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A multidisciplinary journal for publication of medical and biomedical research findings on issues pertinent to improving family health and related issues of public health

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INFORMATION

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A QUESTIONNAIRE-BASED STUDY TO ASSESS HEALTH CARE PROVIDERS' KNOWLEDGE, ATTITUDES, AND PRACTICES REGARDING ORAL HEALTH AND ORAL CARE FOR HOSPITALIZED PATIENTS AT ST GILES PSYCHIATRIC HOSPITAL IN FIJI

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ABSTRACT:

A mental disorder is a pattern of behavior or thought that causes severe suffering or impairs one's ability to function. Due to their inability to lead a regular life, mentally challenged people have been found to have poor oral health. The aim of this study was to assess health care providers' knowledge, attitudes, and practices regarding oral health care of hospitalized patients at St Giles Psychiatric Hospital in Fiji. A cross-sectional survey design was employed in which 29 health care providers completed a questionnaire that collected socio-demographic information, knowledge, attitude and practices regarding oral health maintenance and care of psychiatric patients. Results revealed that all participants (100%), had knowledge on oral health and oral hygiene practices. However, only 9 nurses (50%) and 5 ward orderlies (63%) reported practicing oral hygiene for in – patients. In fact, 5 (17%) respondents did not view oral hygiene as an important aspect in their patients' health. All participants (100%) reported unavailability of oral hygiene aids and absence of frequent dental visits, as a key barrier in the oral health care of patients. The results emphasize on the need for a formal training program for health care providers, and clear policies and guidelines about oral health care of hospitalized patients must be instituted.

Keywords: Fiji, Oral Health, Psychiatric Patients, Knowledge, Attitude, Practice.

INTRODUCTION:

Fiji is a South Pacific island nation made up of 332 islands, one-third of which is inhabited. It is located halfway between Vanuatu and the Kingdom of Tonga [1]. It had an estimated population of 884887 in 2017, an increase of 47616 from 2007 [2]. Fiji is a developing country with a developing health-care system [1], and its citizens, similar to other developing nations, suffer from a high rate of oral diseases [3]. There is no epidemiological data on the national prevalence or burden of mental disorders disease in Fiji [4]. However, a report highlighted that, underdeveloped or developing countries account for three-quarters of the worldwide burden of mental disease [5]. Thus, it could be assumed that Fiji has a high burden of mental disorders.

Studies have shown that inpatient psychiatric patients have high prevalence of poor oral hygiene, caries incidence and periodontal disease [6-8]. According to the American Psychiatric Association (APA) [9],

"A mental disorder is a syndrome characterized by clinically significant disturbance in an individual's cognition, emotion regulation, or behavior that reflects a dysfunction in the psychological, biological, or developmental processes underlying mental functioning. Mental disorders are usually associated with significant distress or disability in social, occupational, or other important activities".

In general, patients admitted in hospitals where oral health care practices are inadequate, show increased risk of developing oral pathologies [10]. Patients with psychiatric disorders who are admitted to psychiatric hospitals are also entitled to the same dental care needs as other patients [11]. This is because oral health care is a critical component of medical care for hospitalized patients [12]. Thus, necessitating the need for healthcare staff involved in delivering bedside care, to be made aware and educated in dental health measures, so as to prevent deterioration of oral and general health in admitted patients [11, 13].

In Fiji, St. Giles Psychiatric Hospital, the country's only psychiatric hospital, remains the focal point for mental health services [1]. It was built in 1884 as a single ward, to care for expatriates with mental disorders, and was known as "lunatic asylum" [14]. In 1935, the name was changed to St Giles Mental Asylum [14]. Currently, the institution comprises of a 136-bed inpatient facility, outpatient department, psychosocial rehabilitative, and community psychiatric services [15]. In 2010, 460 people were hospitalized as in - patients, with 249 being men and 211 being females [16]. Schizophrenia was found to be the most common mental disorder, accounting for 50.7% of admissions. Mood disorder was found to be the second most common mental disorder, accounting for 38% of admissions, while personality disorder and other conditions accounted for 2% and 9.3% of admissions, respectively [16]. Lastly, the average length of stay in St. Giles Psychiatric Hospital was 110

days, while the bed occupancy rate of psychiatric beds was 108.25 out of the 136 beds [16].

To the best of the authors' knowledge, there are no reported studies in the literature concerning mental health workers' knowledge, attitudes and practices regarding oral health and oral care for hospitalized patients in Fiji. In addition, oral health is neglected in contrast to overall health in the country [17]. A simple assessment of knowledge, attitudes and practices, may be the first step in identifying the areas of weakness. Therefore, the aim of this study was to assess health care providers' knowledge, attitudes, and practices regarding oral health and oral care of hospitalized patients at St Giles Psychiatric Hospital in Fiji.

METHODOLOGY:

Setting and Sample

The present study utilized a cross – sectional survey design in which the participants were the health care providers at St. Giles Psychiatric Hospital. Eligibility criteria included: nurses, student nurses, doctor on duty, dentist, and ward orderlies. According to data from 2013 [4], the institution has 5 physicians, 31 nurses, and 48 ward orderlies. Furthermore, approximately 15 student nurses were also rostered in the hospital, as part of their education and training program. Thus, of the potential 89 participants, 29 chose to take part in this survey, giving a response rate of 33%. A total of 11 (38%) participants were males and 18 (62%) were females. The health care providers in the study sample included: 18 (62%) nurses, 8 (28%) ward orderlies, 3 (10%) doctors. Ethnic distribution of healthcare providers encompassed, 22 (76%) *i– taukei*, and 7 (24%) Fijians of Indian descent. In terms of education, 26 (90%) of the respondents had tertiary level qualification, while 3 (10%) respondents had only achieved secondary level education.

Study Method

A self-designed pretested questionnaire was used to conduct this study. The questionnaire items were presented in English, and were reviewed by 2 consultants: one from dentistry and one from public health. The aim of the review was to ensure clarity and face validity of the questionnaire content. The questionnaire was divided into three sections. The first section was designed to collect sociodemographic data. The second section assessed the knowledge of the health care providers regarding oral health maintenance of hospitalized patients. Finally, the third section assessed their attitudes and practice toward the oral health care of psychiatric patients at the hospital. A copy of the questionnaire is presented in appendix 1.

Data Collection and Analysis

After obtaining ethics approval, the questionnaire was distributed to the healthcare providers at St Giles Psychiatric Hospital. A

brief explanation was presented on the cover page of the questionnaire mentioning the purpose of the study, confidentiality of information, anonymity, and the voluntary nature of participation. Once all data was collected it was entered and analyzed in Microsoft Excel and Epi Info Software.

Ethics Approval

This study was conducted in full accordance with the World Medical Association Declaration of Helsinki [18]. This study was conducted between May 2015 and July 2015. The study was approved by the Ministry of Health and Medical Services, School of Dentistry and Oral Health, Fiji National University, and St. Giles Psychiatric Hospital. Written informed consent was obtained from the study participants.

RESULTS AND DISCUSSION:

This study looked at the knowledge, attitudes, and practice of 29 health care providers at St Giles Psychiatric Hospital in Fiji, regarding oral health and oral care for hospitalized patients.

The results of the study showed that all participants (100%) knew that consumption of sugar in the presence of bacteria, and not having good oral hygiene leads to dental caries. In addition, all participants (100%) knew about fluoride and its role in protecting teeth, as well as the fact that cleaning the mouth with a soft tooth brush and fluoridated toothpaste is effective. When it comes to their information source, 15 (52%) participants reported that they were aware of oral health care on their own, 7 (24%) respondents stated that they were informed by a dentist, 4 (14%) participants described getting information off the internet, while 3 (10%) participants stated that their knowledge on oral health care was from their friends. As a result, it is reasonable to state that the health care providers at St Giles Psychiatric Hospital have knowledge on oral health care. However, their source of information is not consistent and reliable. Thus, health care providers at St Giles Psychiatric Hospital must be formally trained and educated in oral health and oral health care practices. For instance, in a pilot study conducted by de Mey et al [19] which looked at the collaboration between oral hygienists and mental health nurses. The study [19] revealed that, after a brief educational intervention by oral health hygienists addressing themes such oral illnesses, oral health-related issues, and basic oral care, the knowledge of the participating nurses on oral health improved dramatically.

Moreover, results showed that all participants (100%) had knowledge of oral hygiene aids such as toothbrushes, dental floss, fluoridated toothpaste, as well as knowledge of dental pathologies. In addition, all participants (100%) reported that toothpaste and toothbrushes were readily available to patients, while mouth rinses and floss were not easily accessible. In St Giles Psychiatric Hospital, cleaning the patient's mouth is a responsibility shared by the ward orderlies and nurses. Out of the 18 nurses and

8 ward orderlies, only 9 nurses (50%) and 5 ward orderlies (63%), reported practicing oral hygiene for in – patients, while the remaining 9 nurses (50%) and 3 ward orderlies (37%) together with the 3 doctors, considered that it was not their responsibility and/ or had increased workload. In fact, 5 (17%) respondents did not view oral hygiene as an important aspect in their patients' health. Such negative perception and attitude is common towards oral health and oral health care of hospitalized patients. For instance, in a study conducted by Ashour [11], 148 (60%) nursing staff at a mental health hospital in Taif, Saudi Arabia, reported that cleaning the oral cavity of the patient was an unpleasant task, indicating a negative attitude towards the oral health care of hospitalized patients. Moreover, in a research performed by Hijji [20], nurses expressed similar perceived challenges to providing high-quality dental care in the wards. The author [20] further elaborates that, such barriers might range from nurses' personal dislike of providing oral health care to factors such as: a lack of time, understaffing, uncooperative patients, or a lack of materials and resources. Lastly, in a study conducted by Gillam et al [21], nurses agreed that oral care should be a high priority on the ward, however, when the ward became busy, oral care was often pushed to a lower priority.

Lastly, due to lack of availability, oral hygiene aids such as mouth rinses, dental floss, and interdental brushes were not included in the patient's oral hygiene program. According to Griffiths et al [22], preventive programs must be adapted to the specific needs of patients with various diagnoses, prognoses, stages, and severity levels of mental illness. Maintaining dental health requires careful attention and the use of appropriate oral hygiene practices [22]. Moreover, all (100%) participants of the current study, described the absence of frequent dental visits as a key barrier in the oral health care of their patients. Similar findings were seen in a study conducted by Couatarmanach et al [23], whereby, participants agreed on the need for regular dental visits for psychiatric inpatients, however, such interventions were deemed difficult to establish.

This study provides valuable insight regarding the delivery of oral health care to patients in St Giles Psychiatric Hospital. The information presented in this research, could be used in the development and implementation of policies and guidelines that could improve oral health care of patients admitted in the institution.

CONCLUSION:

In conclusion this study assessed the knowledge, attitudes and practice of health care providers at St Giles Psychiatric Hospital, regarding oral health and oral care of hospitalized patients. The results emphasized on the need for a formal training program for health care providers about the importance of oral health care in their patients. Furthermore, oral hygiene aids must be made readily

available, and clear policies and guidelines about the oral health care of hospitalized patients must be instituted. Lastly, multidisciplinary approach and collaboration is needed from health care providers and oral health practitioners so that the patient's oral health status is maintained and does not deteriorate.

Limitations of the study:

There are limitations to the present study that should be mentioned. Firstly, although the sample size was acceptable, the response rate indicated that almost two thirds of the staff did not respond. As such, one cannot be sure that the results are representative of the entire health care providers at St Giles Psychiatric Hospital. Furthermore, this study was designed to provide a general overview and not an in-depth exploration on the knowledge, attitude and practices of health care providers at St Giles Psychiatric Hospital. Future research could be done to investigate any of these factors in greater detail.

Recommendations:

It is recommended that health care providers at St Giles Psychiatric Hospital receive oral health education in the form of Continuing Professional Development (CPD) from oral health practitioners like dentists, so that their knowledge and awareness on oral health is consistent and reliable. In addition, more emphasis on oral hygiene and oral health must be done. For instance, incorporating oral health check – up as part of routine check – up or ward rounds. Furthermore, oral hygiene aids such as mouth rinses and floss must be readily available, and health care providers must be encouraged to integrate these in everyday oral hygiene practices. Finally, provisions must be made for patients to undergo regular dental check-ups, so that oral diseases can be detected early and treated by dentists, rather than waiting until the condition becomes severe/painful and tooth extraction becomes the only treatment option.

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Conflict of interest**:**

There are no conflicts of interest.

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APPENDIX 1: QUESTIONNAIRE

Topic: A Questionnaire – Based study to assess health care providers' knowledge, attitudes, and practices regarding oral health and oral care for hospitalized patients at St Giles Psychiatric Hospital

General Information

Gender: M _____ F_____ (please tick)
Age: _____ Ethnicity: _____

Highest level of Education:

- Primary school
- Secondary School
- Tertiary school

Classification of the Health Care Providers:

- Ward orderlies
- Nurses
- Doctors
- Dentists
- Others
- Please specify _____

Health Care Providers Knowledge

How did you know about oral health care practice?

The dentist told me	
From the internet	
A friend told me	
I knew it myself	

1. What do you think causes tooth decay?
   - Sugar/sweets
   - Bacteria
   - Not tooth brushing
2. What is your understanding of fluoride on its impact on teeth?
   - No idea
   - No effect
   - Make teeth stronger
   - Make teeth discoloured
3. Do you think fluoride is good?
   - Yes
   - No
4. Do you think it is important that your patient cleans their mouth every day?
   - Yes
   - No
5. Is it good to use soft toothbrush to clean the teeth?
   - Yes
   - No
6. Do you agree that consumption of sugar causes caries?
   - Yes
   - No
7. Do you know about gum disease?
   - Yes
   - No
8. Do you think gum disease is part of oral health?
   - Yes
   - No
9. Do you know what floss is?
   - Yes
   - No

Practice and Attitude of Health Care Providers

10. What oral hygiene aids are available for use at your Institution?
    - toothbrush
    - toothpaste
    - mouth rinse
    - dental floss
    - interdental brushes
11. Do you clean their teeth?
    - Yes
    - No
    - If no, go to Q13.
12. How do you clean their mouth?
    - Finger with cloth and water
    - Rinsing with water alone
    - Finger with Water and Toothpaste
    - Toothbrush with Water &fluoridated toothpaste
    - Others, Please Specify……
13. What are the reasons for not carrying out oral hygiene care for your patients? (Can tick more than 1 box)
    - no oral hygiene aides available
    - no time available, due to work overload
    - do not see it as my role
    - difficulty in carrying it out on patients
14. Do you consider oral health as important as the overall health of the patient?
    - Yes
    - No
15. When was the last time your patient visited a dentist?
    - Last 6 months
    - Last 12 months
    - 2 years or more
    - Never

CARDIAC FIBROSIS IN RIGHT ATRIAL TISSUE IS NOT DIFFERENT IN MALE PASIFIKA AND PĀKEHĀ CARDIAC SURGERY PATIENTS IN AOTEAROA

Running title: Cardiac histopathology and miRNAs in New Zealand Pacific Islanders

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ABSTRACT:
Cardiovascular disease (CVD) is the leading cause of death worldwide and in New Zealand. However, a significant inequality in the burden of CVD amongst different ethnic groups exists with a 2 - 3-times higher CVD mortality rate in Pasifika compared to Pākehā. It is unknown whether a difference in cardiac fibrosis might underly this ethnic inequality in CVD mortality. To address this, we determined cardiac fibrosis, myocardial fat infiltration, and the expression of some key miRNAs (miR-15a, miR-15b, miR-34a and miR-153) in right atrial appendages of Pacific Islanders and New Zealand European patients (n=21) undergoing cardiopulmonary bypass surgery. Cardiac fibrosis was measured by total collagen deposition identified by Picro Sirius Red staining, whereas fat accumulation was determined via Oil-Red-O staining. No differences in cardiac fibrosis were observed between ethnic groups (Collagen: Pasifika 23.4±12.5% vs. New Zealand European 29.4±13.2%, one-way ANOVA, p=0.17). Similarly, no differences were observed in accumulation of lipid nor the expression of the miRNAs examined (-15a, -15b, -34a and -153) between different groups. In conclusion, the earlier requirements for surgical intervention for CVD of Pasifika in Aotearoa might not be explained by differences in miRNAs associated with cardiomyocyte loss, fibrosis or myocardial lipid infiltration.

New and Noteworthy

Despite the established significant inequality in the burden of CVD amongst the Pasifika compared to the Pākehā (New Zealand European) populations in Aotearoa, we found no difference in histopathological (cardiac fibrosis, lipid infiltration, or associated pro- or anti-fibrotic miRNAs) features of right atrial tissue from cardiac surgery patients of the different ethnic groups.

KEYWORDS: Cardiac fibrosis, microRNA, fat infiltration, human cardiac tissue, health inequality

INTRODUCTION:

Cardiovascular disease (CVD) is the major cause of death worldwide [1] and accounts for approximately 35% of deaths within Aotearoa (New Zealand) [2]. The risk, morbidity and mortality consequences of CVD are markedly varied in different races and ethnic backgrounds [3]. Indigenous populations such as American Indians, Alaska natives and Aboriginal Australians are often shown to be at higher risk of CVD [4]. This is often associated with socioeconomic status [5] alongside elevated incidence of classical CVD risk factors such as hypertension, obesity, diabetes and high cholesterol [6]. This inequality in the burden of CVD is similar in Pasifika and Māori people in Aotearoa who are more likely to have CVD risk factors [7-9] and have a 2 – 3-times higher mortality rate than Pākehā people of NZ European descent [10]. The ethnic disparity in CVD risk factors has been extensively studied [11-12] however; potential underlying physiological differences behind the difference in CVD incidence are not clearly understood.

Cardiac fibrosis is a hallmark of cardiac remodelling resulting from excess accumulation of extracellular matrix (ECM) components in the interstitial and perivascular regions of the heart, which eventually contributes to impaired cardiac function [13]. However, the complex molecular mechanisms that control cardiac fibrosis are not fully understood. One potential mechanism is alteration to the microRNA (miRNA) profile. MiRNAs are small non-coding RNAs that negatively modulate the translation of their target proteins. The overall profile of miRNAs is known to change in disease [14], including CVD [15]. Numerous miRNAs have been implicated in fibrosis, and down regulation of the antifibrotic miRNA-15a and miRNA-15b have been associated with several cardiac diseases [16-17]. Cardiac fibrosis often occurs as a consequence of cardiomyocytes loss, and this has been associated with the upregulation of miRNA-34a both in age [18] and diabetes [19] and miRNA-153 in cardiac disease [20-21]. Alternatively, myocardial lipid infiltration has also been associated with an unfavorable change in cardiac structure and function [22-23].

In this study, we aimed to investigate the differences in cardiac fibrosis, myocardial lipid infiltration, and expression of a select group of miRNAs in cardiac tissue from Pasifika and New Zealand Europeans. We hypothesized that cardiac fibrosis and myocardial lipid infiltration in right atrial appendage tissue of patients undergoing coronary artery bypass surgery would be increased in Pasifika compared to Pākehā populations. In addition, the expression profiles of antifibrotic miRNAs (miRNA-15a and -15b) would be lower and apoptotic miRNAs would be higher in cardiac tissue of Pasifika.

METHODOLOGY:

Ethics:

The study was conducted under human ethical approval granted by the Southern Health and Disability Ethics Committee (LRS/12/01/001/AM17) and conformed to the Declaration of Helsinki principles, with patients providing informed consent for collection and use of tissue. Consultation was undertaken with the Ngāi Tahu Research Consultation Committee to provide the framework for an appropriate and mandated research consultation process. Based on input from the Pacific communities in the Otago region, culturally-sensitive protocols were followed for acknowledging and respecting tissue donated from our Pasifika volunteers for inclusion in this study [24].

Inclusion criteria:

The HeartOtago tissue collection database contained 851 patient samples collected between 2012 – 2019. Retrospective analysis was performed on a subset of patients (n=7 per group) from the HeartOtago tissue collection (Figure 1). Inclusion criteria were patients undergoing clinically indicated on-pump coronary artery bypass surgery (CABG) in Dunedin Hospital in the period from 2012-2019, with or without valve replacement. The patients were males with a BMI > 30 kg/m^2 and prescribed at least two different classes of CVD medications prior to surgery (Table 1). Females were excluded as the numbers available were insufficient (n=1) and sex differences in cardiac fibrosis are known [25]. To mitigate compounding effects when comparing between Pasifika and New Zealand European the groups were matched across physiological and clinical characteristics. In addition, to account for age-related differences, a second group of NZ European patients (n=7) was included that was matched for all parameters, including age.

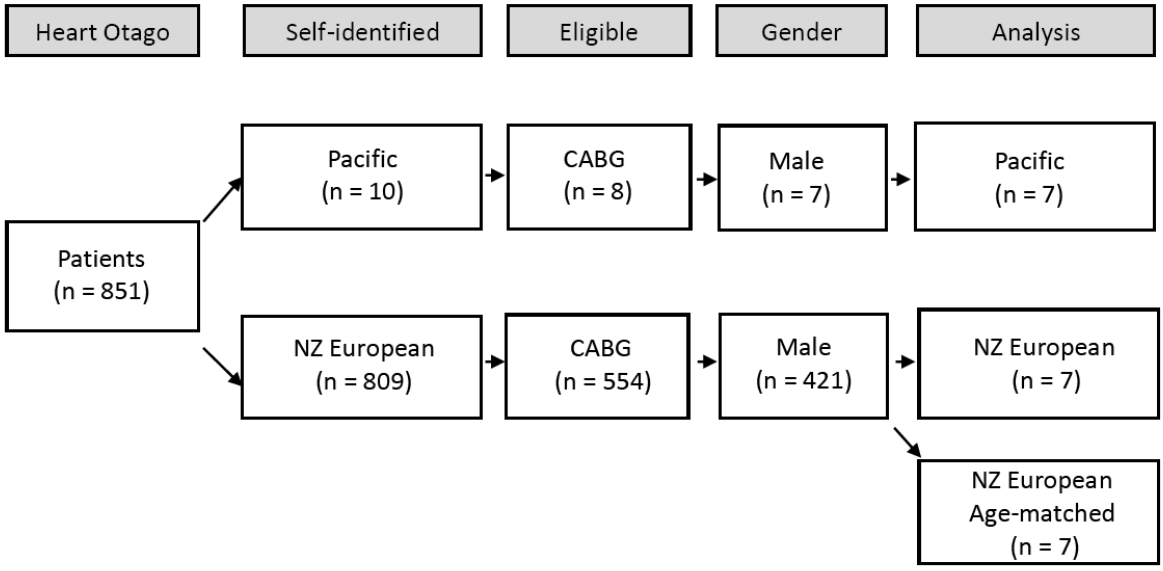
Ethnicity:

Ethnicity was self-reported with selection as outlined in NZ Ministry of Health guidelines [2]. Patients selected had identified as either Pasifika or New Zealand European descent. Within the Pasifika group the patients identified as Samoan (n = 3), Cook Island Māori (n = 3) and Niuean (n =1).

Clinical and anthropometric data:

Standard clinical, biochemical and anthropometric data was collected pre-operatively. Cardiac function was determined from comprehensive echocardiography using commercially available machines (Vivid E9 or E95, GE Healthcare, Chicago, US), according to the recommendations of the American Society of Echocardiography [26].

Figure 1: Patient selection from HeartOtago biobank
CONSORT diagram indicating process of selection of patients from the HeartOtago tissue collection for inclusion within this retrospective study.



Sample preparation:

During cannulation in cardiopulmonary bypass surgery the right atrial appendage (RAA) is routinely removed. This excess tissue was collected and processed for either histological analyses or miRNA assessment. One portion of the RAA was immediately frozen in liquid nitrogen for miRNA assessment, and the remainder part for histological analysis was fixed in 4% neutral buffered formalin (Sigma Aldrich, St Louis, MO, USA) for 24h, prior to treatment with 30% sucrose (Merck, Kenilworth, NJ, USA), and embedding in cryoprotect matrix (Thermoscientific, MA, USA). Frozen sections (8µm) of the RAA were prepared and standard histological stains used to demonstrate key cellular features. The presence of collagen was demonstrated by Picro Sirius Red (PSR) staining, with a light green counterstain [27], whereas fat deposits were identified by Oil-Red-O (ORO) staining [28].

Image analysis:

Digital images of stained PSR sections were obtained with Aperio slide scanner (Leica Biosystems, Wetzlar, Germany). In addition, these sections were imaged at x20 magnification under polarized light, with images captured with a standardized exposure of 208.5s, gain 5.2 and offset -1017. Sections stained with ORO were imaged at x40 on

Moticam 580 digital camera attached to Miotic BA310 light microscope (Motic Asia, Kowloon, Hong Kong).

All image quantification measurements were conducted with the assessor blinded to the patient group. For each patient, images of 15 regions of interest (ROI) were analyzed, taking care to avoid introduction of bias by excluding the edges of each section which could include some pericardial tissue. Quantification of the extent of fibrotic or fat deposition was conducted using a color-based digital analysis method (Adobe Photoshop, CS5 v12.1, San Jose, CA, USA). A standardized mask was created for each color and this mask applied to all sections for quantification.

The color-based quantification system was also applied to the polarized light images of the PSR stained sections. The different color birefringence arises from the different structure of the collagen types: Collagen I show as red/orange color whereas collagen III has yellow/green color [29] . The area of each of the colors was measured separately and then subsequently combined to provide a pixel count of each collagen type. This allowed the calculation of the percentage of collagen I and III the I/III collagen ratio [30].

MiRNA assessment:

Total RNA was isolated from snap frozen RAA samples with miRNeasy mini kit (Qiagen, Hilden, Germany). The primer sequence for the specific miRNAs were: miR-16 (UAGCAGCACGUAAAUAUUGGCG), miR-24 (UGGCUCAGUUCAGCAGGAACAG), miR-15a (UAGCAGCACAUAAUGGUUUGUG), miR-15b (UAGCAGCACAUCAUGGUUUACA), miR-34a (UGGCAGUGUCUUAGCUGGUUGU) and miR-153-5p (UCAUUUUUGUGAUGUUGCAGCU). Quantitative real-time PCR with iTaq Universal SYBR Green Supermix (BioRad, Hercules, CA, USA), was conducted on a StepOne Plus Real Time PCR Systems (Applied Biosystems, Foster City, CA, USA). Individual miRNA expression was normalized to the average of two internal controls (miRNA-16 and miRNA-24) with expression reported as log 2-ΔCt. The inter-plate co-efficient of variation was 4.9%, indicative of reproducibility between PCR runs.

Data analysis:

Data is presented throughout as mean ± SD, with individual patient values shown. Histological values are presented as the average of the 15 ROI, unless specified. Measured differences between ethnic groups were assessed with one-way ANOVA, with Tukey's post-tests. Fisher's exact test was used to demonstrate effective matching in patient clinical characteristics. Correlation between the different components of the RAA (e.g., collagen, fat) and clinical parameters was determined by two-tailed non-parametric Spearman r correlation.

The histopathological composition of the RAA in the patient cohorts was compared by non-parametric one-sample Wilcoxon test to percentage values of collagen, fat and cardiomyocyte expected in healthy individuals with values obtained from the literature as we had no access to cardiac tissue from non-cardiac patients. Normal healthy values were taken from post-mortem studies of individuals aged (50 – 70 years old) of European descent, with no signs of cardiac disease [31-34]. Normal comparator values selected were: 5% for collagen [31], 1% for fat [32], 65% for cardiomyocytes [33] and 0.6 for the ratio of collagen I/III [34].

RESULTS:

The HeartOtago database was investigated to identify patients for inclusion in this retrospective study (Figure 1). Within each self-identified ethnic cohort, males dominated the patient population (>75% samples from males), and 70% of the surgical interventions conducted were coronary artery bypass grafts (CABG). The number of Pasifika CABG patients available within the database was low (n = 8), with only a single female. As sex differences in fibrosis are known [25], the female patient was excluded. The available Pasifika male group was the driving force for the selection of patients from NZ European cohorts. The patients (n=7 per group) were selected to match in terms of obesity, diabetes, hypertension and current CVD medication status. No significant differences in clinical or cardiovascular characteristics were observed between the groups (Table 1). The only major finding was that Pasifika patients were undergoing surgical intervention at significantly ($p = 0.004$) younger ages than NZ European, with CABG performed at 56 ± 11 years old, compared to 79 ± 5 year of age in NZ European patients.

Cardiac fibrosis was demonstrated in all samples by PSR (Figure 2A). RAA collagen fraction was increased in patients undergoing CABG, when compared to published expected values (~5 %) found in healthy right atrial tissue [31], with 23.4 ± 12.5%, 36.7 ± 12.2% and 29.4 ± 13.2% collagen in Pasifika, New Zealand European, and NZ European age-matched patients, respectively. Inter-ethnic comparison showed no significant variation in overall collagen content (Figure 2B) within the RAA ($p = 0.17$). The increase in RAA collagen content did not correlate with RA area ($r= -0.134$, $p = 0.60$) or RA length ($r = -0.208$, $p = 0.42$). Examination of PSR images under polarized light provided further information on the differential distribution of structurally different collagens, allowing estimation of both collagen I and collagen III within the samples [29] (Figure 3A). Like total collagen, the values of collagen I and III in RAA samples from CABG patients were higher compared to published healthy values and showed no inter-ethnic variation (data not shown). In contrast, the ratio of

collagen I/III was unchanged in CABG patients compared to expected healthy value [34] (Figure 2C), although large variations were observed in the age-matched NZ European group. Collagen content showed no associations with clinical or cardiac parameters, either as an overall study cohort or within the different ethnicities.

Another key feature of damaged myocardium is fat infiltration as demonstrated by ORO stain (Figure 3A). The proportion of lipid in the CABG patients was higher ($p < 0.05$) compared to the ~1% previously reported in healthy hearts [32] (Figure 3B). There were no significant differences in lipid infiltration between the ethnic groups ($p = 0.80$) with 12.7 ± 9.2%, 15.3 ± 11.9% and 11.3± 11.9% lipid in the Pasifika, NZ European and NZ European age-matched patient cohorts. Within the entire study cohort or within the different ethnicities there was no association of lipid content within the RAA to general clinical and cardiac characteristics, nor to the size of the RAA. The exception was a positive correlation of lipid to blood pressure (Figure 4). There was a significant ($p < 0.05$) positive Spearman r correlation of percentage lipid to systolic ($r = 0.94$, $p = 0.017$; Figure 4A), diastolic ($r = 0.87$, $p = 0.033$; Figure 4B) and mean arterial blood ($r = 0.89$, $p = 0.033$; Figure 4C) in the Pasifika cohort, with no associations observed in the both the NZ European cohorts (r values less than 0.64).

The other main component of the myocardium is cardiomyocytes, which in the healthy heart occupies 65% of the right-side myocardium [33]. The presence of CVD significantly ($p < 0.01$) reduced the area occupied by cardiomyocytes in all ethnicities compared to healthy control levels (Figure 3C), with no ethnic differences.

Overall, the composition of the RAA proportion of lipid, collagen and cardiomyocytes in the different ethnic groups showed no differences (Figure 3D), and is thus, unlikely to be responsible for the large inequality of health outcomes in the indigenous populations.

We have previously found that the RAA expression of anti-fibrotic miRNA-15a and miRNA-15b was down-regulated in NZ European patients undergoing CABG surgery [17], and that miRNA-34a was increased [19]. Therefore, we investigated whether the expression of these miRNAs was changed dependent on the ethnicity of the CABG patient. We found that the expression of miRNA-15a (Figure 5A) -15b (Figure 5B) and miRNA-34a (Figure 5C) was not different across the three groups ($p = 0.41$, 0.75 and 0.16, respectively). Similarly, there was no difference ($p = 0.80$) in the expression of miRNA-153 (Figure 5D). Interestingly, we did detect an age-related difference in the miRNA-34a when restricting the comparison of the NZ European cohorts ($p = 0.023$), which was not present in the other miRNAs.

Table 1: Clinical and cardiovascular characteristics

	Pasifika (n=7)	NZ European (n=7)	NZ European aged matched (n=7)	p value
Age (years)	56 ± 11	79 ± 14*	57 ± 12	0.004
BMI (kg/m2)	33.6 ± 5.2	30.9 ± 3.6	36.3 ± 6.9	0.2697
BSA (m2)	2.1 ± 0.2	2.1 ± 0.2	2.2 ± 0.4	0.445
Medical history				
Hypertension	4 (57%)	6 (86%)	7 (100%)	0.115
Diabetes	3 (43%)	3 (43%)	3 (43%)	0.999
Myocardial infarction	2 (29%)	1 (14%)	2 (29%)	0.769
Smoking (current or ex)	6 (86%)	4 (57%)	4 (57%)	0.424
Pre-operative AF	3 (43%)	0 (0%)	1 (14%)	0.115
Post-operative AF	3 (43%)	1 (14%)	1 (14%)	0.350
Medication				
Statins	6 (86%)	5 (71%)	7 (100%)	0.311
ACE inhibitors	5 (71%)	4 (57%)	3 (43%)	0.558
Beta blockers	6 (86%)	5 (71%)	7 (100%)	0.311
Diuretics	1 (14%)	1 (14%)	0 (0%)	0.575
Anti-coagulants	1 (14%)	2 (28%)	0 (0%)	0.311
Cardiovascular				
MABP (mmHg)	109 ± 32	95 ± 9	87 ± 10	0.196
Ejection fraction (%)	58.6 ± 11.2	52.4 ± 9.8	53.1 ± 4.3	0.417
Fractional shortening (%)	36.6 ± 11.6	34.6 ± 10.3	29.9 ± 8.7	0.587
RA area (cm^2)	18.6 ± 4.8	15.7 ± 4.2	16.6 ± 2.6	0.456
RA length (cm)	5.3 ± 0.6	5.4 ± 0.7	5.3 ± 0.4	0.929

Physical characteristics, medical history, medication and cardiovascular function of patients included in the study (n=7 per group). Patients self-identified as of Pacific Island or NZ European descent. The only statistical difference detected was that Pasifika underwent CABG at younger ages than NZ Europeans (*). BMI, body mass index; BSA, body surface area; AF, atrial fibrillation; ACE, angiotensin-converting-enzyme; MABP, mean arterial blood pressure; RA, right atrial.

Figure 2: Cardiac fibrosis of the right atrial appendages (RAA) of coronary artery bypass graft (CABG) patients. **Fig 2A**: Representative RAA images from each ethnic cohort stained with Picro Sirius Red (PSR) under bright field and polarized light. In PSR stained sections collagen is stained red (yellow arrows) and cardiomyocytes stained green. Collagen shows birefringence under polarized light, with orange/red birefringence depicts collagen type I whereas yellow/green demonstrates collagen type III. Scale bars represent 100μm.

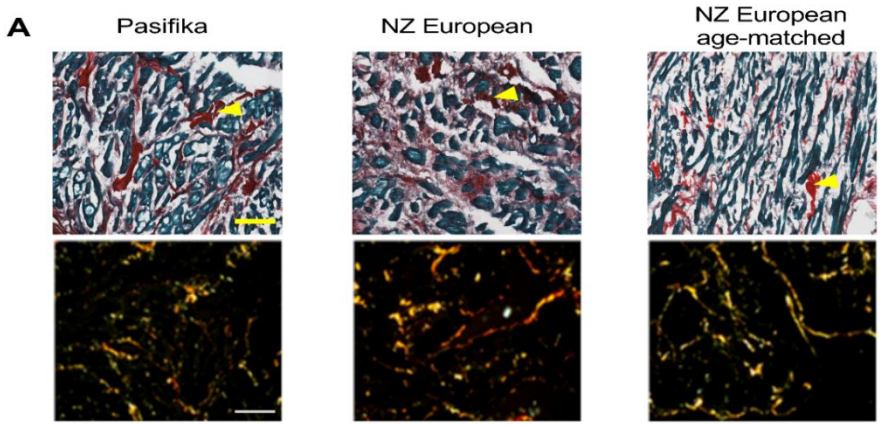


Figure 2B: Color-based quantification of percentage area of RAA of CABG patients occupied by collagen (red). Collagen was significantly higher than 5% observed in healthy RAA (dotted line, from literature), but not different between ethnic groups. Data in bar graph is shown as mean ± SD, with individual patient data illustrated (n = 7) per group. Statistical differences from non-cardiac disease values were determined by one-sample Wilcoxon test versus control values obtained from the literature (# $p < 0.05$). Differences between ethnicities was determined by one-way ANOVA, with statistical significance set at $p < 0.05$, with Tukey's post-tests between all three groups conducted if appropriate. NZE = New Zealand European, NZE-AM = New Zealand European Age-Matched.

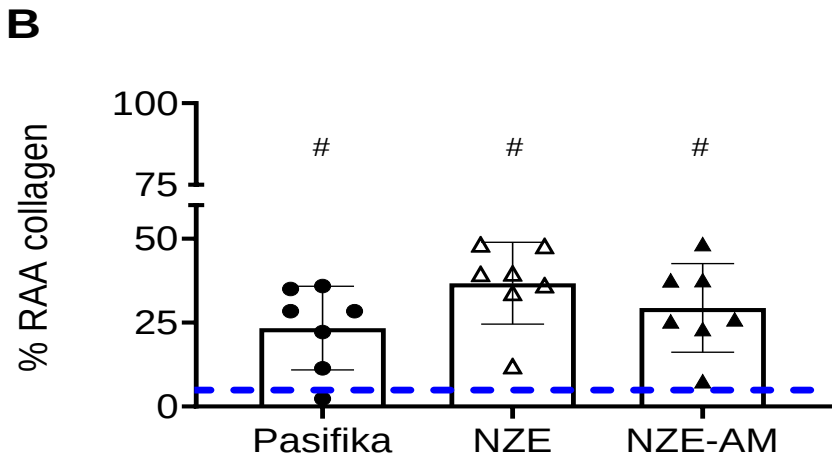


Figure 2C: Ratio of collagen I/III from color-based quantification. The ratio of collagen was not different from healthy value (dotted line) and no differences were observed between the groups. Data in bar graph is shown as mean ± SD, with individual patient data illustrated (n = 7) per group. Statistical differences from non-cardiac disease values were determined by one-sample Wilcoxon test versus control values obtained from the literature (# $p < 0.05$). Differences between ethnicities was determined by one-way ANOVA, with statistical significance set at $p < 0.05$, with Tukey's post-tests between all three groups conducted if appropriate. NZE = New Zealand European, NZE-AM = New Zealand European Age-Matched

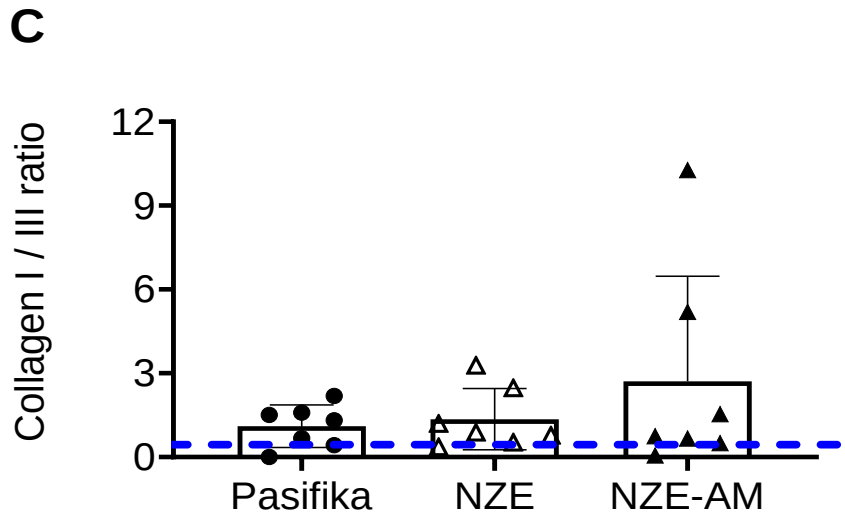


Figure 3: Myocardial fat and cardiomyocyte composition of the right atrial appendages (RAA) of coronary artery bypass graft (CABG) patients.
Fig 3A: Representative RAA images from each ethnic cohort stained with Oil-Red-O (ORO; red stain). Scale bar represent 10µm. The lipid deposits were mainly within individual cardiomyocytes (white arrows), with occasional extracellular fat depositions noted (yellow arrow head).

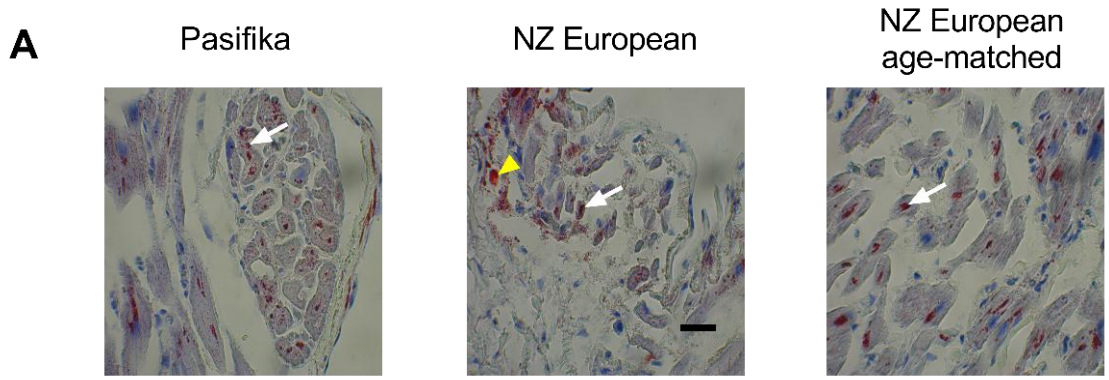


Figure 3B: Color-based quantification of percentage area of RAA of CABG patients occupied by lipid (red). Percentage fat was higher than 1% observed in healthy RAA (dotted line, from literature), but not different between ethnic groups. Data in bar graphs is shown as mean ± SD, with individual patient data illustrated (n = 7) per group. Statistical differences versus healthy atrial tissue values were determined by one-sample Wilcoxon test versus literature obtained hypothetical values (# $p < 0.05$). Differences between ethnicities was determined by one-way ANOVA, with statistical significance set at $p < 0.05$, with Tukey's post-tests between all three groups conducted if appropriate. NZE = New Zealand European, NZE-AM = New Zealand European Age-Matched.

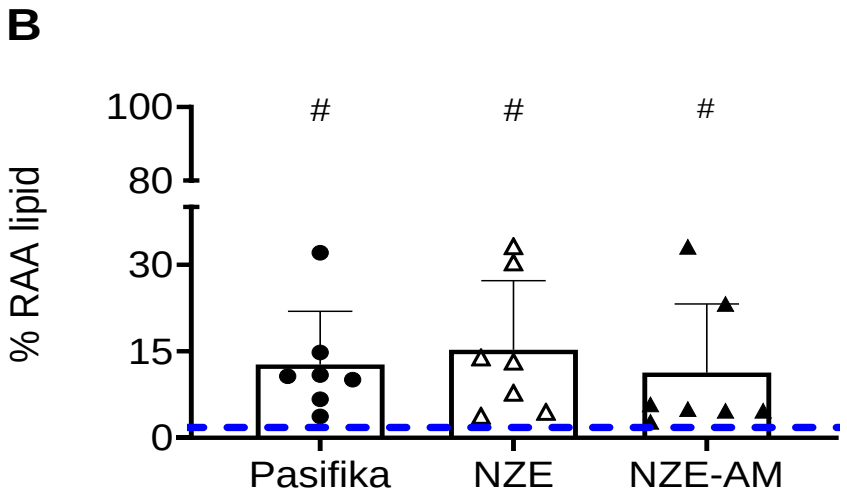


Figure 3C: Color-based quantification of percentage area of RAA of CABG patients occupied by cardiomyocytes (blue). The area occupied by myocytes was significantly lower than 65% observed in healthy RAA (dotted line, from literature). Data in bar graphs is shown as mean ± SD, with individual patient data illustrated (n = 7) per group. Statistical differences versus healthy atrial tissue values were determined by one-sample Wilcoxon test versus literature obtained hypothetical values (# $p < 0.05$). Differences between ethnicities was determined by one-way ANOVA, with statistical significance set at $p < 0.05$, with Tukey's post-tests between all three groups conducted if appropriate. NZE = New Zealand European, NZE-AM = New Zealand European Age-Matched.

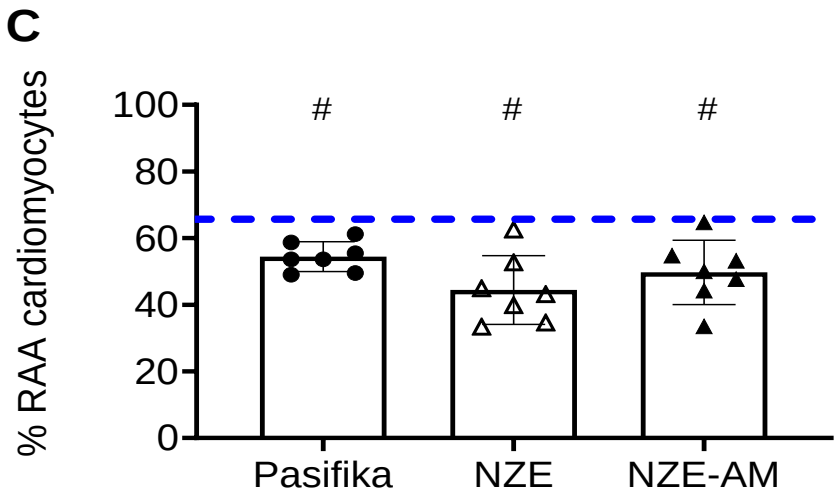


Figure 3D: Overall contribution of collagen, lipid, cardiomyocytes and other structures to the composition of the RAA, expressed as a percentage of whole area. Data in pie charts is shown as mean percentage composition.

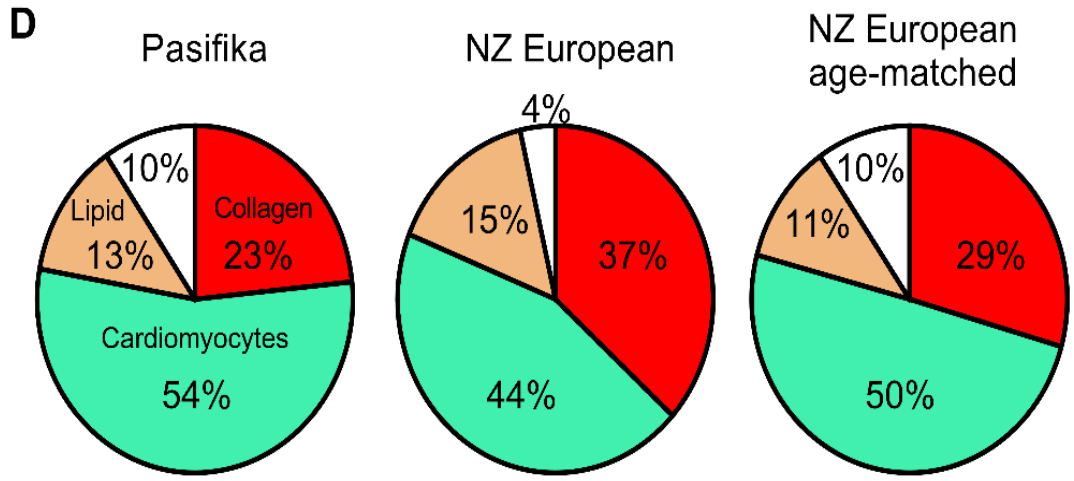


Figure 4: Association of percentage lipid in the RAA to A) systolic, B) diastolic and C) mean arterial blood pressure (mmHg) in Pasifika (closed circles), NZ European (open triangles) and NZ European age-matched (closed triangles) for n = 7 per group. Significant positive correlations (non-parametric Spearman correlation r) of percentage lipid within RAA to systolic (r = 0.94, p = 0.017), diastolic (r = 0.87, p = 0.033) and mean arterial blood pressure (r = 0.89, p = 0.033) were detected in the Pasifika cohort (lines), but not the NZ European cohorts (r < 0.64, p > 0.05).

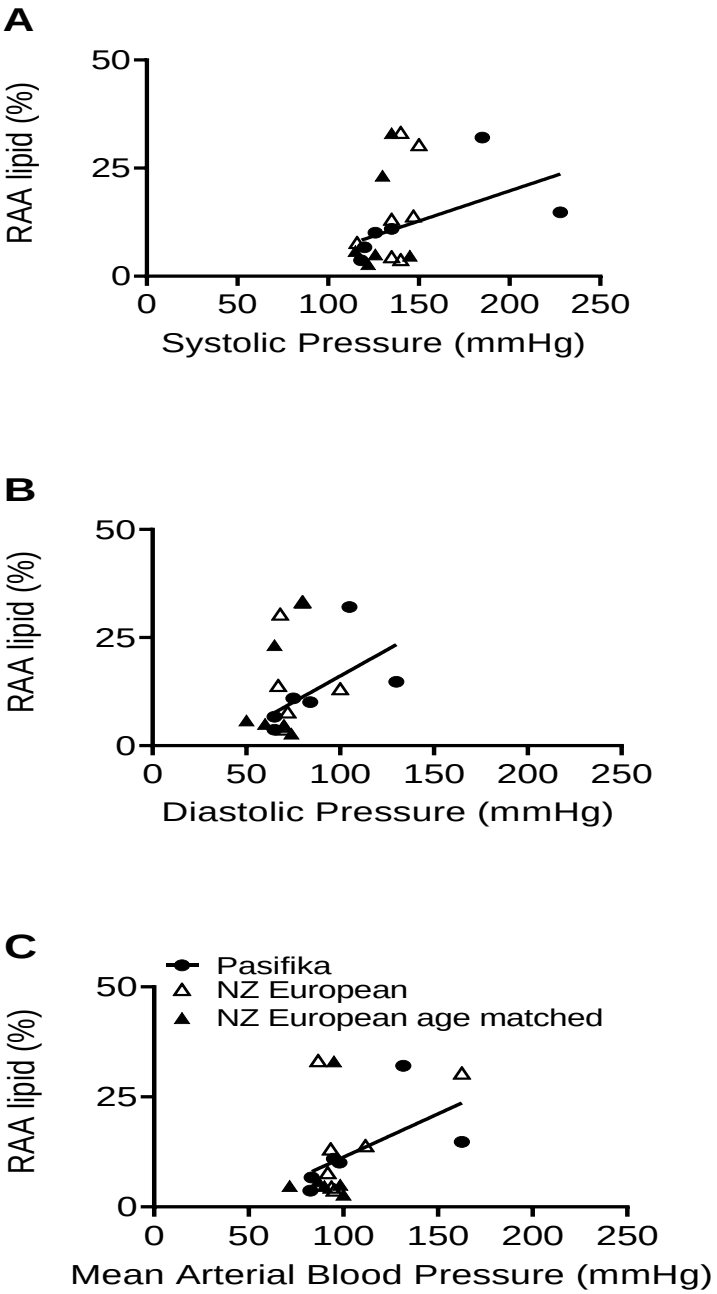
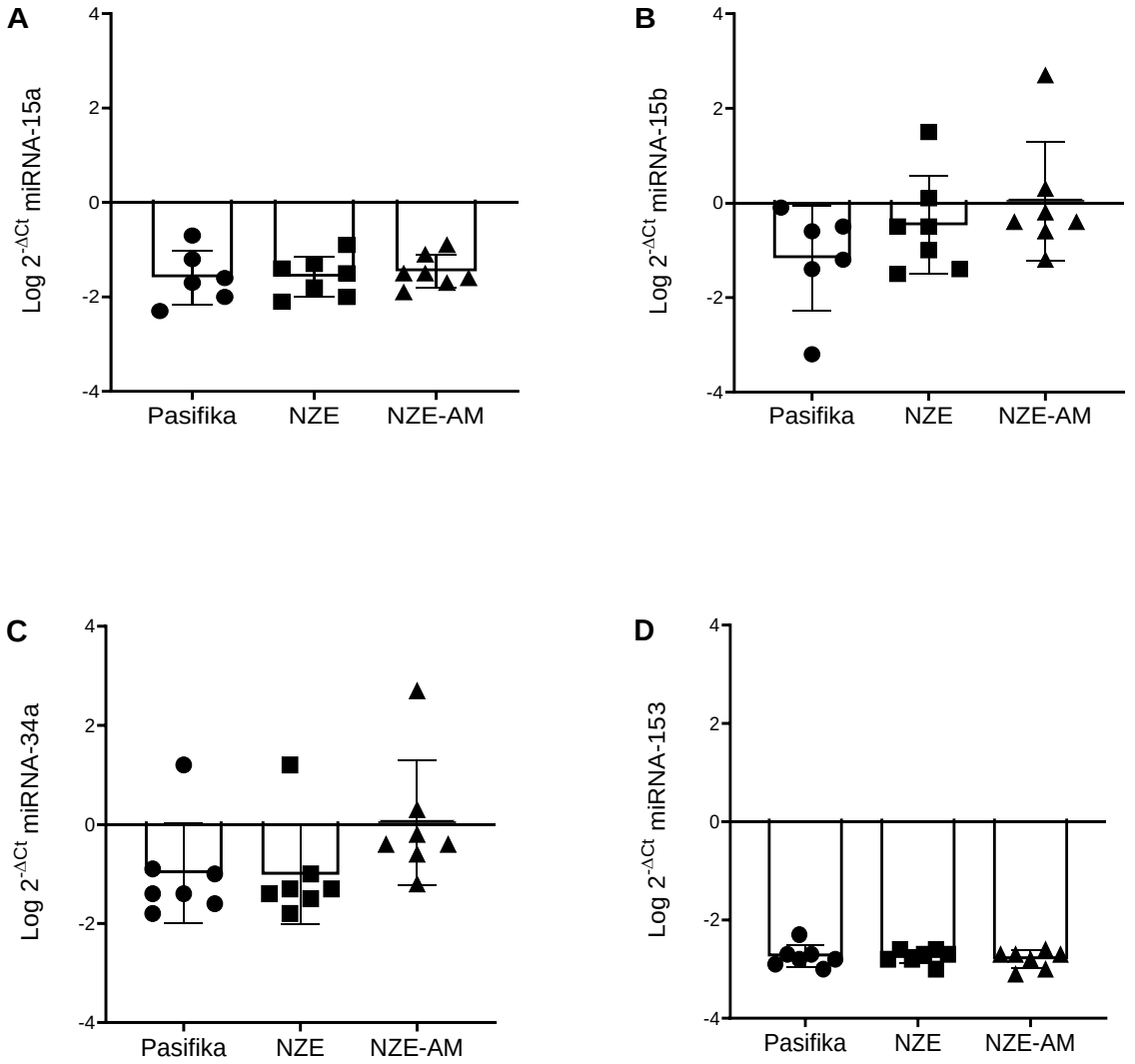


Figure 5: MicroRNA expression in RAA of CABG patients. Expression of miRNA-15a, 15-b, -34a and -153 in right atrial appendage (RAA) tissue of coronary artery bypass graft (CABG) patients are not altered by ethnicity. **A) miRNA-15a**, **B) miRNA-15b C) miRNA-34a and D) miRNA-153**. Data is expressed as Log 2-ΔCt of miRNA compared to endogenous control (average of miRNA-24 and -16), with mean ± SD, n = 7 per group with individual patient samples shown. One-way ANOVA detected no significant differences between ethnicities. NZE = New Zealand European, NZE-AM = New Zealand European Age-Matched.



DISCUSSION:

The main finding of this study was that no ethnic differences were found in histopathological assessment of right atrial tissue or in the expression of four miRNAs whose targets are associated with fibrosis and cardiomyocyte loss in a small population of Pasifika and New Zealand European cardiac surgery patients.

Pasifika and New Zealand Māori people tend to have poorer health outcomes compared to Pākehā population [5]. Differences in socio-economic and classical CVD risk factors are known contributing factors to the health inequality [12]. However, these factors do not fully explain the ethnic inequality and it is likely that other factors are also in play. Ethnic differences in CVD risk [7, 35], even following adjustment for other risk factors, have been detected [36] alongside ethnic differences in the heart structure and function [37]. This suggests that underlying physiological factors could play a role, as well. Our study focused on determining whether the composition of the heart tissue was different between Pasifika and NZ Europeans in Aotearoa undergoing surgical interventions for coronary artery disease. We found no differences in tissue composition between the ethnic backgrounds of CABG patients that could explain the health inequality in the Pasifika population. This suggests that, at least when CABG is clinically indicated, there seem to be no underlying differences in cardiac composition quantified in this study between the ethnic cohorts. Whether differences exist in the healthy population, people with preclinical disease or within the female population remain undetermined.

Hallmarks of a dysfunctional myocardium are marked ECM deposition, epicardial and intra-myocardial fat deposition, and loss of ventricular myocytes [38]. These histopathological changes were all detected within the RAA (compared to established values in the literature). A fibrotic response to the presence of CVD was detected across all ethnicities of the cardiac surgery patients in this study, with at least doubling of the cardiac collagen content compared to values obtained in tissue from healthy controls [32]. The extent of fibrosis observed in our patients was very similar to the elevated levels observed in American patients undergoing CABG [39]. The small group size limits meaningful statistical comparison within the different pacific ethnicities, but there was no clear difference between fibrosis in patients that identified as Samoan or Cook Island Māori. Therefore, it appears that the fibrotic response of the right atrium to coronary artery disease is similar independent of ethnic background, both in NZ and across the globe.

Fibrotic deposition in the myocardium of coronary artery disease patients has been shown to be located both perivascular and interstitial [17]. In our RAA samples there was minimal vascular tissue present hence the increase in fibrosis is assumed to be primarily

interstitial. In general, the diffuse spatial distribution of the fibrosis, alongside minimal change in RA dimensions and the relatively small reduction in cardiomyocytes within the RAA, was more indicative of reactive fibrosis to chronic stressors, rather than replacement scar tissue [40].

The two major collagen types within the extracellular matrix of the myocardium are generally type I and type III, and alterations to the ratio is one way that changes to the ECM can adversely affect cardiac functioning [41]. Previous studies have shown that increases in collagen I/III ratio are detected in end-stage dilated cardiomyopathy patients with reduced EF (<50%) [42]. Whilst we observed no significant change in the ratio in CABG patients, we did note a large variation in collagen I/III ratio in the age-matched NZ European group, with two individuals demonstrating a larger ratio that the other patients (Figure 2C). The clinical relevance of this is uncertain. Future studies including patients with EF < 50% would be required to see if the increase in collagen I/III ratio is present in CABG patients.

Intra-myocardial fat, the deposition of lipid droplets within cardiomyocytes, was the main location of lipid deposition within the RAA (Figure 3A), with only occasional extracellular fat deposits. Despite the knowledge that intra-myocardial fat is known to increase with age, obesity and metabolic syndromes [32, 43], we did not detect any association of fat deposition to blood glucose, possibly as a consequence of our matching of groups for these factors.

All the hallmarks of a dysfunctional myocardium were all detected within the RAA of CABG patients, with no ethnic differences observed. It is plausible that the stress on the myocardium from the presence of severe atherosclerotic disease is a much stronger driver of fibrosis, than ethnicity. This theory is supported by an association of diffuse interstitial fibrosis and prior cardiovascular events [44], alongside less fibrosis in patients with cardiac valve, not coronary artery, disease [45].

All patients in our study had BMI> 30 kg/m2, which is known to have a direct influence on fibrosis [46] and fat [42] deposition. We noted some ethnic variations in the relationship between blood pressure and fatty infiltration, with a strong association in Pasifika, but not other cohorts. These differences in correlations whilst, subtle, were identified despite our study design to effectively match patients in all groups to a wide range of clinical and cardiovascular parameters. Recently we indicated that BMI was associated with epicardial adipose tissue thickness in NZ European patients, but not in Pasifika/Māori patients [47]. Combined with the current correlation data from this study, further research is needed into the association between mechanisms and consequences of fat

deposition in Pasifika and New Zealand European peoples.

Greater up-regulation of the age and cardiac fibrosis related miRNA-34a [18] could be responsible for the earlier manifestation of clinically indicated cardiac disease in Pasifika, but this was unsupported by our data. However, with a focus just on the NZ European cohort, an age-related increase in miRNA-34a was apparent (Figure 5C). Hence, further investigation is warranted as our low group sizes may have masked potential ethnic differences. Previously, in RAA samples from the HeartOtago tissue collection, a down-regulation of miRNA-15a/b was found in diabetic patients with coronary artery disease of NZ European origin, compared to patients without coronary artery disease which was shown to influence cardiac fibrosis [17]. Given that within each of our ethnic cohorts no differences in miRNA-15a or -15b was observed between patients with or without diabetes, it is most likely that a similar overall down-regulation of miRNA-15a or 15b has occurred in our CABG patients, independent of ethnicity.

Our study has several limitations, with the most important one the relatively small number of patients included. To minimize imbalances between the ethnic groups, the number of tissues examined were matched to the available tissue of our heterogenous Pacific Islanders cohort (n = 7). This low number is most likely caused by the relative low number of Pasifika people living in the geographical area of Otago and Southland that present for cardiac surgery at the Dunedin Hospital (1%) compared to national rates. However, problems of Pasifika with access to health care cannot be excluded. The small group size also prevented any meaningful comparisons between the Pasifika sub-groups, where differences have recently been highlighted in CVD prevalence [48]. Because gender differences of cardiac fibrosis have been identified in mice [49] and humans [33], it would be interesting to explore in the future the cardiac histopathological status of female Pasifika, as well. Care should also be taken in interpolating our findings in the RAA directly to the whole heart. Indeed, we have previously shown chamber specific differences in Ca^{2+} handling proteins in HeartOtago patient samples [50], whereas others showed chamber-specific variation in fibrosis [51, 52] and fat [32]. However, the right atrium is important for right ventricular function and especially for electrical conduction with approximately 30% of all cardiac arrythmias originating from the right atrium [53].

CONCLUSION:

Our study suggests that despite the greater risk of premature death and earlier requirements for surgical intervention for CVD of the Pasifika people from Aotearoa, this is not explained by differences in histopathology of the heart. Future investigations should investigate other potential physiological reasons, in parallel to

the socioeconomic reasons, why Pasifika reach a clinical indication for cardiac surgery years before NZ Europeans.

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THIAMINE LEVELS IN MALNOURISHED CHILDREN IN PORT MORESBY GENERAL HOSPITAL

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ABSTRACT:
Thiamine deficiency may be associated with severe acute malnutrition (SAM) and contribute to its clinical signs and complications. This hospital-based prospective study aimed to determine if thiamine deficiency is present in children with SAM in Port Moresby General Hospital (PMGH). Convenient sampling was used to select 208 children aged between 2 months and 13 years (median age 15 and IQR 11-32 months) presenting to the Children's Emergency Department requiring venepuncture for routine testing who had additional blood taken for assay of thiamine levels. Nutritional status was determined using the WHO weight for height (WFH) z-scores. Details of socioeconomic background and diet were recorded. Thiamine levels were determined using enzyme-linked immunosorbent assay (ELISA) test kits. A total of 158 (76%) of the 208 samples were satisfactory for analysis; 86 (54%) from children with normal WFH, 26 (17%) from those with moderate malnutrition and 46 (29%) from those with severe malnutrition. Thiamine levels were normally distributed overall. The mean was 34.18 $\pm$ 5.8 ng/ml. This was within the reference level of 16-48ng/ml. There was no statistically significant difference in levels between the normal, moderately and severely malnourished children (33.6 $\pm$ 5.6, 35.3 $\pm$ 5.7 and 34.4 $\pm$ 5.7 ng/ml). The assay of thiamine levels in serum using ELISA is not the best method for determining thiamine deficiency and further studies using whole blood and high-performance liquid chromatography are needed.

Keywords: Thiamine deficiency, children, severe malnutrition, serum, micronutrients

INTRODUCTION:

Severe acute malnutrition (SAM) in children under 5 years of age was the second commonest cause of admission to hospitals in Papua New Guinea (PNG) in 2019. It was either a direct cause of admission or an associated morbidity in 8.1 % of children with a case fatality rate of 10.4% [1].

SAM is defined by a very low weight for height (<-3 z-scores of the median WHO growth standards) and/or by presence of nutritional oedema (kwashiorkor; defined as bilateral pitting oedema) [2]. SAM is caused by

macronutrient deficiency, although micronutrient deficiency is almost always present as well [3]. Heart failure, shock, metabolic disturbances, sepsis, and severe oedema are common complications [4,5].

Thiamine (vitamin B1), a water-soluble vitamin is an essential micronutrient. In its active form thiamine diphosphate (also known as thiamine pyrophosphate or TPP) functions as a vital co-factor to several important enzymes in cellular metabolism [5] and its deficiency may well contribute to the complications of severe malnutrition like heart failure, sepsis, oedema, and refeeding syndrome commonly seen in PNG. Although the prevalence of thiamine deficiency is not well documented worldwide, studies done in Jamaica and Ghana showed thiamine deficiency in 37% and 40% of malnourished children respectively [6,7]. A study from Cambodia reported a prevalence of thiamine deficiency of 38% in children aged 6-12 months using the most conservative cut off level [8]. In contrast malnutrition was not associated with low thiamine levels in a study of children admitted to an intensive care unit in Brazil [9].

In PNG, thiamine deficiency was documented in 6% of boarding school children in the southern region [10]. No studies have been done to document thiamine levels in malnourished children in PNG.

This study aimed to determine the thiamine levels in severely malnourished children admitted to Port Moresby General Hospital (PMGH). This is important because if thiamine deficiency is common this will have implications for the standard management of children with SAM.

METHODOLOGY:

This was a prospective descriptive hospital-based study carried out at the PMGH Paediatric Department. This hospital is a tertiary referral hospital, receiving referrals from other provincial centres as well as the National Capital District (NCD), Central and Gulf provinces. PMGH admits over 4200 children per year.

Children between 2 months and 13 years of age were enrolled by convenience sampling at presentation to the Children's Emergency Department. Those who had SAM who were already on ready to use therapeutic food (RUTF) and/or milk feeds (F75 or F100) that contain thiamine were excluded from the study.

On presentation, each child had anthropometric measurements of weight, height or length, mid-upper arm circumference, and head circumference taken [11].

The nutritional statuses of the children were determined using the WHO Anthro Calculator for children less than 2 years of age, and the standard WHO Weight for Height Charts for children above 2 years [11,12]. They were then categorized as normal, moderate malnutrition or SAM:

- Normal: a WFH/L between -2 & +2SD

- Moderate malnutrition: a WFH/L between -2 & -3SD is moderate malnutrition
- SAM: a WFH/L <-3SD, and/or presence of oedema

Written informed consent to participate in the study was obtained from the parent or guardian. A questionnaire was used to collect their demographic details including a dietary history based on the food consumed in a typical day. Clinical findings such as skin and hair changes were recorded. The maternal consumption of substances potentially interfering with their children's thiamine levels was also noted.

Venous blood was collected from the child during cannulation or when routine investigative blood tests were done for the child. None of the children had venepuncture done separately or only for the purpose of this study.

For the assay of thiamine, 1.5-2ml of venous blood was placed in a plain sterile labelled microtainer. The blood was allowed to clot before being placed in a microtainer-box inside a cool-box kept at a temperature of 4-8 degrees C and transported to the Micronutrient laboratory. The blood samples were centrifuged for 10 minutes at about 10 degrees Celsius. Each serum sample was separated into a properly labelled sterile eppendorf vial which was securely closed and stored at -20 degrees C until analysis.

Thiamine levels in serum were assayed using the Aviva Systems Biology Vitamin B1 Enzyme-Linked Immunosorbent Assay (ELISA) kits [13]. Data was entered into a Microsoft Excel spreadsheet and descriptive statistics determined using Stata V.14 and IBM SPSS statistical software.

Ethical clearance was given by the University of Papua New Guinea (UPNG) School of Medicine and Health Sciences (SMHS) Research and Ethics Committee and the study was approved by the PMGH Director of Medical Services

RESULTS:

A total of 208 patients aged between two months and 13 years (median age 15 and IQR 11-32 months) were recruited for this study between June and August 2021. The 208 adequately documented blood samples were sent to the micronutrient laboratory. Of the 208 serum samples obtained, 50 samples were deemed unsuitable for analysis due to various reasons (insufficient and/or hemolysed samples).

Of the 158 serum samples 54.4% (n=86) were from normally nourished children, and 16.5% (n=26) from children with moderate malnutrition (z-score between -2 & -3 SD), and 29.1% (n=46) from children with SAM. The median (IQR) age of the 158 children was 15.5 (12-36) months. Sixty five (median age 12 [9-16] months) were receiving breast milk. The

median age of the 93 not receiving breast milk was 24 (12-48) months.

The overall mean serum thiamine level in the 158 children was 34.1ng/ml and standard deviation (SD) was 5.7ng/ml (minimum 20ng/ml and maximum 49ng/ml). The summary statistics of the thiamine levels in serum from children in the three groups are presented in Table 1. There was no statistically significant difference in thiamine levels between the three groups.

Table 1: Serum thiamine levels (ng/ml) in normally nourished, moderately malnourished, and severely malnourished children

Parameters	**Normal status (N = 86)**	**Moderate status (N = 26)**	**Severe status (N = 46)**
Mean	33.6	35.3	34.4
SD (Standard deviation)	5.6	5.7	5.7
95% CI (Confidence Interval)	32.4- 34.8	33.0 – 37.6	32.7 – 36.8
Range	20.1 – 48.1	26.2 – 47.1	25.6 – 49.0
Median	33.8	34.2	34.0
IQR (Interquartile range)	29.7 – 36.7	31.6 – 39.1	29.0 – 37.1

141 (89%) of the 158 children were living in the Port Moresby suburban area and 88 (56%) were males.

The mean thiamine levels in the severely malnourished children were similar in those breast feeding (33.9 $\pm$ 5.0ng/ml) and not breastfeeding (34.7 $\pm$ 6.3ng/ml). The solid diet mostly consisted of vegetables, fruits, washed white rice, and some animal protein when available. Fortification of all rice sold in PNG is a legal requirement. Cooking practices most often involved washing the white rice before cooking - a practice that results in significant loss of the fortificants in white rice, which include thiamine. None of the mothers practiced changing of rice water during the rice-cooking process.

The family's consumption of different foods on a typical day and the thiamine levels of the children regardless of their nutritional status are shown in Table 2. The serum thiamine levels are similar. Thiamine levels are within the normal reference range regardless of diet.

Table 2: Mean serum thiamine levels in children from families that consumed and those that did not consume food items listed on a typical day

Food Items	Consumed		Not Consumed	
	N = 158			
	N (%)	Thiamine (ng/ml)	N (%)	Thiamine (ng/ml)
Fruits	110 (69.6)	34.10	48 (30.4)	34.02
Vegetables	131 (82.9)	33.88	27 (17.1)	35.03
Unwashed rice	102 (64.6)	33.71	56 (35.4)	34.76
Washed rice	31 (19.6)	34.05	127 (80.4)	34.09
Brown rice	3 (1.9)	32.42	155 (98.1)	34.11
Meat	14 (8.9)	35.23	144 (91.1)	33.97
Fish	48 (30.4)	33.86	110 (69.6)	34.18
Eggs	89 (56.3)	34.07	69 (43.7)	34.09
Biscuits	118 (74.7)	33.86	40 (25.3)	34.13
Processed snacks	54 (34.2)	33.65	104 (65.8)	34.30

Most of the mothers (95%, n=150) in this study chewed betelnut on a daily basis some up to or more than 5 betel nuts in a day. A large proportion of these mothers drink 1-2 cups of strong tea or coffee in a day (95%, n=150). In our sample, there were no significant effects of these consumption practices in mothers on thiamine levels in their children; however the comparator samples were small.

None of the children had clinical signs of beriberi or thiamine deficiency on admission.

DISCUSSION:

Several thiamine reference ranges have been published [7-9], with different metrics and measurement methods – including erythrocyte transketolase pyrophosphate effect, erythrocyte thiamine diphosphate concentrations, and whole blood thiamine level. Our study found the mean (SD) serum thiamine level in the 158 children was 34.18 (5.8) ng/ml (minimum 20.1, maximum 49.3). This was within the reference range for whole blood thiamine levels used in the Brazilian study using a high-performance liquid chromatography (HPLC) assay on whole blood: 16–48 ng/mL [9].

In our population sampled there was no difference in serum thiamine levels between well-nourished and severely malnourished children and all levels found were within the normal range. However, it is important to understand a major limitation of our study - that we measured the levels of thiamine detected by an ELISA assay on serum. This is not the ideal assay method and has a poor sensitivity [14 - 16]. Less than 10% of whole blood thiamine is contained in plasma [14 - 16] and plasma thiamine concentration reflects recent intake

rather than body stores. Whole blood thiamine assay method is more accurate, as 90% of thiamine in the body is in the form of thiamine diphosphate (TDP) in red blood cells. This is ideally measured by HPLC, which is expensive and was not readily available [14].

To our knowledge, there have been no other studies of thiamine levels in serum using ELISA. In studies from Jamaica reporting subclinical thiamine deficiency in 7% of normal children and 37% of malnourished children and from Ghana which reported thiamine deficiency in 40% of malnourished children, the erythrocyte transketolase assay was used [6,7]. A Brazilian study using HPLC to measure whole-blood thiamine concentrations in children admitted to an intensive care unit found no association of low thiamine levels with malnutrition [9]. There was however an association with levels of C-reactive protein, an inflammatory marker. An ultra-HPLC assay was used to measure thiamine levels in red cells in the Cambodian study which reported low thiamine levels in 38% of malnourished children aged between 6-12 months [8]. Accurate measurement of thiamine levels is clearly difficult and it is perhaps not surprising that there is a scarcity of literature on the subject. Thiamine deficiency is generally diagnosed based on the classical clinical findings but the relation of subclinical thiamine levels to the morbidity and mortality associated with malnutrition remains unclear.

Betel nut, strong tea and coffee are known to contain thiaminase with the potential to lower thiamine levels [17]. Betel nut chewing is a common social habit in PNG. Our study was not designed to examine the effect of these thiaminase containing substances on the levels of thiamine in breast milk and the children of breast feeding mothers.

Whilst acknowledging that the method used for measurement of thiamine levels was not ideal, none of the children exhibited clinical signs of thiamine deficiency. It is known that increased intestinal reabsorption of thiamine takes place under deficient conditions [18]. This mechanism may be operating in our study population. It is also possible that the diet in this predominantly urban population provides adequate amounts of thiamine. However, in the only other study of thiamine levels in the PNG population, 6.4% of boarding school students had marginal to severe deficiency detected with HPLC measurement of thiamine pyrophosphate in whole blood [10].

CONCLUSION:

Our study which used an ELISA assay for measuring thiamine levels in serum did not show a difference in levels between normally nourished and severely malnourished children. This was unexpected, and since thiamine deficiency has both subclinical and clinical adverse effects and is easily treatable, further

studies using different methodology are indicated.

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THE RELATIONSHIP BETWEEN PSYCHOLOGICAL DISTRESS AND SELF-ESTEEM AMONG NURSING MOTHERS ATTENDING IMMUNIZATION CLINIC OF A TERTIARY HOSPITAL IN NIGERIA

Running title: Psychological Distress and Self-Esteem among Nursing Mothers.

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ABSTRACT:
Psychological distress is a state of emotional suffering characterized by symptoms of depression and anxiety. There is an association between maternal psychological distress and reduced caregiving behavior. Reduced maternal care to babies is also associated with the low self-esteem of the mothers. The study assesses the prevalence of psychological distress and its relationship with self-esteem among nursing mothers attending the immunization clinic in Ekiti State University Teaching Hospital Ado-Ekiti. This is a descriptive cross-sectional study with 458 nursing mothers recruited. A pretested, adapted, structured interviewer-administered questionnaire was used; data were analyzed using SPSS version 25. Descriptive statistics and inferential statistics were done using the Chi-square and the Spearman correlation coefficient. The level of significance was set at $p < 0.05$. The mean age of the respondents was 31.7±4.8 years, 398 (86.9%) had tertiary education, 440 (96.0%) were married and 15 (3.3%) were single mothers. Sixty-seven (14.6%), 28 (6.1%), and 24 (5.2%) had mild, moderate, and severe psychological disorders, respectively. Those with low and high self-esteem were 222 (48.5%) and 236 (51.5%) respectively. There was a statistically significant relationship between psychological distress and self-esteem with about 29.6% of the variability in psychological distress being explained by self-esteem alone in the nursing mothers ($p< 0.01$). Stress of child nursing leads to psychological distress for some nursing mothers and this was significantly associated with self-esteem.

Keywords: Stress; Psychological distress; Self-esteem; Nursing mothers; Ekiti State

INTRODUCTION:

The birth of a child and becoming a mother are wonderful and exciting experiences that most females look forward to. However, for nursing mothers, these come with a lot of responsibilities, challenges, and stress as they require the acquisition of skills and knowledge by the mothers to transit successfully [1-3]. Some women can go through this transition successfully especially, where there is social support like surrogate parenting by grandmothers. This was common in African settings and it reduces the stress of child-rearing for the mothers [4]. However this trend of having extended family as social support is changing and the responsibility of the mothers are more [4]. The enormous task of becoming a mother can lead to psychological distress after delivery, consequently, affecting their mental health status and their maternal roles leading to being psychologically distressed [1, 5].

Psychological distress is a state of emotional suffering characterized by symptoms of depression and anxiety [5]. It differs from organic mental disorders, in the sense that it is a reactive disorder affected by external stressors which are more prevalent among women [6]. Psychological distress is determined by the level of stress perceived and by the individual ability to cope with exposure to stressful situations. Individual coping ability differs, some cope better because of previous experiences and/or skills acquired in the past [7]. Psychological distress symptoms include fatigue, restlessness, apathy, changes in sleep, difficulty concentrating [5]. The nursing mothers present in the clinics with these symptoms and other co-morbidity, so most times if not all the times the mental health status go unrecognized, undiagnosed, and untreated[1,8]. For any woman to transit this period successfully, her psychological state is important, and this is enhanced by her self-esteem [4].This untreated malady leads to a poor outcome for mothers and their babies [1].

A study in Brazil revealed that about a quarter (24.4%) of the nursing mothers has a common mental disorder, and this negatively affects childcare and feeding practice [10]. Some women said they produced insufficient milk or they didn't feel like breastfeeding when they were going through stressful situations as documented in a qualitative study done by Emerson JA et al in Congo [11].

Several studies have indicated a link between maternal psychological distress and reduced caregiving behavior. For example, studies from Ghana, and Côte d'Ivoire showed a higher incidence of febrile illness in infants [12], poor infant growth and cognitive development [13], and lack of attachment between mother and child [5]. It is documented in the literature that mothers with depressive symptoms stopped exclusive breastfeeding earlier compared to

their counterparts [14, 15] or stop breastfeeding completely. Their children were less likely to have up-to-date immunizations [16]. Babies that were exclusively breastfed for less than 6 months are prone to developing psychological disorder later in life [9, 17, 18].

There is an inverse relationship between psychological distress and self-confidence in mother. In other word, mothers with high psychological distress tend to have low self-confidence [4]. Psychological distress experienced by mothers while nursing can affect their sense of adequacy to cope with the stress of maternal role thereby leading to low self-esteem [2].

Branden defined self-esteem as the disposition to experience oneself as competent to cope with the basic challenges of life and as worthy of happiness [19]. Self-esteem is a combination of self-confidence and self-worth. People with a lack of skills or knowledge to cope with stressful events are likely to experience negative self-perception and subsequently low self-esteem [19]. It has been documented elsewhere that mothers with high self-confidence are less likely to have psychological distress [2]. There is a dearth of literature in Nigeria on the prevalence of psychological distress among nursing mothers, probably because mental health status is not part of the periodic evaluation in the clinics. The mental health status of mothers is not part of the routine evaluation in our ante-natal, post-partum, and immunization clinics. Neither do we check mental health status when they report in the out-patient clinics with other co-morbidity. It is important to know the prevalence of psychological distress among nursing mothers and how it can be managed. However, there is a need to determine how self-esteem affect psychological distress among nursing mothers also. Hence the objectives of this study were to assess the prevalence of psychological distress among nursing mothers in the immunization clinic and the relationship between psychological distress and self-esteem.

METHODOLOGY:

Study location

This study was carried out in the immunization clinic of the Ekiti State University Teaching Hospital (EKSUTH), Ado-Ekiti, and the capital of Ekiti State, Nigeria. EKSUTH is a referral center for the primary and secondary facilities within Ekiti and other neighboring states. The clinic offers a full range of immunization for infants and other age groups. This study was conducted from July 2020 to September 2020. Ado-Ekiti has a population of 480,000 [20]. The population of the caregiver of infants in Ado-Ekiti was estimated to be 19,200, which is about 4.0% of the Ado-Ekiti population. The immunization clinic runs every day of the week and an average of 120 clients are seen weekly.

Study design and sampling:

This was a descriptive cross-sectional study. The study population consisted of nursing

mothers attending the immunization clinic. The purpose of the study was explained to the nursing mothers. Those nursing mothers that agreed to participate were recruited. Convenience sampling method was used to select each of the consented nursing mothers that attended immunization clinic with a child between the ages of 0 to 18 months. The mothers with acutely ill children were excluded from the study.

Sample size and data collection:

A total sample size of 458 was obtained using the Fishers formula [21] with a prevalence of 48% for psychological distress among nursing mothers obtained from a previous study[22], confidence interval of 95%, and the margin of error of 0.05 with a non-response rate of 10%.

A pretested, structured interviewer-administered questionnaire was used. The questionnaire was adapted from previous literature [23, 24, 25] and consists of three sections: socio-demographic characteristics, psychological distress, and self-esteem. The questionnaire was administered by three trained Resident Doctors in the Department of Community Medicine. Kessler Psychological Distress Scale (K10) [23] was used to measure psychological distress while Rosenberg Self-esteem Scale (SES) [24] was used to measure the self-esteem of the participants.

Kessler Psychological Distress Scale (K10): This is a 10-item questionnaire intended to yield a measure of distress based on questions about anxiety and depressive symptoms that a person has experienced in the most recent 4 weeks period.[23] This is a self-report measure of assessing distress. All items were answered using a 5-point Likert scale: none of the time (1 point), a little of the time (2 points), some of the time (3 points), most of the time (4 points), all of the time (5 points). Scores ranged from 10 to 50. Participants who scored under 20 were well, score 20-24 had a mild mental disorder, score 25-29 had moderate mental disorder while a score of 30 and over had a severe mental disorder. K10 has been used in Nigeria in a study in the East by Onyechi with internal reliability consistency of 0.93 with Cronbach alpha [23]. Rosenberg Self-esteem Scale: This is a 10-item scale that measures global self-worth by measuring both positive and negative feelings about the self. All items were answered using a 4-point Likert scale format ranging from strongly agree to strongly disagree. The scores were as follows: “Strongly disagrees” 1 point, “Disagree” 2 points, “Agree” 3 points, and “Strongly agree” 4 points. The highest possible score was 40 points and the lowest 10 points. Scores were on a continuous scale and higher scores indicated higher self-esteem. For this study, those with scores equal to the mean and above were classified as high self-esteem and those with scores below the mean were classified as low self-esteem. The scale has a reported reproducibility coefficient of 0.92 and a test-retest correlation of 0.85 over two weeks.

Okwaraji reported the Cronbach alpha scale in their study in Nigeria to be 0.84 and the two-week test-retest reliability coefficient was 0.76 [24].

Data analysis and ethical approval:

Data were analyzed using SPSS version 25. Descriptive statistics such as mean, and frequency were done. Inferential statistics were carried out using a Chi-square by finding the association between socio-demographic characteristics and psychological distress. Chi-square was also used to determine the association between categories of psychological distress and self-esteem. The correlation between psychological distress and self-esteem was done using the Spearman correlation analysis. The level of significance was set at 0.05

Ethical approval (protocol number EKSUTH/A67/2020/09/001) was obtained from the Research Ethics Committee of the Ekiti State University Teaching Hospital. Informed consent of the participants was received before recruiting participants.

RESULTS:

General characteristics: The results for the socio-demographic characteristics of the respondents are presented in Table 1. Majority of the respondents 283 (61.8%) were in the age range 30 to 39 years with a mean age of 31.7±4.8, 398 (86.9%) had tertiary education and 417 (91.0%) were Christians. The dominant ethnic group among the respondents was the Yoruba 412 (90%) and 234 (53.1%) were self-employed.

The results obtained for the Obstetric characteristics of the respondents are presented in Table 2. Of the 458 respondents 173 (37.8%) were primiparous and 372 (81.2%) of them planned their pregnancy. Most of the respondents 299 (65.3%) delivered via spontaneous vagina delivery (SVD) and most of the delivery 352 (76.8%) took place in a government-owned hospital. Most of the respondents 358 (78.2%) had someone (either relative or friend) to assist them during the early puerperium stage.

Psychological Distress and Self-esteem of the Respondents:

The majority of the respondents 339 (74%) had normal psychological assessment, while 67 (14.6%) had a mild psychological disorder, while 28 (6.1%) and 24 (5.3%) had a moderate and severe psychological disorder, respectively (Table 3). The mean for the self-esteem of the respondents was 32.3±3.7, 222 (48.5%) had low self-esteem and 236 (51.5%) had high self-esteem.

Table 1: Socio-demographic Characteristics of the Respondents

Variables	Frequency (%)
Age ranges of mothers (n = 458)	
20 - 29 years	146 (31.9)
30 - 39 years	283 (61.8)
40-49 years	29 (6.3)
Mean age	31.7±4.8
Educational Status (n = 458)	
None	11 (2.4)
Primary	4 (0.9)
Secondary	45 (9.8)
Tertiary	398 (86.9)
Religion (n = 458)	
Christianity	417 (91.0)
Islam	37 (8.1)
Others	4 (0.9)
Ethnicity (n = 458)	
Yoruba	412 (90.0)
Igbo	29 (6.3)
Hausa	6 (1.3)
Others	11 (2.4)
Employment Status (n = 449)	
Self employed	234 (53.1)
Privately employed	70 (15.3)
Government employed	94 (20.5)
Unemployed	51 (11.1)
Marital Status (n = 458)	
Married	440 (96.0)
Single	15 (3.3)
Divorced	3 (0.7)

Table 2: Obstetric Characteristics s of the Respondents

Variables	N (%)
Parity (n = 455)	
1	173 (37.8)
2 – 3	246 (54.3)
4 and above	36 (7.9)
Planned pregnancy (n = 458)	
Yes	372 (81.2)
No	86 (18.8)
Mode of Delivery (n = 458)	
SVD	299 (65.3)
C/S	159 (34.7)
Place of Delivery (n = 458)	
Government Hospital	352 (76.8)
Private Hospital	66 (14.4)
Mission Home	31(6.8)
At Home	9 (2.0)
Assistant from Relatives (n = 458)	
Yes	358 (78.2)
No	100 (21.8)

Table 3: Levels of Psychological Distress of the Respondents

Measure of Distress (n = 458)	Frequency (%)
Normal	339 (74)
Mild Mental Disorder	67 (14.6)
Moderate Mental Disorder	28 (6.1)
Severe Mental Disorder	24 (5.3)

Socio-demographic characteristics associated with psychological distress among the Respondents:

As shown in Table 4, age and marital status were a significant association with the psychological distress of the mothers in this study. Looking at the age, the respondents in the age group 20-29 years, 12 (8.2%) of them had severe psychological distress while 12 (4.2%) in the age group 30 -39 years had severe psychological distress with (p=0.02). Equally, the result showed that 13.5% of the single mothers have severe psychological distress while 5% of the married mother had severe psychological distress with a p-value of 0.04, however the magnitude of the single mother in was quite small.

The results presented in Table 5 indicated statistically significant relationship between the psychological distress and self-esteem with p-value of 0.002. The higher the psychological distress the lower the self-esteem of the nursing mothers, with 18 (75.0%) of those with severe psychological distress having low self-esteem, and 32 (47.8%) of those with mild psychological distress with low self-esteem.

Correlation between Psychological distress and Self-esteem:

There was a weak negative correlation between psychological distress and self-esteem ($r_s = -0.17$). Furthermore, there was a statistically significant negative correlation between psychological distress and self-esteem with 29.6% of the variability in psychological distress being explained by self-esteem alone in the nursing mothers with $p < 0.01$ as shown in table 5.

Table 4: Socio-demographic characteristics associated with psychological distress among the Respondents.

Variables	Normal	Mild	Moderate	Severe	χ 2	p-value
Age						
20-29 years	98 (67.1)	26 (17.8)	10 (6.8)	12 (8.2)	**5.905***	**0.015**
30-39 years	218 (77.0)	37 (13.1)	16 (5.7)	12 (4.2)		
40-49 years	23 (79.3)	4 (13.8)	2 (6.9)	0		
Ethnicity						
Yoruba	303 (73.5)	64 (15.5)	23 (5.6)	22 (5.3)	11.788*	0.23
Igbo	23 (79.3)	1 (3.4)	4 (13.8)	1 (3.4)		
Hausa	3 (50.0)	1 (16.7)	1 (16.7)	1 (16.7)		
Others	10 (90.9)	1 (9.1)	0	0		
Education						
None	8 (72.7)	0	1 (9.1)	2 (18.2)	15.287*	0.226
Primary	4 (0.9)	0	0	0		
Secondary	30 (66.7)	7 (15.6)	6 (13.3)	2 (4.4)		
Tertiary	297 (74.6)	60 (15.1)	21 (5.3)	20 (5.0)	11.503	0.243
Employment						
Self employed	187 (77.0)	31 (12.8)	16 (6.6)	9 (3.7)	6.323	0.710
Private	48 (68.6)	12 (17.1)	5 (7.1)	5 (7.1)		
Government	70 (74.5)	15 (16.0)	4 (4.3)	5 (5.3)		
Unemployed	34 (66.7)	9 (17.6)	3 (5.9)	5 (9.8)		
Marital Status						
Single	10 (66.7)	3 (20.0)	0	2 (13.3)	**13.151***	**0.041**
Married	329 (74.8)	62 (14.1)	27 (6.1)	22 (5.0)		
Divorce	0	2 (66.7)	1 (33.3)	0		
Religion						
Christianity	309 (74.1)	58 (13.9)	25 (6.2)	24 (5.8)	11.215*	0.082
Islam	29 (78.4)	7 (18.9)	1 (2.7)	0		
Others	1 (25.0)	2 (50.0)	1 (25.0)	0		

Likelihood ratio *

Table 5: Relationship between Psychological distress and Self-esteem among the Respondents

Psychological Distress	Self-esteem		Chi-Square	p-value
	Low	**High**		
Normal	152 (44.8%)	187 (55.2%)	14.476	0.002
Mild	32 (47.8%)	35 (52.2%)		
Moderate	20 (71.4%)	8 (28.6%)		
Severe	18 (75.0%)	6 (25.0%)		

Correlation between Self-esteem and Psychological Distress

R(%)	rs	p-value
29.6	-0.17	0.01

r = Spearman's correlation coefficient, R or r2 = Coefficient of determination

DISCUSSION:

In this study, 26% of the nursing mothers had some degree of psychological distress, ranging from mild to severe. These findings corroborate with other studies that have been done on nursing mothers which reveal significant psychological distress [26-28]. This may have occurred because childbirth usually brings about important life changes and challenges among nursing mothers, hence exposing them to experience psychological distress [29]. However, increased maternal distress has been linked to poor supportive maternal behaviour, making it difficult for mothers to recognize infant cues [30]; and it has been observed that supportive maternal behaviour is essential and sensitive to the infant's physical and emotional needs[31]. This suggests that a nursing mother with severe psychological distress may find it difficult to exhibit maternal behaviour that will be beneficial to the infants being nursed by her, which will, in turn, affects the infant's health physically and psychologically.

From this study, there is no significant statistical association between the demographic factors and psychological distress except with age and marital status. Looking at the age range, the respondents within 20-29 years are more likely to have psychological distress compared to other age groups (p=0.015). This finding agrees with some studies that age can determine or serves as a risk factor of one's level of psychological distress [32, 33]. This shows that the older the nursing mothers are the better the self-efficacy in taking care of their babies and the more psychologically sound they are. This most likely might be that the Nursing Mothers with an increase in age gain experience which impacts their ability to cope with their role as nursing mothers and their self-esteem. This study also collaborates with this, in that, with an increase in self-esteem the psychological distress decreases because three out of ten decreases in psychological distress can be explained by self-esteem. However, in another study, contrary to the findings of this study, higher maternal age may increase the risk of psychological distress [34]. So, age differences are factors to watch for when considering the mental health status of nursing mothers.

The proportion of psychological distress among the single nursing mothers was more in this study compared to the married nursing mothers, although the magnitude of single nursing mothers was quite small. This finding is similar to the study by Babatunde T et al in a work among immigrant women in South-East London [25]. This is likely because the infant's father is not available to support emotionally, financially, and physically. Furthermore, a similar study by Gondwe et al suggested that lower psychological distress among married mothers might be related to presence of support from the father or partner [35]

To address psychological distress, the coping skills of an individual have been recognized as a good strategy. Coping with stress is essential

for human survival. It involves the process of managing external or internal demands that are perceived as taxing on personal capacities and resources [36]. In addition, good self-esteem has been recognized as a coping strategy to managing stress or distress. This study has shown an inverse relationship which suggests that with an increase in the self-esteem of the respondents, the psychological distress decreases. A nursing mother who has good coping skills, for example, high self-esteem stands the chance of having a better mental health status than a nursing mother with low self-esteem.

Conclusion: Psychological distress and low self-esteem tended to occur among nursing mothers, they are associated with several public health concern. Nursing mothers of younger age and being a single mother were found to be significantly associated with psychological distress. This study also found that there is a link between psychological distress and self-esteem. Those with high self-esteem may likely pull through the stressful period without having psychological distress.

Recommendation: Identified risk factors for psychological distress among nursing mothers can be targeted for early intervention. Healthcare practitioners attending to nursing mothers should pay attention to their self-esteem. Building social skills, self-esteem of nursing mothers will go a long way to lessen their psychological burden or distress.

Public health relevance: The implication of the psychological stress among nursing mother includes: It reduce the maternal mental health status; If not pick early, it can be severe with other serious complication; it can affect the work and invariably the income; it can affect the care of the child (child growth and development) [10, 37, 38].

Limitation of the study: The study was limited in some analysis by the relatively few numbers of mothers in some sub-groups (single and divorce mothers). However this limitation was accommodated in the analysis.

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QUALITY OF CLINICAL GUIDELINES FOR TYPE 2 DIABETES MELLITUS FROM KENYA, ZIMBABWE, TANZANIA AND NEPAL

Running Title: Quality of Type 2 diabetes guidelines

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ABSTRCT:
The objective of this study was to describe and compare the quality of clinical guidelines for Type 2 diabetes mellitus (T2D) from Kenya, Zimbabwe, Tanzania and Nepal. Alumni from "peoples-uni" were invited to review and evaluate T2D clinical management guidelines used in their settings. The "Appraisal of Guidelines for REsearch & Evaluation II" (AGREE II) instrument was used to evaluate the guidelines. Each guideline was randomly allocated to three assessors, who evaluated the guidelines separately and allocated scores for items on the AGREE II tool. The guidelines from Zimbabwe and Kenya scored generally better than the Tanzania and Nepal guidelines. The main areas that needed the most improvement across all the guidelines were rigour of development (41%), applicability (40%) and editorial independence (35%). There is a need to improve several aspects of T2D clinical guidelines, which is a useful starting point to improve management of these patients.

Keywords: Appraisal; Developing Countries; Diabetes mellitus; Disease Management; Guidelines

INTRODUCTION:

Diabetes and its complications have become an epidemic in the developing world. In Africa, there will be a significant impact, with a high risk of premature mortality among thousands of Africans due to diabetes [1]. Some epidemiologists predict the economic impact and death toll from diabetes will surpass that of HIV infections and AIDS in the near future [1].

A systematic review of the economic impact on household expenditures showed that in low- and middle-income countries (LMIC), 6 -11% of the total population would be impoverished if they had to purchase the lowest price generic diabetes medication [2]. This is likely an underestimate due to economic domains such as coping strategies and the exclusion of marginalized or vulnerable people who do not seek medical attention. Thus, diabetes is likely to have a significant global impact on households and impoverishment in all continents and levels of income [2].

The Diabcare Africa project spanning across six sub-Saharan African countries found that among 2352 type 2 diabetes (T2D) patients treated at specialist clinics, half the patients received standard care with only one-third achieving appropriate glycaemic control. This was attributed to access to, rather than quality of care [3]. A more recent study of T2D patients from Nigeria, Ghana and Kenya found a high burden of comorbidities, with 71% having hypertension, 34% with hyperlipidaemia and 27% obesity; as well as complications, with 32% cataracts, 15% diabetic retinopathy, 13% nephropathy and 35% with erectile dysfunction [4]. This reinforces the urgent need for public health strategies prioritising prevention and early detection of T2D; as well as strengthening health care systems to treat diabetes and its complications.

In LMICs, the main challenges to manage T2D include inadequate financial and human resources in health systems, underdeveloped service delivery models and information systems, and a need to improve the evidence-base around clinical management [5]. The availability of quality management guidelines will help to raise the standards of care provided to T2D patients. Clinical practice guidelines are systematically developed statements to assist clinicians and patients decide on appropriate healthcare for specific clinical circumstances. This includes recommendations intended to optimise patient care informed by systematic review of available evidence and an assessment of benefits and harms of alternative care options [6,7].

In this paper, we describe and compare the quality of clinical guidelines for T2D from Kenya, Zimbabwe, Tanzania and Nepal and provide recommendations to improve this aspect of T2D management.

METHODOLOGY:

Peoples-uni (People's Open Access Education Initiative) provides postgraduate level online courses to help build public health capacity in LMICs. Graduates are invited to join an online alumni group to collaborate on research and developing public health systems in their countries [8].

Peoples-uni alumni were invited to review and evaluate T2D clinical management guidelines used in their settings. The Appraisal of Guidelines for REsearch & Evaluation II (AGREE II) instrument was used to evaluate the guidelines. This consists of a 23-item tool, with six quality-related domains, which includes scope and purpose, stakeholder involvement, rigour of development, clarity of presentation, applicability and editorial independence [9,10].

Graduates that participated in the project had facilitated online discussions, including a one-hour interactive session on the use of the AGREE II instrument. This involved pre-reading material about the AGREE II instrument prior to the session, followed by guided examples of rating each component during the session. Each guideline was randomly allocated to three assessors, who then evaluated the guidelines separately using the online version of the AGREE II tool.

RESULTS:

Four guidelines (from Kenya, Zimbabwe, Tanzania and Nepal) were assessed [11-14]. The scores for each of the 23-items in the six domains are shown in Table 1.

There was generally a consensus for rating scores between at least two of the assessors for all domains; with two assessors (C and D) marking several domains with lower scores than their peers. The T2D guidelines from Zimbabwe and Kenya scored generally better than the Tanzania and Nepal guidelines. The main areas which needed the most improvement across all the guidelines were rigour of development (41%), applicability (40%) and editorial independence (35%). Clarity of presentation was the highest scoring domain (72.5%) on the AGREE II tool, followed by scope and purpose (58.5%). The overall total percentage scores for each domain of the AGREE II tool are shown in Table 2.

Table 1: Scores of the four T2D clinical guidelines using the AGREE II Instrument

	Origin of Guidelines:	Kenya			Zimbabwe			Tanzania			Nepal		
	Assessors (indicated by letters A-F):	A	B	C	D	E	F	A	B	D	E	F	C
Scope & Purpose	Objectives specifically described	6	6	7	1	6	7	5	6	3	3	2	1
	Health questions specifically described	7	5	4	2	6	7	5	4	3	7	7	1
	Population to apply guideline specifically described	7	5	2	3	7	7	5	5	3	6	7	3
Stakeholder Involvement	Development Group includes individuals from all relevant professional groups	7	5	6	5	7	7	4	4	2	3	2	2
	Views & preferences of target population sought	7	5	3	3	4	2	4	3	2	1	2	1
	Target users clearly defined	7	6	2	3	5	6	5	5	4	7	1	1
	Systematic methods used to search for evidence	2	5	2	1	5	6	3	3	4	7	4	3
Rigour of development	Criteria for selecting evidence clearly described	2	5	1	2	2	7	2	4	3	4	1	1
	Strengths and limitations of the body of evidence clearly described	2	2	1	2	1	5	1	4	1	7	1	2
	Methods for formulating recommendations clearly described	2	4	5	3	1	7	2	5	3	1	1	3
	Health benefits, side effects, and risks have been considered in formulating recommendations	5	6	5	3	7	7	5	6	5	7	6	5
	Explicit link between recommendations and supporting evidence	5	5	3	3	3	6	5	5	2	7	7	4
	Guideline externally reviewed by experts prior to publication	5	2	5	3	5	2	5	5	5	1	2	1
	Procedure for updating guideline provided	2	2	6	5	6	6	7	2	4	1	1	1
Clarity of presentation	Recommendations are specific and unambiguous	4	6	6	4	6	6	4	6	5	7	7	6
	Different options for management of the condition or health issue clearly presented	6	6	6	5	7	6	5	6	6	7	7	6
	Key recommendations are easily identifiable	4	6	6	4	7	7	4	6	4	7	7	5
Applicability	Guideline describes facilitators and barriers to application	4	4	2	3	7	6	3	4	3	4	2	1
	Guideline provides advice and/or tools how the recommendations can be put into practice	5	5	2	5	5	7	3	5	5	2	7	2
	Potential resource implications of applying recommendations have been considered	4	5	1	3	7	7	3	5	3	1	2	1
	Guideline presents monitoring and/or auditing criteria	1	5	1	3	5	2	1	3	3	1	6	1
Editorial Independence	Views of the funding body have not influenced the content of the guideline	5	6	3	3	3	7	4	3	4	1	7	2
	Competing interests of guideline development group members have been recorded and addressed	1	5	3	3	2	4	2	4	2	1	1	2
Overall Assessment		5	6	5	4	6	7	4	4	4	5	6	4

Table 2: Total percentage Scores for each of the domains on the AGREE II tool

	Kenya	Zimbabwe	Tanzania	Nepal	Mean
Scope and Purpose	74%	69%	56%	35%	58.5%
Stakeholder Involvement	72%	61%	44%	11%	47%
Rigour of Development	42%	51%	47%	24%	41%
Clarity of Presentation	76%	80%	69%	65%	72.5%
Applicability	38%	67%	40%	15%	40%
Editorial Independence	47%	44%	36%	13%	35%

The overall comments by the assessors for each guideline were as follows:

For Kenya: "the guidelines cover a wide area in the management of diabetes in Kenya. The technical aspects were strong. However, some information related to the guideline development process and stakeholders' involvement and scope were missing. The drafting process, methodology, criteria, use of external reviewers, recommendations and funding or conflicts of interests should have been described".

For Zimbabwe: "the guideline met the basic requirements for an internationally reputable standard. However, there needs to be further details regarding steps taken to arrive at their conclusions. There is room to review, revise and edit the contents to align with the AGREE II Plus appraisal tool".

For Tanzania: "the process of development should involve a wider range of stakeholders. Methodology, criteria, declarations of competing interests and providing clear recommendations with evidence can be improved".

For Nepal: "the guideline focused more on the technical and management aspects. The rationale, target group, use of guidelines, process involved, methods used, evidence and applicability were not described".

DISCUSSION:

There was some variability in the quality of T2D clinical guidelines between four LMICs (Kenya, Zimbabwe, Tanzania and Nepal), which may have implications on the management of T2D in these countries. The main areas for improvement were in terms of rigour of development, applicability and editorial independence, which was consistent with three other systematic reviews.

A systematic review of 17 T2D management guidelines found variation in quality when assessed using the AGREE II tool, with the highest scoring domain as clarity of presentation and the lowest being applicability (37%) and rigour of development (43%) [15]. These findings were similar for paediatric T2D guidelines with clarity of presentation being the highest scoring domain (72%) and rigour of development (45%) and editorial independence (45%) being the lowest scoring domains on the AGREE II tool [16]. A systematic review of 98 T2D guidelines from China also identified a need for improvement, particularly rigour of development (19.1%), applicability (18.1%) and editorial independence (0%) [17]. These aspects can be improved by using the AGREE II tool as a basis for developing guidelines to ensure the different domains are covered.

Limited involvement of patients was also identified, with these guidelines mainly focusing on the perspective of clinicians. A cross-sectional survey of 4071 hypertensive and

diabetic patients from Thailand found that despite a policy initiative to improve primary care using a Chronic Care Model, it did not necessarily satisfy the patient's perception on quality of chronic care [18]. Thus, their perspective as the main end-user and care recipient should be sought to improve outcomes.

Their opinions would also be valuable to ensure applicability to their settings and identifying barriers to implementation. A systematic review of T2D patients from sub-Saharan Africa found that patients rarely checked their glucose levels, had inadequate physical activity, were only moderately compliant to diet and medications and had poor knowledge regarding diabetes related complications [19]. These aspects all need to be improved on and should be considered in guideline development, as self-management is essential to reduce complications of T2D.

CONCLUSION:

Overall, the impact of diabetes is significant in sub-Saharan Africa, with unique challenges such as limited funding for non-communicable diseases, limited studies or guidelines specific to the population, limited access to medications, and inequity between rural and urban, as well as public and private sector health care [20].

Quality guidelines are a useful starting point to improve management of T2D patients. However, there is a need to improve several aspects of T2D clinical guidelines, particularly rigour of development, applicability and editorial independence.

Limitations:

The study assessed only the main national guidelines identified and/or used by the co-author from the respective country. Other guidelines related to T2D management, such as hospital or clinic specific guidelines from these countries were not evaluated.

Conflict of Interest:

The authors have no conflicts of interest to declare.

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FALL ASSESSMENT AUDIT IN OLDER PATIENTS WITH NECK OF FEMUR FRACTURES IN RIPAS HOSPITAL

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Short Running Title: Fall audit of hip fractures RIPAS Hospital

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ABSTRACT:
Hip fractures are a significant contributor to increased dependence, reduced quality of life and mortality in older adults. All patients with fragility fractures should be assessed for fall risk factors and managed to reduce future risk of falls and fractures. The aim of this study was to evaluate the quality of secondary fall prevention assessment in older patients admitted with neck of femur fractures in Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital. Patients aged 65 years old and older admitted with a neck of femur fracture from 1st January 2021 to 31st March 2021 in RIPAS Hospital were included. Electronic health records for these patients were reviewed for assessment of fall risk factors. Data was entered into Excel and analysed using descriptive statistics. There were 28 patients, with the majority (20; 71.4%) being female. Mean age was 89.4 years. Among the hip fractures, 24 (85.7%) received inpatient orthogeriatric medical input. Previous history of falls was documented in 15 (53.6%) patients, while 27 (96.4%) had the nature of falls documented. Orthostatic blood pressure was not assessed in 23 (82.1%) patients. There were 27 (96.4%) patients who received physiotherapy input, 25 (89.3%) patients received Occupational therapy input, and 20 (71.4%) patients had a home assessment done during the admission. Among the 25 (89.3%) patients not known to have a diagnosis of cognitive impairment prior to admission; 17 (68.0%) were screened via focused history taking regarding cognitive issues. All patients had their medications reviewed during admission for drugs associated with risk of falls. In conclusion, the main aspects to improve on were history taking of previous falls, evaluation for orthostatic hypotension and assessment for cognitive impairment. Other aspects related to standards of care for hip fracture patients such as fracture prevention should also be evaluated to improve outcomes.

Keywords: Elderly; Hip fracture; Orthogeriatrics; Osteoporosis; Rehabilitation

INTRODUCTION:

Hip fractures are a significant contributor to increased dependence and reduced quality of life in older adults [1,2]. In fact, hip fractures contribute the highest burden in terms of cost, morbidity and mortality compared to other types of fractures [3]. A recent projection done in 2018 showed that the number of hip fractures will increase from 1.1 million to more than 2.5 million in 2050 [4]. The cost of hip fracture will also correspondingly increase from 9.5 billion USD in 2018 to 15 billion USD in 2050 [4].

Primary and secondary prevention of hip fractures are important. According to British Orthopedic Association guidelines, all patients with a fragility fracture should be managed on an orthopaedic ward with routine input from an ortho-geriatric medical team and should be offered multidisciplinary assessment and intervention to prevent future falls [5]. It has been shown that the collaborated care provided by orthopedic surgeons and geriatricians in hip fracture patients are associated with better patient outcomes and the risk of future fractures reduced with interventions provided [6,7]. In order to improve patient outcomes after hip fractures, continuous audit should be performed based on standards provided in evidence-based guidelines.

Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital is a tertiary hospital in Brunei. Hip fractures are generally admitted to an Orthopaedic ward, with geriatrics consultations provided routinely twice a week to review fall and fracture risks. All hip fractures are automatically reviewed by the orthogeriatrics service and do not require referrals from the orthopaedics team. These patients are identified by screening orthopaedics wards through the electronic medical records, Brunei Healthcare Information and Management System (Bru-HIMS). After discharge from hospital, hip fracture patients are provided orthogeriatrics clinic follow-up appointments. In addition to falls, bone health and rehabilitation outcomes, hip fracture patients also receive cognitive assessment in this clinic if a history of cognitive impairment was identified during the admission.

This paper describes an audit performed on older patients who presented with neck of femur fractures in RIPAS Hospital to evaluate the standards of care provided in terms of fall assessments.

METHODOLOGY:

All older patients age 65 years and older admitted with neck of femur fractures from 1st January 2021 to 31st March 2021 were included. Data collection was done using a self-designed structured proforma (Appendix A), which included age, gender, pre-fall mobility baseline, history of falls, history of cognitive

impairment, orthostatic blood pressure, home assessment, occupational therapist and physiotherapist review, medication review and pre-discharge mobility. Data collected was analysed using Excel for descriptive statistics.

This audit assesses the following standards of hip fracture care:

- All hip fracture patients should be reviewed by the Orthopaedic-Geriatrics Liaison Service.
- All hip fracture patients should have documented history of previous falls in the past six months.
- All hip fracture patients should have documented the nature of falls.
- All hip fracture patients should have documented orthostatic blood pressure
- All hip fracture patients should have a review by occupational therapist (OT).
- All hip fracture patients should have a review of their home environment for fall risks.
- All hip fracture patients should have a review by physiotherapist (PT).
- All hip fracture patients should have an evaluation for cognitive impairment in hospital
- All hip fracture patients should have a medication review for drugs contributing to falls or osteoporosis.

RESULTS:

Demographics:

A total of 28 patients were included. The majority were female (20; 71.4%) with mean age of 89 years, ranging from 69 to 93 years. Figure 1 shows the distribution of the patients according to age categories.

The median duration of hospitalization was 22 days, ranging from 3 to 56 days. Twenty- four patients were able to mobilise with or without walking aids independently prior to the fall or hip fracture. Table 1 summarises the pre-fall mobility of the patients. None of the patients regained their baseline mobility on discharge. Three (10.7%) patients passed away during the admission.

Orthogeriatric input:

Twenty- four (85.7%) patients received orthogeriatric medical input during the admissions.

Two patients were admitted under renal ward due to the need for renal replacement therapy. A patient refused surgery and was discharged before being seen by the orthogeriatric medical team. One patient was reviewed by an on-call senior medical officer for acute medical issues in the orthopedics ward, but was missed by the geriatrics team.

Figure 1: Age category of patients (n = 28)

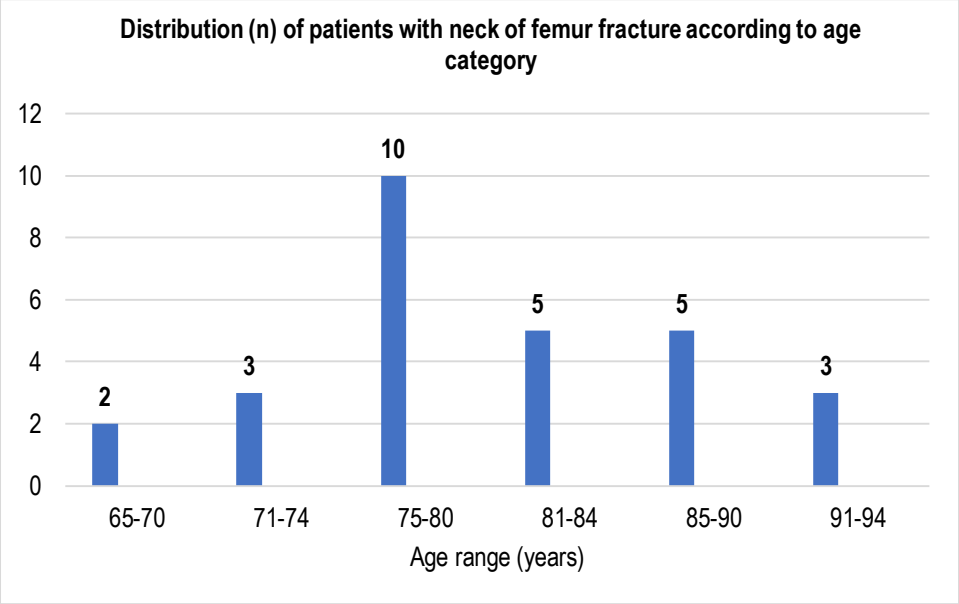

Table 1: Pre-fall mobility (n = 28)

Without walking aid	10 (35.7%)
With walking aid	14 (20.0%)
Wheelchair	3 (10.7%)
Bedbound	0
Not documented	1 (3.6%)

Documented history of falls over the past 6 months:

Fifteen (53.6%) patients had their previous history of falls being recorded in their medical notes. Of these, only four (26.7%) patients admitted to having another previous fall in the past 6 months. A patient with previous falls did not have the number of falls documented.

Documented nature of fall:

Twenty- seven patients (96.4%) had their nature of falls resulting in their hip fracture documented.

Documented orthostatic blood pressure:

Twenty-three (82.1%) patients did not have an orthostatic blood pressure documented in their

medical notes. Of these, eight (34.8%) patients were already hypotensive, which may explain why orthostatic blood pressure was not assessed.

Occupational therapist (OT) involvement:
Twenty-five (89.3%) patients were reviewed by an occupational therapist (OT) during the admission. One patient was seen as outpatient. Two patients did not receive OT input as they deteriorated in intensive care unit and passed away.

Home assessment:
Twenty (71.4%) patients had home assessments done by the occupational therapist during their admission. Two home visits were done as outpatient and another two home visits could not be carried out due to the distance of the patients' residence. Three patients passed away, thus home visits were not carried out. One patient was referred to an occupational therapist on the day of discharge. Environmental fall risk factors were only evaluated via feedback from the patient and family.

Physiotherapist (PT) involvement:
Twenty- seven (96.4%) patients received physiotherapy input during the admission. One patient did not receive physiotherapy input, as they were medically unstable (and subsequently passed away).

Cognitive assessment:
Twenty-five (89.3%) patients were not known to have cognitive disorders prior to the admission. Out of these, seventeen (68.0%) patients were being screened via a focused history regarding cognitive issues.

Medication review:
All patients had their medications reviewed during the admission. Two patients were on long- term sedatives (fall risk) and one patient was on long-term lamotrigine (osteoporosis risk).

DISCUSSION:
According to the British Orthopedic Association guidelines, all patients presenting with a fragility fracture should be managed on an orthopaedic ward with routine access to acute orthogeriatric medical support from the time of admission and should be offered multidisciplinary assessment and intervention to prevent future falls [5]. Studies have shown that patients with hip fractures had better outcomes when there was integrated care from orthopedics and geriatricians [6-8].
There are different types of orthogeriatric care models in different countries. Baroni et al. showed that patients under orthogeriatric co-management (OGC) had better outcomes compared to those under a geriatric consultant service (GCS) [9]. Patients in the OGC model received joint care from orthopedic surgeons and geriatricians daily from the time of

admission, while patients in the GCS model were mainly under the management of traumatologists, who referred to geriatricians according to the patients' condition, without a standard multidisciplinary treatment plan. Our local orthogeriatric service was initially closer to the GCS model, which then transitioned more towards the OGC model. However, due to the limited number of geriatricians, patients are reviewed twice weekly, and contacted as required on the remaining days of the week.

In terms of falls history, only 53.6% were asked about a history of previous falls over the past six months. While this is less than the findings from a national UK audit of inpatient falls [10], more than 95% of our patients had the nature of the fall resulting in the hip fracture documented. Previous history of falls is a strong risk factor for further falls, while knowing the nature of falls would assist in fall risk assessment and rehabilitation planning [11].

Although postural hypotension is a risk factor for falls in older adults, only a minority of our patients (17.9%) had orthostatic blood pressure checked. This was also found to be an area of potential improvement in the national UK audit, which found only 16% (in 2015) and 19% (in 2017) of patients had lying and standing blood pressure checked [10].

A majority of patients received care from OT (89.3%), PT (96.4%) and had a home assessment performed (71.4%). However, the timeframe for review was not included as a standard for our audit. According to the National Institute for Health and Care Excellence (NICE) guidelines, it is recommended that patients receive PT assessment and mobilise on the first postoperative day and then at least once daily [12]. This improves the prognosis of gaining pre-morbid mobility on discharge. Unfortunately, none of our patients in this audit regained baseline mobility.

An audit as part of UK National Hip Fracture Database Report in 2011 had early mobilization started from the day of surgery (25% of the patients) to the following day of surgery (100% of the patients). A prospective study also showed that inpatient OT and PT benefits patient outcomes upon discharge but did not help with recovery and risk of future falls after a month [13]. Thus, it is recommended that patients have continuous rehabilitation after discharge, with follow-up organized to assess their progress [14,15].

Nearly 70% of our patients had screening for cognitive impairment. According to NICE guidelines, patients should be assessed for cognitive impairment when presenting with a hip fracture [12]. Patients with Alzheimer's dementia have a higher risk of falls and sustain hip fractures [16]. A study from Norway showed that orthopaedic surgeons may also be able to identify chronic cognitive impairment [17]. It is also important to identify delirium, which is common following hip fractures. A potential area of improvement is screening for delirium, and applying objective measures of cognition,

such as cognitive testing during the orthopaedics admission. However, this is currently not done due to staffing restrictions, and the preference to put patients through detailed cognitive testing after recovery (in outpatient clinic settings). All our patients had medications reviewed during admission.

It would be beneficial to introduce a standardized checklist for fall risk assessment following hip fractures. This would help ensure all patients receive basic assessment for secondary fall prevention, which is a standard for hip fracture care. This would also assist and guide other specialties to perform the necessary assessments and / or interventions for patients with hip fractures.

Limitations:

The main limitation of this audit is the small number of patients. Data was also retrospectively collected from medical notes, which is limited by adequacy of documentation.

CONCLUSION:

Our audit showed that the main aspects to improve on were history taking of previous falls, evaluation for orthostatic hypotension and assessment for cognitive impairment. Other aspects related to standards of care for hip fracture patients such as fracture prevention should also be evaluated to improve outcomes.

Conflicts of Interest

The authors have no conflicts of interests to declare.

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Appendix I Audit:
Fall assessment in older patients with NOF fracture (Self-designed proforma)

1.	BN			
2.	Age / DOB			
3.	Gender	Male	Female	
4.	Pre-fall mobility	Without walking aid		
		With walking aid	If yes, what & how many	
		Bedbound		
5.	Length of stay			
6.	Previous history of fall in past 6 months documented	Yes, how many	No	Unavailable
7.	Nature of falls documented	Yes	No	Unavailable
8.	Postural BP documented	Yes	No	N/A
9.	Dstix documented	Yes	No	N/A
10.	OT assessment done	Yes	No	N/A
11.	PT assessment done	Yes	No	N/A
12.	Home visit done	Yes	No	N/A
13.	Cognitive assessment done	Previous hx of dementia	Not known previously, was it done?	Yes
				No
14.	Medications	Benzodiazepines	Stopped?	Yes
				No
		Sedatives	Stopped?	Yes
				No
		Antipsychotics	Stopped?	Yes
				No
		Antidepressants	Stopped?	Yes
				No
		CVS meds	Stopped?	Yes
				No
15.	Pre-discharge mobility	Back to baseline	Deteriorated	

RETROSPECTIVE ASSESSMENT OF THE PREVALENCE OF TUBERCULOSIS FINDINGS AMONG PAEDIATRIC PATIENTS REFERRED FOR COMPUTED TOMOGRAPHY SCAN AT PORT MORESBY GENERAL HOSPITAL, PAPUA NEW GUINEA

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ABSTRACT:
Tuberculosis (TB) is a major cause of death among all people worldwide. TB is prevalent in the developing countries resulting in deaths. Papua New Guinea (PNG) is a developing country that is greatly affected by TB, particularly paediatric TB. This study is a retrospective assessment of TB findings among paediatric patients referred for computed tomography (CT) scan at the Port Moresby General Hospital (PMGH) over a period of 24 months (January 2019 to December 2020). The case files of all the paediatric patients were collected from the CT register books after obtaining ethical clearance. The relevant information was recorded in Excel Spread sheet. The data was statistically analysed using Microsoft Excel 2013. A total of 234 TB findings were recorded. Of these, space occupying lesions (SOL) (71%) was the prevalent finding identified more frequently compared to tuberculoma (22.6%) and TB meningitis (TBM) (6.4%). The highest number of cases was among children in the 3 to 11 years' age group. We cannot conclude that SOL is the common TB findings in PNG currently, because no standardized data recording is available and CT data alone is not relevant as most paediatrics preferred non-ionising radiation.

Keywords: tuberculosis, tuberculoma, space occupying lesion, tuberculosis meningitis, paediatric, computed tomography, Papua New Guinea

INTRODUCTION:

Tuberculosis (TB) is a communicable disease that is one of the top 10 causes of death worldwide and the leading cause of death from a single infectious agent [1]. TB is caused by the bacillus *Mycobacterium tuberculosis*, which is spread when people who are sick with TB expel bacteria into the air; for example, by coughing [1]. The 2004 Priority Medicines Report stated that TB is a major and growing threat to public health for Europe and the world, with new epidemiological challenges [2]. In

2020, the World Health Organisation (WHO) estimated that 10.0 million of the world's population were infected with TB and an estimated 1.2 million deaths from TB occurred in the world with 87% of all cases in 22 countries, mainly in South-East Asia (44%), Africa (25%) and the Western Pacific (18%) [1]. In that year, children (aged <15 years) accounted for 12% of the population with TB cases. It is however important to note that TB is curable and preventable. About 85% of people who develop TB disease can be successfully treated with a 6-month drug regimen; treatment that has the additional benefit of curtailing onward transmission of infection [1]. However, non-compliance of the 6-month TB drug regimen may result in drug-resistant TB (DR-TB), which continues to be a global public health threat [1]. Although the global incidence rate of TB is falling, it is not fast enough to reach the 2020 milestone of a 20% reduction between 2015 and 2020 [1].

Incidence of TB in Papua New Guinea [PNG]:

At present, TB incidence has more impact on low-and-middle-income countries (LMICs) than high-income countries [2]. PNG, a LMIC, is located in the Western Pacific Region and is categorised as one of the areas in the world that have high incidence of TB [1]. A recent epidemiology study carried out in PNG involved analysis of TB cases and treatment outcomes using routine surveillance data from the national TB database for the period 2008-2016 [3]. The study reported that the case notification rate for all forms of TB in PNG was 333 per 100 000 of the population. Interestingly, the proportion of paediatric TB in PNG (26.7%) was found to be higher than other high-burden countries in the Western Pacific Region [3-5]. This proportion was higher than the global estimate of 12% of all TB cases [1], and the highest proportion of TB cases in children reported globally [6]. Paediatric TB remains a public health emergency and this is particularly evident in LMICs countries such as PNG with poor public health infrastructure [7].

Patterns of paediatric central nervous system TB:

The natural history of TB in children and paediatrics follows a series of 5 steps in which phase 1 occurs after an incubation period of 3-8 weeks after primary infection and phase 5 occurs up to 3 years after phase 1 [7]. After primary infection, the regional nodes enlarge and organisms escape into the blood stream [8]. Extrapulmonary TB or miliary TB is a complication of primary TB in young children which includes peripheral lymphadenopathy, TB meningitis, skeletal TB, and other organ involvement [7]. TB commonly affects the lungs and when not treated early, it may spread to other parts of the body, mainly the brain and the spinal cord which are referred to as central nervous system (CNS) TB. CNS TB occurs in

approximately 1% of all patients with active TB, and is the most lethal complication of TB in developing countries [9]. The four main patterns of CNS TB include: tuberculous meningitis (TBM); tuberculomas in brain and spinal cord (TBT); tubercular brain abscess (TBA); and tuberculous encephalopathy (TBE) [10]. TB of the CNS may present in 3 different ways including meningitis, encephalitis and as a space occupying lesion (SOL) [8]. The commonest cause of SOL in children in most tropical countries is tuberculoma (in up to 50% of cases) [8]. Tuberculoma is caused by mycobacterium TB (MTB) that results in a caseous mass encapsulated by multiple concentric layers of connective tissue without surrounding inflammation or spread [11-13]. Tuberculomas account for up to 40% of brain tumours in some areas of the world [11], while in developing countries, the incidence of tuberculoma varies from 5% to 30.5% of all intracranial SOLs [13]. Intracranial tuberculomas occur in 13% of children with neurotuberculosis [9]. TBM is the most fatal form of TB and the incidence varies from 1% to 5%, affecting mainly children under 5 years of age [14-15].

Paediatric Age Category and TB Diagnosis in Medical Imaging:

The WHO published pediatric-specific disease estimate for the first time in 2012 reported that approximately 500,000 cases of TB among children are younger than 15 years of age [16]. Children and young adults are categorised under paediatric. According to US Food and Drug Administration, paediatric patients are defined as aged up to 16 years only and are categorised into four different groups which include the following: (1) Neonates: age group 0 to 1 month; (2) Infants: age group 1 month to 2 years; (3) Children: age group 2 to 12 years; (4) Adolescents: age group 12 to 16 years [17]. Clinical assessment, laboratory testing and chest radiograph are used to confirm the diagnosis for TB [5]. In medical imaging, different modalities can be used to identify TB depending on its location. In the case of CNS TB, the two imaging modalities used are Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) [11].

TB remains a public health problem with lethal CNS complications in developing countries [14]. PNG is a developing country with a growing population of over seven million [18-20] and is considered to have a high prevalence of paediatric TB cases [3, 5-6]. In PNG, there are twenty-two provinces and the National Capital District (NCD) in four administrative regions. The rural areas of PNG comprise a higher population of 87.5%, whilst only 12.5% of the populations live in urban areas and about 400,000 people (4.5%) live in the capital Port Moresby [18-20].

There are no published studies on the prevalence of TB findings among pediatric patients and its diagnosis using CT scan in PNG.

The major objective of this study was to retrospectively assess TB findings among paediatric patients referred for CT scan at the PMGH over a period of 24 months (January 2019 to December 2020).

METHODOLOGY:

This was a descriptive study with convenience sampling conducted at PMGH Radiology Department [21-23]. The PMGH is the major public general, specialist and reference hospital in the National Capital District (NCD) and PNG offering level 7 medical services [23]. It is also the teaching hospital for the School of Medicine and Health Sciences (SMHS), University of Papua New Guinea (UPNG). The patients represent a cross-section of the NCD population and the Central Province [23].

Cases of paediatric patients with TB findings were collected retrospectively from the CT record book from January 2019 to December 2020. The variables collected were age, gender and findings associated with TB. The data were recorded in Microsoft (MS) Excel Spreadsheets.

Patients whose age ranged above 17 years and did not present with TB findings were excluded in this study. Patients' cases files that did not record the specific age and cases from other imaging modalities were also excluded from the study. A total of 278 TB findings were recorded. Of these, 44 (15.8%) cases were excluded from the study due to age above 17 years, did not present with TB findings, no recorded age and were diagnosed using other imaging modalities. Thus, a total of 234 cases were suitable for analysis. The data for the 234 cases was analysed statistically using the MS Excel Spreadsheets data pack version 2013.

Ethical approval for this study was granted by the School of Medicine and Health Science Research and Ethics Committee (SMHS REC). Written consent was granted by the Director of Medical Service at PMGH with the approval from the Head of Radiology Department.

Criteria for data analysis by paediatric age groups: Four categories of paediatric age groups were used in the present study [17]. Neonate: 0 to 1 month. Infant: 2 months to 2 years. Children: 3 to 11 years. Adolescence: 12 to 16 years.

RESULTS:

Over the duration of 24 months a total of 278 cases with TB findings were recorded in the CT record book in PMGH. However, because of the exclusion criteria in the present study only 234 (84.2%) TB findings were found suitable for analysis. Table 1 shows the distribution of all the paediatric patients according to gender

and age groups. In the present study, 137 males (58.5%) and 97 females (41.5%) were examined. The age range for all patients was from 2 months to 16 years.

The prevalence of TB findings was highest (68.4%) among those in the 3 to 11 years' age group. There was equal distribution of TB findings among those in the 12 to 16 years' age group and 2 months to 2 years' age group with 15.8% each. There was no recorded distribution of TB findings among neonates from birth to 1 month.

TB findings identified in paediatric patients:

Three common TB findings were recorded among the patients. Space occupying lesion (SOL) (71%) was the prevalent finding that was identified more frequently compared to the others. This was followed by tuberculoma (22.6%), and TB meningitis (TBM) (6.4%) was the very least finding identified among the 234 patients (Table 2).

TB findings according to age category:

In terms of the distribution of TB findings among different age groups, the results reveal that children had the highest distribution of SOL (71.7%), followed by infant (14.5%) and adolescence (13.9%). Tuberculoma was the second common finding among children (58.5%), followed by adolescence (24.5%) and infants (17%). TBM was common among children (73.3%) and infants (26.7%). There was no recorded distribution of TBM among the adolescence while neonates recorded no distribution of all three TB findings (Table 3).

TB findings of male versus female paediatric patients according to age categories and gender:

Table 4 shows the distribution of TB findings according to age category and gender. The results reveal that male children had the highest distribution of SOL (43.4%), TBM (60%) and tuberculoma (37.7%) compared to female at 28.3%, 13.3% and 20.8%, respectively. Among the infants, the percentage distribution of TBM (20%) and tuberculoma (13.2%) were higher among the female patients compared to male patients at 6.7% and 3.8%, respectively; while male patients have high percentage of SOL (9%) compared to female (5.4%). In adolescence, females have higher distribution of tuberculoma (15.1%) compared to males at 9.4%; while males have slight higher frequency of SOL (7.8%) compared to females (6%). There was no recorded distribution of TBM among both male and female patients in the adolescence category.

Table 1: % (n) distribution of all the paediatric patients according to gender and age groups.

Age groups	Males % (n = 137)	Females % (n = 97)	Total % (n = 234)
12 - 16 years	13.1 (18)	19.6 (19)	15.8 (37)
3 - 11 yeas	73.7 (101)	60.8 (59)	68.4 (160)
2 months - 2 years	13.1 (18)	19.6 (19)	15.8 (37)
0 - 1 month	0	0	0

Table 2: % (n = 234) distribution of TB findings among all the paediatric patients.

TB Findings	% (n)
Space occupying lesion (SOL)	71.0 (166)
TB Meningitis (TBM)	6.4 (15)
Tuberculoma	22.6 (53)

Table 3: % (n) distribution of TB findings according to age categories.

Age category	SOL (n = 166)	TBM (n = 15)	Tuberculoma (n = 53)
Adolescence (12 - 16 years)	13.9 (23)	0	24.5 (13)
Children (3 - 11 years)	71.7 (119)	73.3 (11)	58.5 (31)
Infant (2 months - 2 years)	14.5 (24)	26.7 (4)	17.0 (9)
Neonate (0 - 1 month)	0	0	0

Table 4: % (n) distribution of TB findings of male versus female paediatric patients according to age categories and gender.

Age category	Gender	SOL (n = 166)	TBM (n = 15)	Tuberculoma (n = 53)
Adolescence (12 - 16 years)	M	7.8 (13)	0 (0)	9.4 (5)
	F	6.0 (10)	0 (0)	15.1 (8)
Children (3 - 11 years)	M	43.4 (72)	60.0 (9)	37.7 (20)
	F	28.3 (47)	13.3 (2)	20.9 (11)
Infant (2 months - 2 years)	M	9.0 (15)	6.7 (1)	3.8 (2)
	F	5.4 (9)	20.0 (3)	13.2 (7)
Neonate (0 - 1 month)	M & F	0	0	0

DISCUSSION:

TB may affect male and female at the same rate or may affect them differently. More than half (58.5%) of all the paediatric patients with TB findings referred for CT scan in PMGH in the duration of this study were males.

Our findings are in contrast to a study by Al-Hussaini et al. who assessed the intracranial tuberculoma in different age and gender groups [24]. Their study involved cases of 291 pediatric patients (0-19 years of age) where they concluded that females were more likely to be affected in 2nd and 3rd decades of life, while males were more likely to be affected in later decades.

The present study however did not assess cases of paediatric patients above 17 years of age to predict their risk of survival from TB. In the present study, the prevalence of TB findings was highest (68.4%) among those in the 3 to 11 years' age group. This finding is consistent with evidence that among children, the greatest numbers of TB cases are seen in children less than 15 years of age [1-2, 16]. There was equal distribution of TB findings among those in the 12 to 16 years' age group and 2 months to 2 years' age group with 15.8% each in the present study.

This finding suggests that TB cases among paediatrics can be disaggregated by sex and age groups and may account for variations in incidence rates by age, sex and country [1].

TB findings identified in paediatric patients:

In the present study, space occupying lesion (SOL) (71%) was the prevalent finding that was identified more frequently compared to the others. This finding is consistent with a study done elsewhere [10] reporting that SOL associated with headache and seizures accounted for 60 to 100% of intracranial tuberculoma. This was followed by tuberculoma (22.6%), and TB meningitis (TBM) (6.4%) which was the least finding identified among the 234 patients in the present study. These findings are consistent with evidence that tuberculomas account for up to 40% of brain tumours in some areas of the world [11], while in developing countries, such as PNG, the incidence of tuberculoma varies from 5% to 30.5% of all intracranial SOLs [13]. Other similar evidence confirm that intracranial tuberculomas occur in 13% of children with neurotuberculosis [9], whilst TBM is the most fatal form of TB and the incidence varies from 1% to 5%, affecting mainly children under 5 years of age [10, 14-15]. The total number of tuberculoma cases recorded in the present study is 53 (22.6%), however this was not the actual number of cases that underwent CT examination over the duration of 24 months.

Magnetic resonance imaging (MRI) has been found to be superior to CT of the head for visualization of tuberculomas [25], however the

present study did not assess tuberculoma cases referred for MRI examination. It is well known that tuberculoma is associated with both SOL and TBM and is defined as SOL resulting from metastatic TB [10-11, 26]. This definition may imply that SOL can be used to represent tuberculoma. Therefore, the total number of tuberculoma cases in the present study may not be 53 (22.6%), however could take into account the total number of SOL (n=166, 71%) and TBM (n=15, 6.4%).

TB findings according to age category:

In terms of the distribution of TB findings among different age groups, the present study revealed that SOL is present in infants with a total of 14.5% cases and is increased to 71.7% in children and then decreases to 13.9% in adolescent. Like SOL, tuberculoma also followed the same trend. It had 17% cases in infants and then increased to 58.5% in children and later decreased to 24.5% in adolescent. TBM on the other hand, only increased in infants from 26.7% cases to 73.3% cases in children. In all three age groups, children have the highest number of all three TB findings, which suggest that tuberculoma mostly affects children [8-9] compared to those in the neonate, infant and adolescent groups. To confirm this finding, the mean age of the patients in the present study is 7 years and the median age is 6 years and mode is 6 years. This imply that the majority of paediatric cases were around 6 and 7 years of age which falls under the children category that consist of age ranging from 3-11 years old [17]. This finding aligns with WHO published pediatric-specific disease estimate reporting that approximately 500,000 cases of TB among children are younger than 15 years of age [16]. Further evidence confirms that where there is a greater number of TB, there is also an increase in tuberculoma cases [27]. This evidence is also revealed in the present study which shows a positive relationship; meaning tuberculoma increases and decreases with its associated indications (SOL and TBM). Another interesting finding in the present study revealed that neonates recorded no distribution of all three TB findings. This does not mean that neonates are not being affected by tuberculoma. This finding confirms the evidence that neonates normally undergo different imaging modality examination because of their increase risk of developing cancer [28]. Further evidence from the American Academy of Paediatrics (AAP), confirmed that CT increases the risk of cancer especially in new-borns because their brains are still developing, whilst unnecessary CT scan examination can lead to more tests and treatments with more risks [28].

TB findings according to age categories and gender:

The present study shows the distribution of TB findings according to age category and gender.

Overall, the ratio of a male to female is 1.4:1 which implies that the males were affected more than the females over the duration of 24 months. This finding differs with a study done by Al-Hussaini et al. [24] on the assessment of intracranial tuberculoma in different age groups and the method used for diagnosis. The same study was based on 291 cases where the result showed that the male and female were affected almost equally with a male to female ratio of 1:1.03. In contrast, the ratio of tuberculoma among male and female children in the present study is 1.8:1 which implies that male children were affected more with tuberculoma than the female children, while male adolescence and male infants were least affected with tuberculoma than their female counterparts with a ratio of 1:1.6 and 1:3.5, respectively.

Limitation of the study:

Since CT uses ionizing radiation, it is not recommended for neonates. This may influence the recorded cases of TB findings for neonates.

CONCLUSION:

The results of the present study revealed that SOL (71%) was the prevalent finding identified more frequently compared to tuberculoma (22.6%) and TBM (6.4%). Tuberculoma is associated with SOL and TBM. Overall, males were affected more than females with a ratio of 1.4:1 over the duration of 24 months. Male children were affected more with tuberculoma than the female children with a ratio of 1.8:1, while male adolescence and male infants were least affected with tuberculoma than their female counterparts with a ratio of 1:1.6 and 1:3.5, respectively. Among paediatrics, the most affected age group is children (3 to 11 years). We cannot conclude that SOL is the common TB findings in PNG currently, because no standardized data recording is available and CT data alone is not relevant as most paediatrics preferred non-ionising radiation.

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ANDROGENIC EFFECTS OF AQUEOUS SEED EXTRACT OF MORINGA OLEIFERA IN MALE WISTAR RATS

Running title: Androgenic effects of Moringa oleifera

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ABSTRACT:
Androgenic effects of Aqueous Seed-extract of Moringa oleifera (ASMO) in male Wistar rats were investigated. Eighteen (18) male Wistar rats weighing 200-240g were used for this study. The rats were divided into three (3) groups: Control (Group 1) that received 10 ml/kg of normal saline, Group 2: received low dose of ASMO (200mg/kg), and Group 3: received high dose of ASMO (500mg/kg). The animals were treated for twenty-eight days. On the 29th day, the rats were sacrificed and the testes were carefully removed for semen and biochemical analysis. Body weight, reproductive and vital organ weights were determined. Sperm parameters (motility, morphology, count and viability), tissue testosterone, luteinizing hormone (LH), Malondialdehyde (MDA) and Catalase were also determined using standard methods. Data were analysed using one-way ANOVA followed by Duncan new multiple range post hoc test. The result showed ASMO significantly increased ($p<0.05$) the final body weight, weight of reproductive and vital organs. Moreover, 200mg/kg body weight dose of ASMO significantly increased ($p<0.05$) the sperm parameters but 500mg/kg body weight dose significantly decreased it. ASMO also caused a significant dose dependent increase ($p<0.05$) in testosterone and catalase level but a significant decrease ($p<0.05$) in MDA and LH level compared with the control. In conclusion, this study revealed that ASMO has androgenic effects in male rats and thus provides a basis for the traditional use of Moringa oleifera in the management of male sexual disorders.

Keywords: Moringa oleifera, Testosterone, Malondialdehyde, Catalase, Sperm parameters

INTRODUCTION:

Every human being has a right to enjoy the highest attainable standard of physical and mental health. Infertility negates the realization of these crucial human rights. It affects about 46 million couples and about 186 million individuals worldwide [1-3]. The contribution of male factor in infertility is now considered as important as the female factor and in some cases account for almost 60% of all cases of infertility [4,5]. Globally, deficient testosterone and low sperm count are major causes of male factor infertility, contributing to the increased incidence of infertility [6,7]. Ageing, toxins, drugs, trauma, infections, ionizing radiation from chemotherapy, environmental stressors like hot weather, air pollution, interfere with androgenesis [8-11]. The need for clinical management of some of these conditions have resulted in the development of a number of available treatment options like Testosterone Replacement Therapy (TRT) [11], drugs like clomiphene, tamoxifen. Others include In vitro fertilisation (IVF) for oligospermia and surgery for hydroceles, varicoceles and vas deference obstruction [12]. Unfortunately, some of these options are quite expensive, not easily accessible and may not blend with the sociocultural life of some people. Some of them are also associated with adverse side effects such as, testicular atrophy, stroke, myocardial infarction, hepatotoxicity, worsening of benign prostatic hyperplasia symptoms and prostate cancer [13].

The natural composition of some approved herbal medicines may actually reduce certain side effects many people experience when taking synthetic drugs, while achieving favourable results [13]. In addition, some herbal supplements may naturally improve the body's ability to synthesize the hormone being targeted, instead of receiving exogenous hormones when the level is low [13]. Some herbal supplements also have systemic effect in providing nutrition [14,15].

Moringa oleifera is one of the World's most useful trees, as almost every part of the tree can be used for food, medicine and industrial purposes [16,17]. It belongs to the Family Moringaceae [18]. The plant has gained a lot of names such as Horseradish tree, Drumstick tree, Ben oil tree, Miracle tree, "Okwe Oyibo" in Igbo language, "Zogale" in Hausa and "Ewe Ile" in Yoruba language [18]. The flowers, leaves, seeds and roots of Moringa oleifera (M. oleifera) has many chemical components, including crude fiber, reducing sugars, resins, alkaloids, flavonoids, saponins, phenols, terpenoids, glycosides, organic acids, sterols, tannins, saponins, proteins, vanillin, carotenoids, ascorbate, tocopherols, beta-sitosterol, kaempferol, and quercetin [19].

In addition, it contains unsaturated fatty acids, especially linoleic, oleic and palmitic acids. M. oleifera is rich in amino acids, vitamins,

minerals particularly iron, and potassium [20]. M. oleifera has been used for many decades as traditional medicine. This has made herbal practitioners lay claims to it having the cure to a myriad of ailments of which, only a few have undergone scientific validation. The leaves of M. oleifera are used as purgative, applied as poultice to sores, rubbed on the temples for headaches, used for piles, fevers, sore throat, bronchitis, eye and ear infections, scurvy and catarrh [21]. The leaf juice is believed to control glucose levels and reduce glandular swelling [22,23]. The seeds are used to decrease liver lipid peroxides, insulin resistance and inflammation. It is also used as an antimicrobial and anti-cancer agent [24-26]. The stem bark is used as an antioxidant and in treating rheumatism [27]. The roots of M. oleifera were shown to possess antilithic, anti-inflammatory, stimulant in paralytic afflictions; act as a blood tonic, used as a laxative, to treat rheumatism, lower back or kidney pain [28,29].

Although some studies have reported the fertility enhancing effect of Moringa oleifera in murine animals [14,24,29,30]. This study aims to shed light on the androgenic potential of Aqueous Seed-extract of Moringa oleifera (ASMO) in healthy male Wistar rats.

METHODOLOGY:

Collection of plant material:

They were identified and authenticated in the Department of Plant Biology, University of Ilorin, and allocated the voucher number UILH/001/1275/2020.

Preparation of extract:

M. olifiera seeds were decapsulated and dried in a shaded, well-aerated environment. They were subsequently, grinded into slightly coarse powder to improve percolation of solvent. The powder weighing 300g was macerated in 1.5L of distilled water for 48 hours under room temperature and was stirred every 3 hours.

It was then filtered. The filtrate was concentrated by lyophilisation (Freeze-drying). The concentrate was refrigerated at 4°C for storage [31].

Procurement and acclimatization of the animals:

Eighteen (18) healthy male Wistar rats (about 65 days old) weighing 200-250 gm were procured from the Department of Biochemistry, University of Ilorin. The rats were transported to the animal house of the Faculty of Basic Medical Sciences, University of Ilorin, where they were acclimatized to the animal house environment, for a period of 14 days before the experiment. The rats were housed in well-aerated plastic cages, at normal room temperature. They were fed pellets from Vital feed depot, Sango, Ilorin and tap water ad libitum. The beddings were changed daily to provide a hygienic environment.

Animal grouping and administration

The rats were separated into three (3) groups, of six (6) animals each and kept in separate cages during the experiment as follows:

Group 1: Control Group received 10 ml/kg of normal saline orally daily.

Group 2: Low Dose Treated Group received aqueous seed-extract of Moringa oleifera (ASMO) orally at the dose of 200 mg/kg daily.

Group 3: High Dose Treated Group received aqueous seed-extract of Moringa oleifera (ASMO) orally at the dose of 500 mg/kg daily.

Administration process lasted for 28 days with administration time between 8:00am to 09:00am daily. All the animals were strictly handled in conformation to the Declarations of Helsinki in 1995 (as revised in Edinburgh 2000) and the University's guidelines on Care and Use of Laboratory Animals.

Phytochemical screening:

Preliminary phytochemical screening of Aqueous Seed-Extract of Moringa oleifera (ASMO) was done using the methods of Khadabadi and Deore [32].

Sample Collection:

Organ Weight Measurement

Following 28 days of treatment, the control and experimental groups of male rats were weighed. The animals were completely anaesthetized with ketamine. The following organs; testis, seminal vesicles, epididymis, vas deference, penis and prostate glands alongside vital organs like liver, kidney, adrenal gland, and spleen were carefully removed and weighed using sensitive digital scale (LCD Precision Scale 0.01 g-1000 g).

Semen Analysis:

Sperm count

Upon the elapse of 28 days administration period, the testes from each rat were carefully dissected and excised. The epididymis was identified and removed. Using modified method of Yokoi and Mayi [33], the Spermatozoa in the right epididymis were counted. Briefly, the epididymis was minced with anatomic scissors in 5mL normal saline, placed in a rocker for 10 minutes, and allowed to incubate at room temperature for 2 minutes. After incubation, the supernatant fluid was diluted 1:100 with solution containing 5g sodium bicarbonate and 1mL formalin (35%). Total sperm number was determined using the new improved Neuber`s counting chamber (haemocytometer). Approximately 10µL of the diluted sperm suspension was transferred to each counting chamber of the haemocytometer and was allowed to stand for 5 minutes. This chamber was then placed under a binocular light microscope using an adjustable light source. The ruled part of the chamber was then focused and the number of spermatozoa counted in five 16-celled squares.

The sperm concentration was then multiplied by 5 and expressed as [X] x 106 /ml, where [X]

is the number of spermatozoa in a 16-celled square [34].

Sperm motility:

Sönmez et al. [35] method of analyzing sperm motility was employed. Fluid from the left caudal epididymis was extracted and pipetted, diluted via Tris buffer solution to a volume of 0.5ml. An aliquot of this solution was placed on a glass slide, already resting on a heated table and subsequently introduced to the stage of a light microscope with an adjustable light source. At X400 magnification, percentage motility was evaluated. Motility estimates were performed from three different fields in each sample. The mean of the three estimations was used as the final motility score.

Sperm viability:

40µl of freshly liquefied semen was thoroughly mixed with 10µl of eosin-nigrosin, and 1 drop of this mixture was transferred to a clean slide, to determine viability. At least 200 sperms were counted at a magnification of ×100 under oil immersion. Unstained sperm cells were considered viable, while either red or pink stained sperm cells were nonviable [36,37].

Sperm morphology:

Morphology was assessed at X400 magnification. Caudal sperm were taken from the original aliquot for motility, dilution factor of 1:20 using 10% neutral buffered formalin as diluent (Sigma-Aldrich, Oakville, ON, Canada). 500 sperms from the sample were scored for morphological abnormalities [38]. Spermatozoa were categorized in wet preparations, using phase-contrast optics. A spermatozoon was considered abnormal morphologically if it possessed any of the following features; rudimentary tail, round head and detached head. Result was expressed as a percentage of morphologically normal sperm [34].

Testis Collection:

The scrotums of the rats were carefully dissected and testes were carefully removed. Each testis was separated from the epididymis and was weighed. With a clean mortar and pestle a 10% tissue homogenate was prepared using normal saline as solvent. The homogenate was then transferred into a plain sample bottle for each animal and centrifuged. The centrifugation was done at 4000 rpm for five (5) minutes. The supernatant from the centrifuged homogenate was then transferred using a micropipette into a clean plain bottle and refrigerated.

Measurement of Testosterone:

Testosterone was assayed for by Enzyme-Linked Immunosorbent Assay (ELISA) using Calbiotech's testosterone ELISA kit. The procedures for the assay as contained in the manufacturer's manual were strictly followed [39]. The absorbance was read on ELISA Reader for each well at 450nm within 15 minutes after adding the stop solution.

Measurement of Luteinizing Hormone:

Luteinizing Hormone was assayed for by Enzyme-Linked Immunosorbent Assay (ELISA) using Calbiotech's Luteinizing Hormone ELISA kit. The procedures for the assay as contained in the manufacturer's manual were strictly followed [40]. The absorbance was read with ELISA Reader for each well at 450nm within 15 minutes after adding the stop solution.

Malondialdehyde (MDA):

The level of Malondialdehyde (MDA) was determined indirectly as thiobarbituric acid reactive substances (TBARS) according to the thiobarbitutric acid reaction of Uchiyama and Mihara [41].

Catalase:

The assay buffer, colorimetric assay substrate solution, and color reagent were allowed to equilibrate to room temperature. 25µl of sample and 75µl of assay Buffer was added to a test tube. The reaction was started by adding 25µl of the colorimetric assay substrate solution to the test tube. The solution was mixed by inversion and incubated for 15 minutes. 825µl of stop solution was added and mixed. An aliquot of 10µl of the mixture is added to another test tube to which 1ml of chromogen reagent added and mixed for at least 15 minutes at room temperature for color development. 1ml of the resulting solution is transferred to a cuvette and the absorbance was measure at 520 nm [42].

Statistical Analysis:

All the data were analyzed using one-way analysis of variance (ANOVA) and subjected to Duncan new multiple range post hoc tests. The results are expressed as Mean ± S.E.M using SPSS software (version 23). Values of $p<0.05$ were considered statistically significant

RESULTS:

Phytochemical Screening

Qualitative analysis of Aqueous Seed-Extract of Moringa oleifera (ASMO) shows the presence of phenols, saponins, tannins, alkaloids, flavonoids, steroids, terpenoids, glycosides and proteins.

Body Weight:

There was no significant difference ($p<0.05$) in the initial body weight across all groups.

Administration of ASMO caused a significant increase in body weight ($p<0.05$) as shown in Table 1 when compared with the control rats at the end of the 28-day experiment. In addition, there was a significant difference ($p<0.05$) in mean body weight of the treated rats which was dose dependent.

Weights of some organs and tissues:

The mean weight of the testes, caput segment of the epididymis, ventral prostate, seminal vesicle, penis and vas deferens increased

significantly ($p<0.05$) when compared with the control (Table 2). Likewise, there was a significant increase in the mean weights of the liver, adrenal gland, kidney and spleen ($p<0.05$), when compared with that of control (Table 3).

Sperm Analysis:

ASMO significantly increase the spermatic profile of the male rats (Table 4). The treated rats had a significant increase ($p<0.05$) in sperm count, sperm motility, sperm morphology, sperm viability when compared with the control rats. The differences were not dose dependent (Table 4).

Hormone Level:

Table 5 depicts the effect of administration of two different concentrations of ASMO on serum testosterone and Luteinizing Hormone (LH) levels in male Wistar rats. The serum testosterone level in the treated rats was significantly higher ($p<0.05$) when compared with the control rats (Table 5). However, there was no significant difference in the testosterone level between the two groups of treated rats

ASMO decreased serum LH levels significantly ($p<0.05$) in the treated rats when compared with the control (Table 5).

Serum Catalase and Malondialdehyde (MDA) Levels:

The results of administration of ASMO on the serum levels of catalase and MDA are shown in Table 6. ASMO proved to increase the catalase levels in the treated rats significantly ($p<0.05$) when compared with the control rats (Table 6). On the other hand, lipid peroxidation was significantly decreased as shown by the results of MDA level, (Table 6).

The MDA level decrease significantly ($p<0.05$) in the treated groups when compared with the control group.

Table 1: Effect of ASMO on Body Weight of Male Rats

Animal groups	Initial body weight (g)	Final body weight (g)	Differences in body weight
Group 1 (Normal saline)	220.0±4.38^{a}	224.2±4.43^{a}	4.2 ± 0.05
Group 2 (Low dose ASMO)	227.8±5.0^{a}	239.0±8.12^{ab}	11.2 ± 3.12
Group 3 (High dose ASMO)	232.4±3.26^{a}	256.0±16.73^{b}	23.6 ± 13.47

Key: Means with different alphabets are significantly different ($p<0.05$) from each other

Table 2: Effect of ASMO on Reproductive Organs and Tissues of Male Rats

Animal groups	Testis (mg)	Epididymis (mg)	Prostate (mg)	Seminal Vesicle(mg)	Penis (mg)	Vas deference (mg)
Group 1 (Normal saline)	1.27±0.03^{a}	0.40±0.04^{ab}	0.25±0.01^{a}	0.28±0.02^{a}	0.28±0.01^{a}	0.22±0.01^{a}
Group 2 (Low dose ASMO)	1.48±0.05^{b}	0.53±0.04^{b}	1.48±0.04^{b}	0.61±0.02^{bc}	0.38±0.02^{b}	0.26±0.03^{ab}
Group 3 (High dose ASMO)	1.50±0.06^{b}	0.77±0.10^{c}	0.56±0.03^{b}	0.69±0.05^{c}	0.48±0.02^{c}	0.33±0.01^{b}

Key: Means with different alphabets are significantly different ($p<0.05$) from each other

.

Table 3: Effect of ASMO on some Vital Organs of Male Rats

Animal groups	Liver (%)	Adrenal gland (%)	Kidney (%)	Spleen (%)
Group 1 (Normal saline)	3.41±0.01^{a}	0.077±0.001^{a}	0.30±0.01^{a}	0.32±0.01^{a}
Group 2 (Low dose ASMO)	3.68±0.01^{ab}	0.084±0.001^{a}	0.32±0.01^{a}	0.51±0.01^{bc}
Group 3 (High dose ASMO)	3.70±0.01$_{ab}$	0.118±0.001^{b}	0.40±0.01^{b}	0.54±0.01^{c}

Key: Means with different alphabets are significantly different ($p<0.05$) from each other

Table 4: Effect of ASMO on Spermatic Profile of Male Rats

Animal groups	Sperm count (million)	Sperm morphology (%)	Sperm motility (%)	Sperm viability (%)
Group 1 (Normal saline)	50.08±0.97^{a}	83.38±0.99^{ab}	82.23±0.74^{bc}	81.28±4.64^{a}
Group 2 (Low dose ASMO)	66.39±0.94^{c}	87.83±0.92^{c}	83.87±0.97^{c}	88.83±1.33^{b}
Group 3 (High dose ASMO)	56.24±0.36^{b}	85.83±0.64^{abc}	82.23±0.74^{bc}	85.82±1.14^{ab}

Key: Means with different alphabets are significantly different ($p<0.05$) from each other.

Table 5: Effect of ASMO on Serum Testosterone and LH Levels in Male Rats

Animal groups	Testosterone (ng/ml)	Luteinizing hormone (ng/ml)
Group 1 (Normal saline)	4.58±0.06[a]	107.84±7.62[c]
Group 2 (Low dose ASMO)	5.88±0.54[b]	70.39±4.95[b]
Group 3 (High dose ASMO)	5.20±0.29[b]	28.23±3.64[a]

Key: Means with different alphabets are significantly different ($p<0.05$) from each other

.

Table 6: Effect of ASMO on Serum Catalase and MDA Levels in Male Rats

Animal groups	Malondialdehyde (U/mg Protein)	Catalase (U/mg Protein)
Group 1 (Normal saline)	0.82±0.07bc	2600.44±390.92b
Group 2 (Low dose ASMO)	0.62±0.01ab	3358.39±518.77bc
Group 3 (High dose ASMO)	0.42±0.01a	3495.08±389.29c

Key: Means with different alphabets are significantly different ($p<0.05$) from each other

DISCUSSION:

Phytochemical screening of the plant shows that the aqueous seed extract of ASMO contains various constituents, which can be responsible for its androgenic effects. Some of these compounds include steroids, terpenoids, proteins, glycosides, alkaloids, tannins, flavonoids, and saponins. It has been documented from studies that medicinal plants with fertility potentiating effects often contain high amount of these compounds [43-45].

Physiologically, an increase in steroids causes pan-systemic anabolism that resulted in growth and development [46]. The significant increase in the weight of vital organs, reproductive organs as well as body weight may be due to androgenesis caused by phytochemicals in ASMO. This agrees with the work of Varsha et al. [47]. The significant increase in sperm motility, sperm count and sperm morphology and sperm viability in the epididymis of low dose ASMO treated rats which was decreased when compared with high dose ASMO treated rats clearly indicates that it has positive effect on spermatogenesis in rats at low doses, and that it could decrease the quality of spermatozoa at high doses [48]. This might be as a result of the presence of alkaloids which

was more prevalent at dose 500 mg/kg body weight and further gave an impact on spermatogenesis process. Alkaloid compound can suppress the secretion of male reproductive hormone (testosterone) so that it will inhibit spermatogenesis process [49,50]. Moreover, treatment dose of 500 mg/kg body weight decreased spermatozoa morphology significantly when compared with control and 200mg/kg body weight. This may be caused by the tannin compounds of ASMO which were higher in 500mg/kg body weight. The tannin content in ASMO at treatment doses of 200mg/kg body weight did not affect the percentage of spermatozoa morphology compared to the control. High tannin content in the treatment doses of 500 mg/kg body weight impacted the binding of protein and ions in the spermatozoa membrane so that the tyrosine enzyme and phosphorylation process in the spermatozoa membrane were disrupted and eventually resulted in morphological abnormalities of spermatozoa [51].

Reactive oxygen species (ROS) and free radicals are produced in organs of high metabolic activities like the testis, which results in depletion of the antioxidant capacity of spermatozoa, seminal plasma, and testis causing oxidative stress [52,53].

Oxidative stress damages spermatozoa membrane, sertoli cells and leydig cells by lipid peroxidation and molecular damage. Thus, it is a facilitator of sperm cells dysfunction, low testosterone and ultimately infertility [54].

Catalase is one of the important enzymes in the enzymatic antioxidant defense system. It reduces hydrogen peroxide to water and oxygen thus, diminishing the toxic effect caused by the formation of free radical.

The significant increase in the level of the activity of catalase (CAT) following treatment with ASMO is in consonance with previous studies [55-57], reporting antioxidant effects of ASMO. This increase may be as a result of increase in the synthesis of antioxidant molecules or reduced oxidative load due to the presence of different antioxidant compounds in the plant. Similarly, the decrease in MDA (biomarker of lipid peroxidation) in rats treated with ASMO clearly revealed anti-lipid peroxidative effect of the plant. This is also in agreement with previous studies documenting anti – lipid peroxidative effect of M. oleifera [58,59]. The decreased level of MDA in ASMO treated rats may be due to the presence of the antioxidant compounds like flavonoids, phenols, terpenoids reported in this study. Furthermore, antioxidant and anti - lipid peroxidative effects of this plant may also explains the significant increase in the spermatic parameters at low dose (200mg/kg body weight). These findings suggest that ASMO at low doses boost fertility by increasing the antioxidant level similar to findings by Suaskara et al. [48] and Jamalan et al. [60]. Testosterone is the primary male sex hormone.

It plays a key role in growth of reproductive tissues as well as spermatogenesis, libido, growth of muscle and bone mass [61]. The increase ($p<0.05$) in the testicular testosterone level recorded in this study may also be connected to its phytoconstituents (flavonoids, saponins, terpenoids and alkaloids). This finding agrees with the works of Gan [15], Dafaalla et al. [29], Zade et al. [30], Cele et al. [44], Ghosh et al. [62] and Hassan et al. [63] who documented that phytochemicals like alkaloids, flavonoids and saponins play a role in adrogenesis.

The anterior pituitary gland secretes gonadotropins (LH and FSH) which act on the testis to produce testosterone. Physiologically, increased testosterone level inhibits LH production in a negative feedback mechanism. This may explain the significant reduction in LH level in this study. The reduction in the LH level may also be due to the phytochemicals present in the plant extract, because study [64] have shown that some phytochemicals mimic the negative feedback effect of LH on hypothalamus. This in turn inhibits the secretion of hypothalamic gonadotropin releasing hormone, thereby decreasing the level of endogenous LH secretion by pituitary gonadotropes as seen in this study.

CONCLUSION:

In conclusion, ASMO increase sperm parameters (at treatment dose 200mg/kg), testosterone, and anti-oxidant capacity of experimental rats. This partly validates the traditional use of Moringa oleifera seed herbal preparation in the management of male infertility. However, treatment dose of 500 mg/kg body weight significantly reduced the sperm parameters; it proved that the higher doses of ASMO decreased the sperm parameters.

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A REFLECTION ON CONSTRUCTIVE ALIGNMENT OF THE COMMUNICATION SKILLS COMPONENT IN AN UNDERGRADUATE MEDICAL EDUCATION PROGRAM AT THE UNIVERSITY OF PAPUA NEW GUINEA: Constructive Alignment in Course Design.

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ABSTRACT:
The University of Papua New Guinea (UPNG) undergraduate medical education curriculum is problem-based and grounded in constructivist learning theory. This theoretical foundation provided the springboard from which the 'communication skills' component, taught in the curriculum was redesigned using constructive alignment (CA). Introducing a change into what is taught and how it is taught warranted a reflection to determine whether the innovation was worthwhile. To this end, reflective practice was employed through document analysis to assess the degree to which CA was achieved across all core elements of the course. Results were then analysed by combining elements of both content and thematic analysis. The teaching and learning activities (TLAs), seminars and assessment tasks (ATs) were found to be not clearly articulated and constructively aligned to the course learning outcomes (CLOs). This resulted from not clearly articulating the expected targeted knowledge and skills in the CLOs. This, in turn, had the effect of highlighting the importance of ensuring that the nominated verbs in each CLO were used to establish alignment between the learning outcomes, TLAs and ATs. The findings indicated the need to rectify the problems identified using CA as the learning improvement plan and adjusting TLAs as the means of achievement.

Key words: Constructive alignment, curriculum design, constructivist theory, problem-based learning, self-directed learning, teaching strategies, reflection, reflective practice

INTRODUCTION:

Constructive Alignment (CA) in Course Design:
Constructive alignment (CA) is a curriculum design and teaching strategy using outcomes-based approach in which the learning outcomes that students are expected to have achieved at the end of a particular course, subject or unit are clearly stated before teaching takes place. Teaching is then designed to engage students in learning activities that will optimize their chances of achieving those learning outcomes, and

assessment tasks are designed to enable students to clearly judge how well they have attained those outcomes [1]. The terms "course", "subject" and "unit" are used in different higher education institutions and they mean the same and refer to the different curricular elements. They are defined as one element of many that constitute a larger degree program of study [2]. In the undergraduate medical problem-based learning (PBL) program at the University of Papua New Guinea (UPNG), the program objectives are clustered into five domains and full-time students enroll in these domains each year [3]. Domains are similar to core courses of a program because they are assigned specific course numbers. Country specific health problems are then, used as the main criteria to select the problems which are delivered as "Patient and Community" (P & C) problems that students work on in small tutorial groups each week. These are similar to the main topics of a course and they are supported by "Learning Issues" which are brief reviews written by faculty to help students solve the P & C problems. Other topics related to each P & C problem are also selected and delivered as seminars, practical classes, clinical activities, and exercises in critical reasoning, which interface with all the domains. These are referred to as "Components" in the program [3]. Communication Skills is a cross-cutting component relevant to all P & C problems and delivered both as a seminar and practical class under Public Health domain (Domain 1) and taught throughout the whole undergraduate medical program (Years 2 – 5).

In CA, the core elements of a course, subject, unit or component that need to be aligned are course learning outcomes (CLOs), teaching approaches (TAs), learning activities (LAs) and assessment tasks (ATs) [2]. These need to be clearly defined, articulated and constructively aligned before teaching takes place. CLOs define the specific knowledge and skills students should learn. They also define how the contents and topics are to be dealt with and in what context. TAs are the specific types of work teachers do to promote student learning; for example, lecturing or leading discussions. LAs are the specific types of work students are assigned by the teacher in order to learn, individually or in groups, for example, discussing assignment questions/problems. ATs are the specific types of work teachers design and students carry out to demonstrate the quality and quantity of their learning in order to gain formative feedback or summative marks [2]. Jones and Biggs' [1, 4) argument concerning CA is that, for students to be engaged in a deeper process of learning, processes that are related to learning objectives, learning activities and assessment must be aligned. It was also noted that such alignment should favor criterion-referenced assessment rather than norm-referenced assessment. This in effect suggests when course content related to specific learning

outcomes employs pedagogical perspectives and techniques which, over time, are tested using criterion-base assessment, an iterative process emerges where any element of teaching delivery can be adjusted to further enhance student learning [1, 4]. In terms of the component which is the subject of this paper, the ongoing effects of teaching and learning have proved this perspective to be true. The CLOs, TLAs, ATs and the seminar contents of the component continues to be reviewed to ensure there is appropriate alignment between them.

Constructivist Theory and the UPNG Undergraduate Medical PBL Program:

The UPNG undergraduate medical education program adopts a fully problem-based and integrated instructional method using problem-based learning (PBL) which has a strong community health orientation. The emphasis is on self-directed learning approaches and development of independent learning skills [3] to foster "key skills of researching, acquiring knowledge, communication, collaboration, problem-solving and transferring knowledge to new situations" [5]. Students work on the weekly P & C problems which are open-ended clinical scenarios using multiple sources of guided information in small tutorial groups. There are also other P & C problem related components that are delivered as seminars, practical classes, clinical activities, and critical reasoning exercises which are referred to as "formal support structures" [5] in a PBL curriculum. They provide opportunities for "just-in-time learning" [5] to help students work on the clinical problems presented in the scenarios. This means that relevant materials that students need to solve the P & C problems are presented to them in a timely manner through these support structures. If the contents of the formal support structures are presented out of context, or for some unspecified possible future use, students may not appreciate the importance of the information or activity, which may affect their motivation to learn and retain the learning [5].

The first step in PBL is to identify the key learning outcomes of a course as this is critical to the development of content and assessment and this need to be clearly understood by both teachers and students for effective learning to take place. The components of the domain can then be refined and the problem and relevant resources for delivery can be woven together [5]. The weaving process in the UPNG undergraduate medical PBL curriculum uses CA. This ensures that each element of planning the PBL curriculum sees methods and resources chosen for teaching and learning delivery in all courses and components produce a coherently constructed PBL program. This requires an emphasis on self-directed learning and the development and use of independent learning skills. It should be noted that here the CA is informed by constructivist theory [1].

Firmly establishing a learning theory, framework or model and using that as a springboard to design a course is a requirement for planning and initiating any Scholarship of Teaching and Learning (SoTL) project. This is because SoTL places heavy emphasis on the use of a framework, model or theory to drive the directions of any change in curriculum [6]. The onus then rests on the discipline professional who teaches into the program to be wary of the design choices he/she makes overall, and in relation to each core element as these choices can raise or lower the odds that students will learn deeply and well [2].

Justification for this study:

The presence of a clear learning theory to underpin course design strategy program which is constructivist theory [1] was intriguing and this triggered a critical examination into aspects of the design of the course structure and teaching and assessment practices for all the courses taught. The examination revealed fertile ground for application of the learning derived from tertiary teaching studies. Previously undetected disconnections between the core elements of the courses, particularly, alignment between the CLOs, TLAs and ATs were noted. The degree of disconnection varied, but provided ample motivation to revisit all of the courses to ensure that appropriate CA was implemented. Prioritization of the courses for further in-depth examination revealed that the Communication Skills component was in most need of attention. This component is one of the formal support structures that provides just-in-time learning opportunity for students [5] in Public Health domain of the UPNG undergraduate medical PBL program. Hence, the redesigning of the component was initiated beginning with the Year 2 component. A reflection was then carried out to determine the degree to which the core elements of the component were articulated and aligned, which is the focus of this study.

Thus, the aims of this study were to assess the degree to which CA was achieved across all core elements of the Year 2 Communication Skills component and to determine whether or not these core elements were clearly articulated and constructively aligned at the component level.

The ethical approval for this study was given by the James Cook University Ethical Committee with approval number H7065.

METHODOLOGY:

The reflection by both teachers and students is an important part of the PBL learning process. It is considered a key part of any PBL implementation and assessment plan. Reflective practice helps to develop and hone facilitation and teaching skills [5] and enables the teacher to critically reflect on existing understandings, beliefs, assumptions and attitudes and create a safe learning

environment to nurture reflective expression [7]. The "5Rs reflective scale" (Reporting, Responding, Relating, Reasoning and Reconstructing) [5] was used to guide the reflective practice as part of the continuous course improvement strategy as this scale was seen to be the simplest and easy to use. Frameworks that can be used to develop teacher reflection abound in the literature but for a small scale reflective study such as this project, the 5Rs scale was seen to be the most appropriate scale to use.

Reporting:

As a beginning step, a systematic inquiry and critical examination was carried out into the existing curricula for the Public Health domain, which was developed in 1996 [8]. The overall teaching and learning objectives were defined for each level (year) but they were not articulated in detail as to how the set objectives would be achieved through the main components of the Domain. Individual seminars under each main component of the Domain were clearly defined and aligned to the relevant P & C problems at each level but they were not articulated in detail. The document was meant to be an outline of the Public Health Domain (course) for those teaching into the domain to use it as a guide to further develop their respective components. Therefore, based on this domain outline and experience and also practical circumstances within a hospital setting, a communication skills curriculum was developed and it was in use until tertiary teaching studies provided exposure to the foundational knowledge and skills associated with core aspects of university teaching and learning, and enabled creativity and innovation in utilizing research informed teaching and learning strategies to improve student learning.

Responding:

During the inquiry and examination of the existing curricula it was observed that the communication skills components, which are taught throughout the whole undergraduate medical PBL program (Years 2 – 5) were not integrated into any of the main P & C problems that students work on each week, which according to the public health domain outline [8] the individual components were supposed to be covered under the relevant P & C problems. Instead, the component was expected to be taught separately. However, the reason for the component not being integrated into the main P & C problems was because the course was a cross-cutting component that needed to be carefully developed to capture just the essential learning that students would require to solve the clinical problems and also apply in the real world.

Relating:

The challenge in the communication skills component not being integrated into the main clinical scenarios created the opportunity to redesign the component using CA as the

concept behind the learning improvement plan, and adjusting the teaching and learning activities as the means of achievement.

Reasoning:

The inquiry and examination revealed serious disconnections between the core elements of the communication skills component, particularly with clearly defining, articulating and alignment to the learning objectives stipulated in the public health domain outline. The component needed proper designing with appropriate alignment of the core elements at the component level.

Reconstructing:

Re-designing of the whole communications skills component began with the Year 2 component, and the eventual reflection on the initiated change with 'reflection' being the main focus of this study.

The reflection took place within the very performance itself (performance being, the redesigning of the component), which is referred to as "reflection in action" [9].

This type of reflection is possible if there is mental processing capacity available to accumulate and evaluate immediate feedback within the performance context. It allows learning to become apparent within the performance, and also allows the modification of the performance plan to make it more efficacious [9].

Data collection and analysis:

Data was collected through document analysis [10]. The analysis of the core elements of the redesigned communication skills component was carried out appropriately. The reflections and review focused mainly on the articulation and alignment of the core elements, which were, CLOs, TLAs, ATs and seminars. The reflections were to determine whether or not these elements were clearly defined, articulated and constructively aligned at the component level.

The data analysis process combined elements of both content and thematic analysis. In content analysis, the categories under which the reflections would be organized were already provided by way of the core elements; hence all responses of the reflections were recorded under the respective core elements (categories). The combined responses were quite dense and rich, thus the "winnowing" process was used to single out responses that were pertinent and directly related to CA in course design and organized them under the same respective core elements [10].

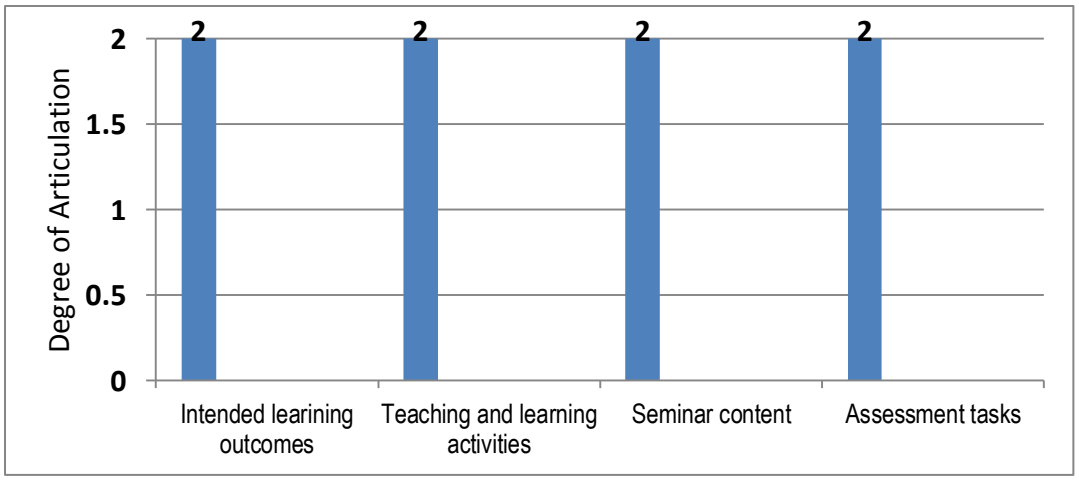
In thematic analysis, the narrative nature of the study (telling a story about the articulation and alignment of the core elements of the redesigned component) warranted a pattern to be identified based on certain characteristics of the winnowed responses. Hence, this process involved a careful and a more focused re-

reading and review of the winnowed responses and identified a pattern based on the following characteristics – key words, descriptive phrases and brief comments. These three key characteristics guided the construction of sub categories under each main core element which in turn helped to establish a clear flow of the narrative about the articulation and alignment of the core elements of the communication skills component

RESULTS:

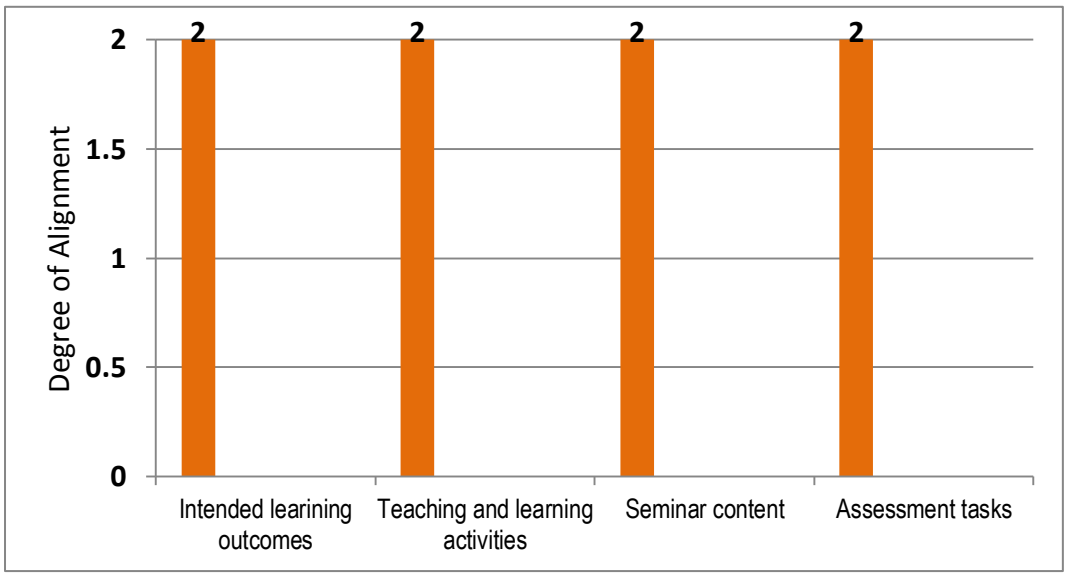
Figures 1 and 2 show the degree to which articulation and alignment of the core elements of the component were achieved. As the results show, the degree of articulation and alignment for all core elements stand at 2, these indicate that they were not clearly articulated and not constructively aligned. This means that for the CLOs, the targeted knowledge and skills that the students were supposed to have acquired at the end of the component were not clearly articulated. The nominated verbs in the CLOs did not become common links that established alignment between TLAs, ATs and seminars. For the contents of the TLAs, they were not clearly articulated and aligned to the CLOs. There was also no clear common link that established alignment between the CLOs and TLAs. For the ATs the nominated verbs in the CLOs that students would enact were not clearly articulated in the contents of the ATs. The contents of the ATs also lacked clear alignment to the CLOs. The verbs nominated in the CLOs that students would enact were not clearly articulated in the contents of the seminars. The contents of the seminar notes were not aligned to the CLOs and there was no clear common link that established alignment between them.

Figure 1: Articulation of the Core Elements of the Year 2 Communication Skills Component



1 = Not Articulated; 2 = Not Clearly Articulated; 3 = Clearly Articulated; 4 = Very Clearly Articulated

Figure 2: Alignment of the Core Elements of the Year 2 Communication Skills Component



Key to Fig 2: 1 = Not Aligned; 2 = Not Constructively Aligned; 3 = Constructively Aligned

DISCUSSION:

Course Learning Outcomes (CLOs):

Although the CLOs in the present study were framed from the perspective of student learning and they addressed one discrete action per outcome, the expected targeted knowledge (knowledge of basic principles of effective communication) and skills (acquisition of basic communication skills) were not specifically articulated in the CLOs. It also appeared that the expectations of the nominated verbs (recognize and acquire) in the CLOs were at a higher level of the cognitive taxonomy [11], thus inappropriate at the current level. According to Krathwohl [11] the different categories of the cognitive domain (knowledge, comprehension, application, analysis, synthesis and evaluation) in both the original and the revised taxonomy frameworks are ordered from simple to complex and from concrete to abstract and assumed to represent a cumulative hierarchy. This implies that mastery of each simpler category is a prerequisite to mastery of the next more complex one. Hence, the original intentions for developing cognitive taxonomy frameworks were not well captured in the framing of the learning outcomes in the communication skills component. The verbs nominated in the CLOs should be at a low level of the cognitive taxonomy and the levels can be increased when redesigning the Years 3, 4, and 5 components respectively. In addition, the nominated verbs in the CLOs become the common link that establish alignment between the CLOs, TLAs and ATs. In this component the CLOs were not clearly defined and aligned,

that is, what the students were supposed to be able to do with the content they learnt were not clearly articulated thus affecting the alignment as well.

Teaching and Learning Activities (TLAs):

The case study materials (contents of the TLAs) in particular appeared to be detailed and engaging and showed clear alignment between authentic clinical scenarios and contents of the seminar. However, the nominated verbs in the CLOs were not clearly and specifically articulated in the TLAs. There was no clear common link that established alignment between the CLOs and the TLAs, although they were somewhat implied within the contents of the TLAs. According to Biggs [1, 12], the key is to clearly define and articulate what students are supposed to be able to do with the content they learn by carefully choosing or nominating the verbs that students would enact in the CLOs. Once this is in place, the appropriate learning activities can fall into place, and the teaching will be to get the students to engage or demonstrate those nominated verbs in the CLOs. This will ensure that the desired outcome is achieved in a reasonably effective manner. These articulation and alignments needed to be explicitly stated in the activity handouts and also explained to the students instead of implying within the contents of the TLAs. This will help students to see clearly that they are actually enacting the nominated verbs in the exercises they do.

Seminars:

Seminars in the UPNG undergraduate medical PBL program are formal lectures in which the knowledge that students need are presented to a potentially large number of students at one time. Contents of the seminars for different components in the different domains vary depending on their learning outcomes. For the communication skills component, the verbs nominated in the CLOs need to be clearly articulated in the contents of the seminars and aligned to the CLOs, which was not the case. Although the seminar contents in the slideshows supported understanding of the principles and processes associated with communication generally, the nominated verbs in the CLOs were not clearly articulated within the contents, though implied in some ways in the contents of the seminars. The seminar contents need to be reviewed in order to inform a more-sharper link to the CLOs.

Assessment Tasks:

The unfolding authentic case scenarios spread over the different trimesters that students engaged with through the role plays were elegant. However, the verbs nominated in the CLOs were not clearly defined and articulated in the contents of the ATs (role play scenarios), although they were alluded to in some way. Students needed to be fully aware and clear from the outset that they were enacting the

nominated verb(s) of the CLOs in their ATs but this clarity was lacking.

Generally, a CLO denotes how the contents or topics are to be dealt with and in what context [1, 12]. Hence, to begin with, the nominated verbs in the CLOs were not specifically articulated but to communication generally, which in turn affected the articulation of the context, for example, in a doctor – patient interaction. The most useful way of stating curriculum objectives is to express them in terms that identify both the kind of behavior to be developed and the context or area of life in which this behavior is to operate [1, 12].

CONCLUSION:

The results of this study showed that the core elements (TLAs, ATs and seminars) of the redesigned Year 2 Communication Skills component were not clearly articulated and aligned to the CLOs. The key issue with these results is to do with not clearly defining and articulating the nominated verbs in the CLOs, which in turn affected the articulation and alignment of the other core elements. The verbs that are nominated in the CLOs are the ones that are going to become the common link that establish alignment between the TLAs, ATs and the CLOs. Hence, the fundamental task for the teacher is to carefully select the verbs or actions in the CLOs that students are supposed to put into play and they must be at an appropriate level of the cognitive taxonomy. Once these are in place, appropriate learning activities can be developed, ensuring that the nominated verbs or actions in the CLOs are clearly articulated in the contents of the learning activities. Teaching tasks can then be developed to get the students to engage in those learning activities that will enable them to achieve those learning outcomes; and assessment tasks are determined to judge how well students can perform the nominated verbs in the CLOs in appropriate contexts.

In the final analysis, the contents of the TLAs and ATs should address the same verbs that are nominated in the CLOs. This type of teaching design is called “constructive alignment”. The reflections in this study focused only on just within-component alignment. But if any effective self-directed learning and development of independent learning skills is to be promoted in an integrated curriculum such as the UPNG undergraduate medical PBL program, a whole-of-program alignment is desirable. For a cross-cutting component such as Communication Skills that has a strong program and extends through the PBL curriculum, the following recommendations should be considered if the component is to help promote effective self-directed learning and development of independent learning skills. Firstly, each of the problems identified in this study be analyzed and rectified through further reflective/action research using CA. Secondly, the component needs to be properly developed in a way that could promote student progressive learning

from one level/year to the next level/year – CLOs, TLAs and ATs need to be carefully developed and appropriately aligned and linked to each other at each level/year to promote coherent progressive learning. Finally, a whole-of-program alignment project can be undertaken which will be a mammoth task, given that the component is only a just-in-time-learning opportunity in a complex integrated curriculum.

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PERCEPTION OF RADIOGRAPHERS ON THE IMPACT OF COVID-19 PANDEMIC AT PORT MORESBY GENERAL HOSPITAL, PAPUA NEW GUINEA

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ABSTRACT

The World Health Organization (WHO) declared Coronavirus disease 2019 (COVID-19) a pandemic on March 11, 2020 and the global impact of this new epidemic is yet uncertain. Radiographers are among the front line healthcare workers (HCWs) in tackling the impact of this pandemic. This is a prospective observational study assessing the perception of radiographers on the impact of COVID-19 pandemic at the Port Moresby General Hospital (PMGH) over a ten-month period (March 2020 to December 2020). The personal experiences and observation of radiographers on the impact of COVID-19 pandemic in the ten-month period were evaluated using a paper-based survey after obtaining ethical clearance. The relevant information was recorded in Excel Spread sheet. The data was statistically analysed using Microsoft Excel 2013. A total of 18 radiographers participated in the survey. All participants identified personal protective equipment (PPE) being provided, with a majority (94.4%) identifying donning, doffing and decontamination training were also provided. More than half (55.6%) of the participants observed social distancing and reduced working staff as part of infection control and protection measures. Specific training on how to handle and deal with COVID-19 infected patients was noted among 66.7% of the participants. The perceived level of stress due to COVID-19 revealed 44.5% of the participants being stressful. This study has demonstrated that although some radiographers have experienced some level of stress in their line of work, there were no reported mental health programmes provided during the COVID-19 pandemic at PMGH.

Keywords: Coronavirus disease, severe acute respiratory syndrome-coronavirus 2, COVID-19 impact, radiographers, personal protective equipment, medical imaging, Papua New Guinea

INTRODUCTION:

Coronaviruses belong to a large family of single-stranded ribonucleic acid (ssRNA) viruses [1]. They are a group of zoonotic viruses that cause illness ranging from the common cold to severe respiratory diseases [2]. There are six coronavirus species which are responsible for human disease; four of them (OC43-CoV, NL63-CoV, HKU1-CoV, 229E-CoV) affect the respiratory system mildly causing symptoms of the common cold in people without any underlying disease [3]. The other two species (SARS-CoV and MERS-CoV) cause Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS), respectively, have been associated with a fatal illness in many cases [3]. Since coronaviruses are widely distributed, their genetic material is constantly evolving due to recombination events, and they are also frequently transmitted between different species (e.g. human – animal interactions), the emergence of a new coronaviruses in a periodic pattern is possible to happen [3].

MERS-CoV of 2012 was found to transmit from dromedary camels to humans. SARS-CoV of 2002 was found to transmit from civet cats to humans. SARS spread rapidly in 2002–2003 [1-3, 4-5]. In 2002, the SARS-CoV originating in China had an 11% mortality rate, while in 2012 the MERS-CoV in Saudi Arabia had a mortality rate of 34%. Both viruses originated from wild animals [1, 5]. A cluster of patients presented with cases of severe pneumonia of unknown aetiology were first documented in Chinese city of Wuhan in December 2019 [1-5].

The novel severe acute respiratory syndrome coronavirus 2 (SARS- CoV-2) was confirmed as the pathogenic cause of these cases by the World Health Organisation (WHO), and the outbreak was then named coronavirus disease (COVID-19) [6].

Many health experts believe that the new strain of coronavirus (SARS- CoV-2) likely originated in bats or pangolins [7]. Although the transmission of coronaviruses from animals to humans is rare, this new strain likely came from bats [5, 8], though other studies [5, 7] suggest pangolins may be the origin. It is still unclear as to how exactly the virus first spread to humans [1, 7]. Many of the initial cases had a common exposure to the Huanan wholesale seafood market that also traded live animals in Wuhan, a city in the Hubei province of China [5].

It may have been from there that SARS-CoV-2 started to spread to humans [7]. Since then, the virus has mostly spread through person-to-person contact [5]. Finding effective ways to prevent the spread of SARS-CoV-2 remains a global challenge. The Centres for Disease Control and Prevention (CDC) recommend washing the hands with soap and water for at least 20 seconds per time or using hand sanitizers with at least 60% alcohol after visiting public places [7].

The WHO declared the outbreak as a health emergency on January 30th, 2020 because of the rapidly increasing number of cases and deaths associated with the virus globally [6]. On March 11, 2020, the WHO declared COVID-19 a pandemic [7]. As of June 30, 2020 there were 10,117,687 confirmed cases and 502,278 deaths in 216 countries, areas and territories around the world [9]. Mostly affected countries include; USA, Italy, Spain, Germany, China, France, Iran, UK, Switzerland and Turkey [10]. The WHO reported that the risk of developing COVID-19 is higher in older adults, people with underlying chronic health conditions, and for anyone in close contact with people who have COVID-19, such as healthcare workers (HCWs) [5, 7]. HCWs deserve the right to decent, healthy and safe working conditions in the context of COVID-19. Primary prevention of COVID-19 among HCWs should be based on risk assessment and introduction of appropriate measures [11]. Provision of adequate personal protective equipment (PPE) is of paramount importance and is a critical component of infection control and prevention throughout the duration of COVID-19 pandemic [12].

HCWs are among the frontlines of this global crisis. They have the substantial task of diagnosing and treating an exponentially growing number of acutely ill patients, often having to make critical decisions under physical and psychological pressure [13-14]. Radiographers are among the HCWs front liners in tackling the COVID-19 pandemic. Multiple evidence reported elsewhere [1, 3-4, 6, 12, 15-20] demonstrate that radiographers require proper training for dealing with such patients to reduce the impact of COVID-19 in their line of work as health care professionals. In Papua New Guinea (PNG), there were no reported studies done to investigate the impact of the COVID-19 pandemic on radiographers.

PNG is a developing country with a growing population of over seven million [21]. There are twenty-two different provinces and the National Capital District (NCD) in four administrative regions. The rural areas of PNG comprise a higher population of 87.5% whilst only 12.5% of the populations live in urban areas and about 400,000 people (4.5%) live in the capital Port Moresby [21]. There are no published studies on the impact of COVID-19 among radiographers as front line HCWs in PNG.

The major objective of this study was to prospectively assess the perception of radiographers on the impact of COVID-19 pandemic at the Port Moresby General Hospital (PMGH) over a ten-month period (March 2020 to December 2020).

METHODOLOGY:

This was a hospital based prospective observational study conducted at the PMGH

Radiology Department. The PMGH is the major public general, specialist and reference hospital in the National Capital District (NCD) and PNG offering level 7 medical services. It is also the teaching hospital for the School of Medicine and Health Sciences (SMHS), University of Papua New Guinea (UPNG).

The personal experiences and observation of radiographers on the impact of COVID-19 pandemic in the ten-month period were evaluated using a paper-based survey. Since the number of radiographers present during the study period was very small, convenience sampling technique was used [21]. A total of 20 radiographers participated in the study.

Pre-tested questionnaires comprising close-ended and open-ended questions were administered to the radiographers using both quantitative and qualitative approach for data collection [23-24]. The questionnaire contains three sections. The demography of the radiographer; information collected include age of radiographers, gender, professional status and years of work experience.

In the other two sections variables collected the radiographers experience and observations during the COVID-19 pandemic lockdown, radiographers' knowledge of COVID-19, trainings provided, infection control and protection measures used at the facility, and radiographers' perception on the impact of COVID-19 on staff well-being [3-4, 6, 17, 19]. The data were recorded in Microsoft (MS) Excel Spreadsheets and analysed statistically using Excel Data Pack version 2013 [21-22].

Exclusion criteria**:**

Participants excluded from the study were those working in other specialised imaging modalities such as magnetic resonance imaging (MRI), mammography, ultrasound and fluoroscopy and those radiographers that were contract workers during the pandemic. Included in the study were those radiographers that have worked full time in general radiography, and other two imaging specialty including mobile radiography and computed tomography (CT) scan during the pandemic.

Ethical approval for this study was granted by the School of Medicine and Health Science Research and Ethics Committee (SMHS REC). Written consent was granted by the Director of Medical Service at PMGH with the approval from the Head of Radiology Department. Participation in the radiographer survey was entirely voluntary.

RESULTS:

Of the 20 radiographers that participated in the study, 18 of them responded to the survey with a response rate of 90%. Of the 18 respondents, 10 (55.6%) were female and 8 (44.4%) were male radiographers. Table 1 shows the

demographic distribution of all the respondents. Of the total respondents, 88.9% (n=16) were registered radiographers in general radiography with 11.1% (n=2) as registered radiographers from other imaging specialties. The other results are presented in Table 1.

Participants' response on COVID-19 in terms of infection control and protection measures; workshops and trainings; and well-being**:**

Table 2 provides detailed data on participants' response to survey. All (100%, n=18) of the participants strongly agreed that they are the front line HCWs in response to COVID-19; of which 55.6% (n=10) strongly agree that they have a good understanding on how the COVID-19 is transmitted with 33.3% (n=6) agree and 11.1% (n=2) being neutral. When asked whether the facility has provided full training on how to deal with/handle COVID-19 patients without getting COVID-19 infection, 66.7% (n=12) said yes and 33.3% (n=6) said no. Concerning the well-being of participants, 5.6% (n=1) strongly agree that the facility has provided Mental Health Programmes on how to manage work related stress regarding the COVID-19 pandemic, 5.6% (n=1) agreed, 33.3% (n=6) neutral, 50% (n=9) disagree and 5.6% (n=1) strongly disagreeing. The other results are presented in Table 2.

The free-text comments provided by the respondents were reviewed and two key themes on PPE and workshops are presented in Table 3.

Table 1: Demographic distribution of respondents.

Variables	% (n)
Age group (years)	
18 – 29	16.7 (3)
30 – 39	50.0 (9)
40 – 49	5.6 (1)
50 – 59	22.2 (4)
60+	5.6 (1)
Gender	
Male	44.4 (8)
Female	55.6 (10)
Professional status	
Resident Radiographers	0
Registered Radiographers in General Radiography	88.9 (16)
Registered Radiographers Specialising in Mobile and CT Radiography	11.1 (2)
Years of work experience	
1 – 5 years	27.8 (5)
6 – 10 years	27.8 (5)
11 – 15 years	11.1 (2)
16 years and above	33.3 (6)

Table 2: Participants' response to survey on the impact of COVID-19.

Statement/Question	**Response, n (%)**				
1. Radiographer's knowledge on COVID-19					
	Strongly agree	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
Radiographers are part of the frontline Health Care Workers in response to COVID-19.	18 (100)	0 (0)	0 (0)	0 (0)	0 (0)
I have a good understanding on how the COVID-19 virus is transmitted.	10 (55.6)	6 (33.3)	2 (11.1)	0 (0)	0 (0)
2. Perception of radiographers on infection, control protection measures and trainings					
	Yes		**No**		
The facility has provided the following strategies as means of infection protection and control;					
PPE (N95 mask, face shield)	18 (100)		0 (0)		
Donning /doffing, decontamination workshops/ trainings	17 (94.4)		1 (5.6)		
Social distancing & reduced working staff	10 (55.6)		8 (44.4)		
Specific training on how to deal with/handle COVID-19 patients	12 (66.7%)		6 (33.3%)		
Has the facility provided full training on how to deal with/handle COVID-19 patients without getting COVID-19 infection?	12 (66.7)		6 (33.3)		
3. Impact of COVID-19 on radiographers well-being					
	Strongly agree	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
Fear of COVID-19 infection, increased workload, changes in work routine, and other changes in department protocols has contributed largely to my stress.	3 (16.7)	7 (38.9)	7 (38.9)	0 (0)	1 (5.6)
The facility has provided Mental Health Programmes on how to manage work related stress regarding the COVID-19 pandemic.	1 (5.6)	1 (5.6)	6 (33.3)	9 (50)	1 (5.6)
I am confident to face similar pandemic in future in my line of work with my experience on this current ongoing COVID-19 pandemic.	5 (27.8)	7 (38.9)	1 (5.6)	5 (27.8)	0 (0)
	Very stressful	**Stressful**	**Neutral**	**Somewhat stressful**	**Not stressful at all**
What is your level of stress in regard to the impact of COVID-19 pandemic on your work performance?	5 (27.8)	3 (16.7)	9 (50)	0 (0)	1 (5.6)

Table 3: Participants' free-text comments to survey addressing two themes on PPE and workshops.

Respondent ID Number	Respondents' free-text comments
ID: 7, Registered Radiographer (RR7)	"The institution provided training/ workshop on PPE/ donning and doffing and visits from WHO personal as well"
ID: 8, Registered Radiographer (RR8)	"The hospital initially provided adequate amount of PPE to handle COVID-19 cases, but the workload was too much and at times we did not have enough PPE supply. Workshops were provided for proper donning and doffing of PPE, so that was good"
ID: 10, Registered Radiographer (RR10)	"Not adequate PPE was provided as well as training to prepare mentally"
ID: 4, Registered Radiographer (RR4)	"In regard to PPE we were not always fully given PPE, there were times we did not have swipe to wipe our equipment and other times communication was not related properly. You might be handling a symptomatic patient and not being told by the people who sent the patient over so you close down the whole place for infection control people to disinfect the whole place. With training, we were reminded every day"
ID: 13, Registered Radiographer (RR13)	"A continuous in-house training or practice in terms of PPE should/must be done, so staff members will be confident and well prepared for COVID-19 cases"
ID: 12, Registered Radiographer (RR12)	"I think trainings on protection of personal from infections should be done on routine basis to keep staff and students plus patients vigilant on cross infection prevention. PPE training here in Radiology was done only once as far as I could remember. Workshops on prep and post COVID counselling should be organized for staff who have acquired the virus or also for all staff to keep them mentally fit or to avoid episodes of psychological stress or breakdown"
ID: 15, Registered Radiographer (RR15)	"No workshop training was conducted during and after the pandemic. The pandemic has not really impacted our department in a large way. Maybe in terms of re-enforcing personal hygiene in the workplace then yes that has changed. Otherwise everything is the same as it was before the pandemic hit"
ID: 14, Registered Radiographer (RR14)	"There should be proper training involved in this situation. Especially the Mental Health programmes"

DISCUSSION:

To our knowledge, this is the first prospective study done since COVID-19 pandemic, and has surveyed about 90% of the registered radiographers on the perceived impact of COVID-19 at the PMGH. Half (50%) of all the radiographers who participated in this study were in the 30 to 39-year age group, which aligns with other studies [14, 17] reflective of an effective health care workforce with a predominance of females (55.6%) in the respondents [20].

Radiographers' knowledge and perception on COVID-19 infection, control protection measures and trainings:

Results from the present study revealed that all respondents (100%) are aware that radiographers are part of the frontline HCWs in response to COVID-19 while more than half (55.6%) have a good understanding on how the COVID-19 virus is transmitted. These findings concur with studies done elsewhere [6, 15-17] reflecting radiographers' knowledge on the importance of their role as key frontline HCWs and having a thorough understanding of transmission, infection control and prevention of COVID-19. All respondents (100%) in the present study identified PPE being provided, although at times 'workload' (RR8) and 'communication' (RR4) affected the supply of PPE. This finding supports the evidence that as more COVID-19 patients were being admitted during the pandemic period, enough manpower would be required to meet the demands of increased workload [12]. Furthermore, as the pandemic continues to spread globally, clear communication with radiographers is necessary to ensure infection control [12], to safeguard HCWs and to minimise unnecessary anxiety and distress [15]. A majority (94.4%) of respondents in the present study identified donning, doffing and decontamination training were provided, while more than half (55.6%) of the participants observed social distancing and reduced working staff as part of infection control and protection measures. These findings are consistent with those reported elsewhere [1, 6, 16]. However, in contrast to these findings, some radiographers in Gauteng South Africa (SA) [4] indicated that the correct guidelines for donning and doffing of PPE were not demonstrated in their departments noting concerns for the proper wearing of the PPE and its safety. Furthermore, a study in the Republic of Cyprus [3] revealed that participants have not received adequate training concerning decontamination methods while another study by Yasin and colleagues [19] reported radiographers facing significant challenges with the additional cleaning and decontamination routines that were required.

These differences could be attributed to limited resource and training on COVID-19 infection control guidelines [12] and confirms the evidence that radiology practices vary widely across different settings and among countries, often due to differences in both expert human and physical resource availability [18]. Although few radiographers in the present study reported that 'not adequate PPE was provided as well as training to prepare them mentally' (RR10) and 'no workshop training was conducted during and after the pandemic' (RR15), specific training on how to handle and deal with COVID-19 infected patients was noted among majority (66.7%) of the respondents. These differences in

radiographers' perception could be attributed to the patterns of work changed during the pandemic where some diagnostic radiographers may perform mobile radiography [16] and may undergo these trainings while other co-workers may be redeployed or re-assigned to other imaging modalities [12] due to changes in work routine, and other changes in department protocols.

Impact of COVID-19 on radiographers' well-being:

In terms of radiographers' well-being, more than half (55.6%) of the respondents in the present study reported that fear of COVID-19 infection, increased workload, changes in work routine, and other changes in department protocols contributed largely to their stress. The perceived level of stress in regard to the impact of COVID-19 pandemic on work performance revealed that half (50%) of the respondents in the present study were "neutral" while less than half (44.5%) of the respondents reported being in the "very stressful" to "stressful" level. These findings are consistent with studies done elsewhere [12, 18-20] reporting that frontline HCWs like radiographers, who often had to take on the role of caring directly for patients with COVID-19 were at a higher-level risk of having severe mental health symptoms, emotional/psychological dilemma, anxiety and workplace-related stress. Similar experiences of workplace-related stress and anxiety were reported among radiographers in the Republic of Cyprus [3], Gauteng SA [4], United Kingdom [6], Ireland [15], Australia [16] and Ghana [17]. These findings suggest that radiographers at PMGH experience workplace-related stress similar to their co-workers globally due to COVID-19 pandemic and should be provided with occupational health services, mental health and psychosocial support, adequate sanitation, hygiene and rest facilities to support them as front line HCWs [11].

Further results in the present study reveal that a majority (66.7%) of the respondents were confident to face similar pandemic in future in their line of work with their experience on this current on-going COVID-19 pandemic. This response could be attributed to 'training/workshop on PPE, donning, doffing and visits from WHO personal' as commented by a radiographer in the present study (RR7). Similar to radiographer 7 (RR7), more radiographers commented on the need for continued in-house training:

"A continuous in-house training or practice in terms of PPE should/must be done, so staff members will be confident and well prepared for COVID-19 cases." (RR13)

"I think trainings on protection of personal from infections should be done on routine basis to keep staff and students plus patients vigilant on cross infection prevention. PPE training here in Radiology was done only once as far as I could remember." (RR12)

These findings suggest that to prepare radiographers for and respond to such pandemic events in future, it is advocated by the WHO to ensure appropriate and quality training and education are in place for all staff [11-12, 25]. It is also important to note that PMGH is the teaching hospital for the SMHS, UPNG [21-22], hence highlighting the importance of academic institutions in raising the pandemic readiness of students in terms of training [12]. Some potential solutions for student radiographers to enhance their training may include virtual meetings for e-learning and participation in remotely accessible research opportunities, simulated daily radiographic exam sessions during protected education time slots, reconfiguring rotations to ensure distancing while enabling preparation for delayed core exams, need for targeted support for students undertaking clinical placement, and avoiding multiple radiographic procedures whenever feasible [20, 25].

Interestingly, findings in the present study revealed that more than half (55.6%) of the respondents "disagree" and "strongly disagree" that the facility has provided mental health programmes on how to manage work related stress regarding the COVID-19 pandemic. Similar comments were echoed from some radiographers on the need for mental health training:

"Workshops on prep and post COVID counselling should be organized for staff who have acquired the virus or also for all staff to keep them mentally fit or to avoid episodes of psychological stress or breakdown." (RR12)

"There should be proper training involved in this situation. Especially the Mental Health programmes" (RR14)

These findings show the importance of providing mental health programs which can prevent radiographers from experiencing psychological breakdowns in future pandemic events [11, 19, 25]. Although radiographers are highly resilient people who are used to dealing with difficult and sometimes traumatic situations, they were concerned about contracting COVID-19 [19] at the work place. It is however important to note that the associated risk of infecting family, friends and colleagues, isolation from family, childcare struggles, economic struggles, misinformation and lack of information from COVID-19 [19] among radiographers at PMGH were not reported in the present study.

Limitation of the study:

The primary limitation is the small sample size, which limits generalizability. The study only looked at the perception of radiographers on the impact of COVID-19 within the general radiography, mobile radiography and CT, excluding other imaging modalities such as MRI, mammography, ultrasound or fluoroscopy. A further limitation is the lack of one or more reference groups of survey

participants other than radiographers (including physicians from other specialties, radiologists, nurses, and/or a general public outside the healthcare environment), potentially allowing to better discriminate findings specific to radiographers from those (e.g. symptoms of psychological distress) that might be shared by other groups [25]. Results may not be transferrable to other professions within PMGH or even to the same profession (both in private or public health facilities) elsewhere. A more comprehensive research is needed to determine the true impact of the pandemic on PNG radiographers. Despite the small number in the surveyed population, impact of COVID-19 on PMGH radiographers well mirrored current global estimates.

CONCLUSION:

The results of the present study revealed that all participants (100%) identified personal protective equipment (PPE) being provided, with a majority (94.4%) identifying donning, doffing and decontamination training were also provided. More than half (55.6%) of the participants observed social distancing and reduced working staff as part of infection control and protection measures. Specific training on how to handle and deal with COVID-19 infected patients was noted among 66.7% of the participants. The perceived level of stress due to COVID-19 revealed 44.5% of the participants being stressful. This study has demonstrated that although some radiographers have experienced some level of stress in their line of work, there were no reported mental health programmes provided during the COVID-19 pandemic at PMGH.

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SHORT COMMUNICATION:

AUDIT OF ASSESSMENT OF RISK FACTORS AND COMPLICATIONS FROM DELIRIUM IN GERIATRIC MEDICINE INPATIENTS

Running title: Geriatrics audit of delirium risk factors

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ABSTRACT:
Delirium is an acute confusional state and is common in hospitalised patients. Delirium is also a risk factor for dementia and should be recognised and managed in hospital settings. The aims of this audit were to identify whether the risk factors for delirium were identified and whether investigations to evaluate for causes were performed. All patients admitted under Geriatric Medicine, RIPAS Hospital from 1st to 31st May 2021 were included. Data was obtained via the hospital electronic clinical records. This included patient demographics, documented assessment of risk factors such as cognitive impairment, falls, dehydration and pain, and whether investigations for delirium were performed. Data was entered into Excel and analysed. There were 34 patients included in the audit. There were 26 (76%) females and 8 (24%) males. Median age was 82 years (Range 70-93 years), while median length of hospitalisation was 6 days (Range 1-26 days). There were 16 (47.1%) with known dementia, 3 (8.8%) with depression, while 5 (14.7%) did not have cognitive function documented. There were 12 (35.3%) with previous falls, while history of falls was not documented in 15 (44.1%). Hydration status was documented in most, except for 2 (5.9%). In terms of investigations, serum vitamin B12 and folate were not done in 17 (50%), serum calcium not performed in 4 (12%) and thyroid function test not done in 13 (38.2%) patients. Among the 17 (50%) that complained of pain, 15 (88%) were prescribed analgesia. This audit identified a need to improve identification of risk factors for delirium.

Keywords: Delirium, Dementia, Falls, Geriatric assessment, Pain

INTRODUCTION:

Delirium is an acute confusional state associated with illness, which increases in older people. Up to 20% of older people admitted to hospital have delirium [1]. Delirium is associated with increased complications in hospital, longer inpatient length of stay, impairment in long-term cognition and a higher risk of mortality. The risk is highest in acutely unwell patients, affecting up to 80% of those requiring the intensive care unit (ICU) [2].

A study of Geriatric medicine inpatients in a tertiary hospital in Brunei identified that two-thirds of the patients had functional impairment, with more than a third having a previous diagnosis of dementia [3]. These patients are at risk of delirium, which requires proactive assessment and management. This delirium risk was exacerbated during the COVID-19 pandemic, which was likely precipitated by increased unwellness due to delayed presentation to hospital, limited personal contact from family due to social restrictions, as well as lack of orientation and interruptions to routines in isolation wards [4].

Comprehensive geriatric assessment is the recommended approach for older people with complex medical conditions. It is a multi-dimensional approach to review the medical, psychosocial and functional aspects of a patient, and should be applied for patients at risk of or with delirium [5]. In addition to knowledge regarding baseline cognition and function, assessment and investigations to identify exacerbating factors such as infections and metabolic disturbances should be carried out, and these perturbations treated as part of delirium management. Blood tests to include for patients with cognitive issues include Vitamin B12 levels, folate, calcium and thyroid function [6]. Patients may also benefit from allied health professional input and therapy to recover from the delirium [5].

An audit of geriatric medicine inpatients was performed to evaluate the assessment of patients for delirium, in particular risk factors such as background cognitive impairment, pain, medications such as sedatives and whether relevant blood tests were obtained. In addition, assessment for complications such as falls, malnutrition, pressure injuries; as well as whether patients received corresponding allied health input was reviewed.

METHODS:

This was a retrospective review of all patients admitted under Geriatric Medicine in RIPAS Hospital from the 1st to 31st May 2021. Data was obtained via the hospital electronic medical records. The following information was obtained: patient demographics, documented history of previous cognitive impairment, pain assessment and treatment, medications and blood tests for evaluation of delirium (Vitamin B12, folate, calcium, thyroid function). Assessment for falls, pressure injuries, malnutrition, hydration status and input from allied health professionals were also reviewed.

RESULTS:

There were 34 patients, of which 26 (76.5%) were female. Median age was 82 years, with a range of 70 to 93 years. Median length of stay in hospital was 6 days (Range 1 to 26 days). Two (5.9%) patients were restrained due to delirium; one had mittens on the hands, while the other had both hands tied to the bedside

rails. Three (8.8%) patients passed away in hospital.

The most common risk factor for delirium was dementia, present in 13 (38.2%). Three patients had concurrent delirium and dementia; while one patient with delirium had suspected dementia. There were 6 (17.6%) patients who were documented as no previous cognitive impairment, while 5 (14.7%) did not have documentation regarding whether they had cognitive impairment or not prior to admission. Other risk factors for cognitive impairment were depression in 3 (8.8%), cerebral palsy in 2 (5.9%) and epilepsy in one patient.

Pain assessment was performed for all patients except for one. There were 16 (47.1%) patients identified as having pain. A wide range of analgesics were prescribed; the most common was paracetamol in 11 (32.4%), morphine in 5 (14.7%), tramadol in 3 (8.8%), gabapentin in 3 patients and diclofenac gel in 3 patients. Fentanyl was prescribed for two (5.9%) patients due to renal impairment. More than half, 18 (52.9%) did not have analgesia prescribed, 7 (20.6%) had one type of analgesic, 6 (17.6%) had two types, while three (8.8%) patients had three analgesics prescribed. Medication review for potential triggers or contributors to delirium identified six (17.6%) on sedatives, four (11.8%) on anticholinergic medications, and one patient on an antidepressant.

Blood tests performed for assessment of delirium identified that half the patients did not have their Vitamin B12 or folate levels done. For patients with these levels checked, none were found to be deficient. Calcium levels were normal for 27 (79.4%), abnormal for 3 (8.8%), and not done in 4 (11.8%). Thyroid function tests were not performed in 13 (38.2%) patients; of those checked, the results were within normal limits.

In terms of falls, 12 (35.3%) had documented previous falls, while 7 (20.6%) did not have previous falls. Fall history was not documented in 15 (44.1%) of the patients. Pressure injuries were identified in 13 (38.2%) patients, while 8 (23.5%) did not have pressure injuries. The presence or absence of pressure injuries was not documented in 13 (38.2%). A majority of patients, 32 (94.1%) were malnourished, with 25 (73.5%) seen by a dietitian. Similarly, 32 (94.1%) had hydration status documented, with intravenous fluids started for all 32 patients. Allied health professional input obtained for the patients included physiotherapy for 25 (73.5%) patients and occupational therapy for 16 (47.1%).

DISCUSSION:

This audit reviewed the assessment of patients for delirium risk factors and complications from delirium. There was a high rate of patients with known background of dementia (47.1% in this audit); this was slightly higher compared to the

previous study from the same hospital, identifying almost 40% with premorbid cognitive impairment [3].

Pain assessment was done well and performed in almost all patients. As untreated pain may contribute to delirium, a standard approach to pain assessment and management, including compliance to pain guidelines is essential for delirium management [7]. In terms of medications, some patients were on sedatives and anticholinergics, which may affect cognition and contribute to delirium. Clinicians should always reassess the appropriateness of prescribed medications during each clinical encounter. For patients with delirium, medications with anticholinergic properties should be deprescribed where possible [8]. The routine request of blood tests such as Vitamin B12, folate, calcium and thyroid function tests could be improved; with up to 50% of specific tests not requested.

Patients with delirium are at higher risk of falls. Screening for fall risk is important and should be a standard process for all older people admitted to hospital [9]. This is an area that should be improved on, with almost half the patients not having documented fall risk assessments in the clinical notes. Another standard of care for older people is screening for pressure injuries, which was not documented in up to 40% of the patients. A previous study identified up to a fifth of medical inpatients with pressure injuries, highlighting an ongoing need to improve pressure injury assessment and prevention [10].

A large number of patients received dietitian, physiotherapy and occupational therapy input. There was a surprisingly high rate of malnutrition identified (94%); most of whom appropriately received input from a dietitian. This was higher than a previous review of malnutrition screening, identifying 50% of geriatric inpatients in the same hospital being malnourished [11]. Previous COVID-19 lockdowns and social restriction measures during the first wave may have contributed to this; further assessment of the consequences of the pandemic in older people is required to evaluate this further. The rate of referrals to physiotherapy (73.5%) and occupational therapy (47.1%) was similar to a previous study with referral rates of 71.4% and 30.2% respectively [3]. During pandemic settings, as it is necessary to limit social contact to reduce infection and transmission risk, proactive planning is required to ensure provision of rehabilitation services [12]. As allied health staff require additional time to don personal protective equipment, this may also reduce the number of patients that can be seen compared to the pre-pandemic situation.

While it is outside the scope of this audit, further consideration should be given to follow-up of patients with delirium in hospital. Patients who are acutely unwell are at risk for long-term

complications, affecting cognitive, psychiatric and physical domains [13]. As patients admitted to hospital with delirium are at risk of developing dementia, it is important to monitor their cognition after discharge.

CONCLUSION:

Areas of improvement for delirium assessment were identified in this audit. This includes documentation of pre-morbid cognition, assessment for pain and the routine blood tests that should be performed for patients with cognitive impairment (Vitamin B12, folate, calcium, and thyroid function).

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