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Spatial clustering of maternal health services utilization and its associated factors in Tanzania: Evidence from 2015/2016 Tanzania Demographic Health Survey

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Abstract

Background: Utilization of maternal health services is the most significant component of safe motherhood, with severe effects on mother and child health. Though early and timely utilization of maternal health care services is recommended, many women do not access them. This study is aimed at examining the spatial clustering of maternal health services utilization and its associated socio-economic factors in Tanzania.

Methods: The secondary data analysis was conducted using Tanzania Demographic and Health Survey and Malaria Indicator Survey (TDHS-MIS) 2015-16. Spatial clusters of high and low use of maternal health care were detected using the Bernoulli model implemented in SaTScan™ software. The multiple logistic regression model was used to identify the predictors of maternal health services utilization in Tanzania.

Results: The Spatial analysis revealed that antenatal care and delivery care are heterogeneous across regions. High utilization was detected in Eastern and East-central regions, while low utilization was detected in northern and northwest regions. Moreover, mother's age, education level, wealth status, and several children were identified as predictors of the use of antenatal care and delivery care.

Conclusion: Results suggest spatial variation across the regions, though the data are insufficient to identify factors associated with a specific cluster. More data and analysis are needed to establish factors associated with high and low utilization of maternal health care services.

Keywords: Spatial clustering, maternal health, antenatal care, delivery care, Tanzania

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Introduction

Maternal mortality has been taking the lives of millions of women every year Worldwide (WHO, 2015). WHO estimated that 303,000 women each year were dying due to birth complications (WHO, 2015). Researchers and health experts agree that maternal mortality in developing countries is worse than in developed countries, and approximately 830 women die every day (Alkema et al., 2016). It was revealed that complications during delivery and pregnancy took 50% of pregnant women's lives in Sub-Saharan Africa, where the maternal mortality ratio was approximately 239 per 100,000 live births (WHO, 2015).

Tanzania is among the ten low-income countries contributing to 61 percent of global maternal deaths (Lozano et al., 2012; Lwelamira and Safari, 2012). More than 7,900 mothers die due to preventable childbirth and pregnancy-related complications (Alkema et al., 2016; Dagne, 2010). The Tanzania Demographic Health Survey and Malaria Indicator Survey report showed an increased maternal mortality ratio from 454 per 100,000 live births in 2010 to 556 per 100,000 live births in 2015 (TDHS-MIS, 2016).

Maternal health care services have been identified as one of the health indicators that can reduce maternal mortality and are taken as significant components of safe motherhood (ML et al., 2012). Previous studies have used these maternal health services, including antenatal care, delivery care, and postnatal care, as a pathway to track the progress of Sustainable Development Goals (SDGs) toward maternal mortality reduction (Atuoye et al., 2017; Kuuire et al., 2017). However, in Tanzania, data on maternal mortality are not readily available. As a result, many researchers have

used maternal health care service indicators as proxies for maternal mortality (Storeng and Béhague, 2017).

Early and timely utilization of maternal health care services can prevent maternal deaths (Babalola, 2014; Shrestha, 2017). However, in Tanzania, many women do not access those services during pregnancy, delivery, and the postnatal period (Atuoye et al., 2017). Many factors such as early marriage, high parity, and demographic and household characteristics have been identified as limiting factors to the utilization of maternal health services (Shrestha, 2017; Singh et al., 2014; Tarekegn et.al., 2014).

Various spatial statistical analyses and geographical information systems have been progressively used in epidemiology to examine the disease and non-disease distribution patterns and the associations between health events and correlations (Warden, 2008). However, research on spatial patterns has focused much on the disease rather than non-disease health outcomes (Meliker et al., 2009). The geographic variation of maternal health service utilization would provide information for policymakers and planners in the health sectors by targeting limited maternal health indicators in risky areas. Therefore, this paper examines the spatial clustering and determinants of maternal health care services utilization among reproductive women aged between 15 and 49 years in Tanzania using the TDHS-MIS 2015-16.

Materials and Methods

Study Design

A population-based cross-sectional study was used in this study**.** The data were drawn from the TDHS-MIS 2015-16, a nationwide household survey conducted to obtain reproductive and child health outcome indicators. The survey is the 9th series of DHS implemented by the Tanzania National Bureau of Statistics and the Office of the Chief Government Statistician Zanzibar, in collaboration with the Ministry of Health and Social Welfare. The detailed methods and procedures used in the data collection have been published elsewhere (TDHS-MIS, 2016). The survey collected information from a national representative sample of 13,266 reproductive women. Finally, 6,978 reproductive women aged between 15 to 49 years who had given birth in the past five years preceding the survey were picked. The data also comprise spatial features such as latitude and longitude, which consist of 608 sample points.

Statistical Analysis

Secondary data analysis was conducted using STATA and SaTScan software. The STATA version 14 was used to process and describe the selected two dependent variables for maternal health care services. Antenatal care visits were collapsed and a dichotomous variable was created based on whether women had attended 4 or more ANC visits during the pregnancy or otherwise. Also, the delivery care was coded to a dichotomous variable based on whether pregnant women had delivered in the health facility or not. Explanatory variables to assess the use of ANC and delivery care at the individual level were both categorical and continuous. These variables were; residence, mother's age, level of education, household wealth, marital status, parity, and mother's working status.

The chi-square (χ^2) test was used to show the association between dependent variables and independent variables. Those independent variables which showed significant association with the dependent variable were entered in the multiple logistic models to determine the effect of collective independent variables on the outcome variables. Odds Ratios (OR) and 95% Confidence Interval (CI) were computed to measure the effects of explanatory variables on the outcome variable. Variables with p values less than 0.05 were considered statistically significant.

Spatial Scan statistical analysis was used to identify significant clusters of ANC and delivery care. A Bernoulli-based model was used to analyze cases with binary events (i.e., whether the

woman had attended 4 or more ANC visits or not as 1or 0 and whether a woman delivered in the health facility or not as 1or 0). The scan statistics developed by Kulldorff and SaTScan™ software version 9.4 was employed to identify low and high ANC and livery care lusters. The high utilization clusters denoted those with 4 or more ANC visits/health facility-based delivery while the low utilization clusters represented those with less than four ANC visits/delivery in non-health facilities. The pure spatial Bernoulli model was used to detect and evaluate clusters by scanning windows gradually across the space. The scanning process was employed for noting the number of observed and expected observations inside the window at each location. The scanning window with the maximum likelihood was the most likely higher-performing cluster, and a p-value was assigned to this cluster (Kulldorff, 1997). The SaTScan requires three input files, case file, control, and location file. The number of women with 4 or more ANC visits/health facility-based delivery was considered a case. Moreover, the number of women with less than four ANC visits/non-health facility was considered a control.

Ethical Considerations

This study used secondary data from the Tanzania Demographic and Health Survey and Malaria Indicator Survey (TDHS-MIS) 2015-16. Using the University of Dar es Salaam research permit, the data was requested and approved through https://dhsprogram.com/data on 14th Feb 2017.

Results

Description of Socio-demographic Characteristics

A total of 6,978 reproductive women aged 15 to 49 years of age who had at least one birth five years before the survey were included in the analysis. The majority (74%) of respondents were from rural residences. Most of the respondents (65%) were in the age group 20-35, and 7% were less than 20 years old. About 61% of the respondents had a primary education level, and roughly 20% had no formal education. Moreover, 22% of the respondent were in the richer wealth status, and 21% were in the poorest wealth status. Most of the respondents (82%) were married, and 6% of them were single. Regarding the total number of children, 24.58% had one child, 47.76% had 2 to 4 children, and 27.66% had five or more children. About 83% of the women worked, and only 17% did not work. About 51% of women had attended four or more ANC visits compared to 49% who attended less than four ANC visits. There is a high rate of delivery care in the country, with 67% of the women using health facility-based delivery care compared to 33% who still use non-health facility-based delivery care **(Table 1).**

Table 1: Sociodemographic characteristics of respondents

Demographic Attributes	Number	Percent (%)
Residence		
Urban	1814	26.00
Rural	5164	74.00
Age group		
15- 19	521	7.47
20 -34	4592	65.81
35 -49	1865	26.73
Educational level		
No education	1370	19.63
Primary	4227	60.58
Secondary/ Higher	1381	19.79
Wealth Status		
Poorest	1436	20.58
Poorer	1348	19.33
Middle	1362	19.52
Richer	1540	22.07

Demographic Attributes	Number	Percent (%)
Richest	1292	18.52
Marital status		
Single	434	6.22
Married	5710	81.83
Widowed	843	11.95
Parity		
1	1715	24.58
2-4	3333	47.76
5 and above	1930	27.66
Mother's Occupation		
Not working	1167	16.72
Working	5811	83.28
Number of ANC visits		
less than four visit	3530	50.59
four or more visit	3448	49.41
Delivery Care		
Non-health facility	2291	32.83
Health facility	4687	67.17

Identified Clusters with Higher and Low Utilization of ANC Care

The spatial scan statistics results identified only one significant cluster of high use of ANC care and ten significant clusters of low use of ANC care (Figure 1). The most likely cluster of high utilization of ANC care was detected in the Eastern and East-central parts of the country. The cluster included Morogoro, Manyara, Tanga, Pwani, Lindi, Mtwara, Ruvuma, Njombe, Mbeya, Iringa, Singida, Dodoma, Tabora, Dar es Salaam, Kusini Unguja, Kaskazini Unguja and Kilimanjaro regions with the LLR = 179.91, at p<0.001.Women in this cluster were 2 times more likely to have high utilization of ANC care [RR=1.67, p<0.01] than women in other clusters. In terms of low utilization of ANC care, ten significant clusters were identified. The first (primary) cluster was most likely, and 9 were secondary clusters ordered by their statistical significance of log-likelihood, located in the western part of the country. The most likely clusters of low utilization were found in Katavi, Kigoma, Tabora, and Geita regions with the LLR= 56.90, at p<0.01. Women in this cluster were less likely to have low utilization of ANC care than women in other clusters. Another significant secondary cluster of low utilization of ANC care was detected at Mwanza, Simiyu, and Kaskazini Pemba.

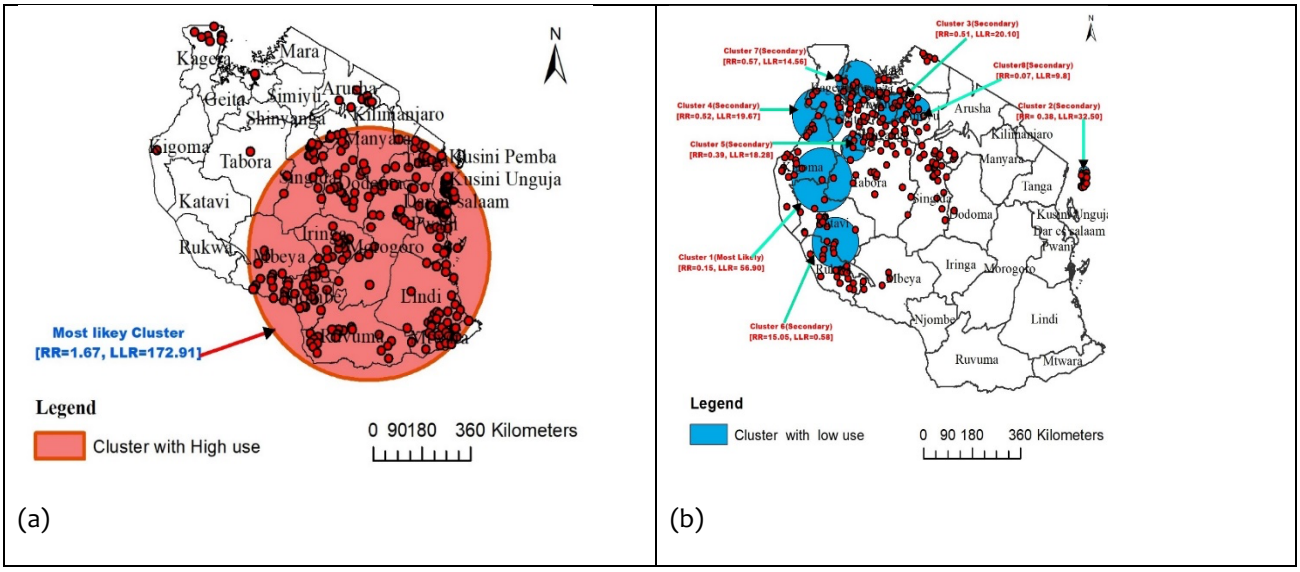

Figure1: Detected clusters with (a) High and (b) Low utilization of ANC care

Clusters with High and Low Utilization of Delivery Care

The spatial scan statistics analysis for cluster detection bases identified four significant clusters of high utilization of delivery care and eight significant clusters of low utilization of delivery care (Figure 2). The cluster of increased utilization of delivery care was located in the east-central part of the country. The most likely cluster with high delivery care was found in Mtwara, Mbeya, Iringa, Dodoma, Morogoro, Pwani, and Dar es Salaam, Lindi, Njombe, Ruvuma, and Mtwara regions with the LLR =391, at p<0.01. Women in this cluster were 2 times more likely to utilize delivery care [RR=1.84, p<0.01] than women in other clusters. The significant clusters for low utilization of delivery were located in the north and northwest of the country. Katavi, Kigoma, Tabora, Simiyu, Kagera, and Geita regions were detected in the most likely cluster with LLR=95.72, at p<0.01. Women in this cluster were 35% less likely to have low use of health facility-based delivery [RR= 0.65, p<0.01] than women in other clusters. Other significant secondary clusters of low utilization of delivery care were detected in Rukwa, Mbeya, and Mara.

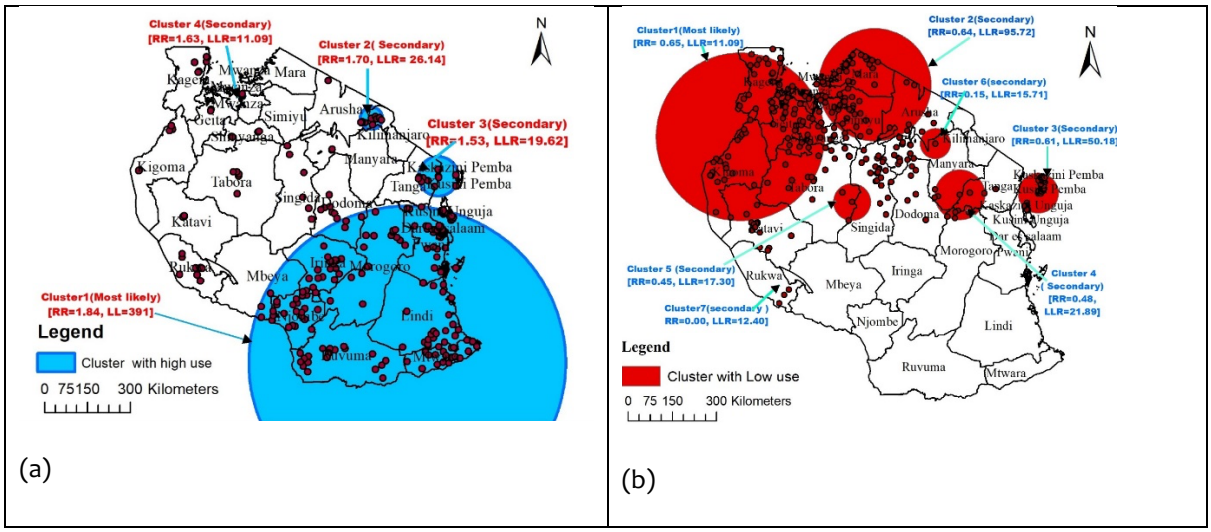

Figure 2: Detected clusters with (a) high and (b) low utilization of delivery care

The Relationship between Demographic Characteristics and Maternal Health Care

ANC care had a significant relationship with residence, women's age, education level, wealth status, and mother's occupation. Also, the delivery care had a significant association with residence, age, educational level, wealth status, marital status, and parity **(Table2).**

Table 2: The relationship between demographic characteristics and maternal health care

	Maternal Health care services			
	Antenatal care		Delivery care	
Variables	P-Value	χ^2	P-value	χ^2
Residence	0.0**	118.7	0.0**	517.92
Age group	0.0**	10.18	0.0**	20.02
Level of education	0.0**	134.14	0.0**	503.6
Wealth status	0.0**	272.59	0.0**	871.94
Marital status	0.07	5.42	0.0**	46.19
Parity	0.0**	112.92	0.0**	332.19

Mother Occupation	0.0***	8.47	0.09	2.71

Note: Significance level: **=p<0.001, ***=p<0.05

Factors associated with utilization of Antenatal Care

ANC care utilization was high among women with secondary education (61.55%) and low among those with primary education (39.71%). Women who belong to the rich wealth status (66.02%) tend to use ANC visits compared to those in the poorest wealth status (38.65%). Also, the utilization of ANC visits was high among women who have given birth to one child (57.67%) and lower among those with five or more children (40.26%). The multiple logistic regression shows that women aged 30- 49 years are more likely to utilize ANC [AOR= 1.18; 95% CI: 1.03 -1.35, p=0.001] than women aged 20-35 years. Women with secondary and higher education levels are more likely to utilize ANC [AOR= 1.12; 95% CI: 0.67 -1.28, p=0.13] than those with primary education. Women who had no formal education were 14% less likely to utilize ANC care [AOR=0.86; 95% CI: 0.76 -0.98, p=0.12] than those with primary education. Likewise, women who belong to the richest wealth status were two times more likely to utilize ANC care [AOR: 1.39, 95% CI= 1.17-1.64, p<0.001] than those in the richer wealth status. Regarding the total number of children, women with one child were two times more likely to utilize ANC care [AOR=1.24, 95% CI= 1.09-1.39, p<0.001] than those with 2 to 4 children. Women with five or more children were 22% less likely to utilize ANC care [AOR=0.78, 95% CI= 0.70-0.88, p<0.05] than those with 2 to 4 children (**Table 3).**

Table 3: Socio-demographic characteristics by utilization of ANC care

Covariates	Number of ANC Visit		Adjusted odds ratio	
	Less than 4 visits N (%)	4 or more visits N (%)	AOR(95%CI)	Overall p-value
Residence				$p < 0.001$
Urban	718 (39.58)	1096 (60.42)	1.67 (0.93 -1.23)	
Rural	2812 (54.45)	2352 (45.55)	*Ref*	
Age group				$p < 0.001$
15- 19	280 (53.74)	241(46.26)	0.72(0.59-0.88)***	
20 -34	2260 (49.22)	2332(50.78)	*Ref*	
35-49	990 (53.08)	875(46.92)	1.18(1.03-1.35)***	
Education Level				$p < 0.001$
No education	826 (60.29)	544 (39.71)	0.86 (0.76 – 0.98)**	
Primary	2173 (51.41)	2054 (48.59)	*Ref*	
Secondary/ Higher	531 (38.45)	850 (61.55)	1.12 (0.67 – 1.28)	
Wealth Status				$p < 0.001$
Poorest	881 (61.35)	555 (38.65)	0.57 (0.49 – 0.67)***	
Poorer	784 (58.16)	564 (41.84)	0.64 (0.55 – 0.75)***	
Middle	743 (54.55)	619 (45.45)	0.72 (0.61- 0.84)***	
Richer	683 (44.35)	857 (55.65)	*Ref*	
Richest	439 (33.98)	863 (66.02)	1.39 (1.17 – 1.64)****	
Parity				$p < 0.001$
1	726 (42.33)	989 (57.67)	1.24 (1.09 – 1.39)***	

2- 4	1651 (4953)	1682 (50.47)	*Ref*
5 and above	1153 (59.74)	777 (40.26)	0.78(0.70 - 0.88)***

Significance level: ***= p<0.01, **= p<0.05, *= p<0.1, and *Ref*: reference categories

Factors associated with utilization of delivery care

More than 70% of the women aged below 20 years tend to give birth in the health facility, though this trend declines as the women grow older. The utilization of delivery care is higher (86.89%) among women with secondary and higher levels of education and low (46.72%) among those with a primary education level. Most women (80.25%) with one child prefer to give birth in a health facility than those with five or more children (52.28%). Women residing in urban areas were 2 times more likely to utilize the delivery care [AOR=2.19, 95% CI: 1.81-2.64, p<0.01] than women in rural areas. Women aged 35-49 years were two times more likely to utilize delivery care [AOR=1.45, 95% CI: 1.25-1.73, p<0.01] than those in the reference group 20-34 years. Concerning educational level, women with secondary and higher education were more likely to utilize the delivery care [AOR=1.41, 95% CI: 1.16-1.75.p<0.01] than women with primary education. Also, women with no formal education were 39% less likely to utilize the delivery care [AOR=0.61, 95% CI: 0.53-0.69] than women with primary education. Furthermore, the odds of women who utilize the delivery care is increased with -wealth status. Thus, women from the richest wealth status were two times more likely to utilize the delivery care [AOR= 1.92, 95% CI= 1.48-2.49, p<0.01] than women in the richer wealth status. In addition, women from the middle-wealth status were 34% less likely to utilize the delivery care [AOR=0.66, 95% CI: 0.56-0.79, p<0.01] than women from the more affluent household. In terms of parity, women with one child were two times more likely to utilize the delivery [AOR= 1.74, 95% CI= 1.46-2.06, p<0.01] than women with two to four children. Likewise, women with five or more children were 45% less likely to utilize the delivery care [AOR= 0.55, 95% CI= 0.47-0.64, p<0.01] than women with 2 to 4 children **(Table 4).**

Table 4: Socio-demographic characteristics by delivery care

Covariates	Delivery Care		Adjusted odds ratio	Overall p-Value
	Non-Health facility delivery N (%)	Health facility delivery N (%)	AOR(95% CI)	
Residence				$p < 0.001$
Urban	204 (11.25)	1610 (88.75)	2.19 (1.81-2.64)****	
Rural	2087 (40.41)	3077 (59.59)	*Ref*	
Age group				$p < 0.001$
15-19	156 (29.94)	365 (70.06)	0.86 (0.67- 1.09)	
20 -34	1446 (31.49)	3146 (68.51)	*Ref*	
35 -49	689(36.94)	1176 (63.06)	1.45 (1.25 -1.73)***	
Education Level				$p < 0.001$
No education	730 (53.28)	640 (46.72)	0.61(0.53 – 0.69)***	
Primary	1380 (32.65)	2847 (67.35)	*Ref*	
Secondary/Higher	181 (13.11)	1200 (86.89)	1.41(1.16 – 1.71)***	
Wealth status				$p < 0.001$
Poorest	777 (54.11)	659 (45.89)	0.36(0.30 -0.42)***	
Poorer	612 (45.40)	736 (54.60)	0.49 (0.41 – 0.59)***	
Middle	484 (35.54)	887 (64.46)	0.66 (0.56 – 0.79)***	
Richer	321 (20.84)	1219 (79.16)	*Ref*	
Richest	97 (7.51)	1195 (92.49)	1.92 (1.48 – 2.49)***	
Marital status				$p < 0.001$

Single	82 (18.89)	352 (81.11)	1.02 (0.77 – 1.35)	
Married	1957 (34.27)	3753 (65.73)	*Ref*	
Widowed	252 (30.22	582 (69.78)	1.07 (0.90 – 1.27)	
Parity				$p < 0.001$
1	339 (19.77)	1376 (80.23)	1.74 (1.46 -2.06)***	
2-4	1031 (30.93)	2302 (69.07)	*Ref*	
5 and above	921 (47.72)	1009 (52.28)	0.55 (0.47- 0.64)***	

Significance level: *** = p<0.01, ** = p<0.05, * = p<0.1, and *Ref*: reference categories

Discussion

This study conducted secondary data analysis to examine spatial clustering of maternal health care utilization and its correlations among reproductive women aged between 15 and 49 years in Tanzania. The spatial analysis shows the variation in utilization of ANC care and delivery care across regions. Kagera, Geita, Kigoma, Simiyu, Tabora, Shinyanga, Manyara, Kusini Pemba, and Kaskazini Unguja regions located in northern and northwest Tanzania were found to have low utilization of ANC and delivery care. The high utilization of ANC and delivery care cluster was detected in the Eastern and East-central of Tanzania, including Lindi, Ruvuma, Mtwara, Njombe, Dodoma, Singida Dodoma, Dar es Salaam, Iringa, Kusini Unguja, and Kaskazini Unguja regions.

According to TDHS-MIS 2016 survey, it was shown that the distribution of ANC and delivery care among pregnant women in Tanzania is quite different across the regions(TDHS-MIS, 2016). These results were also the same as those presented by Asamoah et al. (2014), Gayawan (2014), Tripathi and Singh (2017), and Yeneneh et al. (2018) in their study researched in Ghana, Nigeria, India, and Ethiopia. These researchers found that maternal health care services varied across the regional level of their countries. The results may be attributed to poor health infrastructure and facilities invested in these regions that support ANC and delivery care. Such findings call for government and stakeholders to improve health infrastructure and delivery facilities by investing in areas with low utilization of ANC and delivery care.

The study assessed the relationship between the socio-economic factors and the use of ANC and delivery care in all regions of Tanzania. The study revealed that women between 34 and 49 years were more likely to utilize ANC and delivery care than those below 20 years. This implies the fear of young aged women attending ANC with their parents. It was further noticed that at this age, most of these women are unmarried. Such practices limit them to exposure in the public because it is an embarrassment to their parents. These findings are in line with the observation of Njiku et al. (2017), who presented similar results. However, the findings are contrary to Tsawe and Susuman (2014), who found that young women were more likely to use maternal health care services than older women. Also, the findings imply that more efforts are needed to create awareness among the young generation because their fear of their parents and service provider regarding the utilization of ANC and delivery care had a consequence on their health and newly born.

Besides the age of women, the study assessed the influence of education on the use of ANC and delivery care. Findings indicated that women with secondary or higher education levels were more likely to utilize ANC and delivery care than women with no education. These results concur with the study conducted by Gupta et al. (2014), Lwelamira et al. (2015), and Tarekegn et al. (2014). The above researchers reported that educated women usually had significant knowledge of ANC and delivery care utilization and could make the right decisions about their health. Moreover, the study found that educated women are located in urban areas where the health facilities are excellent. It is worth noting that health education must be encouraged among young generations and the community because poor strategies would increase maternal deaths.

The wealth status is one of the critical variables in assessing the association between income and the use of ANC and delivery care in regions of Tanzania. Findings revealed that the utilization of ANC and delivery care increases with the wealth status. The study found that women from the wealthiest households were more likely to use ANC and delivery care than affluent households. Similar, findings appear in the work of Chimankar and Sahoo (2011), Gupta et al.(2014), Toan (2012), and Yeneneh et al. (2018) that women from a wealthy status can incur transport costs and other expenses associated with the utilization of ANC and delivery care because most of the health facilities are not located near the households. Despite the government waiving some costs for maternal health care services, there are some items that women must pay for from their pocket. This implies that the policymakers and health care providers must strategize on providing ANC and delivery care services for free, more specifically to those below 20 years and residing in rural areas where their income is impoverished.

Many studies, including Ghaffar et al. (2015), Tarekegn et al. (2014), and Yeneneh et al. (2018), indicated that woman's number of children had a significant association with the utilization of ANC and delivery care. The study has noted that women attending ANC and delivery care are higher among nulliparous women than multiparous women. Experiences and statistical facts show that nulliparous women might develop less confidence in pregnancy period and delivery time that motivates them to use maternal health services than multiparous women. Moreover, nulliparous women tend to be afraid of pregnancy complications and outcomes since they have no prior pregnancy and delivery experience. This implies that awareness linking the number of children born by a woman and the use of ANC and delivery care must focus on the consequences of ignoring it across all ages and regardless of women's experience.

Conclusion

This study identified high and low use of ANC and delivery care. The analysis found that the high use of ANC and delivery care were detected in East and East-central, and low utilization was dominant in the northern and northwest of Tanzania. The study revealed that mothers' age, educational level, wealth status, and parity had a strong relationship with ANC utilization and delivery care in the country. Based on the findings, interventions in the identified hotspot areas are paramount for improving women's maternal health.

The results provide an avenue to further analysis of factors associated with specific areas. Policymakers and health care planners need to utilize the information to fill the gaps in ANC uptake and delivery care across clusters. Moreover, results call for health providers/stakeholders to invest in disadvantaged groups and regions, specifically rural areas. Therefore, inequality in the utilization of ANC and delivery care may be addressed to improve the uptake of maternal health care services in Tanzania.

Conflict of Interest: Authors declare no conflict of interests

Authors' contributions

BT has made substantial contributions to the conception, design of the work, manuscript drafting, analysis, and interpretation of data. AM provided her expertise on the study's design and use of SaTScan software, which in spatial analysis of maternal health services utilization. MM has provided his expertise in the design of the study, editorial work, and arrangement of the manuscript for publication. All authors read and approved the final manuscript.

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Technical factors influencing family planning data management process in private hospitals in Ilala Municipal Dar Es Salaam, Tanzania: A qualitative study.

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Abstract
Introduction: Sound and reliable information is the foundation of decision-making across all health system building blocks. Strengthening the health information system is a global concern, especially in developing countries where data management is reported to be weak. In Tanzania, the family planning data management process is faced with discrepancies, such as completeness, timeliness, and accuracy thus calling for a need to explore technical factors that influence it.
Objective: To explore technical factors influencing the family planning data management process among private hospitals in Ilala Municipal Council.
Methodology: It was a cross-sectional explorative study design that used a qualitative approach. In-depth interviews were conducted by using the semi-structured interview guide. Twelve participants were involved. The study participants were purposively sampled. They included the health secretary, reproductive and child health in-charge, a nurse, and the data focal person. An inductive content analysis approach was used during data analysis.
Results: Poor data quality characterized by inaccuracy, inconsistency and untimely recording and transferring to DHIS2, inadequate skilled manpower, and poor capacity building were the factors influencing the family planning data management process.
Conclusion: The family planning data management process is affected by numerous factors, among which are poor data quality, inadequate skilled manpower, and poor capacity building. The MTUHA book 8 should be reviewed by the Ministry of Health and other implementing partners to ensure curative pill data are being captured.

Keywords: Data Management, Family Planning, Technical Factors, Health Management Information System, Contraceptives, District Health Information System

Introduction

Health systems require quality data from Health Management Information System (HMIS) to plan for and ensure that the workforce is fully funded and equipped with the necessary commodities, infrastructure, resources, and policies to deliver services. Quality health data are, in and of itself , a prerequisites to improving each of the other five building blocks of the health systems (Nutley, 2012). The Global Alliance for Vaccines and Immunization (GAVI) has initiated the Data Quality Audit (DQA) to improve the monitoring progress of health services (Matsuoka et al., 2014). In low-income countries, there are different initiatives to improve the quality of health data, including Health Metrics Networks and Performance of Routine Information System Management (PRISM) (Nutley & Reynolds, 2013).

In most developing countries, each of the HIS stages of collection, collation, compilation, analysis, and reporting of HMIS data is burdened by major problems ranging from inadequate

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human resources (who mostly cannot undertake the assigned tasks) to excessive and uncoordinated reporting requirements (Karuri et al., 2014). The data collection process faces challenges like poor supply of tools, timeliness of reporting, poor understanding of data collection tools, duplication/overlap of data tools, too much to collect, and low data quality.

In 2011, the Pwani region was used as a testbed for paper-based data collection tools and the District Health Information System (DHIS2). Two years of the revised systems were rolled out to the remaining 24 regions and associated districts and health facilities on the Tanzanian mainland. On completion of this rollout, efforts were directed towards the integration of all major vertical programs such as malaria, tuberculosis (TB)/leprosy, Reproductive and Child Health (RCH), and HIV/AIDS into DHIS2. Since 2014, DHIS2 has been integrated with other software systems, enabling health workers to cross-cut, analyze, and share data across organizations (THDC, 2017).

Maternal, newborn, and child health care, is one of the key components of the National Package of Essential Reproductive and Child Health Interventions, focusing on improving the quality of life for women, adolescents, and children. Maternal, newborn, and child outcomes, are interdependent, and maternal morbidity and mortality impact neonatal and under-five survival, growth, and development (National Family Planning & Message Guide, 2013). It is noted that family planning is critical for preventing unintended pregnancies and unsafe abortions, ultimately contributing to reducing maternal and child mortality. Family planning also contributes to the reduction of poverty and empowers men and women to freely and responsibly choose the number and spacing of children (Brosche, 2016).

In Tanzania the government introduced the National Family Planning Costed Implementation Program guideline (NFPCIP). NFPCIP shows that monitoring and evaluation (M&E) systems need strengthening. The 'way forward' calls for investments in developing a comprehensive M&E and research strategy for the health and social welfare sector that is integrated with the health management information system (HMIS). For the NFPCIP, this includes having adequately trained personnel to collect, report, analyze, and use family planning (FP) data for oversight of plan implementation and to recognize needs for and make decisions (NFPCIP, 2010).

National HMIS guidelines have been developed and are accompanied by training materials. The guidelines spell out the objectives of the HMIS system, describe the system in detail, contain all the data collection tools (registers, tally sheets, and summary forms) for every health program, and contain instructions on how to use each data collection tool within the HMIS. Data on family planning services is collected using the family planning register, MTUHA book 8, tally sheet, and a summary report daily at the facility level. Every month, data are summarized using a standardized monthly facility report that is sent to the sub-district information office. Data are entered into DHIS2, from which the electronic export file is exported to the district information office (MoHCDGEC, 2016).

When these data are summarized in the monthly facility report for DHIS2, there are some challenges facing data quality, including but not limited to poor numeracy skills by the healthcare workers, poor understanding of indicators, high staff turnover, and unstandardized collection tools (Garrib et al., 2008). Another problem commonly cited with HIS systems in these countries is the lack of data ownership, leading to a situation where there is no incentive for health workers at levels below the national level to analyze, use, and interpret health data (Aqil A. et al., 2010).

The use of family planning contraceptive methods among married women aged 15-49 years and young women age 20-24 years is still low, with a prevalence of 22% and 23.5%, respectively (Brosche, 2016). This indicates there is a mismatch between the quantities of contraceptives distributed and the data reported. This implies that there are challenges in the data management process implementation, especially in the context of the collection, compilation, and entry into DHIS2. A study done in Kenya revealed problems facing data entered into DHIS2 are due to inadequate training for users, low deployment to all facilities, and a lack of management support.

Even those that have deployed were not fully utilizing the system to generate important information for use at the facilities (English et al., 2014).

Little is known about the quality of the family planning data management process and its influencing factors, especially in private health facilities where a huge disparity is experienced (Ministry of Health and Social Welfare, 2018). To improve the performance of the RHIS for family planning, this study explored technical factors influencing the family planning data management process.

Methods

Study design

An audit evaluation design adopting a qualitative approach was deployed to explore technical factors influencing the family planning data management process among private hospitals in Ilala Municipal. The audit was used to examine the set procedures in the national guideline of 2017 for family planning data on the data management process. The qualitative approach helps to uncover trends in thought and opinions and dive deeper into the problem. It also provides insights into the problem and helps develop ideas for potential quantitative research. This enabled us to get the experience of the respondents concerning our matter of interest (Cochran, 2002).

Study setting

The healthcare system in Tanzania is organized in a pyramid shape with three levels of healthcare service provision (Kwesigabo et al., 2012). The study was conducted in private hospitals that are in Ilala Municipal Council, Dar es Salaam. Ilala has more private hospitals on a regional level, compared to other municipals in Dar es Salaam. It has six private hospitals at a regional level which are Burhani, Hindu Mandal, Regence, Aga Khan, and Tumaini hospitals.

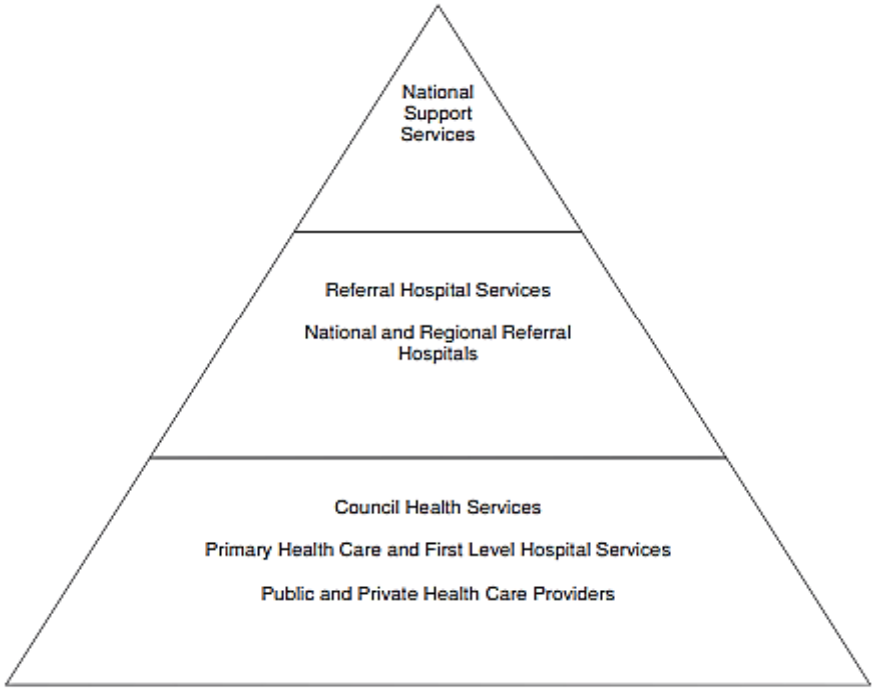

Figure 1: Health system in Tanzania(Source: The United Republic of Tanzania; Ministry of Health and Social Welfare (Ministry of Health and Social Welfare [Tanzania], 2008).)

Data collection

Qualitative methods using in-depth interviews with twelve purposively selected key informants from five private hospitals were done. They were selected based on their knowledge of the study of interest. Data were recorded using a digital recorder.

Data analysis

Audio-recorded interviews were transcribed verbatim and then translated from Swahili to English. Data were analyzed by using inductive content analysis to capture the experience of the participant (Erlingsson & Brysiewicz, 2017). All authors read and re-read the full transcript to identify the sense of the whole interview. Texts were divided into meaning units, and the latter were condensed while keeping the core meaning. The next step was to label condensed meaning units by formulating codes and then codes were grouped into categories. Analysis was done using QSR International NVivo12 (QSR International Pty Ltd, 2018) into themes to identify emerging trends between and within variables.

Ethical consideration

Ethical approval from the Muhimbili University of Health and Allied Sciences (MUHAS), Research Ethical Committee (REC) was granted for this study (reference number; DA.287/298/01A/). Permission to carry out the study was obtained from the management of the respective hospitals. The purpose of the study was explained to participants and written informed consent was sought before the interview. Privacy and confidentiality were highly considered whereby each interviewee was interviewed alone in the room and no names were required. Participants were informed that their participation was purely voluntary and they had the right to withdraw from the study at any time.

Results

Socio-demographic characteristics

The study involved 12 key informants, 10 from five private hospitals (1 nurse and 1 RCH in charge from each hospital) 1 health secretary, and 1 data focal person.

Table 1: Summary of key informants from Ilala Municipal Council

Key informant	No. of KIIs
Nurses	5
Reproductive and Child health in charges (RCH)	5
Health secretary	1
Data focal person	1
Total	12

Technical factors Influencing Family Planning Data Management Process

Poor data quality

Inaccurate data characterized by wrong data recorded in the MTUHA book 8, un-entered data, and unavailability of treatment data were found to affect the data management process. Informants from this study revealed that it has been difficult to capture some information especially when family planning products have been used for treatment so that they can be excluded. The latter leads to the lumping of family planning products that have been used for treatment with the ones used for family planning purposes, which have been lumped together.

"The register does not have a component for treatment, therefore if a patient is administering an injection as part of treatment when it comes to incorporating such information into a register. it becomes impossible. Therefore, we recommend such a part has to be included in the updated version of the register" (KI-01)

Informants recommended that the register needs to be improved so it can capture all important information to have quality and reliable statistics. Dissemination of information is one

of the key parameters of the research; it was found that the reports are disseminated every three months. This study suggests the monthly dissemination of reports.

"Registers have to be improved so that only specific indicators have to be included and reports should be disseminated every month."(KI-08)

Inconsistent data attributed to unstructured book, redundant data, mismatching of registers' data with that entered in DHIS2, and duplicates were mentioned as affecting the family planning data management process. It has been noted that data are not timely entered into the system due to limited time allocated for data entry and having multiple tasks within hospitals. Informants also revealed that little attention has been given to data entry; this has led to untimely data entry and hence delays in the reports and other planning. This happened in a private hospital where they have computers for entering data.

"There is untimely data entry and inconsistency of collected information due to errors from registers; this leads to having wrong statistics."(KI-03)

Confusion was found to be existing as spotted by key informants that there was a mismatch of register. This has been happening when the family planning commodities have been used for curative purposes. It has been difficult for them to capture such information.

"We do not have enough knowledge on how to capture information to register and there is some confusion, especially when family planning data have been used for curative purposes." (KI-02)

Inadequate skilled manpower

Informants revealed that health workers in the family planning department are sometimes over-tasked as they are overwhelmed with other responsibilities. They suggested that an adequate and competent number of nurses/staff for collecting and entering information into DHIS2 was required for the successful implementation of the HMIS project in selected hospitals and timely submission of reports. Findings have shown that there is a shortage of staff with knowledge of collecting, entering, and processing the collected data. This has lowered the speed of collecting, entering, and processing the family planning data.

"There are fewer staff with knowledge of HMIS especially data on family planning. You may find that among three nurses, only one is competent. Also, sometimes we have the problem of staff turnover as they shift to other NGOs." (KI-07)

HMIS knowledge was found to be among the most challenging factors in the family planning data management process. Findings show that respondents proposed the availability of a specialized nurse who deals with collecting and entering family planning data into DHIS2. This will improve efficiency, data quality, and timely submission of the reports. This strategy has been implemented by MDH, PSI, and so on. The availability of specialized nurses who will work on data management will also reduce the workload on other nurses as they will proceed with other duties according to their job descriptions.

"Some nurses should specialize in taking records for family planning and enter them into DHIS2; and they should not do other jobs as it has been done by MDH. This will help to improve the quality of the collected information."(KI-06)

Some nurses have been doing data collection using their own experiences, which may be one of the factors associated with the low quality of data. These nurses have not been trained elsewhere; they have acquired some skills by working with trained nurses. They have been entering data into the register using their own experience acquired from their fellows.

"We are doing it by experience; my fellow nurses were trained by PSI before joining the hospital."(KI-12)

Findings have shown that some hospitals do not have a specific person who understands how to enter data into DHIS2. Therefore, they normally do not send the report to Ilala Municipal and unfortunately, they do not have family planning products. This led to the under-coverage of information related to family planning as some information in the respective hospitals was not captured.

"We don't have family planning pills; we normally take records on family planning but we don't send a report as we don't have someone who knows how to enter data into the system. "(KI-09)

Poor capacity building

There are inadequate training opportunities in family planning data management. Most nurses who work in family planning data management units are not trained, and they have learned and acquired experience by being taught by those who attended the training in family planning data management. This situation is quite different from government hospitals where nurses who do similar tasks have been trained. This brings the argument that nurses working in private hospitals have to be considered for training opportunities as this will lead to the improvement of data quality.

"There are inadequate training opportunities. Most of us have just been taught by the nurse who attended training, and normally the nurse cannot teach all of us due to limitations of time. Training should involve nurses working in private sectors and not public hospitals only. "(KI-01)

Findings have revealed that some nurses do not have competent knowledge and skills in filling the register, and they have also suggested expansion of their knowledge and reaching the capacity to be able to plug data into the DHIS2 system.

"I have little knowledge of how to fill the register. I was taught by my fellow nurse. I have also been wishing to know how to use the DHIS2 system." (KI-05)

More training is required, from data collection and processing to data analysis. There is an inadequate number of nurses who have been trained; this was pointed out by one of the key informants:

"Very few nurses have been trained on DHIS2, therefore those who have been trained are only those who enter data from the register into the system."(KI-02)

Findings from the Key Informants Interview have shown the need for continuous training on data management for nurses, and it has strongly been proposed that data have to be sent electronically direct from private hospitals. Nurses have to be trained on how to use the DHIS2 system so that data entry can be efficiently done at the hospital to minimize the time between data recording into the register and entry into DHIS2.

"Due to a shortage of trained nurses, some private hospitals have not been submitting their monthly reports on time. We suggest that data entry should be into DHIS2 at the hospital level and not at the council." (KI-06)

Findings have shown that nurses are not motivated to undertake data management tasks in papers. Results suggest that staff need to be recognized (non-financial incentive). Also, they need to be paid for working overtime. One of the key informants pointed out that;

"Sometimes you may find that you need to go home as working hours are already over, but you can't since there are clients to be saved. Unfortunately, you're not even recognized by the management as they think it is your responsibility. Not only do financial incentives motivate us, but even non-financial ones as well. This leads to inefficiency even in terms of data recording in the registers. " (KI-05)

Findings show that there are financial constraints that lower the speed of implementing the family planning data management process in the selected hospitals. There is no fund allocated for paying nurses who work overtime as sometimes clients come and seek services during late hours, whereby respective nurses have to enter all the required information into the register during the same time.

"The council has to set aside funds which may be used in supporting data collection through HMIS. Sometimes customers tend to come for services during the evening, but we cannot overstay after normal working hours, which therefore leads to low coverage of our data collection. " (KI-01)

The allocation of funds for supporting the family planning data management process has been evidenced in government hospitals. Nurses who work on family planning data management have been paid allowances, which have been a motivation for producing high-quality family

planning statistics. NGOs such as Pathfinder have been encouraged to implement a similar strategy in private hospitals as well.

"There should be some allowance for working overtime, especially during the evening. Some of the NGOs such as Pathfinders have been supporting government hospitals by providing allowances to nurses. This should be done for private hospitals also." (KI-05)

Since the hospital does not get the direct benefit and does not consider undertaking data management on family planning as a task that the hospital has to provide some incentives for those who have been working on it, then this leads to demoralization and hence lowers the strategy of harmonization of all family planning data.

"This work is so difficult and our employers are not putting much emphasis on it, it seems that the hospital does not get direct benefits therefore they don't provide any incentives for someone working in the family planning program"(KI-11)

It was also added that private hospitals are business-oriented entities that aim at generating profit after the provision of health-related services. As a result, private hospitals have invested nothing as there is no profit acquired by them when implementing the family planning data management.

"The family planning services are free in hospitals; therefore, the private hospitals have nothing to gain from this service that is why it has not been given much attention." (KII-01)

Discussion

Poor data quality characterized by inaccuracy, inconsistency, and untimely recording and transferring of family planning data jeopardized the data management process. Poor data leads to poor decisions as to the end product of the data management process. The study revealed that the majority of the registers were left incomplete due to technical reasons such as the low knowledge of some nurses they had on filling the register. Also, it was observed that it was difficult to capture some key information related to family planning data. This happened when family planning products were used for treatment purposes while the register was not designed in such a way that it could include the number of products that were used for curative purposes. The problem with poor data quality was reported in Benin as results confirmed poor data quality in three dimensions; completeness, reliability, and accuracy (Ahanhanzo et al., 2015). The similarity of these findings might be because both were done in LMICs where data management is a problem.

The collection of family planning data has not been given much attention in private hospitals. It seems that private hospitals do not realize the importance of these data as they just concentrate on the business part of implementing their health services. To overcome such a situation, the study suggested that there is a need to have specialized nurses in data management, especially HMIS, in private hospitals. Similar findings were presented by (Cheburet & Odhiambo-Otieno, 2016) in Kenya on the presence of an HMIS focal person facilitates data processing, hence improving the quality of data. A sense of data ownership should be introduced to staff working in the family planning department by introducing them to the number of training.

There has been a shortage of staff to implement data management for family planning among private hospitals. Findings reported that staff are sometimes overwhelmed with other tasks, which makes it difficult to record information effectively. Also, the problem of inadequate knowledge of HMIS and skilled HMIS personnel turnover has been suggested to affect the data management process. A study was done suggesting that among the components affecting the data management process, especially in terms of using them for decision-making is having unskilled personnel working with data. This ultimately affects the performance of RHIS (Aqil et al., 2009). Also, (Simba & Mwangu, 2006) suggested that the knowledge and presence of the focal person with skills in HMIS influence the quality of HMIS data. A study done by (Henriksson et al., 2017) suggested that a low level of knowledge was also found to be a factor influencing data management. To tackle this problem, health care workers in the family planning department have to be trained so they can have the proper knowledge and skills to handle the family planning data.

As findings revealed, some staff have never been trained on HMIS. Even those who have been trained have not received adequate training to improve their knowledge and skills. The provision of adequate training is one of the important aspects of the sustainability of family planning data management. It was noted that there has been little attention paid to family planning data management among private hospitals and therefore, human capital investment has not been done at the required pace, very few nurses are trained and the rest have been doing their data management job using their own experiences (Lorenzi et al., 1997).
Filling in the register is the first starting point of family planning data management. Competent knowledge and skills are required to understand how to make records in the register.

Some nurses also thought to shift from knowing how to use hard copies to electronic data management systems using DHIS2. They are eager to be trained in order to improve their knowledge and skills in using the DHIS2 system for data management. Similar results were found from the study on factors affecting the quality of the Health Management Information System (HMIS) in the Kinondoni district, which found that knowledge of the HMIS concepts was found to be associated with better quality of HMIS data (Simba & Mwangu, 2006). The similarity of these findings might be due to the similarity of the context in which they were conducted.

Conclusion

The study has identified several factors influencing the family planning data management process, which are poor data quality associated with wrong data recorded in the MTUHA book 8, un-entered data, and unavailability of treatment data, inadequate skilled manpower, and poor capacity building.

To ensure the data management process is done with fidelity as indicated in the family planning guidelines, the MTUHA book 8 should be reviewed by the Ministry of Health and other implementing partners to ensure curative pill data are being captured. Also, private hospitals and the Municipal Council should organize training on data management process issues for personnel to ensure proper data management processes to enhance family planning data quality.

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Competing interests

All authors declare no competing interests.

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The Excision Wounds Healing Activity of *Centella asiatica* (Gotukola) Extract on Laboratory Rats

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Abstract

Background: Skin wound cases are increasing in hospitals requiring efficient treatment. The dependence on antimicrobial has been expensive and sometimes less effective hence requiring alternatives. Medicinal herbs with wound healing properties could be among the alternatives.

Methods: The current study assessed the wound healing efficacy of *Centella sciatica* (Gotukola leaves) ethanolic extract using Laboratory rats as a model. A total of 32 animals were divided into 8 groups (n=4). G1 (Control group (nothing), G2 (Dexamethasone + 1% Gotukola extract), G3 (0.1% Gotukola extract), G4 (0.5% Gotukola extract), G5 (1% Gotukola extract), G6 (Grounded fresh Leaves of Gotukola), and G7 (Silver sulphadiazine). Excision wounds were made on the skin. The plant extract solution was applied to the wound and results were observed on days 3, 7, and 10. Assessed parameters included wound contraction percentages, wound epithelialization time, duration taken for complete wound healing, and gross appearance of wounds.

Results: wounds treated with 1 or 0.5 percentages of Gatukola leaf extract had relatively higher contraction percentages, shorter epithelialization time, and shorter duration for complete healing compared to wounds of rats treated with the lower concentration of the extract and those of the control rats. Visual assessment of excision wounds in the current study revealed corroborative results in that wounds of rats under Gotukola extract at 1% and 0.5 appeared to be recovering faster similar to that of the positive control compared to the wounds treated with a lower concentration of the extract, leaf juice, dexamethasone incorporated extracts and wounds of the negative control.

Conclusion: The extracts of *C. asiatica* at the dosage of 1 or 0.5 %, promoted wound healing at a rate similar to that of the conventional silver sulphadiazine suggesting its potential use in wound management.

Keywords: Excision Wounds, C. asiatica, Gotukola extracts, silver sulphadiazine, Wistar rats, Healing.

Introduction

Skin wounds are among the most prevalent disease cases presented routinely in health facilities (Sohal and Moshy, 2019, da Rosa et al., 2017). It is reported from some studies that, the most common wound cases presented in hospitals include laceration wounds, dehiscence of old wounds, surgical wound complications (Zabaglo and Sharman, 2021), puncture wounds (Baldwin and Colbourne, 1999) and fistulas, and other miscellaneous wounds (Lyimo and Mosha, 2019).

Wounds management in patients is a vital medical procedure to relieve the patients from intense pain and avoid further lethal health complications. However, in the treatment of skin wounds, numerous underlying factors may affect the healing rate of wounds and sometimes make the wound not heal at all. Such factors which influence the efficacy, speed, and manner of wound healing fall under two types: local and systemic factors (Clark, 1991). Local factors include moisture content, edema, a technique of wound closure, ischemia and necrosis, foreign bodies, low oxygen tension, and perfusion (Clark, 1991). Systemic factors include inflammation, malnutrition/nutrition, metabolic diseases such as diabetes, immunosuppression, connective tissue disorders, and age (Clark, 1991, Stadelmann *et al*., 1998).

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Nevertheless, some documented histological studies report that well-managed wounds heal smoothly under the processes characterized by an increasing fibroplasia, angiogenesis, and wound re-epithelization (Clark, 1991, Maquart *et al*., 1999). Moreover, a smoothly healing wound shows an increased migration and proliferation of cells such as fibroblasts, endothelial cells, and epithelial cells also a deposition of connective tissue leading to enhanced contraction of the wounds (Clark, 1991, Maquart *et al*., 1999, Nguyen *et al*., 2009). When animals have fresh wounds on the skin, the recovery rate needs to be quick since prolonged healing or incompletely healed wounds may proceed to chronic wounds (Ingold, 1993).

Therefore, research efforts in wound management protocols are focusing more on discovering procedures and drug agents that can promote quick healing of wounds. Early efficient treatment of any wound type is important not only to relieve the patient from suffering but also to reduce the cost of hospitalization and save the patient from further severe complications. Antimicrobial ointments such as silver sulfadiazine, mafenide, silver nitrate, povidone-iodine, mupirocin, and bacitracin, have been the most reliable drugs in wound management (Leaper & Gottrup, 1998). However, all these topical antimicrobials are expensive to the majority of the lower-earning end-users in developing countries. Moreover, there are cases where conventional therapeutic agents have been less effective in curing some of the wounds. Therefore exploration of more novel therapeutic agents of wound management that are cheap, effective, and safe to supplement or replace the currently used conventional wound healing drugs is still inevitable (Stadelmann *et al*., 1998). Medicinal herbs have been used since ancient times in the curation of various diseases including wounds.

One of the important medicinal herbs is *Centella. asiatica* (Li *et al*., 2009). *C. asiatica* is a perennial plant that belongs to the family Apiaceae. The plant has small fan-shaped green leaves with white or light purple flowers and it possesses small oval fruit, odorless, tasteless, and thrives around the water (Gohil *et al*., 2010; Flora, 2014). Studies done elsewhere repots that, the whole plant of *C. Asiatica* (gotu kola) has been very useful in traditional medicine for treatments of wounds and other skin diseases, treatment of high blood pressure, purifying blood, and enhancement of memory (Jamil *et al.*,2007; Wangchuk 2018).*C. Asiatica* is a perennial plant, commonly found in tropical and subtropical countries such as India, Sri Lanka, China, Indonesia, Malaysia, South Africa, Madagascar and East Africa (GBIF, 2014, USDA-ARS, 2014). Whether the extract of *C. Asiatica* (gotu kola) found in Tanzania will be efficacious enough in enhancing the wound healing processes as the plant species reported elsewhere need to be studied. Currently, there are no studies in Tanzania reporting the wound healing activity of the locally found *C. Asiatica* (gotu kola) in domesticated animal cases. Hence, the current study was carried out to evaluate the efficacies of the locally found *C. Asiatica* in Tanzania in excision wound healing in animals using rats as a study model.

METHODOLOGY

Study area

The study was carried out in Morogoro urban (6° 50' 42.66'' S, 37° 39' 29.14''E), Tanzania. Studied plant materials were collected around the Sokoine University of Agriculture (SUA), the Main campus in Morogoro Municipal. Plant extraction was carried out in the laboratory of toxicology in the Department of Physiology, Biochemistry, and Pharmacology. Experimental setup and animal treatment were done at the small animal research unit in the College of Veterinary Medicine and Biomedical Sciences at the SUA. The study design was experimental and permission to conduct this study was granted by the Directorate of Postgraduate Studies, Research, Technology Transfer and Consultancy (DPRTC). This study was done to establish the wound healing efficacy of *Centella sciatica* (Gotukola leaves) ethanolic extract as a potential supplement to the conventional drug ointments involved in wound management, using Laboratory rats as a study model.

Preparation of the Ethanolic Extract of *C. Asiatica*

The plant leaves of *C. Asiatica* were harvested, collected, and kept in bags then transported to the laboratory for extraction. Harvested leaves were firstly dried under the shade until they were breakable. The dry leaves were pulverized mechanically by using an electrical grinder to give 732.9g (14.21%) of ground to powder. The powder was macerated by using alcohol (98% ethanol) at a ratio of 1:3 for 5 days. The macerate was filtered using filter paper and the extract was concentrated at 85°C using a rotary evaporator to obtain a viscous solid. This was then left in a water bath to evaporate the remaining ethanol finally producing 90.7 (1.75%) of extract. Three different solution of varying concertation 0.1% (1mg/ml), 0.5% (5mg/ml) and 1% (10 mg/ml) was prepared by dissolving extract paste in distilled water as per Azis *et al.* (2017) with some modifications.

Research animals and Experimental setup

A total of 32 male laboratory rats weighing 250–300g obtained from the small animal unit in the College of Veterinary Medicine and Biomedical Sciences (CVMBS), Sokoine University of Agriculture (SUA), Tanzania were used in this study. These rats were allowed to acclimatize for 7-days to copy with the laboratory environment. The rats were caged in special rooms with a temperature of 27°C, free access to a commercial pellet diet, and water ad libitum. The allocation of animals and their respective treatments have shown in (table 1). All surgical procedures were carried out under chloroform anesthesia and local analgesia at the site of incision using lignocaine.

Table 1. Treatment allocations in different groups of rats were used in the research.

GROUP	NUMBER OF RATS	TREATMENT
T1	4	Control group (nothing)
T2	4	Dexamethasone + 1% Gotukola extract
T3	4	0.1% Gotukola
T4	4	0.5% Gotukola
T5	4	1% Gotukola
T6	4	Grounded fresh leaves juice of Gotukola
T7	4	Silver sulphadiazine

Full-thickness, completely transdermal circular wounds were made on the pre-shaved, 70% alcohol sterilized dorsal surface of the animal with the help of forceps, a scissor, and a skin marker. Gotukola extract solution (0.5 ml/wound) was applied topically in concentrations of 0.1%, 0.5%, and 1% once daily until complete wound healing was attained. The control group received nothing. Other groups of rats received either topical silver sulphadiazine as the positive control, dexamethasone (0.5mg/kg) together with 1% Gotukola extract solution, or the fresh leaf juice of Gotukola.

Test for acute dermal toxicity

Four rats were assigned to this group. The site of application (mid-dorsal region) was shaved and cleaned with distilled water, following disinfection. The extract solution of the herb was applied to the skin. Normal saline was applied to the first shaved rat as a control. Gotukola extract solution of 0.1%, 0.5%, and 1% was applied to second, third, and fourth shaved rats respectively. The shaved area was inspected within 24 hours for any cutaneous changes such as erythema, swelling, and development of vesicular eruptions.

Excision wound preparation and measurements

Excision wounds were prepared using a scissor and tissue forceps with the rats under general anesthesia of chloroform. The size of wounds was measured by a meter rule on days 0, 3, 7, and 10.

Determination of wound contraction percentages

The diameter of the wound was recorded on days 0, 3, 7, and 10 was used to calculate the wound contraction rate. Then the percentages of wound contraction (wound reduction rate) were obtained by dividing the extent to which wound contract (area) on a specific day by that of day zero and multiplying by 100 (Somboonwong *et al*., 2012).

% wound contraction = $\frac{A0-A1}{A0}\ x\ 100$

Whereby: A1 = area of the wound on a specific day, & A0 = area of the wound at day zero.

Determination of epithelialization and complete wound healing duration

Epithelialization simply refers to the process of covering denuded epithelial surfaces that are necessary for the successful closure of the wound (Pastar *et al.,* 2014). And it is a defining parameter of successful wound healing. In the current study, the falling off of the old scar signifying its replacements by the newly formed epithelial tissues marked the completion of epithelialization time (Pastar *et al.,* 2014). Complete wound healing time was the time taken for complete restoration of the epidermis on the excision wound (Pastar *et al.,* 2014).

Visual or gross assessment of excision wounds

Visual assessments of the wounds followed the criteria of Somboonwong *et al*. (2012) whereby the excision wound was evaluated for size, wound bed, color, exudates, swelling of the wound surface, and the consistency of tissues surrounding the wounds.

Data Analysis

Data storage and cleaning were performed using Microsoft Excel. Data analysis for means and standard error of means was done using SPSS version 20 software. Statistical significant differences between groups were tested by the Analysis of variance (ANOVA) at $P < 0.05$.

RESULTS

Acute dermal toxicity test

Observation from the acute dermal test showed no skin reaction on the control rats under normal saline treatments and on the experimental rats under Gotukola leaf extracts at concentrations of 0.1%, 0.5%, and 1%. That is because both the control and treated rats revealed no evidence of edema, erythema, and evident irritation following the application of their respective treatment materials on their intact skin.

Wound contraction percentages

Figure 1. indicates the wound reduction rates (percentages) among the different groups of studied rats. It is shown in Figure 1 that wound contraction percentages increased proportionately with the Gotukola (*C. Asiatica*) leaf extract treatment duration. Wound measurements on days 3, 6, and 10 of treatment revealed a higher contraction rate of wounds in the 1% and 0.5 % dosage of Gotukola extract treatments relative to other comparative groups (figure 1). The wound contraction rate was lowest in the 0.1 % of Gotukola extract-treated and the negative control rats (figure 1).

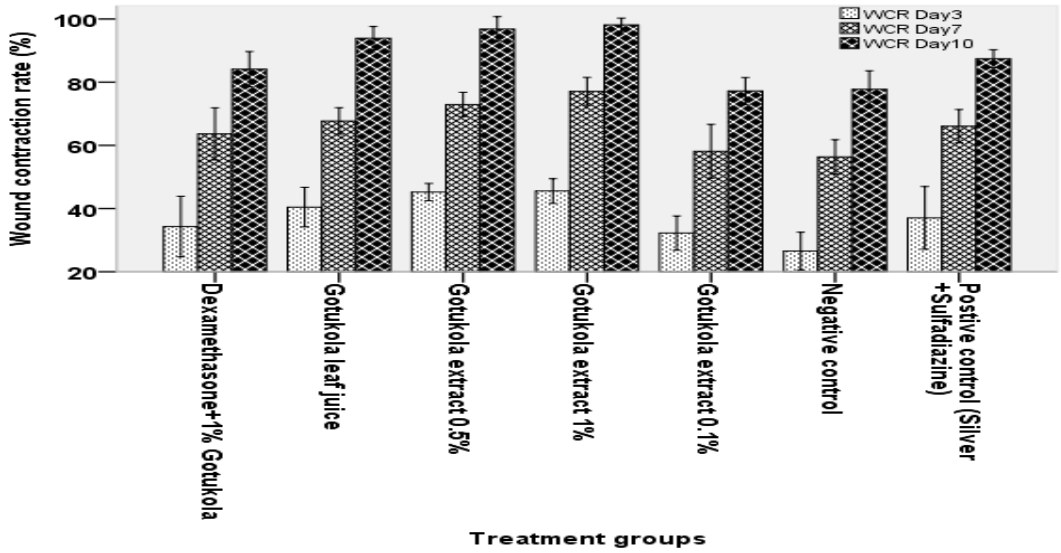

Figure 1. Excision wound contraction rate (percentage) in different treatment groups after different treatment duration (3, 6, and 10 days) with different concentrations of Gotukola (*Centella Asiatica*) leaf extract. ANOVA from repeated measure analysis indicated significantly differing excision wound contraction rates in-within subjects (treatment duration-dependent) (P< 0.0001) and in-between subjects due to different treatments (P<0.0001).

The figure above indicates a significantly differing wound reduction rate amongst the treatment groups of rats. Observations in figure 1 were supported further by the Analysis of Variance (ANOVA) from repeated measure analysis which revealed a significantly differing wound shrinkage percentage which differed within the subjects with treatment duration (P<0.0001) and between the groups due to different treatment types (P<0.0001). Bonferonni test (Table 2) revealed further that, a differing wound contraction percentage between the Gotukola extract at 0.5 % treated, Gotukola extract at 1% treated, fresh Gotukola leaf juice treated, and the dexamethasone + 1% Gotukola extract-treated rats in comparison to the Gotukola extract 0.1 % treated and the negative control rats were statistically significant (P<0.05). No significant differences (table 2) in wound contraction rate existed between the rats under Gotukola extract treatment at 1 % and those under Gotukola extract treatment at 0.5 %. Also, no significant differences (table 2) in wound reduction percentage existed between the rats treated with Gotukola at 0.1 % in comparison to the negative control rats.

Table2. Pair-wise Comparisons (Bonferonni test) of wound contraction percentages among the studied groups of rats under Dexamethazone+ 1% Gotucola, Gotukola leaf juice, Gotukola extract 1%, Gotukola extract 0.5 %, Gotukola extract 0.1, silver + sulfadiazine, and negative control.

Compared groups		Mean Difference (I-J)	Std. Error	P-value
Dexamethazone +1% Gotucola extract	Gotukola leaf juice	-6.509950*	1.0573034	0.000
	Gotukola extract 1%	-12.751752*	1.0573034	0.000
	Gotukola extract 0.5 %	-10.816959*	1.0573034	0.000
	Gotukola extract 0.1%	4.978266*	1.0573034	0.003
	Negative control	7.290261*	1.0573034	0.000

	Postive control + silver sulfadiazine	-2.673784	1.0573034	0.410
Gotukola leaf juice	Gotukola extract 1%	-6.241802*	1.0573034	0.000
	Gotukola extract 0.5 %	-4.307009*	1.0573034	0.011
	Gotukola extract 0.1%	11.488216*	1.0573034	0.000
	Negative control	13.800210*	1.0573034	0.000
	Postive control + silver sulfadiazine	3.836166*	1.0573034	0.033
Gotukola extract 1%	Gotukola extract 0.5 %	1.934793	1.0573034	1.000
	Gotukola extract 0.1%	17.730018*	1.0573034	0.000
	Negative control	20.042012*	1.0573034	0.000
	Postive control + silver sulfadiazine	10.077968*	1.0573034	0.000
Gotukola extract 0.5 %	Gotukola extract 0.1%	15.795226*	1.0573034	0.000
	Negative control	18.107220*	1.0573034	0.000
	Postive control + silver sulfadiazine	8.143175*	1.0573034	0.000

Wound epithelialization time

Wound epithelialization durations among the studied groups of rats are represented in figure 2. It is shown in figure 2 that the completion of wound epithelialization took much shorter in rats treated with Gotukola extracts at 1%, Gotukola extracts at 0.5 % relative to those under Gotukola extract at 0.1%, those under dexamethasone+ 1% Gotukola treatment, and the negative control rats. This was supported further by the ANOVA, from univariate analysis which indicated a significantly differing (P< 0.0001) excision wound epithelialization time (Days) among the treatment groups of rats.

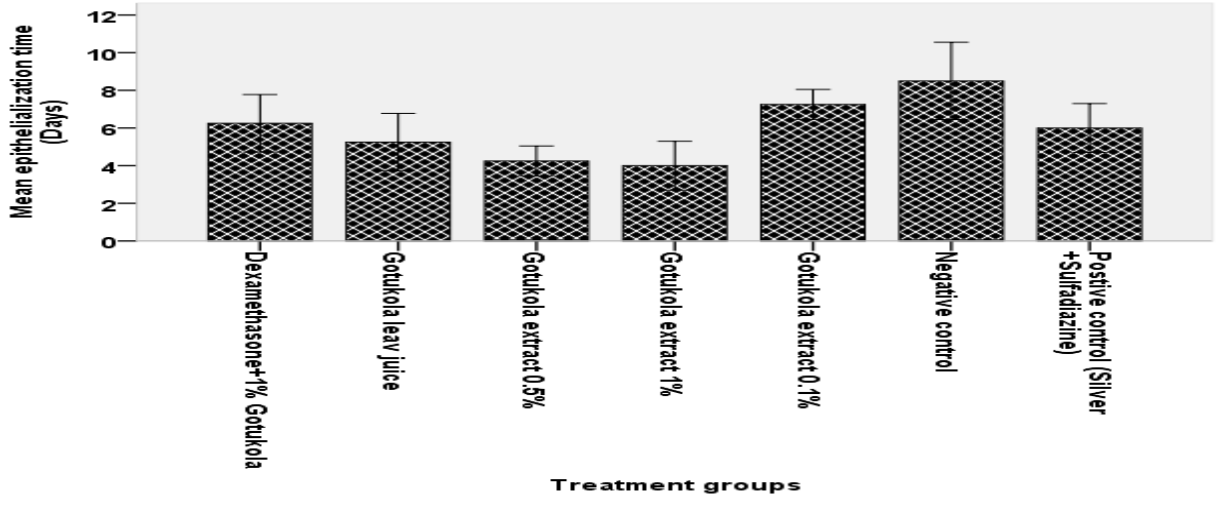

Figure 2. Mean epithelialization time of excision wound in different treatment groups of rats. ANOVA, from the univariate analysis, indicated a significant difference (P< 0.0001) in excision wound epithelialization time (Days) among the treatment groups

Tukey test (table 3) confirmed further that wound epithelialization time differed significantly between the following groups of rats; Gotukola leaf juice treated rats against the

negative control, Gotukola extract 1% treated against Gotukola extract 0.1% treated, and the negative control rats. Also, a significant difference in wound epithelialization time was revealed by the Tukey test between the rats under Gotukola extract treatment at 0.5 % against the rats under 0.1 Gotukola extract treatment.

Table 3 Pairwise comparisons (Tukey test) on wound epithelialization time among the studied groups of rats under Dexamethazone+ 1% Gotucola, Gotukola leaf juice, Gotukola extract 1%, Gotukola extract 0.5 %, Gotukola extract 0.1, silver + sulfadiazine, and negative control.

Compared groups		Mean Difference (I-J)	Std. Error	P-value
Dexamethazone +1% Gotucola extract	Gotukola leaf juice	1.00	0.617	0.672
	Gotukola extract 1%	2.25*	0.617	0.022
	Gotukola extract 0.5 %	2.00	0.617	0.051
	Gotukola extract 0.1%	-1.00	0.617	0.672
	Negative control	-2.25*	0.617	0.022
	Postive control + silver sulfadiazine	.25	0.617	1.000
Gotukola leaf juice	Gotukola extract 1%	1.25	0.617	0.429
	Gotukola extract 0.5 %	1.00	0.617	0.672
	Gotukola extract 0.1%	-2.00	0.617	0.051
	Negative control	-3.25*	0.617	0.001
	Postive control + silver sulfadiazine	-.75	0.617	0.881
Gotukola extract 1%	Gotukola extract 0.5 %	-.25	0.617	1.000
	Gotukola extract 0.1%	-3.25*	0.617	0.001
	Negative control	-4.50*	0.617	0.000
	Postive control + silver sulfadiazine	-2.00	0.617	0.051
Gotukola extract 0.5 %	Gotukola extract 0.1%	-3.00*	0.617	0.001
	Negative control	-4.25*	0.617	0.000
	Postive control + silver sulfadiazine	-1.75	0.617	0.114

Duration for Complete wound healing

Figure 3 represents the duration (Days) taken for excision wound healing completion. The figure indicates that wound healing to completion was markedly faster (took much few days) in the Gotukola extract 1% and Gotukola extract 0.5 % treated rats as compared to the Dexamethasone + 1% Gotukola extracts treated, Gotukola extracts 0.1 % treated and the negative and positive control rats (figure 3). It is indicated further in the figure that the duration for complete wound healing varied only marginally between the Gotukola extract 0.1% in comparison to the Dexamethasone + 1% Gotukola extracts treated, Gotukola leaf juice treated, and negative control rats.

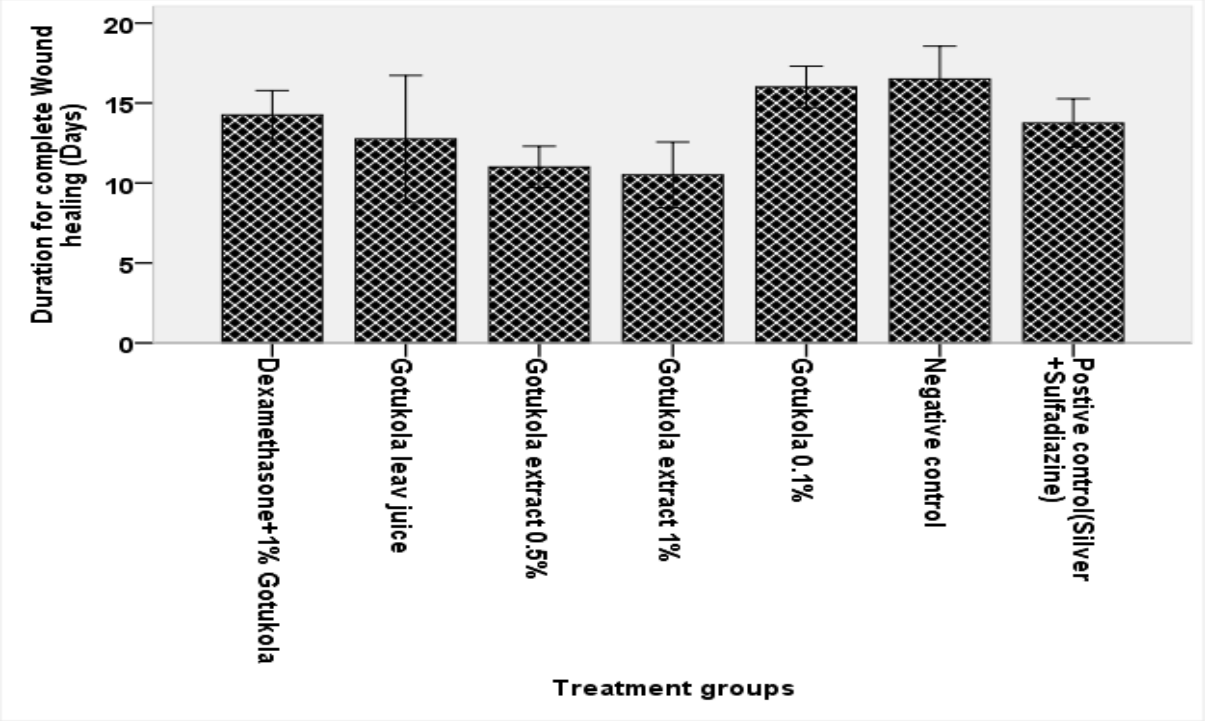

Figure 3. Time is taken for complete excision wound healing among different treatment groups of rats. ANOVA, from the univariate analysis, indicated a significant difference (P< 0.0001) in the complete excision wound healing time (Days) among the treatment groups.

Consistent findings revealed by the analysis of Variance from the univariate analysis indicated a significantly (P<0.0001) varying number of days taken for completion of wound healing among the experimental rats. Pairwise comparison by the Tukey test confirmed further that the duration for complete wound healing differed significantly between the following groups of rats; The dexamethasone + 1% Gutukola extracts treated rats against the Gotukola extract 1% and Gotukola extracts 0.5 % treated rats (table 4), Gotukola leaf juice treated against the Gotukola extract 0.1% treated, and the negative control rats (table 4).

The Tukey test revealed a significant difference in duration taken for complete wound healing between the Gotukola extract 1% treated against the 0.1% Gotukola extract-treated rats, the negative and the positive control rats (table 4). Moreover, the duration taken for complete wound healing differed significantly between the 0.5 % Gotukola extract-treated rats when compared to the 0.1 % Gotukola extract-treated and the negative control rats.

Table 4 Pairwise comparisons (Tukey test) on complete wound healing time among the studied groups of rats under Dexamethazone+ 1% Gotucola, Gotukola leaf juice, Gotukola extract 1%, Gotukola extract 0.5 %, Gotukola extract 0.1, silver + sulfadiazine, and negative control.

Compared groups		Mean Difference (I-J)	Std. Error	P-value
Dexamethasone +1% Gotucola extract	Gotukola leaf juice	1.50	0.954	0.700
	Gotukola extract 1%	3.75*	0.954	0.012
	Gotukola extract 0.5 %	3.25*	0.954	0.036

	Gotukola extract 0.1%	-1.75	0.954	0.542
	Negative control	-2.25	0.954	0.264
	Postive control + silver sulfadiazine	.50	0.954	0.998
Gotukola leaf juice	Gotukola extract 1%	2.25	0.954	0.264
	Gotukola extract 0.5 %	1.75	0.954	0.542
	Gotukola extract 0.1%	-3.25*	0.954	0.036
	Negative control	-3.75*	0.954	0.012
	Postive control + silver sulfadiazine	-1.00	0.954	0.936
Gotukola extract 1%	Gotukola extract 0.5 %	-.50	0.954	0.998
	Gotukola extract 0.1%	-5.50*	0.954	0.000
	Negative control	-6.00*	0.954	0.000
	Postive control + silver sulfadiazine	-3.25*	0.954	0.036
Gotukola extract 0.5 %	Gotukola extract 0.1%	-5.00*	0.954	0.001
	Negative control	-5.50*	0.954	0.000
	Postive control + silver sulfadiazine	-2.75	0.954	0.105

The findings on wound shrinkage percentages, epithelialization time, and total time for complete wound healing were supported further by visual wound assessment which revealed corroborative results (figure 4). General visual assessment of wound status revealed that would recovery was relatively faster in rats on 1% of Gotukola extract treatment followed by the animals on 0.5 % of Gotukola treatment and was relatively slow in the negative control rats (figure 4).

Visual or gross assessment of excision wounds

On day 3 of treatments, the wounds of rats under Dexamethasone + 1% of Gotukola extracts, Gotukola leaf juice, Gotukola extract at 0.1%, and those of the negative control were relatively more swollen, less contracted, and were relatively wet and reddish-brown (figure 4). However, the wounds of rats under Gotukola extract at 1% and 0.5 and were relatively drier, less swollen, appeared to be more contracted with a brownish scar, and were comparable to the positive control wounds(figure 4).

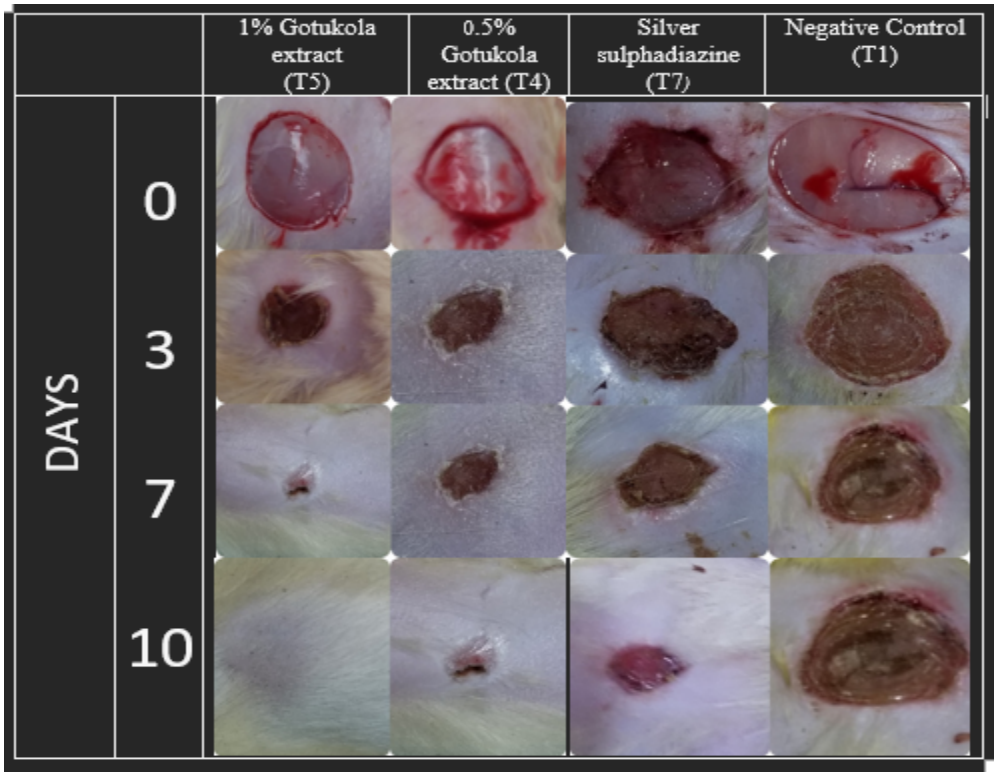

Figure 4. Shows the different rates of wound healing recorded at an interval of days 0, 3, 7, and 10 of treatments. 1% represent Gotukola extract 1%, 0.5 % represent Gotukola extract at 0.5 %, sulfadiazine represents Positive control treated with silver and sulfadiazine, and control represents the negative control group.

The excision wounds of rats were smallest with complete shrinkage or with only a small scar on days 7 and 10 days of treatments in the 1 % and 0.5 % Gotukola extract-treated rats and were comparable to the positive control wounds recovery rate (figure 4). However, there were some delays in wound shrinkage in rats receiving diluted Gotukola extract (0.1%), the negative control, and those receiving Gotukola leaf juice.

DISCUSSION

It was revealed in the current study that, the ethanolic extract of *C. Asiatica* (Gatukola) leaves accelerated the healing process of excision wounds after the extracts were applied at various concentrations to the wound-inflicted experimental Wistar rats. The current study revealed that the wounds treated with 1 or 0.5 percentages of Gatukola leaf extract had relatively higher contraction percentages, shorter epithelialization time, and shorter duration for complete healing compared to wounds of rats treated with the lower concentration of the extract and the control rats.

Also, the incorporation of dexamethasone into the leaf extracts of Gotukola appeared to have delayed the contraction rate of the excision wound, wound epithelialization time, and the duration of complete wound healing. This was expected because dexamethasone has anti-inflammatory and immunosuppressant effects which may delay the wound healing process while preventing wound inflammation (Shetty *et al*., 2006).

Visual assessment of excision wounds in the current study revealed corroborative results in that wounds of rats under Gotukola extract at 1% and 0.5 appeared to be recovering faster similar to that of the positive control compared to the wounds treated with a lower concentration of the extract, leaf juice, dexamethasone incorporated extracts and wounds of the negative control.

The current results correlated well with those of Sunilkumar *et al*. (1998) who reported an increased cellular proliferation and collagen synthesis at the wound site of the *C. Asiatica* extracts treated rats more evidenced by an increased collagen content and tensile strength of the wound. Results from the current study were also in line with the results of (Somboonwong *et al*. 2012) who revealed a significantly increased degree of healing in both the burn and incision wounds treated with the hexane, ethyl acetate, and methanol extracts of *C. Asiatica* when compared to similar wounds on the control rats.

Other documented studies report that the active ingredients contained in the *C. Asiatica* plant are the ones responsible for enhanced wound healing. It is reported that the presence of active compounds in *C. Asiatica* such as saponins and triterpenes particularly the Asiatic acid, madecassic acid, asiaticoside, and madecassoside, enhance wound healing through their antioxidants activities (Shukla *et al*., 1999 a&b; Maquart *et al*., 1999, Liu *et al*., 2008 a&b), microbial inhibitory properties (Gohil *et al.*, 2010) and promotion of angiogenesis and wound epithelialization (Shukla *et al*., 1999).

CONCLUSION

The results revealed that the locally available *C. Asiatica* in Morogoro region in Tanzania enhanced rapid wound healing when the plant ethanolic crude extracts were applied to the excision wounds of rats. It was a concentration of 1 or 0.5 % of the *C. Asiatica* extract in the current study which showed to promote wound healing at a rate similar to that of the conventional silver sulphadiazine. However, since using *C. Asiatica* extracts in wound management can be cheaper than conventional drugs, we recommend further studies on wound healing efficacies of various organs of *C. Asiatica*. Also, we suggest for investigation of the efficacies of higher dosages of the plant extracts in wound healing and the efficacies of the plants on chronic wounds.

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Competing interests

The authors declare that there is no competing interest.

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COVID-19 Knowledge, Attitudes, Practices, and vaccination hesitancy in Moshi, Kilimanjaro Region, Northern Tanzania

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ABSTRACT

Background: The COVID-19 vaccinations have reignited optimism in many cultures devastated by the pandemic's tremendous loss of lives and livelihoods. Vaccination hesitancy is a critical and growing international problem in the global effort to manage the COVID-19 pandemic. To successfully handle vaccination hesitancy concerns, it is necessary to understand the levels of knowledge, attitudes, and behaviors on COVID-19. The purpose of this study was to understand people's knowledge, behaviors, and attitudes about COVID 19 and its related vaccines.

Methods: In October 2021, a cross-sectional study with 232 participants was conducted. A standardized interviewer-administered questionnaire was used to collect data.

Results: Most respondents in the present survey heard about COVID-19 between January and March 2020. Social media and newspapers are the most effective sources of information on COVID-19, reaching 34.48 % of the population. Basic COVID-19 knowledge was reported to be moderate. Nearly half of the respondents (48.3 %) thought SARSCOV-2 was man-made, while 36.21 % were unsure. Good preventive behaviors were indicated by 49.14 % of subjects. Overall, we find that around 65 % of people are reluctant to get vaccinated against COVID-19. Male gender, low education, and occupation were shown to be more hesitant about vaccination. In this study, healthcare workers were averse to getting the COVID-19 vaccine. The reasons for vaccination hesitation were "unknown safety" of the vaccines (17.4 %) and "unknown long-term consequences" of the vaccines (18.97 %). Almost a third (27.59 %) of those interviewed said they had no intention of being vaccinated.

Conclusion: We report moderate knowledge on COVID-19, as well as effective preventive practices, but negative attitudes regarding COVID-19 vaccination, resulting in low vaccination rates of 6.9%. Misinformation regarding COVID-19 appears to play a key role in vaccination reluctance.

Keywords: *COVID-19; behaviors; knowledge; attitudes; practices; vaccination hesitancy*

INTRODUCTION

SARS-CoV-2 infection, also known as new coronavirus illness (COVID-19), was first diagnosed in Wuhan, China, in December 2019, and the World Health Organization proclaimed COVID-19 a pandemic in less than three months. By early May 2020, 3.3 million people had been infected in 213 countries, resulting in 238,628 deaths. The COVID-19 outbreak has resulted in numerous cases of illness and mortality around the world, and the unavailability of a COVID-19 vaccination has played a significant role in the high morbidity and mortality rates. Vaccines for COVID-19 are now being rolled out and made available in several countries. Vaccines' importance as one of the most

significant successes in the fight against communicable diseases has been recognized for a long (Olson *et al.* 2020; Dubé *et al.* 2016).

Due to the very efficient nature of vaccination programs on the African continent against vaccine-preventable diseases as a result of high and sustainable uptake, Africa has historically reported impressive reductions in mortality and morbidity from infectious diseases (Dubé *et al.* 2016; Cooper *et al.* 2018). As a result, vaccination adoption is crucial for personal health, protecting vulnerable people, improving socio-economic life, and achieving population health and safety through immunity. The development of COVID-19 vaccines has rekindled hope in many societies that have been devastated by the pandemic's massive loss of lives and livelihoods. Nonetheless, as the acquisition and distribution of COVID-19 vaccines gain traction, tensions and challenges have surfaced and are developing in tandem. Supply issues, vaccine nationalism, inequitable vaccine distribution and access both within and between nations, and COVID-19 vaccine hesitancy (VH) are only a few examples (National Academies of Sciences 2021; Lancet 2021; Eaton 2021; World Health Organization 2021). When vaccination services are available and accessible, vaccine hesitancy refers to a refusal to get immunizations. It is not only widespread and inaccurate, but it is also extremely contagious (Wiyeh *et al.* 2018). The effectiveness and safety of vaccine campaigns to control COVID-19 are not the only factors to consider.

The general public's and healthcare personnel's acceptance of vaccines appears to play a critical part in the pandemic's successful management. VH and rejection appear to be a rising problem, according to recent continental and global surveys (Murphy *et al.* 2021; Fisher *et al.* 2020; Neumann-B+Âhme *et al.* 2020; Lazarus *et al.* 2020). The highest acceptance rates among adults were found in Ecuador (97.0 %), Malaysia (94.3 %), Indonesia (93.3 %), and China (93.3 %), according to a comprehensive evaluation of global COVID19 acceptance rates from 33 different nations (91.3 %). Kuwait (23.6 %), Jordan (28.4 %), Italy (53.7 %), Russia (54.9 %), Poland (56.3 %), the United States (56.9%), and France (58.9%) had the lowest COVID-19 vaccination acceptance rates (Sallam 2021). In a separate large community-based study on COVID-19 vaccine hesitancy in the US, it was found that 22% of the respondents were hesitant to take these vaccines if they were available (Khubchandani *et al.* 2021). Although data on acceptance rates appear to be scarce, published studies reveal that acceptance rates range from 27.7% in the Democratic Republic of the Congo to 78.1 % in Israel 13]. In the Middle East, Russia, Africa, and various European nations, low rates of COVID-19 vaccine uptake have been recorded (Cooper *et al.* 2018; Murphy *et al.* 2021; Fisher *et al.* 2020; Sallam 2021; Cardenas 2021).

Tanzania embraced the vaccination strategy when it received the first consignment of 1,058,450 doses of Johnson & Johnson COVID-19 vaccines in July 2021, and 1,065,600 doses of Sinopharm vaccines supplied by the Chinese government via the COVAX facility in early October 2021. Despite all of these initiatives to battle the disease through the vaccine, according to a recent report, only 1.5% of Tanzanians have been fully vaccinated [https://ourworldindata.org/covid-vaccinations?country=OWID_WRL], which makes the campaign for covid19 vaccination in Tanzania a challenge. VH poses a serious challenge in the global attempt to control the COVID-19 pandemic at a time when the virus is undergoing fast alterations linked with successive waves of outbreaks.

Vaccination Hesitancy has already been documented in African nations following the introduction of new vaccines. Tanzanians, like many other Africans, were regarded at danger of under-immunization before the COVID19 pandemic, with lower levels of routine vaccine uptake and trust in vaccination (Le Polain de Waroux *et al.* 2013; Aaron *et al.* 2017; Vasudevan *et al.* 2020). Furthermore, these populations may be more prone to COVID-19 vaccine disinformation, particularly due to anti-vaccination buzz, as well as a lack of reliable information due to language hurdles and social marginalization.

In Tanzania, where the first strategy for reducing COVID19 was a mixed model that included hand sanitization, mask-wearing, social distancing, and the use of indigenous medicines without lock-down, an understanding of community members' hesitance is crucial. The purpose of

this study was to gather information on COVID19 knowledge, practices, and attitudes as a disease and COVID19 vaccination in one of the regions most affected by COVID19 morbidity and mortality: the Kilimanjaro region in Northern Tanzania.

METHODOLOGY

Study Design, Site, population, and procedures

A cross-sectional study was conducted in October 2021. Individuals who visited their relatives who were admitted or undergoing medical care at Kilimanjaro Christian Medical Centre were requested to respond to structured questions regarding COVID19.

Due to the country's-imposed measures to control COVID19 resistance at the time of data collection, we opted to interview individuals who visited the mentioned health care facilities while also complying with COVID19 control restrictions. Due to the absence of similar studies on COVID19 in the study area, the sample size was determined to be 232 using a single population proportion formula based on the assumption that the probability of having poor knowledge, attitude, and preventive practice toward COVID19 was 50.0% percent, with a 95.0% confidence interval and a 5% margin of error.

Scoring and definitions of dependent Variables

COVID-19 knowledge assessment

To measure participants' knowledge of covid-19, a total of 23 items were employed. Each correct answer received a score of one, while incorrect answers received a score of zero. Using Bloom's cut-off point, participants' total knowledge was classified as excellent if their score was between 80 and 100% (23-18.4), moderate if their score was between 60 and 79 percent (18.17-13.8), and low if their score was less than 60 percent (13.8) (Feleke *et al.* 2021).

Assessment of attitude towards health seeking

Three items were used to examine participants' attitudes regarding obtaining medical help. A right response received a score of one, while a wrong answer received a score of zero. Bloom's cut-off point was used to describe the attitude toward health seeking as positive if the score was between 80 and 100 percent (3-2.4), neutral if it was between 60 and 79 percent (1.8-2.37), and negative if it was less than 60 percent (1.8) (Seid & Hussen 2018).

Prevention practice assessment

Six factors were used to measure prevention practice against covid-19. A right response received a score of one, while a wrong answer received a score of zero. Using Bloom's cut-off point, participants' overall preventative practice against covid-19 was classified as excellent if the score was between 80 and 100 percent (6-4.8), moderate if the score was between 60 and 79 percent (4.74-3.6), and bad if the score was less than 60 percent (13.6) (Feleke *et al.* 2021).

Assessment of attitude towards COVID-19 vaccine

Three questions were used to examine people's attitudes regarding the COVID-19 vaccination. A right response received a score of one while a wrong answer received a score of zero. The attitude toward the COVID-19 vaccination was classified as positive if the score was between 80 and 100 percent (4-3.2), neutral if the score was between 60 and 79 percent (3.16-2.4), and negative if the score was less than 60 percent (2.4). 2018 (Seid & Hussen 2018).

Quality assurance

The reliability of the knowledge, attitude, and practice questionnaires was assessed, and the Cronbach's alpha values were 0.71, 0.78, and 0.76, respectively, indicating acceptable internal consistency. Four research scientists were involved in data collection. The whole data gathering

procedure was overseen and controlled by the senior supervisors. The completed questionnaires were checked by the supervisors for completeness and consistency of replies. Before the actual data collecting began, the questionnaires were revised as needed.

Data management

Data were exported to Microsoft Excel 2016 for cleaning and coding. The cleaned data was transferred to STATA version 15.1 for analysis. To summarize categorical data, frequencies and proportions were employed. Bloom's cut-off of 80% was utilized to assess if respondents had adequate knowledge (80%), indicating a favorable outcome. Chi-squared test was conducted to evaluate the respondent factors and responses related to limited knowledge and poor practice. With a p-value of 0.05, the test revealed the strength of the relationship between risk variables and knowledge and practice. Finally, the information was arranged and classified.

Study Variables

Independent Variables

Demographic details include sex, age, academic qualification, the highest level of education, work environment, and sources of information on COVID-19. Specific items were specific questions for the determination of knowledge, attitudes, and practices regarding CPOVID-19 and vaccination hesitancy.

Ethics Approval and Consent to Participate

This study was conducted after the approval of the Kilimanjaro Christian Medical University College (KCMUCo) Research and Ethics Committee (Certificate #2419). Permission to conduct the study was also obtained from Kilimanjaro Regional and District Administrative Secretaries and District Medical Officer. The study included only participants who consented to participate.

RESULTS

Social demographic characteristics of participants

The socio-demographic characteristics of respondents are summarized in Table 1. A total of 232 participants were interviewed. The median age of respondents was 33 (IQR: 25,45). One hundred and sixty-eight (72.41%) of the participants were male, while 36.21%(84) had secondary school education. Compared to other occupations, the majority of participants (24.14%) were traders 46.55 % (108). One hundred and sixty-eight (72.41%) of these participants did not suffer income reduction due to the COVID-19 pandemic.

Source of information on COVID-19

Figure 1 shows that most of the participants (55.17%)had heard about COVID-19 for the first time between January and March 2020. The combination of social media, news media, and newspapers was the strongest source of information regarding COVID-19, reaching 34.48% of participants with newspapers alone contributing 32.76% as the strongest source of information (Fig 2).

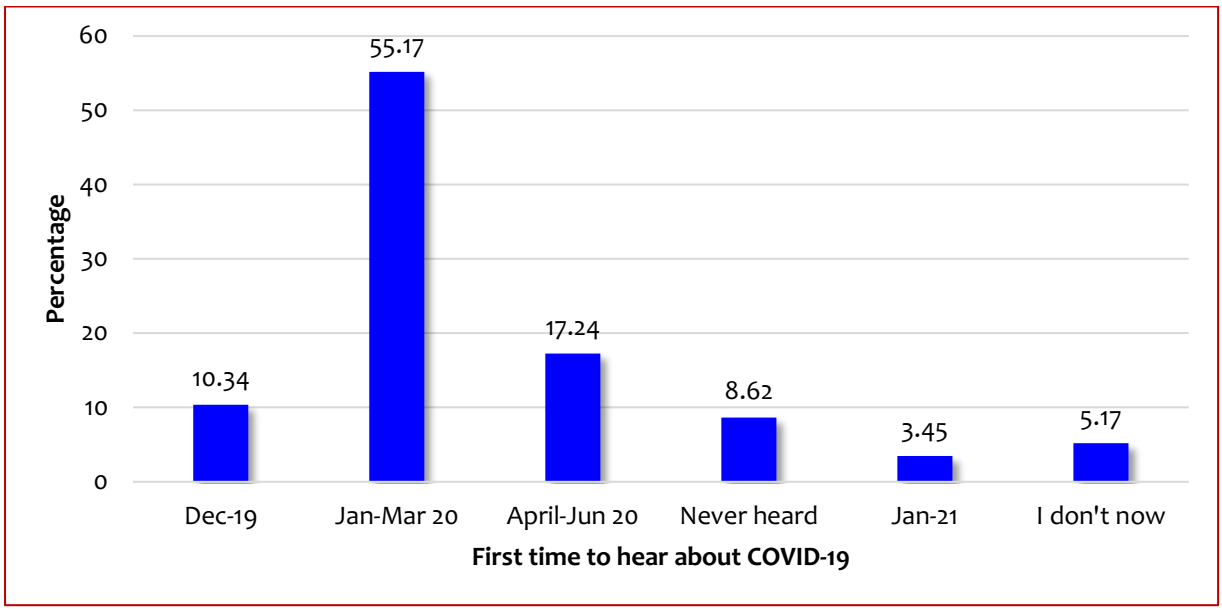

Fig1: Percentage distribution of participant's first-time hearing about COVID-19 (n=232)

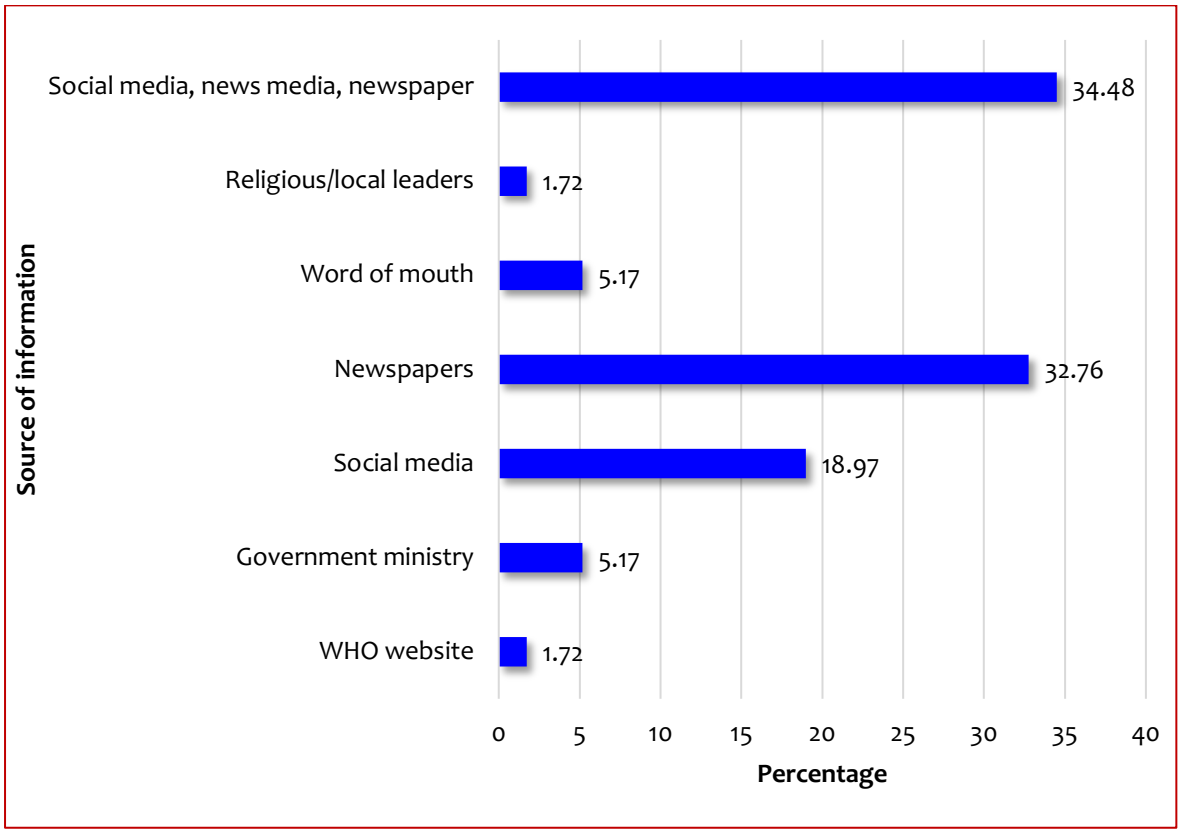

Fig.2 Percentage distribution of Respondent's source of information about COVID-19 (n=232)

COVID-19 knowledge assessment

Table 2 displays the knowledge results for COVID-19. Many participants (65.52%) had a moderate understanding of COVID-19. In terms of primary COVID-19 symptoms, "coughing" was cited by 224 (96.55%) of the participants, followed by "touching" and "handshaking," which were both noted by 212 (91.38%) of the questioned people. Other symptoms cited by 208 (89.66 percent) and 204

(87.93%), respectively, were "runny nose" and "fever." When asked if SARS CoV-2, the cause of COVID-19, was a man-made or natural virus, 112 (48.3%) of participants answered it was man-made, compared to 36 (15.52%) and 84 (36.21%) who replied "natural" and "do not know," respectively. The majority (77.59%) of participants cited China as the origin of the virus that causes COVID-19. Overall, interviewed participants displayed "moderate" knowledge of COVID-19.

Attitude toward health COVID-19 health seeking

In this paper, we assessed the attitude of participants towards COVID19 and associated health-seeking behaviors. Most participants (82.76%) had not contracted COVID19 before this survey (figure 2). More than half of the participants (58.62%) were willing to test for COVID19 voluntarily. All participants showed readiness to seek medical care from a hospital for treatment of other diseases despite the COVID19 preventive measures in place. Regarding isolation, if they contracted COVID19, 156 (67.24%) of the participants preferred hospital isolation to home isolation *(Table 3)*. Most of the participants (n=136, 58.62%) had a neutral attitude towards COVID-19 health-seeking. The most important reasons for vaccination hesitancy were unknown safety of the vaccines (17.4%) and unknown long-term effects of the vaccines (18.97%). Nearly a third (27.59%) of the participants declared to have no intention to get vaccinated whatsoever.

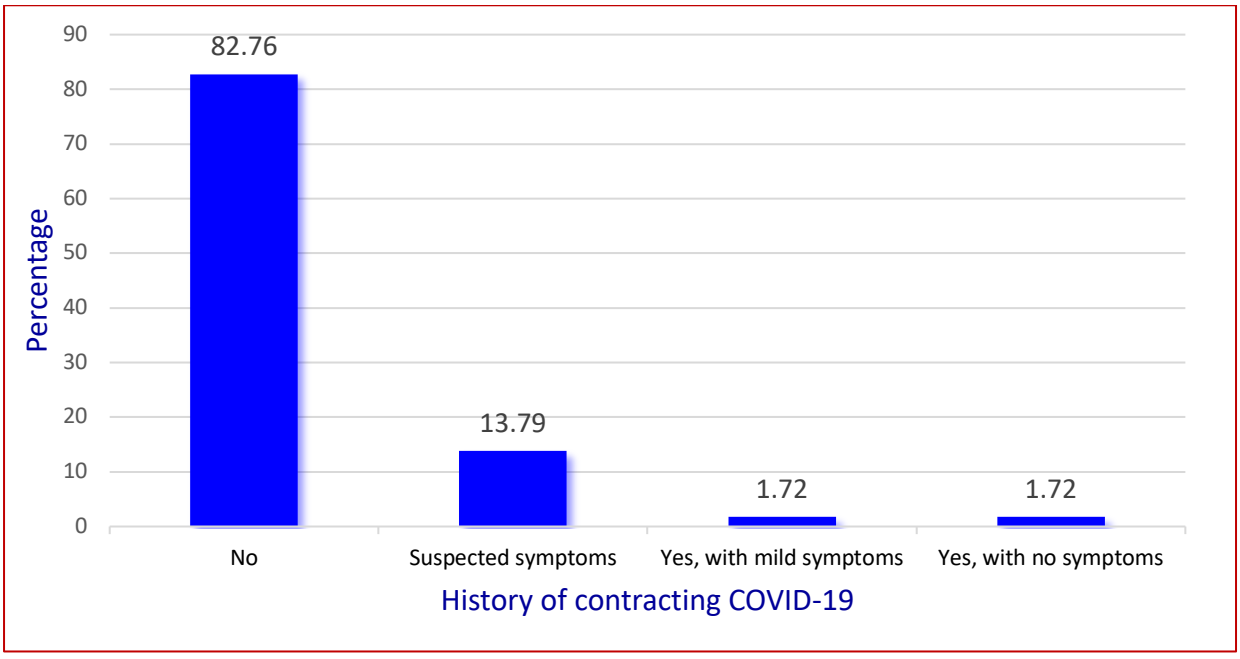

Fig. 2 History of contracting COVID-19: Percentage distribution of participants with a history of contacting COVID-19 (n= 232)

COVID-19 prevention practices

Results presented in Table 4 indicate that most of the participants had good COVID-19 prevention practices 114 (49.14%) of the participants showed to accept and practice prescribed preventive measures. The most adopted preventive practice was "hand sanitization", adopted by all participants. To prevent COVID-19, 224 participants (96.55%) practiced "physical distancing", whereas 216 (93.10%) wore "face masks". Participants who reported practicing "Confinement" were 212 or 91.38% of those interviewed.

Knowledge and attitude to COVID19 vaccine

One hundred and fifty-two (65.52%) of interviewed participants had a negative attitude towards COVID19 vaccines. One hundred and ninety-six (84.48%) of participants acknowledged the presence of a COVID19 vaccine in Tanzania. Despite this knowledge, only 84 (36.21%) of the participants were willing to be vaccinated for fear of unknown long-term effects 18.97% of participants, whereas only 16 (6.9%) were vaccinated against COVID19. The overall attitude towards COVID19 vaccination was reported to be negative (Table 5).

Factors associated with COVID-19 vaccine hesitancy

A chi-square test was performed to understand the factors that were associated with observed knowledge, attitude, and practices towards COVID19 and COVID19 vaccines. Fisher's exact test was used to provide the significant results of the variables. A p-value of <0.05 was selected to show the statistical significance of the associations. Gender, education level, participant occupation, work environment, workplace crowdedness, and COVID19 knowledge were all found to be linked with vaccine hesitancy ($p<0.05$)(Table 6& Figure 3). Male gender, least education level, for occupation: teachers, health care workers, and students, showed the highest level of COVID19 vaccine hesitancy. In addition, poor knowledge of COVID19 was an important factor for vaccine hesitancy whereby only 16.67% of participants with poor COVID19 knowledge compared to 39.5% and 9.09% of those who showed moderate and good knowledge, had a positive attitude toward COVID19 vaccination (Chi-20.06, p=0.001). Consistently, participants who showed poor COVID19 preventive practices were the most hesitant to vaccination against COVID19 (Chi=5.42, p=0.03).

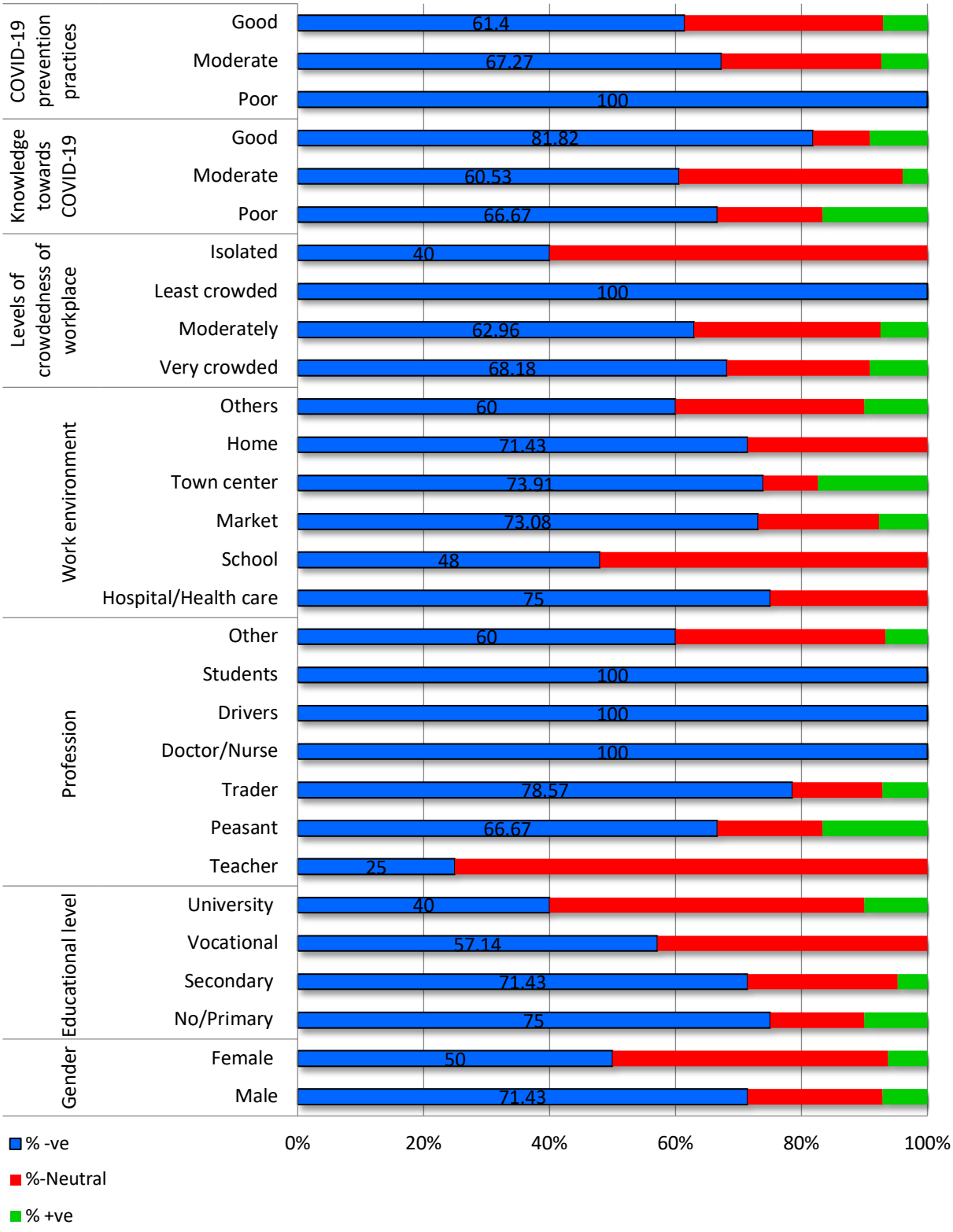

Figure 3: Significant Factors associated with COVID-19 Vaccine Hesitancy

DISCUSSION

This is among the first studies that report on the knowledge, attitudes, and practices of COVID-19 in Tanzania. Ahead of most other studies, this study has also investigated factors for COVID-19 vaccination hesitancy among one of the Tanzanian regions most hit by COVOD-19, Kilimanjaro region. In the current study, the majority of respondents heard about COVID-19 between January and March 2020, indicating a timely awareness of the pandemic in Tanzania. Our findings indicate the combination of social media, news media, and newspapers as the strongest sources of information regarding COVID-19, reaching 34.48% of the population as represented by interviewed participants. During epidemics, effective communication is frequently a critical component of health crisis response. Attempts to connect with the public can take several forms and come from a variety of sources. Given the proliferation of smartphones and the rising worldwide availability and distribution of the internet, social media has become a significant communication channel for communicating health emergencies (Yu & Li), alleviating challenges of public health communication through its affordances and functionality (Schillinger *et al.* 2020). Mobile phone use has also increased the rate at which behavioral change information concerning epidemics is disseminated (Dong & Zheng 2020).

In line with other studies conducted in Tanzania (Khamis & Geng 2021), findings in this study show that social media platforms are an effective way in spreading health-awareness information about COVID-19. Furthermore, while social media use serves as an efficient means of communication during pandemics, alternative ways need to be in place for those with limited internet access. We report that 32.76% of the respondents in this study heard about COVID191 through newspapers. During a pandemic, reliable and timely communication has been stressed as key to the success of any control measures that involve the public (Manganello *et al.* 2020). Beyond the requirement for timely information, there is a need for robust and credible health communication channels, which citizens can trust, rely on, and act on. This is where traditional media such as newspapers becomes a helpful public realm in terms of engaging with the audience and discussing the path forward in terms of the progress made, problems encountered, and plans in place to beat the virus with concerned members of the public.

When participants were interviewed for their knowledge of the basic symptoms of COVID19, moderate knowledge was observed. Of interest was the response to the question of whether SARS COV2, the virus that causes COVID19 was natural or man-made where nearly half of the respondents (48.3%) said it was man-made whereas 36.21% did not know whether it was man-made or natural. Tanzania and other African countries have been working to increase awareness and provide information to the public through various channels of communication (e.g., radio, television advertisements, public health messages by prominent celebrities and national leaders, pamphlets, and signboards in public places) about the mode of infection, symptoms, and infection control measures. However, misinformation about COVID-19 remains intact in these countries.

As previously reported by other studies (Osuagwu *et al.* 2021), misinformation about COVID19 is a significant barrier to global public health since it may inadvertently aggravate public health challenges by indirectly facilitating increased disease transmission (El Sayed 2020). Unfortunately, most social media has been flooded with information regarding the origin and implications of the disease while much of the information about COVID19 its symptoms, transmission routes, and response mechanisms have been largely unreliable (Palade & Balaban 2020; Jelnov 2020; Sahoo *et al.* 2020; Amgain *et al.* 2020). Despite this knowledge and best preventive practices observed in the current study, a considerable proportion of the participants believed the virus was man-made, with evil intentions against targeted communities. Our findings that only 6.9% of the participants were vaccinated against COVID19 largely explain the basis of the vaccination hesitance.

Overall, our study found a high proportion of COVID19 vaccine reluctance of approximately 65 percent. When participant characteristics for vaccine reluctance were examined, male gender, participants with the least education, and occupation (teachers, health care workers, and

students) were shown to be more apprehensive about vaccination. Our findings are both similar and dissimilar to those of other studies. For example, contrary to our findings, a study in the United States found that vaccine hesitancy was higher in females than in males, but when it came to education, the least educated participants were more likely to be hesitant about COVID19 vaccination than those with at least a bachelor's degree (Liu & Li 2021; Soares *et al.* 2021; Aw *et al.* 2021). In this study, healthcare workers (HCWs) were unwilling to get COVID19 immunization. Although the participants correctly judged the severity, prevention, and safety of the COVID-19 vaccine, they were generally hesitant or refused to be vaccinated (Aw *et al.* 2021); (Murphy *et al.* 2021; Fisher *et al.* 2020; Neumann-B+Âhme *et al.* 2020; Lazarus *et al.* 2020). VH among HCWs poses a danger to pandemic-control strategies.

Conclusion

We report an intermediate understanding of COVID19, as well as effective preventive practices, but negative attitudes toward COVID19 vaccination, which has resulted in low vaccination rates. Misinformation about COVID19 appears to be a factor in vaccine hesitancy. COVID-19 vaccination apprehension must be understood in the context of the interaction between misinformation dissemination and accompanying emotional reactions. Because social media and newspapers are effective conduits for health campaigns, vaccination programs should provide a focused, localized, and sympathetic response to misinformation.

Author contribution

JC designed the study and wrote the manuscript. KR analyzed and interpreted data. OB participated in questionnaire validation and data collection. HS made critical reviews of the manuscript. EK designed the study, developed the questionnaire, and made a critical review of the manuscript.

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Availability of data and material

All data generated or analyzed during this study are included in this published article.

Consent for publication

All authors consented to the publication of this manuscript

Competing interests

The authors have no conflicts of interest to declare.

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Prevalence, characterization and antimicrobial resistance profiles of *Salmonella* isolates from healthy broiler and free-range chickens in Morogoro, Tanzania

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Abstract
Background: *Salmonella enterica* is a group of bacteria that cause enteric and systemic infection in animals and human worldwide.
Objectives: The study was conducted to determine prevalence, characterization and antimicrobial susceptibility profiles of Non-Typhoidal Salmonella in indigenous free range and broiler chickens in Morogoro Municipality.
Methodology: A cross-sectional study was conducted from November 2019 to May 2020 whereby 384 cloaca swab samples from health chickens from Magadu, Mzinga and Bigwa wards were collected. Identification was done by standard bacteriological methods, serotyping and genetically confirmed by PCR using *Salmonella* specific primers pair and *Salmonella* enterica primer pair (*invA* and *iroB* gene primers). Sensitivity test was done using Ampicillin, Tetracycline, Imipenem, Gentamycin, Ciprofloxacin, Sulfamethoxazole trimethoprim and Cefaclor antimicrobial discs. Descriptive statistic method was used for analysis, and paired t-test assuming unequal variance was used for comparing overall prevalence of *Salmonella* spp between free range and broiler chickens.
Results: Out of 384 samples, 11 (2.9%) samples confirmed to be Salmonella of which 8(4%) were from broilers and 3(1.6%) were from free range chickens. Of the 11 isolates 8 were from group B serotypes and 3 isolates were from group D serotypes. Susceptibility results showed variable level of sensitivity to majority of antibiotics tested however, level of resistance were also found in 7/11 isolates resistant to Ampicillin, 4/11 isolates resistant to sulfamethoxazole-trimethoprim and 3/11 isolates resistant to tetracycline. Three isolates were found to harbor Sulfamethoxazole*(sulII*) resistant gene.
Conclusion: This study revealed the presence of *Salmonella* carrier among chicken kept in Morogoro with antimicrobial resistances from both free range and broilers chickens. The results underline the importance of the biosecurity measures in the production and processing of chicken for human consumption, similarly improvement of management is recommended to stop transmission of *Salmonella* from natural carriers to chicken as indicated by fecal carriers found.

Key words; Nontyphoidal *Salmonella,* antimicrobial resistance, chickens.

INTRODUCTION

Salmonella enterica are group of bacteria that cause enteric and systemic infection in animals and human worldwide (Abdi *et al.,* 2017).Apart from being public health problem Salmonella infections cause huge financial losses in poultry industry worldwide (Alvarez-Fernandez *et al.,* 2011). Host specific *Salmonella* infections are known to cause systemic infection, typhoid in people and Gallinarum and Pullorum disease in poultry (Kimathi, 2016). A wide range of Nontyphoidal *Salmonella* (NTS), are known to be harboured by poultry that transmit them to human beings as food borne diseases (Castiglioni-Tessari *et al.,* 2012; Umeh&Enwuru, 2014).

In addition to being a foodborne, *Salmonella* infections are also acquired through direct or indirect animal contact in homes, farm environments or other public/ private settings (Moutoutou *et al.,* 2017). NTS is estimated to cause about 93.8 million cases of gastroenteritis and about 155 thousand deaths in humans, 80.3 million cases were estimated as a foodborne origin (Majowz *et*

al., 2010; Antunes *et al.,* 2016) and it is estimated to cause about 3.7 billion dollars annual economic losses in poultry industry worldwide (Nidaullah *et al.,* 2017).

Recently, NTS has been shown to contribute to the increased cases of bacteremia where *S.typhimurium* and *S. enteritidis* have been isolated (Muthumbi *et al*., 2015). In Tanzania, about 12,055 cases of salmonellosis were reported in Njombe Region, under Health Management Information System data of 2016 (Ngogo *et al.,* 2020). Most of these *Salmonella* spp have been shown to possess virulence genes located in the *Salmonella* Pathogenicity Islands (SPI) (Zishiri *et al.,* 2016).

Several studies on NTS have also linked Antimicrobial Resistance (AMR) to the exposure of antibiotics that are commonly used in the area. Resistance to commonly used antibiotics for the treatment of *Salmonella* infection in animals and human has been studied and reported in many parts in the world (Mengistu *et al.,* 2014; Muthumbi *et al*., 2015; Manyi-Loh *et al.,* 2018). The uses of these antibiotics as growth promoting agents, prophylaxis or therapeutics in animal farming have been linked to the development and spread of resistant bacteria in animals, including zoonotic pathogens such as *S. typhimurium*,*S. infantis* and *S. enteritidis* (Van *et al.,* 2007; Andino *et al.,* 2015).

Rapid changes in identification of *Salmonella* have raised questions about types of *Salmonella* reported. Invention of genotypic and molecular techniques like pulsed-field electrophoresis, Polymerase chain reaction (PCR), ribotyping and sequences have been useful addition in epidemiological tracing of *Salmonella* infection (Christensen *et al.,* 1993; Lukinmaa *et al.,* 2004; Scaria *et al.,* 2008; Wise *et al.,* 2009). However, serotyping continues to be the important epidemiological tool for identification of *Salmonella* serovars and making it possible to determine the prevalence (Castiglioni-Tessari *et al.,* 2012), despite the disadvantage of being unable to reveal genetic constitution and intra-serovars variations (Wise *et al.,* 2009). Similarly, different methods have been recommended for antimicrobial susceptibility testing of *Salmonella*, however disc diffusion method is a common one used worldwide in accordance to Clinical and Laboratory Standards Institute (Mrope, 2017).

Most studies on the detection of *Salmonella* in chicken in Africa were carried out on specific areas and some on specific serovars like studies of Aragaw *et al.* (2010);Mdegela *et al.* (2000); &Wesonga *et al.* (2010).The information on prevalence of non-typhoidal *Salmonella* among chickens in Morogoro is scarce and salmonellosis status from the farm level needs to be determined for its proper control and management. The chicken production systems are also known to use antimicrobials at different levels to tackle other diseases (Andino *et al.,* 2015; Boamah *et al.,* 2016). The effect of these in selecting antibiotic resistant *Salmonella* is not precisely known. Thus, this study is aiming at establishing prevalence, antimicrobial resistance profile and resistance gene determination in non-typhoidal *Salmonella* spp in Morogoro, Tanzania.

MATERIAL AND METHODS

Study Area

The study was conducted in Morogoro Municipality, in Morogoro Region between October 2019 and May, 2020. The Municipal Council has one division, which is subdivided into 29 Administrative Wards. About 33% of the population is engaged in subsistence farming and livestock keeping (URT, 2013). Three wards of Magadu, Mzinga and Bigwa were purposively selected as sampling areas based on accessibility of the area and availability of both chickens as study materials.

Study design and sample collection method

A cross-sectional study design was employed whereby multistage random sampling technique was used. A total of 384 cloaca swab samples were collected from healthy free range and broilers chickens using sterile swabs. The swabs were taken in a sterile tube containing 10ml of selenite faecal broth and kept in cooler box with ice pack (4^{o}C), then transported to Microbiology

Laboratory at the Department of Microbiology, Parasitology and Biotechnology at Sokoine University of Agriculture (SUA) for further analysis.

Isolation and Identification of *Salmonella* spp.
Isolation of *Salmonella* spp from cloaca swab samples was done by using conventional and standard microbiological protocols as described by Wallace *et al*., (2009), PHE, (2014),using MacConkey agar (MCA), Blood Agar (BA), Brilliant Green agar (BGA) and Selenite Faecal Broth all from Himedia, India. All media were prepared aseptically and according to manufacturer's instructions. Suspected *Salmonella* colonies were identified phenotypically from different media inoculated and by using Gram stain method, biochemical tests (Triple Sugar Iron, Lysine iron agar, Simmons citrate agar, Motility, Glucose, Dulcitol, Maltose, Indole, Methyl red, Voges Proskauer test, and catalase test (IMVC)), serotyping and genetically confirmed by PCR.

Serotyping of suspected *Salmonella* isolates
Suspected *Salmonella* isolates were further confirmed by slide agglutination method using commercial *Salmonella*-specific polyvalent O (A-S) antisera, *Salmonella* O Group B antisera, and *Salmonella* O Group D antisera. Once the polyvalent group O was positive for agglutination, the isolates were tested in antisera against O groups B and D. Serotyping was done according to National Health Laboratory Quality Assurance and Training Centre, Standard Operating Procedure for Isolation and Identification of *Salmonella* spp.

DNA extraction of Salmonella isolates
Genomic DNA was extracted from the suspected Salmonella spp isolates by using Qiagen Kit (Germany). In brief 5-10 colonies from the pure culture plate were taken by using sterile wire loop and added into tube provided in the kit and extraction process was done following manufacturer instructions. S. typhimurium (ATCC NO 14028) was also extracted and used as a positive control. 100µl of DNA was eluted in 1.5ml eppendorf tube and stored in -20^{o}C freezer for further analysis.

Molecular Detection of Salmonellaspp (Salmonella Specific PCR)
DNA amplification for the invA gene and iroB gene was carried out using Salmonella Specific primer pair and Salmonella enterica serovars enterica primer pair (Table 1) obtained from (Inqaba Africa).PCR reaction was performedusing Agilent Technologies (Sure cycler 8800)PCR machine.

The PCR reaction was performed in a total volume of 25µl that included 1.5µlDNA template,12.5µl One Taq w/standard buffer 2x concentrate (New England, BioLabs) PCR Master Mix, 1µlof each primer and 9µl Nuclease free water. The following PCR running condition were used: initial denaturation at 95˚C for 1 minutes, followed by 34 cycles of denaturation at 95˚C for 30seconds, annealing at 58˚C for 30 seconds, extension at 72˚C for 30 seconds and final extension at 72˚C for 5 minutes (Zishiri et al., 2016, Jamshindi et al., 2009). Gel electrophoresis (1.5 % agarose) using consort EV 243 electrophoresis system was used to analyse the PCR products and 100 bp DNA ladder (New England, BioLabs) was used as a size standard. The agarose gel was visualized under UV trans-illuminator (Uvitec) and the picture was taken using camera.

Antibiotics Susceptibility Testing of *Salmonella*spp
Disc diffusion method was used to determine antimicrobial susceptibility of the *Salmonella* spp in accordance to Clinical and Laboratory Standards Institute for susceptibility testing (Liofilchem, 2017; CLSI 2018). In this study the following antibiotics were tested Ampicillin (AMP 25µg), cefaclor (CF 30µg), Imipenem (IMI 10µg), Gentamycin (Gn 10µg), Ciprofloxacin (CIP 5µg), Sulfamethoxazole-Trimethoprim (SXT 25µg) and Tetracycline (TE 30µg).In brief the test was

conducted by preparing inoculum of each isolate and the control (*E. coli* ATCC 25922) and turbidity of bacterial suspension was adjusted to 0.5 Standard McFarland solution.

Muller Hinton agar media (Oxoid) was used and was prepared according to manufactures instructions. The suspension of each isolate was spread on dried Muller Hinton agar plate using sterile swab. Selected antibiotic discs (Liofilchem-Italy) were then applied to the surface of the inoculated plates using sterile forceps. The plates were then incubated at 37°C for 18-24 hours. Antibiotic profiles were determined based on zones of inhibition showed by each drug. Zones of inhibitions was measured using a ruler and recorded as diameter in mm and interpreted as Sensitive (S), Resistant (R), and Intermediate (I) (Liofilchem, 2017; CLSI, 2018).

Detection of Antibiotic Resistance Genes

PCR was used to detect resistance gene from extracted Salmonella genomic DNA. Three different resistance genes were detected by using specific primers as shown in the Table 1. The genes include Ampicillin resistant gene (pse-l gene), Tetracycline resistant gene (tetA gene) and Sulfamethoxazole Trimethoprim resistant gene (sulII gene).PCR reaction was performed using Agilent Technologies (Sure cycler 8800) PCR machine. The PCR reaction was performed in 34 cycles with a total volume of 25µl that included 1.5µl DNA template,12.5µl One Taq w/standard buffer 2x concentrate (New England, BioLabs) PCR Master Mix, 1µl of each primer and 9µl Nuclease free water.

The following PCR running condition were used:Ampicillin resistant gene (pse-1 gene) with initial denaturation at 94 °C for 12 min, denaturation at 94 °C for 1min, annealing at 57 °C for 30 seconds and extension at 72 °C for 5 min. Tetracycline resistant gene (tetA gene)with initial denaturation at 94 °C for 5 min, denaturation at 94 °C for 25 seconds, annealing at 55 °C for 30 seconds, extension at 72 °C for 50 seconds and a final cycle at 72 °C for 5 min. Sulfamethoxazole Trimethoprim resistant gene (sulII gene) with initial denaturation at 94 °C for 5 min, denaturation at 94 °C for 25 seconds, annealing at 52 °C for 30 seconds, extension at 72 °C for 50 seconds and a final cycle at 72 °C for 5 min (Adesijiet al., 2014; Zishiriet al., 2016).Gel electrophoresis (1.5 % agarose) was used to analyse the PCR products and 100 bp DNA ladder (New England, BioLabs) was used as a size standard. The agarose gel was visualized under UV trans-illuminator (Uvitec) and the picture was taken using camera.

Table 1.Primer sets used

Drugs/*Salmonella* genes	Gene	Sequence	Bp	References
Ampicillin	*pse-1*	F; CGCTTCCCGTTAACAAGTAC R; CTGGTTCATTTCAGATAGCG	419	Zishiri *et al*.,2016
Tetracycline	*tet A*	F:GCTACATCCTGCTTGCCTTC R:CATAGATCGCCGTGAAGAGG	210	Zishiri *et al*.,2016
Sulfamethoxazole	*SulII*	F; CCTGTTTCGTCCGACACAGA R ;GAAGCGCAGCCGCAATTCAT	667	Adesiji *et al*.,2014
InvA	*InvA*	139F;GTGAAATTATCGCCACGTTCGGGCAA 141R; TCATCGCACCGTCAAAGGAACC	284	Jamshindi *et al*.,2009
iroB gene	*iroB gene*	F:TGC GTA TTC TGT TTG TCG GTCC R:TAC GTT CCC ACC ATT CTT CCC	606	Zishiri *et al*.,2016

Ethical Issues

The permission to carry out this study was granted by the Morogoro Municipal Livestock Officer while ethical approval for the study was given by the Ethical Committees of Sokoine University of Agriculture, Tanzania with reference No. SUA IDPRTCIR1186 approved on 29th January 2020. Voluntary participation of each chicken farmer was obtained after informed about the study purposes.

Data Analysis

All the data were entered into Microsoft Excel spread sheet whereby descriptive statistic method was used for analysis. A paired t-test assuming unequal variance was used for comparing overall prevalence of *Salmonella* spp between free range and broiler chickens.

RESULTS

Isolation and Identification of *Salmonella* spp

Results found that 11 isolates of *Salmonella* spp were recovered from 384 collected cloaca swab samples from Magadu, Mzinga and Bigwa Wards. Cultural and morphological growth characteristics of *Salmonella* were used in primary identification of *Salmonella* as recorded in Table 2. Percentage prevalence of *Salmonella* spp in broilers and free-range chickens were determined in Table 4.

Table 2: Cultural and morphological growth characteristic results of *Salmonella* spp.

Culture media	BA	MCA	BGA	Motility	TSI	LIA
Colony characteristic	Greyish/whitish, non-haemolytic and medium size colonies	Pale, colourless, smooth, transparent, raised colonies	Red colonies with bright red background	Motile	Yellow butt, blackening, gas formation	Purple butt, blackening, gas formation

Biochemical Test Results

Different biochemical tests were done and the results obtained were summarized in Table 3.

Table 3:**Results of biochemical characteristics of *Salmonella*spp**

	Biochemical Reaction							
	Indole test	MR Test	VP Test	Glucose	Dulcitol	Maltose	Citrate utilisation test	Catalase test
Overall reaction	-	+	-	+	+, -	+	+, -	+

+ = positive reaction, - = negative reaction, +, - = some positive and some negative

Serotyping Results

All the *Salmonella* isolates (11/11) were confirmed positive by serotyping using polyvalent O (A-S) antisera. 8/11 isolates were under serogroup B and 3/11 isolates were under serogroup D. The most prevalent serogroup identified in this study was serogroup B.

Table 4: Prevalence of *Salmonella* spp among selected wards within Morogoro Municipality

Wards	No. sampled/Total number		Positives	Overall prevalence (%)		Alpha	P-value	Calculated/ Test statistic	Critical/ Tabulated t-value
	Broilers	Free range chicken		Broilers	Free range	0.05	0.45	0.86	3.18
Magadu	65/136	71/136	3/136(2.2%)	4.04	1.61				

Mzinga	83/133	50/133	2/133(1.5%)	
Bigwa	50/115	65/115	6/115(5.2%)	
TOTAL	**198/384**	**186/384**	**11/384(2.9%)**	**2.9**

Molecular Detection of *Salmonella*spp

For the *invA* gene detection, results showed that all eleven (11/11) samples were genetically confirmed to be *Salmonella* spp. The amplicon size was 284bp Fig. 1.

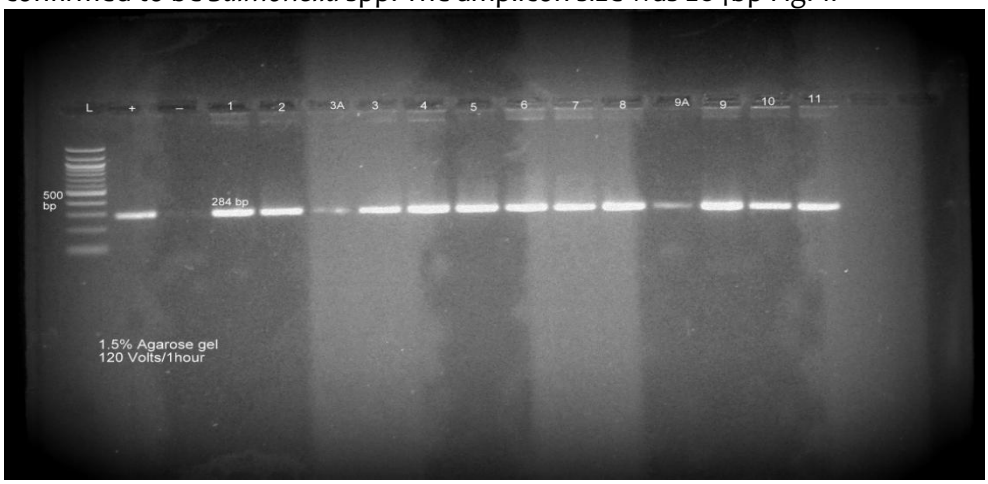

Figure 1: *Salmonella* gene detection, 284bp detected (*invA* gene detection)
L = Ladder, + = Positive control - = Negative control, Lane 1, 4, 5, = Free range positive isolate and Lane 2,3,6,7,8,9,10,11 = Broilers positive isolates

For the *iroB* gene detection, the results showed that all eleven (11/11) samples were confirmed to be *Salmonella* enterica spp, with 606 bp detection Fig.2.

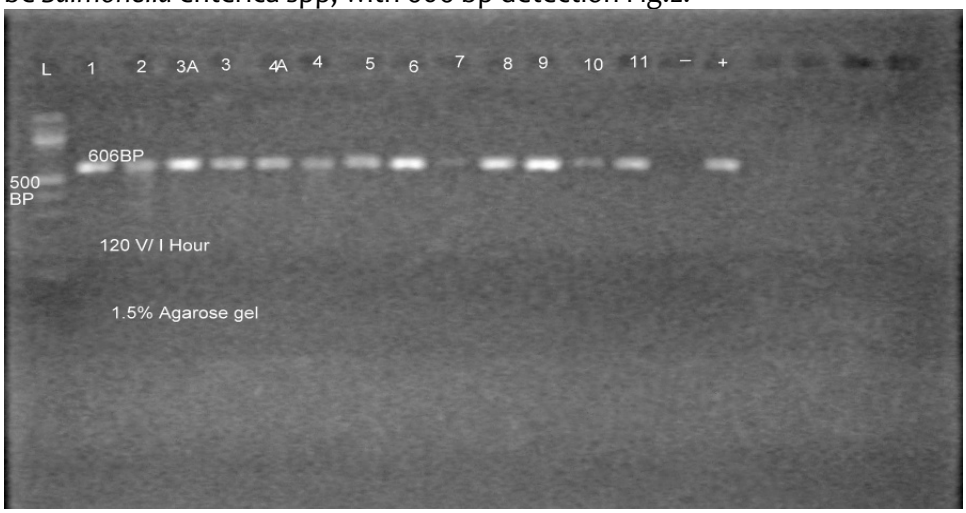

Figure 2: *Salmonella* enterica gene detection, 606bp detected (*iroB* gene detection)
L = Ladder, Lane 1, 4, 5, = Free range positive isolate and Lane 2,3,6,7,8,9,10,11 = Broilers positive isolates, - = Negative control, + = Positive control

Antimicrobial Susceptibility Test

Seven antibiotics were tested and the results obtained were as indicated in the **Table 5** and **Appendix 1.**

Table 5: Antimicrobial susceptibility results from the isolated *Salmonella* spp
R = Resistance, S = Susceptible, I = Intermediate

Antibiotics	Free range sensitivity profiles			Broilers sensitivity profiles			Overall sensitivity profiles		
	R	S	I	R	S	I	R	S	I
Ampicillin	2/3	1/3	0	5/8	3/8	0	7/11	4/11	0
Gentamycin	0	3/3	0	0	8/8	0	0	11/11	0
Tetracycline	1/3	2/3	0	2/8	6/8	0	3/11	8/11	0
Sulfamethoxazole Trimethoprim	0	3/3	0	4/8	4/8	0	4/11	7/11	0
Imipenem	0	2/3	1/3	0	7/8	1/8	0	9/11	2/11
Ciprofloxacin	0	3/3	0	0	8/8	0	0	11/11	0
Cefaclor	0	3/3	0	0	5/8	3/8	0	8/11	3/11

Detection of *Salmonella* resistance gene by PCR

Three different resistance genes were detected by using specific primers as shown in the Table 1. The genes include ampicillin resistant gene (pse-l gene), Tetracycline resistant gene (*tetA* gene) and Sulfamethoxazole Trimethoprim resistant gene (*sulII* gene). The results showed no resistance genes for tetracycline and ampicillin detected while 3/11 isolates were carried sulfamethoxazole resistance gene (*sulII*gene) Fig. 4 below.

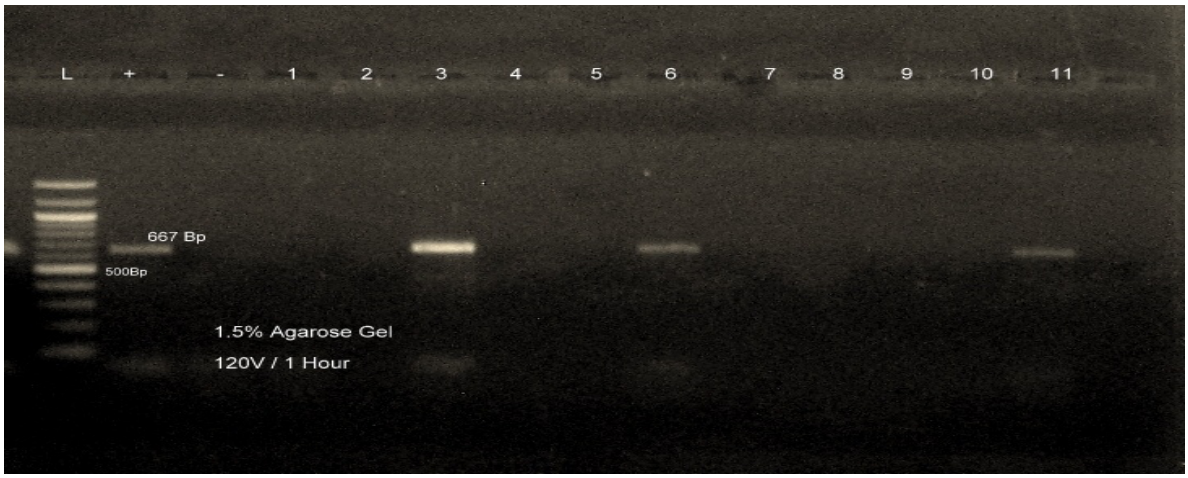

Figure 2: Sulfamethoxazole resistant gene amplification, 667 bp, L = Ladder, + = Positive control - = Negative, 1-11 = isolates (3, 6, 11 positive *SulII* broilers isolates), 1, 2, 4, 5, 7, 8, 9, and 10= Negative *SulII* gene

DISCUSSION

Overall, the present study shows presence of *Salmonella* species in the gastrointestinal tract of healthy indigenous free range and broiler chickens in Morogoro Municipality. About 3% of the chicken were found to carry *Salmonella* and prevalence was found with 4% in broiler chicken and 1.6% in indigenous free-range chickens. However, statistically there were no significant difference between the two groups (P>0.05). Serotyping confirmed 11 isolates as positive with polyvalent O

sera (A-S) and of these 8 isolates were from group B while 3 isolates were from group D. PCR results confirmed eleven (11) isolates as a *Salmonella* spp using both *invA* and *iroB* gene primer. Variable level of sensitivity to majority of antibiotics tested were found; however, level of resistance was also found with 7 isolates resistant to Ampicillin, 4 isolates resistant to sulfamethoxazole-trimethoprim (co-trimoxazole) and 3 isolates resistant to tetracycline. Screening for resistant genes detected *SulII* with 667bp amplification.

The current study found that serogroup B and serogroup D were the most isolates from the cloaca of chicken. These results support those of Al Mamun *et al*., (2017) and Mridha *et al*., (2020), who found serogroup B (O: 4, 5, 27) and serogroup D (O: 9, 46) as the most isolates from chicken cloaca and carcases. However, these findings differ in the ratio of serogroup B to D in that their findings showed that there was more D serotype isolate than B while the current study showed more B serotype than D serotype. The B serogroup were the most common serotype involved in animals and human's salmonellosis frequently isolated before the outbreak of *S. enteritidis* (Oliveira *et al*., 2006). Generally, these serogroups (B and D) contain serovars that can infect a wide variety of animal hosts and they are widely distributed in the environment hence increasing prevalence in food chain (Liljebjelke *et al*., 2005).

The prevalence of 2.9% *Salmonella* cloacal carriers found were low compared to other studies elsewhere in the world including Iran with 5.8% from cloaca swabs, serovar typhimurium and serovar enteritidis as the prevalent ones (Jafari *et al*., 2007), Kenya 3.6 % from faecal samples, serovar typhimurium and serovar enteritidis as the prevalent ones (Nyabundi *et al*., 2017), Brazil with 25% from cloaca swabs, *S. typhimurium* and *S. enteritidis* as prevalent serovars (Paião*et al*., 2013), Wesonga *et al*. (2010), in Kenya and Alam*et al*. (2020), in Bangladesh, 12.5% (*S. typhimurium*) and 35% (*S. typhimurium*) prevalence of *Salmonella* in chicken cloaca swabs respectively. These prevalences were high as compared to prevalence of the present study possibly because of the analysis method used whereby pre-enriched multiplex polymerase chain reaction (m-PCR) assay was used and it is specific and rapid alternative method for *Salmonella* spp identification (Paião *et al*., 2013) as compared to this study which employed culture-based technique (colony isolation) then confirmed by PCR.

Further studies are recommended to compare different methods in the given systems. Also sampling of chicken at different ages pose the possibility of finding contamination rate based on ages as newly hatched chicks were very vulnerable to infection with *Salmonella* than the older chicken (Sterzo *et al*., 2005), the current study sampled on moderate adults' chickens and not on chicks, so this should be taken into consideration while studying this prevalence. The prevalence variations may also be due to several management factors such as hygiene, sanitation and biosecurity of the farms. For the better prevalence establishment, different sample matrix such as chicken feed sample, hand swab of the chicken handler and chicken drinking water are encouraged (Akond*et al*., 2012; Abdi *et al*., 2017). The current study sampled only on faecal swab sample from chicken cloaca.

Comparison of the isolation rate between broiler and free-range chicken showed higher prevalence in broiler (4%) than free range chicken (1.6%) however, the difference (P>0.05) was not statistically significance. These findings are in line with those of Kindu and Addis (2013), who found prevalence of *Salmonella* infection to be higher in indoor chickens (42.7%) than free ranging (40.8%) but without any statistically significant. Presumably free-range chicken is at higher risk of bacterial contamination due to direct contact with the transmitting vectors such as rodents, insects and other animals (Liljebjelke *et al*., 2005). This study showed that intensively managed chicken (broilers) is more likely to carry *Salmonella* than freely range chickens (indigenous), this is due to the reason that chicken kept indoor have lower immunity to diseases and poor management experienced by the chicken owners exposes them to various source of *Salmonella* contamination (Kindu & Addis, 2013). Broader studies are recommended to compare the two systems for a sound conclusion regarding the variation observed.

Antibiotic sensitivity results showed that *Salmonella* isolates had high sensitivity to majority of the antibiotic tested. These findings are in line with the findings by Mrope (2017), who found sensitivity to 100% in Ciprofloxacin, Imipenem and Sulfamethoxazole, Gentamycin 91% and Cefaclor 82%. Also, Naik *et al*. (2015), found high sensitivity profile in Ciprofloxacin while 96.87% and 96.87% were sensitive to Gentamicin and Imipenem respectively. These findings contradict some of the studies done worldwide including study of Al-Ledeni *et al*. (2014), and Ziba *et al*. (2020), which showed resistance to Ciprofloxacin and Gentamycin up to 60.5% and 31.6% respectively

In this study high level of resistance were found to Ampicillin, Sulfamethoxazole-Trimethoprim and Tetracycline. These findings are consistent with those of Bacci *et al*. (2012); Kagambega *et al*. (2013); and Moe *et al*. (2017), who found that most of *Salmonella* isolates to be resistant to Ampicillin, Tetracycline and Sulfamethoxazole. These antibiotics are widely used to treat bacterial infections in both people and animals and they are highly prescribed in Tanzanian hospitals to treat a variety of bacterial infections (Murutu, 2016). Mubito *et al*. (2014), found that these are the most used drugs in poultry production in Tanzania, and they are widely used as therapy, prophylaxis or growth promotion. The presence of resistance to these antibiotics might be related to selection pressure due to antibiotic usage, or due to the occurrence of resistant clonal strains that were successfully disseminated within populations (Katakweba *et al*., 2012; Wigley, 2014). It is also possible to hypothesize that free ranged chickens can be exposed to drug residues due to improper disposal from the environment and thus aid in selection pressure (Wesonga *et al*., 2010; Kissinga *et al*., 2018). However, with small sample size, caution must be applied in interpretation, because no evidence of antimicrobial use was established. Apparently, there is little use of antimicrobials in free range chicken which were also shown to carry resistant isolates.

Another important finding, though to a small proportion, is the presence of Multiple Drug Resistance (MDR) isolates. Out of the 11 isolates 3 were found to be resistant to Ampicillin, Sulfamethoxazole Trimethoprim and Tetracycline. These findings are mirror to those of previous studies by Kagambega *et al*. (2013); and Mengistu *et al*. (2014), which found that resistance to Ampicillin, Sulfamethoxazole Trimethoprim and Tetracycline were the common MDR phenotypes. This study was unable to demonstrate resistance to Ciprofloxacin, Gentamycin, Imipenem and Cefaclor that was shown by Adesiji *et al*. (2014), and Ziyate *et al*. (2016). It is difficult to explain this result, but it may be related to geographical variation and the types of serovars isolated. Being rodent borne bacteria, further work is required to establish if rodent is exposed to antimicrobial in addition to the type of bacteria found in the guts.

The antimicrobial resistance genes results found that, 3 isolates in broilers contain Sulfamethoxazole (*sulII*) resistance gene and was unable to show presence of resistance gene for the Ampicillin (pse-1) and Tetracycline (*tetA*). These results agree with those of Bacci *et al*. (2012), who found pse-1 gene absent to all the isolates from chicken carcasses (skin swabs) and low percent of sulII gene while Zishiri *et al*. (2016), found high percentage of sulII genes from the chicken meat. However, phenotypic results showed resistance to Ampicillin, Tetracycline and Sulfamethoxazole but only Sulfamethoxazole was carried resistant gene. This is because phenotype of most isolates is influenced by specific and non-specific resistance mechanisms such as lower membrane permeability and a high active efflux (Bacci *et al*., 2012). Surprisingly, *tetA* gene was not found despite the fact that they are widely distributed in *Salmonella* strains circulating in animals and was found on plasmids as well as on the chromosome (Frech & Schwarz, 2000; Pezzella *et al*., 2004). According to Katakweba *et al*. (2018), the *sulII* is the most common gene encoding sulphonamides resistances. Sulfamethoxazole, Tetracycline and Ampicillin were the most commonly used antimicrobials in the study area hence the possibility of detecting these genes was high.

To conclude, the presence of *Salmonella* in this study suggests that rodent exposure, public health risk contamination of meat and proper cooking (if not done) are the possible source of transmissions of *Salmonella* from natural carriers to chicken as indicated by faecal carriers found.

This work contributes to the existing knowledge of salmonellosis in chickens, highlighting on non-host specific *Salmonella* which cannot cause disease in chickens but pose public health risks and has added to their AMR risks to people and animals. Finally, the number of limitations need to be considered. First, this study sampled only chicken cloaca swabs, multiple sampling source such as hands swab of the chicken handler, feeds and chicken drinking water could have created a nice ground for the broad prevalence establishment and antimicrobial susceptibility. Second, sample size used was small, larger sample size is encouraged. Third, in this study only cross-sectional study design was used, cross sectional prospective longitudinal study could help to have the variable number of samples at different period of time.

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CONFLICT OF INTEREST
Authors do not have any conflict of interest.

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Appendix 1: Antimicrobial susceptibility results profiles based on zones of inhibition (mm)

Source	No	AMP 10 µg S ≥ 17 I:14-16 R ≤ 13		GENT10 µg S ≥ 15 I:13-14 R ≤ 12		TE30 µg S ≥ 15 I:12-14 R ≤ 11		STX25 µg S ≥ 16 I:11-15 R ≤ 10		IMI10 µg S ≥ 23 I:20-22 R ≤ 19		CIP5µg S ≥ 21 I:16-20 R ≤ 15		CF30 µg S ≥ 18 I:15-17 R ≤ 14	
Free range	118	0	R	25	S	22	S	22	S	29	S	35	S	19	S
Broiler	301	0	R	24	S	22	S	18	S	34	S	35	S	17	I
Broiler	353	23	S	26	S	10	R	30	S	52	S	51	S	18	S
Free range	121	19	S	25	S	10	R	20	S	51	S	46	S	19	S
Free range	102	0	R	30	S	32	S	27	S	21	I	35	S	20	S
Broiler	372	0	R	27	S	34	S	22	S	50	S	39	S	15	I
Broiler	166	0	R	26	S	24	S	0	R	40	S	35	S	21	S
Broiler	291	31	S	22	S	21	S	30	S	45	S	45	S	20	S
Broiler	199	32	S	26	S	18	S	9	R	38	S	35	S	18	S
Broiler	308	0	R	28	S	16	S	0	R	21	I	34	S	22	S
Broiler	302	0	R	18	S	11	R	0	R	46	S	35	S	15	I

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Factors associated with uptake of postpartum family planning services in Dodoma City Council, Tanzania: A cross-section study

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Abstract
Background: Postpartum family planning is very essential to mothers' health. However, its utilization remains low in developing countries.
Objective: To determine the proportion and factors associated with uptake of PPFP services in Dodoma Tanzania.
Methods: A cross-sectional study employing a quantitative approach was conducted among women who gave birth one year before the study period (June 2020) in Dodoma city council. A two-stage sampling technique was employed to recruit a total number of 209 participants. An interviewer-administered questionnaire was used to collect data. Data were entered and cleaned using Epi Info 7 and later exported to and analyzed using SPSS version 25.0. Bivariate and multiple logistic regression models were employed during data analysis. Odds ratios with 95% confidence intervals were computed to identify factors associated with postpartum family planning.
Results: Majority (53.6%) of women used contraceptives within one year after delivery. Three factors were significantly associated with the uptake of postpartum family planning. Lower odds for uptake of PPFP were found among self-employed women (AOR: 0.5, 95% CI 0.25–0.74) and unemployed women (AOR: 0.2, 95% CI 0.05–0.31) when compared with employed women. Using community health fund insurance (AOR: 2.4, 95% CI 1.09–6.42) and National Health Insurance Fund (AOR: 2.7, 95% CI 1.54–5.99) as a mode of payments for health had higher odds for uptake of PPFP compared to cash mode. Women with an adequate number of antenatal care visits had higher odds (AOR: 2.9, 95% CI 1.24–6.89) of uptake of PPFP compared to women with an inadequate number of antenatal care visits.
Conclusion: The uptake of PPFP among women was not adequate and was associated with being employed, being covered by health insurance and adequate antenatal care visits. More interventions are needed to enhance PPFP use among women.

Keywords: *postpartum, family planning, uptake, Tanzania, Dodoma*

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Background

Globally family planning is recognized as a key life-saving intervention for mothers and their children (1). The consequences of not using family planning include high levels of unintended pregnancies, and this is especially being observed in low and middle-income countries. Unintended pregnancies have implications for the health and well-being of women and children (2). Furthermore, short birth intervals harmfully affect the health of mothers and the survival of their children.

Similarly, the risk of the death of a child increases if the interval between the birth of the child and the previous birth is less than 24 months (2). For instance, when a mother becomes pregnant soon after childbirth, she is more likely to develop several complications (3). World Health Organization recommends waiting for at least 24 months period before the mother becomes pregnant to reduce the risk of adverse maternal, prenatal, and infant outcomes (1).

Postpartum Family Planning (PPFP) prevents unintended pregnancy and closely spaced pregnancies through the first 12 months following childbirth (4). The postpartum period is a time

when many routine interventions are provided to mothers and during this period, most mothers want to delay or stop the next pregnancy (5). On contrary, closely spaced pregnancies within the first year after delivery increase the risks of preterm birth, low birth weight, and small-for-gestational-age babies. The risk of child mortality is the highest for very short birth-to-pregnancy intervals that are less than 12 months (2).

PPFP plays a vital role in preventing unintended pregnancies and reducing maternal and child mortality. It promotes the health of mothers and children by expanding the inter-pregnancy interval and helps to avoid financial, psychological, and health costs due to unplanned pregnancies (6). However, following childbirth women frequently initiate sex before starting contraception henceforth leading to the risk of unintended pregnancies (7). Furthermore, many families overlook the utilization of modern family planning methods due to negative perceptions, difficulty in accessing services, and sociocultural factors such as taboos and dependent on males' decisions (8).

Global and national policies have refocused attention on PPFP as an important intervention to guarantee health outcomes for women and infants. For instance, Tanzania National Health Policy 2007 emphasizes the use of PPFP. Also, National Population Policy 2006 recognizes the need to educate women about the importance of PPFP. International Extended Maputo Plan of Action on sexual and reproductive health and rights 2016 -2030 emphasizes the importance of PPFP. The postpartum period is an important period to intervene in improving access to family planning services. Evidence suggests that spacing pregnancies appropriately could help prevent adverse perinatal outcomes and that PPFP use is of supreme importance (1,9). However, Nigussie and colleagues (2016) found that there is a limited utilization of PPFP services (10).

Efforts have been made in Tanzania through the Ministry of Health, in collaboration with non-Governmental organizations to improve the quality of postnatal care among women. Dodoma Region is among the prioritized regions for the interventions of PPFP in Tanzania. The successes have been obtained in awareness of PPFP services in the country such as integrating PPFP services in other health interventions such as HIV/AIDS, family planning, and maternal and child health that are implemented in the Dodoma Region. Despite all these efforts uptake of PPFP remains low in Tanzania. The proportion of postpartum women using PPFP and associated factors is not well known. Therefore, this study aimed to determine the proportion and factors associated with the uptake of PPFP services among women in Dodoma city, Tanzania.

Materials and Methods

Study design

This study employed a cross-sectional design with a quantitative approach for data collection.

Study Area

The study was carried out in Dodoma city which is the capital city of Tanzania. The region has a total number of 60 facilities providing reproductive and child health services to women. According to data available in district health information systems (DHIS2), only six of all facilities in Dodoma provide PPFP services.

Study population

The study population was women of reproductive age (15–49 years) who had a live birth one year before the survey and have lived in Dodoma City for at least one year. This population was selected because they are active in childbearing and targeted to use PPFP for childbirth spacing. We excluded all women who were in the postpartum period but were critically ill during the study.

Sample Size

The sample size was determined by using the formula for cross-sectional prevalence studies (11). The proportion (p) of 10.4% (12) of women using postpartum family planning, 95% confidence interval, and marginal error (e) of 4.5% were used as inputs for sample size computation which gave a minimum sample size of 177. This sample size was finally adjusted for expected non-response of 15% resulting to a sample size of 209. The formula used is given below:

$$n = \frac{\left(Z_{\alpha/2}\right)^2 p(1-p)}{e^2}$$

Therefore, a total of 209 eligible women were recruited from four health facilities (Hombolo health center, Kikombo health center, Makole health center, and Chamwino DTC dispensary). To obtain the number of eligible women to be sampled from each selected facility, the monthly average catchment for the last three months was computed then a probability proportional to size was applied to allocate women to be recruited per each selected facility (Table 1).

Table 2: Sample size allocation to different health facilities

S/N	Facilities selected	Quarterly average catchment	Proportion	n
1.	Makole HC	4163	0.47	98
2.	Hombolo HC	863	0.098	20
3.	Kikombo HC	351	0.04	9
4.	Chamwino DTC Disp	3422	0.389	82
Total		**8799**	**1**	**209**

Data collection method

Data were collected in June 2020 by using an interviewer-administered questionnaire. The information collected included socio-demographic characteristics, reproductive variables, and information on the use of modern family planning methods.

Data Processing and analysis

Data cleaning, categorization, and coding were done after data collection using EPI-info. Data were then exported to IBM SPSS version 20 for analysis. Descriptive analysis was performed, and results were summarized using frequency tables. Binary logistic regression was done to identify factors associated with the uptake of PPFP. Further multivariable logistic regressions were run for all variables with a p-value less than 0.2 to obtain adjusted odds ratios (AOR). All analyses were set at a 5% level of significance.

Results

Socio-demographic, reproductive characteristics and contraceptive use among study participants

Among all 209 participants recruited, about half of them, 101 (48.3) were aged between 25 -34 years. Most women 179 (85.7%) were married. More than half, 114 (54.5%) had less than secondary level education. More than half of the respondents, 109 (52.2%) were self-employed. Most of the women, 131 (62.7%) reported paying their health bills through cash mode. Most women had a parity

of 2-4 children. In terms of the utilization of ANC services, most women (82.3%) had an adequate number of ANC visits as per WHO recommendations (4 and above visits). Among those with at least one ANC visit, 176 (85.4%) received PPFP counselling during their visits.

Overall, more than half of the study participants (53.6%) reported using modern contraceptives use during postpartum. Injectable and implant contraceptive methods were reported to be used by many women (31.2% and 28.6% respectively). The time to use contraceptive methods was reported by many women (72.3%) was between 6-12 months after birth (Table 2).

Table 3: Socio-demographic, reproductive characteristics, and contraceptive use among study participants

Variable	Frequency	Percent
Age Group		
15 – 24	81	38.8
25 – 34	101	48.3
35 – 49	27	12.9
Marital Status		
Not married	30	14.4
Married	179	85.6
Level of Education		
Non-formal	19	9.1
Primary	95	45.5
Secondary+	70	33.5
Tertiary	25	11.9
Occupation		
Employed	17	8.1
Self-employed	109	52.2
Unemployed	52	24.9
Others	31	14.8
Mode of Payment		
Cash	131	62.7
CHF	34	16.3
NHIF	30	14.4
Other insurance	14	6.7
Parity		
1	74	35.4
2 – 4	120	57.4
5+	15	7.2
Number of ANC visits		
0	3	1.4
1– 3	34	16.3
4+	172	82.3
PPFP counselling during ANC visits		
Yes	176	85.4
No	30	14.6
Modern contraceptive use		
Yes	112	53.6
No	97	46.4
Contraceptive methods used		
Condom	15	13.4
Pills	10	8.9
Injectable	35	31.2
Implant	32	28.6

Variable	Frequency	Percent
IUCD	5	4.5
Other	15	13.4
Time to use contraceptive methods after delivery		
Within 6 months	31	27.7
Between 6 to 12 months	81	72.3

Factors associated with uptake of postpartum family planning services

In the univariate analyses, three factors (occupation, mode of payment, and ANC visits) were found to be significantly associated with the uptake of postpartum family planning services. The odds for uptake of PPFP were lower for self-employed women (COR: 0.5, 95% CI 0.24–0.97) and unemployed women (COR: 0.1, 95% CI 0.04–0.33) when compared to employed women. Women who reported paying for health services using CHF (COR: 2.8, 95% CI 1.22–6.21), and NHIF (COR: 2.9, 95% CI 1.14–6.28) had higher odds for uptake of PPFP compared to women who reported paying via cash. Women who had an adequate number of ANC visits (4 and above) had higher odds (COR: 2.1, 95% CI 1.01–4.55) of uptake of PPFP compared to women with an inadequate number of ANC visits (less than 4). In the multivariable logistic regression analysis, only three variables were included and all of them were still found to be significantly associated with uptake of PPFP. We only observed a little change in the magnitude of the odds ratios and confidence intervals as indicated by the adjusted odds ratios (AOR) in Table 3.

Table 4: Estimates of crude odds ratios (COR) and adjusted odds ratios (AOR) for uptake of PPFP services

Variable	% taking family planning	COR [95% CI]	p-value	AOR [95% CI]	p-value
Age (years)					
15 – 24 (ref)	54.3	1			
25 – 34	54.5	1.0 [0.56, 1.81]	0.986		
35 – 49	48.2	0.8 [0.33, 1.87]	0.578		
Marital Status					
Married (ref)	53.6	1			
Not married	53.3	1.0 [0.46, 2.15]	0.976		
Level of Education					
Non-formal (ref)	47.4	1			
Primary	50.5	1.1 [0.42, 3.04]	0.802		
Secondary	60.0	1.7 [0.60, 4.62]	0.326		
Tertiary	52.0	1.2 [0.37, 3.97]	0.761		
Occupation					
Employed (ref)	71.2	1			
Self employed	58.9	0.5 [0.24, 0.97]	0.172	0.5 [0.25, 0.74]	0.016
Unemployed	52.1	0.1 [0.04, 0.33]	<0.001	0.2 [0.05, 0.31]	<0.001
Others	22.6	0.7 [0.15, 1.41]	0.054	0.8 [0.05, 1.28]	0.064
Mode of Payment					
Cash (ref)	46.6	1		1	
CHF	70.6	2.8 [1.22, 6.21]	0.015	2.4 [1.09, 6.42]	0.032
NHIF	70.0	2.9 [1.14, 6.28]	0.024	2.7 [1.54, 5.99]	0.005

Variable	% taking family planning	COR [95% CI]	p-value	AOR [95% CI]	p-value
Other	42.9	0.9 [0.28, 2.62]	0.792	1.0 [0.30,3.24]	0.981
Parity					
1 (ref)	48.7	1			
2-4	56.7	1.4 [0.77, 2.47]	0.277		
5+	53.3	1.2 [0.40, 3.67]	0.741		
Number of ANC visits					
0-3 (ref)	38.2	1		1	
4+	57.0	2.1 [1.01, 4.55]	0.048	2.9 [1.24, 6.89]	0.014
PPFP counselling during ANC					
Yes (ref)	55.1	1			
No	46.7	0.7 [0.33, 1.55]	0.392		

Discussion

Postpartum family planning utilization within one-year post-delivery

In this study, more than half of the respondents reported utilizing modern contraceptives during the postpartum period. The finding of this study corroborates other studies conducted in other places, for example, the study conducted in Hosanna town (5) and another one carried out in Addis Ababa (13) and rural Kenya (14). The difference might be due to the socio-economic characteristics of participants, the time of the study, and variation in reproductive characteristics. For example, the study conducted in Hosanna town (2018) with almost all respondents (97%) were married (5) whereas the study conducted in 2020 two years later with 85% of married women among the study respondents.

Another reason may be the difference in age of participants whereby most study respondents in Hosanna study were aged between 25 – 34 years whereas in this case less than half of women had the same age category. It was revealed that study findings on age for women in this study are higher in percentages than those conducted in Uganda (28%) in 2015, Gondar (48.4%) in 2015, and Northern Ethiopia (48.0%) in 2017, and that conducted in Burie District, Ethiopia (20.7%) in 2020 (13–16). Also, the difference in time of the study may be one of the reasons for the difference.

Factors associated with PPFP services utilization

Contrary to other studies that showed the significant association between age, education level, marital status, and PPFP utilization (5,10,13,16), this study revealed different variables which are women's source of income, the number of ANC visits, and mode of health services payment to be statistically significantly associated with PPFP utilization. The source of income showed a statistically significant association with PPFP utilization. This can mean that sources of income can determine the access and willingness to pay for health services. Antenatal care visits are another variable that showed a significant association with PPFP utilization among women in Dodoma City. This might be caused by the fact that women attending ANC are more exposed to information about reproductive health and PPFP services compared to those who do not attend or attend fewer visits (16,17).

Additionally, findings from this study showed that women with health insurance (CHF and NHIF) are more likely to receive PPFP than those who use cash and another payment mode. This is

because women with CHF and NHIF might not be worried about different health expenses that they might pay at the clinic as they can be covered by their insurance.

The modern contraceptive knowledge was relatively high in this study but below the study conducted in Hosanna town (2018) which showed that almost all respondents knew at least one modern family planning method (5). Almost all study participants delivered at the health care facilities for their last birth were exposed to PPFP. This is comparable to the study conducted in Debre Tabor town, Ethiopia in 2018 which showed that facility delivery was 97.4% (19).

Most respondents reported deciding with their partners on the utilization of PPFP services and men were ready to discuss the utilization of modern contraceptive methods within one year after delivery. This finding is consistent with the study conducted in Ethiopia whereby most women reported discussing and jointly deciding with their partners on PPFP utilization (18).

Study limitations

This study has some limitations. First, the study assessed only individual level and reproductive health factors for contraceptive utilization during the postpartum period whereas other factors were not assessed. Second, the study findings cannot be generalized as the study was conducted among women attending maternal and child health clinics in Dodoma city, hence not representative of all women in the postpartum period.

Conclusion and recommendations

The uptake for PPFP utilization among women attending health facilities within one year postpartum was low and was strongly associated with women's source of income, the number of antenatal visits, and mode of health services payment. It is recommended that the government and other stakeholders should think of different public health interventions such as awareness campaigns targeting women of reproductive age with messages focusing on the benefits and importance of PPFP utilization.

Ethical Issues

Ethical clearance was obtained from the Institutional Review Board of Muhimbili University of Health and Allied Sciences (MUHAS). Further permission to collect data was obtained from the local authorities. Written consent from all respondents was sought before participating in this study. All information was kept confidential, with names excluded from the recorded materials to avoid giving away the identity of the participants. This study involved those under 18 but have 15 years or above with a child, so this category of participants consented to be involved in this study on their own.

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Competing Interests

The authors declare that they have no competing interest.

Authors' contributions

MJE conceptualized the idea, drafted the manuscript, and interpreted the results. ERA collected the data, conceptualized the idea, and analysed the data. CHM Revised the manuscript and interpreted the results, IHM Revised the manuscript, and interpreted the results. All authors read and approved the final version of the manuscript.

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A population-based study on smoking, alcohol consumption, and substance use among women of reproductive age in Mbeya City, Tanzania

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Abstract

Background: Knowledge of smoking, alcohol and substance use during pregnancy among women of reproductive age is critical in reproductive health and managing unintended pregnancies.

Methods: A population-based and descriptive cross-sectional study was conducted for six months, from July to December 2020. Data were collected on socio-demographic characteristics and alcohol, smoking, and other substance use patterns. Descriptive statistics and $\chi 2$ tests were used to assess the significance levels of associated variables.

Results: The study involved 376 respondents with ages ranging from 15 to 45 years, with a mean age of 30.4 years. The majority of the respondents, 336 (89.36%) were aware of substance use and its effects during pregnancy. Knowledge about the effects of alcohol, smoking, and other substances was significantly associated with the level of education ($\chi 2 = 37.06$, $p < 0.0001$). Among all respondents, 161 (42.82%) reported everyday consumption of substances during pregnancy; the majority consumed alcohol, 120 (74.53%). Findings show an association between younger age and substance use ($\chi 2 = 34.03$, $p < 0.0001$).

Conclusion: The existing perceptions and behaviours of people regarding substance consumption necessitate urgent health education to promote healthy pregnancy and avoid mental health issues that could jeopardize women's safety and well-being.

Keywords: Smoking, Alcohol, Substance Abuse, Reproductive Age Women, Tanzania

Introduction

Smoking, alcohol consumption, and other substance use during pregnancy are major concerns when talking about maternal and prenatal health care (Economidoy et al., 2012). It can cause a slew of health and social issues for both the mother and the child, including miscarriage, low birth weight, premature labour, placental abruption, physical abnormalities, neurological damage, foetal death, and even maternal death (CDC, 2015; Cornelius & Day, 2000; Edwards et al., 2000; Forray, 2016). Smoking, alcohol, substance use, and substance abuse and their impacts on everyday life are known worldwide (Mburu et al., 2020). Using alcohol while pregnant might result in various complications, including foetal alcohol syndrome and other harms such as spontaneous abortion, stillbirth, low birth weight, prematurity and congenital disabilities (WHO, 2014).

Illegal or legal use of substances during pregnancy is not safe until the prescription is provided by competent healthcare providers (Dathe & Schaefer, 2019). The World Health Organization Program has set guidelines that present strategies to reduce the harmful use of alcohol. These sets provide the governments and societies guidelines in controlling substance use and recites that health professionals must play a big role in treating, managing, and assuming the teaching role to provide comprehensive education on the effect of harmful use of alcohol (WHO, 2014). Pregnancy should be a thrilling and empowering experience for a woman's life. Unfortunately, addiction and mental health problems associated with substance abuse can compromise a woman's safety and well-being (Stone, 2015).

Unintended pregnancies account for 41% of all pregnancies worldwide, implying that many women take substances before becoming aware of their pregnancy (Sedgh et al., 2014). Substance use increases the risk of unintended pregnancy (Brown & Eisenberg, 1995). Because the signs and symptoms of substance abuse during pregnancy are often subtle, self-reports of substance use may be misleading or infrequently elicited, physicians may fail to screen for use routinely, and substance-abusing pregnant women may seek little or no prenatal care, substance abuse during pregnancy is difficult to detect (Wilson et al., 2008). Substance abuse is more prevalent among reproductive-age women than in the general population. The average pregnant woman will take four or five drugs during her pregnancy, with 82% taking prescribed drugs and 65% using non-prescription drugs, including illicit drugs.

In another study, more than 90% of pregnant women use non-prescription medications throughout their pregnancy (Kamuhabwa & Jalal, 2011). The majority of women between the ages of 15 and 45 who seek treatment are already pregnant at admission, which can cause health problems for both the mother and the child (Kifle et al., 2017). Similarly, in Tanzania, smoking, alcohol consumption, and substance use are associated with emerging non-communicable diseases (Kagaruki et al., 2015; Mashili et al., 2018).

The majority of studies on smoking, alcohol drinking, and drug use in Tanzania focused on adolescents and other groups of people (Mbatia et al., 2009; Mnyika et al., 2011). At the same time, other similar studies on knowledge were conducted in different locations (Isaksen et al., 2015; Kamuhabwa & Jalal, 2011; Mnyika et al., 2011; Mpelo et al., 2018). These previous studies to analyze drug distributors and pregnant women's knowledge in Dar es Salaam indicated that 66.5% of women hesitated to take medications without consulting their physicians, 61.5% mentioned that it was important to consult a doctor, while 15% did not have any preference. In a similar study, it was reported that 31/5% were aware of the drugs that should not be taken during pregnancy (Kamuhabwa & Jalal, 2011).

In Northern Tanzania, in a registry-based study of 34,090 deliveries from 2000 to 2010, Isaksen et al. (2015) reported that 34.1 % of pregnant women consumed alcohol during pregnancy, with a decline from 49.5 % in 2000 to 21.5 % in 2010. In Dodoma, a hospital-based study on alcohol use and risk factors among pregnant women was found to be prevalent in 15.1% of the 365 women who attended prenatal services (Mpelo et al., 2018). As a result, there hasn't been much coverage of similar investigations in Tanzania's Southern Highlands. This study aimed to look into the effects of smoking, drinking, and substance misuse on reproductive health among pregnant women in Mbeya, Tanzania. The findings of this study will be used to develop policies, initiatives, and campaigns to assist pregnant women involved in substance addiction.

Materials and methods

Study area

This study was conducted in Mbeya City, Southern Highlands of Tanzania. The city is surrounded by Mbeya District in all directions. According to the 2012 National Census, Mbeya City Council had a total population of 385,279 inhabitants, out of which 182,620 (47%) are male and 202,659 (53%) are female (URT, 2013). Mbeya City council has 19 government Health facilities, of which 2 are hospitals, 4 Health centres, and 13 Dispensaries that the Council directly owns. Four health facilities are owned by religious organisations, of which 2 are health centres and 2 are dispensaries (Schweikart et al., 2014). Women of reproductive age, 15-49 were 48.5% of all females in the region. Commerce and trade, agriculture and livestock husbandry, small-scale and large-scale industrial production and service providers such as transport, hotel, medical services, and civil service are major economic activities. Accordingly, an estimated 33.3% of city residents rely on subsistence, while 21% work in the public sector and 43.4% work in the informal sector, such as small-scale production, petty trading, and crop selling. The rest (2.3%) are involved in other works.

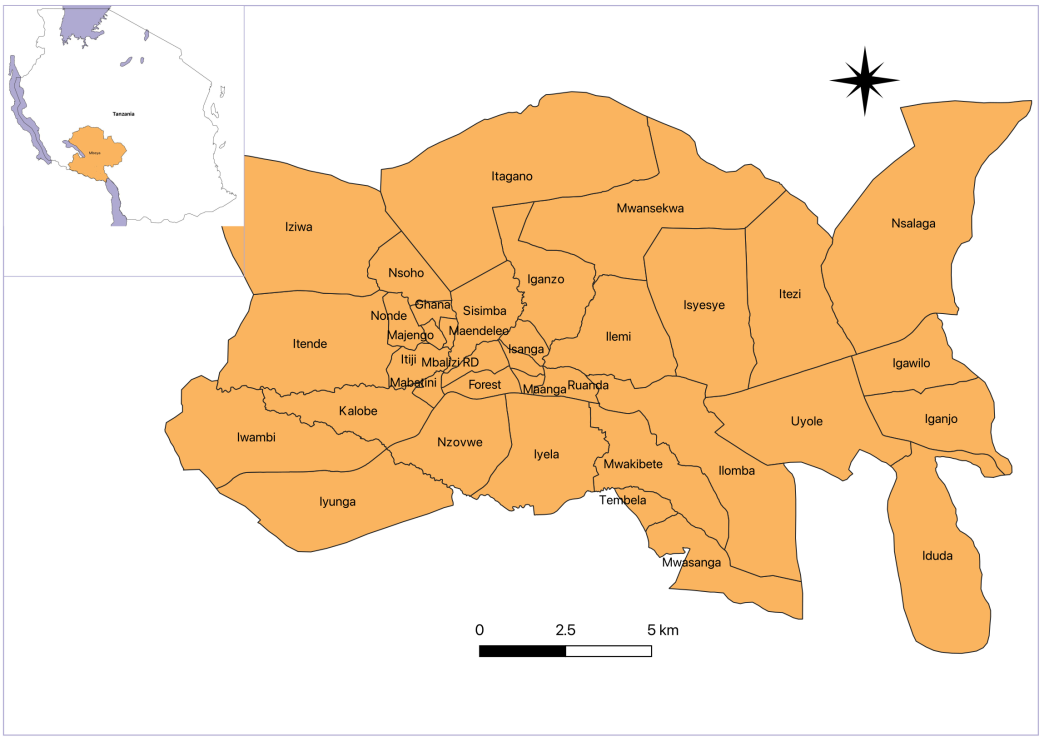

Figure 3: Map of the study area, Mbeya City, Southern highlands of Tanzania

Study design and data collection

A population-based descriptive cross-sectional study was conducted among women in Mbeya City for six months, from July to December 2020. The sample size was calculated using a specific formula, and an estimated 376 participants were required. Simple random selection was used to select ready and qualified participants. Information on questionnaire administrations was shown to study participants, including assurance of confidentiality and use of the information obtained for research purposes only.

Statistical analysis

Statistical data analysis was done using IBM SPSS Statistics 19.0 (IBM Corp., Armonk, NY, USA). Both descriptive and inferential statistics were used to describe and make inferences from the data where applicable. The descriptive statistics for categorical variables were expressed in the number and percentages. Chi-square test for categorical variables according to the expected counts. Chi-square and confidence intervals of the main outcome variables were cross-analyzed with independent variables, including the demographic characteristics of women and their behaviour on smoking, alcohol consumption, and substance abuse. The $\chi 2$ test was applied to determine associations between variables and was considered significant when the p-value was less than 0.05. the final results were presented in texts, figures, and tables.

Ethics and consent

Ethical approval was obtained from the University of Dar es Salaam, Mbeya College of Health and Allied Science Research Ethical Clearance Sub-Committee. Permission to conduct the study was taken from the Regional Admiration. Before proceeding with the study, informed consent was sought and obtained from all participants.

Results

Demographic characteristics

Our study involved 376 reproductive age women respondents with ages ranging from 15 to 45 years. Most of the participants, 94 (75%) aged between 26 and 35 years. The mean age of

respondents involved in the study was 30.4 years. The majority of the respondents, 217 (57.7%) were married. Only a few respondents, 18 (4.8%), reported not attending any formal education. Occupation status indicated that most of the study participants were entrepreneurs, 176 (46.82%), followed by 91 (24.20%) employed workers, with the least group being people without a specific job, 3 (0.8%) as well as 2 (0.5%) working as religious officials. Of all respondents, 371 (95%) reported participating in agricultural and animal-keeping activities. Nearly all respondents indicated having many children ranging from one to eight, of which 361 (96%) children reported no disabilities. The social-demographic characteristics of the participants are summarised in Table 1.

Table 1: Demographic characteristics of study participants in Mbeya City, Tanzania

Variable	Factor	Frequency (%)	χ^2 (p-value)
Respondent Age	15 – 20	48 (13%)	32.4787 (< 0.0001)
	21 – 25	53 (14%)	
	26 – 30	94 (25%)	
	31 – 35	82 (22%)	
	36 – 40	46 (12%)	
	41 – 45	53 (14%)	
Marital status	Single	107 (28.4%)	263.2553 (< 0.0001)
	Married	217 (57.7%)	
	Divorced	16 (4.3%)	
	Co-habit	36 (9.6%)	
Level of education	No formal education	18 (4.8%)	123.1223 (< 0.0001)
	Primary education	70 (18.6%)	
	Secondary education	150 (39.9%)	
	College/University	81 (21.5%)	
	Others	57 (15.2%)	
Type of work	No work	3 (0.89%)	344.1277 (< 0.0001)
	Entrepreneur	176 (46.82%)	
	Business	67 (17.8%)	
	Religious	2 (0.5%)	
	Employed workers	91 (24.24%)	
	Peasant	37 (9.84%)	
Number of children in the family	1 – 2	130 (34.57%)	253.6011 (< 0.0001)
	3 – 5	150 (39.89%)	
	6 – 8	89 (23.67%)	
	9 – 12	4 (1.06%)	
	Others	3 (0.80%)	
Children with disabilities	No disability	361 (96%)	1705.0426 (< 0.0001)
	Cripple	5 (1.33%)	
	Mental retarded	8 (2.13%)	
	Blind	0 (0.0%)	
	Deaf	1 (0.27%)	
	Dump	1 (0.27%)	

Knowledge about the effects of taking alcohol, smoking, and other substances during pregnancy

Out of the 376 women of reproductive age in Mbeya City who participated in the study, 336 (89.36%) were aware of substance use and its effects during pregnancy. Only 30 (7.98%) were not aware of the harmful effects of alcohol, smoking, and use of other substances during pregnancy, while 10 (2.67%) did not respond. Their main source of information about the effect of using drugs during pregnancy was reported as health workers, of which 130 (34.57%) reported being from nurses, and 21 (16.22%) of respondents reported source of information came from their doctors. It was reported that other sources of information were family members by 45 (11.97%) respondents, friends by 27 (7.18%), news 21 (5.59%), and 46 (12.23%) from other sources. 30 (7.98%) respondents choose not to respond directly to this question. Despite being aware, 161 (42.82%) of all respondents continued to consume alcohol, cigarettes, and other drugs during pregnancy while knowing their harmful effects on pregnancy. Knowledge about the effects of alcohol, smoking, and use of other substances during pregnancies showed to be significantly associated with educational level ($\chi 2 = 37.06$, $p < 0.0001$).

Frequency and patterns of substance use

Findings showed that 161 (42.82%) were everyday consumers of substances and reported consuming substances during pregnancy among all study participants. The majority of daily substances reported having been consumed are alcohol by 120 (74.53%) respondents, 33 (20.50%) smoked cigarettes, 5 (3.11%) participants reported anonymously use of marijuana, and 3 (1.86%) reported anonymously use of heroin. Findings show that 17 (51.51%) smokers are heavy daily smokers by consuming four or more cigarettes daily, 15 (20.83%) alcohol consumers who take four or more bottles daily are heavy drinkers, and 3 (60%) of those who use marijuana are lightly addicted. The frequency and amount of using different substances during pregnancy are indicated in Figure 2. It was reported that individuals are indirectly affected by smoking by members of their own families, whereas most of the indirect effect of drugs is from people who are not relatives 121 (32.18%), followed by 97 (25.8%) from friends, 53 (14.1%) from husbands, 44 (11.7%) from parents, 36 (9.57%) from brothers, 5 (1.33%) from sisters and 20 (5.32%) from children (Figure 2). However, the high frequency of substance use did not show statistical significance associated with incidences related to children's disabilities ($\chi 2 = 204.05$, $p < 0.7$).

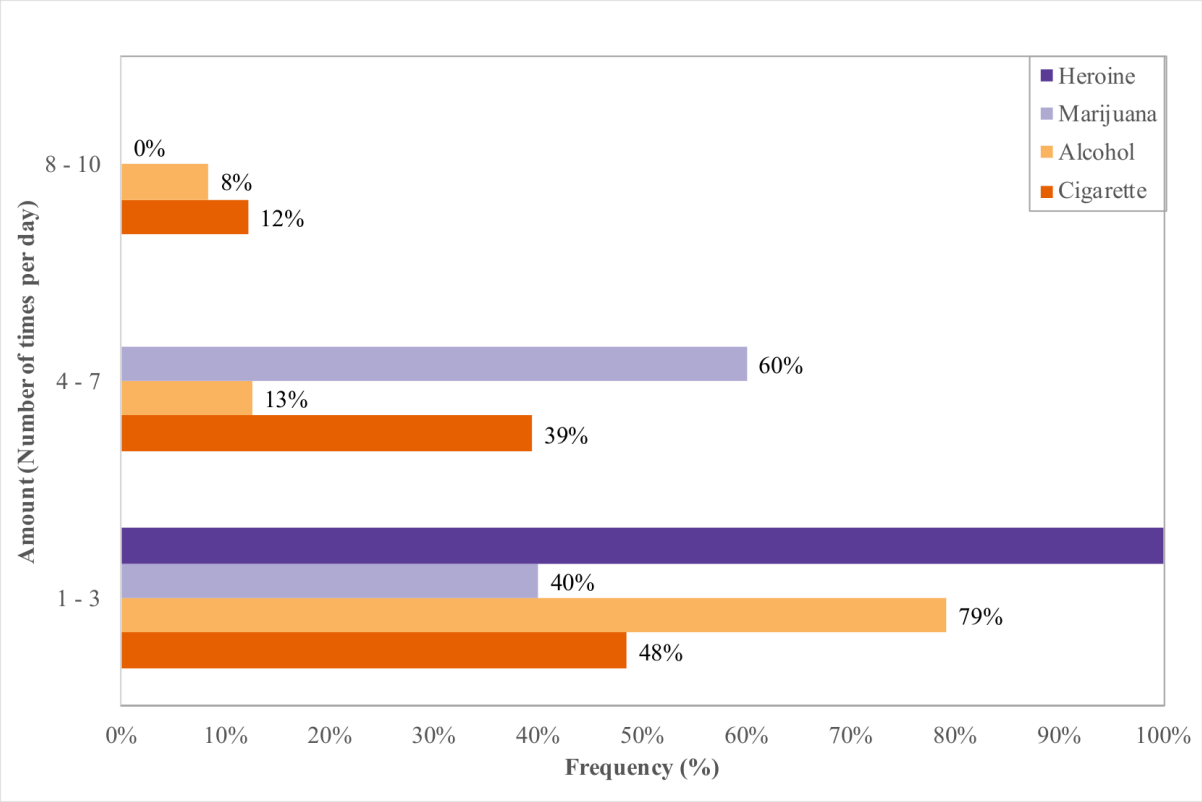

Figure 4: Frequency and amount of substance use among study participants in Mbeya City, Tanzania

Age profile, occupation, and substance use

The majority of study participants aged between 15 to 30 have shown to be higher consumers of substances during pregnancy, 118 (73.29%). Among 161 respondents who reported continuing to continue using substances while pregnant and daily consumers, 45 (27.95%) were aged between 15 to 20 years as the highest group, whereas the least group was the aged between 41 to 45 with 7 (4.35%) respondents. Findings showed that there was a direct link between occupation and substance abuse. Many people who own their jobs (entrepreneurs) seem to be the highest consumers of drugs and other substances during pregnancy, as reported by 69 (43%) participants, followed by office workers, and the least group is a group of people without official jobs. Hence it looks like as income increases, activities to engage in substance use also increase, but it may all depend on the nature of one's job as we can see, religious did not engage themselves with substance use, as indicated in Figure 3. Findings from this study show an association between younger age and substance use ($\chi 2 = 34.03$, $p < 0.0001$).

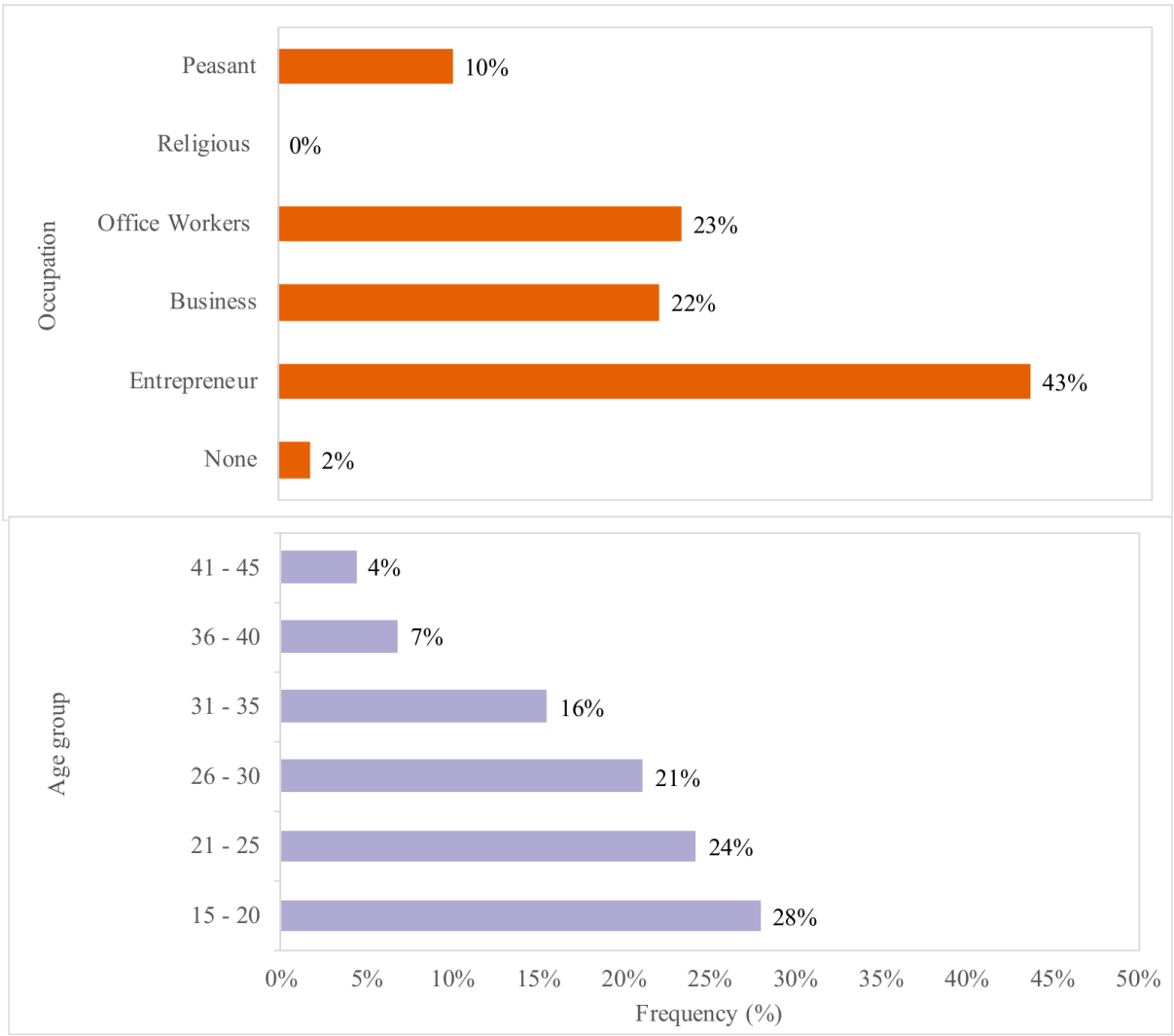

Figure 5: Age profile, occupation, and substance use among study participants in Mbeya City, Tanzania

Discussion

Understanding the implications, prevalence, patterns, and substance use profile among women of reproductive age is key to improving healthy pregnancy and avoiding mental health problems that can compromise women's safety and well-being. Alcohol and other substance addiction can impede a person's ability to perform as a parent, spouse, or partner, as well as instigate and provoke gender-based and domestic violence, all of which have a substantial impact on children's physical, mental, and emotional development (WHO, 2014). In our study, we found several causes by which women succumbed to substance use and substance abuse. Some are due to the stress of life, some are due to poor knowledge of the negative impacts of substances, and some could just smoke as a usual lifestyle as friends, parents, and other relatives do it.

Findings from this study are similar to Yotebieng et al., 2016 which suggested there is a need for concerted efforts to understand that substance use and abuse are embedded within the social-ecological system of health. It is urged to call for health programs for women in comprehensive and integrated, taking into account the circumstances in which substance use begins and continues during pregnancy (Roberts et al., 2016).

According to the World Health Organization (WHO, 2014), pregnancy provides an opportunity for women, their partners, and other family members to change their alcohol and other substance use patterns. To provide appropriate advice and support to women with substance use disorders

during pregnancy and the postpartum period, health care providers must understand the complexity of the woman's social, mental, and physical problems. Our study findings showed that knowledge about the effects of alcohol, smoking, and use of other substances during pregnancies showed to be significantly associated with education level.

The majority of women knew from several sources, but this did not deter them from drug and alcohol consumption during pregnancy. Women of reproductive age are at high risk of harmful effects caused by the substance of addiction; also, the child is at higher risk of compromised life and of becoming a substance user later in life. By doing this research, we need to notify the society that prevalence of substance abuse is real and must be taken care of. According to our data, knowledge related to drugs and alcohol use during pregnancy was associated with the level of education.

Findings from our study indicated an association between younger age and substance use similar to other previous studies. A study by (Strashny, 2013) indicated that women of childbearing age are at a greater risk of addiction due to a similar age group and that pregnant teens are more prone to consume drugs than older women. Studies have presented that most substance abuse is caused by (apart from age); unplanned pregnancies, prescription drugs, difficulty quitting, risk miscalculation, fear of repercussions, and postpartum depression are all factors to consider (Biaggi et al., 2016). Our findings demonstrate that being between the ages of 15 and 20 is related to greater substance use, although other characteristics, particularly married status, can account for some of this association. However, the high frequency of substance use did not show statistical significance associated with incidences related to children's disabilities.

Our study findings suggest a need for culturally appropriate education for women of childbearing age together with healthcare providers. Throughout the reproductive life course, interventions related to substance use must be designed rather than focusing on the gestational period alone. Education materials must be culturally relevant, sensitive, and respectful to women. The development of infographics and communication tools advocated by the WHO could be one strategy to educate health providers and women. The government must design an appropriate program for screening all women of reproductive age for substance use. Treatment programs are costly, and it is important for women who have screened positive for substance use to be given ample support to access services.

Social support groups may be created to perform campaigns for combating the problem. And all women who accept to get support must be supported and loved. More research is needed to determine how social support groups integrate HIV/STI care, alcohol and drug screening and education, violence and mental health programs, and links to economic and material support for women outside of clinical settings as part of an enhanced health systems approach could improve maternal and child health in Tanzania.

Conclusion

This research shows that all women of reproductive age in Mbeya City are aware of the harmful effects of smoking, alcohol, and drugs during pregnancy. Knowing isn't enough; assistance and instruction on combating poverty are also required. The majority of those who abused alcohol and drugs said they struggled to make ends meet and were single parents. The current understanding and behaviours of Mbeya City residents about substance intake call for immediate health education to improve healthy pregnancy and avoid mental health issues that can jeopardize a woman's safety and well-being.

Recommendations

The findings of this study imply that there is a need for culturally relevant substance use education for women of reproductive age. Rather than focusing on the gestational time alone, educational support should be provided throughout the reproductive life. Education materials must be culturally relevant, sensitive, and respectful to women. Develop infographics and other

communication pieces as part of your strategy. The government should develop adequate procedures for screening all women of reproductive age for critical substance use whenever possible. This incidence and pattern among women of reproductive age must be reported to the government to take action.

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Gender Pattern of Family Violence Occurrence: A Study of Family Units in Selected Communities of Ondo State.

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Abstract

Background: Violence in families is a global public health issue requiring inquiries for appropriate intervention. The study assessed the prevalence, forms, and gender dimensions of family violence in the study setting.

Methods: The study adopted the cross-sectional design, conducted in three Local Government areas in Ondo State among one hundred and twenty family units consisting of 3 members (a male husband, a female wife, and a child). The data for the study was collected using structured questionnaires. Institutional review board approval was also obtained for the study.

Results: Findings showed that the prevalence of family violence reported by the wife (35.8%) was similar to that of the husband (36.7%). Children, however, reported a higher prevalence of 62.5 % which was far higher than that of their parents. The wives seemed to be mostly the victims of family violence from the children's perspective. Expatiating this further, showed that more wives were victims of physical battery (63.8%) economic violence (65.0%), and not participating in decision making (59.8%). The gender dimension showed that wives perpetrate isolation (59.0%) and forced their spouses to act involuntarily (63.3%). While more husbands perpetrate sexual violence (67.2%), intimidation (64.0%), economic violence (62.0%), and do not allow their spouse to participate in decision making (58.2%) more than their wives.

Conclusion: The study concluded that many families experienced family violence with either of the spouses as the perpetrator or victim, although the forms perpetrated may differ by gender. Hence, intervention should be targeted at the family as a whole rather than the victim in the family.

Keywords: *Family violence, children experiences, couples, gender dimension.*

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Introduction

Emerging evidence points to the daily occurrence of family violence across social settings and spaces (Rakovec-Felser, 2014). In these settings, individuals and social categories are vulnerable differently to the various forms of family violence depending on their network of relations and expectations governing these interactions. Violence can occur in relationships that are governed by familial roles and responsibilities, including those built around piety values and standards. Managing the possible occurrence of family violence and the attendant consequences requires the actions and efforts of a diverse group of stakeholders. Nurses, among other key stakeholders within and outside the health care system in any given social setting, are in the form of searching for explanations, predictors, vulnerability, and possible ways to address the growing cases of family violence. Within the home front, family violence is of various types, and the efforts aimed at addressing these forms of violence have maintained diversity.

Family violence is multidimensional in occurrence and the possible impacts on victims and the perpetrators. The complexities and variations in impacts are sometimes traceable to the typology involved and the frequency of occurrence. The dominant typologies of family violence within the home setting include physical, sexual emotional (psychological), controlling behaviors,

and economic (World Health Organization, 2012). The various acts of family violence have been associated with interconnected factors that mirror levels of interactions. First is the individual phase, followed by family relationships, and the community or societal phase (Heise, 1998). Thus, a focus on any phase or level of occurrence would likely yield unique insights into the root causes of family violence and possible approaches to address the consequences on victims and perpetrators in any given social setting or society.

The analytical focus of this study was on the family phase, which appears robust in improving the existing body of knowledge for policy and practice, especially for public and community health nursing. Practitioners in these broad fields occupy critical positions in diagnosing victims of family violence, advocating measures that can minimize the occurrence, and providing prompt care to reduce the consequences of family violence on victims. A focus on the family unit is also useful in diagnosing the early warning signs of family violence and how the most vulnerable can be protected, including changing the behaviors of perpetrators. Within the home front, the common position is that men are the perpetrators, and children and women as victims (Silva et al., 2015; Miller et al., 2013). Whether such women and children are from homes where the couples involved are married or cohabiting, victims sometimes appear before healthcare providers with unfathomable symptoms that may be difficult to diagnose. Emotional violence often induces stress-related conditions that may lead to chronic health problems among victims (Karakurt et al., 2014). These complexities call for more sensitive dispositions and focus on the early warning signs of family violence, especially in low-resource settings where the risk factors for perpetrating and becoming a victim are high.

The literature from low and poor resource settings shows a high prevalence of family violence. In sub-Saharan Africa, a figure that is higher than that of the global prevalence was found (Mccloskey & Hunter, 2016; Cools & Kotsadam, 2017; Wandera et al., 2018). The growth in Africa is further worsened by the patriarchal system that exists in most communities.

However, considering several studies on family violence, a controversial topic with much debate is a gender difference in forms, perpetration, and victimization (Caldwell et al., 2012; Lee et al., 2014). The perpetrator and victim can switch per time in a heterosexual relationship. Although, the traditional belief is that males are the perpetrators of family violence in heterosexual relationships (Chuemchit & Perngparn, 2014; Machado et al., 2014). The gender symmetry perspective with the fundamental assumption that there is an overall equal use of violence in an intimate relationship irrespective of gender (Dutton, 2006). This is relevant in the context of this study as perceived by the authors that women, as men are also perpetrators of violence in intimate relationships. A preliminary qualitative study conducted by the authors in a similar setting in Nigeria showed that women perpetrate more verbal abuse than men and men are mostly guilty of physical violence (Ogunlade et al, 2019). A man's ego makes it difficult to openly disclose their experiences of violence from female partners, making it difficult to identify male victims of family violence (Campbell-Hawkins, 2019). Nevertheless, women are more likely than men to experience severe physical and sexual victimization, resulting in either being injured or killed (World Health Organization, 2012; Khalifeh et al., 2013). Variability in prevalence rates exists based on different cultures and societies (World Health Organization, 2013), probably explained by cultural differences because of the acceptability of violent behaviors in some societies while others have developed a standard framework for family violence prevention and management.

In recent times in Nigeria, the media (print, electronic and social) reported cases of homicides against men and women by their spouses. This is an emerging issue that justifies further study into the pattern of family violence in the Nigerian context. Thus, there exists a dearth of empirical data about the gender dimensions with consideration to simultaneous perpetration and victimization of family violence as experienced by couples and witnessed by the children. The additional data from the children's point of view was sought to assess children's experiences and for their parents' data verification. The knowledge of gender perpetration of the different forms

of violence should be a concern to researchers, policymakers, and other relevant stakeholders to shape public health responses and policy decisions guiding necessary interventions to address family violence. Hence, this study assessed the patterns (prevalence, forms, and gender dimensions) of family violence within the family. This is to generate data for possible focused intervention development for the family.

Methods

Design and Participants

This is a cross-sectional descriptive study, targeted at nuclear family members from Ifedore, Owo, and Ileoluji/Okeigbo Local Government Areas (LGAs) of Ondo State. The selected areas are located in the North, Central, and Southern parts of the state. These sites were Igbaraoke in Ifedore LGA, Owo in Owo LGA and Okeigbo in Ileoluji/Okeigbo LGA. These sites are located in Ondo State, the southwest region of Nigeria predominantly inhabited by the Yoruba ethnic group. The local economy is largely agrarian with men and women playing active roles. Although there is a presence of some corporate organizations in these communities, women's involvement in the informal sector is common in the three sites. Multistage sampling was used to select the study settings. The first step randomly selected an LGA), each from the three senatorial districts through balloting (balloting is a procedure of selection that gives all the LGAs the chance to be selected).

The names of all the LGAs were written on white sheets made into balls by senatorial districts, then an LGA was picked randomly from each of the three senatorial districts making three selected LGAs. Then, two communities were selected randomly from each LGA, while households were systematically selected. A consenting nuclear family unit was selected per household. The consenting couples were male husbands and female wives with a minimum age of 18 years, either married or cohabiting with a child or children and living together. A child not less than eight years of age available was selected per family. Single parents commuted families, and families with children less than eight years were excluded. Using the Cochran's, (1963) sample size formula for large populations; a 28.5% Nigerian DHS prevalence of women experiencing any form of violence in Ondo State, 95% confidence interval, and ±5% precision 360 sample size was generated with the consideration of 10% non-response rate and selection of three respondents per family.

Therefore, 120 nuclear family units (a male father, female mother, and a child not less than eight years of age irrespective of gender) made a total of three hundred and sixty individuals participate in the study. The sample size was distributed by the number of LGAs (Three), 40 family units per LGA, and 20 family units per community. This is with the focus of identifying the patterns (prevalence, forms, and gender dimension) of family violence in the study setting.

Data Collection

Data were collected with paper-based structured questionnaires for couples and a paper-based semi-structured child-friendly questionnaire for the children. The structured questionnaire for couples had two sections, used to collect data from the husband and wife separately. The first section assessed the demographic characteristics of the couple as individuals. The second section assessed the prevalence and forms of family violence perpetrated or experienced by each of the couples separately. This questionnaire was developed from an extensive literature review while using the adapted forms of violence as highlighted on the power and control wheel. The questionnaire was slightly modified for it to be fit for administration to both males and females.

A semi-structured child-friendly questionnaire that gathered data from children in the selected families was adapted from the children screening tool developed by the Children's Aid Society Domestic Violence and Child Welfare Initiative. These questions were modified to accommodate the forms of violence as deduced from literature except sexual violence because children may not be able to identify if sexual violence is occurring in their parents' relationship. The questions were also framed for children to understand and be able to answer. The children's

questionnaire consisted of questions relating to demographics and the occurrence of family violence as observed by the children. The questions inquired about the forms of violence they witnessed, and who the perpetrators or victims were. The questionnaires were given to experts in the field of nursing and sociology who have conducted research in this area for content validity, cultural suitability, and adaptability.

A pilot study was conducted for the feasibility of the study and pre-test the questionnaire among a selected population for reliability by using the internal consistency method. Following the pre-test, some items were modified to suit the Nigerian socio-cultural context. The questionnaires used in this study were translated into the Yoruba language and retranslated into English by official independent translators in both languages. The Cronbach alpha coefficients for the couple and children's scales were 0.76 and 0.70 respectively. The data were collected from respondents in their households at different locations within the home through the interviewer facilitated method by the researcher and the assistants.

Analysis

The data were properly processed by examining, categorization, and numbering questionnaires to identify any inappropriately completed questionnaires. Data collected were thoroughly cleaned, coded, and computed using Statistical Package for Service Solution (SPSS/IBM) software version 23. Descriptive analysis and the Chi-square goodness of fit test were used to determine gender differences in violence perpetrated and experienced.

Ethical Considerations

Ethical approval with protocol number OSHREC/15/11/2018/071 for the research was obtained from the Research and Ethics Committee of the Ondo State Ministry of Health, Akure. Further permission was granted through the State Primary Health Care Development Board to access study sites. These were taken to identified gatekeepers and community leaders with the detailed information about the research given to them for the permission to access the people in the community in consideration of equity, justice, beneficence, and maleficence. Informed consent was obtained from the parents after a detailed discussion of the research aim and objectives in the local language before the survey.

Parents also gave consent to their children while the children gave their assent. Questions raised were patiently answered, with emphasis on voluntary participation and the opportunity to withdraw at any point without prejudice for the persons who refused to participate or participants that withdrew from the study. Participants' identities were not represented with names, only signatures were required on the consent form. A trained psychologist as part of the research team to address emotional issues that may likely occur during data collection. The information for availability of such care if required was also made known to participants but it was not utilized during this study.

Results

120 family units that participated in this comprised of a male husband, a female wife, and a child (360 participants in all) across all the study sites. The socio-demographic profile of respondents that participated in the survey was presented in Table 1. Sixty-eight percent of the couples were middle-aged adults, with the mean age for wives (38.8±8) and husbands (45±11). The age of the children ranged from 8 to 28 years with a mean of 13±3.30. Their positions ranged from first to sixth in the family; about half were the first children of their families and more than half were females. The majority (85%) of the families had four children while 15% had five and more children. 60.8% were females and 39.2% were males, their educational status was the primary (25%), secondary (66.7%), tertiary (7.5%) and 0.8% had completed the tertiary level.

Table 1: Socio-Demographics of the Parents

Characteristics	Husband (N=120)	Wife (N=120)
Age in Years	**F (%)**	**F (%)**
18-35	21 (17.5%)	26 (21.7%)
36-55	85 (70.8%)	78 (65.0%)
≥ 56	14 (11.7%)	16 (13.3%)
Marital status		
Married	93 (77.5%)	93 (77.5%)
Cohabiting	27 (22.5%)	27 (22.5%)
Duration of Relationship		
1- 10 years	24 (20.0%)	24 (22.5%)
11-20 years	76 (63.3%)	76 (60.8%)
21 years and above	20 (16.7%)	20 (16.7%)
Educational Status		
No Formal Education	2 (1.7%)	1 (0.8%)
Primary	13 (10.8%)	17 (14.2%)
Secondary	40 (33.3%)	48 (40.0%)
Tertiary	65 (54.2%)	54 (45.0%)
Occupation		
Senior Civil Servant	34 (28.3%)	18 (15.0%)
Junior Civil Servant	22 (18.3%)	17 (14.2%)
Petty Trader	25 (20.8%)	49 (40.8%)
Artisan	19 (15.8%)	14 (11.7%)
Others	20 (16.7%)	22 (18.3%)
Average monthly income		
less than N30,000	32 (26.7%)	58 (48.3%)
N31,000 – N60,000	55 (45.8%)	52 (43.3%)
N61,000 – N90,000	23 (19.2%)	7 (5.8%)
N91,000 and above	10 (8.3%)	3 (2.5%)

The pattern of Family Violence from Couples' Perspective

Family violence was seen as a common occurrence as found by the respondents. A greater proportion (62.5%) of the children had witnessed the occurrence of family violence by their parents in their families. There was a similarity in the perpetration prevalence of husbands (36.7%) and wives (35.8%) as against what was reported by the children witnesses which was 62.5% (**Figure 1**). The wives had the highest prevalence (58.3%) as victims in comparison with the husband (38.3%). This showed that the wives were frequently the victims of the violence in the homes. This was further confirmed by **Figure 2** which showed that Wives were victims of most forms of violence. The figure further showed that men perpetrated more physical battery (52.0%), sexual violence (67.2%), intimidation (64.0%) and not allowing wife participation in decision making (58.2%) while women perpetrated more verbal insult (54.2%), isolating spouse (59.0%) and monitoring their movement (51.2%). **Figure 3** also showed that women mostly were victims of physical battery (63.8%), denied access to work or education (65.0%) non participation in family decision making (59.8%) while men mostly are victims of restricted access to financial resources (51.0%), isolation (49.2%) and forced to act involuntarily. The age group of the couples about the prevalence of violence showed statistical significance among the husband-and-wife age groups respectively (χ^2 = 8.80, p = 0.01) (χ^2 = 9.70, p = 0.00).

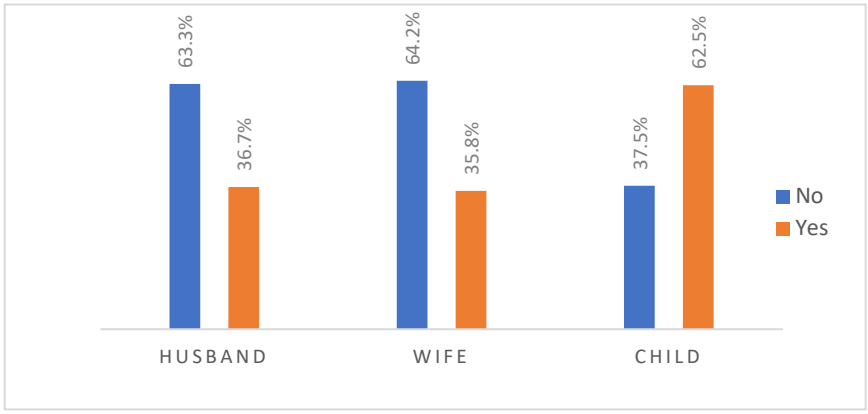

Figure 1: Prevalence of Family Violence as indicated by Family Members

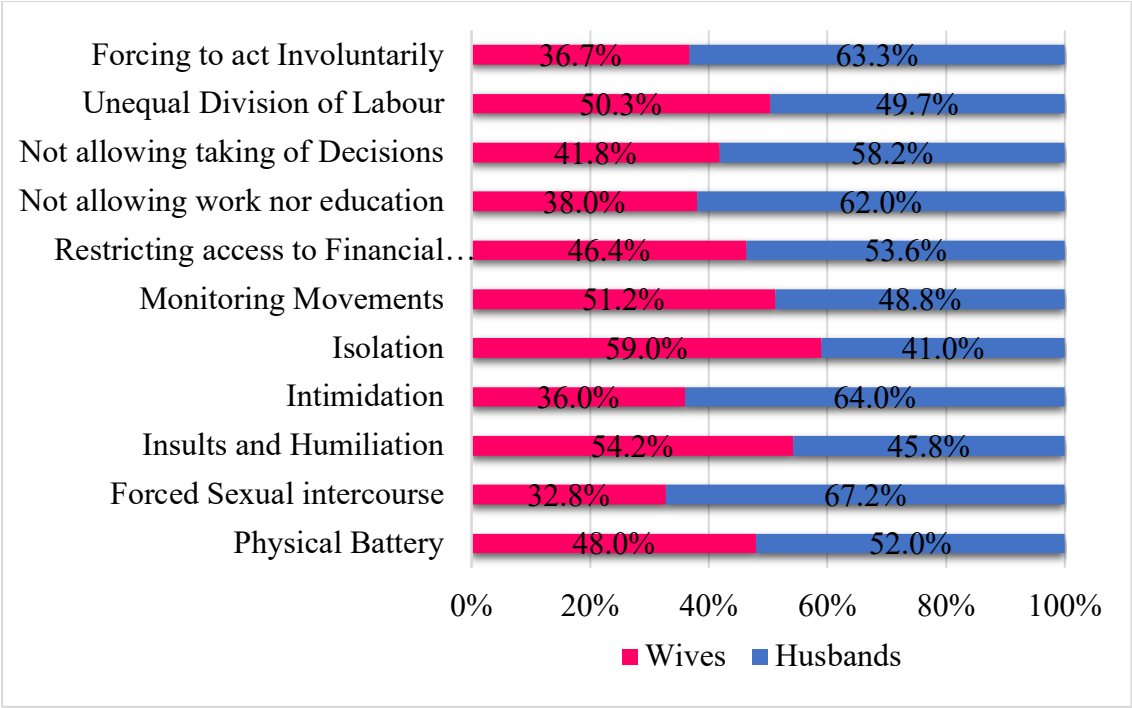

Figure 2: Perpetration by Forms and Gender of Family Violence

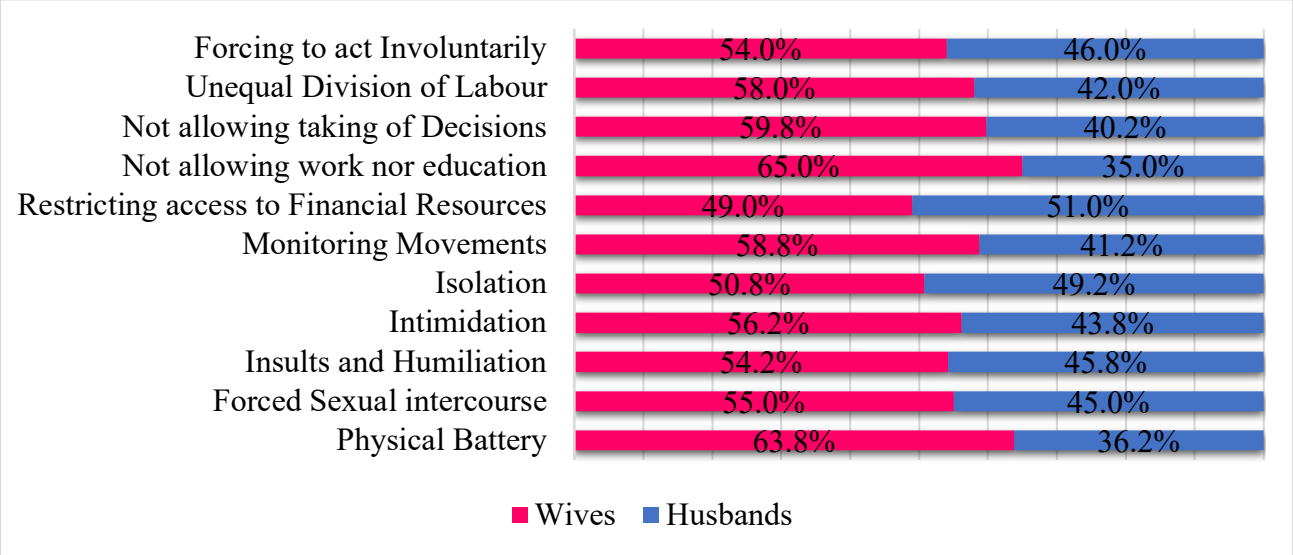

Figure 3: Experience by Forms and Gender of Family Violence

Table 2 provides the findings of the Chi-Square for Goodness of Fit test of violent actions as perpetrated by couples. There are statistically significant gender differences in the perpetration of forced sexual intercourse (χ^2 = 14.70, p = 0.00) intimidation (χ^2 = 9.63, p = 0.00), not allowing work nor education (χ^2 = 6.53, p = 0.01) men as perpetrators and forced to act involuntarily (χ^2 = 8.53, p = 0.00) with men as major perpetrators, while women were major perpetrators of isolation (χ^2 = 4.03, p = 0.04), violent actions by couples. The result showed that men perpetrate these violent actions in family relationships more than women.

Table 2: Gender Differences by Forms of Violence Perpetrated

Forms of family violence Perpetrated	Gender				
	Wife	Husband	χ^2	Df	P-value
Physical Battery	58 (48.0%)	62 (52.0%)	0.13	1	0.71
Forced Sexual Intercourse	39 (32.8%)	81(67.2%)	14.70	1	0.00*
Insults and Humiliation	65 (54.2%)	55 (45.8%)	0.83	1	0.36
Intimidation	43 (36.0%)	77 (64.0%)	9.63	1	0.00*
Isolation	71 (59.0%)	49 (41.0%)	4.03	1	0.04*
Monitoring Movements	59 (51.2%)	61 (48.8%)	0.03	1	0.86
Restricting Financial Resources	56 (46.4%)	64 (53.6%)	0.53	1	0.46
Not Allowing Work or education	46 (38.0%)	74 (62.0%)	6.53	1	0.01*
Not Allowing taking of decisions	50 (41.8%)	70 (58.2%)	3.33	1	0.06
Unequal division of Labour	61 (50.3%)	59 (49.7%)	0.03	1	0.86
Force to act Involuntarily	76 (63.3%)	44 (36.7%)	8.53	1	0.00*

** Significant at P < 0.05*

Table 3 shows the actual result of the Chi-Square for Goodness of Fit test of experienced violent actions as victims. There are statistically significant gender differences in being the victim of physical battery (χ^2 = 9.63, p = 0.00), monitoring of movements (χ^2 = 4.03, p = 0.04), not allowing work nor education (χ^2 =10.80, p = 0.00) not allowing participation in decision making (χ^2 = 4.80, p = 0.02) with more women as victims. The result showed that more women were victims of violent actions than men.

Table 3: Gender Differences by Forms of Violence Experienced

Forms of family violence	Gender				
	Wife	Husband	χ^2	Df	P-value
Physical Battery	77(63.8%)	43 (36.2%)	9.63	1	0.00*
Forced Sexual Intercourse	66 (55.0%)	54 (45.0%)	1.20	1	0. 27
Insults and Humiliation	65 (54.2%)	55 (45.8%)	0.83	1	0.36
Intimidation	67 (56.2%)	53(43.8%)	1.63	1	0.20
Isolation	61(50.8%)	59 (49.2%)	0.03	1	0.85
Monitoring Movements	71(58.8%)	49 (41.2%)	4.03	1	0.04*
Restricting Financial Resources	59 (49.0%)	61 (51.0%)	0.03	1	0.85
Not Allowing Work or education	78 (65.0%)	42 (35.0%)	10.80	1	0.00*
Not Allowing taking of Decisions	72 (59.8%)	48 (40.2%)	4.80	1	0.02*
Unequal division of Labour	70 (58.0%)	50 (42.0%)	3.33	1	0.06
Force to act Involuntarily	65 (54.0%)	55 (46.0%)	0.83	1	0.36

** Significant at P < 0.05*

Family Violence Occurrence from the Children's Perspective

The findings from the children's perspectives as witnesses, revealed that victims are either the mothers or the children, while perpetrators are the men, most of the time. The children saw men as the main perpetrator of physical battery (33.3%), intimidation (60%), not allowing mothers to participate in decision making (78.6%), not allowing mothers to work (83.3%) and unequal division of labor (86.7%) i.e., mothers are mostly involved in the house chores and keeping the home running. Children saw their mothers as victims of all these acts of violence and claimed to rarely see their mothers as perpetrators. The authors recognize the fact that it may be pretty difficult for the children to recognize the antecedents to some of these violent acts in the family. They only reported the violent acts they could see occurring. Insults claimed to be perpetrated by women were not reported by any of the children. However, that does not rule out the fact that they may occur in a subtle way that is not obvious to the children. The children's point of view still supported the general belief that males are perpetrators of violence.

Discussion

This study assessed the pattern of family violence with the prevalence and gender dimensions of forms of family violence experienced by the participants. Findings from the research showed that family violence occurrence was prevalent in the study setting with either husband or wife as perpetrator or victim. Forms of family violence perpetrated may differ by husband or wife. The study further showed that children confirmed violence occurrence in the families and reported men as perpetrators and women as victims.

The prevalence of perpetration was lower than findings from some African countries; Zambia, Ethiopia, and Uganda. The perpetration prevalence of the wives and husbands was lower than findings reported in Northern (Ibrahim et al., 2014) and Southwestern (Adejimi et al., 2014) parts of Nigeria among samples that were not couples. However, the children reported a higher prevalence which nearly doubles the prevalence reported by their parents. This may imply that some couples still keep the occurrence of violence secret, confirming the cultural silence around violence in marital relationships in the study settings (Choi, 2016).

This study also revealed that both genders perpetrated violence, but perpetration was more among the male spouses. This is contrary to the stereotyped belief that only men are perpetrators of violence in heterosexual relationships but supports the claim that men could also be victims of family violence (Ibrahim, Idris, Umar, Bashir, & Gobir, 2014). as their wives could be the perpetrators. The similarity in the prevalence of some forms of violence found between couples in this study may probably suggest that either of the couple's perpetuation of family violence was in the context of retaliation or self-defense (Gesinde, 2019; Leisring & Grigorian, 2016). This implies that either of the couples might have perpetrated violence as a reaction (self–defense or retaliation) to violent acts by their spouse (Machado et al., 2014; Ibrahim et al., 2014; Gesinde, 2019; Leisring & Grigorian, 2016). Even though the females also perpetrated violence in this study, a critical review of the result showed that the males were major perpetrators of violence. The prevalence of intimate partner violence as recorded by W.H.O was from the victims' perspectives (W.H.O., 2013). This study found that the victims' prevalence was higher in women than men which are similar to previous findings (Chuemchit & Perngparn, 2014; Leisring & Grigorian, 2016), where women had a higher victimization prevalence than men.

Gender has been revealed to be associated with forms of family violence perpetrated or experienced as victims. The female gender has been associated with emotional violence (Swan, Gambone, Jennifer, Caldwell & Sullivan, 2008) more often expressed by the wives as verbal insults and humiliation towards the husbands. Most times, the verbal abuse by the women often goes unnoticed by immediate family members and this type of abuse makes family members suffer in silence with consequences of psychological trauma manifesting as fear, anxiety, depression, and in extreme cases suicide (Scarduzio et al., 2017). However, the findings from this study also showed women as victims of emotional violence. The immediate family members, such as the children, may recognize the occurrence of emotional violence against the women as confirmed by this study. This is because women display their emotions with their facial expressions, crying, or displaced aggression indicating psychological stress from the emotional violence (Lee et al., 2014).

Isolation is being perpetrated at almost the same rate by both men and women. Being too possessive on the part of the men is a precursor for isolating the spouse from family and friends (Adejimi et al., 2014) and by extension not allowing the spouse to accept work away from the house. Women on the other hand perpetrate isolation by monitoring the movements of their spouses and shielding them away from friends perceived to negatively influence the men and their marriage. Women of the older age also isolate or neglect their men to care for grandchildren, most especially the newborns and their mothers as part of the socio-cultural roles expected of older women in the study setting. However, the current result showed that men are mostly the victim of isolation.

Men on the other hand isolate their spouses by not allowing them to work or get an education as shown by the findings of this study. Thus, the women may not be economically empowered (economic violence) to care for themselves and support the family. Sometimes, the economic burden of coping with the demands of the family may bring about frustrations on the part of the man leading to family dysfunction and the accumulation of stressors (Razera et al., 2016; Oh et al., 2019). This study nevertheless showed that economic violence was perpetrated by either of the spouses. The perpetuation of economic violence may be influenced by who has the higher

socioeconomic status at any point in the relationship (Harris, Kruger & Scott, 2020) although perpetuation of economic violence is higher among men than women.

From the results of this study, the gender dimensions of the perpetration of some forms of violence, such as physical, sexual, psychological, and economic violence, demonstrated that physical and sexual violence alongside intimidation, restricting access to financial resources, not allowing participation in decision making and forcing the spouse to act involuntarily is perpetrated more by men than women. This may be consequential to the patriarchal culture (Allanana, 2013), wife ownership norm (Boateng, 2017), and stereotyped gender roles (Reichel, 2017).

Sexual violence (forced sexual intercourse) from the findings of this study showed the wives as the main victims. Conversely, sexual violence in a marital relationship or a cohabiting relationship may not be termed as such in Nigeria because the law of the land does not recognize it (Omidoyin, 2018; Ochem & Emejuru, 2015). The cultural belief of the husband possessing the wife as a property embedded in the custom of bride price could support forced sex in a marital relationship. Nevertheless, this does not justify such an undue act. So, there is a need for community re-orientation of myths and beliefs around gender norms that often fuel the occurrence of violence in a family relationship.

Unequal division of labor is perpetrated at almost the same rate by the wives and husbands from the findings of this study, probably because of stereotypic gender roles of house chores culturally attributable to the female gender and the provider role to the husband (Tekkas, Kerman & Betrus, 2019). So, either party sees themselves as a victim of doing more, performing one role more than the other. There is a need to promote a sense of support for each other between spouses as the need arises.

This study has been able to ascertain the occurrence of family violence as a phenomenon without boundaries, either a male or female may perpetuate some particular forms of family violence in a heterosexual relationship and the possibility of children witnessing family violence occurring in a family relationship was affirmed. Considering the impact of violence whether male-perpetrated or female-perpetrated on the health and functioning of the family and the society at large, this study recommended that family-focused intervention that fosters a positive relationship that would guarantee physical, psychological, sexual, and economic safety of the family members be promoted across the society.

Hence, interventions for control and prevention should target every member of the family including the children who often witness it. Family violence experience in childhood may provide a behavioral model that influences the decisions and choices made in adulthood about peaceful co-existence free of violent acts. Also, including the children in such intervention could help avert the occurrence of such in the future relationships of the children and other associated consequences of violence. In addition to the above and from the children's submissions, the males require additional support and intervention to reduce the occurrence of family violence in society.

Furthermore, the need for gender mainstreaming into all interventions designed to address violence in intimate relationships cannot be overemphasized. This could be done by dealing with issues that influence each gender to perpetuate one form of violence more than the other.

Limitations

The data collected were specific to married couples and cohabiting couples with children in their current relationships. The study did not address family violence as it is related to same-sex relationships. Also, the study only focused on violence between intimate partners. The children's personal experiences of violence from parents were not captured in this study. The self-reported nature of the study was subjected to bias as each gender may want to respond in a way that favors them.

Conclusion

The study concluded that violence was supported by the stereotyped gender norms prevalent in the study setting. Family violence occurrence was prevalent in the study setting with either husband or wife as perpetrator or victim. The study further showed that children were witnesses of the violence that occurred in the home. Family-focused intervention is required for each member of the family as perpetrator, victim, and witness.

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Patterns of immediate post-anesthetic complications and associated factors among patients undergoing major surgery at Bugando Medical Centre, Mwanza, Tanzania

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Abstract
Background: The subject of post-anesthetic complications in the recovery room and their prevention has continued to generate interest in the last decade. Unfortunately, there is a paucity of published data regarding this subject in Tanzania and Bugando Medical Centre (BMC) in particular. This study sought to describe the patterns of immediate post-anesthetic complications and associated factors among patients admitted to the operating theatre recovery room following major surgery at BMC.
Methods: This was a cross-sectional study of patients aged 18 years and above admitted to the operating theatre recovery room following major surgery at BMC from March 2019 to May 2019.
Results: A total of 430 patients (M: F ratio = 1: 1.7) were studied. The median age at presentation was 35 [interquartile range, 27-52] years. A total of 294(68.4%) patients developed immediate post-anesthetic complications. Of these, postoperative nausea and vomiting were the most common post-anesthetic complication accounting for 43.5% of cases. American Association of Anesthesiologists (ASA) II ($p = 0.017$), general anesthesia ($p = 0.011$), and abdominal surgery ($p = 0.023$) were found to be statistically significantly associated with post-anesthetic complications on multivariate logistic regression analysis.
Conclusion: This study has demonstrated that the incidence of immediate post-anesthetic complications among patients admitted to the operating theatre recovery room following major surgery at BMC is unacceptably high despite recent advances in anesthetic techniques and the introduction of newer anesthetic drugs. We recommend that factors responsible for an increased incidence of immediate post-anesthetic complications at BMC should be addressed to reduce the occurrence of these complications.
Keywords: Immediate post-anesthetic complications, patterns, major surgery, recovery room, operating theatre, Tanzania

Introduction

The recovery room in the operating theatre, also called a post-anesthetic care unit, is a specialized area in a hospital in which intensive monitoring and care are provided to all patients immediately after surgery (Allman., 2000; Smedley., 2012. The recovery room was established to monitor the

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vital signs of patients following surgery and to identify any potentially serious problems before transferring the patient to the ward or the intensive care unit (Allman., 2000; Godden., 2015).
The immediate post-anesthetic period in the recovery room is a known period of high risk for anesthetic and or surgical complications to occur (Weiser et. al., 2008; Tennant et. al., 2012. The immediate post-anesthetic period is a time when surgical patients undergo many significant physiologic changes, even for relative health patients Norsidah & Puvaneswari., 1997; Peskett., 1999; Allman., 2000; Weiser et. al.,2008; Smedley., 2012). Several studies have shown clearly that approximately 10% of all anesthetic-related complications occur in the recovery period (Hines et. al. 1992; Norsidah &; Puvaneswari., 1997; Tennant et. al., 2012). Post-anesthetic complications cover a wide spectrum of severity from mildly distressing with no long-term sequelae to death or permanent disability (Tennant et. al., 2012). The presence of post-anesthetic complications in the recovery room is associated with increased length of hospital stay, increased perioperative morbidity, and prolonged overall recovery (Allman., 200.
Despite decades of research and advances in monitoring and anesthetic management, the incidence of complications in the immediate post-anesthetic period has been reported to be high in developing countries such as Tanzania where resources are limited (Polepole & Mwafongo., 2011) Several studies have identified several factors that increase the likelihood of post-anesthetic complications in the recovery room (Manninen et. al., 1999; Polepole &Mwafongo., 2011; Smedley., 2012; God den., 2015). These can generally be categorized into surgical and anesthetic factors (Godden., 2015). Identification of factors that are responsible for the increase in the immediate post-anesthetic complications can assist the anesthetist in the judicious use of pharmacotherapy to ameliorate this problem, especially among the high-risk patients; and may lead to a cost-effective active, and efficient means of managing these complications (Tennant *et. al*., 2012).
Anesthetic complications in the immediate postoperative period (recovery room)have been reported mostly in the western population (Allman., 2000; Kehlet & Dahl., 203), but, in contrast, little has been documented in the literature in the Tanzania context, even though these complications are common in many operating theatres in the country including BMC (Polepole & Mwafongo., 2011; BMC-Medical record database,2017/2018 *unpubl*.). It is because of this existing knowledge gap, we thought it is necessary to conduct this study in our local setting on this subject. This study sought to describe the patterns of immediate post-anesthetic complications and associated factors among patients admitted to the operating are recovery room following major surgery at Bugando Medical Centre, a tertiary care hospital in northwestern Tanzania.

Patients and Methods

Study design and setting

This was a cross-sectional study of patients admitted to the operating theatre recovery room following major surgery at Bugando Medical Centre from March 2019 to June 2019. The study was conducted in the operating theatre recovery room of Bugando Medical Centre. Bugando Medical Centre is the tertiary health institution serving the whole of the north-western part of Tanzania, serving a population of about 17 million people. It is a 960-bed referral hospital located in Mwanza City on the southern border of Lake Victoria. It is also a teaching hospital for the Catholic University of Health and Allied Sciences (CUHAS). The hospital has one main operating theatre which has ten rooms and one recovery room. These rooms are used for general surgery, orthopedic surgery, otorhinolaryngology, ophthalmology, obstetrics and gynecology, urology, cardiothoracic, and neurosurgery operations. One theatre for obstetrics is located in the labor ward and this operates only during the day.
The recovery room is within the vicinity of the operating theatre and is equipped with emergency equipment such as; oxygen, intravenous fluids, suction, airways, and emergency medications. The

recovery room is open 24 hours a day, and it is staffed by nurses that have been trained in anesthesia for one year. All patients scheduled to undergo elective surgical procedures are usually seen by the surgeon a day before surgery either in the ward or at the surgical or gynecological outpatient clinics. Before being scheduled for operation, all patients are usually fully investigated and prepared according to the diagnosis. The operating list is prepared by the surgeons, verified by the head of the firm, and sent to the theatre. The head of the firm who in most cases a senior consultant surgeon, confirms bookings and supervises these (scheduling) activities. A pre-surgical anesthetic assessment of the patient's fitness for surgery and anesthesia is usually performed a day before the operation by the anesthetist. Patients undergoing emergency surgery are usually seen at the emergency department, Intensive Care Unit (ICU), or wards by an on-call surgical team, resuscitated, and send to the operating theatre for emergency operation. After the operation all patients are admitted to the recovery room, from there they may be discharged to the apparent wards if fully recovered from anesthesia or to the ICU in case of failure to recover fully from anesthesia.

Study population &selection criteria

The study subjects include all patients from general surgery, orthopedics, otorhinolaryngology, obstetrics and gynecology, urology, cardiothoracic, plastic, and neurosurgery department scheduled to undergo major elective and emergency surgery and subsequently admitted to the operating theatre recovery room of Bugando Medical Centre during the period of study. Patients aged 18years and above admitted in the recovery room after surgical procedures as elective or emergency by using either general or loco-regional anesthesia during the period of study were enrolled in the study. The study included only patients who consented r to the study. Patients who were unable to give consent for the operation and those who died on the table were excluded from the study. Patients who went straight to the ICU and wards without passing the via recovery room were also excluded from the study. Patients who underwent major surgery were subsequently admitted to the recovery room and who met the inclusion criteria were recruited serially until the desired sample size was reached.

Recruitment of patients

Recruitment of patients to participate in this study was done during the pre-anesthetic visits of patients scheduled to undergo major elective and emergency surgery. Patients were screened for inclusion criteria and those who met the inclusion criteria were enrolled in the study after informed consent. All patients enrolled in the study were assessed preoperatively, intraoperatively, and postoperatively. Preoperatively, all patients underwent preoperative anesthetic assessment using the American Society of Anesthesiology (ASA) classification (Duncan et al., 1992). Patients were assessed for preoperative medical conditions and smoking status. Patients were subjected to surgery either under general or regional anesthesia according to the anesthesiologist's decision.
Intraoperatively, the type of anesthesia, type of surgery, duration of anesthesia, and surgery were documented. Post-operatively, in the recovery room patients were monitored for vital signs. Peripheral oxygen saturation was measured and monitored using a Datex-Ohmeda, Inc, Trust Sat pulse oximeter, and pulse rate was measured and monitored using Datex-Ohmeda, Inc, Trust Sat pulse oximeter, systolic blood pressure, and diastolic blood pressure were measured using a Geratherm GP- 6621 digital blood pressure machine. The respiratory rate was counted manually per min and the axillary temperature was measured using a mercury thermometer. All patients were under continuous monitoring for Oxygen saturation and pulse rate by a pulse oximeter.

Data collection

A structured, coded and pre-tested data collection tool designed for the study was used. Information to be collected included; demographic information, American Society of Anesthesiology class, nature of the surgical procedure(emergency v/s elective), surgical specialty (general surgery, obstetrics, and gynecology, urology, cardiothoracic, plastic and neurosurgery

general), non-invasive measurements of systolic blood pressure, diastolic blood pressure, Oxygen saturation (SaO2), and pulse rate will be recorded. Anesthetic technique and duration of anesthesia were recorded as obtained from the anesthetic chart.
The time of admission and discharge from recovery was recorded. Patients were observed for the occurrence of any postoperative complications and thereafter discharged to either ICU or in the ward.

Statistical data analysis

Data were entered using epi-Data version 3.1 (Atlanta, US) and analyzed using STATA version 13 (College Station, Texas, US). The median (+IQR) and ranges were calculated for continuous variables whereas proportions and frequency tables were used to summarize categorical variables. Chi-square ($\chi 2$) test was used to test for the significance of the association between the independent and dependent variables in the categorical variables. The level of significance was considered as a p-value of less than 0.05. Study variables that were found to be statistically significant in univariate analysis were subjected to multivariate logistic regression analysis to determine predictor variables that predict the immediate postoperative complications.

Ethical consideration

Ethical clearance was sought from the Joint CUHAS/BMC Research, Ethics, and review committee. Permission to conduct the study was obtained from the hospital authority and anesthesia department. In this study, patients were requested to sign an informed written consent form the study. Patients were assured that the information collected was maintained under strict confidentiality. Patients had the right to withdraw from the study at any time during the study. There was full disclosure of risks and benefits to all study participants. The study did not interfere with the decision of the attending doctor/Nurse.

Results

Patient's characteristics

Between March 2019 and June 2019, a total of 450 patients were admitted to the recovery room following major surgery and were recruited for eligibility in the study. Of these, 20 (4.4%) were excluded from the study due to failure to meet the inclusion criteria. Thus, a total of 430 patients, representing 95.6% of cases were available for the final analysis as shown in Figure 1 below. Their ages at diagnosis ranged from 18 to 97years with a median age of 35 [IQR, 27-52] years. The modal age group was 21-30years accounting for 31.6% of cases (Figure 2). Two hundred seventy (62.8%) were females and 160 (32.2%) were males giving a male to female ratio of 1: 1.7 with a female predominance in each age group. The majority of patients, 217(50.5%) had normal body weight (BMI range, 20-25). Eleven (2.6%) patients were smokers. Pre-existing medical illness was reported in 34 (7.9%) patients.

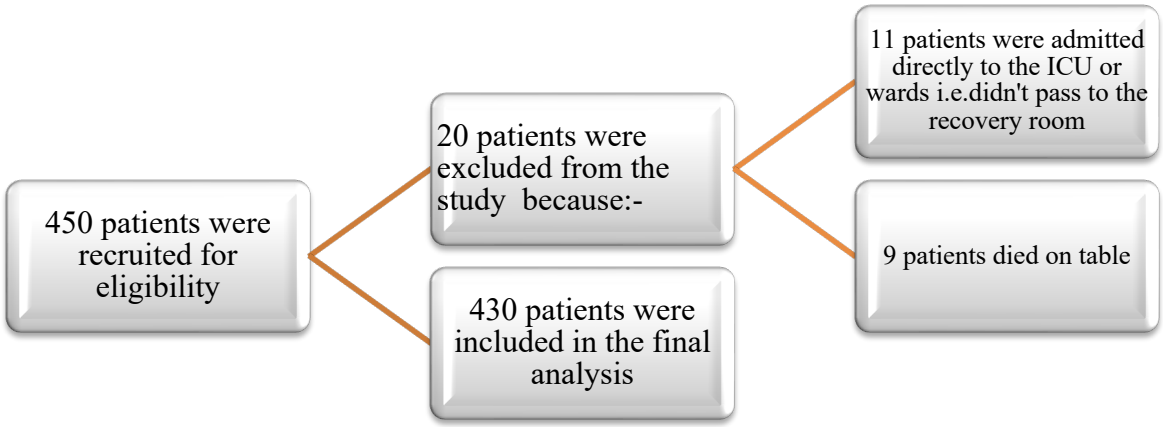

Figure 1: Patient's recruitment flow chart among patients admitted to the operating theatre recovery room at Bugando Medical Centre

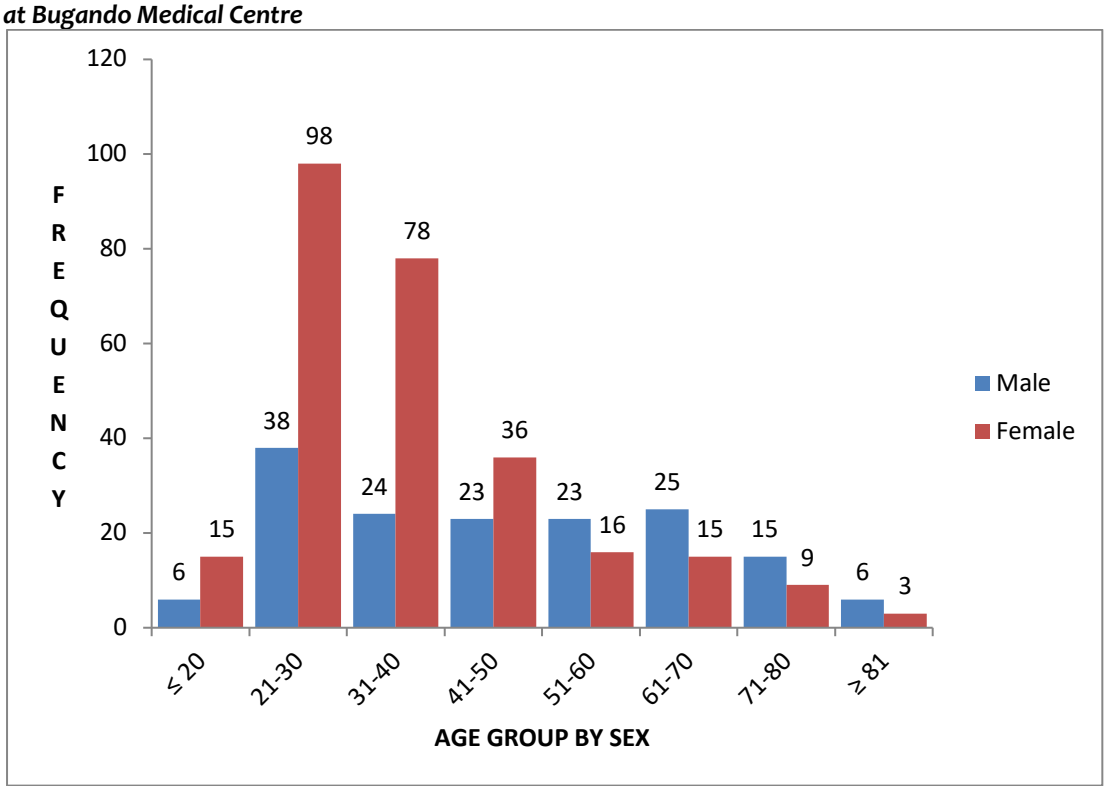

Figure 2: Age group distribution by sex among patients admitted to the recovery room following major surgery

Preoperative characteristics

All patients scheduled for major surgery in this study were assessed preoperatively using the American Society of Anesthetists (ASA) pre-operative grading as follows; 226(52.6%) had ASA I, 195(45.3%) had ASI II and 9 (2.1%) had ASA III. The majority of patients, 246 (57.2 %) were booked for elective surgery and had the highest number of patients booked for operation (44.7%) followed

by orthopedic surgery in 14.2% of patients. Cardiothoracic surgery and dental/maxillofacial surgery had the least number with 0.9% and 0.2% of patients booked for operations respectively (Figure 3).

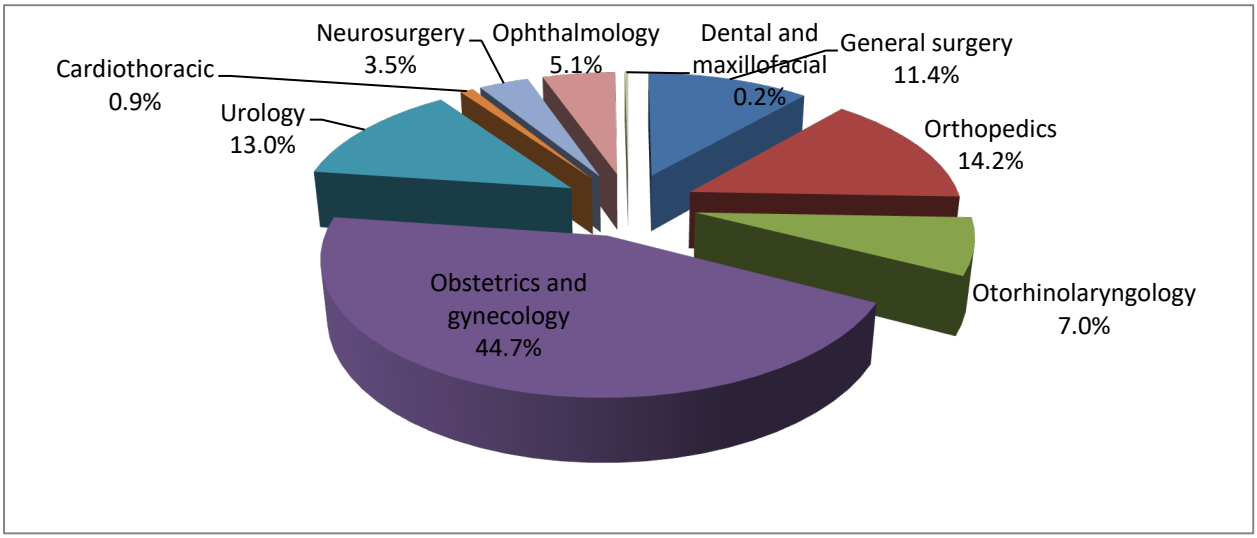

Figure 3: Distribution of patients according to surgical specialties

Intraoperative characteristics

The majority of surgeries in this study were performed under loco-regional anesthesia in 296(68.8%) patients and general anesthesia in 134 (31.2%) patients. Most of the anesthesia was provided by nurse anesthetists supervised by anesthesiologists in 226 (99.1%) patients and by anesthesiologists in the remaining 4(0.1%) patients. Cesarean section was the most frequent surgical procedure performed in 146 (34%) patients (Table 1). The duration of operation ranged from 5 to 240 minutes with a median of 45 minutes [IQR, 30- 60minutes].

The majority of the patients, 241 (56.1%) had the duration of surgery from 30-59minutes, followed by the duration of more than 60 minutes and less than 30 minutes in149(34.7%) and 40 (9.3%) patients, respectively. On the other hand, the duration of anesthesia ranged from 17 to 270 minutes with a median of 60 minutes [IQR, 45- 80minutes]. The of patients, 224 (52.1%) had the duration of anesthesia last for more than 60 minutes. This was followed by the duration of 30-59 minutes and less than 30minutes in 192(44.7%) and 14 (3.3%) patients, respectively.

Table 1: Surgical indications and procedures for major surgeries at Bugando Medical Centre

Indication/procedure	Response	Frequency	Percent
Surgical indications	Delivery Indications	146	34.0%
	Acute abdomen	14	3.3%
	Fractures and dislocation	53	12.3%
	Benign prostate hyperplasia	25	5.8%
	Cataract	17	3.9%
	Gynecological diagnosis	40	9.3%
	Goiter	11	2.6%
	Urethral stricture	20	4.6%
	Chronic tonsillitis	6	1.4%
	All tumors at different sites	10	11.9%
	Others	11	11.2%
Surgical procedures	Cesarean section	146	34%
	Laparotomy	25	5.8%
	ORIF/EXFIX	50	11.6%

	TURP	25	8.8%
	Eye surgery	17	3.9%
	Hysterectomy and myomectomy	34	7.9%
	Thyroidectomy	11	2.6%
	Surgery for strictures	20	4.6%
	Tonsillectomy	6	1.4%
	Excision and biopsy	39	9.1%
	Others	58	13.5%

Keys: ORIF= Open reduction and internal fixation; EXFIX=External fixator, TURP = Transurethral resection of the prostate

Postoperative characteristics

The duration of stay in the recovery room immediately after major surgeries ranged from5 to 80 minutes with a median of 16 minutes [IQR, 15-20 minutes]. The majority of patients, 376 (87.4%) stayed in the recovery room for less than 30 minutes. The remaining 40 (9.3%) and 14 (3.0%) patients stayed for 30-59 minutes and≥ 60 minutes, respectively. A total of 294(68.4%) patients developed immediate post-anesthetic complications (Figure 4). Of these, postoperative nausea and vomiting (PONV) was the most common post-anesthetic complication accounting for 41.6% of cases (Figure 4).

Tables 2 &3 below show preoperative and intra-/postoperative factors associated with post-anesthetic complications according to univariate and multivariate logistic regression analyses, respectively. According to multivariate logistic regression analysis, ASA II (OR 2.1; 95% CI [1.1-3.7]; p-value =0.017), general anesthesia (OR0.3; 95% CI [0.1-0.6]; p-value = 0.017) and laparotomy (OR 37.1; 95% CI [1.6-841.2];p-value = 0.023) were found to be statistically significantly associated with post-anesthetic complications.

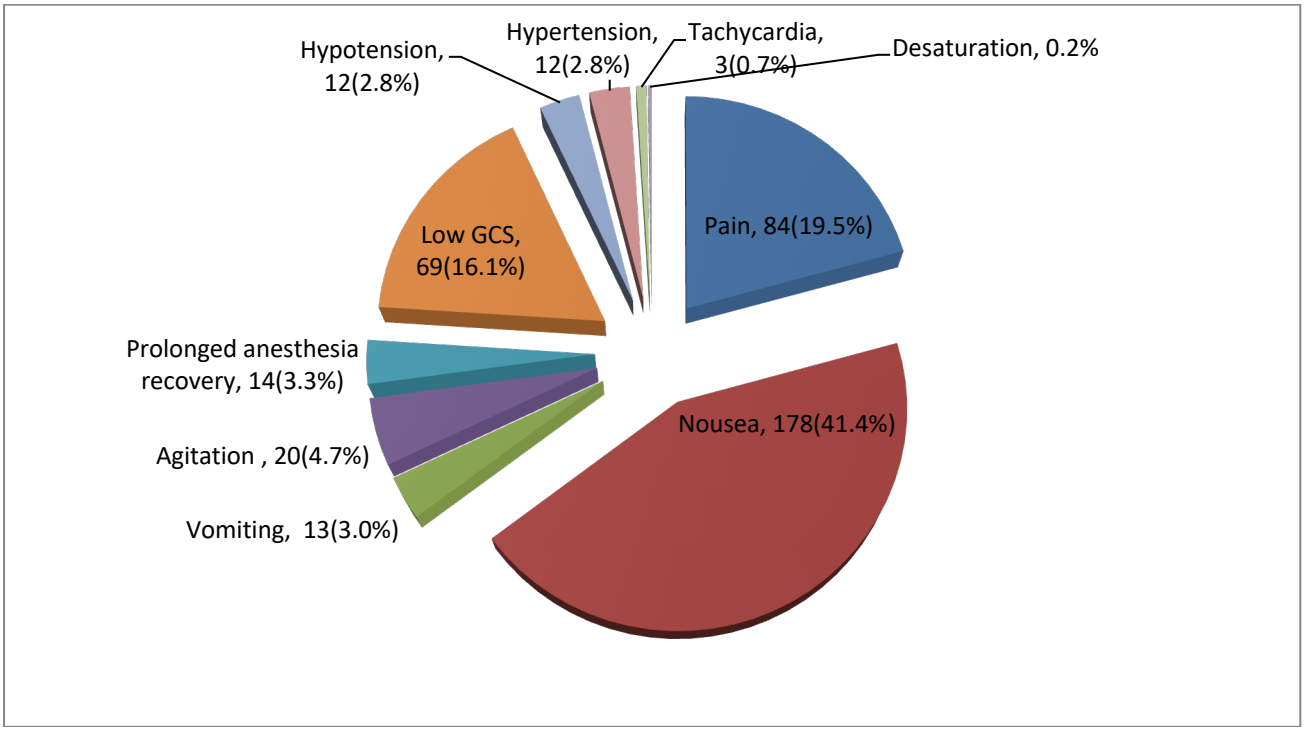

Figure 4: Distribution of patients according to post-anesthetic complications

Table 2: Preoperative factors associated with post-anesthetic complications according to univariate and multivariate logistic regression analyses

Predictor (independent) variables	Immediate post-anesthetic Complications Yes =294 N(%)	No =136 N (%)	Univariate OR[95%CI]	p-value	Multivariate OR[95%CI]	p-value
Age (year)						
18-39	187(73.1)	69(26.9)				
40-59	63(62.4)	38(37.62)	0.6[0.4-1.0]	**0.048**	0.8[0.4-1.5]	0.476
60-97	44(60.3)	29(39.7)	0.6[0.3-1.0]	**0.037**	0.9[0.4-2.0]	0.728
Sex						
Male	100(62.5)	60(37.5)				
Female	194(71.9)	76(28.1)	1.5[1.0-2.3]	**0.044**	1.4[0.7-2.9]	0.341
Smoke						
Yes	8(72.7)	3(27.3)				
No	286(68.3)	133(31.7)	0.8[0.2-3.1]	0.753		
Pre-existing						
Yes	23(67.6)	11(32.4)				
No	271(68.4)	125(31.6)	1.0[0.5-2.2]	0.925		
ASA						
I	141(62.4)	85(37.6)				
II	146(74.9)	49(25.1)	1.8[1.2-2.7]	**0.006**	2.1[1.1-3.7]	**0.017**
III	7(77.8)	2(22.22)	2.1[0.4-10.4]	0.359	2.2[0.3-13.8]	0.407
BMI						
Underweight	11(100)	0(0.0)				
Normal weight	144(66.4)	73(33.6)	1.0[0.5-1.9]	0.966		
Overweight	103(69.7)	45(30.4)	1.1[0.6-2.2]	0.691		
Obese	36(66.7)	18(33.3)				
Surgical Specialty						
General surgery	29(59.2)	20(40.8)				
Orthopedics	39(63.9)	22(36.1)	1.2[0.6-2.6]	0.61	0.9[0.3-3.7]	0.993
Otorhinolaryngology	18(60.0)	12(40.0)	1.0[0.4-2.6]	0.943	1.3[0.3-4.7]	0.716
Obstetrics and gynecology	143(74.5)	49(25.5)	2.0[1.0-3.9]	**0.037**	0.5[0.0-5.0]	0.572
Urology	36(64.3)	20(35.7)	1.2[0.6-2.7]	0.591	3.5[0.9-13.3]	0.067
Cardiothoracic	3(75.0)	1(25.0)	2.1[0.2-21.3]	0.541	1.30[0.1-16.]	0.839
Neurosurgery	15(100.0)	0(0.0)				
Ophthalmology	10(45.5)	12(54.5)	0.6[0.2-1.6]	0.284	2.2[0.3-17.2]	0.468
Dental and maxillofacial	1(100)	0(0.0)				

Table 3: Intra- and postoperative factors associated with post-anesthetic complications according to univariate and multivariate logistic regression analyses

Predictor (independent) variables	Immediate post-anesthetic Complications Yes =294 N(%)	No =136 N (%)	Univariate OR[95%CI]	p-value	Multivariate OR[95%CI]	p-value
Age (year)						
18-39	187(73.1)	69(26.9)				
40-59	63(62.4)	38(37.62)	0.6[0.4-1.0]	**0.048**	0.8[0.4-1.5]	0.476
60-97	44(60.3)	29(39.7)	0.6[0.3-1.0]	**0.037**	0.9[0.4-2.0]	0.728
Nature of surgery						
Emergency	135(73.4)	49(26.6)				
Elective	159(64.6)	87(35.4)	0.7[0.4-1.0]	0.055		
Type of Anesthesia						
General anesthesia	107(79.8)	27(20.2)				
Locoregional anesthesia	187(63.2)	109(36.8)	0.4[0.3-0.7]	**0.001**	0.3[0.1-0.6]	**0.001**

Anesthesia provider						
Nurse	290(68.1)	136(31.9)				
doctor	0(0.00)	4(100.0)	2.46*[0.30-+Inf]	0.434		
Diagnosis						
Delivery Indication	104(71.7)	41(28.3)				
Acute abdomen	11(78.6)	3(21.4)	1.4[0.4-5.4]	0.586	0.03[0.001-1.3]	0.071
Fracture and dislocation	36(67.9)	17(32.1)	0.8[0.4-1.6]	0.603	1242694[0-.]	0.99
Benign prostate hyperplasia	14(56.0)	11(44.0)	0.5[0.2-1.2]	0.12	0.2[0.01-2.6]	0.209
Cataract	7(41.2)	10(58.8)	0.3[0.1-0.8]	**0.014**	0.2[0.01-3.9]	0.275
Gynecological diagnosis	32(80.0)	8(20.0)	1.6[0.7-3.7]	0.296	0.5[0.02-11.5]	0.659
Urethral stricture 7	6(54.5)	5(45.4)	0.5[0.1-1.6]	0.237	0.1[0.01-1.5]	0.091
All tumors at different sites8	14(70.0)	6(30.0)	1.0[0.3-2.6]	0.873	0.3[0.02-4.5]	0.397
Tonsillitis	3(50.00)	3(50.00)	0.4[0.1-2.0]	0.266	0.1[0.01-2.3]	0.157
Procedure						
Caesarea section	104(71.7)	41(28.3)				
Laparotomy	24(96.0)	1(4.0)	9.5[1.2-72.2]	**0.03**	37.1[1.6-841.2]	**0.023**
ORIF and EXFIX	33(66.0)	17(34.0)	0.8[0.4-1.5]	0.446	0.045[0-.]	0.99
TURP	14(56.0)	11(44.0)	0.5[0.2-1.2]	0.12		
SILI ± PC	7(41.2)	10(58.8)	0.3[0.1-0.8]	**0.014**		
TAH and myomectomy	26(76.5)	8(23.5)	1.3[0.5-3.1]	0.577	2.1[0.1-46.4]	0.634
Surgery for strictures	6(54.5)	5(45.5)	0.5[0.1-1.6]	0.237		
Excision and biopsy	8(20.51)	31(79.49)	1.0[0.3-2.6]	0.873		
Tonsillectomy	3(50.0)	3(50.0)	0.4[0.1-2.0]	0.266		
Excision and biopsy	21(53.8)	18(46.2)	0.5[0.2-1.0]	**0.036**	1.0[0.04-17.2]	0.909
Duration of surgery (minute)						
<30	24(60.00)	16(40.00)				
30-59	156(64.7)	85(35.3)	1.2[0.6-2.4]	0.564	1.0[0.5-2.2]	0.968
>60	114(76.5)	35(23.5)	2.2[1.0-4.5]	**0.039**	1.3[0.6-3.0]	0.546
Duration of anesthesia (minute)						
<30	12(85.7)	2(14.3)				
30-59	126(65.6)	66(34.4)	0.3[0.1-1.5]	0.141		
>60	156(69.6)	68(30.4)	0.4[0.1-1.8]	0.216		
Duration of stay (minute)						
<30	250(66.5)	126(33.5)				
30-60	31(75.6)	10(24.4)	1.6[0.7-3.3]	0.24		

Discussion

In this study, post-anesthetic complications accounted for 68.4%, a figure which is low compared to 87.5% that was found in Dar es Salaam, Tanzania (Polepole &Mwafongo.,2011). A high figure of 83.0% was also reported in Jamaica by Tennant et al (2012). An analysis of immediate post-anesthetic complications seen in a large teaching hospital including over 60,000 patients found incidences of 0.04% for major and 9.4% for minor immediate postoperative complications (Cohen et al., 1986). However, a study that looked specifically at minor postoperative complications after general anesthesia in4,173 patients reported an incidence of 41% (Myles et al., 1997). Our figure is significantly high compared to what is reported in developed countries (Allman., 2000; Kehlet & Dahl., 2003). This difference in the incidence of post-anesthetic complications in these studies may be explained in part by the differences in exposure to risk factors for these complications.

In keeping with other studies (Polepole &Mwafongo., 2011; Tennant et al., 2012), the peak age incidence in this study was found to be in the second and third decade of life and tended to affect more females than males. The female predominance demonstrated in this study is by the results of other workers (Hines et al., 1992; Norsidah & Puvaneswari., 1997; Tennant et al., 2012) and this can be explained by the fact that the highest number of patients booked for the operation were from Obstetrics and gynecology specialty.

In the present study, postoperative nausea and vomiting (PONV) was the most common post-anesthetic complication accounting for 43.5% of cases, a figure which is higher than the overall global incidence of 25-30% among surgical patients (Van derBosch et al., 2005; Gan, 2006; Smith et al., 2012). Ssebuufu et al. (2009) in Uganda and Amponsah (2007) in Ghana reported the incidence of PONV within 24 hours after surgery to be 40.7% and 34.6%, respectively. A study by Chalya et al (2015) at the same institution reported the incidence of PONV to be 41.4%. One study from Guyana reported a significantly low incidence of postoperative nausea and vomiting (PONV) of2.9% (Hines et al., 1992). In high-risk patients, the incidence of PONV has been reported in the literature to be as high as 70-80% (Apfel et al., 2005). This difference in the incidence of PONV in these studies may be explained in part by the differences in exposure to risk factors such as the female gender, history of motion sickness or previous PONV, nonsmoking, and the use of postoperative opioids.

Postoperative pain was the second most common anesthesia-related complication in our study which is in contrast to Polepole and Mwafongo (2011) in Tanzania who reported postoperative pain as the most frequent post-anesthesia complication followed by respiratory complications. Another study in Toronto which assessed over 5,000 high-risk patients in the recovery room found that the rate of excessive pain was 14.8% (Mayer & Liebeskind., 1974). The rate of excessive pain in the recovery room may vary depending on patient age, preoperative analgesic use, the surgical procedure, and strategies to reduce post-operative pain (Mayer & Liebeskind.,1974; Murray & Retief., 2016). Inadequately treated post-operative pain is a prevalent phenomenon worldwide that adversely affects patient experience and outcome (Mayer & Liebeskind., 1974; Murray & Retief., 2016). In a resource-limited environment with an expected high incidence of post-operative expected high incidence of postoperative pain, it is necessary to fully utilize basic analgesic modalities and to reserve more costly advanced methods for those who need them most. For this reason, the incidence and risk factors associated with a higher incidence of postoperative pain need to be identified.

Cardiopulmonary complications have been reported to occur in the recovery room from 2.3% to 15.3% of patients (Tennant et al., 2012). A study of 18380 patients found an overall incidence of cardio-pulmonary complications of 7.2% of all admissions to the recovery room (Hines et al., 1992). The overall incidence in our study was 6.3% which is similar to this previous study. There were no major cardiovascular complications such as pulmonary edema or myocardial ischemia during the study period.

Several factors have been reported in the literature to be associated with post-anesthetic complications in recovery rooms (Manninen et. al., 1999; Smedley., 2012; Godden., 2015). Most

studies have reported that age is associated with an increased incidence of immediate post-anesthetic complications in the recovery room (Hines et al., 1992; Polepole & Mwafongo., 2011). In this study, age was not associated with immediate post-anesthetic complications. The reason for the association between age and increased incidence of immediate post-anesthetic complications is not yet clear and this warrants further investigation.

It has been shown in several studies that the female gender has a greater risk of immediate post-anesthetic complications, such as nausea and vomiting, headache and backache (Myles et al., 1997). In the present study, the female gender was more likely to have immediate post-anesthetic complications than their male counterparts, though this was not statistically significant in multivariate logistic regression analysis. One possible explanation for this observation is that it is more socially acceptable for women to express their discomfort, while males tend to underreport complications. This gender difference may also be attributed to variation in serum gonadotropin or other hormone levels (Myles et al., 1997).

Body mass index (BMI) has been reported in the literature to be associated with immediate post-anesthetic complications, such as nausea and vomiting (Gan, 2006; Ssebuufu et al., 2009; Smith et al., 2012). Obese patients have been reported as more likely to experience PONV (Gan., 2006). In the present study, there was no statistically significant association between BMI and immediate post-anesthetic complications. This association between increased BMI and PONV may be due to an increased intra- abdominal pressure and the pharmacokinetic effects of lipophilic anesthetic agents having prolonged half-lives in these patients. In this case, adipose tissue acts as a reservoir for inhaled anesthetic agents, from which they continue to enter the bloodstream even after their administration, has been discontinued (Smith et al., 2012).

Several studies have shown a strong association between ASA status and immediate post-anesthetic complications (Hines et al., 1992; Polepole & Mwafongo.,2011; Tennant et. al., 2012). Increased ASA scores have been reported to be associated with an increased risk of immediate postoperative complications in the recovery room (Tennant et. al., 2012). In this study, we found a strong association between ASA II and immediate post-anesthetic complications. On the other hand, our finding is in keeping with Tennant et. al. (2012) who found no correlation between ASA III and the frequency of immediate post-anesthetic complications attributing this to the low number of ASA III patients in this study, making it difficult to make comparisons.

The anesthetic technique has been reported to be a predictor of immediate postoperative complications (Polepole &Mwafongo., 2011; Tennant et. al., 2012). Compared with loco-regional anesthesia, general anesthesia is associated with an 11-fold increase in risk for immediate postoperative complications (Myles et al., 1997; Tennant et. al., 2012). Increased incidence of immediate postoperative complications such as nausea and vomiting with general anesthesia could be related to using volatile anesthetic with perioperative opioids. General anesthetic drugs decrease the level of consciousness by decreasing the action potential amplitude and frequency of the central nervous system (Tennant et. al., 2012). This disruption of normal neural electrical output can stimulate the chemoreceptor trigger zone (CTZ) and vomiting center (Tennant et. al., 2012). In this study, general anesthesia had a significant association with immediate post-anesthetic complications both in univariate analysis and multivariate analysis.

The effect of the type of surgical procedure on the incidence of immediate post-anesthetic complications has been debated in the literature (Hines et al., 1992; Polepole& Mwafongo., 2011; Tennant et. al., 2012). Some studies have suggested that the type of surgical procedure is associated with a high incidence of immediate post-anesthetic complications, whereas others have suggested that differences in the incidence of immediate post-anesthetic complications are mainly due to patient- or anesthesia-related factors (Myles et al., 1997; It is unclear if the association is caused by the different anesthetic agents, the different lengths of operation, or the operation itself (Polepole &Mwafongo., 2011; Tennant et. al., 2012). In our study, laparotomy was found to be significantly associated with immediate post-anesthetic complications, a finding which is

consistent with Ssebuufu et al (2009) in Uganda who reported an association between orthopedic operations and PONV.

The duration of surgery/anesthesia has been reported to affect the incidence of immediate post-anesthetic complications, with more frequent immediate post-anesthetic complications being reported after longer operations. With increasing duration of surgery and anesthesia, the risk of immediate post-anesthetic complications increases (Polepole & Mwafongo., 2011; Smedley., 2012; Godden., 2015). However, in this study, we observed no association between the duration of operation /anesthesia and the incidence of immediate post-anesthetic complications.

In conclusion, this study has demonstrated that the incidence of immediate post-anesthetic complications among patients admitted to the operating theatre recovery room following major surgery at BMC is unacceptably high despite recent advances in anesthetic techniques and the introduction of newer anesthetic drugs. We recommend that factors responsible for the increased incidence of immediate post-anesthetic complications at BMC should be addressed to reduce the occurrence of these complications.

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Admission hyperglycemia as a prognostic indicator of outcome in major trauma patients at Bugando Medical Centre, Mwanza, Tanzania

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Abstract
Background: Admission hyperglycemia has been reported to be associated with poor outcomes among patients with major trauma. However, most of the available literature on this subject has been conducted in the developed world. This study aimed to determine the association between admission hyperglycemia and the outcome of major trauma patients admitted to Bugando Medical Centre.
Methods: This was a prospective cohort study, involving major trauma patients admitted to Bugando Medical Centre (BMC) within 6 months from Sept 2017 to February 2018. The exposure was admission hyperglycemia (>11.1mmol/l) and non-exposure was normoglycemia (≤11.1mmol/l).
Results: A total of 217 patients (M: F ratio = 4.1: 1) were recruited. Their ages ranged from 4 – to 97 years with a median age of 31 years. Out of 217 patients, 106 (48.8%) were hyperglycemic and the remaining 111(51.2%) were normoglycemic. The overall median days of the length of hospital stay (LOS) was 15 days. There was no statistically significant association between admission hyperglycemia and LOS (p =.0.875). In this study, 73 patients died giving a mortality of 33.6%. Patients with admission hyperglycemia (>11.1mmol/l) had significantly higher mortality as compared to normoglycemic patients (≤11.1mmol/l) (p < 0.001).
Conclusion: From this study, it was found that admission hyperglycemia was statistically significantly associated with increased mortality among major trauma patients at BMC. Therefore, there is a need to institute regular monitoring of blood sugar levels among these patients and give appropriate treatment to those found with elevated blood sugar levels.

Keywords: *Admission hyperglycemia, prognostic indicator, major trauma outcome, Tanzania*

Introduction

Trauma continues to be an enormous public health problem globally and contributes significantly to high morbidity, mortality, and long-term disabilities in the first four decades of life (Park, 2000; Hofman *et al*., 2005). In low-income countries including Tanzania, trauma, in general, is increasing due to an increase in urbanization, motorization, civil violence, wars, and criminal activities (Museru & Leshabari, 2002; Bevan *et al*., 2008; Chalya *et al*., 2010). In these countries, major trauma remains a major cause of hospitalization and intensive care utilization and consumes a significant amount of the health care budget (Bevan *et al.,* 2008). At Bugando Medical Centre, major trauma is the single most common reason for trauma admission to the Intensive Care Unit (Chalya *et al*., 2011), and is it associated with a substantial emotional, physical and financial burden on the community and hospital resources.

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All major trauma patients experience a hyper-metabolic response characterized by among other features massive protein catabolism and stress-induced hyperglycemia (Marik & Bellomo., 2013; Simsek *et al.,* 2014). Hyperglycemia, one of the two most prominent features of the hyper-metabolic response has been recognized as a common occurrence in trauma patients (Marik & Bellomo., 2013). The etiology of hyperglycemia in these patients is a multifactorial and complex cascade (Simsek *et al.,* 2014). A combination of several factors, including the presence of excessive counter-regulatory hormones such as glucagon, growth hormone, catecholamines, glucocorticoids, and cytokines such as IL-1, IL-6, and TNF-a plays an important role (Reinhold *et al.,* 1996).

Additionally, insulin resistance and decreased insulin production have also been implicated (Rassias *et al.,* 1999). Previously, this hyperglycemia was perceived to be a 'normal' response to the major trauma and thus it was thought that intervention was not needed (Black *et al.,* 1990). Recent studies have however established that there is an association between hyperglycemia and poor outcome in patients with major trauma (Gore *et al*., 2002; Yendamuri *et al*., 2003; Simsek *et al.,* 2014; Torbati *et al.,* 2015). Early recognition and treatment of this profound metabolic change have been shown to improve clinical outcomes (Torbati *et al.,* 2015).

Even though stress-induced hyperglycemia has been associated with an increase in morbidity and mortality among patients with major trauma (Simsek *et al.,* 2014; Torbati *et al.,* 2015). The available literature on stress-induced hyperglycemia post-trauma has been conducted in the developed world (Gore *et al*., 2002; Yendamuri *et al*., 2003; Sung *et al.,* 2011; Simsek *et al.,* 2014; Torbati *et al.,* 2015). This study is distinct from other reports in the literature, for its setting in a developing country with unique characteristics, challenges, and the largest burden of trauma. It is because of this knowledge gap the author decided to conduct this study to provide baseline data from our local setting. This study aimed to determine the association between admission hyperglycemia and the outcome of major trauma patients at Bugando Medical Centre, a tertiary care hospital in northwestern Tanzania.

Patients and Materials

Study design and setting

This was a prospective cohort study, involving major trauma patients admitted to Bugando Medical Centre (BMC) from September 2017 to February 2018. The study was conducted in the Emergency Department, ICU, surgical wards, and surgical outpatient clinic (SOPD) at Bugando Medical Centre. Bugando Medical Centre is the tertiary health hospital providing tertiary care and teaching hospital for the Catholic University of Health and Allied Sciences-Bugando Mwanza, Tanzania (CUHAS) and has a bed capacity of 900. It is located in Mwanza City, along the shores of Lake Victoria in north-western Tanzania. The hospital provides service to a population of approximately 16 million people from its neighboring regions in northwestern Tanzania. There is no trauma center or established advanced pre-hospital care in Mwanza City as a result all major trauma patients are referred to BMC for expertise management. At BMC, trauma patients are triaged at the Emergency department according to injury severity to identify critically injured patients who need rapid surgical intervention or the specialized services

Study population

The study included all major trauma patients (KTS II ≤ 6) of all age groups and gender who consented to the study during the study period. Patients who met the inclusion criteria were stratified into hyperglycemic >11.1mmol/l (exposed) and normoglycemic 3.7 - ≤ 11.1mmol/l (unexposed). Patients who had hypoglycemia on admission, those who died before complete assessment, and those who had established diabetes mellitus on admission were excluded from the study to minimize the overlap between stress-induced hyperglycemia and diabetic hyperglycemia. The study also excluded all patients who were given DNS and dextrose before RBS

measurement; identified by acquiring from an escort nurse, or referral letter. The sample size (n) for all patients enrolled in the study was calculated using the formula by Kirkwood and Sterne (2003). Convenience sampling for patients who met the inclusion criteria was enrolled until the sample size is reached.

Recruitment of patients

Recruitment of patients to participate in the study was done at the Emergency department. Patients were screened for inclusion criteria and those who met the inclusion criteria were enrolled in the study after signing informed consent to participate in the study. All recruited patients were resuscitated on admission according to advanced trauma life support (ATLS). In all patients who were enrolled in the study, random blood sugar (RBS) was taken on admission before resuscitation with intravenous fluid was done by the admitting surgical team. Random blood sugar (RBS) was measured using coded glucose and recorded.

According to their admission RBS, all enrolled patients were divided into two groups: normoglycemic 3.7 - ≤ 11.1mmol/l and hyperglycemic ≥11.1mmol/l. The severity of the injury was determined using the Kampala trauma score II (KTS II) (Mutooro *et al*., 2010). According to KTS II, severe (major) injury consists of a KTS II ≤ 6. Depending on the type of injury, patients were treated either conservatively or by surgery. Patients were admitted to surgical wards or the intensive care unit (ICU) to continue with treatment, serial blood glucose measuring/monitoring, and other investigations. Patients were followed up for 90 days during the life follow-up and by phone. Data collection from patients or their relatives or Assert was done using a structured questionnaire (in both English and Swahili language).

Statistical data analysis

Data collected were entered into a computer and analyzed using STATA version 13. The continuous variable was summarized using median with interquartile range (IQR) whereas proportions (percentages) and frequency tables were used to summarize categorical variables. To determine the association between admission hyperglycemia with mortality and length of hospital stay we determined the unadjusted and adjusted Odds ratios (OR) together with 95% CI using logistic regression analysis. Factors with a p-value less than 0.05 were considered statistically significant.

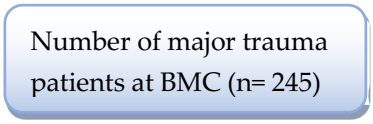
Ethical consideration

Ethical approval to conduct the study was obtained from the CUHAS-BMC joint institutional ethic review committee (CREC /239/ 2017) before the commencement of the study. Permission to conduct the study was obtained from the BMC administration. Informed written consent was sought from each patient before being enrolled in the study. The patient was assured that the information collected was maintained under strict confidentiality and the patient's refusal to consent or withdraw from the study could not alter or jeopardize their access to medical care. The study did not interfere with the decision of the attending doctor. In patients aged below 18years consent was sought from guardians or parents.

Results

Recruitment of major trauma patients

During the study period, a total of 245 major trauma patients were screened for eligibility of being enrolled in the study. Of these, 217 (88.6%) patients were recruited for the study whereas 29 (11.8%) were excluded due to various reasons. Of the 217 enrolled, 111 (51.2%) were having normoglycemia whereas 106 (48.9%) were hyperglycemic. Figure 1 below summarizes the number of major trauma patients at BMC.



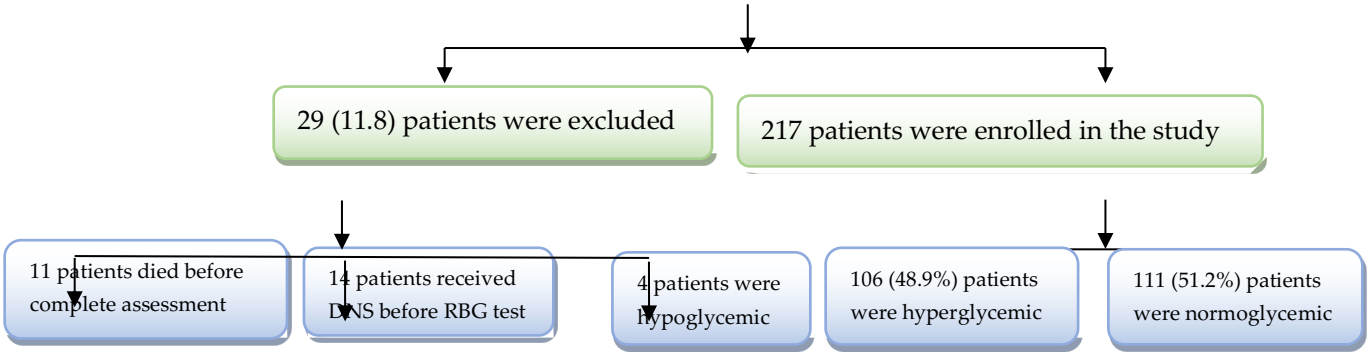


Figure 1: Flow chart showing recruitment of major trauma patients at BMC

Socio-demographic of the 217 major trauma patients

Among 217 major trauma patients included in the study, their ages at diagnosis ranged from 4 – 97 years with the median age of 31 [IQR 24 – 40] years. The age peak incidence was 21-40 years accounting for 61.8% of cases. One hundred and eighty (83.0%) were males and 37 (17.0%) were females with a male to female ratio of 4.7:1. The majority of patients, 141 (65.0%) were from urban areas and most of them, 143 (65.9%) were unemployed. Table 1 summarizes the socio-demographics of the 217 major trauma patients.

Table 4: Socio-demographic of the 217 major trauma patients

Patient particulars	Numbers (n)	Percent (%)
Age group		
< 20	33	15.2
21 – 40	134	61.8
41 – 60	36	16.8
>61	14	6.5
Sex		
Male	180	83.0
Female	37	17.1
Residence		
Urban	141	65.0
Rural	76	35.0
Occupation		
Employed	74	34.1
Unemployed	143	65.9

Injury characteristics in major trauma patients

A road traffic accident was the most common cause of major trauma accounting for 64.5% of cases. The majority of patients, 109 (50.2%) sustained blunt injuries and 67.7% of cases had multiple injuries. Fractures were the most common type of injury occurring in 39.1% of cases. Most of the patients, 143 (65.9%) were unresponsive to pain during the initial assessment. Table 1 summarizes the injury characteristics of the major trauma patients.

Table 5: Injury characteristics of major trauma patients

Injury characteristics	Numbers (n)	Percent (%)
Cause of injury		

Road traffic accident	140	64.5
Assault	58	26.7
Fall	10	4.6
Bullet injury	2	0.9
Others	7	3.2
Mechanism of injury		
Blunt injury	109	50.2
Penetrating injury	108	49.8
Anatomical site injured		
Head/neck	38	17.5
Thorax	13	6.0
Abdomen	12	5.5
Pelvis	2	0.9
Extremities	5	2.3
Multiple injuries	147	67.7
Type of injury		
Hematoma	37	17.6
Laceration	8	3.8
Cut wound	17	8.1
Penetrating wounds	66	31.4
Fractures	82	39.1
Level of consciousness		
Unresponsive to pain	143	65.9
Respond to pain	74	35.1

Treatment modalities and Outcomes

Among the 217 patients enrolled in the study, 151 (69.6%) were treated surgically and the remaining 66 (30.4%) had non-surgical treatment. Out of the 217 major trauma patients, 66 developed complications giving a complication rate of 36.5%. Of these, pressure sores were the most common complication accounting for 42.4% of cases (Figure 2). The overall median days of the length of hospital stay (LOS) was 15 days. Of the 217 patients with major trauma, 144 (66.4%) stayed longer (>14 days) in the hospital and the remaining 73 (33.6%) had short LOS (≤ 14 days). In this study, 73 patients died in-hospital giving a mortality rate of 33.6%.

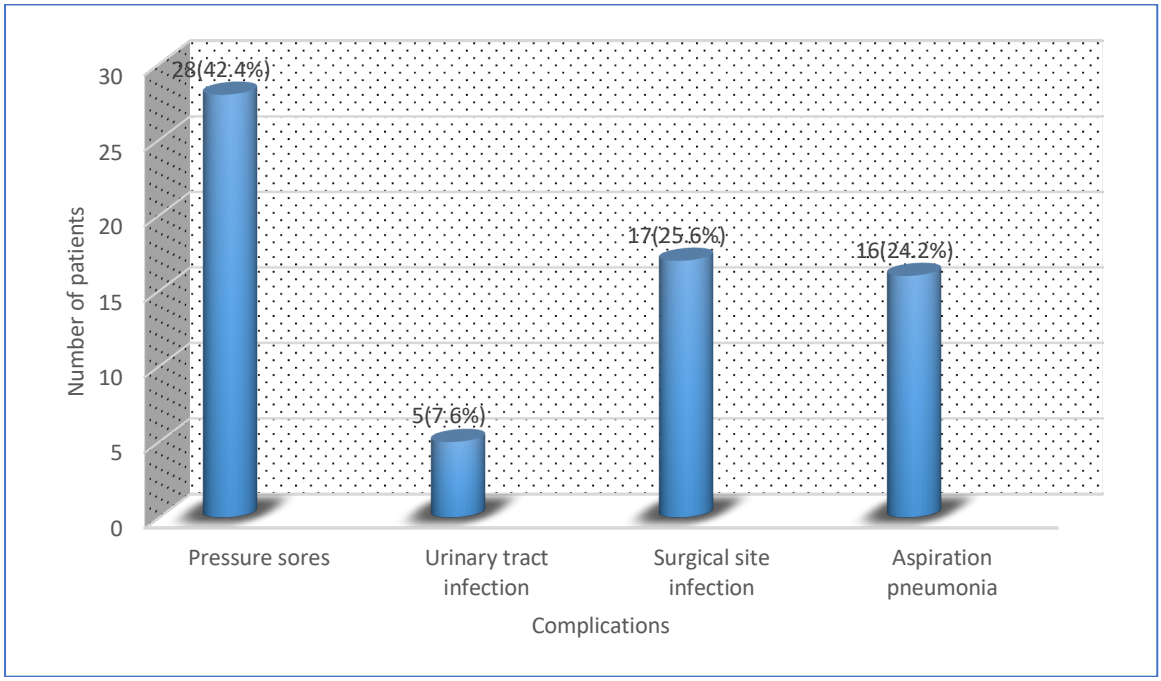


Figure 2: Complications among major trauma patients at BMC

Association between admission hyperglycemia and length of hospital stay among major trauma patients

There was no statistically significant association between admission hyperglycemia and length of hospital stay (p = 0.875) as shown in Table 3 below.

Table 3: Association between admission hyperglycemia and length of hospital stay among major trauma patients

Patients' characteristics	Length of hospital stay		Un-adjusted		Adjusted	
	Long	Short				
	n (%)	n (%)	OR[95%]	p-value	OR[95%]	p-value
	Median [IQR]	Median [IQR]				
Level of blood glucose						
≤ 11.1 *mmol/l*	74 (51.4)	37 (50.7)	1.0			
> 11.1 *mmol/l*	70 (48.6)	36 (49.3)	1.0[0.6 – 1.7]	0.922	1.0 [0.6-1.9]	0.875

Adjusted for age, sex, type of injury, and level of consciousness

Association between admission hyperglycemia and mortality among major trauma patients

Admission hyperglycemia had an increased mortality rate compared with patients with normal admission hyperglycemia (50.9% versus 17.1%).To control the possibility of the confounding effect of other variables on the effect of hyperglycemia on mortality, age, sex, type of injury, and level of consciousness were adjusted for hyperglycemia. There was a strong association between admission hyperglycemia and mortality rate ($p < 0.001$). Table 4 below summarizes the association between the admission of hyperglycemia and the mortality rate among major trauma patients.

Table 4: Association of admission hyperglycemia and mortality among major trauma patients

	Death		Un-adjusted	Adjusted
	Yes	No		

Patient Characteristics	n (%)	n (%)	OR[95% CI]	p-value	OR [95% CI]	p-value
Level of blood glucose (mmol/l)						
≤ 11.1	19(17.1)	92 (82.9)	1.0			
> 11.1	54 (50.9)	52 (49.1)	5.0 [2.7 – 9.4]	0.001	5.7[3.0 – 11.3]	< 0.001

Adjusted for age, sex, type of injury, and level of consciousness

Discussion

In this study, most of the trauma patients were young adults and showed a male preponderance. This finding is similar to the previous studies reported by others (Otieno *et al*., 2004; Solagbaru *et al*., 2006 Chalya *et al*., 2013). This male preponderance among young adult trauma patients may be attributed to the fact that males and young adults are more mobile looking for daily earnings to support their life as compared to females, and therefore exposes themselves to road-traffic accidents. In keeping with what was observed by Solagbaru *et al* (2006) in Nigeria, this study also found that the majority of trauma patients were unemployed. This observation could be attributed to the fact that unemployed people move around a lot more than the formally employed ones and hence predisposes them to road traffic accidents. These movements may include selling goods for petty trading which make them move from one place to another.

The length of hospital stay has been reported to be an important measure of morbidity among trauma patients (Chalya *et al*., 2010). Prolonged hospitalization is associated with an unacceptable burden on resources for health and undermines the productive capacity of the population through time lost during hospitalization and disability (Krug *et al.*, 2000). Prolonged LOS in our study is attributable to the presence of multiple injuries that recovered slowly example severe head injuries and a large number of patients with long bone fractures most of which are open and of the crushed type which took time to heal.

Among trauma patients, the association of outcome with hyperglycemia has been studied extensively in major trauma patients, in whom it portends a poorer prognosis (Gore *et al*., 2002; Yendamuri *et al*., 2003; Simsek *et al.,* 2014; Torbati *et al.,* 2015). This finding is attributed to the fact that trauma patients present with a hypermetabolic response to injury that is driven by an increase in the activity of the hypothalamus and sympathetic nervous system that leads to an increased release of ACTH, catecholamine, and glucagon. Stress carbohydrate metabolism in these patients is characterized by increased glycogenolysis and gluconeogenesis with an increased glucagon/insulin ratio (Chernow *et al*., 1982; Black *et al.,* 1990; Simsek *et al.,* 2014). These acute changes lead to hyperglycemia.

Previous studies have shown that both insulin and glucose can affect the systemic inflammatory response (Reinhold *et al.,* 1996; Rassias *et al.,* 1999). It has been found that high plasma glucose concentrations impair immune function by altering cytokine production from macrophages, diminishing lymphocyte proliferation, and depressing intracellular bacterial activity of leukocytes (Sung *et al.,* 2011). A reduction in chemotaxis, adherence to vascular endothelium, phagocytosis, and cell-mediated immunity has also been described (Reinhold *et al.,* 1996) the concentrations above 11.1mmol/l (200 mg/dl) have been shown to glycosylate immunoglobulin causing a significant reduction in opsonic activity (Mowlavi *et al.,* 2000). As a result, the presence of elevated blood glucose impedes normal host defenses against infection and impairs normal inflammatory response (Reinhold *et al.,* 1996). Response several cytokines are released, including

TNF-α, and IL-6. TNF contributes to insulin resistance and hyperglycemia secondly, inflammatory responses increase the level of corticotrophin-releasing hormone (CRH) and stimulate the release of adrenocorticotropic hormone (ACTH) from the anterior pituitary, which induce elevated levels of blood glucose (Reinhold *et al.,* 1996).

Several studies have demonstrated that admission hyperglycemia is an independent predictor of hospital length of stay among trauma patients (Bochicchio *et al.,* 2005; Mecott *et al.,* 2010; Marik & Bellomo., 2013). However, in our study, there was no statistically significant association between admission hyperglycemia and prolonged hospital stay. This finding is similar to a previous study which was done in Taiwan by Cheng *et al* (2017) which demonstrated no association between admission hyperglycemia and length of hospital stay. This observation could be attributed to the fact that most major trauma patients who died had a short hospital stay.

The association between admission hyperglycemia and mortality among major trauma patients has been largely studied (Black *et al.,* 1990; Reinhold *et al.,* 1996; Gore *et al.,* 2001; Laird *et al.,* 2004; Bochicchio *et al.,* 2005; Bosarge *et al.,* 2015). In agreement with other studies, this study has demonstrated a strong association between admission hyperglycemia and mortality (Black *et al.,* 1990; Reinhold *et al.,* 1996). Patients who died had significantly higher admission blood glucose levels than those who survived. This association provides another variable apart from hypoxia, bleeding, and hypotension that can be easily obtained early in the clinical course of traumatic patients that may allow the ability to triage these patients appropriately and optimize resources available for early intervention to minimize mortality caused by transient hyperglycemia. Failure to determine HbA_{1c} levels to exclude the confounding effects of preexisting diabetes mellitus in patients with major trauma was the major limitation of this study. However, despite this limitation, the study has provided local data that can be utilized in the establishment of management guidelines for patients with major trauma having transient hyperglycemia.

In conclusion, this study has demonstrated a strong association between admission hyperglycemia and mortality in patients with major trauma at BMC. Therefore, there is a need to institute regular monitoring of blood sugar levels among these patients and give appropriate treatment for those found with hyperglycemia. A further larger study should be done which will include an HbA_{1c} test to exclude the confounding effects of preexisting diabetes mellitus in patients with major trauma

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Assessment of Knowledge and Practices on Cord Care among postnatal mothers attending public health facilities in Morogoro Municipality

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Abstract

Background: The lives of newborns depend on the mother's knowledge of health care and practices about cord care. It is because the cord stump is the major means of entry for infections after birth. Clean cord care practices help to prevent infections and hence reduce neonatal morbidity and mortality. In this study, we assessed knowledge and practices on cord care among postnatal mothers attending public health facilities in Morogoro municipal.

Methods: It was a cross-sectional study that used a quantitative approach that involved 251 postnatal mothers attending a postnatal clinic during the study time. Data were analyzed using Statistical Package for Social Sciences software version 21.0. Both descriptive and inferential analyses were done whereby logistic regression and the chi-square test to determine the association between dependent and independent variables.

Results: Out of 251 postnatal mothers (95.2%) got information about postnatal checkups at the health facility. Also, 132(52.6%) had adequate knowledge and 47(4%) had inadequate knowledge. The majority (85.7%) stated that the cord stump should be handled with a clean dressing/cover and 80.1% of them reported that the cord stump should not be wet/soiled. Of all factors assessed only education level showed a significant relationship with the knowledge of cord care; the higher the education level, the higher the knowledge of cord care. Mothers who at least attended primary, secondary or higher education more often had adequate knowledge about cord care as compared to mothers with no formal education**.**

Conclusion: The level of knowledge among the study participants about cord care was moderately satisfactory. This study identified that level of education was an independent predictor of their level of knowledge about cord care. Mentorship session for nurses and midwives about postnatal care services is hence needed and also mothers need competency-based training from nurses and midwives about cord care.

Keywords: Knowledge, Practice, Cord care, Cord stamp, postnatal mothers, public health facilities.

Background

The first week of life is very critical because most neonatal deaths occur at this age. Most of these neonatal deaths occur due to unacceptable health care practices, unhygienic practices, taboos, and superstitions associated with cord care that contribute to neonatal cord infection (Efa BW et al., 2020). Newborn health and survival depend on the precaution given to newborn care and are a significant component in reducing child mortality. The lives of newborns send on mothers' knowledge of health care and practices especially cord care. Global estimates show that about 7,000 neonatal deaths occur every day in the first week of life and 2.5 million children die in the first month of life (Structures MB et al., 2015).

In most African countries including Tanzania, most postnatal mothers lack regular attendance to health facilities (Mohan D et al., 2015) this result in low knowledge of good cord

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care practices (Mildred E et al., 2015). Good cord care practices include; cutting the umbilical cord with a sterile playing tie with sterile materials, don't apply any substance on the cord, and keeping the cord stump clean and dry. The cord stump will dry and shrink if exposed to air without any dressing, binding, or bandages (Efa BW et al., 2020). It remains clean when it is protected with clean clothes and should be kept away from contamination such as urine and feces soiling. Local practices of putting various substances on the cord stump whether in health facilities or homes should be carefully examined and discouraged. Poor or unhygienic cord-cutting and tying practices have been identified as risk factors for neonatal infection (J. Kayombo E et al 2013).

The National Bureau of Statistics of Tanzania estimates that 25 neonates die out of 1000 live birth each year and the neonatal mortality rate in the Morogoro region is estimated to be 8.3/1000 live births. (TDHS 201-16). However, about 75% of newborn deaths could be avoided simply by the use of sterile blades for the umbilical cord and the use of clean drapes for wrapping the baby to avoid umbilical cord infections and allow maintain the newborn hygiene (Nigatu SG et al., 2015). With these alarming rates of neonatal deaths newborn cord, care has been identified as a proven intervention that saves newborn lives (Osuchukwu NP et al., 2019).

Material and Methods

Study design

This was a descriptive cross-sectional study where data was collected at one point in time from postnatal mothers at Mafiga and Nunge health facilities.

Setting

The study was conducted at Morogoro municipal which is among seven administrative districts in the Morogoro region. The study involved two public health facilities Mafiga and Nunge out of five public health facilities. These two were purposively selected based on a high number of clients attending the clinic.

Study participants and sampling procedures

The study population involved postnatal mothers within 42 days post-delivery who attended Mafiga and Nunge postnatal clinics during the data collection process. A total of 251 postnatal mothers were recruited from postnatal clinics by using a simple random sampling method. Participants selected a piece of paper inside. Those who selected pieces of paper written YES were included in the study and those who selected NO were not included in the study. The sampling process continued until the required sample size was reached.

Data collection instruments

The study used a semi-structured questionnaire with both open and closed questions on the demographic information, knowledge of cord care, and practice of cord care. The questionnaire was prepared in Kiswahili the language that is spoken by the majority for easy understanding. After consenting and knowing the study intention, mothers were asked to fill in the questionnaires with assistance from research assistants.

Data processing and analysis

Data that was generated from the respondents was daily checked and cleared to ensure the quality and consistency of data. Also, all questionnaires were coded by numbers to maintain the anonymity of participants. Data analysis was conducted using Statistical Package for Social Sciences (SPSS) version 21. The analysis involved descriptive statistics to describe the sample population and relevant proportions, in the frequency table and cross-tabulations between independent and dependent variables. A scoring system was used to analyze responses to closed-ended questions on knowledge: 1 = Correct response (consistent with WHO essential newborn care guidelines); 0 = Incorrect response (inconsistent with WHO essential newborn care guidelines). Any mother who did not know the answer was considered to have an incorrect response.

The responses to the open-ended questions were summarized and inferential statistics was carried out whereby the chi-square test was calculated to show the association between study variables. Continuous variables were represented by mean and standard deviations and categorical data by whole numbers and percentages. We did logistic regression to determine factors associated with knowledge of cord care. A p-value of ≤ 0.05 was considered statistically significant.

Results

Social demographic characteristics of study participants

A total of 251 participants were recruited for this study. Their ages ranged from 13 to 44 years with a median age of 27 years (IQR 23-30 years). Most participants 152(60.6%) belonged to the age group 20-29 years old. The majority 202(80.1%) of respondents were married; 128(51.0%) had primary education and 88(35.1%) had secondary education. The majority3 (33.1%) had two children (Table 1)

Table 1. Socio-demographic characteristics of study participants (n=251).

Variables	Frequency	Percent
Age (years)		
10-19	**22**	**8.8**
20-29	**152**	**60.6**
30-39	**75**	**29.8**
40+	**2**	**0.8**
Median age (Interquartile range (IQR))	**27 (23-30)**	
Marital status		
Single	40	15.9
Married	201	80.1
Separated	8	3.2
Widow	2	0.8
Level of education		
No formal education	17	6.8
Primary	128	51.0
Secondary	88	35.1
Higher education	18	7.1
Occupation		
Employed	22	8.8
Self-employed	50	19.9
Businesswoman	50	19.9
Peasant	49	19.5
Housewife	80	31.9
Parity		
1	61	24.3
2	83	33.1
3	55	21.9
≥ 4	52	20.7

Relationship between knowledge of mothers on postnatal care and their responses on how often a mother should go for a postnatal checkup.

There is a strong relationship between knowledge of mothers on how often a mother should attend the clinic for a postnatal checkup and general knowledge of mothers on postnatal care. Generally, a total of 132(52.6%) mothers had adequate knowledge (Table 2).

Table 2: Relationship between knowledge of postnatal care and their responses on how often they should go for a postnatal checkup (n=251)

Responses of mothers on how often they should go for postnatal checkups	Knowledge of mothers on cord care	
	Adequate (n)	Inadequate(n)
Once	18(69.2)	8(30.8)
Twice	23(60.5)	15(39.5)
3 times	27(73.0)	10(27.0)
4 times	20(58.8)	14(41.2)
Don't know	53(45.7)	63(54.3)
Total	**132(52.6)**	**119(47.4)**

Source of information on the postnatal checkup

Almost 95.2% of postnatal mothers who participated in the study reported that they got information about a postnatal checkup from a health facility; 2.0% from social media, 0.8% from Church/Mosque, and 1.2% from colleagues as shown in Figure 1 below.

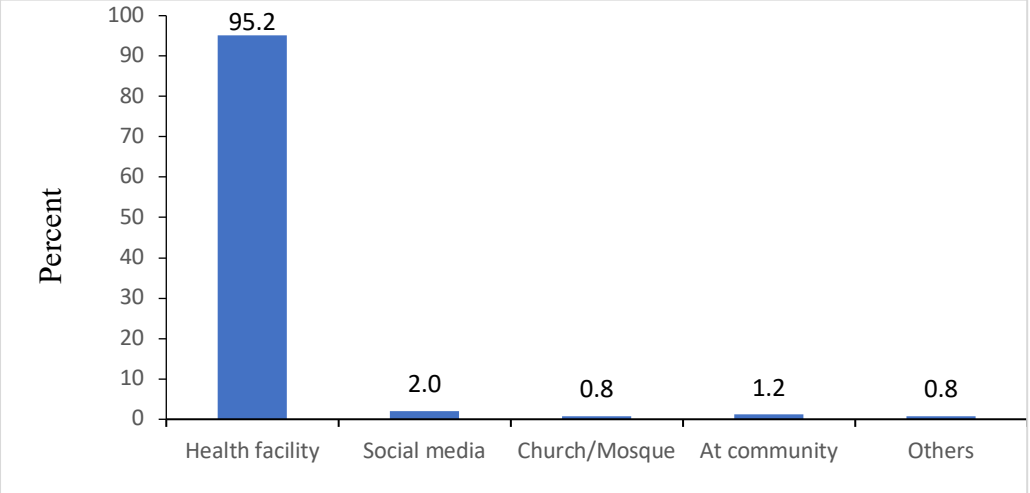

Figure 1: Response of mothers regarding the source of information on the postnatal checkups

Mothers' knowledge of danger signs to the newborn related to cord care would alert them to seek medical advice

Table 3 below indicates that more than half of 162(64.5%) of postnatal mothers knew that high temperature is one of the danger signs to newborn babies that would make them seek medical advice, followed by bleeding from the cord stump 144(57.4%) and 6(2.4%) of the respondents said they don't know when they should seek for medical advice.

Table 3: Mothers' knowledge about when to seek medical advice for issues related to cord care (n=251)

When to seek medical advice	Frequency	Percent
Heavy crying	39	15.5
High temperature	162	64.5
Bleeding of the cord	144	57.4

Don't know	6	2.4

Note. *The number and percent do not add up to 251 and 100% as this was a multiple-response question*

How should cord stump be handled after cutting and how should it be kept

The findings show that the majority 215(85.7%) of postnatal mothers stated cord stump should be handled with a clean dressing/cover and 201(80.1%) of them reported that the cord stump should not be wet/soiled as detailed in table 4 below:

Table 4: Response of mothers on how to handle cord stump (n=251)

Variables	Frequency	Percent
Handling of cord stump after cutting		
With clean dressing/cover	215	85.6
Without dressing	11	4.4
Don't know	25	10.0
The cord stump should be wet/soiled		
Yes	8	3.2
No	201	80.1
Don't know	42	16.7

Association between social-demographic characteristics and knowledge of cord care

All mothers recruited were asked five questions related to cord care to judge their knowledge about cord care. The questions were rated and those who answered 4 questions and or above correctly were regarded as having adequate knowledge and those who answered below 4 questions correctly were regarded as having inadequate knowledge. Out of all postnatal mothers who were recruited 132(52.6%) had adequate knowledge and 119(47.4%) had inadequate knowledge.

We did logistic regression to assess socio-demographic factors associated with knowledge of mothers on cord care. Of all factors assessed education level and several parities showed a significant relationship with knowledge on cord care while others were not statistically significant. Mothers who at least attended primary and secondary education were three times more likely to have adequate knowledge of cord care compared to those with no formal education OR 3.19(95%CI 1.06-9.57) p-value=0.04 and 3.16(95%CI 1.02-9.73) p-value=0.05 respectively. Likewise, those with higher education had even higher odds of adequate knowledge on cord care six times compared to those with no formal education OR 6.24(95%CI 1.44-27.06) p-value=0.01. Women who had given birth to four or more children were 3 times more likely to have adequate knowledge of cord care as compared to women who had given birth to a single child OR 3.11(95%CI 1.42-6.81) p-value 0.01. For more details see table 5 below:

Table 5. Association between socio-demographic characteristics and knowledge on cord care among postnatal mothers (n=251)

Variable	Cord care			
	Adequate knowledge (%)	Inadequate knowledge (%)	Odds ratio (95% CI)	P-value
Total	**132(52.6) (95%CI: 49.8%-62.4%)**	**119 (47.4)**		
Age (years)				
10-19	11(50.0)	11(50.0)	Ref	

20-29	77(50.7)	75(49.3)	1.03(0.42-2.51)	0.95
30-39	44(58.7)	31(41.3)	1.42(0.55-3.68)	0.47
40+	1(50.0)	1(50.0)	1.0(0.06-18.08)	1.00
Marital status				
Single	19(47.5)	21(52.5)	Ref	
Married	116(57.7)	85(42.3)	1.51(0.73-2.98)	0.24
Separated	5(62.5)	3(37.5)	1.84(0.39-8.77)	0.44
Widow	1(50.0)	1(50.0)	1.11(0.06-18.93)	0.95
Education level				
No formal education	5(29.4)	12(70.6)	Ref	
Primary	73(57.0)	55(42.10)	3.19(1.06-9.57)	0.04
Secondary	50(56.8)	38(43.2)	3.16(1.02-9.73)	0.05
Higher education	13(72.2)	5(27.8)	6.24(1.44-27.06)	0.01
Occupation				
Employed	15(68.2)	7(31.8)	Ref	
Self-employed	29(58.0)	21(42.0)	0.64(0.22-1.86)	0.42
Businesswoman	24(48.0)	26(52.0)	0.43(0.15-1.24)	0.12
Peasant	28(57.1)	21(42.9)	0.62(0.22-1.80)	0.38
Housewife	45(56.3)	35(4.8)	0.60(0.22-1.63)	0.32
Number of parities				
1	27(44.3)	34(55.7)	Ref	
2	38(45.8)	45(54.2)	1.06(0.55-2.07)	0.86
3	31(56.4)	24(43.6)	1.63(0.78-3.39)	0.19
≥4	37(71.2)	15(28.8)	3.11(1.42-6.81)	0.01

Practices of postnatal mothers on cord care

Participants were asked if they applied anything to the baby's cord stump. The majority (88.1%) of postnatal mothers said that they did not apply any material to the cord stump while (11.9%) said they applied something to the cord stump. See figure 2 below:

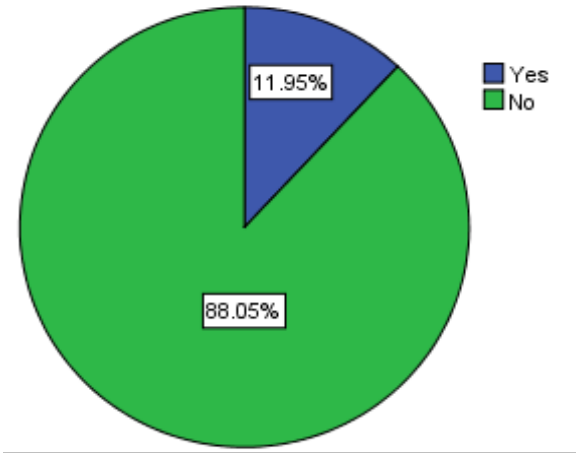

Figure 2: Responses of postnatal mothers on substances applied on baby's cord stump.

Substances applied on cord stump

Of the 11.9% of postnatal mothers who reported that they were applying some materials on cord stump, 33.3% of them were applying spirit, 24.2% coconut oil, 40.0% baby powder with ingredients

of blended talc and fragrance, 26.7% cow dung while others (0.1%) applied medicines from the pharmacy and so on. For more detail see Table 6 below:

Table 6: Response of mothers to substances applied to baby's cord stump (n=30)

Item	Frequency	Percent	Percent of all babies
Things applied on cord stump			
Spirit	10	33.3	4.0
Coconut oil	7	24.2	2.8
Talc Powder	12	40.0	4.8
Cow dung	8	26.7	3.2
Others	3	0.1	1.2

Note: *The number and percent do not add up to 30 and 100% as this was a multiple-response question*

Practices on the care of cord stump and proper place for medical advice when cord stump bleeds

The majority (76.5%) of postnatal mothers who participated in the study reported keeping the cord stump dry and clean all the time and (98.4%) of them reported that, when the cord stump bleeds, they will be going to a health facility for medical advice. On the frequency of cord cleaning, 155(45.8%) of postnatal mothers stated that they don't know the frequency of cord cleaning and 60.2% of them stated that they don't know how to clean the cord. For more detail see Table 7 below:

Table 7: Response of respondents on practice related to cord care (n=251)

Question and responses	Frequency	Percent
What did you do when the cord stump bleeds or have unpleasant discharge		
Go to the health facility	247	98.4
Home medication	3	1.2
Wait until it heals by itself	1	0.4
What do you do to keep the cord clean and safe*		
Reporting of cord bleeding	72	28.7
Keeping it dry and clean	192	76.5
What is the frequency of cord cleaning		
Once-daily	38	15.1
Morning, afternoon, evening	53	21.2
After each nappy is changed	45	17.9
Don't know	115	45.8
How to clean the cord		
Clean cord base before cord stump	19	7.5
Clean cord stump only	5	2.0
Clean surrounding skin only	53	21.1
Clean the material used to tie the cord	23	9.2
Don't know	151	60.2

Note: *******The number and percent do not add up to 251 and 100% respectively as this was a multiple-response question.*

Discussion

In this study, the results show that mothers with adequate knowledge about cord care were 52.6% (95%CI: 49.8%, 62.4%). Mothers who are married, separated, and widowed were 51%, 84%, and 11% respectively more likely to have adequate knowledge of cord care compared to single mothers. The reason for this difference may be that majority of married women and those with at least have had a child may have prior experience of issues related to cord care than those who are single.

We also noticed that level of education and parity were significant association with knowledge of cord care among post-natal women. Women who attended primary school and secondary school were three times more likely to have adequate knowledge of cord care compared to those with no formal education. Also, those who attended higher education were even having higher odds of adequate knowledge by six times compared to those with no formal education. Similar findings were reported in Ghana by Nutor and others in 2016 that higher education was more associated with best practices of cord care (Osuchukwu NP et al., 2019). The reason for this difference may be due to most educated women adhering to what they have been taught in both antenatal, and postnatal clinics and learning from other sources than those with no formal education. Women who had given birth to four or more children were 3 times more likely to have adequate knowledge of cord care as compared to women with had given birth to a single child OR 3.11(95%CI 1.42-6.81) p-value 0.01.

In this study age, marital status, occupation, and parity of the mother were not significantly associated with knowledge about cord care. This is contrary to studies done in Kenya by Amolo and others in 2017 and Ethiopia by Behre and others in 2017 (Nutor JJ et al. 2016 and Tutor JJ et al., 2016). The reason for this difference may be due to the case that health care providers deliver or do not deliver correct health information or counseling about cord care regardless of age, parity, and occupation of the mother.

We also noticed that postnatal mothers generally knew that cord stump should be handled with care and should always be kept dry and clean. This was observed in 80.1% of mothers among all who responded to the question on how the cord stump should be handled. Similarly to this, the study done in Ethiopia reported that cord stump should be kept dry and clean as reported by (59.0%) of the participants (Efa BW et al., 2020). The reason was that dry cord care quickens umbilical cord separation.

In this study also about 82.1% of women knew neonatal danger signs that would alert immediate postnatal care and or seeking medical advice. Of those women who participated 64.5% knew that they would seek medical advice if the child had a high temperature and 57.4% once they see bleeding from the cord. There were few mothers (2.4%) who said they don't know what would alert them to seek medical service on issues related to cord care. The reason for this may be due to not adhering to attending antenatal care visits to some women where they can be taught about all issues related to newborn care before delivery. These findings agree with findings from the study done in Ethiopia where more than 79.8% of participants mentioned at least one key danger sign (Mersha A et al., 2017).

This study indicated that almost (95.2%) of postnatal mothers who participated got information about postnatal checkups at the health facility, 2.0% through media and 1.2% heard about it from the community. Having information about postnatal check-ups has a greater impact on a mother's knowledge of cord care. As most women said they got information about postnatal check-ups at the health facility this calls for improved health education given to these women by the health care workers. Also, this calls for recognizing the importance of community health education where the majority can be met and brought to attention about all issues related to maternal and child health. Furthermore, none of the postnatal mothers reported that they got information from the traditional birth attendants. The findings are similar to the study done in Nigeria whereby the commonest source of information on cord care as nurses, as reported by (44.8%) of the participants during health talks at the antenatal clinic (Mersha A et al, 2012).

We also noticed that 46.2% of women do not know how often they should attend the postnatal clinic for a check-up. Results also concluded that there's strong evidence to suggest a real association between knowing how often she should go for a postnatal check-up and knowledge about cord care. Those who said that you should at least attend three to four times for a postnatal check-up had more adequate knowledge of cord care compared to those who said something else.

Study limitation

The limitation of this study was that the study population was recruited from a limited geographical area and therefore, the results cannot be generalized to other regions in Tanzania. However, these findings may represent other contexts with similar socio-economic characteristics. Also, the study findings are not in the position to show cause and effect relationships because the study design was cross-sectional.

Conclusion

This study revealed that mothers' level of knowledge about cord care is moderate though more effort is needed to provide awareness to mothers on the importance of the information provided at health care facilities which are effective and evidence-based interventions. Also, on part of practice, respondents do not know the frequency of cord cleaning and how to clean the cord. It is, therefore opined that this study will provide the foundation for further studies to structuring appropriate interventions to address some of the unbeneficial cord care practices. In general, this study identified that level of education and parity was an independent predictor of a mother's knowledge about cord care. Based on the above findings, we would like to provide the following recommendations

Ethical consideration

This study was approved by MUHAS ethical committee; certificate No. DA.287/298/01A.

Competing interests

The authors declare that they have no competing interests in the study.

Author's contributions

SM conceived, designed, and conducted the study. SM and MN analyzed the data and wrote the manuscript. AO supervised the whole study process. All authors read and approved the final manuscript.

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