100.0	0.0
Co-trimoxazole (SXT)	100.0	0.0
Piperacillin–Tazobactam (PIPTA)	100.0	0.0
Gentamicin (G)	75.0	25.0
Piperacillin–Tazobactam (PIPTAZ)	71.4	28.6
Ciprofloxacin (CIP)	60.0	40.0
Meropenem (MEM)	16.7	83.3
Cephalexin (CF)	0.0	100.0
Tobramycin (AN)	0.0	100.0

**Indwelling Medical Device (IMD) Isolates:**

In contrast, *Pseudomonas aeruginosa* isolates from IMD cultures demonstrated higher overall resistance levels. **Ceftazidime (83.4%), Piperacillin–Tazobactam (82.3%), and Ciprofloxacin (71.6%)** retained relatively good activity, whereas **Gentamicin (65.5%)** and **Piperacillin (75%)** displayed moderate sensitivity. **Meropenem** showed a significantly reduced sensitivity rate (**28.3%**) with **71.7% resistance**, and **Amikacin** was resistant in **83.7%** of isolates. **Cefotaxime, Ceftriaxone, and Meropenem (reported as “Meropenum”)** demonstrated 100% sensitivity in a few isolates, possibly reflecting selective use or smaller sample numbers. (Table 6)

Table 6: Antibiotic Sensitivity Pattern of *Pseudomonas aeruginosa* — Indwelling Medical Device (IMD) Isolates (2019–2023)

Antibiotic	Sensitive (%)	Resistant (%)
Ceftazidime (CAZ)	<b>83.4</b>	16.6
Piperacillin–Tazobactam (PIPTAZ)	<b>82.3</b>	17.7
Ciprofloxacin (CIP)	71.6	28.4
Piperacillin (PIP)	75.0	25.0
Gentamicin (GM)	65.5	34.5
Co-trimoxazole (SXT)	50.0	50.0
Meropenem (MEM)	28.3	71.7
Amikacin (AN)	16.3	<b>83.7</b>
Cefotaxime / Ceftriaxone (CF / CRO)	<b>100.0</b>	0.0
Meropenem (“Meropenum”)	<b>100.0</b>	0.0

**Discussion**

Pseudomonas Positive Blood Cultures

Based on data from 2019-2023, we found that on average there were 5 *Pseudomonas* positive blood cultures per year. *Pseudomonas* on average was responsible for **0.4%** of positive blood cultures over the five-year period. Results showed an increasing trend from 2019 to 2021 (0.4%, 0.5% and 0.8% respectively) but then decreased to 0.2% and 2022 and 2023.

There was no significant difference between gender distribution (58% males and 42% females).

There was no significant difference in the age distribution either. The highest was in the >55 year age group (7) and lowest in <1 year age group (3).

Pseudomonas Positive IMD Cultures

It was worth noting that 90.5% of all cultures done had positive results. *Pseudomonas* alone was responsible for 20.0% of all positive cultures.

ICU had the highest *Pseudomonas* positive IMD cultures at 111 cases (54.2%)

There was no significant difference in the gender distribution (51% males and 49% females). However, there was an interesting pattern noted in the age distribution. The >55 year age group had the highest *Pseudomonas* isolated in the central line and IDC tip cultures. The highest positive ETT tip cultures were in the 15-34 year age group.

There was vast difference noted between *Pseudomonas* positive blood cultures (0.4%) and IMD cultures (20.0%). This result further solidifies the fact that patients with indwelling medical devices are more at risk of *Pseudomonas* infections. Other factors that contribute to the positive results include breach of sterility during insertion or removal of IMDs.

According to the Centre for Disease Control (CDC), the overall incidence of *P. aeruginosa* infections in the US hospitals averages about 0.4% (4 per 1,000 admissions),

According to the data in this research, the incidence of *P. aeruginosa* at Labasa Divisional Hospital averages about 0.7% (7 per 1,000 admissions).

Sensitivity Pattern

Overall, the findings indicate that *Pseudomonas aeruginosa* exhibits **high resistance to carbapenems and aminoglycosides**, while maintaining moderate sensitivity to **Ceftazidime and Piperacillin–Tazobactam**. The higher resistance rates observed in IMD isolates likely reflect increased antibiotic exposure, biofilm formation, and the frequent use of invasive devices in critically ill patients.

The data highlight the organism’s remarkable **adaptive resistance mechanisms**, including efflux pumps, β-lactamase production, and biofilm-associated tolerance. These findings align with global data from the ATLAS surveillance program (Gales et al., 2023), which reported rising carbapenem resistance among *Pseudomonas* isolates.

The results also mirror the experience in other Pacific Island hospitals, where the heavy use of broad-spectrum antibiotics during the COVID-19

pandemic may have accelerated resistance trends. Despite infection control protocols, persistent *Pseudomonas* isolation from device-related cultures suggests the need to **strengthen aseptic insertion and maintenance practices and review disinfection processes** at Labasa Divisional Hospital.

From a clinical standpoint, **Ceftazidime** and **Piperacillin–Tazobactam** remain appropriate first-line options for empirical treatment, while **Amikacin** or **Colistin** should be reserved for multidrug-resistant (MDR) cases. Regular antimicrobial audits and a structured **Antimicrobial Stewardship Program (ASP)** are essential to preserve the efficacy of currently available agents and mitigate further resistance development.

During data collection, it was surprising to see a lot of CNS positive blood and IMD cultures. Total positive CNS positive blood cultures were as follows: 31.2% in 2019; 36.9% 2020; 32.2% in 2021; 36.4% in 2022 and 35% in 2023. CNS was one of the most common blood culture isolate.

The total CNS positive IMD cultures were as follows: 22.2% in 2019; 15.1% in 2020; 16.1% in 2021; 9.7% in 2022 and 23.2% in 2023. Here too CNS was one of the most commonly isolated organism. CNS accounted for 32% of all positive blood cultures and 20.0% of all IMD cultures. CNS predominately being a contaminate had the highest isolate. This raises a question on the sample collection technique. Further studies can be done to review the factors contributing to this outcome including a review of the sample collection technique.

In conclusion, there was a significant difference noted between the culture results of IMD (20.0%) and blood cultures (0.4%). Infection rates of *Pseudomonas* in blood cultures were similar to that of other developed countries. Moreover, looking at the five-year trend, *Pseudomonas* blood cultures isolate was highest in 2021 which was during COVID-19 and *Pseudomonas* isolate in IMDs was highest in 2022 which was just after COVID-19. This raises a question of the effectiveness of the infection control measures implemented at the hospital during COVID-19, considering that infection control was paramount during that period.

Furthermore, studies are needed to determine the effectiveness of the current infection control measures, this can include a review of the disinfecting process and the disinfectants being used. Subsequently, the insertion and removal technique of IMDs should be reviewed to prevent bacterial introduction into host during insertion and sample contamination during removal. Blood culture collection technique should also be reviewed to prevent contamination.

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## Patterns Of Electroencephalogram Abnormalities At A Tertiary Care Center Of Fiji – A Retrospective Study

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### Abstract

#### Background:

Electroencephalography (EEG) is essential for diagnosing and monitoring neurological disorders, detecting abnormalities, assessing cognitive function, and guiding treatment in epilepsy. EEG use in Fiji is relatively recent, having been available for only the past decade. This study aimed to analyze all EEGs performed from April 2013 to December 2022 to identify the most common abnormalities in the Fijian population.

#### Objectives:

The primary objective was to determine the proportion of normal versus abnormal EEGs and identify the most common abnormality. Secondary objectives included analyzing patient demographics, referral sources, indications for EEG, known versus new epileptic cases, and patterns of abnormalities across different age groups.

#### Methods:

A retrospective review of all EEG reports conducted at Colonial War Memorial Hospital (CWMH), Suva, Fiji, between April 2013 and December 2022 was performed. Demographic and clinical data were extracted from EEG requisition forms and reports. Duplicate entries were excluded. Variables included patient age, gender, referral source, indications, waiting time, comorbidities, anti-epileptic drug use, and EEG findings (background activity, symmetry, reactivity, and abnormal patterns—epileptiform or non-epileptiform, focal or generalized).

#### Results:

A total of 1,960 EEG reports were analyzed; 52% were male. Most referrals originated from public hospitals (87%), primarily from CWMH (80.24%). Two-thirds (67%) of EEGs were performed within two weeks of referral, mostly on an outpatient basis. Seizure was the most common indication (59%), with 34.7% showing abnormalities. Among all EEGs, 28% were abnormal, with epileptiform discharges being the most frequent (73%). Generalized epileptiform activity accounted for 56% (including 9% absence seizures), while 30% were focal. Abnormal EEGs were more common in adults (57%), though epileptiform discharges occurred equally in adults and children (36.75%). Non-epileptiform abnormalities were more frequent in patients over 14 years.

#### Conclusion:

The study found that 28% of all the EEGs done were abnormal, with epileptiform discharges being the most common outcome (73%). The predominant epileptiform activity seen in our study was generalized waveforms (56%), followed by focal waveforms (30%). These results highlight the diagnostic value of EEG in epilepsy evaluation and underscore the need for expanded EEG services in Fiji.

#### Keywords

Electroencephalogram, Epilepsy, Fiji, EEG abnormalities, Neurology, Retrospective study

#### Introduction

Electroencephalography (EEG) measures brain's electric fields non-invasively using scalp electrodes to record postsynaptic potentials from neurons (Biasiucci et al., 2019). Its use has evolved from primarily psychiatric disorders to a gold standard for electrophysiological testing and brain analysis (Jadah, 2020).

However, EEGs are often inappropriately ordered to exclude epilepsy and brain disorders, especially for patients with suspected syncope or "funny turns," often by junior staff (Ai Ogbebor, 2017). Adhering to NICE and SIGN guidelines could prevent unnecessary tests, improve outpatient wait times, and ensure appropriate use.

In Fiji, epilepsy caused 0.24% of total deaths in 2020, with an age-adjusted death rate of 1.89 per 100,000. Over 85% of people with epilepsy live in low- and middle-income countries, with a treatment gap exceeding 80%. As Fiji is classified as an upper middle-income country (World Bank), reducing this gap is crucial (Cicccone et al., 2018)

**Methodology**

**Study Design and Setting**

This retrospective, descriptive study reviewed all electroencephalogram (EEG) cases conducted at the Colonial War Memorial Hospital (CWMH) between April 2013 and December 2022.

**Study Population**

The study included all patients who underwent EEG during the study period. Data were obtained from official EEG reports and requisition forms, without patient interaction. A total of 1,960 EEG reports were analyzed; therefore, no sampling or recruitment was required, and power analysis was not applicable.

**Data Collection**

Data were extracted from EEG reports and requisition forms, tabulated, and analyzed using Microsoft Excel. Six investigators worked in pairs to ensure accuracy. Results were summarized using percentages and displayed in tables, bar graphs, and pie charts. A pilot test involving 10 reports was conducted to validate the data collection tool.

**Data Management and Confidentiality**

Hard copies of collected data were securely stored under lock and key, while electronic files were password-protected and accessible only to the principal investigator. All personal identifiers were removed and replaced with coded entries (e.g., A0001, P0001) to maintain confidentiality.

**Ethical and Cultural Considerations**

As a retrospective record review with no direct participant involvement or associated risks, informed consent and cultural measures were not required. Ethical approval was obtained from the Hospital Research and Ethics Committee and the Ministry of Health Research Committee before data collection began.

**Results**

*Table 1. Diagnosis on EEG*

Diagnosis on EEG	
Normal	69%(n=1351)
Abnormal	28.32%(n=555)
Intermediate	2.50%(n=49)
Unknown	0.26%(n=5)
<b>Total</b>	<b>100%(n=1960)</b>

*Table 2. Abnormal results on EEG*

Abnormal Results On EEG	
Epileptiform	73.5%(n=408)
Focal (Non Epileptiform)	16.7%(n=93)
Generalized (Non-Epileptiform)	5.76%(n=32)
Encephalopathy	2%(n=12)
Unknown	1.8%(n=10)
<b>Grand Total</b>	<b>100%(n=555)</b>

*Table 3. Types of Epileptiform discharges*

Types of Epileptiform Discharges	
Generalized	56.12%(n=229)
Focal	30%(n=122)
Focal to Bilateral	5.6%(n=23)
Multifocal	4.41%(n=18)
Generalized, Multifocal	2.45%(n=10)
Unknown	1.47%(n=6)
<b>Grand Total</b>	<b>100%(n=408)</b>

*Table 4. Type of Generalized Epileptiform*

Type of Generalized Epileptiform	
Unknown	47.28%(n=113)
Non Absence	44%(n=106)
Absence	9%(n=20)
<b>Grand Total</b>	<b>100%(n=239)</b>

Table 5. Age and Type of Epileptiform Abnormality

		Multifocal	0.25%(n=1)
		<b>25 years to &lt;35 years</b>	<b>10.05%(n=41)</b>
		Focal	2.94%(n=12)
		Generalized	6.62%(n=27)
		Generalized, Multifocal	0.25%(n=1)
		Multifocal	0.25%(n=1)
		<b>35 years to &lt;45 years</b>	<b>9.56%(n=39)</b>
		Focal	3.19%(n=13)
		Focal to Bilateral	0.74%(n=3)
		Generalized	5.64%(n=23)
		<b>45 years to &lt;55 years</b>	<b>2.45%(n=10)</b>
		Focal	1.47%(n=6)
		Focal to Bilateral	0.25%(n=1)
		Generalized	0.74%(n=3)
		<b>55 years to &lt;65 years</b>	<b>2.45%(n=10)</b>
		Focal	1.47%(n=6)
		Generalized	0.74%(n=3)
		Generalized, Multifocal	0.25%(n=1)
		<b>65 years to &lt;75 years</b>	<b>1.72%(n=7)</b>
		Focal	1.47%(n=6)
		Generalized	0.25%(n=1)
		<b>75 years to &lt;85 years</b>	<b>0.25%(n=1)</b>
		Focal	0.25%(n=1)
		<b>&gt;85 years</b>	<b>0.25%(n=1)</b>
		Focal	0.25%(n=1)
		<b>Grand Total</b>	<b>100.00%(n=408)</b>
<b>&lt; 1 month</b>	<b>0.98%(n=4)</b>		
Focal to Bilateral	0.25%(n=1)		
Generalized	0.49%(n=2)		
Multifocal	0.25%(n=1)		
<b>1 month to &lt;1 year</b>	<b>4.41%(n=18)</b>		
Focal	1.72%(n=7)		
Focal to Bilateral	0.25%(n=1)		
Generalized	1.72%(n=7)		
Multifocal	0.49%(n=2)		
Unknown	0.25%(n=1)		
<b>1 year to &lt;3 years</b>	<b>6.37%(n=26)</b>		
Focal	2.70%(n=11)		
Focal to Bilateral	0.25%(n=1)		
Generalized	2.21%(n=9)		
Multifocal	0.98%(n=4)		
Unknown	0.25%(n=1)		
<b>3 years to &lt;10 years</b>	<b>22.06%(n=90)</b>		
Focal	7.84%(n=32)		
Focal to Bilateral	1.96%(n=8)		
Generalized	10.05%(n=41)		
Generalized, Multifocal	0.49%(n=2)		
Multifocal	0.98%(n=4)		
Unknown	0.74%(n=3)		
<b>10 years to &lt;14 years</b>	<b>16.18%(n=66)</b>		
Focal	3.68%(n=15)		
Focal to Bilateral	0.74%(n=3)		
Generalized	9.80%(n=40)		
Generalized, Multifocal	0.98%(n=4)		
Multifocal	0.74%(n=3)		
Unknown	0.25%(n=1)		
<b>14 years to &lt;18 years</b>	<b>11.76%(n=48)</b>		
Focal	2.21%(n=9)		
Focal to Bilateral	0.98%(n=4)		
Generalized	7.60%(n=31)		
Generalized, Multifocal	0.49%(n=2)		
Multifocal	0.49%(n=2)		
<b>18 years to &lt;25 years</b>	<b>11.52%(n=47)</b>		
Focal	0.74%(n=3)		
Focal to Bilateral	0.25%(n=1)		
Generalized	10.29%(n=42)		

Table 6. Age and Type of Generalized Epileptiform Abnormality

Generalized Epileptiform				
	Absence	Others	Unknown	Grand Total
< 1month	0.42%(n=1)		0.42%(n=1)	0.84%(n=2)
1 month to <1 year	0.42%(n=1)		2.51%(n=6)	2.93%(n=7)
1 year to <3 years		4.18%(n=4)	2.09%(n=5)	3.77%(n=9)
3 years to <10 years	1.67%(n=4)	4.18%(n=10)	12.13%(n=29)	17.99%(n=43)
10 years to <14 years	3.35%(n=8)	7.11%(n=17)	7.95%(n=19)	18.41%(n=44)
14 years to <18 years	0.84%(n=2)	6.69%(n=16)	6.28%(n=15)	13.81%(n=33)
18 years to <25 years	0.84%(n=2)	10.88%(n=26)	5.86%(n=14)	17.57%(n=42)
25 years to <35 years		6.69%(n=16)	5.02%(n=12)	11.72%(n=28)
35 years to <45 years	0.42%(n=1)	5.02%(n=12)	4.18%(n=10)	9.62%(n=23)
45 years to <55 years		0.84%(n=2)	0.42%(n=1)	1.26%(n=3)
55 years to <65 years	0.42%(n=1)	0.84%(n=2)	0.42%(n=1)	1.67%(n=4)
65 years to <75 years		0.42%(n=1)		0.42%(n=1)
<b>Grand Total</b>	<b>8.37%(n=20)</b>	<b>44.35%(n=106)</b>	<b>47.28%(n=113)</b>	<b>100%(n=239)</b>

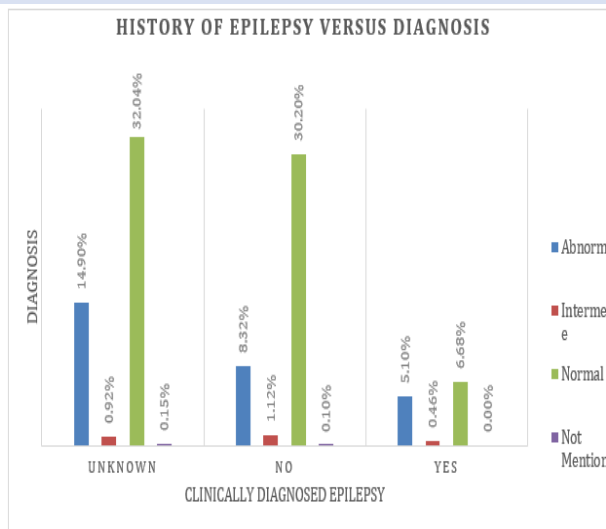


Figure 1. History of epilepsy vs diagnosis

For patients who had a history of epilepsy and had an abnormal EEG, 76% of the abnormalities were epileptiform in nature. For patients who did not have a history of epilepsy, 20.92% had an abnormal EEG,

with epileptiform discharges accounting for 63.8% of these abnormalities.

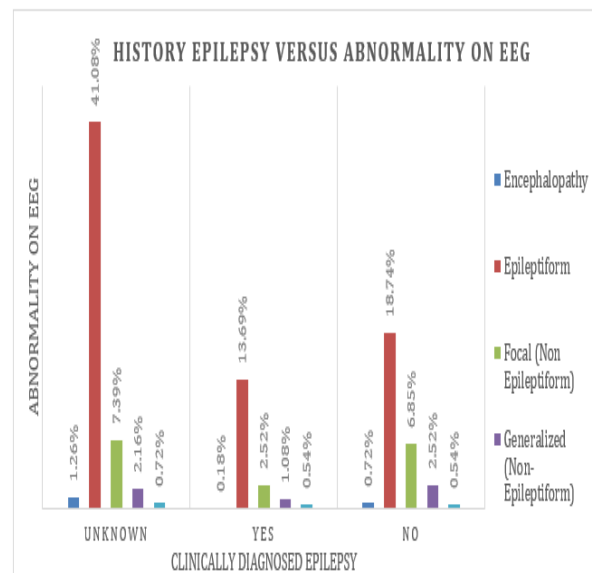


Figure 2. History of epilepsy vs abnormality on EEG

Table 7. Indications for referral and EEG findings

	Abnormal	Intermediate	Normal	Unknown	Grand Total
Seizure	393	46	723	3	1165
Not Mentioned	83	1	280	1	365
Syncope	9	2	119		130
Abnormal/ Jerky Movement	4		38		42
Motor or Sensory Impairment	2	3	24		29
Suspected Seizure	7	1	17		25
Behavioral Anomalies	2		22		24
Altered Level of Consciousness	5	1	13		19
Staring Episodes	4		12		16
Altered Mental State	5	3	8		16
Amnesia	1	1	12		14
Dizziness			14		14
Headache/ Migraine		1	13		14
Psychosis	1	1	11	1	14
Tumor	6	1	4		11
Stroke	3	1	5		9
Trauma/ Head Injury		1	7		8
History of Falls	1		7		8
Sleep Anomalies	1		5		6
Meningitis/ Encephalitis	2	1	1		4
Mood/ Panic/ Personality Disorder			4		4
Aura			4		4
Facial Twitching	2		2		4
Dementia			3		3
Hypoxic Brain Injury	3				3
Developmental Delay	1		1		2
Birth Asphyxia			2		2
Cyanosis	1		1		2
Apnea			2		2
Unspecified Chronic Illness	1				1
<b>Grand Total</b>	<b>537</b>	<b>64</b>	<b>1354</b>	<b>5</b>	<b>1960</b>

Table 8. Abnormal Diagnosis in Pediatric Age Group

	Encephalopathy	Epileptiform	Focal (Non Epileptiform)	Generalized (Non-Epileptiform)	Unknown	Grand Total
< 1month	0.00%	1.66%(n=4)	0.00%	0.41%(n=1)	0.00%	2.07%(n=5)
1 month to						
<1 year	0.00%	7.47%(n=18)	1.24%(n=3)	0.83%(n=2)	0.41%(n=1)	9.96%(n=24)
1 year to						
<3 years	1.24%(n=3)	10.79%(n=26)	1.24%(n=3)	0.41%(n=1)	0.00%	13.69%(n=33)
3 years to						
<10 years	0.00%	37.34%(n=90)	4.15%(n=10)	2.07%(n=5)	0.83%(n=2)	44.40%(n=107)
10 years to						
<14 years	0.41%(n=1)	27.39%(n=66)	1.66%(n=4)	0.41%(n=1)	0.00%	29.88%(n=72)
<b>Grand Total</b>	<b>1.66%(n=4)</b>	<b>84.65%(n=204)</b>	<b>8.30%(n=20)</b>	<b>4.15%(n=10)</b>	<b>1.24%(n=3)</b>	<b>100.00%(241)</b>

Table 9. Abnormal diagnosis in adult age group.

	Encephalopathy	Epileptiform	Focal (Non Epileptiform)	Generalized (Non-Epileptiform)	Unknown	Grand Total
14 years to <18 years	0.00%	15.29%(n=48)	2.55%(n=8)	1.27%(n=4)	0.96%(n=3)	20.06%(n=63)
18 years to <25 years	0.00%	14.97%(n=47)	2.87%(n=9)	0.32%(n=1)	0.32%(n=1)	18.47%(n=58)
25 years to <35 years	0.64%(n=2)	13.06%(n=41)	6.69%(n=21)	2.23%(n=7)	0.64%(n=2)	23.25%(n=73)
35 years to <45 years	0.32%(n=1)	12.42%(n=39)	2.87%(n=9)	0.64%(n=2)	0.00%	16.24%(n=51)
45 years to <55 years	0.32%(n=1)	3.18%(n=10)	1.27%(n=4)	0.64%(n=2)	0.00%	5.41%(n=17)
55 years to <65 years	0.64%(n=2)	3.18%(n=10)	3.82%(n=12)	1.27%(n=4)	0.00%	8.92%(n=28)
65 years to <75 years	0.32%(n=1)	2.23%(n=7)	2.55%(n=8)	0.64%(n=2)	0.32%(n=1)	6.05%(n=19)
75 years to <85 years	0.32%(n=1)	0.32%(n=1)	0.64%(n=2)	0.00%	0.00%	1.27%(n=4)
>/85 years	0.00%	0.32%(n=1)	0.00%	0.00%	0.00%	0.32%(n=1)
<b>Grand Total</b>	<b>2.55%(n=8)</b>	<b>64.97%(n=204)</b>	<b>23.25%(n=73)</b>	<b>7.01%(n=22)</b>	<b>2.23%(n=7)</b>	<b>100.00%(n=314)</b>

Most EEGs were performed in children aged 3–10 years and adults aged 25–35 years, followed by those 18–25 years. Slightly more EEGs were conducted in males (52%) than females (48%).

The majority of EEGs (67%) were conducted within two weeks of request. Delays were likely due to staff shortages, equipment issues, incomplete referrals, patient accessibility, and COVID-19 closures.

Most of the patients (72.06%) were done for outpatients with 27.94% were done on inpatients. This also reflected with 95% of referrals from public sector when compared to 5% from private sector.

Data on admission status and referral source was only available for a small subset of patients.

Of all the EEGs requested, Physicians accounted for a majority of the requests (47.45%), followed by Paediatricians at 30.47%, and Psychiatrists at 7.86%.

14% of the patients were asleep when the EEG was being recorded. Majority of these cases were paediatric cases. The most common sedative agent used was Chloral hydrate (61.83% and it was effective in 95% patients. Of the 262 patients, 91.2% (n=239) were paediatric patients and 8.7% (n=23) were adult patients.

Table 10. Type of sedation used.

	Type of Sedation:
Chloral Hydrate	162
Chloral Hydrate, Midazolam	4
Chloral Hydrate, Midazolam, Ketamine	4
Diazepam	3
Ketamine	5
Midazolam	10
Midazolam, Ketamine	3
Unknown	71
<b>Grand Total</b>	<b>262</b>

## Discussion

The 28% abnormal EEG rate aligns with regional studies but is slightly lower than international figures. Tayeb et al. (2015–2018, Jeddah) reported 42.4% abnormal EEGs, with 14.6% showing definite epileptiform discharges.

The high prevalence of epileptiform discharges (73%) in this study supports EEG’s diagnostic value in epilepsy, consistent with NICE and SIGN guidelines. In contrast, Tayeb et al. found only 14.6% epileptiform activity, likely due to differences in sample size, demographics, and comorbidities. Most EEGs were conducted for patients aged 3–10 and 25–35 years; 52% were male and 48% female, similar to findings by Stone & Moran (2003).

The predominance of generalized epileptiform activity matches global pediatric trends. A high number of syncope referrals reflects inappropriate EEG use, as noted by Pearce & Cock (2006). Studies show EEG is not useful for syncope: Dantas et al. (2012) found 89.5% normal EEGs in 1,003 syncope cases, and Ateş & Can (2020) reported 77% normal results. Misdiagnosis can lead to unnecessary treatment, stigma, and lifestyle restrictions.

Most EEGs were outpatient with short waiting times (67% within 2 weeks), though earlier EEGs increase yield. Pohlmann-Eden et al. found EEGs within 24–48 hours of a first seizure show abnormalities in 70% of cases, dropping with delay. Llauro et al. (2019) also showed best detection within 16–20 hours post-seizure. Factors extending wait times include staff shortages, equipment issues, and COVID-19 closures.

Provoking maneuvers were used in 94% of EEGs, increasing diagnostic yield—especially for absence seizures (Rozenblat et al., 2020). Both photic stimulation and hyperventilation were used in 78.6% of cases.

Epileptiform abnormalities were equally common in adults and children (36.75%), while non-epileptiform changes were higher in adults (19.81%) than children (6.48%). Owolabi et al. found 52.5% abnormal EEGs among Saudi pediatric epilepsy patients, mostly generalized (81.9%).

Normal EEG background during wakefulness typically shows a symmetrical, posteriorly dominant alpha rhythm (Britton et al., NLM).

A notable number of abnormal EEGs in patients without diagnosed epilepsy highlights EEG’s value in detecting undiagnosed seizure disorders, but clinical correlation remains essential. The study

underscores the need for wider EEG access, more trained staff, and better referral practices.

### Recommendations

According to the WHO, 0.4%–1% of the population is estimated to have epilepsy. However, this study shows that only 0.24% of Fiji's population has undergone EEG testing in the past 13 years, indicating significant under-utilization. To improve access and diagnostic coverage, the following recommendations are proposed:

1. Expand EEG services: Establish additional EEG units in major divisional hospitals such as Labasa and Lautoka (Aspen) to increase accessibility. Currently, CWM Hospital is the only facility offering EEGs.
2. Increase trained staff: Train more nurses to perform EEGs to meet population needs and reduce cancellations due to staff shortages.
3. Develop local reporting expertise: Train more clinicians, including those in Paediatrics, to interpret EEGs using digital platforms (e.g., DICOM). At present, only one local specialist handles reporting, with occasional support from international experts.
4. Raise clinical awareness: Educate healthcare personnel on the importance of EEG as a diagnostic tool, proper completion of request forms, and appropriate referral indications to enhance data quality and usage.
5. Evaluate outcomes: Conduct follow-up studies to assess the effectiveness of these measures compared to current results.

### Conclusion

This descriptive study emphasizes the vital role of EEG in evaluating seizure disorders, especially after a first convulsive episode. Over a 10-year period (2013–2022), 1,960 EEGs were performed, with 28% showing abnormalities. Among these, 73% displayed epileptiform discharges—the most common finding—highlighting EEG's importance in diagnosing epilepsy and guiding treatment.

The high rate of abnormalities underscores EEG's value in distinguishing epileptic from non-epileptic events and indicates that many patients assessed likely have underlying seizure disorders, reinforcing the need for timely intervention.

These results have implications for healthcare planning and resource distribution. Since epilepsy often affects socioeconomically disadvantaged groups and remains stigmatized, expanding EEG access and improving physician awareness are critical for better diagnosis and management.

The study also provides feedback to referring clinicians on EEG's diagnostic utility and serves as a quality assessment for the CWMH EEG unit by comparing outcomes with international standards. Disseminating these findings through conferences and local journals can promote discussion and drive improvements in EEG utilization and epilepsy care nationwide.

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