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Contents

Mental Health of People in State Quarantine during COVID-19 Situation in Thailand

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Abstract

When the COVID-19 outbreak spread across the globe, Thailand was the first country to report a COVID patient outside of China. We conducted a cross-sectional descriptive study to examine the mental health condition and the risk factors associated with the mental health problems of people in state quarantine. Our study sample included 4,069 people who were in state quarantine in the eastern region of Thailand. We administered a stress assessment test, a depression screening questionnaire, a suicidal risks screening tool and a COVID-19 anxiety screening scale, which were developed by the Department of Mental Health, Thailand. We found that most people in state quarantine reported a moderate level of COVID-19 anxiety, a mild level of stress, and no current risk of suicide. The risk factors associated with stress were female gender (OR = 2.290, $p < 0.001$, 95% CI [1.687, 3.109]) and having chronic diseases (OR = 2.443, $p < 0.001$, 95%CI [1.720, 3.470]). The factor associated with depression was female gender (OR = 1.380, $p < 0.001$, 95%CI [1.201, 1.586]). The factors associated with risks for suicide were female gender (OR = 2.059, $p < 0.001$, 95%CI [1.553, 2.729]) and having chronic diseases (OR = 2.128, $p < 0.001$, 95%CI [1.510, 2.998]). The factors associated with COVID-19 anxiety were female gender (OR = 1.469, $p < 0.001$, 95%CI [1.294, 1.669]) and having chronic diseases (OR = 1.329, $p = 0.011$, 95%CI [1.066, 1.657]). A system to screen for mental health problems and rapid assistance offered to people in state quarantine who are at risk of mental health problems are recommended to reduce the severity of the problems.

Keywords: anxiety, COVID- 19, depression, state quarantine, stress, suicidal risk

1. Introduction

Due to the situation caused by COVID-19, which began in China then spread worldwide with increasing severity, the WHO declared the COVID-19 outbreak a pandemic (World Health Organization [WHO], 2020). COVID-19 has had tremendous impact on the health and living conditions of people in every region of the world. Thailand was the first country to report COVID patients outside of China on January 13, 2020 (WHO, 2020). The Thai government announced a general state of emergency nationwide on March 26, 2020 (Royal Thai Government Gazette [RTGG], 2020a). Thailand rapidly developed policies and established the Center for COVID-19 Situation Administration (CCSA) to perform duties in accordance with the Emergency Decree on Public Administration in Emergency Situations B.E. 2548. The CCSA launched a public relations campaign to disseminate accurate and factual information and news in order to enhance good understanding between the government and the public (Royal Thai Government Gazette [RTGG], 2020b). The CCSA required people returning from abroad to be quarantined for 14 days at places designated by the government to prevent infected persons and vulnerable persons from spreading the disease to others since April 3, 2020.

Although successful quarantine can prevent the spread of the disease, state quarantine potentially impacted the quarantined persons, especially with regards to their mental health. Quarantine is mostly perceived as an unpleasant experience for people who undergo it. It may cause negative psychological effects, including post-traumatic stress symptoms, confusion and anger (Brooks et al., 2020). A study that was conducted with persons older than 18 years in Wuhan, China during the COVID-19 outbreak and national lockdown measures

found that 48.3%, 22.6%, and 19.4% of study participants experienced depression, anxiety, and depression together with anxiety, respectively (Gao et al., 2020). In addition, another study was conducted on the factors influencing mental health problems in residents of 31 cities in China, which employed household quarantine measures. According to this study, the most frequently encountered mental health problems were depression and stress. The factors influencing the onset of mental health problems were perceived disease severity and self-control (Li, Yang, Dou, & Cheung, 2020).

In Thailand, the Department of Mental Health closely followed the people's mental health condition in the ongoing COVID-19 crisis. Nationwide, the reported suicide rate increased from 6.64 per 100,000 population in 2019 to 7.37 per 100,000 population in 2020 (Department of Mental Health Thailand [DMH], 2020$_a$). According to a nationwide cross-sectional survey in Thailand, depression, anxiety, stress, and insomnia were significant mental health problems found in Thai people during COVID-19 crisis. These mental health problems were correlated with an exposure to COVID-19 information. The participants who exposed to information for 3 or more hours per day had a higher risk of developing symptoms of depression, anxiety, and insomnia than those exposed to information for less than 1 hour per day. (Mongkhon et al., 2021). Stress and depression were significant psychological impacts on healthcare workers during COVID-19 outbreak. Sangsirilak and Sangsirilak (2020) found that a majority of healthcare workers in disease control department and cohort ward reported a moderate level of stress and depression. To our knowledge, no previous study has reported the mental health condition of people in state quarantine in Thailand. The psychosocial and emotional reaction to the COVID-19 pandemic reported in the general population may be different from persons in state quarantine. Therefore, we conducted a cross-sectional descriptive study to examine the mental health condition of persons placed in state quarantine. We explored relationships between mental health problems and personal factors, including age, gender, and having chronic illnesses of persons placed in state quarantine. Results from our study can help design the proper psychosocial intervention to ease mental health problems of people in state quarantine and guide policy makers who create quarantine management plans.

2. Methods

2.1 Study Design and Setting

The study was a cross-sectional descriptive study. The setting of study was the Health Region 6 of Thailand, which consists of eight provinces in eastern region of Thailand. The government assigned Health Region 6 to set up places to quarantine people from Suvarnabhumi and Utapao airports. During the first wave of COVID-19 outbreak in Thailand (March 26, 2020 to July 8, 2020), all persons returning from aboard were required to quarantine in designated places. The Health Region 6 selected 17 qualified hotels in the area to be places for state quarantines. The criteria for selecting the hotels composed of five dimensions, including building structure, staffing, essential material provision, medical supplies, and environment management. The building structure required a private room with separate air condition system and CCTV (Closed-circuit television) for each person. The staffs required a training course for every person involved. Essential material provision included a computer with free wifi, a flashlight, a kettle, towels, bedsheet, food and drinking water. Medical supplies included alcohol gel, basic medicines, gloves and trash cans. Environment management included a standard waste and water management system, and also making community surrounded understand and accept the hotel's quarantine.

2.2 Participants

The participants were 4,082 persons who placed in those 17 hotels designated for state COVID-19 quarantine from 16 April to 30 June 2020. There were 4,069 participants provided written informed consent before participating in the study.

2.3 Research Instruments

We administered five questionnaires, which we summarize as follows:

1)   A demographic data questionnaire was developed by researchers to assess personal data, covering gender, age, a history of having chronic disease, domicile, and the country in which the quarantined person resided prior to return to Thailand.

2)   A stress self-assessment test developed by Silpakit (2008). It consisted of five questions asking the participants to rate their feelings over the past two weeks. The four-rating scale ranged from not at all (0) to most of time (3). The scores were interpreted as follow:

0-4 indicated mild stress or regular stress in daily life.

5-7 indicated moderate stress or stress during a crisis or disaster, in which a person needed to make preparations to

deal with problems. This stress level is still considered normal, and it can cause a person to have enthusiasm in confronting problems.

8-9 indicated severe stress or stress in a crisis or disaster in which temporary severe responses might occur, and this stress normally decreases after the situation has ended.

10-15 indicated the most severe stress or stress so severe that physical symptoms occur, including weakness and vulnerability to illness. This stress also influences the mental state and might lead to anxiety, depression, or risk of suicide. Thus, treatment is required.

The cut-off to indicate a level of stress that need a concern from health care team was five or more. The reliability of this questionnaire examined using Cronbach alpha coefficient was 0.80

3)   A depression screening questionnaire developed by Chantakarn, Pukrittayakamee and Saisavoey (2014). It consisted of two questions (2Q) asking the participants to rate their feelings based on "Yes" or "No" options. If "No" was answered for both questions, then the person assessed did not have depression. If "Yes" was answered for either one or both questions, then the person assessed had depression. The psychometric properties of this questionnaire showed a sensitivity of 73%, specificity of 90%, positive predictive value of 59%, negative predictive value of 94%, likelihood ratio of positive result of 7.3, and likelihood ratio of negative result of 0.3 (Chantakarn et al., 2014).

4)   A suicidal risk screening tool developed by the Department of Mental Health (DMH, 2020b). It consisted of eight questions asking the participants check their thoughts and behavior using "Yes" or "No" answers. The score was given differently to each question with a minimum score of 1 and maximum score of 10. The scores were summed and interpreted as follow:

0 indicated no risk of suicide at the present.

1-8 indicated low risk of suicide at the present.

9-16 indicated moderate risk of suicide at the present.

More than 17 indicated high risk of suicide at the present.

The score of one or more was a cut-off for risk of suicide that health care team should be concern. The reliability of this questionnaire examined using Cronbach alpha coefficient was 0.65

5)   A COVID-19 anxiety screening scale developed by the Department of Mental Health (DMH, 2020b). It consisted of five questions asking the participants to rate their feelings over the past two weeks on three rating scale ranging from not at all (1) to most of time (3). The scores were interpreted as follows:

5–6 indicated low anxiety.

7–11 indicated moderate anxiety.

12–15 indicated high anxiety.

The cut-off to indicate a level of anxiety that need a concern from health care team was seven or more. The reliability of this questionnaire examined using Cronbach alpha coefficient was 0.70.

2.4 Ethical Considerations

We applied for ethical approval on research involving human subjects and the study was approved by the Institutional Review Board on Research Involving Human Subjects of the Baromarajonani College of Nursing, Chonburi, with No. BNC REC 16/2563. We explained the purpose of the study and process of collecting data to participants. We received informed consent from participants who were willing to participate in the study. The participants had a right to refuse and still received care for persons in state quarantine as declared in a protocol.

2.5 Data Collection

We combined all five instruments into an online questionnaire using the Google Forms. The online questionnaire was distributed to all participants individually through "LINE" application. The participants could complete the questionnaire at their own convenience starting on day 3 of quarantine. Most of participants (95.65%) completed the questionnaire in the day three. The data were collected from April 16, 2020 to June 30, 2020. The researchers verified the correctness and completeness of data after the end of data collection. Next, the data were analyzed.

2.6 Data Analysis

We calculated descriptive statistics, including frequencies, percentages, mean and standard deviations, for demographic variables, stress, depression, suicidal risk, and anxiety levels.

Since we concerned about persons who had mental health problem or not, we categorized participants into two groups for each symptom using its cut-off. We analyzed the relationship between various demographic factors and having stress, depression, suicidal risk, and anxiety using binary logistic regression. The effect estimates were presented as odds ratio along with their corresponding 95% confidence intervals (CIs).

3. Results

3.1 Demographic Data

The study population consisted of 4,069 people. Most of the subjects (56.60%) were female. In addition, 51.2% of the subjects were 30 years and over with mean age at 32.82 years. Only 9% of the subjects had chronic diseases, which included allergies, gastritis, hypertension, asthma, and diabetes. The domicile of most subjects was the northeastern region of Thailand (34.79%), followed by the central region of Thailand (17.91%) and Bangkok (17.31%), respectively. The largest percentages of subjects were returning from Taiwan (15.73%), the United States (12.16%), and Australia (8.09%), respectively.

3.2 Mental Health Condition of People in State Quarantine

The mental health condition in the study was assessed through levels of stress and anxiety related to COVID-19, depressive symptoms, and risks of suicide as shown in Table 1

Table 1. Numbers, Percentages, Means, Standard Deviations, and Level of Mental Health Condition of People (N= 4,069) in State Quarantine

Mental Health Condition	N	Percentage (%)	Mean Score (SD)	Interpretation of Mean Score
Stress				
Mild Stress	3169	77.9		
Moderate Stress	669	16.4	2.82(2.61)	Mild
Severe Stress	131	3.2		
Most Severe Stress	100	2.5		
Depression				
No	2885	70.9		
Yes	1184	29.1		
Risk of Suicide				
No Current Risks	3810	93.6		
Low Risk	225	5.5	0.37(2.17)	No risk
Moderate Risk	18	0.4		
High Risk	16	0.4		
Coronavirus-Related Anxiety				
Low Anxiety	1619	39.8		
Moderate Anxiety	2368	58.2	7.24(1.81)	Moderate
High Anxiety	82	2.0		

According to Table 1, most participants (77.9%) had mild stress with a mean score of 2.82. Although the majority of participants (70.9%) reported no depression, we are concerned about the 29.1% of participants who reported symptoms of depression. The mean suicidal risk score indicated no risks for suicide among participants overall. However, the mean score of coronavirus-related anxiety indicated a moderate level of anxiety among participants.

3.3 Relationships between Demographic Variables and Mental Health Conditions

The binary logistic regression was conducted to analyze a probability of having mental health problems, including stress, depression, suicidal risk and anxiety (Table 2). We reported the odd ratio for the probability of having mental health problems (Table 3).

Table 2. Relationships between Demographic Variables and Mental Health Conditions Using Binary Logistic Regression

Mental Health Outcome/ Demographic variable	B	S.E	Wald	EXP(B)	p-value
Stress					
Gender	-.828	.158	28.193	.437	<0.001
Age	-.452	.140	10.442	.636	<0.001
Having chronic diseases	-.893	.179	24.891	.409	<0.001
R^2 = .045, Constant = -1.550					
Depression					
Gender	-.322	.071	20.619	.724	<0.001
Age	-.204	.070	8.609	.815	<0.001
Having chronic diseases	-.133	.115	1.319	.876	.251
R^2 = .011, Constant = -.538					
Risk of suicide					
Gender	-.722	.144	25.241	.486	<0.001
Age	-.253	.131	3.740	.777	.053
Having chronic diseases	-.755	.175	18.615	.470	<0.001
R^2 = .032, Constant = -1.655					
Coronavirus-Related Anxiety					
Gender	-.385	.065	35.195	.681	<0.001
Age	-.158	.065	5.967	.854	.015
Having chronic diseases	-.285	.113	6.394	.752	.011
R^2 = .016, Constant = -.923					

According to Table 2, being female, older age and having chronic diseases were significant demographic variables that when combined were able to explained 4.5% of the variance in stress, and 1.6% of the variance in anxiety. Only being female and older age were significant demographic variables that explained variance of depression at 1.1%. Being female and having chronic diseases were combined to explain 3.2% of the variance in suicidal risk.

Table 3. Relationship between Demographic Data and Mental Health Condition

Mental Health/ Demographic data	OR	95% CI		p-value
		LL	UL	
Stress				
Gender				
Female	2.290	1.687	3.109	0.000
Male				
Age				
Under 30 Years	0.636	0.484	0.837	0.001
30 Years & Up				
Chronic Disease				
Yes	2.443	1.720	3.470	0.000
No				

Mental Health/ Demographic data	OR	95% CI		p-value
		LL	UL	
Depression				
Gender				
Female	1.380	1.201	1.586	0.000
Male				
Age				
Under 30 Years	0.815	0.711	0.934	0.003
30 Years & Up				
Chronic Disease				
Yes	1.142	0.911	1.432	0.251
No				
Risk of Suicide				
Gender				
Female	2.059	1.553	2.729	.000
Male				
Age				
Under 30 Years	.777	.601	1.003	.053
30 Years & Up				
Chronic Disease				
Yes	2.128	1.510	2.998	.000
No				
Coronavirus-Related Anxiety				
Gender				
Female	1.469	1.294	1.669	.000
Male				
Age				
Under 30 Years	.854	.752	.969	.015
30 Years & Up				
Chronic Disease				
Yes	1.329	1.066	1.657	.011
No				

Table 3 showed that the likelihood of stress onset depended on gender and presence of chronic disease. In addition, females were more likely to experience greater stress when compared with males (OR = 2.290, $p < .01$, 95%CI [1.687, 3.109]), and stress was also likely to be higher in the presence of chronic disease when compared with absence of chronic disease (OR = 2.443 $p < .01$, 95%CI [1.720, 3.470]). Depression depended on gender, by which females were more likely to experience greater depression when compared with males (OR = 1.380, $p < .01$, 95%CI [1.201, 1.586]). Risk of suicide depended on gender and the presence of chronic disease, by which females were more likely to have greater risk of suicide when compared with males (OR = 2.059 $p < .01$, 95%CI [1.553, 2.729]), and the presence of chronic disease contributed to greater risk of suicide when compared with no chronic disease (OR = 2.128 $p < .01$, 95%CI [1.510, 2.998]). COVID-19 anxiety rose with gender and chronic disease, by which the female gender was more likely to have greater anxiety when compared with males (OR = 1.469, $p < .01$, 95%CI [1.294, 1.669]), and chronic disease contributed to greater likelihood of higher anxiety levels when compared with those having no chronic disease (OR = 1.329, $p < .05$, 95%CI [1.066, 1.657]).

4. Discussion

This study examined the mental health condition of persons placed in state quarantine and analyzed the relative risk in the onset of their mental health problems associated with various demographic variables.

4.1 The Mental Health Conditions

People in state quarantine in Thailand reported a moderate level of anxiety related to COVID-19, and mild stress. These results contradicted with a systematic review by Salari et al. (2020). In our study, the majority of people reported no depressive symptoms and no risk of suicide, indicating fairly low mental health problems. Studies on psychological impact of quarantine found that inadequate supplies, inadequate information, frustration and boredom, and finances are significant stressors during quarantine (Brook et al., 2020; Pellecchia et al., 2015; Wilken et al., 2017). The Thai government set up a management system that not only for prevented disease, but also protected people in state quarantine. Thai government provided food, accommodation, transportation, and necessary supplies for Thai citizens in state quarantine with no charge. Health information and practice guidelines were provided by health personnel regularly every day. This information included the low mortality rate in the situation of the pandemic in Thailand (1.85%) and high rate of recovery (96.2%), which contributed to low stress, depression, and risk of suicide (DMH, 2020c).

4.2 Relative Risk in the Onset of the Mental Health Problems

The study found that the mental health problems of people in state quarantine in Thailand were associated with being female and having chronic diseases. Females in our study were more likely to experience stress, depression, and risk of suicide than males. These results are consistent with studies in China and Iran, which found that females were more likely to experience stress, anxiety and depression from the COVID-19 pandemic than males (Moghanibashi-Mansourieh, 2020; Wang et al., 2021; Zhou et al., 2020). Roongrueangkolkit (2010) addressed the relationship between gender and mental health of Thai people. Roongrueangkolit stated that women usually adapted emotion focused coping patterns, which led to women having more emotional problems than men.

In addition, we also found that people in state quarantine with chronic diseases were more likely to experience stress, depression, risk of suicide, and anxiety than those without chronic diseases. In the COVID-19 pandemic, persons with chronic illness must cope not only with their existing illness, but also with a deadly, invisible, and mysterious virus. Ciacci and Siniscalchi (2020) recommended that the health care providers should provide prompt psychological support in addition to medical assistance for chronically ill patients in the lockdown situation from COVID-19 pandemic.

4.3 Limitation of the Study

The study has some limitations that need to be addressed. Since the state quarantine was set up in an emergency situation, we need to rapidly screen these mental health problems using an online survey. The measures used were developed by the Department of Mental Health Thailand based on Thai context, not standardized measures. The mental health problems reported in the study is not a standard medical diagnosis. Only necessary personal characteristics were recorded. Therefore, further study to examine mental health problems of those who reported a high level of stress, a risk of suicide, having depression and anxiety using a standard medical diagnosis should be done.

5. Conclusion

The mental health problems of persons placed in state quarantine in Thailand included stress, depression, risk of suicide and anxiety. We found that being female and having chronic illness were associated with greater risk for mental health problems. Anxiety related to COVID-19 was the most problematic issue perceived by people in state quarantine. Therefore, health care providers in the state quarantine must provide psychological support to reduce their anxiety. Although levels of stress and depression were minimal, those who report depressive symptoms need to be assisted. We recommend the presence of a mental health screening system for persons placed in state quarantine to detect persons at risk of mental health problems. We also recommend the development of interventions to decrease the severity of mental health problems during disease outbreaks.

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Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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The Relationship between Smartphone Addiction and Academic Performance in College Students

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Abstract

Objectives: Smartphone addiction is a growing concern that can impact social, psychological, and health, while contributing to functional impairments. This study aimed to determine the relationship between smartphone addiction and the grade point average (GPA) of undergraduate college students in the U.S.

Methods: This descriptive study consisted of 53 undergraduate college students. The Smartphone Addiction Scale (SAS) and overall grade point average (GPA) was gathered via survey. The data was analyzed through Pearson's correlation to demonstrate the association between these variables.

Findings: While not statistically significant at the $\alpha = .05$ level, the results suggest an almost statistically significant negative correlation ($r = -0.210$, $p = .066$) indicating a weak but noteworthy association between smartphone addiction and GPA.

Conclusion: Smartphone addiction is a growing concern that has shown to impact quality of life in Asian countries. These results suggest further research with larger samples in the U.S. is needed to inform college students of the risks smartphone addiction can have on academic success.

Keywords: smartphone addiction, cellphone addiction, GPA, college students, academic performance

1. Introduction

Cell phones or "smartphones" are an essential part of college life and culture, as they are observed to be used in every college setting, including the classroom (Lepp, Barkley, & Karpinski, 2015). Smartphones can enhance students' educational experience by providing immediate and convenient access to online information retrieval, file sharing, and interaction with their classmates and instructors (Lepp, Barkley, & Karpinski, 2015). The term "smartphone" was first introduced in 1997, when a phone company named, Erricson introduced its GS 88 "Penelope," branding it as the first "smartphone" due to its advanced features (Sonawane, Mahajan, & Shinde, 2019).

Research reports that many college students perceive their phones primarily as a leisure device and most commonly use them for social networking, watching videos, surfing the net, and gaming (Lepp, Li, & Barkley, 2015). If used for non-class-related purposes, smartphones can negatively distract learning and potentially create an adverse effect on learning (Omer, 2020). The main differentiating feature of a smartphone from a standard phone is that it has permanent access to the internet, and consequently, all of the internet's appealing and/or possible problematic content (Panova & Carbonell 2018). Smartphones were used by 2.5 billion people in 2016, 2.7 billion in 2017, 2.9 billion in 2018, 3.4 billion in 2019, 3.6 billion in 2020, and predicted usage will increase to 3.8 billion by 2021, raising smartphone addiction concerns (O'Dea, 2020).

According to a study conducted by Prekshaa et al. (2019) of 146 medical students in India, 25% scored in the addicted category; while Aljomaa and colleagues (2016), in an assessment of 416 participants found 48% ($n = 200$) met their standard of 'addiction.' While relevant literature has sprouted over recent years, most of the research that has occurred in Asian countries and continues to be not recognized in the Diagnostic and Statistical Manual of Mental Disorders (Boumosleh & Jaalouk, 2017). The purpose of this current research study is to examine the

relationship between smartphone addiction and academic performance (GPA) in college students. Further research on the topic of smartphone addiction was recommended by American Psychiatric Association (APA) in order to list it as a formal diagnosis in the DSM-5 (Cha & Seo, 2018). This study aimed to fill that gap and determine the relationship between smartphone addiction and academic performance (GPA) in American college students, as guided by the following research question: *Is there a relationship between smartphone addiction and academic performance among college students?* Based on the analysis of existing research, the present authors hypothesized that students with a higher degree of smartphone addiction would have lower GPAs as measured by the smartphone addiction scale (Kwon et al., 2013).

2. Literature Review

Smartphone addiction is a phenomenon that concerns the uncontrollability of smartphone use, leading to social, psychological, and health problems such as withdrawal, tolerance, and functional impairments (Cha & Seo, 2018). Other addiction symptoms include salience, phantom phone signals, anxiety, and behavioral addictions, posing a severe risk to health and overall quality of life (Omer, 2020). It has also been found that smartphone addiction could be related to depression, loneliness, and lowered self-esteem (Kwon et al., 2013a).

A study by Lepp et al., (2015) examined the relationship between total cell phone use and academic performance while controlling for confounding variables of academic performance which included the student's *major* (p = 0.081), *gender* (p < 0.001), *class standing* (p < 0.001), and *smoking* (p < 0.001). The population consisted of 518 college students from the Midwestern United States. The self-efficacy for self-regulated learning (SE: SRL) and the self-efficacy for academic achievement (SE: AA), and self-assessment of how many hours are spent on their phone per day. They found a negative correlation between college students' GPA and cell phone use (r = -0.234), after controlling for confounding variables. Compared to the low-use and moderate groups, the GPA of students with higher cell phone use was significantly lower (p < .001) (Lepp et al., 2015). Another research study by Bjornsen & Archer (2015) examined the relationship between cell phone use and academic performance among 218 college students from a medium-sized Southeastern University. They used a *cell phone use* questionnaire and found that in-class test scores were negatively associated with cell phone use (p = .035).

Conversely, a similar study found no significant correlation between smartphone use and GPA in Australian students (r = -0.1) and Korean students (r = -0.12) (Winskel et al., 2019). However, when looking at specific phone apps and comparing it to GPA, there was a negative correlation with social media (r = -.24, p < .05), buying tickets/shopping (r = -.21, p < .05), and watching videos (r = -.20, p < .05).

Similarly, Afrein and colleagues (2017) administered the *Smartphone Addiction Scale* (SAS) to a 30-item questionnaire to 247 business students from a private university in Dhaka City of Bangladesh. The researchers also administered an *Internet-Related Addictive Behavior Inventory,* which resulted in five smartphone addiction factors: withdrawal, impatience, daily-life disturbance, withdrawal, and positive anticipation, which led to hampered relationships between students and their family members. They found the primary concern to be the daily-life disturbance of daily life activities (p = 0.000), leading to hampered relationships between students and their family members.

A study conducted by Khan et al. (2019) also had similar results among a sample size of 360 students from two private universities using a self-administered questionnaire, validated by other studies using the *Estonian Smartphone Addiction Proneness Scale*, and the *Smartphone Addiction Inventory*. This study concluded a significant negative correlation between smartphone addiction and GPA among college students (r = -0.52, p < 0.01). The outcomes of smartphone addiction were negatively associated with time management among college students (r = -0.29, p < 0.01) (Khan et al., 2019).

In contrast, a recent study by Boumosleh and Jaalouk (2017), found opposing results. The purpose of this study was to examine the relationship between smartphone addiction and academic performance after controlling for the potential confounding variables, such as gender, drinking alcohol, age at which a smartphone was used for the first time, smartphone use for study-related purposes, class, and faculty. Results suggest that smartphone addiction among college students did not correlate with academic performances after controlling for the confounding effects (p = 0.08) (Boumosleh & Jaalouk, 2017). Similarly, Hawi and Samaha (2016) determined that, regardless of the students' genders, those who were at low risk of smartphone addiction, as determined by the SAS, had a higher chance of achieving higher academic performance than those at high risk of smartphone addiction (Hawi & Samaha, 2016). In a study performed by Karki, Singh, Paudel et al. (2020), they determined that males are more addicted to smartphones than the females using the mean addiction score from SAS-SV.

The research found that the risks related to problematic mobile phone use include physical, psychological, and

mental health conditions (Omer, 2020). Research also found that University students are at potential risk because they reportedly spend a considerable amount of time using their smartphones for either academic or entertainment-related purposes (Omer, 2020). In a more practical sense, Kuznekoff and Titsworth (2012) quantified this impact by having 47 students participate in a study in which three groups participated in a learning activity. The participants were spread among three groups: control, minimally smartphone distracted, and highly smartphone distracted. On average, the students in the control groups score a letter grade and a half higher than those on the highly distracted group on two post-lesson tests.

2.1 Purpose

The present study was guided by the *Model of Human Occupation* (MOHO), a client-centered holistic approach to care (Cole & Tufano, 2020). Addiction interferes with the ability to engage in education, affecting overall academic performance. The theoretical base of MOHO focuses on the dynamic interplay of the person and the environmental variables. Thus, the present authors hypothesize that smartphone addiction can affect the process of engagement in higher education learning, where students must fully engage with academic material with reduced external distractors.

While the literature presents a significant amount of research in this area, results are inconsistent, and few have occurred with US participants. This study seeks to further add to the literature specific to the US northeast population. This study is both relevant and timely as college students must continue to manage work, study, social activities, particularly in increasingly stressful environments such as the Covid-19 pandemic, which was simultaneously occurring during the collection of this data in October of 2020.

3. Methodology

3.1 Participant Selection & Data Collection

Dominican College's Institutional Review Board (IRB) approved the study. Study subjects consented to participation via email. The survey was sent via email to all undergraduate Dominican College students. The online survey included two sections: Smartphone Addiction Scale Short-Version (SAS-SV) and a demographic questionnaire. Students were provided detailed step-by-step directions on how to obtain their actual GPA. The final data removed participants who were either not undergrad college students or failed the embedded trap questions designed to ensure accurate and meaningful participation.

3.2 Reliability/Validity of Outcome Measures

The Smartphone Addiction Scale Short-Version (SAS-SV) developed by Kwon et al., (2013) has been commonly used in previous research on smartphone research. The initial version was a modification of the Korea-scale (K-scale), which looked at internet addiction. The SAS consists of 33 items with a six-point Likert scale that ranges from a 1 (strongly disagree) to a 6 (strongly agree) and is based on six factors (Kwon et al., 2013a). The six factors include *withdrawal, daily-life disturbances, overuse, positive anticipation, tolerance, and cyberspace-oriented relationships*. The SAS-SV has a strong internal consistency with a Cronbach's alpha = 0.91, as well as high internal-reliability (Cronbach's alpha = 0.966) during its developmental stages (Kwon et al., 2013a).

3.3 Data Analysis/Statistical Procedures

This study was a quantitative design and used a parametric test (Pearson's Correlation) to find the strength to determine the relationship between academic performance and smartphone addiction. Statistical Analysis of data was performed using the statistical program Statistical Package for the Social Sciences (SPSS). A statistical significance was set to 0.05. This study is one-tailed based on the literature and unidirectional hyposthesis. Based on the G power calculation, the study required a minimum population size of 150 participants with an effect size of $r = 0.20$.

4. Results

Participants who completed the survey consisted of 83 undergraduate students with diverse nationalities, backgrounds, and courses, attending Dominican College in Orangeburg, New York. The students completed the Smartphone Addiction Scale, the background information survey, and the consent form. However, several students ($n = 29$) failed to fulfill the trap questions within that sample. Furthermore, among the 54 final participants who were eligible to be part of the study, one participant could not obtain their GPA due to computer error. Ultimately, the final sample was refined to 53 students (43 females, 10 males), with an attrition rate of 36.14%.

The GPA of undergraduate students ($n = 53$) ranged from 0 to 4.0, with a mean of 3.3661 (SD = 0.61554). The mean GPA for this sample was higher than expected for the average undergraduate population, which means there

is a possibility of skewness due to the high achieving nature of students who take the time to complete a research survey request.

Among this sample, a negative correlation was found between GPA and SAS scores (r = -0.210, p = .066) using Pearson's correlation, suggesting that the higher the student scored on the smartphone addiction score, the lower the student's GPA was.

5. Discussion

While these results are not statistically significant at the α = 0.05 level, results demonstrated a negative correlation between smartphone addiction and GPA, which is consistent with earlier research studies (Afrefin et al., 2017; Bjornsen, & Archer, 2015; Hawi & Samaha, 2016; Khan et al., 2019; Lepp et al., 2015; Omer, 2020; Winskel et al., 2019). The present study is *underpowered* and would likely have met statistical significance with a larger sample, as evident by similar effect size findings in the literature. Results are congruent with the theoretical framework for this study, suggesting that addiction might impact academic performance and impacting function.

The present study used the SAS-SV as the measure for smartphone addiction, which has been the most widely reported in the literature. Other measures consist of the Smartphone Addiction Inventory (SPAI), which has also demonstrated satisfactory validity and reliability (Lin et al., 2014; Lin et al., 2017), and researcher-created surveys (Lepp et al., 2015; Bjornsen et al., 2015). Present authors attempted to categorize findings in the literature by outcome measures; however, no patterns appear obvious. Studies that used SAS-SV resulted in r values of -.315 (Omer, 2020), -.2 (Hawi & Samaha, 2016), -.748 (Chaudhary & Tripathy, 2018), and -.12 (Winskel et al., 2019). Studies using the SPAI resulted in an r-value of -.52 (Kahn et al., 2019) and an Odds Ratio of 1.018 (Boumosleh & Jaalouk, 2017). The two self-report studies reported findings consisting of weak-moderate correlations, similar to results in studies that used the SAS-SV (Lepp et al., 2015; Bjornsen et al., 2015).

Strangely, the study with the largest sample size (n = 688) is one of the few studies suggesting no correlation between smartphone addiction and GPA. However, this study suggests predictive factors when adding covariates such as alcohol drinking, age at first use of smartphones, and purpose of smartphone use (Boumosleh & Jaalouk, 2017).

The present study results, in corroboration with the present literature, suggest there appears to be a weak negative correlation with academic performance among college students, a participant group that is relatively easy to study among researchers. However, it seems evident that further exploration of this work must look at confounding variables that may influence the intended smartphone use and other addictive behaviors the participants may engage in. Furthermore, research results focused on college students should not be generalized to the academic success among all students of varying ages. College students were academically successful before the college experience and thus did not represent younger and adolescent-aged school students who never go on to higher academic learning environments.

5.1 Limitations and Future Research

The small sample size is a significant limitation to this study which increased the probability of making a type II error if the present authors accept the null hypothesis that there is no association between smartphone addiction and GPA. The average GPA collected during this study is higher and does not represent the average GPA of Dominican College undergraduate (freshman-senior), thus suggesting the sample group may not accurately reflect the greater student population. The present study's final limitation is that the data was collected through a self-reported survey, leading to GPA self-reporting bias.

Future research should include a larger sample size of undergraduate college students from various colleges so the results can be generalizable to adolescents who may struggle more significantly and never reach the college environment. Researchers should also consider further investigating the adverse side effects of social media apps that potentially impact individuals' mental health and well-being.

Future research could also examine the potential confounding variables' effects on the relationship between smartphone addiction and GPA such as class year, smoking, drinking, and age at first use of a smartphone (Boumosleh & Jaalouk, 2017); as well as socioeconomic status and usage pattern (Cha & Seo, 2018).

5.2 Contributions to Practice

The findings from this study can help promote the awareness of mental health, smartphone addiction and provide an improved understanding of potential functional impacts on the academic success of undergraduate college students. Informing college students on the risk factors of smartphone addiction and GPA can help them become self-aware of this issue while also informing best practices for targeting smartphone use toward activities that

promote academic success.

Previous literature suggests that higher education institutions and educators can enhance academic success and well-being by engaging the students physically and socially. Furthermore, spreading awareness of the benefits of using on-campus group study rooms and/or library lab rooms for in-person interactions may yield positive academic performance results rather than rely on self-studying, resulting in increased distractibility and decreased focus on academic-related tasks. Although previous studies suggest that smartphone addiction may negatively affect academic performance, using smartphones in a productive manner, such as being used as an educational tool during study sessions, may yield positive outcomes (Arefin et al., 2017; Khan et al., 2019; Klimova, 2019).

6. Conclusion

The findings from the present study help provide further evidence of the impact of smartphone addiction on GPA among undergraduate college students. While smartphones can be beneficial in the learning environment if used for educational purposes that promote learning and productivity overall, the present study results suggest there is a negative correlation between increased smartphone addiction and decreased academic performance. Thus, it appears institutions should take the necessary steps in creating environmental and educational awareness programs with the aim of promoting function and productivity; while also educating on the unstructured and unproductive behaviors that impair academic success.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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Complementary and Alternative Medicine Use among Gynaecological Cancer Patients in Enugu, South-East Nigeria

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Abstract

Introduction: The high cost and associated adverse effects of conventional therapy make the patients seek complementary and alternative medicine. Complementary and alternative medicine use may contribute to the delay the patients have before seeking orthodox care.

Objectives: To determine the prevalence, pattern, factors responsible for complementary and alternative medicine use and if complementary and alternative medicine use causes delay in seeking orthodox care among gynaecological cancer patients in Enugu.

Material and Methods: A pretested, semi-structured interviewer-administered questionnaire -based cross-sectional survey of 396 eligible gynaecological cancer patients recruited from both University of Nigeria Teaching Hospital, Enugu and Enugu State University of Science and Technology Teaching Hospital, Enugu between January, 2018 and June, 2020. The data was analyzed using the statistical package for social sciences version 23 (IBM SPSS, Chicago, IL).

Results: The mean age of the respondents was 57.3 years and it ranged from 41 to 77 years. Cervical cancer (76%) was the most common type of gynaecological cancer. A total of 283 (71.5%) of the respondents used complementary and alternative medicine. Herbs (65%) were the most common type of complementary and alternative medicine used. Majority (56.9%) of complementary and alternative medicine users rarely used it. A total of 178 (62.8%) complementary and alternative medicine users presumed that it would cure them while 105 (37.1%) presumed that it would relieve the symptoms of their cancer. However, 197 (69.6%) complementary and alternative medicine users stated that there was no actual benefit from its use. The low educational status has a statistically significant influence on complementary and alternative medicine use among the respondents (P-value=<0.0001). Complementary and alternative medicine use had a significant influence on delay to seek orthodox care among the study participants (P-value=<0.0001). Majority (84.5%) of the doctors, caring for the patients, were not aware of the patients' use of complementary and alternative medicine.

Conclusion: Complementary and alternative medicine use among gynaecological cancer patients is high in Enugu. It also delays their presentation for orthodox care. Female education and public sensitization on the effect of complementary and alternative medicine use is necessary to curb this trend.

Keywords: complementary and alternative medicine, gynaecological cancer, delay, Enugu

1. Introduction:

Gynaecological cancers comprise cancers of the vulva, vagina, uterus, fallopian tubes and ovaries. Apart from the cervical cancer which has a screening method and can be detected early, most gynaecological cancer patients present late (WHO, 2016). The conventional therapies of gynaecological cancers such as surgery, chemotherapy, radiotherapy, and hormonal therapy are usually expensive and some aspects of them have much adverse effect, and often force patients to seek complementary and alternative therapy (Al-maggar et al., 2013; Ezeome & Anarado, 2007). Complementary and alternative medicine (CAM) is defined as medical and health systems, practices, and products that are not currently considered as an integral parts of conventional medicine (NCCI, 2016; Algier et al.,

2005). Each particular therapy isconsidered as complementary if it is used in addition to conventional medical treatment. On the other hand, it is viewed as alternative if the patient decides to use it in place of a prescribed allopathic treatment (NCCI, 2016). Drug interaction between CAM and chemotherapy or radiotherapy or both has a potentially hazardous outcome and can also be associated with cancer treatment delay (Lee et al., 2006; Gupta et al., 2006; Davis et al., 2005).

Based on World Health Organization report, the global prevalence of CAM use ranges from 30 to 75% (WHO, 2002). Because of this high prevalence, about 88% of countries in the world are integrating certain aspects of CAM into their healthcare policy (WHO, 2019). Approximately 35.9% of cancer patients in Europe use CAM (Molassiotis et al., 2006). Also 61.2% of gynaecological oncology patients in Turkey used CAM (Nazik et al., 2012). Ezeome et al reported 65% of CAM use among surgical oncology patients in Enugu (Ezeome & Anarado, 2007). Similarly, Nwankwo et al reported that 64.3% of gynaecological cancer patients used CAM in the same centre (Nwankwo et al., 2019). The high prevalence of CAM use among cancer patients in these studies could be attributed to the traditional nature of the society, cultural affinity, religious beliefs and practices, high cost of allopathic treatment and ignorance.

Cancer patients take a wide range of CAM and they include ingested therapies such as herbs, homeopathic remedies, psychological, physical and spiritual techniques (Nwankwo et al., 2019; Verhoef et al., 2005; Ernst & Cassileth, 1998). The reasons while oncology patients resort to CAM use comprise symptom and side effect relief, improving physical and/or emotional well being, perceived improvement in quality of life, desire for greater control and participation and perceived effectiveness of CAM (Lengacher et al., 2006; Ernst, 2000; Friedman et al., 1997). The allopathic related factors for CAM use by cancer patients include dissatisfaction with some aspects of conventional health care like adverse effects and high cost, poor doctor-patient relationship, poor accessibility of conventional care and poverty (Ernst, 2000).

Because CAM use is engraved in Nigerian culture and predates allopathic medicine use, there seems to be less restrictive regulation of CAM when compared with allopathic medicine use. Paradoxically, some herbal medicines have been shown to contain toxic substances that are injurious to health (Sharwan et al., 2015). This may affect the health of gynaecological cancer patients. CAM practitioners have been accused of exaggerated claims without having scientific data about treatment effectiveness, thus making it difficult to ascertain the legitimacy and effectiveness of the therapy (Abolfotouh et al., 2013). Inadequate coordination of the practitioners' activities, poor communication between the practitioners and their patients, secrecy of treatment content and difficulty in determining treatment ingredients are some of the drawbacks of CAM (FRN, 2010; Donkor, 2008). In addition, incorrect diagnosis, imprecise dosage, low hygiene standards, and absence of documentation adversely affect the authenticity of CAM especially in sub-Saharan Africa. Though there have been previous studies on CAM use among cancer patients in Enugu (Nwankwo et al., 2019; Ezeome & Anarado, 2007), there are however paucity of studies on determination of, if CAM use causes delay in seeking orthodox care among gynaecological cancer patients. Delay before seeking orthodox care has contributed to maternal mortality in Nigera (Okonofua et al., 2017). Besides, the previous studies in Enugu were single-centre studies while the current one is a multi-centre study. This study is therefore aimed at determining the prevalence, pattern, predictors of CAM use and if CAM use causes delay in seeking orthodox care among gynaecological cancer patients in Enugu,South-East Nigeria. The finding from this study could help bridge the knowledge gap and possibly help in policy formulation towards solving the problem.

2. Material and Methods

2.1 Study Area

Enugu state is one of the five states in south-East Nigeria. It is bounded in the north-west by Kogi State, north-east by Benue State, east by Ebonyi State, west by Anambra State and south by AbiaState.The state has a population of 3,267,837 according to the 2006 population census (FRN, 2010). Enugu State is predominantly Igbo but there are pockets of other tribes.

2.2 Study Centres

The study sites were purposively selected. The University of Nigeria Teaching Hospital (UNTH) is a 500 bed tertiary hospital located in a 306 -hectare expanse of Land in Ituku-Ozalla. The hospital is along Enugu-Port Harcourt Expressway and about 21 kilometres from Enugu metropolis. It has a functional oncology centre and serves as a referral centre to other hospitals in South-East, South-South and North-Central Nigeria. Certain specialized cases are also referred from Cameroun. The availability of radiotherapy services at the hospital has further increased referral of cancer cases to the centre.

Enugu State University of Science and Technology (ESUT) Teaching Hospital, Park Lane, Government Reserved Area (GRA), Enugu is a tertiary hospital located in Enugu metropolis. It also has a gynaecological oncology unit and gets referrals from other hospitals in Enugu State and neighbouring states.

2.3 Study Population

This comprised all gynaecological cancer patients attending gynaecological oncology clinics or admitted in the wards with histology diagnosis of gynaecological cancer.

2.4 Study Design

This was a cross sectional descriptive study in which interviewer-administered semi-structured questionnaireswere usedto collect information from eligible participants between January, 2018 and June, 2020. Prior to this study, the questionnaires were pretested on 10 gynaecological cancer patients at Alex Ekwueme University Teaching Hospital, Abakaliki, Ebonyi State. The number of patients recruited at each of the study centres was based on the proportion of patient load at such centres.The eligible participants were consecutively recruited after individual counselling and consent was obtained from each of them. The first step in administering the questionnaire was assurance section, in which the patients were informed that the information sought was not part of their treatment and would no way influence the treatment of their cancer. The questionnaire comprised the socio-demographic data, the type of cancer, when the patient noticed the symptoms, when she presented for orthodox treatment, previous treatment received (if any) and the current treatment being received, information on the stage of the disease (this was obtained from the case notes), whether the patient had used CAM and whether CAM use by the participants contributed to delay in their seeking orthodox care. For the purpose of this study, participants who used CAM daily during the current cancer treatment were regarded as very often users, those that used CAM two to three times in a week were regarded as often users while those that used CAM less than two times a week but more than once per month were regarded as rare users.Those that used CAM once per month were regarded as very rare users. Also the participants who had used CAM prior to onset of the cancer and those who had never used CAM where regarded as non users. CAM use delay was assessed by obtaining information on when the respondents started having the symptoms of the disease, if they started using CAM because of the symptoms and when they sought for orthodox care. The gynaecological cancer patients who presented at stages 1 and 2 were regarded as presenting in early stages while those who presented at stages 3 and 4 were regarded as presenting in advanced or late stages of the cancer.

2.5 Sample Size Determination

The minimal sample size for the study was calculated using the formula for cross-sectional studies (Charan & Biswas, 2013):

$$n = z^2pq/d^2$$

n = minimum sample size; z = standard normal deviate at 95%; confidence interval =1.96

p = prevalence from a previous study on CAM use among gynaecological cancer patients in UNTH given at 64.3% (Nwankwo et al., 2019); q = 100-p and d = level of precision/ accuracy, set at 5%. After adding 10% attrition rate, n was 388.

Inclusion criteria

All the consenting gynaecological cancer patients who had histological diagnosis of the cancer were included in the study.

Exclusion criteria

These comprised the patients who did not have histological diagnosis of gynaecologic cancer and those who, despite adequate counselling, declined consent to participate in the study.

2.6 Data Analysis

The data was analyzed using the statistical package for social sciences version 23 (IBM SPSS, Chicago, IL).Categorical variables were analysed with chi-square test. The level of significance was set at P-value < 0.05.

2.7 Ethical Consideration

Ethical clearance for the study was obtained from the Human Research Ethics Committee of the University of Nigeria Teaching Hospital. The ethical approval number is NHREC/05/01/2008B-FWA00002458-1RB00002323. Institutional permission for the study was also obtained from Enugu State University of Science and Technology Teaching Hospital.

3. Results

A total of 341 (86.1%) and 55 (13.9%) of the study participants were consecutively recruited at the University of Nigeria Teaching Hospital and Enugu State University of Science and Technology Teaching Hospital respectively. The mean age of the respondents was 57.3 years and it ranged from 41 to 77 years. A total of 303 (76.5%), 58 (14.6%), 34 (8.6%) and 1 (0.3%) of the participants were diagnosed of cervical cancer, endometrial cancer, ovarian cancer and vulva cancer respectively. Approximately 7%, 17%, 56% and 20% of the participants were in stages 1, 2, 3 and 4 of the gynaecological cancers respectively. Therefore majority (76%) of the gynaecological cancer patients presented in advanced stage. The low educational status has a statistically significant influence on CAM use among the respondents. Majority (84.5%) of the respondents stated that their doctors were not aware of their use of CAM. Doctors' history of CAM use by the respondents had a significant effect on their awareness of patients' use of CAM (P-value=<0.0001).

Table 1. Socio- Demographic Characteristics of Respondents

Socio-demographic characteristics	Frequency (N=396)	Percentage
Age(years)		
41-50	69	17.4%
51-60	208	52.5%
61-70	106	26.7%
71-80	13	3.2%
Tribe		
Igbo	365	91.9%
Hausa	1	0.3%
Yoruba	7	1.8%
Others	23	5.8%
Religion		
Christianity	385	97.0%
Islam	4	1%
Jewish	3	0.8%
ATR	4	1%
Marital Status		
Single	8	2%
Married	247	62.2%
Divorced	25	6.3%
Widowed	116	29.3%
Educational Attainment		
No formal education	58	14.6%
Primary	165	41.6%
Secondary	116	29.2%
Tertiary	57	14.4%
Job Description		
House Wife	85	21.4%
Farmer	162	40%
Trader	100	25.2%
Civil Servant	49	12.3%

Table 1 shows the socio-demographic characteristics of the respondents. Majority of the respondents were between 51 and 60 years old, Igbos, christians, married, farmers and had primary education.

Table 2. Prevalence, types, Frequency of use, and benefits of complementary and Alternative Medicine (CAM) use among the participants

CAM USE (N=396)	Frequency	Percentage
Yes	283	71.5%
No	113	28.5%
Types of CAM used by respondents(N=283)		
Herbs alone	184	65.0%
Combined prayers with herbs	39	13.8
Spiritual sacrifice	27	9.5
Prayers alone	24	8.5
Medicinal tea	9	3.2
Frequency of CAM USE (N=283)		
Very Often	11	3.9%
Often	85	30.0%
Rarely	161	56.9%
Very Rarely	26	9.2%
Presumed Benefit (N=283)		
Total Cure	178	62.8%
Symptom Relief	105	37.1%
Actual benefit of CAM (=283)		
None	197	69.6%
Little	86	30.4

The prevalence, types, frequency of use, and perceived benefits of CAM use among the participants were shown in Table 2. A total of 283(71.5%) of the respondents had used CAM. The most common types of CAM used by the respondents were herbs (65%). The majority (56.9%) of CAM users rarely used it. A total of 178 (62.8%) CAM users presumed that it would cure them while the remaining 105 (37.1%) presumed that it would relieve the symptoms of their gynaecological cancer. However, 197 (69.6%) CAM users realised that there was no actual benefit from its use.

Table 3. Influence of CAM use on orthodox care delay among the participants

Variable	Frequency (%)		X2	P-value
Delay	**CAM USERS (N= 283)**	**Non- CAM USERS (N=113)**	**75.608**	**< 0.0001**
Yes	200 (70.7%)	25 (28.4%)		
No	83 (29.3%)	88 (71.6%)		
Delay Duration	**CAM USERS (N=200)**	**Non- CAM USERS (N=25)**	**40.672**	**<0.0001**
< 1 year	13(6.5%)	13 (52%)		
1-5 years	186(93.0%)	12 (48%)		
6-10 years	1(0.5%)	0 (0%)		

The influence of CAM use on orthodox care delay among the participants is shown in table 3. CAM use had a significant influence on delay to seek orthodox care among the study participants (P-value=<0.0001).

4. Discussion

This study showed that the prevalence of CAM use among gynaecological cancer patients in Enugu was 71.5%. Cervical cancer was the most common gynaecological cancer recorded among the respondents. Most of the gynaecological cancer patients presented at an advanced stage. Herbs were the most common CAM used by the respondents. Majority of the patients rarely used CAM. Majority of the respondents presumed that CAM would cure them but later realised that it did not have any actual benefit. The low educational status has a statistically significant influence on CAM use among the respondents. CAM use had a significant influence on delay to seek orthodox care among the study participants. Majority of the doctors managing these patients were not aware of the patients' CAM use .The doctors' history of CAM use by respondents had a significant effect in their awareness of patients' use of CAM.

The 71.5% prevalence of CAM use from this study was essentially similar to 64.5% and 65% reported in Enugu among gynaecological and surgical oncology patients respectively (Nwankwo et al., 2019; Ezeome & Anarado, 2007). This is however higher than 14% and 38.7% reported in Malaysia and India respectively (Al-maggar et al., 2016; Lee et al., 2006). The discrepancies in prevalence between this study and the Malaysian and Indian studies could be attributed to the difference in what constitutes CAM in the different studies. While the previous studies in Enugu and this study included prayer as part of CAM, the Indian and Malaysian studies excluded prayer. The difference in prevalence could also be attributed to the disparity in belief and cultural practices between sub-Saharan Africa and Asia. Cancer in this environment is perceived, with misconception, as being caused by spiritual forces beyond the reach of conventional medical therapy. Herbs being the most common CAM used in this study is similar to previous reports in Nigeria (Nwankwo et al., 2019; Onyiapat et al., 2017; Ezeome & Anarado, 2007). This study showing a low educational status having a significant influence on CAM use among the respondents is similar to a previous study in Ekiti, South-west Nigeria (Aina et al., 2020). This is however contrary to a previous report by Okoronkwo et al in Enugu, South-East Nigeria which showed a relationship between CAM use and higher educational status (Okoronkwo et al., 2014).

Cervical cancer being the most common gynaecological cancer in this study is supported by previous reports in Nigeria (Abdullahi & Ayogu, 2020; Nwankwo et al., 2019). This is contrary to reports in the developed countries like the United States of America where it is third after cancer of the corpus uteri and ovary (CDC, 2019). The disparity in cervical cancer incidence between sub-Saharan Africa and the developed countries could be attributed to inadequate cervical cancer preventive measures being carried out in sub-Saharan Africa. Majority of the patients presenting in advanced stages of gynaecological cancer in this study is similar to a previous report in Enugu (Nwankwo et al., 2019). This underscores the need for public health sensitization on cancer screening, early detection and treatment of cancers in this environment. The delay, before presentation for orthodox care, caused by CAM use by the gynaecological cancer patients in this study is supported by a previous report in the United States of America (Greenlee et al., 2016). This may have contributed to the late presentations of most of the patients in this environment. This study revealing majority of the participants expecting total cancer cure from CAM use is supported by a previous study in Turkey (Ceylan et al., 2002). However, this is contrary to a United States of American study which showed that cancer patients use CAM primarily to boost their immunity and for improvement of their quality of life such as use of radiotherapy, chemotherapy and endocrine therapy (Hammersen et al., 2020).

The poor doctors' awareness to the respondents' use of CAM in this study is similar to the previous report in Pakistan (Malik et al., 2000). This is mainly due to lack of detailed history taking among the doctors. This underscores the importance of good and detailed history taking as it might be the only opportunity to obtain the information and counsel patients against those substances and practices that might have adverse effect on them.

This study is weakened by the cross-sectional design in which some information sought from the patients are prone to recall bias. It is also a hospital-based study in which its findings may not be a true reflection in the society.

5. Conclusion

There is a high prevalence of CAM use among gynaecological cancer patients in Enugu, South-East Nigeria. CAM use causes delay at presentation for orthodox care among the gynaecological cancer patients. Female education and enlightenment is necessary to curb this ugly trend.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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A Pilot Study of Visual Function Parameters and Their Relationship to Road Traffic Accidents among Drivers in Trinidad and Tobago

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Abstract

Background: Vision attributes to about 95% of the sensory requirements for driving. When driving, impaired visual functions will undoubtedly result in a delayed response to obstructions. The regulations governing the issuing and renewal of a driver's license in Trinidad make no provision of a visual requirement assessment. The study was prompted by an upsurge in road traffic accidents in Trinidad and Tobago, a twin-island nation.

Aim: This pilot study investigates the relationship between defects in visual functions and traffic accidents among drivers on the island of Trinidad.

Methodology: This descriptive cross-sectional study utilizes a non-probability purposive sampling approach to enroll licensed drivers who had been driving within the island's districts for the past five years, the study conducted at a Multi-Health-Training Facility in Trinidad's Central Area. After completing a semi-structured questionnaire, participants were given a full eye examination.

Results: 128 licensed drivers, both male and female, were enrolled for this study with ages ranging from 20 to 70 years with a mean age of 40.9 years ± 13.3 years, in which majority (83.6%, n = 107) of the drivers did not perform an eye exam before obtaining/renewing their driver's license. About 32% (n = 41) of these drivers were involved in an RTA in the last five years. There was a statistically significant association between colour vision defect (χ^2 = 15.94, p = 0.00), contrast sensitivity with a logCS score of less than 1.52 (χ^2 = 25.05, p = 0.00, Cramer's V= 0.442) and the occurrence of road traffic accident.

Conclusion: According to this study, one-quarter of drivers have been involved in a road traffic accident within the last five years, and three-quarters have never had an eye examination before obtaining or renewing their driver's license. The relevance of designing and developing a screening protocol that can be easily applied to driving safety licensing policies were established in this study. Based on these findings, prospective driver's license applicants must undergo a complete eye examination, to drastically reduce RTAs.

Keywords: visual function, drivers, road traffic accident, Caribbean, Trinidad and Tobago, visual defect

1. Introduction

The ability to see is undeniably an essential component of being considered a good driver, as the driving action is heavily reliant on vision for its efficient and proper execution (Pepple, 2014). Clear and comfortable vision is necessary for driving for various reasons, including identifying road traffic signs, identifying traffic lights, and making appropriate decisions to avoid potholes. Driving requires a combination of sensory, emotional, motor, and compensatory abilities. It is primarily a cognitive (thinking) and sensory (vision) activity (Karthaus & Falkenstein, 2016). Vision accounts for approximately 95% of the sensory requirements for driving. Impaired visual functions will invariably result in a delayed reaction to obstacles while driving (Owsley, 2010). Thus, a driver's vision would ultimately decide how effectively he can perform, determining the probability of Road Traffic Accidents (RTAs).

RTAs have emerged as a significant public health issue in this century, and they are currently considered a neglected pandemic. Road accidents claim the lives of over 1.3 million people every year. As a result, almost 50 million individuals are disabled, costing most countries 3% of their gross domestic product (GDP) (Behzadi, 2020). The World Health Organization (WHO) reported that RTAs account for 2.1% of total deaths and 21% of total injuries worldwide. Developing countries such as the Islands of Trinidad and Tobago account for 80% of those

deaths (Peden, 2005). The rate of fatalities from traffic accidents in the Caribbean region grew from 14.75 to 17.68 deaths per 100,000 population between 2000 and 2010, increasing by 20% (Gopaul, 2016). Trinidad and Tobago is currently ranked 97th out of 183 countries in terms of RTAs, making it the Caribbean's third highest-ranked country, behind Suriname (79th) and Guyana (94th) (Road Traffic Accidents Death Rate, 2021).

Trinidad and Tobago is a Caribbean twin-island that is a developing nation and the region's economic hub. It saw a boost in the automobile industry in 1995 with the opening of the foreign-used car market, enabling customers to increase their living standards and lead to a higher GDP by purchasing a car (Gopaul, 2016). Road transport is considered the most crucial means for moving goods and people within the Twin Islands. Other alternative means of transport are not an option. The demand for privately and commercially owned cars has increased in the past two decades. During the period 2000–2011, the number of people who died from all causes in Trinidad and Tobago was 119,020. Of these, RTAs accounted for 2,360 deaths (≈2.0%) in 2,073 fatal collisions (≈1.1 deaths per collision) (Gopaul, 2016).

Driver fitness in Europe is regulated by the European Union (EU) law and locally made legislation in individual jurisdictions. According to the Road Safety Authority (RSA) and the National Office for Traffic Medicine of Ireland, all prospective drivers or drivers already in possession of a driver's license must fit specific Visual Acuity (VA) and Visual Field (VF) criteria. Group 1 license applicants or holders must have a binocular acuity, with a refractive correction, if necessary, of at least 20/40 on a Snellen chart (Rae, 2016). In the United States of America (USA), the testing parameter that varies least from state to state is VA. Georgia requires a Best Corrected Visual Acuity (BCVA) of at least 20/60 in at least one eye. Some states will not issue any driver's license to people with homonymous hemianopia. Evaluating optimal visual functions such as VA, colour vision, depth perception (stereopsis), contrast sensitivity, and peripheral vision are critical in issuing a driver's license or permitted to drive (Steinkuller, 2010). The Trinidad and Tobago Motor Vehicle and Road Traffic Act (1936) legislation give authority to the Ministry of Works and Transportation (MoWT) authority to execute its function in vehicle-related matters such as issuing drivers licenses to eligible drivers were amended in 2017. However, the regulations governing the issue and renewal of a driver's license in Trinidad do not have a specific Snellen or LogMar visual requirement nor a VF angle requirement.

These visual function parameters' importance among drivers cannot be overstated. However, there is a paucity of knowledge on the extent to which they affect drivers in Trinidad. Therefore, this pilot study was conducted to investigate the relationship between visual function parameters and the occurrence of RTAs among drivers. Acquiring this information will contribute to effective policy formulation on the visual aspects of road safety on the island to improve safety on roads.

2. Method

2.1 Study Design

This descriptive cross-sectional study enrolled drivers in Trinidad using a non-probability purposive sampling approach. Participants had to be Trinidadian citizens, have at least one year of driving experience as a licensed driver, and be between the ages of twenty and seventy. The data was gathered in two ways: ocular examination and semi-structured questionnaire.

2.2 Sampling Approach

Public announcements were made across a variety of communication platforms to recruit participants for the study. Participants initially communicated their interest in participating in the survey to the investigators via phone call, email, or instant messaging. A codebook was used to register each participant and confirm their availability for the study; all respondents then provided informed consent. Based on the selection criteria, a total of 128 licensed drivers were chosen for the study.

2.3 Study Population

This study comprised various ethnic backgrounds, religious and political beliefs, and the age range of twenty (20) to seventy (70) years. Subjects must have had at least one year of driving experience and a valid driver's license obtained from Trinidad and Tobago's licensing authority. Unfortunately, candidates who are less than twenty years of age, institutionalized or not mentally or physically able to communicate, and those who do not consent to participate in the study were excluded from this study.

2.4 Data Collection

The data collection started from January to April 2020 and was obtained from two sources: an ocular examination and a semi-structured questionnaire. The probes in the questionnaires were based on previous studies (Boadi-Kusi

et al., 2016). The questionnaire was validated using a Cronbach's alpha correlation of 0.75 on ten (10) drivers who did not participate in the study. The main results compared various aspects of visual function, such as the drivers' ability to detect the traffic lights and pass objective colour vision testing criteria. The interviews were conducted by a researcher who had prior fieldwork experience and was retrained for this project. The questionnaire contained sections on socio-demographics, duration of driving, perceived difficulties in driving related to the visual status, and a brief history of their driving experience. However, the driving-related ocular exam provided the researchers with measurements of the driver's current visual status. The tests to examine the ocular status included eight non-invasive procedures conducted by an experienced optometrist in a clinical setting following specific guidelines (Elliott, 2021).

At 3m, VA was measured for each eye with a high contrast LogMAR chart. When VA was less than 0.2 LogMAR, pinhole acuity was used. Disability glare testing—using the 3m LogMar chart and a flashlight shone directly below the pupil, the participant is expected to read the smallest letter possible. A hand-held retinoscope (Keeler, 3.6V LED Professional Streak Retinoscope) was used to perform objective refraction on all participants. Certified optometrists optimized the measurements obtained to produce the final spectacle prescription for participants. The TNO fly test was used to measure the drivers' gross and fine depth perception. In contrast, the drivers' colour vision was tested using the Ishihara Colour Deficiency Test (pseudo-isochromatic plate). Following the refraction, the participants were checked for colour vision and stereopsis while wearing their best-corrected spectacle prescription.

Examining the eye's anterior segment with a Slitlamp Biomicroscope (Haag Streit UK) and the posterior segment of the eye using a Volk lens along with the Slitlamp Biomicroscope were also conducted to detect the presence of any pathology. The participants' intraocular pressure (IOP) was measured using an i-care 300 tonometer (Topcon, Canada). In case of further evaluation, participants were referred to the appropriate hospital for attention.

2.5 Data Analysis

The data generated from this study were analyzed using the IBM Statistical Package for Social Sciences (SPSS) version 19 for Microsoft Windows 10 Home Edition version 1903. The data was initially entered into Microsoft Excel 2015 Edition. To further categorize the data, a binocular LogMAR score greater than 0.2 was classified as abnormal. A LogMAR score of less than 0.2 binocularly was considered normal, similar to the Drivers' and Vehicular License Act of 1999 (DVLA, 1999). The Intraocular Pressure (IOP) was categorized into two subgroups labelled as "below 22 mmHg", classified as standard, and above "22 mmHg", which was noted as abnormal (Wójcik-Gryciuk et al., 2015). According to the manufacturers of the Mars Letter Contrast Sensitivity Test (The Mars Perceptrix Corporation, 2013), a Log contrast sensitivity (LogCS) of 1.52 or higher was classified as normal, and less than 1.52 was classified as abnormal. "Stereoscopic acuity less than 50" was considered normal, and "scores greater than 50" were deemed abnormal (Lee et al., 2005). These standards were created because there are no set standards and laws in Trinidad and Tobago, which govern a person's visual status to obtaining a driver's license.

The categories of the data and their subcategories were all meticulously transferred and analyzed with SPSS. Cross-tabulation was performed on all data and contingency Chi-square tests on the sub-categorical data. Within the 95% confidence level, a p-value of 0.05 or less was considered significant, and a Cramer V score was used to measure the strength of the association determined by the Chi-square tests.

2.6 Ethical Consideration

The UWI Ethics Committee gave ethical approval to conduct this study with the reference number: CREC-SA.0068/10/2019. After a verbal description of the study's procedures, the licensed drivers gave their consent. The study followed the Helsinki Declaration to the letter.

3. Results

3.1 Socio-Demographics Characteristics of Drivers

3.1.1 Age and Gender Distribution

A total of 128 vehicle licensed drivers were enrolled in the study. Their ages ranged from 20 to 70 years with a mean age (±SD) of 40.9 years ± 13.3 years. Most of the drivers (27.3%, n=35) were aged 20–30 years, followed by the age group of 31–40 years (25.8%, n=33), and the least aged (61–70 years) accounted for (9.8%, n=12) of the population (Table 1).

3.1.2 Level of Education

Most of the participants had a formal education. Those that completed tertiary education (48.4%, n=62) were the

majority, followed by "A" levels (28.9%, n=37), and primary education accounted for the least group (5.5%, n=7) considering their level of education (Table 1).

Table 1. Socio-demographic variable (N=128)

Variables	Frequency	Percentage
Gender		
Female	63	49.2
Male	65	50.8
Age		
20-30	35	27.3
31-40	33	25.8
41-50	25	19.5
51-60	23	18.0
61-70	12	9.4
Ethnic Background		
White/Caucasian	9	7.0
Hispanic/ Latino	17	13.3
Indo-Caribbean	49	38.3
Afro-Caribbean	53	41.4
Level of Education		
Primary School	7	5.5
CSEC Level	21	16.4
A levels/ CAPE	37	28.9
Tertiary Education	62	48.4
Other	1	0.8

3.2 Driving Duration and Obtaining/Renewing License

The duration of continuous driving among the drivers showed that most drivers drive continuously for 6 – 10 hours (61%, n=79). This is followed by 4–5 hours (21.1%, n=27). The least driving hours among drivers is > 15 hours (3.1%, n=4). One hundred and seven (83.6%) drivers reported that they have never had an eye examination before obtaining or renewing their driver's license. Drivers who reported having an eye examination prior to renewing their license account for the fewest participants, approximately (16.4%, n=21) (Table 2).

Table 2. Possession and Mode of Obtaining License by Respondents (N=128)

Driving License Variables	Frequency	Percentage
Possession of driver's license		
Yes	128	100
No	0	0
Eye exam conducted		
No	107	83.6
Yes	21	16.4

3.3 History of Road Traffic Accident and Drivers Experience

The majority (68%, n=87) reported "no road traffic accidents" in the previous five years, accounting for two-thirds of the sample population, while one-third (32%, n=41) reported being "involved in road traffic accident" in the previous five years. The driving experience among drivers reflects that the majority (24.2%, n=31) of the drivers had 11–15 years of driving experience, followed by 6–10 years (23.4%, n=30), whereas the least driving experience was 1–5 years (13.3%, n=17) (Table 3).

Table 3. Experience and Road Traffic Crash History among Respondents (N=128)

Driving History Variable	Frequency	Percentage
Drivers Experience		
1-5 years	17	13.3
6-10 years	30	23.4
11-15 years	31	24.2
16-20 years	24	18.8
>20 years	26	20.3
RTA in the last 5 years		
No	87	68.0
Yes	41	32.0
Average Driving Duration		
4-5 hours	27	21.1
6-10 hours	79	61.7
11-15 hours	18	14.1
>15 hours	4	3.1

3.4 Contrast Sensitivity and Stereopsis (TNO fly test)

The findings indicate that drivers in the study had profound (0.7%, n=1), severe (5.5%, n=7), and moderate (13.3%, n=17) contrast sensitivity defects in both eyes. On the other hand, most drivers were considered to have an excellent log contrast sensitivity score. Within the last five years, the driver has been involved in RTAs with profound (0.7 %) and severe (4.5%, n=6) contrast sensitivity impairment (Table 4). The cross-tabulation for stereopsis indicates that 36 (28%) drivers had abnormal stereopsis, and 18 (13.7%) drivers had been involved in RTAs within the previous five years (Table 4).

3.5 Visual Acuity and Glare

About twenty-six (20.3%) drivers with visual acuity score of <0.2LogMAR involved in RTAs within the last five years, seventeen (13.3%) of the drivers reported reduced VA with a glare in either eye. It can be observed that drivers who had a VA of 0.1 to 0.0 LogMAR (10.9%, n=14) were primarily involved in an RTAs in the last five years in comparison to drivers with a worse VA score (Table 4).

3.6 Colour Vision (Ishihara Pseudoisochromatic Plate)

Drivers (20.3%, n=26) with colour vision defects who missed less than 13 Ishihara plates were most frequently involved in RTAs than drivers (11.7%, n=15) who missed more than 13 Ishihara plates. However, most drivers (62.2%, n=80) who missed less than 13 Ishihara plates never reported being involved in RTAs within the past five years (Table 4).

Table 4. Relationship between Visual Function Parameters and Involvement in Road Traffic Accident in the last 5 years (N=128)

Vision Parameters	Involvement in Road Traffic Accident in the last 5 years		
Visual Acuity (LogMAR)	No (%)	Yes (%)	Total(N=128)
0.1 - 0 (Excellent)	40(31.2%)	14(10.9%)	54(42.2%)
0.02 - 0.1 (Good)	27(21.1%)	11(8.6%)	38(29.7%)
0.12 - 0.2 (Normal)	7(5.5%)	1(0.8%)	8(6.3%)
0.22 - 0.3 (Moderate)	12(9.4%)	8(6.3%)	20(15.6%)
> 0.32 (Severe)	1(0.8%)	7(5.5%)	8(6.3%)
$P > 0.05$: Statistically not significant			
Stereopsis			
160" - 100" (Severe)	6(4.6%)	5(3.6%)	11(8.5)
63" - 50" (Moderate)	12(9.4%)	13(10.1%)	25(19.5%)
40" - 32" (Normal)	40(31.2%)	17(13.3%)	57(44.5%)
25" - 20" (Excellent)	29(22.6%)	6(4.7%)	35(27.3%)
$P > 0.05$: Statistically not significant			
Contrast Sensitivity (LogCS)			
<0.48 (Profound)	0	1(0.7%)	1(0.7%)
0.52 - 1.00 (Severe)	1(0.8%)	6(4.7%)	7(5.5%)
1.04 -1.48 (Moderate)	4(3.1%)	13(10.2%)	17(13.3%)
1.52 - 1.76 (Normal)	30(23.4%)	12(9.4%)	42(32.8%)
1.72-1.92 (Excellent)	52(85.2%)	9(14.7%)	61(47%)
$P < 0.05$: Statistically Significant			
Glare Assessment			
No	60(46.9%)	24(18.7%)	84(65.6%)
Yes	27(21.1%)	17(13.3%)	44(34.4%)
$P > 0.05$: Statistically not significant			
Colour Vision Assessment			
< 13 Plates Missed (Colour vision defect)	80(62.5%)	26(20.3%)	106(82.8%)
>13 Plates Missed (No defect)	7(5.5%)	15(11.7%)	22(17.2%)
$P < 0.05$: Statistically Significant			

4. Discussion

The results of this pilot study revealed that neither gender dominates driving; eligible licensed drivers for this study included males (50.8%, n=65) and females (49.2%, n=63). In contrast, a study conducted in Ghana found that males (100%, n=520) dominated as drivers; however, this study was conducted among commercial drivers in Ghana (Boadi-Kusi et al., 2016). This could be due to the perception that driving is a dangerous task that males are better equipped to handle than females (Martin & Barnard, 2013). According to the study, the most active driving age groups were between 20 to 30 years old (27.3%), with the mean age of 40.9 years ± 13.3 years, and the age group of 31 to 40 years experienced RTAs more than other groups. A similar study in China supports these findings, showing that drivers aged 18–30 years are more active and more likely to cause accidents (Hu et al., 2020). On the other hand, another study found that Nigeria's most active driving age groups are between 40 and 49 years old

(Ekpenyong et al., 2020). The active age of 21–29 years is exposed to the risk of a crash. In most cases, due to nighttime driving. This exposure decreases with age. However, the fatality rate is common among the elderly. This can be attributed to their frail nature (Regev et al., 2018).

RTAs have been reported by about one-third of drivers in the last five years, resulting in a prevalence of 32 % for both "major" and "minor" accidents. This result is significantly higher than other studies' prevalence of RTA history, which has been as low as 15.3% (Biza et al., 2013). 16.2% (Bekibele et al., 2008) 19.5% (Oladehinde et al., 2007) 20.8% (Adekoya et al., 2009) 22.5% (Boadi-Kusi et al., 2016) 26.5% (Chidi-Egboka et al., 2017). The variations in the study population may be attributed to the following: sample population size, characteristics of the sample population, research methodology utilized and research funding (Emerole & Nneli 2013, Boadi-Kusi et al., 2016, Pepple, 2014, Ekpenyong et al., 2020).

Before obtaining a driver's license on the island, all (100%) participants had to pass a driving test. This is higher than a study conducted in Nigeria's Niger-Delta region (Pepple, 2014) and similar to another study conducted in Ibadan (Nwosu, 1989). The latter study may share similarities attributed to the strict measures implemented by various regulatory agencies in these countries. Most of the drivers had between 11 and 15 years of driving experience. According to the China In-Depth Accident Study (CIDAS), drivers with 6 to 11 years of driving experience cause the most RTAs attributed to driving style and crash propensity (Hu et al., 2020).

In this study, the evidence was insufficient to support the relationship between poor VA, the effect of glare on VA and stereopsis defect. However, the study found that drivers (20.3%, n=26) with colour vision problems and poor vision were frequently involved in RTAs. The research is of value to the visual function of drivers in the Caribbean and Trinidad and Tobago in particular. This is the first pilot study that we are aware of on drivers' visual status concerning RTAs.

This finding identifies more colour vision impaired licensed drivers (83.8%, n=106) than the research done by Tang et al. (2006), where only 9.9% of the drivers were found to have colour vision defects. A similar study found that drivers with colour defects are more likely to be involved in RTA, particularly protans and deutrans (Boadi-Kusi et al., 2016). On the other hand, studies found that all drivers who missed less than 13 Ishihara plates had never been involved in RTA (Ovenseri-Ogbomo & Omuemu, 2010, Oladehinde et al., 2007). However, the discrepancy between these studies could be related to the instrument utilized, such as the pseudoisochromatic plate and Hardy Rand and Rittler (HRR) plate, which can detect congenital and acquired colour vision impairments (Ovenseri-Ogbomo & Omuemu, 2010).

Due to traffic signs and signals, a colour vision defect may jeopardize the driver's ability to drive safely. Protanopia-affected drivers were more likely to miss the red signal from a traffic light, which could have resulted in RTAs (Boadi-Kusi et al., 2016).

A total of 36 (28.1%) drivers were found to have a stereoscopic acuity greater than 50", with 18 drivers having been involved in an RTA in the previous 5 years and scoring less than 50" in stereoscopic acuity, which follows the findings of Tang et al., who found that 18.5% of drivers had poor stereo acuity (Tang et al., 2006). Stereopsis had a positive effect on driving performance only in dynamic situations at intermediate distances, according to a study investigating the impact of stereoscopic depth perception on automobile driving performance (Bauer et al., 2001). Another survey of 15.4% of drivers with abnormal stereopsis found that 5.2% of these drivers admitted to having difficulty judging distance when driving (Boadi-Kusi et al., 2016).

Correlational analysis showed that on performing a Chi-Square test on the VA, it was further categorized into candidates having a binocular VA better than 0.2LogMar or worse than 0.2LogMar. Chi-Square test revealed a relationship between the VA being less than 0.2LogMar and RTA occurrence in the last five years (p<0.05). However, a Cramers V score of 0.244 indicates a weak relationship, which is consistent with the findings from Odisha, India, where it was discovered that there was no significant relationship between refractive error and RTA (Kshatri et al.).

However, 42 (32.8%) of the drivers studied scored below the standard limit of 1.52 Log CS unit. Crosstable data analysis revealed that most (31.7%) of the RTA occurred with drivers considered to have moderate contrast sensitivity (Log CS unit 1.04–1.48). The Log CS unit score worse than 1.52 being abnormal revealed an association (p < 0.05) with RTAs. This relationship was amplified with a Cramers V score of 0.442. This finding is similar to the one obtained in the North-Central State of Nigeria conducted by Chidi-Egboka et al., where it was discovered that there was also an association with Contrast Sensitivity Impairment and RTA (Chidi-Egboka et al., 2017). The Chi-Square, χ^2 test revealed no statistical relationship between having a stereoscopic acuity worse than 50" and RTA occurrence in the last five years (p > 0.05).

Ultimately, this study revealed that approximately 25% of drivers had been involved in RTAs in the past five years, and 75% of these drivers had never had an eye exam before obtaining or renewing their driver's license. It also discovered a relationship between the occurrence of RTAs in the past five years and abnormal colour vision and contrast sensitivity.

5. Conclusion

This study established the importance of adopting and developing a screening protocol that can easily be translated into driving safety licensing policies. Based on these findings, a mandatory comprehensive eye examination for prospective driver's license applicants is necessary. This will contribute significantly to the reduction of RTAs. A robust partnership approach between the Ministry of Works and Transportation's Licensing Office in Trinidad and Tobago, the Trinidad and Tobago Optometry Association (TTOA), and other stakeholders is critical to ensuring proper screening before the issuance of a driving license, both initially and during renewals.

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On the Agreement between Patients' Perceptions and Expectations about the Quality of Hospital Services

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Abstract

Minimizing the gap and ensuring agreement between patients' perceptions and expectations is an indication of a better quality of hospital services. This study aimed to examine the agreement between patients' perceptions and expectations of the quality of hospital services. A cross-sectional design was adopted, and quantitative methods were employed for data collection. The SERVAQUAL tool was used. The sample size was 415 participants. This study was conducted in Jordanian teaching hospitals. The study population was patients who used outpatient clinics in these hospitals. The study found that there is very low agreement between patients' expectation and their perceptions. Overall, the perceived service quality was significantly lower than the expected service quality across all of the dimensions used to measure the service quality gap (reliability, responsiveness, assurance, empathy, and tangibles). The results suggest regional variation, where patients who sought care at hospitals in Amman have a four-fold higher perception of the quality of services than patients who visited Irbid hospitals. Also, patients who are more highly educated (Diploma, Bachelor, or Higher Studies) have a higher perception than patients who have less than secondary education. Age and gender were found to have no significant association with patients' perceptions. The findings of this study suggest that there is a gap between patients' perceptions and expectations. Thus, there is a need to close this gap by improving patient satisfaction with the quality of services.

Keywords: patients' perceptions, patients' expectations, hospital quality of services, Jordan

1. Background

Hospitals play a significant role in providing vital services for patients. They have exerted huge efforts to overcome obstacles to introduce medical services that meet patients' expectations. There is high competition among hospitals to improve their services and achieve high performance, and hospitals can evaluate their service quality improvement according to their patients' satisfaction (Mahmoud, Alatrash, Fuxman, Meero, & Yafi, 2019). Hospital managers can achieve patient satisfaction if they achieve agreement between patients' perceptions and expectations. This agreement can be attained by reducing the distance between patients' expectations and their perceptions. The agreement drives to quality in the healthcare sector, which is defined based on different perspectives. One perspective focuses on adapting the degree between patients' perceptions and their expectations. Patients' perceptions are based on their interaction with the services provided. When patients receive a specific service, they form perceptions based on the assessment of the quality of the services. In addition, perceptions vary from time-to-time based on the quality of the services received. Hence, hospitals should review continuously review their patients' perceptions. Meanwhile, patients' expectations reflect beliefs about specific services, which involve procedures or tasks based on reference points, standards or criteria against which achievement is judged. In other words, they have faith in the services provided as a reference point against which performance is judged (Girmay et al., 2018).

Enhancement of services is one way to improve patients' perceptions towards healthcare quality and meet patients' needs in order to reduce the distance with patients' expectations. Small and large hospitals can prove great

performance when they meet the quality factors and patients' expectations. Some hospital managers have measured the quality of healthcare services based on only specific standards and have neglected the importance of patients' perceptions (Nguyen, 2016).

However, these days, patients' perceptions are considered a significant source of information to address managerial and technical problems and develop efficient and effective plans for quality improvement in hospitals. Therefore, hospital managers can assess the quality of their hospital services by measuring the gap between expectations and perceptions. Usually, patients can judge low performing quality of services if the actual service provided to patients is less than patients' expectations and vice versa (Ali et al., 2019). Hospital managers should find and address factors related to determining whether a patient's judgment of the hospital services they receive is negative or positive. This action can help hospital management and health care providers to increase their efforts on these factors that hinder their quality improvement, and hence improve healthcare services.

When people receive services or goods, they create an attitude about these services or goods based on their evaluation. In order to measure attitudes about specific services, many tools have been used (Mahmoud et al., 2019). Parasuraman et al. (1991) developed a scale called SERVQUAL to measure quality based on customer expectations and experiences of services. The SERVQUAL is widely used to measure the gap between perceptions and expectations, and agreement can be identified according to these variables. The SERVQUAL model has also drawn attention to the concept of Perceived Service Quality, which focuses on the difference between customers' expectations and perceptions. The SERVQUAL has five domains. First, tangibility is an indication of the physical items that can be recognized by human senses. Second, reliability is the ability to provide service in the same way repeatedly. Third, responsiveness relates to delivering a service at the required time. Fourth, assurance means providing a service with qualified and trained staff, and fifth, empathy refers to understanding of customers' needs and taking care of them.

There are many procedures that have been used to improve the healthcare system in Jordan, and patients believe that Jordanian hospitals have many qualified practitioners. Therefore, patients expect high-quality procedures that meet their needs. Although hospitals have exerted serious efforts to improve the quality of services, and have clarified the importance of a successful health information system (Ayaada et al., 2019), there are many challenges and obstacles that hinder the healthcare system in Jordan from providing patients with high-quality services that meet their expectations. Some of these obstacles are lack of reward, inadequate authority delegation, inadequate material resources, and insufficient budget for a quality management system (A'aqoulah et al., 2016). Consequently, Jordanian hospitals should assess the quality of services and understand how big the gap is between patients' expectations and their perceptions. Therefore, this study aims to examine the agreement between patients' perceptions and expectations of quality hospital services.

2. Materials and Methods

A cross-sectional design was adopted, and a quantitative method was employed for data collection. The SERVQUAL tool was used with minor adaptation to measure agreement between patients' perceptions and expectations. An expert translated the SERVQUAL to Arabic from English, and it was then retranslated back to English by another professional translator to be sure that the Arabic SERVQUAL had been translated correctly.

This study was conducted in Jordanian teaching hospitals. The study population was patients who used outpatient clinics in these hospitals. Teaching hospitals were chosen because they have training programs for medical school students. Consequently, it is expected that these hospitals have high-quality healthcare services. The study population included only adult patients who used the teaching hospitals, and a sample of 415 patients was driven by the study population. The study used a simple random sample to distribute the SERVQUAL among participants in order to take a representative sample from the target group. The completed SERVQUALs were collected from the participants directly, and the response rate was 83%. Five hundred questionnaires were distributed, while 415 questionnaires were returned.

The SERVQUAL has five domains about expected services and the five domains were repeated to assess the patients' perceptions. The domains are tangibility, reliability, responsiveness, assurance, and empathy. The SERVQUAL contains 21 items, and uses a 5-point Likert scale which starts at 1 (strongly disagree) to 5 (strongly agree). The SERVQUAL is classified into three categories based on the mean score: (1) low agreement degree, where the mean is < 2.33; (2) medium agreement degree, where the mean is from 2.34 to 3.66; and (3) high agreement degree, where the mean is 3.67 to five. The questionnaire was sent to three experts to check the validity of the questionnaire and suitability for Arabic culture. A pilot study was conducted with 50 patients. A reliability analysis was conducted, and it showed an alpha of 0.82. The collected data was analyzed using the IBM SPSS (International Business Machines - The Statistical Package for the Social Sciences) program. The coding for the

negatively worded items of the questionnaire was reversed, and the data was used for analysis in relation to the study aims. Descriptive statistic procedures were completed to determine the mean scores of expectations and perceptions.

The study used Cohen's kappa coefficient (κ) to test the agreement between the SERVQUAL domains of tangibility, reliability, responsiveness, assurance, and empathy for both patients' hospital service expectations and quality of service perceptions. κ is a statistic that is used to measure inter-rater reliability (also Intra-rater reliability) for qualitative (categorical) items (McHugh, 2012). κ statistics are a more robust measure than simple percent agreement calculation, as κ takes into account the possibility of the agreement occurring by chance. κ is a quantitative measure of reliability for two raters that are rating the same domain, corrected for how often the raters may agree by chance. Cohen suggested the Kappa result should be interpreted as follows: values ≤ 0 indicate no agreement and 0.01–0.20 as none to slight, 0.21–0.40 as fair, 0.41– 0.60 as moderate, 0.61–0.80 as substantial, and 0.81–1.00 as almost perfect agreement. κ has been widely used in healthcare research (McHugh, 2012; Tsang et al., 2020; Bordalo-Rodrigues et al., 2020).

The study then categorized patients' perceptions into high and low and used *logistic* regression to model the probability of that experience using patients' expectations and demographic factors. Using interaction terms, we further tested whether the effect of patient's expectations on the patients' perception of hospital service quality varied with their level of education. Finally, we used the area under the Receiver Operating Characteristic (ROC) curve to capture whether patients' observations were correctly classified.

3. Results

The results reveal that, overall, perception (experience) ranked lower than expectation. Overall, there was very low agreement as shown by the Kappa statistics ($\kappa = 0.17$), which was statistically significant ($p < 0.001$). The mean difference of the domains of expectation and perception are statistically significant ($p < 0.001$). As shown in Table 1, the results also reveal that the mean of the domain of tangible expectations (4.49) is significantly ($p < 0.001$) higher than the mean of the domain of tangible perceptions (3.97). The rest of the domains of empathy, assurance, responsiveness and reliability reveal similar results, where there is a very low agreement between expectation and perception and the mean difference was greater in the expectations.

Table 1. Agreement between the domains of expectation and perception

	N	Mean	SD	κ	P-value
Expectation: Tangibles	415	4.49	.64	0.139	< 0.001
Perception: Tangibles	415	3.97	.97		
Expectation: Empathy	415	4.31	.72	0.087	< 0.001
Perception: Empathy	415	3.82	.99		
Expectation: Assurance	415	4.39	.73	0.125	< 0.001
Perception: Assurance	415	3.83	1.01		
Expectation: Responsive	415	4.40	.70	0.137	< 0.001
Perception: Responsive	415	3.80	1.06		
Expectation: Reliability	415	4.37	.70	0.101	< 0.001
Perception: Reliability	415	3.86	.98		
Mean Expectation: All domains	415	4.39	.64	0.170	< 0.001
Mean Perception: All domains	415	3.83	.87		

Table 2 shows the results of logistic regression. The results reveal that by visiting a hospital in the Amman region, patients' perceptions increase by a factor of 4.139 ($p < 0.001$) compared to visiting a hospital in the Irbid region. In addition, the results show that having an education level of diploma, bachelor degree or higher education, patients' perceptions increase by a factor of 3.675 ($p = 0.013$), 3.83 ($p < 0.001$), and 2.59 ($p = 0.041$), respectively, compared to no schooling. The patients' demographic profiles such as gender and age, as well as their expectations about the services, were not associated with the perceptions of patients about the quality of services in the hospitals they visited. Further analysis did not reveal that the influence of patient expectation on perceptions varied with the level

of education (Table 3).

Table 2. Experience/perception and associated factors

	Variable	OR	[95% C.I]		P-value
Expectation (low=base)	High expectation	1.244	0.79	1.944	0.337
Region of hospital (Irbid =base)	Amman region	4.139	2.63	6.505	< 0.001*
Age category 20-30 = base	31-40	1.04	0.61	1.753	0.884
	41-50	1.327	0.68	2.561	0.399
	>50	1.216	0.56	2.635	0.62
Education level <High school=base	High school	1.364	0.59	3.152	0.467
	Diploma	3.675	1.31	10.292	0.013*
	Bachelor	3.83	1.88	7.797	< 0.001*
	Higher Educ.	2.587	1.04	6.425	0.041*
Gender Male = base	Female	0.694	0.43	1.107	0.125
	Intercept	0.333	0.14	0.753	0.008*
	Wald Chi2 (14)	56.18			
	Prob > Chi2	<0.001			
	Pseudo R2	0.1292			
	Linktest	0.528			
	Goodness fit (Lfit)	0.2923			

*Notes. *significant at 5% level.*

Table 3. Experience/perception and associated factors with interactions

	Variable	OR	[95% C.I]		P-value
Expectation (low=base)	High expectation	1.090	0.321	3.695	0.891
Region of hospital (Irbid =base)	Amman region	4.089	2.584	6.472	< 0.001*
Age category 20-30 = base	31-40	1.06	0.624	1.801	0.828
	41-50	1.332	0.689	2.578	0.394
	>50	1.271	0.575	2.808	0.553
Education level <High school=base	High school	1.100	0.335	3.614	0.875
	Diploma	5.042	1.061	23.949	0.042*
	Bachelor	3.829	1.442	10.17	0.007*
	Higher Educ.	1.560	0.369	6.594	0.546
Gender Male = base	Female	0.697	0.437	1.111	0.129
Education expectation interaction	High school × High expectation	1.496	0.288	7.76	0.631
	Diploma × High expectation	0.653	0.084	5.052	0.683
	Bachelor × High expectation	1.040	0.267	4.051	0.955
	Higher Educ × High expectation	2.257	0.343	14.83	0.397
	Intercept	0.349	0.131	0.928	0.035
	Wald Chi2 (14)	58.320			
	Prob > Chi2	<0.001			

Pseudo R2	0.1322
Linktest	0.462
Goodness fit (Lfit)	0.2439

*Notes. *significant at 5% level.*

Figure 1 shows a 45-degree line of evidence of good fit, which is reflected in a receiver operating characteristic (ROC) curve that lies above the 45-degree line. The area under the ROC curve = 0.74029, implying that 74% of the observations about the perception of hospitals are correctly classified.
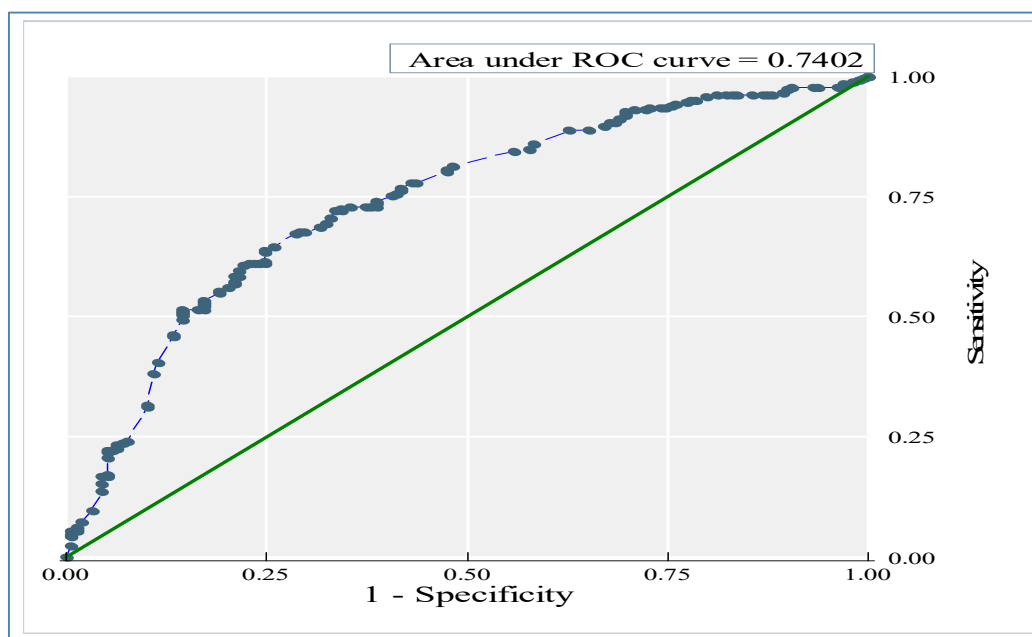
Figure 1. A Receiver Operating Characteristic (ROC) fitness

4. Discussion

This study attempted to answer the question of whether there is agreement between patients' perceptions and expectations using the SERVQUAL tool. The agreement between patients' perceptions and expectations gives an important indication of the level of service quality that they have been provided in any hospital. However, Jordanian hospitals have neglected to measure the quality of their services according to the gap between patients' perceptions and their expectations. Measuring the gap provides hospitals with suggestions for how to improve dealing with patients, facilitate the various procedures of treatment, and enhance the medical practice to reach patient satisfaction. This leads hospitals to make a commitment to the quality of healthcare services.

Generally, the results revealed a difference between the mean of the domains of patients' expectations and perceptions, with the domain of expectations being significantly higher. However, overall, there was very low agreement between patients' expectations and perceptions. Hospital staff could give low attention to patients, physicians do not provide patients with adequate information their health status or patients did not receive effective and safe results. The study results are consistent with the findings of previous studies that demonstrate a difference between patients' expectation and their perceptions, where expectations were reported to be higher (Mahmoud et al., 2019). The finding is also consistent with another study that found patient expectations regarding the effectiveness of treatment were higher compared to their experiences (Moor et al., 2020). In addition, there is agreement between this study result and that of Al-Monani (2016), who showed a gap between patients' expectation and their perceptions in a public hospital in Saudi Arabia. Moreover, in other studies conducted in Pakistan and Iran, researchers found a gap between patients' expectations and perceptions of healthcare service quality (Ali et al., 2019; Abedi et al., 2015). In contrast, the results in this study are not consistent with some other studies. One study found that the perceived services of primary care physicians in Poland met patients'

expectations (Krztoń-Królewiecka et al., 2020), and another study, which examined patient expectation and experience on the interaction between a self-management system and patients, found that patients' expectations were close to their experience (Hallberg et al., 2018). In the current study, perceived service quality was significantly lower than the expected service quality. The wide gap between expectation and perception may be an indication that Jordanian teaching hospitals provided a low level of service quality.

The present study results also show regional variation in the perception of patients about service quality, where visiting a hospital in the Amman region is more likely to be perceived higher compared to Irbid. This result could be because the teaching hospital in Amman is older than the teaching hospital in Irbid, implying that it has more experience in dealing with its patients. This result is consistent with a study in Iran that found gaps in the mean score in all SERVQUAL domains in four different hospitals (Nadi et al., 2016).

The results indicate a mixed effect with regards to patients' demographic characteristics. On the one hand, the study found that having an education level of Diploma, Bachelor's degree or attending higher education is more likely to result in a higher perception about the quality of services compared to patients with less than high school education. This result may be because the patients who are more highly educated know how to use this facility and are more realistic with their perceptions. However, other studies have revealed that the influence of patients' expectations on perceptions did not vary with the level of education (Girmay et al., 2018; Al-Momani, 2016). Patients' demographic profiles, such as gender and age, were not associated with the perceptions of patients about the quality of services in the hospitals they visited. While these results are consistent with some studies (Girmay et al., 2018; Al-Momani, 2016), other studies have shown that women's perceptions of inpatient care were generally less positive than men's (Elliott et al., 2012).

Overall, our study showed that the observations about the perceptions of hospitals are correctly classified. When we adjusted for the effect of expectation on perception, the study revealed no association between patients' expectations about the services and their perception about the quality of services in the hospitals they visited. The lack of agreement between patients' expectations and perceptions means that teaching hospitals in Jordan may have been less optimal in meeting patients' expectations. Patients who attended these hospitals expected a higher level of services. Whereas this study found moderate service quality, the level of service quality was less satisfying for the hospital patients. Patient satisfaction is today a focal point for most hospitals because patients pay for services. Therefore, hospital managers need to recognize that patients receive safe and effective healthcare. This should drive hospital managers to lead their hospitals towards better service quality. Patient satisfaction is an important indication of a hospital's performance. Many hospitals link physicians' incentives with their patients' evaluations.

High-performing hospitals recognize that high satisfaction from patients yields advantages. The following are several reasons that focus on the importance of meeting patients' expectations. First, patients' satisfaction increases their loyalty. There is high competition in the market among hospitals. Therefore, it is required from hospital managers to do their best to increase patients' loyalty by addressing the issues that face them. If any hospital meets its patients' needs, the patients are more likely to come back to the same hospital rather than look for a new hospital (Rostami et al., 2019). Second, meeting patients' expectations enables hospital managers to improve patient retention and attract new patients. Patients share their experiences with one another, and if a hospital has qualified staff and introduces high-quality services to its patients, this will make patients come back again to the same hospital (Abraham et al., 2011). In addition, good service acts as marketing because satisfied patients will discuss their good experiences with their friends, and this could encourage their friends to go to the same hospital. Moreover, improving the outcomes of healthcare services reduces the risk of malpractice. If patients are satisfied with the healthcare services that were provided by staff members, they will adhere to the staff treatment recommendations. Patient satisfaction also makes the hospital staff satisfied with their work and increases staff morale, which leads to a decrease in the risk of malpractice (Prakash, 2010). Furthermore, good service offers the opportunity to make a consistent profit and makes it less likely that a hospital will lose its patients due to service prices. Patients are willing to pay more money to receive healthcare services that meet their expectations. High performing hospitals with high patient loyalty can ask their patients to pay a relatively higher price without losing them, but a hospital that is not interested in its patients' satisfaction will lose them. As a result, this will negatively affect the hospital's income (Richter & Muhlestein, 2017). In addition, most hospitals look forward to local or international accreditation, which is required from hospitals to demonstrate a commitment towards their patients by introducing high quality and safe services (Richter & Beauvais, 2017; Mahmoud, Ekwere, Fuxman, & Meero, 2019).

Hospital managers should pay more attention and take several actions to enhance their hospital services in order to

reduce the gap between their patients' expectations and perceptions. First, it is necessary to improve the appearance of physical materials, equipment, and facilities. Hospital managers need to emphasize cleanliness in their hospitals and employ enough workers to cover all of the hospital facilities. Cleanliness has to be practiced every day, and a hygiene culture must be disseminated among the hospital staff. Hospitals must also ensure that there is car parking available for hospital visitors. Hospital staff need to appear neat and deal with patients in a gentle manner. All tools and machines that are used in the hospital should be up to date. Ali et al. (2019) discuss that tangible resources are essential in organizations to facilitate their services. Second, the ability to implement services to patients reliably and accurately must be enhanced. Appropriate and immediate actions should be taken to address any issues that hinder patient services. In addition, all medical and non-medical mistakes must be reported. Patients must be provided reliable information about their medical status, and providing the right treatment makes patients feel confident with the ability of staff to take care of them. Devi and Muthuswamy (2016) examined service quality perceptions in Indian hospitals, and they found that reliability was one of the most important domains connected with healthcare service quality based on patients' perceptions. Furthermore, Al-Damen (2017) found that the reliability dimension had the most impact on patient satisfaction. Third, hospitals need to provide quick and responsive services to patients. All patient queries should be answered and explained clearly, which will make patients more likely to commit to following the staff recommendations. In addition, all phone calls should be answered promptly. Hospital staff should inform patients exactly when services will be performed, and the service should be at a convenient time for the patient. Moreover, working during the weekend should be organized. Kashkoli et al. (2017) found that the responsiveness of hospital staff has a positive effect on patient satisfaction. They recommend that hospitals should respond to their patients' needs in a quick manner to provide high-quality service. Furthermore, dealing with patients with courtesy and knowledge helps to build a trusted environment. Hospitals should employ qualified staff who can take care of patients and respect their privacy. Naik et al. (2010) found that the staff of any institution need to be trained well to help their customers and be able to provide them with the right information in a timely manner. Moreover, the training program should include etiquette, courtesy, and communication skills. Finally, each patient should feel cared for and attended to. Medical staff should be aware and understand when patients are in discomfort. Hospital staff should also deal with patients with a caring and warm attitude, in addition to providing medical attention to every patient. Nguyen (2016) focused on the empathy factor in a study which examined patients' expectations and perceptions. The study mentioned that health workers should take care and have an interest in all patients; they should understand and listen to each patient to give him or her the best healthcare service that the patient needs.

All of the SERVQUAL domains need to be addressed to improve the quality of services. Thus, it is required from hospital managers to perform corrective actions where these procedures are lacking, in order to improve the quality of services. Improving quality on the ground in hospitals eliminates or reduces the gap between patients' expectations and their perceptions in different domains. As a result of these actions, patients will receive a high level of healthcare service quality and become satisfied with their hospitals. Hospital managers need to constantly review their patients' expectations and perceptions, and eliminating a gap between these factors will enhance the hospital's reputation, locally and globally.

The study limitations include collecting data only from teaching hospitals and only covering some demographic factors. This study did not include private hospitals because of concerns of accessibility to data and privacy issues, thereby limiting the generalizability of the results of the study. Jordan has many private hospitals that are considered high-performing hospitals. These hospitals have modern equipment and qualified staff. However, the services of these hospitals are expensive and are out of reach for many patients, as only wealthy patients and patients who have private insurance can afford the cost of the services of these hospitals. In addition, this study did not capture all demographic characteristics of patients because of privacy issues. Future research should measure patients' expectations and perceptions in private hospitals and focus on other demographic factors that were not covered in this study.

5. Conclusion

Measuring the gap between patients' expectations and their perceptions is a vital procedure to improve the quality of healthcare services and achieve patient satisfaction. Teaching hospitals in Jordan have a significant gap between their patients' expectations and perceptions, which is an indicator that these hospitals do not meet their patients' needs. Hospital managers need to meet their patients' needs because this will increase patient loyalty, enhance patient retention and attract new patients, generate marketing via satisfied patients, improve hospital outcomes and reduce the risk of malpractice, and contribute to generating a consistent profit with less chance of losing patients due to service prices. As a result, serious action needs to be taken by hospital managers to eliminate the gap between patients' expectations and perceptions. These actions include improving the appearance of physical

materials, equipment, and facilities; enhancing the ability to implement services to patients reliably and accurately; improving responsiveness to patient needs and providing efficient services; dealing with patients with courtesy and knowledge to build a trusted environment; and introducing more caring practices and providing enough attention to each patient.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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Willingness to Vaccinate against COVID-19 among Healthcare Workers: An Online Survey in 10 Countries in the Eastern Mediterranean Region

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Abstract

Background: Willingness of healthcare workers to be vaccinated is an important factor to be considered for a successful COVID-19 vaccination programme. This study aims to understand the willingness of health workers to receive a COVID-19 vaccine and its associated concerns across 10 countries in the Eastern Mediterranean Region (EMR).

Method: A cross-sectional study was conducted in January 2021 among healthcare workers in EMR using an online survey. Data were analyzed using IBM SPSS software package version 20.0.

Results: A total of 2806 health workers (physicians, nurses and pharmacists) completed and returned the informed consent along with the questionnaire electronically. More than half of the respondents (58.0%) were willing to receive a COVID-19 vaccine, even if the vaccination is not mandatory for them. On the other hand, 25.7% of respondents were not willing to take COVID-19 vaccine while 16.3 % were undecided. The top three reasons for not willing to be vaccinated were unreliability of COVID-19 vaccine clinical trials (62.0%), fear of the side effects of the vaccine (45.3%), and that COVID-19 vaccine will not give immunity for a long period of time (23.1%).

Conclusion: Overall, the study revealed suboptimal acceptance of COVID-19 vaccine among the respondents in the EMR. Significant refusal of COVID-19 vaccine among healthcare professionals can reverse hard-won progress in building public trust in vaccination program. The findings suggest the need to develop tailored strategies to

address concerns identified in the study in order to ensure optimal vaccine acceptance among healthcare workers in the EMR.

Keywords: COVID-19, vaccination, healthcare workers, global health, Eastern Mediterranean Region

1. Introduction

Coronavirus disease (COVID-19) is an infectious disease caused by the novel coronavirus that was first discovered in Wuhan, China. In 2020, the World Health Organization (WHO) declared the outbreak a global health emergency and later a pandemic after it has spread to many countries of the world (Cucinotta & Vanelli, 2020). COVID-19 pandemic has raised immense global concerns for humanity and has posed unprecedented challenges to healthcare systems worldwide. As of 12 July 2021, globally, there have been 187,632,756 confirmed cases of COVID-19 reported to the WHO, including 4,049,071 deaths. Unsurprisingly, healthcare workers account for a number of the reported cases (Gagneux-Brunon et al., 2021).

The healthcare workers are on the first line of the battle against the COVID-19 (Nemat et al., 2020). Thus, protecting them should be one of the top priorities in the fight. Their contacts with patients can facilitate the spread of the virus (Jin et al., 2020). Moreso, healthcare workers are at highest risk of COVID-19 exposure and mortality due to work environment conditions, including personal protective equipment (PPE) shortages, insufficient staffing, and inadequate safety training and preparation amid the COVID-19 pandemic (Nemat et al., 2020). As of July 2020, the United Nations announced that over 1.4 million infections of COVID-19 are accounted for in healthcare workers, at least 10% of all cases. Comparisons of healthcare workers with and without COVID-19 infection showed an increased relative risk related to personal protective equipment, workplace setting, profession, exposure, contacts, and testing (Gholami et al., 2021).

In low-income countries, healthcare workers are more vulnerable to the devastating impact of COVID-19. Being away from home and facing the hardship of fighting COVID-19 place healthcare workers in dire situations (Nemat et al., 2020). The economic hardship is another major problem facing healthcare workers amid the pandemic (Kelley et al., 2020). The COVID-19 pandemic continues to pose multiple health challenges across the world. In the Eastern Mediterranean Region (EMR), morbidity and mortality from the disease remain serious causes for concern (Al-Mandhari, 2020). Concerns like these can pose serious psychological health impact on healthcare workers (Lai et al., 2020), hence causing serious health implications for them.

Since the emergence of the pandemic, the world is desperately waiting for a safe and effective vaccine. Efforts such as preventative measures have been put into action to curb the spread of the virus (Koirala et al., 2020). However, implementing a global vaccination program with broad range of clinical and socioeconomic benefits is the most effective means to end the pandemic (Adebisi et al., 2020). Starting in December 2020, several vaccines against COVID-19 have been authorized (Schaffer Deroo et al., 2020). However, with the growing vaccination coverage, under-vaccinated or non-vaccinated communities are still a concern for vaccination programs worldwide (Pugliese-Garcia et al., 2018).

The complex phenomenon of vaccine hesitancy refers to "delay in acceptance or refusal of vaccines despite availability of vaccine services" (Dubé et al., 2014), it is one of the top public health issues listed by the WHO (Graham, 2019). Despite of proven safety, efficacy and effectiveness of vaccines, an increasing number of individuals perceive vaccines as unsafe and unnecessary (Dubé et al., 2013). Addressing vaccine hesitancy among healthcare workers is crucial. Healthcare workers are considered one of the most important strata of society and a priority target group for COVID-19; vaccinating them is an utmost task for the world. However, willingness to take COVID-19 vaccine depends on the confidence and safety of the vaccine. Amid the pandemic, healthcare workers have also shown skepticism towards vaccines even in developed countries (Dror et al., 2020; Karafillakis et al., 2016). This is a point of great concern for the world since healthcare workers are the most credible and trusted sources of the information; and their doubt on vaccine will subjugate other people to follow the same belief pattern.

To find out the behaviour of healthcare workers towards vaccination in a bigger context, this study has been conceived. This research is aimed at understanding the willingness of healthcare workers (physicians, nurses, and pharmacists) from 10 countries in Eastern Mediterranean Region to receive COVID-19 vaccines.

2. Method

2.1 Study Design and Sampling Technique

This is a cross-sectional survey among health workers (physicians, nurses, and pharmacists) in 10 countries in the Eastern Mediterranean Region (Afghanistan, Egypt, Iraq, Kuwait, Lebanon, Libya, Morocco, Pakistan, Sudan, and Yemen). Non-probability convenient sampling technique was used to recruit the respondents. The inclusion

criteria were being a physician, a nurse or a pharmacist working in one of the study countries at the time of data collection and having access to Internet connection to fill out the online questionnaire. Individuals who do not consent to participate in the study were excluded.

2.2 Study Instrument and Administration

A short online questionnaire was developed which was based on similar studies (Adebisi et al., 2020). It comprised sections on the demographic characteristics of the respondents including nationality, age, sex, marital status, profession and years of work experience which were all considered independent variables.

Outcome variables include the respondents' willingness to vaccinate against COVID-19 and the reasons for not willing to undertake COVID-19 vaccination among non-intenders. For example, question 1 was: if you are given the option to choose to take COVID-19 vaccine, will you take the vaccine? (With a Yes, No or Undecided options). Participants who answered not willing or undecided yet, were further asked question 2: what is your reason(s) for not willing to be vaccinated against COVID-19? The questionnaire was pilot-tested and comments were used to revise it.

The questions were entered into an online survey system and a link to the electronic questionnaire was generated. The final questionnaire was distributed by the research team members in each country to respondents across social media platforms, specifically groups of health workers as used in previous studies (Awucha et al., 2020). The data collection took place in January 2021.

2.3 Data Analysis

Data was analyzed using IBM SPSS software package version 20.0 (Armonk, NY: IBM Corp). The Kolmogorov-Smirnov was used to verify the normality of distribution of variables and comparisons between groups for categorical variables were assessed using Chi-square test. Binary logistic regression analysis was carried out to identify parameters more strongly associated with respondents' willingness to vaccinate against COVID-19. Significance of the obtained results was set at the 5% level of alpha error.

2.4 Ethical Considerations

This study has been approved by the Ethics and Technical Committee of High Institute of Public Health Alexandria University. Confidentiality and anonymity were also ensured by not putting names or attaching any identifiable codes to the online questionnaires. The rights of the participants to withdraw anytime from the study were also clearly stated in the online survey.

3. Results

3.1 Sociodemographic and Professional characteristics of Respondents

A total of 2,806 health workers with 1,413 females (50.4%) and 1,393 males (49.6%) from 10 countries in the EMR completed the online survey. The mean age of the participants was 31.3 ($\pm$ 9.1 years). Most respondents were physicians (58.0%). Table 1 shows the sociodemographic characteristics of the respondents.

Table 1. Sociodemographic characteristics of study respondents

Socio demographic data	Number	%
Nationality		
Egypt	261	9.3
Sudan	520	18.5
Yemen	717	25.6
Libya	328	11.7
Kuwait	239	8.5
Iraq	127	4.5
Morocco	111	4.0
Afghanistan	143	5.1
Pakistan	152	5.4
Lebanon	208	7.4

Sex		
Male	1393	49.6
Female	1413	50.4
Age (years)		
18 – 30	1577	56.2
31 – 45	1023	36.5
46 – 60	174	6.2
61+	32	1.1
Mean ± SD.	31.3 ± 9.1	
Marital Status		
Single	1494	53.2
Married	1206	43.0
Divorced / widowed	106	3.8
Profession		
Physician	1628	58.0
Pharmacist	724	25.8
Nurse	454	16.2
Years of Working Experience		
Less than 2 years	722	25.7
2–5 years	458	16.3
More than 5 years	1626	57.9

3.2 Health Workers' Willingness to be Vaccinated

More than half of the respondents (58.0%) were willing to receive COVID-19 vaccine, even if the vaccination is not mandatory for them. On the other hand, 25.7% of respondents were not willing to vaccinate against COVID-19 while 16.3% answered 'undecided'. Figure 1 shows willingness to vaccinate against COVID-19 among health professionals in studied countries.
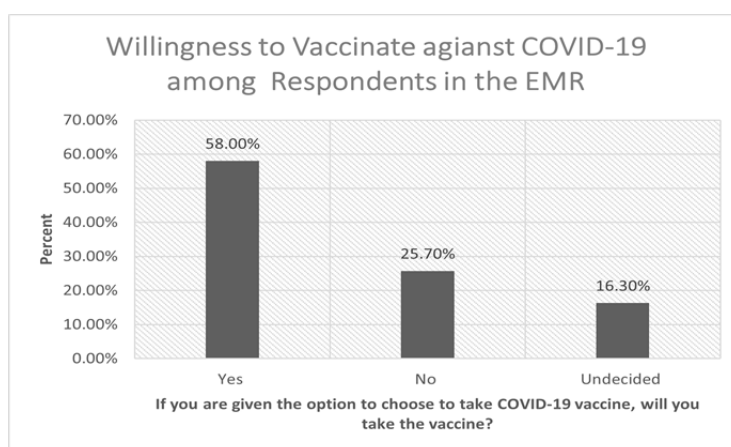
Figure 1. Willingness to be vaccinated against COVID-19 among health professionals in EMR countries

3.3 Variables Associated with Respondents' Willingness to Receive COVID-19 Vaccines

As shown on Table 2, results indicated respondent's nationality (P value <0.001), sex (P value <0.001), marital

status (P value <0.022), profession (P value <0.001) and years of working experience were significantly associated with willingness to receive COVID-19 vaccination. However, there was no significant association between age group and willingness to receive COVID-19 vaccine. Additionally, Figure 2 below shows high vaccine acceptance among healthcare professionals working in Afghanistan (72.0%) and Libya (70.0%).

Table 2. Association between sociodemographic variables and respondents' willingness to receive COVID-19 vaccine

Sociodemographic variables	If you are given the option to choose to take COVID-19 vaccine, will you take the vaccine?		Test of Significance	
	Yes (n=1626)	No/Undecided (n=1180)	χ^2	p
Nationality				
Egypt	119 (7.3%)	142 (12.0%)		
Sudan	292 (18.0%)	228 (19.3%)		
Yemen	464 (28.5%)	253 (21.4%)		
Libya	230 (14.1%)	98 (8.3%)		
Kuwait	103 (6.3%)	136 (11.5%)	122.43*	<0.001*
Iraq	58 (3.6%)	69 (5.8%)		
Morocco	64 (3.9%)	47 (4.0%)		
Afghanistan	103 (6.3%)	40 (3.4%)		
Pakistan	106 (6.5%)	46 (3.9%)		
Lebanon	87 (5.4%)	121 (10.3%)		
Sex				
Male	926 (56.9%)	467 (39.6%)	82.55*	<0.001*
Female	700 (43.1%)	713 (60.4%)		
Age (years)				
18 – 30	904 (55.6%)	673 (57%)		
31 – 45	608 (37.4%)	415 (35.2%)	1.766	0.622
46 – 60	96 (5.9%)	78 (6.6%)		
61+	18 (1.1%)	14 (1.2%)		
Marital Status				
Single	865 (53.2%)	629 (53.3%)		
Married	713 (43.8%)	493 (41.8%)	7.66*	0.022*
Divorced / widowed	48 (3%)	58 (4.9%)		
Profession				
Physicians	993 (61.1%)	635 (53.8%)		
Pharmacists	369 (22.7%)	355 (30.1%)	20.69*	<0.001*
Nurses	264 (16.2%)	190 (16.1%)		
Experience (Years)				
Less than 2 years	0 (0%)	722 (61.2%)		
2–5 years	0 (0%)	458 (38.8%)	2806.0*	<0.001*
More than 5 years	1626 (100%)	0 (0%)		

χ^2: Chi square test.

*: Statistically significant at $p \leq 0.05$.

3.4 Parameters Affecting Health Workers' Willingness to Receive COVID-19 Vaccines

As shown on Table 3, Health professionals working in Sudan (P <0.001), Yemen (P <0.001), Libya (P <0.001); Afghanistan (P <0.001), Pakistan (P <0.001) or Morocco (P <0.001) were more likely to be willing to receive COVID-19 vaccine than healthcare professionals working in the other countries. Females (P <0.001), pharmacists (P <0.001) and older ages (P <0.001) were more significantly associated with having reservations towards vaccination (not willing or have not decided to receive COVID-19 vaccine).

Table 3. Multivariate binary logistic regression analysis for the parameters affecting health workers' willingness to receive COVID-19 vaccines

Variables	p	OR	95% C.I	
			UL	LL
Nationality				
Egypt	0.308	0.820	0.560	1.201
Sudan	<0.001*	0.541	0.388	0.754
Yemen	<0.001*	0.408	0.293	0.568
Libya	<0.001*	0.305	0.208	0.449
Kuwait	0.965	0.991	0.666	1.474
Iraq	0.967	0.991	0.628	1.563
Morocco	0.019*	0.566	0.352	0.912
Afghanistan	<0.001*	0.364	0.227	0.584
Pakistan	<0.001*	0.397	0.251	0.628
Lebanon	0.308	0.820	0.560	1.201
Age (Years)	0.031*	1.013	1.001	1.024
Sex (Female)	<0.001*	1.898	1.610	2.238
Marital Status				
Single®				
Married	1.039	0.843	1.281	1.039
Divorced / widowed	1.473	0.950	2.283	1.473
Profession				
Physician®				
Pharmacist	<0.001*	1.422	1.171	1.725
Nurse	0.647	0.947	0.751	1.195

OR: Odds ratio.

CI: Confidence interval.

LL: Lower limit.

UL: Upper Limit.

®: reference group.

*: Statistically significant at p ≤ 0.05.

3.5 Vaccination Hesitancy among Health Workers in the Studied EMR Countries

In this study, vaccine hesitancy is described as unwillingness to take COVID-19 vaccine despite the availability, confirmed safety and efficacy. Figure 2 shows the COVID-19 vaccine acceptance, and hesitancy level among health care workers by countries, with the highest vaccine hesitancy observed in Lebanon (58.2%), Kuwait (56.9%) and Egypt (54.4%).
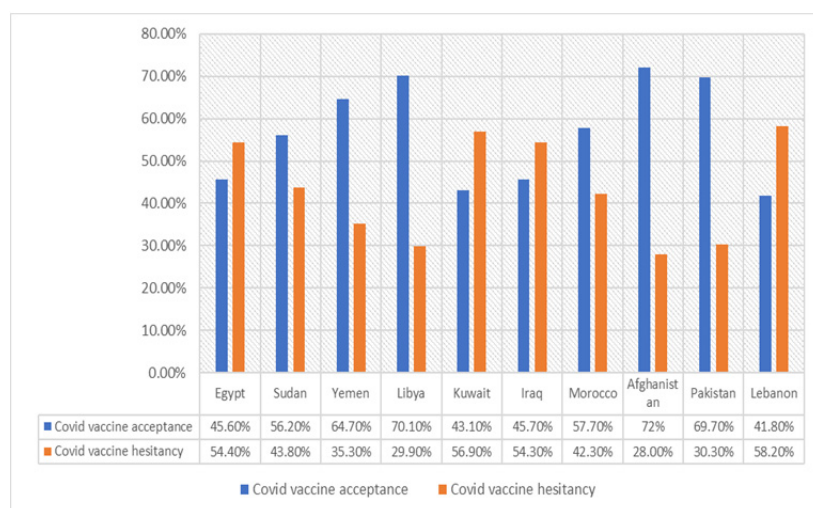
Figure 2. COVID-19 vaccine acceptance and hesitancy among health workers by countries

3.6 Reasons Associated with COVID-19 Vaccination Hesitancy

Table 4 shows various reasons associated with COVID-19 vaccine hesitancy among the respondents. The unreliability of COVID-19 vaccine clinical trials and fear of the vaccine side effects were reported as reasons behind COVID-19 vaccine hesitancy at 62.0% and 45.0% of the study participants, respectively. Approximately 23.0% of the healthcare professionals thought that the vaccine would not give immunity for an extended period.

Table 4. Respondents' reported concerns towards COVID-19 vaccination

Reported concerns	Number	%
Unreliability of COVID-19 vaccine clinical trials	736	62.0
Fear of the side effects of the vaccine	535	45.3
COVID-19 vaccine will not give immunity for a long period	272	23.1
The immune system is sufficient to defeat the virus	216	18.3
COVID-19 vaccine is likely to be expensive	123	10.4
Strict infection control measures in my health facility (s) are sufficient to protect from the virus	99	8.4
The vaccine is not necessary since the mortality rate is very low	80	6.8
Results of safety and efficiency are still not completed	63	5.3
Adverse events should be observed at the developed countries for some time	57	4.8
After a lot of people take the vaccine and I see them safe I could take it	49	4.6
Symptomatic treatment is sufficient	23	1.9
Personal protective equipment and hygiene is enough	11	0.9
The vaccine can cause death	37	3.1

4. Discussion

Vaccination is an important public health tool and one of the most important advances in healthcare in the fight against infectious diseases (Alaran et al., 2021). It is responsible for the eradication of rinderpest and smallpox and the control of infectious diseases such as polio in many parts of the world (Adebisi et al., 2020). It is therefore clear that a safe, highly effective, and globally acceptable and equitable vaccination program, together with pre-existing precautionary measures, is essential to effectively contain the outbreak (Lucero-Prisno et al., 2021).

It is often mistakenly believed that healthcare professionals attitudes must be positive towards vaccines because they have scientific and medical training. However, this is not always the case because healthcare workers are not

a homogenous group, and most are not experts in the field of vaccination. This study presents insights into the willingness of healthcare professionals in the EMR region. Healthcare workers are among the priority groups to receive vaccination, thus it is important to understand their attitude towards and willingness to take COVID-19 vaccine (Shekhar et al., 2021). This understanding will provide better insights to address barriers to widespread COVID-19 vaccination acceptance.

Interestingly, it was found that overall, more than half (58.0%) of the study respondents are willing to take the COVID-19 vaccine. The study also revealed that less than half of the respondents in Egypt, Kuwait, Iraq, and Lebanon are willing to take the COVID-19 vaccine. Similarly, a study also revealed that 28% of healthcare workers in Democratic Republic of Congo are willing to take the COVID-19 vaccine (Ditekemena et al., 2021). A study among healthcare workers in the United States revealed that only one in three said they would take the vaccine immediately when it becomes available (Shekhar et al., 2021). In Malta, only half of the participants (healthcare workers) stated that they intend to take the COVID-19 vaccine (Grech et al., 2020). Less than half of the healthcare workers in a survey conducted in France and in the French-speaking part of Belgium and Canada showed high acceptance of COVID-19 vaccine (Verger et al., 2021). Some of these findings are worrisome because healthcare professionals are expected to have a considerable understanding of the safety and efficacy as well as the benefits COVID-19 vaccine can reap for the pandemic response.

In addition, healthcare workers, as models, are typically entrusted with the task of providing reliable information about health issues to the public and this is associated with greater compliance with health interventions. The study revealed high vaccine acceptance among healthcare professionals working in Afghanistan (72.0%) and Libya (70.0%). This can be compared to a study in Turkey, where 68.8% of the healthcare worker are willing to take the COVID-19 vaccine (Kose et al., 2021).

Findings from this study also revealed that the three major reasons for not willing to be vaccinated are "unreliability of COVID-19 vaccine clinical trials", "fear of the side effects of the vaccine", and "COVID-19 vaccine will not give immunity for a long period." This presents a challenge because healthcare professionals provide a key role in influencing the behavior and acceptance of vaccines by their patients. They serve as an important source of information for the general public and during patient consult, they can be a key factor in the decision of the patient to be vaccinated or not. There is a significant need to address concerns and increase awareness to improve chances for higher acceptance of a COVID-19 vaccine. Otherwise, this poses additional possibility of mass rejection of COVID-19 vaccine in the general population.

A major strength of the study is the large sample size thus providing a better picture of the population studied. The survey population is also diverse with representation from different gender groups, ages, ethnicities, and roles in healthcare. However, the study is not without limitations. There is a risk of selection bias, and this would limit the generalizability of the study findings to all the healthcare professionals in the EMR. The study only included nurses, physicians, and pharmacists. Despite these limitations, these findings are not inconsistent with the findings from other studies about the willingness to be vaccinated or vaccine hesitancy among healthcare workers. The survey questionnaire was available in English and distributed in an online format, which may have introduced selection bias favoring English-literate HCWs and those with access to the Internet. Social desirability bias may also affect the interpretation of the study results. Moreover, the survey was conducted in January 2021 when information regarding COVID-19 vaccines may have not circulated widely. Therefore, it possible that intention to be vaccinated would have changed.

5. Conclusion

Overall, this study revealed suboptimal acceptance of COVID-19 vaccine among the respondents in the EMR region. The study elucidated the landscape and a number of factors with regards to vaccine hesitancy and acceptance. Significant refusal of COVID-19 vaccine among healthcare professionals can reverse hard-won progress in building public trust in COVID-19 vaccination program. Study findings suggest the need to develop tailor-made strategies to address concerns identified in the study in order to ensure optimal vaccine acceptance among healthcare workers in the EMR. The study also provides a glimpse on how the health community will move forward in this area which will immensely contribute to the initiatives against the pandemic.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data presented in this study are available on request from the corresponding author.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

Authors' Contributions

The concept for this study was developed by Y. A. M. E., and he wrote the first draft. Y. A. M. E., H. M. E., S. A. A., O. H. A., D. E. C., Z. Y., E. A., S. A., S. U., B. A. A. and A. N. collected the data and developed the draft with an important contribution from A. M., Y. A. A., M. M. S., D. E. L and A. Z. in writing, reviewing and editing.

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Determinants of Poor Utilization and Accessibility of Immunization Services: A Qualitative Study in Selected Counties in South Sudan

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Abstract

Background: Reducing vaccine-preventable diseases mortality and morbidity in non-industrialized countries requires the enforcement of robust immunization strategies aimed at increasing coverage and reducing dropouts and missed immunization opportunities. Attaining high (>80%) immunization coverage with a low drop-out rate in South Sudan has been challenging because of the program's high defaulting rates. This study aimed to determine the reasons for poor accessibility and utilization of immunization services in counties earmarked for Fragility, Emergency and Refugees (FER) in South Sudan.

Methods: A descriptive phenomenological study design was conducted across four counties of Northern Bahr El Ghazal, South Sudan, between May 2019 and December 2020 in which 42 focused group discussions and key-informant interviews involving the community and primary healthcare centers and units were conducted. Relevant EPI (Expanded program on immunization) tools were reviewed and data were analyzed using thematic analysis.

Results: The main reasons identified were negative attitudes towards healthcare workers and immunization services, competing priorities of the caregivers, delayed opening of the immunization sessions, insufficient cold chain facilities, inadequate knowledge and information about immunization services, and non-availability of vaccines at the health facility.

Conclusions: A plan to supply adequate vaccines and related supplies to the counties by identifying stock levels in time must be a priority. Health facility micro-plan development and implementation should be supported by increased funding for the implementation of outreach and mobile sessions to reach missed children, intensified door-to-door health awareness, and regular community meetings to increase vaccine uptake.

Keywords: accessibility, determinants, immunization, utilization, South Sudan

1. Background

Immunization has been one of the most economical public health measures that have significantly contributed to reducing child morbidity, mortality, and disability. Immunization is a key strategy in achieving Sustainable Development Goal (SDG) number three-reduction of under-five mortality to below 25/1000 live births by 2013 (WHO, 2013). The World Health Organization (WHO) reports of 2018 suggest that approximately 2.5 million child and 6 million adult deaths are prevented annually through immunization programs (WHO, 2017). Regardless of these attainments, low-income countries continue to experience vaccine-preventable diseases (VPDs) outbreaks (WHO, 2018). Timely vaccination and completion of immunization schedules are mandatory in controlling VPDs in Sub-Saharan Africa (Lydon et al., 2014; Janusz et al., 2020; Cherian et al., 2020).

Vaccination became the backbone of public health interventions when WHO launched the Expanded Programme on Immunization (EPI) in 1974 to help member states expand on immunization and surveillance programs against measles, poliomyelitis, tuberculosis, diphtheria, pertussis, and tetanus (WHO, 2018; Hwang et al., 2020). Since then significant progress has been achieved in upgrading vaccination coverage for six major vaccine-preventable

diseases: pertussis, childhood tuberculosis, tetanus, polio, measles, and diphtheria in Africa using an equitable and cost-effective approach (WHO, UNICEF, 2018). The World Health Assembly endorsed the Global Vaccine Action Plan in 2012 to strengthen routine immunization and ensure improved access, and the use of routine immunization (RI) services as one of its guiding principles. However, about 70% of children with incomplete vaccination schedules were from only 10 countries in the world, indicating disparities in vaccination coverage among countries. Two-thirds of these countries achieved the Global Vaccine Action Plan target of 90%, while the other one-third achieved <80% of the diphtheria-tetanus-pertussis three (DTP3) coverage in districts, further corroborating the evidence of disparity (WHO, 2017; WHO, 2018). Nevertheless, this improvement has been due to the international efforts aimed at advancing the quality of immunization services, which include the Universal Childhood Immunization Initiative, the Global Alliance for Vaccines and Immunization (GAVI), the Sustainable Development Goals (SDGs), the Global Immunization Vision and Strategy (GIVS), and the Global Vaccine Action Plan (GVAP). These initiatives combined with WHO's African Region expanded program on immunization (EPI) - strategic plan of action for 2000 and 2014, the Reach Every District (RED) approach, and the national immunization programs have contributed to raising Africa's immunization coverage for DTP3 from 57% in 2000 to over 80% in 2017(WHO, 2017).

In 2019, 116 million infants received basic vaccines globally (WHO, 2019,) which accounts for about 84% of the pediatric population of the world. Still, about 19.7million infants remain unvaccinated, 6.2 million of which live in the Democratic Republic of Congo, Ethiopia, and Nigeria, (in the WHO African Region). An estimated 14 million infants out of the million surviving infants in 2019 never received their third dose of the DTP vaccine. Approximately 60% of these children are from Chad, the Democratic Republic of the Congo, Ethiopia, India, Indonesia, Mexico, Nigeria, South Africa, and South Sudan. Likewise, in poor, remote, and inaccessible areas of the African region, only one-in-twenty children had access to vaccination (Restrepo-Méndez et al., 2016; WHO, 2019).

The immunization program for South Sudan was established in 2005 after the signing of a comprehensive peace agreement and established an EPI. A year later, the autonomous government of Southern Sudan published the first policy documents 'Health Policy, 2007-2011' and the 'Basic Package of Health and Nutrition Services' (MOH, 2017). The Ministry Of Health, South Sudan used these policy documents as a cornerstone to prepare the EPI program 2011-2016 for a Comprehensive Multi-Year Plan (cMYP) for Immunization (MOH, 2017). Despite these efforts, there has been a recent progressive declination in the immunization performance in South Sudan, with routine immunization (pentavalent-3) declining from 71% in 2012 to 55% in 2013 and reducing further to 26% in 2016. Consequently, only 9 out of the 80 counties (11%) were able to achieve vaccination coverage of 80% in 2016. A 2017 EPI survey in South Sudan indicated that 18.9% of children under 1 year of age were fully immunized. Immunization coverage estimates by card and history were higher (49.1%) compared to coverage by card alone (20.9%). The dropout rate decreased from 20% in 2014 and 23.7% in 2016 to 16.8% Pentavalent 1- Measles and 12.9% Pentavalent (Penta 1) 1- Pentavalent (Penta 3) respectively against the standard 10% (MOH, 2018). South Sudan is still classified as facing a medium to high risk for polio outbreaks. Likewise, by 2017, 48.7% of children were vaccinated against measles, and so, only a few counties reached the desired coverage of ≥ 80% and above to mitigate measles outbreaks. The foremost challenge faced by most communities is a lack of access and the ability to utilize immunization services. The set targets for Penta 3 and Penta 1 to Penta 3 dropout have not been achieved. In this regard, this study aims to determine the reasons for poor accessibility and utilization of immunization services in counties earmarked for Fragility, Emergency and Refugees (FER) in South Sudan (MOH, 2017).

2. Methods and Materials

2.1 Study Population and Setting

The study was conducted in the state of Northern Bahr el Ghazal (NBGS), one of the ten states in the Republic of South Sudan. The state borders Warrap to the southeast, Western Bahr el Ghazal state to the southwest, and Sudan to the northwest. According to the South Sudan Bureau of statistics (2020), Northern Bahr el Ghazal has a projected population of 1,253,442 (NBS, 2008), of which 5% of the population (62,672) are under 1 year of age, 21% (263,223) under 5 years of age, 49% (614,187) are under 15 years of age, and the rest 25% (313,361) are women of reproductive age (WRA). The state has 5 counties and 38 administrative units after the county called the payams. The study focused on counties receiving FER funding due to their high number of unvaccinated children.

The Penta 1 performance for the NBGS as of 2020 is 82% coverage, suggesting that the communities have good access to immunization services. However, the Penta 3 coverage as of 2020 is 67% and the dropout rate (DOR) is 18%, indicating poor utilization of immunization services. A total of 12,496 targeted children had not received Penta 1 dose and 10,299 children dropped out by the end of 2020 (MOH, 2020). Northern Bahr el Ghazal state has

had influx of internal displaced persons (IDPs) from neighboring states and countries with frequent population movement. The state is bordering Sudan and Central African Republic. In addition, the state experiences seasonal flooding.

2.1 Study Design

A descriptive phenomenological study design was employed to understand the reasons for poor accessibility and utilization of immunization services among caregivers or mothers of children under 1 year of age, community leaders, and healthcare providers in the FER-earmarked counties and acquired the participants' perceptions and experiences. To interpret different themes in this study, a holistic approach was pursued presuming an interactive and inseparable relationship between the researcher and participants. Data were collected using in-depth, interviews and focused group discussions guided with open-ended questions. The qualitative data obtained were analyzed using thematic analysis.

2.2 Selection Criteria and Participant Sampling

The study was conducted between May 2019 and December 2020 to cover health facilities selected based on the problem analysis of utilization and accessibility. Health facilities with low utilization and poor accessibility were prioritized and their catchment population was subsequently selected using purposive sampling for focused group discussion. Caregivers or mothers above 18 years who lived within the health facility catchment area for more than a year, community leaders, and healthcare providers were considered the respondents of the study. A proposed sample of 10–15 caregivers and/or mothers and community leaders for focused group discussion and 7 key informants was decided for data collection. The potential participants were invited for an interview, while a letter of invitation containing details of the study had been sent to the county authorities prior. On the day of the interview, the purpose of the study was explained to all participants. The total number of study participants was 22 and all participants consented to participate in the study. Forty (40) health facilities in four counties with poor access and poor utilization of immunization activities in Northern Bahr el Ghazal State were prioritized (Tables 1, 2, 3 & 4). Poor access was indicated by Penta1 coverage of below 80%, and high dropout rate was indicated by over 10% DOR rate. The health facilities with high number of unvaccinated children were given first priority and the ones with low number of unvaccinated children were accorded the next priority level (Tables 1, 2, 3 & 4).

Table 1. Health facilities selected for the study in Aweil Centre, Northern Bahr el Ghazal 2020

	Health facilities selected in Aweil Centre for micro-plan										
	Population data & EPI coverage data							Problem Analysis			
	2020	# vaccinated		Coverage %					Identify problem		Categorize problem	Prioritize
HF	< 1year pop	Penta 1	Penta 3	Penta 1	Penta 3	P1_P3 DOR	unvaccinated	under-vaccinated	Access	Utilisation	Problem 1,2,3,or 4	Priority 1,2,3…
Aroyo PHCC	595	414	280	70	47	32	181	134	Poor Access	Poor Utilisation	4	6
Awada PHCC	497	340	332	68	67	2	157	8	Poor Access	Good Utilisation	3	7
Kuom PHCU	427	207	212	48	50	-2	220	-5	Poor Access	Good Utilisation	3	5
Alok PHCU	686	330	144	48	21	56	356	186	Poor Access	Poor Utilisation	4	4
Bar Mayen Hospital	1008	547	460	54	46	16	461	87	Poor Access	Poor Utilisation	4	3
Mabok Akot PHCU	742	202	171	27	23	15	540	31	Poor Access	Poor Utilisation	4	1
Gabat PHCC	721	223	270	31	37	-21	498	-47	Poor Access	Good Utilisation	3	2

Source: MOH (2020). Definition: PHCC; Primary Health Care Centre, PHCU; Primary Health Care Unit.

Table 2. Health facilities selected for the study in Aweil East, Northern Bahr el Ghazal 2020

	Health facilities selected in Aweil East for micro-plan											
	Population data & EPI coverage data							Problem Analysis				
	2020	# vaccinated	Coverage %						Identify problem		Categorize problem	Prioritize
HF	< 1year pop	Penta 1	Penta 3	Penta 1	Penta 3	P1_P3 DOR	unvaccinated	under-vaccinated	Access	Utilisation	Problem 1,2,3,or 4	Priority 1,2,3…
Mangok PHCU	1999	421	393	21	20	7	1578	28	Poor Access	Good Utilisation	3	
Manyiel PHCU	1394	218	153	16	11	30	1176	65	Poor Access	Poor Utilisation	4	1
Malual bai PHCC	998	275	166	28	17	40	723	109	Poor Access	Poor Utilisation	4	2
Tit-Chok PHCU	1032	347	350	34	34	-1	685	-3	Poor Access	Good Utilisation	3	3
Madhol PHCU	888	222	213	25	24	4	666	9	Poor Access	Good Utilisation	3	4
Yargot PHCU	834	280	209	34	25	25	554	71	Poor Access	Poor Utilisation	4	5
Malualkon Hospital	1339	825	701	62	52	15	514	124	Poor Access	Poor Utilisation	4	6
Wunlang PHCU	803	297	317	37	39	-7	506	-20	Poor Access	Good Utilisation	3	7
Wanyjok PHCC	1116	694	535	62	48	23	422	159	Poor Access	Poor Utilisation	4	8
Ameth Akok PHCU	694	283	175	41	25	38	411	108	Poor Access	Poor Utilisation	4	9
Gordhim TB Hosp	632	259	186	41	29	28	373	73	Poor Access	Poor Utilisation	4	10
Atuet PHCU	676	324	299	48	44	8	352	25	Poor Access	Good Utilisation	3	11
Baach PHCU	437	102	76	23	17	25	335	26	Poor Access	Poor Utilisation	4	12

Source: MOH (2020). Definition: PHCC; Primary Health Care Centre, PHCU; Primary Health Care Unit.

Table 3. Health facilities selected for the study in Aweil West, Northern Bahr el Ghazal 2020

Aweil West Selected HFs for Micro-plan												
Population data & EPI coverage data									Problem Analysis			
	2020	# vaccinated		Coverage %						Identify problem	Categorize problem	Prioritize
HF	< 1year pop	Penta 1	Penta 3	Penta 1	Penta 3	P1_P3 DOR	unvaccinated	under-vaccinated	Access	Utilisation	Problem 1,2,3,or 4	Priority 1,2,3…
Aguat PHCU	315	149	139	47	44	7	166	10	Poor Access	Good Utilisation	3	10
Aluel Acot PHCU	475	138	110	29	23	20	337	28	Poor Access	Poor Utilisation	4	6
Angot Leek PHCU	637	296	406	46	64	-37	341	-110	Poor Access	Good Utilisation	3	5
Anyopjang PHCU	493	210	123	43	25	41	283	87	Poor Access	Poor Utilisation	4	8
Maleka Dera PHCU	486	261	204	54	42	22	225	57	Poor Access	Poor Utilisation	4	9
Marial Bai PHCC	1146	740	674	65	59	9	406	66	Poor Access	Good Utilisation	3	4
Nyamlel PHCC	1312	860	202	66	15	77	452	658	Poor Access	Poor Utilisation	4	3
Nyinbouli PHCC	900	311	173	35	19	44	589	138	Poor Access	Poor Utilisation	4	2
Riangangon PHCU	535	248	220	46	41	11	287	28	Poor Access	Poor Utilisation	4	7
Wedweil PHCU	1177	279	265	24	23	5	898	14	Poor Access	Good Utilisation	3	1

Source: MOH (2020). Definition: PHCC; Primary Health Care Centre, PHCU; Primary Health Care Unit.

Table 4. Health facilities selected for the study in Aweil North, Northern Bahr el Ghazal 2020

	Aweil North Selected HFs Micro-Plan											
	Population data & EPI coverage data								Problem Analysis			
	2020	# vaccinated		Coverage %						Identify problem	Categorize problem	Prioritize
HF	< 1year pop	Penta 1	Penta 3	Penta 1	Penta 3	P1_P3 DOR	unvaccinated	under-vaccinated	Access	Utilisation	Problem 1,2,3,or 4	Priority 1,2,3…
Arieth PHCU	544	344	386	63	71	-12	200	-42	Poor Access	Good Utilisation	3	6
Gok Machar PHCC	1080	642	560	59	52	13	438	82	Poor Access	Poor Utilisation	4	1
Jaac PPF PHCU	300	165	125	55	42	24	135	40	Poor Access	Poor Utilisation	4	10
Kajik PHCU	474	217	228	46	48	-5	257	-11	Poor Access	Good Utilisation	3	5
Majak Bai PHCC	550	242	194	44	35	20	308	48	Poor Access	Poor Utilisation	4	4
Mayen Ulem PHCU	772	366	291	47	38	20	406	75	Poor Access	Poor Utilisation	4	2
Mayom Adhal PHCU	326	156	123	48	38	21	170	33	Poor Access	Poor Utilisation	4	7
Warapei PHCC	400	242	181	61	45	25	158	61	Poor Access	Poor Utilisation	4	9
Wargeng PHCU	344	209	135	61	39	35	135	74	Poor Access	Poor Utilisation	4	10
Wathok PHCU	496	112	66	23	13	41	384	46	Poor Access	Poor Utilisation	4	3

Source: MOH (2020). Definition: PHCC; Primary Health Care Centre, PHCU; Primary Health Care Unit.

2.3 Data Collection

A conducive and quiet venue was identified at the health facility or community facilities premises for conducting focused group discussions and key informant interviews. Before beginning the interview, the interviewers introduced themselves, read and explained the details of the consent form, and requested participants' verbal consent for the interview and its audio recording. A pre-tested in-depth interview guide, consisting of thematic open-ended questions, was used to collect data from key informants. Then, the interviewer supplemented the interview guide with follow-up questions, paraphrasing, and/or adding short silence breaks to further the discussion, or probe the study participant's comments. Twenty-two (22) interview notes were taken to supplement the audio recordings to capture all possible impressions and observations. The audio recordings were backed up on personal electronic devices to prevent data loss.

2.4 Data Analysis

The devices containing audio recordings were kept in a secure place and audio files were protected with a strong password. The interviews were conducted in Dinka and Luo dialects which were spoken by the majority of study participants. The audio data were transcribed verbatim to English using thematic analysis. After transcription of the audio file, the data was saved on an external hard drive and both the audio files were kept safe which would be deleted after one year from the date of the study. The manifest and latent content analyses of qualitative data were employed wherever visible and obvious components of the text were described. Supplemental notes for each interview were revised after each day of the interview and unnecessary terminologies were removed. The

transcribed notes were then read through to ensure meaning out of them. Sentences or phrases that contained similar aspects were merged to form one theme. The themes were then summarized to remove redundancy and repetitions while preserving the original meaning of the text.

3. Results

3.1 Participant Characteristics and Key Themes

The interviewers conducted 15 focused group discussions (FGDs) with mothers and caregivers, 5 FGDs with healthcare workers, and 7 key informants across the four counties that were earmarked for health facility micro-plan development in the Northern Bahr el Ghazal state. Each FGD comprised 10-15 participants, and consequently, about 70 mothers and caregivers, and 42 healthcare workers were interviewed during the study. The healthcare workers participating in FGDs were from different backgrounds at the health facility, while the key informants came from both the health facility and the community.

The main themes from the thematic analysis of the data include perceptions of healthcare workers, integration of immunization with other primary care services, staffing of healthcare workers, availability of vaccines at the health facility, and lack of immunization information. The findings are summarized by key themes in the subsequent paragraphs and verbatim quotes recorded during the interview and FGDs are also included.

3.2 Perceptions of Vaccination

The participants expressed mixed reactions – while some had negative experiences and attitudes towards healthcare workers and immunization services, other mothers and caregivers believed that healthcare workers were generally knowledgeable: "*Sometimes the vaccinators are available at the health facility some other we don't get them*" (Caregiver). The vaccinators/healthcare workers and the key informants expressed a similar sentiment with perceptions of caregiver dissatisfaction: "*Some of our women, including my wife, if you tell them to go for ANC or take a child for vaccination, they don't go. This is not something we can count on the service providers.*" (Key Informant). "*Mothers don't bring their children for vaccination and……*", "*yes, (the other interjected in agreement)*" (Vaccinator).

3.3 Health Systems and Health Care Workers Factors

Many participants noted that there was a need to address some of these problems. Besides, long distances limit the caregivers' and mothers' accessibility to the immunization services, but they do come whenever they get a chance to do so: "*Long-distance to the health facility is one major challenge…..*" (Key informant). Another concern was the cold chain facility. When a woman comes to the health facility and finds out that there are no vaccines available today, *they don't return as advised. Others take 2-3 months before returning.*" "*There is a challenge where some of the health facilities under government have been closed down. These created a challenge of access as some of the remaining facilities are farfetched*" (Key informant).

3.4 Vaccines Supply Problems

"*We come to the health facility and find they are not working, because they say vaccines are not available*" (Caregiver). "*So next time I will not come because I will find the same situation*", another caregiver added. This deficiency is compounded by out-of-stock vaccines in the health facilities and beyond-limit vaccination days for antigens, such as for BCG and measles vaccines: "*Vaccines are given on a specific day*" (Caregiver).

The key informants discussed various reasons for vaccine stock-out, which included lack of coordination with various agencies, delay in vaccine delivery to health facilities from the county cold-chain store, and lack of transportation funds. Logistic challenges were also discussed, such as the unavailability of bicycles for supervision and outreaches in distant health facilities: "*Our facility covers a very wide area. Our vaccinators ought to have bicycles to help them conduct outreach services*" (Key informant). Vaccines stock and other supplies and cold chain equipment were also some of the problems identified by the participants: "*Shortage of cold chain in our facility is the major challenge. We, community members who understand the importance of immunization will help mobilize our community if we have a cold chain here in our facility*" (Key informant). A vaccinator added, "*For example, there was a time we go for three months without BCG, some of them never have their BCG vaccination until today*" The health workers also added a breakdown of their refrigerator: "*sometimes, the refrigerator is not working well and the technician is not available to fix it, form the national level*" (Key informant).

The limited vaccine stocks discouraged caregivers or mothers to return for vaccination: "*the mothers will bring their children on the day of visit but not return; they will as well tell the members of their community that there are no vaccines in the health facility*" (Vaccinator).

3.4 Awareness about the Benefits of Immunization

Surprisingly, some caregivers had negative attitudes towards the importance of vaccines and expressed competing for priorities to take their children for vaccination: "*....they say if I go and spend the whole day in the line just for my child to receive vaccine dose, where will I get food for them at the end of the day?*" (Key informant). Also, rumors and misconceptions about adverse events were common among the caregivers/mothers: "*My child got sick after receiving the first dose*" (Caregiver).

3.5 Poor Referral for Immunization Services

Some key informants and vaccinators reported that mothers and caregivers bring their children to the health facilities only for nutrition services: "*Our women only go for services where they can have direct benefits. They don't understand the importance of immunization. When you tell a woman with a child who is not malnourished to go for vaccination, they ask what will be the benefit. They say if I go and spend the whole day in the line just for my child to receive vaccine dose, where will I get food for them at the end of the day?*" Another added, "*when there was a nutrition site here, we used to receive more children for routine EPI services. Little had we known that those children were attracted by the nutrition program?*" "*The presence of nutrition program here made many women come with their children where they could receive both the nutrition services and routine immunization program*" (Key informant). These findings suggest that the integration of immunization services with other primary health care services can be decisive in improving immunization coverage.

Furthermore, consistency should be maintained across the health facilities in checking vaccination status on the child's health card. The ground situation revealed that the systems for monitoring the vaccination status lack uniformity in protocol across health facilities, as some of the key informants stated about checking the vaccination status of children at their visit to the health facility, while others checked it during the child's visit to nutrition services: "*Many women come for nutrition services with their children but when we remind them to ensure they complete RI services, they ignore them. For example, one woman came with her child and when I told her to take the child for RI dose, she claimed that the child was sick and when I checked, the child was fine. I had to convince here.*"

Additionally, mothers and caregivers were dissatisfied with the long waiting-time due to the absence of a vaccinator in the health facility: "*The vaccinator is not in the health facility or sometimes they are doing other work within the health facilities*" (Caregivers/Mothers). "*During outreach day, one of us remains in the health facility and the other goes for outreach, mothers will wait for a longer time and some don't come back for vaccination*" (Vaccinator).

3.6 Child Health Card

Another important problem expressed by health workers/vaccinators was that mothers or caregivers do not carry the child's Health Card during their visit to the health facility: "*Most women leave the immunization cards behind and use it as a trick to refuse routine immunization*" (Vaccinator).

3.7 Health Education (Lack of Information)

The themes of health education and social mobilization were also discussed in the FGDs: "*The women in our community are highly illiterate. If there is any support that you need from us, then we will support you. These messages have to be passed on Akolyam Radio.*" (Key informant). "*Some women say that if a child is not malnourished then there is no reason to take that child to the health facility because they do not enroll healthy children for a nutrition program*" (Key Informant). The health care workers suggested that health facilities should prioritize community-involvement in the immunization services planning: "*Thank you all for coming. Some women give birth at the health facility and after one dose, they don't return. When they come for nutrition services, they should be asked to present an immunization card. Some men when they hear children crying at night after vaccination stop their wives because they don't understand it. This message has to be broadcast regularly on Akolyam to remind parents of the importance of the vaccine for children*" (Key informant). "*Immunization is important. One issue that needs to be stressed is that when a child receives the vaccine dose and develops some reactions then they think it's the vaccine that causes that. Many children have not completed their doses*" (Key informant).

Both, the caregivers and the health worker, acknowledged the importance of health education: "*The challenge for healthcare service uptake is a challenge for us as parents – both men and women. All of us are ignorant about the health of our children. Sometimes the father tells the mother to take the child to the health facility and the woman ends up not taking the child to the health facility. We need health education on this*" (Caregiver). "*Health education should also be provided for mothers to understand why their children need the vaccination*" (Health worker).

3.8 Community-Involvement in Immunization Service

Some health care workers raised notable concerns about the difficulties they faced while carrying out community mobilization: "*When I go out on defaulter tracing, some parents claim that my child got sick after receiving the first dose. Others travel away from where their children received the first doses of vaccines*" (Health worker). "*The major challenge is that the health facility is cut off by the flood. Mobilizers have been going out to mobilize mothers and caregivers to bring children to the health facility for vaccination, but they don't turn up*" (Health worker).

4. Discussion

This study reveals the ground-situation in one of the South Sudanese states, highlighting the reasons for poor accessibility and utilization of the existing immunization services. It embraces issues about the health systems and health workers, vaccine supply, awareness about immunization, the inconsistency in the referral system for immunization services, the consequent poor handling of the Child Health Card, and the important themes of health education and community involvement.

Lack of information with the mother/caregiver is a frequently reported factor resulting in poor exploitation and low accessibility of the available resources. Our results further corroborate this observation as a majority of the caregivers participating in our study were reportedly unaware of the benefits of immunization and the vaccination schedules. Similar observations were reported in previous studies that explored reasons for incomplete immunization and stated the lack of knowledge to be the main reason (Negussie et al., 2016; Animaw et al., 2013; Babriye et al., 2014, Etana et al., 2012). Likewise, a study conducted in Southern Ethiopia about defaulting from childhood immunization revealed that mothers were not sufficiently aware of the various operational aspects and schedules (Zewdie et al., 2016). Furthermore, it was seen that caregivers deliberately left their child's vaccination card at home to avoid vaccination. Zewdie et al. (2016) described that the mothers did not know what to do in the event the vaccination card was lost, and thus, they recommended that no child be denied vaccination when the mother fails to carry the child's health card to the health facility (Zewdie et al., 2016). Availability of the vaccination card improves the probability of the child getting immunized, besides ensuring continuity in availing immunization by the beneficiaries, as well as improving the validity by avoiding revaccinating (Itimi et al., 2012; Elizabeth et al., 2015). The Ministry of Health, South Sudan also recommends that every child gets vaccinated even when the caregiver fails to produce the vaccination card at the time of vaccination to reduce the missed opportunities for vaccination. Therefore, to tackle this lack of awareness and the unwillingness by caregivers/mothers to conform to the vaccination schedules and maintain the vaccination cards, there is a need to intensify health education in the community through innovative ways to reach out and create demand.

Another reason for the low utilization of immunization services was competing for priorities like income-generating activities to support their families than take their children for vaccination. These findings are similar to Babirye et al. (2011) and Biset et al. (2021), who have also revealed that competing priorities limited the mother's ability to complete the immunization schedule.

Our study also identified certain issues related to the existing health system that limit the full exploitation of these resources. The World Health Organization (WHO) recognizes factors related to the health system and health workers as the key barriers to low utilization of immunization services (WHO, 2013; Hailu et al., 2019). It was observed that distance was a significant factor responsible for the poor accessibility of immunization services. Abdulraheem et al. (2013) also reported similar results as the mothers found it difficult to commute/take the child to the health facility and hence opted to discontinue the immunization schedule. However, it is notable that the estimated distance to the health facility as described by the caregivers was not reliable because they could not accurately remember the distance they traveled to the health facility.

Our study also highlighted the weak state of health education sessions. Mothers who participated in the study were not sure about the aim of immunization, while some only visited the health facility to avail nutrition services for their children, which they believed was of immediate benefit. Zewdie et al. (2016) also disclosed that mothers lacked clear and quality information on scheduling, services planning, and benefits of vaccination owing to poor counseling, and improper, inadequate guidance regarding immunization. Adedemy et al. (2012) have also cited the same reasons for non-compliance. Another explanation for this could be attributed to poor handling of rumors by the health workers about the adverse effects following immunization, vaccine administration, and vaccine hesitancy related to multiple injections. Meanwhile studies have shown that health information from health workers is the most trusted by the community (Mishra et al., 2014; Wallace et al., 2018; Grant et al., 2017). Hence, inadequate knowledge within the workers of the existing health systems could setback the utilization and accessibility of immunization services (Li et al., 2020).

Our study uncovered some disappointing facts as well. Negative attitudes by the vaccinators coupled with absence from the health facility led to mothers waiting for long hours. Maina et al. (2013) and Zewdie et al. (2016) have also documented negative views held by caregivers about the healthcare workers based on their management of the incoming people. Other studies have also noted that caregivers/mothers did not get a polite response from health care workers when they sought advice about their children getting missed vaccine doses (Babirye et al., 2014; Abdulraheem et al., 2011; Negussie et al., 2016). These findings underscore the fact that immunization-service providers must be trained adequately in the necessary knowledge-building activities to change this narrative. Besides, irregularity of the fixed and outreach sessions owing to absent vaccinators in the health facilities and a lack of transportation facilities also contributed to the poor accessibility and utilization. Irregularities in these activities and their importance to the beneficiaries can confuse them, leading to defaulting (Zewdie et al., 2016).

To counter the inadequacies in vaccine information, the key informants stressed the need to increase the use of radio to pass quality and reliable information. Radio systems have been established as a key medium for the dissemination of information about vaccination to improve vaccine uptake (MacDonald et al., 2015). It worth noting that the source of information used to influence the caregivers' choice should be selected carefully to improve the reach of immunization services. Also, providers must choose communication methods that further the aim of successful utilization of immunization services by the caregivers (Opel et al., 2013; Aregawi et al., 2017; Fite et al., 2019). Further, to achieve better utilization of immunization services, social mobilization structures embedded within the EPI should be strengthened to change social behavior hindering vaccine utilization by the beneficiaries. Additional efforts should be focused on building skills and knowledge of these social mobilizers (Ruso et al., 2015; Acharya et al., 2018; Li et al., 2020).

Besides the aforementioned revelations, the study also identified factors associated with vaccine availability, like logistic constraints and poor vaccine forcasting leading to stock-out, which hamper the routine immunization process. Li et al. (2020) and Etana et al. (2012) reported that vaccine stock-out has an impending effect to daunt caregivers from seeking immunization services from the nearby health facilities if they have had a previous experience of not having their children vaccinated due to unavailability (Wado et al., 2014; Adokiya et al., 2017; Butt et al., 2020). The strength of this current study was that, a holistic approach was pursued in which interactive and inseparable relationship between the researcher and participants was key to avoid researcher's bias. This also gained insights for the reasons for poor utilization and accessibility in depth. The limitation was that, this study did not account for exit interviews of the caregivers at the immunization units, and the impact of COVID-19 on immunization uptake in South Sudan. However, South Sudan immunization coverage in 2019 was 58% for Penta 3 compared to 2020 (MOH, 2019, 2020) which witnessed an increase to about 61% for Penta 3 during COVID-19 pandemic. We could not, therefore, associate low utilization of immunization services to the pandemic. However, the impacts of the COVID_19 pandemic on the immunization programme, general health and the livelihoods of the people is a rife topic for subsequent studies.

5. Conclusion

The study highlights that low uptake of the immunization services by eligible children may be attributed to several factors, including negative attitudes towards healthcare workers and immunization service, competing priorities of the caregivers, delayed opening of the immunization sessions, insufficient cold chain facilities, inadequate knowledge about immunization services and schedules, and unavailability of vaccines at the health facility. To improve vaccine utilization and accessibility, health workers must develop their knowledge, attitudes, and practices to address these factors. A plan to supply adequate vaccines and related supplies to the counties must prioritize identifying stock levels in time to reduce lead time. Also, the health facility micro-plan development and implementation, as used in 80 counties in South Sudan (gold standard to identify missed children for immunization), must be supported by increased funding for implementation of outreach and mobile sessions, intensified door-to-door health awareness, and regular community meetings to increase uptake.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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The Effect of Aerobic Exercise on Blood Pressure and Type of Labor in Primigravidas with Hypertension

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Abstract

Preeclampsia is one of the main causes of maternal mortality in Indonesia and in the world. The exact cause of preeclampsia is not known at this time. Aerobic exercise as an effort to prevent preeclampsia. The purpose of this study was to determine the effect of aerobic exercise on maternal outcome in primigravidas with a history of hypertension.

This research was a quasy experimental research with pre and post control group. Aerobic exercise was carried out for 15 weeks in the second trimester of pregnancy, then blood pressure measurements were taken in both groups. The data will be analyzed using the t-test, and a p value <0.05 will be considered statistically significant.

Systolic and diastolic blood pressures were lower in the intervention group than in the control group but not statistically significant, all samples became superimposed preeclampsia and underwent delivery by caesarean section.

Keywords: Aerobic exercise, blood pressure, type of labor, primigravida, hypertension

1. Introduction

Preeclampsia is one of the main causes of maternal mortality in Indonesia and in the world. The Maternal Mortality Rate (MMR) in Indonesia according to the 2012 Indonesian Demographic Health Survey (IDHS) was 359 per 100,000 live births. The main causes that contributed to the maternal mortality rate were bleeding as much as 32%, hypertension in pregnancy of 25%, infection 5%, prolonged labor 5%, other causes 1%. Other causes, namely 32% are quite large, including the causes of non-obstetric diseases (Kemenkes, 2012).

Pre-eclampsia during pregnancy is second cause after embolism in the United States. Hypertension in pregnancy is associated with complications, including placental abruption, cerebral hemorrhage, liver failure, and acute renal failure. Preeclampsia, which is one of the hypertension disorders, occurs in 3% to 4% of pregnancies and contributes to perinatal morbidity and mortality. Little is known about the development of preeclampsia in terms of modifiable risk factors, such as daily physical activity. Although the health benefits of daily physical activity, such as a reduced risk of essential hypertension, coronary heart disease, and type 2 diabetes are well documented, it is known less about the relationship between maternal physical activity and risk of hypertension, pregnancy disorders (Sorensen, 2003).

Preeclampsia is a condition in which hypertension occurs after the 20th week of pregnancy and is accompanied by proteinuria. In pregnancy with preeclampsia, trophoblast cell invasion occurs only in part of the spiral arteries in the myometrium area, resulting in impaired placental function, so the placenta does not meet the blood needs for nutrients and oxygen to the fetus. This disruption of placental function can cause stunted fetal growth (Sherwood, 2006).

The exact cause of preeclampsia is not known at this time. Preeclampsia is a specific pregnancy syndrome with decreased organ perfusion secondary to vasospame, increased peripheral vascular resistance, and endothelial activation that generally occurs after 20 weeks of gestation. The main sign is an increase in blood pressure accompanied by proteinuria, generalized edema, to impaired clotting function and impaired hepatic function. Risk factors that can increase the incidence of preeclampsia include nulliparous, age less than 20 years or more than 35 years, more than one fetus, diabetes mellitus, chronic hypertension, obesity, and kidney disease. Preeclampsia is also influenced by genetic and environmental factors (Cunningham, 2005).

Chronic hypertension is pregnant women who already suffer from high blood pressure (140/90 mmHg) before pregnancy or before 20 weeks of gestation. Usually chronic hypertension will not go away even though the mother has given birth to the baby. Pregnant women with chronic hypertension or pregnant women with a history of pre-eclampsia have an increased risk of developing pre-eclampsia in their pregnancy and an increase in pregnancy complications, a high risk of delivery by cesarean section and the incidence of LBW (Kasawara, 2013).

Superimposed Preeclampsia is a pregnant woman with chronic hypertension after 20 weeks of pregnancy who experiences edema and urine protein or has the classic triad signs of pre-eclampsia (Module of *PPSDM*, 2016).

Pregnancy exercise is recommended for pregnant women with hypertension or pregnant women at risk of pre-eclampsia to reduce the adverse effects of hypertension, including reducing the incidence of pre-eclampsia. The goal is to prevent the incidence of pre-eclampsia in pregnancy, by means of lowering blood pressure and cardiovascular improvement, but the results are still few data on the effect of aerobic exercise on the incidence of pre-eclampsia (Kasawara, 2013).

Based on the results of Yeo's research in 2000, that light exercise in the form of aerobic exercise for 10 weeks reduces diastolic blood pressure among pregnant women who are at risk of developing hypertensive disorders. The reduction may be due to the effect of exercise itself, not on physical activity levels or overall. However, this activity does not affect systolic blood pressure (Yeo, 2000).

Aerobic exercise as an effort to prevent preeclampsia is still a controversial matter, so a variety of studies are still needed so that this can be used as a reference in pregnancy care. However, it is based on evidence based that low impact aerobic exercise is not harmful to the health of the mother and fetus and is not related to premature events (Mascio, 2016).

Based on a preliminary survey at Padangmatinggi community health center in 2017, there were 4 cases of pregnant women with preeclampsia.

From the above, the authors are interested in examining the effect of aerobic exercise on blood pressure and type of labor in primigravida mothers with a history of hypertension.

The purpose of this study was to analyze the effect of aerobic exercise on blood pressure and type of delivery in primigravidas with a history of hypertension.

2. Method of the Study

2.1 Participant (Subject) Characteristics

Appropriate identification of research participants is critical to the science and practice of psychology, particularly for generalizing the findings, making comparisons across replications, and using the evidence in research syntheses and secondary data analyses. If humans participated in the study, report the eligibility and exclusion criteria, including any restrictions based on demographic characteristics.

2.2 Sampling Procedures

This study was conducted to analyze the effect of aerobic exercise on blood pressure and type of delivery in primigravidas with a history of hypertension. The population in this study were all primigravida pregnant women with a history of hypertension in Padangsidimpuan city.

The sample chosen was the sample in this study were all populations that met the inclusion and exclusion criteria. The inclusion criteria in this study were age 20–35, second trimester Primigravida and history of Hypertension 140/90 mmHg. The exclusion criteria were heart disease.

The number of samples taken must be the same between the two groups so that the research results are more significant. The sample in this study was the total population, namely all primigravida mothers with a history of hypertension in the city of Padangsidimpuan at the time of the study (data collection time), namely January - July 2018, it was found that there were 20 pregnant women, who were divided into two groups of the same size, ie 10 people per group. The research flow were:

a. Prospective study participants were primigravida pregnant women by providing prior information about the research objectives. Those who agree to take part in the research are asked to sign the consent letter that has been provided.

b. Then divided into intervention and control groups.

c. Aerobic exercise is carried out 2 times a week with a duration of 30 minutes each exercise, for 12 weeks, starting from 16 weeks of pregnancy.

d.   Exercise was carried out during classes for pregnant women.

Blood pressure was calculated before and after the intervention or aerobic exercise for 12 weeks was completed. The control group did not get any treatment but their blood pressure was still measured. The type of delivery seen at the end of pregnancy.

2.3 Research Design

This type of research was a quasy experimental study with a pre and post control group design to determine the effect of aerobic exercise initiation on blood pressure and type of labor. The intervention group was primigravida with a history of hypertension with aerobic exercise intervention, the control group was primigravida mothers with a history of hypertension without intervention.

2.4 Data Management and Analysis

The measurement results are collected and processed through the process of editing, coding, data entry, then data processing was carried out. Data processing was done by computer. Data analysis used univariate and bivariate analysis to determine the characteristics and data distribution of each variable, by compiling frequency tables for blood pressure, type of delivery, and characteristics of research subjects. Bivariate analysis was performed by t-test.

3. Results

3.1 Recruitment

This research was conducted in the city of Padangsidimpuan from March 2018 to October 2018.

After conducting observations, there were as many as 20 primigravidas who met the inclusion criteria. 10 pregnant women who would be given aerobic exercise were called the intervention group and 10 pregnant women who were not treated were called the control group.

3.2 Characteristics of Respondents

Table 1. Characteristics of respondents

Characteristics	Intervention Mean ± SD	Control Mean ± SD	*p*
Age	27,4 ± 2,1	25,8 ± 3,2	*p>0,05*
Sistolic	147,7 ± 9,0	153,3 ± 10,1	*p>0,05*
Diastolic	96,3 ± 7,8	97,8 ± 7,7	*p>0,05*

Based on its characteristics, the mean age of the respondents was 27.4 years for the intervention group and 25.8 years for the control group. The systolic mean of respondents was 147.7 mmHg for the intervention group and 153.3 mmHg for the control group. The diastolic mean of respondents was 96.3 mmHg for the intervention group and 97.8 mmHg for the control group. Statistically, using the Mann-Whitney technique, there was no significant difference between the two groups with a p value> 0.05.

3.3 Effect of Aerobic Exercise on Primigravida Mother's Systolic

Table 2. Effect of Aerobic Exercise after 12 weeks on Mean ± SD systolic for primigravida mother

	Mean ± SD (mmHg)	*p*
Intervention Group	154,**7**± 14,7	0,54
Control Group	156,**1** ± 12,1	

Table 2 showed that the systolic mean after 12 weeks in the intervention group was lower than that in the control group. The mean systolic in the intervention group was 154.7 ± 14.7 and the mean systolic in the control group was 156.1 ± 12.1. Statistically, using the Mann-Whitney technique, there was no significant difference with a p value of 0.54 (<0.05).

3.4 Effect of Aerobic Exercise on Diastolic in Primigravida Mothers

Table 3. Effect of Aerobic Exercise after 12 weeks of Diastolic Mean ± SD of primigravida mother

	Mean ± SD (mmHg)	*p*
Intervention	94,4 ± 7,1	0,1
Control	97,9 ± **7**,8	

Table 3 showed the diastolic mean after 12 weeks in the intervention group was 94.4 ± 7.1 mmHg and in the control group 97.9 ± 7.8 mmHg. The diastolic mean in the intervention group was lower than in the control group, but statistically, using the Mann-Whitney technique there was no significant difference with a p value > 0.05.

3.5 The Effect of Aerobic Exercise on Types of Labor of Primigravida Mothers

Table 4. Effect of Aerobic Exercise on Type of Labor of Primigravida Mothers

	Type of Labor		*p*
	Normal	*Sectio Caesarea*	
Intervention	-	10	0,5
Control	-	10	

Table 4 showed that all samples in both the intervention group and the control group all experienced labor with action, namely Caesarean section. Statistically, using the Mann-Whitney technique, there was no significant difference with a p value <0.05.

4. Discussion

The measurement results obtained from the mean age, systolic and diastolic were almost the same or homogeneous in the two groups. The systolic mean after intervention was lower than the control group, but statistically there was no significant difference. The same thing also happened to diastolic, where the diastolic mean in the intervention group was lower than in the control group even though there was no statistically significant difference. All respondents, both in the intervention group and in the control group, underwent a type of delivery with action.

Overall, the characteristics of the respondents, namely mean age, mean systolic blood pressure and mean diastolic blood pressure, showed results that were not significantly different between the intervention group and the control group. This shows the homogeneity between the two groups. All respondents in this study were primigravidas. According to Bobak (2005), approximately 85% of preeclampsia occurred in the first pregnancy (primigravida).

Primigravidas often experience stress in the face of childbirth. Emotional stress that occurs in primigravida causes an increase in the release of corticotropic-releasing hormone (CRH) by the hypothalamus, which in turn causes an increase in cortisol. The effect of cortisol is to prepare the body to respond to all stressors by increasing sympathetic responses, including responses aimed at increasing cardiac output and maintaining blood pressure. In women with preeclampsia-eclampsia, there is no decrease in sensitivity to these vasopeptidavasopeptides, so a large increase in blood volume directly increases cardiac output and blood pressure (Bobak, 2005).

In this study, it was found that respondents in the intervention group mean systolic blood pressure after 12 weeks was 154.7 ± 14.7 mmHg and in the control group 156.1 ± 12.1 mmHg. Statistically, using the Mann-Whitney technique, there is no significant difference with p value> 0.05.

The mean diastolic blood pressure after 12 weeks after intervention in the intervention group was 94.4 ± 7.1 and the control group was 97.9 ± 7.8 mmHg. Statistically, using the Mann-Whitney technique, there is no significant difference with p value> 0.05.

In this study, it was found that after doing aerobic exercise for 12 weeks, systolic blood pressure was lower than in the intervention group, diastolic blood pressure was lower than in the control group but it was not statistically significant.

Systolic and diastolic blood pressure measurements were carried out every week but the data analyzed were only the results of the first measurement at the start of the activity and the last measurement after 12 weeks. The

duration of each exercise is 5-10 minutes. Blood pressure measurements were taken before and after the activity. There was an increase and decrease in blood pressure in both the intervention group and the control group during the 12 weeks of activity. Aerobic exercise is carried out at the health center and at the midwife's house, so that the implementation can be controlled. All pregnant women enter a state of pre-eclampsia.

In line with Da Silva's study which examined normal pregnant women, it was found that there was no difference in the incidence of pre-eclampsia in the aerobic exercise intervention group and the control group, but the incidence of pre-eclampsia was lower in the intervention group than in the control group (Da Silva, 20017).

Scholten (2014) who examined the effects of aerobic exercise on pregnant women with a history of pre-eclampsia with a control group who were normal pregnant women, found that aerobic exercise made no difference in systolic and diastolic pressure between the intervention group and the control group, even though it was before aerobic exercise intervention. performed, the mean systolic and diastolic blood pressure in the intervention group was higher than in the control group. Therefore Scholten recommends aerobic exercise to be done in pregnant women with a history of hypertension.

A schoten study with a sample of the intervention group, namely pregnant women with a history of pre-eclampsia and a control group with normal pregnant women, found that aerobic exercise could improve their risk of heart blood vessel problems and improve their heart health. These improvements included metabolic syndromes in both groups experiencing reduced stress on biochemical blood vessels. The effect of exercise on heart protection after childbirth in both study groups was caused by improvements in endothelial function, improvements in blood vessel wall thickening and improvements in the structure of blood vessels (Scholten, 2014).

In line with the results of Berghella's research which concluded, by doing aerobic exercise there will be a decrease in oxidative stress so that it will improve endothelial function, and will have an effect on preventing the occurrence of pre-eclampsia. Aerobic exercise also reduces the risk of childbirth by cesarean section and increases the incidence of vaginal delivery (Berghella, 2017).

However, exercise cannot normalize blood vessels in pregnant women with a history of pre-eclampsia, but what is interesting is that exercise will induce blood vessel repair in both the sample group of pregnant women with a history of pre-eclampsia and the control group of normal pregnant women. Exercise also has the potential to detect risks or problems in pregnant women and result in reduced costs for screening for mothers. Exercise also causes a reduced risk of experiencing pre-eclampsia again in the next pregnancy (Scholten, 2014).

Aerobic exercise is a sport that can be used to reduce the incidence of gestational hypertension. Because of its benefits, aerobic exercise should be used as a lifestyle during pregnancy and after childbirth because of its health benefits (Magro, 2017).

Kasawara in his research the effect of aerobic exercise by cycling is safe for normal pregnant women and pregnant women with a history of pre-eclampsia, and does not cause problems with fetal outcomes and maternal outcomes (Kasawara, 2013).

However, the results of this study are different from the results of the current study, namely that all respondents gave birth with the type of delivery by action. Perhaps this is because all respondents are high-risk primigravida mothers. However, the interesting thing that was found by the researchers was that all respondents, both the intervention group and the control group, were also found after 20 weeks of gestation that edema and urine protein were found. All mothers were categorized as Superimposed Preeclampsia.

5. Conclusions

Systolic and diastolic blood pressures were lower in the intervention group than in the control group but not statistically significant. All respondents have a type of delivery by action.

6. Suggestions

The need to socialize the benefits of aerobic exercise during pregnancy, which is given to pregnant women during antenatal classes. It is recommended that all health institutions and midwifery practitioners routinely do exercise in classes for pregnant women to support the smooth running of the labor process.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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Electroencephalography: Experience at Abakaliki Nigeria

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Abstract

Background: Electroencephalography (EEG) remains the most important investigative modality in the evaluation of individuals with epilepsy and other neurological disorders. The pattern of EEG done in a tertiary hospital at Abakaliki Nigeria is not known. It is against this background that we embarked on this retrospective observational study on the EEG pattern and patient characteristics in Neurophysiology laboratory at Abakaliki Nigeria.

Method: This is a retrospective observational hospital based study where the attendance register of the Neurophysiology laboratory was used to extract information on the demography, clinical characteristics and EEG reports of patients seen at the Laboratory from November 2018 to April 2021.

Results: A total of 125 (Male- 69, Female- 56) persons did EEG over the study period, and 75.2% had epileptiform waves (generalized- 16.8%, focal- 57.6%).

Conclusion: EEG services are been utilized at Abakaliki in evaluation of seizure disorder and other paroxysmal neurological events with more prevalent focal epileptiform waves.

Keywords: electroencephalography, epileptiform waves, neurophysiology laboratory, Abakaliki, Nigeria

1. Introduction

Electroencephalograph (EEG) is a tool for recording spontaneous electrical activities generated in the cerebral cortex using multiple electrodes placed on the scalp (Paudel, Limbu, Panta, Ghimire, Shrestha, & Deo, 2012). EEG signal is a reflection of electrical currents flowing in the extracellular space generated by the algebraic summation of excitatory (EPSP) and inhibitory postsynaptic potentials (IPSP) that occur on many cortical neurons (Paudel et al., 2012). The summated EPSP and IPSP are then conducted through the skull and picked up by electrodes placed on the scalp. One estimate suggests that 6 cm^2 of cortical surface area must be synchronously activated for a potential to be recorded at the scalp (Paudel et al., 2012).

EEG remains the most important investigative modality in the diagnostic evaluation of individuals with epilepsy (Panayiotopoulos, Michael, Sanders, Valeta, & Koutroumanidis, 2008). Although the diagnosis of epilepsy is essentially clinical, EEG is used to confirm the diagnosis, and characterize the seizure type. It is also used to differentiate epileptic seizures from other types of spells, and to differentiate "organic" encephalopathy from primary psychiatric syndromes such as catatonia. Other uses include as an adjunct test of brain death, to prognosticate, in certain instances, in patients with coma and to determine whether to wean anti-epileptic medications.

The duration of EEG recording varies among laboratories and several recommendations have been published.

Craciun and colleagues in a review of 1,005 EEG recordings provided evidence for recommending at least 20 minutes recording duration for standard awake EEG and 30 minutes for sleep EEG in patients with epilepsy-related indications (Craciun, Gardella, Alving, Terney, Mindruta, Zarubova, & Beniczky, 2014).

There has not been any study on the use of EEG at the Alex Ekwueme Federal University Teaching Hospital Abakaliki. It is against this background that we conducted the study on Experience of EEG use at the Alex Ekwueme Federal University Teaching Hospital Abakaliki. The findings in this study will constitute data base for future reference and for health planning purposes.

2. Methodology

This is a retrospective descriptive hospital based study undertaken at the Neurophysiology laboratory of the Alex Ekwueme Federal University Teaching Hospital Abakaliki, a tertiary hospital in Abakaliki Nigeria. The hospital is a referral hub for Ebonyi state, and the surrounding states. The laboratory attends to both pediatric and adult patients with referral from within and outside the hospital. The EEG tests were conducted by certified EEG technologists using Contec KT88–3200, a 32 Channel EEG Machine and the reports were done by Neurologists with special interest in Neurophysiology. The recordings lasted for 20–30 minutes and were obtained by placing electrodes on the scalp with a conductive gel. Prior to electrode placement, the scalp area was prepared by clean shaving and light abrasion of the skin to reduce impedance due to dead skin cells. Electrodes were applied on the scalp using the 10–20 system of electrode placement using electrode gel (Towle et al., 1993). The EEG register was used to extract data on demographic variables and results of the EEG tests done from November 2018 to April 2021. The data were analyzed with Statistical Package for the Social Sciences (SPSS) version 25. The categorical variables were presented as proportions and percentages while numerical variables were presented as means and standard deviations. Chi –square with Yates correction was used to test for statistical significance of categorical variables while t- test for numerical variables and p-value of <0.05 as significant.

3. Results

A total of 125 patients had EEG done during the study period of 2.5 years. There were 69 (55.2%) males and 56 (44.8%) females. The mean age was 28.7 ± 11.5 years and 83 (62.4%) persons were < 40 years. The details of age and sex distribution are found in Table 1.

Table 1. Age and sex distribution

Age range (years)	Male- n (%)	Female- n (%)	Total N (%)
0–9	6 (4.8)	3 (2.4)	9 (7.2)
10–19	6 (4.8)	13 (10.4)	19 (15.2)
20–29	25 (20)	14 (11.2)	39 (31.2)
30–39	13 (10.4)	5 (4.0)	18 (10.8)
40–49	4 (3.2)	10 (8.0)	14 (11.2)
50–59	7 (5.6)	4 (3.2)	11 (8.8)
60–69	6 (4.8)	2 (1.6)	8 (6.4)
70–79	2 (1.6)	5 (4.0)	7 (7.6)
Total	**69 (55.2)**	**56 (44.8)**	**125 (100)**

Thirty one (24.8%) persons had normal EEG tracings while 94 (75.2%) had abnormal EEG studies. The abnormalities seen were focal epileptiform waves- 72 (57.6%), generalized epileptiform waves- 21 (16.8), and diffused slow waves- 1 (0.8%). Generalized epileptiform waves were seen more in young individuals without sex predilection while multifocal epileptiform waves were seen more in older folks. The details are found in Tables 2 and 3.

The sources of patient referral were from Internal medicine department, Psychiatry, Pediatrics, Family medicine, and Peripheral hospitals in descending order of magnitude. The details are found in Table 4.

Table 2. EEG findings

	Normal-n	Diffused Slow waves-n	Focal Epileptiform waves-n	Generalized Epileptiform waves-n	p-value
Male	16	1	42	10	0.7988
Female	15	0	30	11	
<40yrs	20	0	43	20	0.9706
≥40 yrs	11	1	29	1	

Table 3. Focal EEG abnormalities

Variables	Right focal-n	Left focal- n	Multifocal- n	p-value
Male	20	18	4	0.7367
Female	15	12	3	
<40years	22	19	2	0.1728
≥40 years	13	11	5	

Table 4. Source of referral

Source of referral	n (%)
Internal medicine	89 (71.2)
Psychiatry	17 (13.6)
Pediatrics	9 (7.2)
Family medicine	6 (4.8)
Peripheral hospitals	4 (3.2)
Total	125 (100)

4. Discussion

This is the first hospital based study of EEG pattern in Abakaliki Nigeria. The total number of EEG done over the study period of 2.5 years was 125 and it is low compared to other hospital based studies in Nigeria which reported higher values (Lagunju et al., 2015; Ajiboye, Abiodun, & Ogbebor, 2017; Owolabi et al., 2013; Salisu & Senbanjo, 2019; Igwe et al., 2014). This could result from the fact that EEG services domiciled in Neurology unit became available in late 2018. Consequently, the clinicians and patients awareness level is still low. Also, there was significant interruption of the EEG and other clinical services at the study centre during the peak of first wave of Corona virus disease (COVID) 19 lockdown in 2020 (Afolabi et al., 2020).

The male preponderance recorded in this study is similar to the report of other hospital based studies in Nigeria (Lagunju et al., 2015; Ajiboye et al., 2017; Owolabi et al., 2013; Salisu & Senbanjo, 2019; Igwe et al., 2014). The male preponderance sterns from higher prevalence and incidence of seizure in male folks due to their greater exposure to risk factors for symptomatic seizure (McHugh & Delanty, 2008; Fiest et al., 2017). Also, the concealment of the condition in women for sociocultural reasons in certain places may contribute to male preponderance (Bharucha et al., 1988).

The mean age of the study population was 28.7 years and 62.4% were < 40 years. The above findings show that the majority of the patients were young. This is similar to other studies in Nigeria (Lagunju et al., 2015; Ajiboye et al., 2017; L. F., Owolabi, Shehu, S. D., Owolabi, & Umar, 2013; Salisu & Senbanjo, 2019; Igwe et al., 2014). Although the prevalence of seizure is higher in extremes of ages (Fiest et al., 2017; Beghi & Giussani, 2018), it peaks in children in low-middle income countries (LMIC) like Nigeria as a result of under-diagnosis of the condition in older individuals as well as the demographic structure of the country (Beghi & Giussani, 2018). The above could explain the preponderance of young individuals in the study population.

About a quarter of the study population had normal EEG findings while about 75% had abnormal (epileptiform) waves. The presence of epileptiform waves in 75% of the cases was rather high as the test was done in awake state.

Smith (2005) reported a sensitivity of first interictal EEG to be about 50%, though Binnie (1996) noted that it can be increased to 80% by sleep deprivation.Lagunju et al. (2015) reported 87% interictalepileptiform waves in children while Owolabi et al. (2013) reported 57% in adult population both in Nigerian population.The high sensitivity in this study could result from strict patient selection as most of the patients were referred from the neurology clinics. Also, the application of the standard activation procedures of hyperventilation (up to three minutes), photic stimulation, recording during eye closure and long recording duration could contribute to the high yield.

Majority of the patients with abnormal EEG findings had focal epileptiform discharges and it's similar to the studies in the United States (Zarrelli, Beghi, Rocca, & Hauser, 1999; Scheffer et al., 2017). This is contrary to the findings of Lagunju et al. (2015) who reported preponderance of generalized epileptiform waves in children. The above findings could be as a result of majority of the study population been adults with higher risk of focal symptomatic and cryptogenic seizure (Zarrelli et al., 1999).

Multifocal IEDs were reported more in older folks in this study. This is expected as symptomatic seizures from stroke, meningoencephalitis and metabolic disorders are most prevalent cause of seizure disorder in elderly patients (Kaur et al., 2018).

Most of the patients were referred from Internal Medicine, Psychiatry, Paediatrics and Family Medicine in descending order. This is similar to the report of Ajiboye et al. (2017). These departments manage seizure disorder and other paroxysmal conditions in which EEG test may be indicated for their evaluation.

5. Conclusion and Recommendations

There is increasing awareness and utilization of EEG in patient evaluation at Abakaliki Nigeria with preponderance of male folks. The abnormalities noted were predominantly focal epileptiform discharges. Generalized epileptiform discharges were more seen in younger people in contrast to multifocal waves seen predominantly on the older age group.

There is a need for creation of more awareness on the availability of EEG services for more utilization. There is also a need to procure video EEG which will enhance the yield and also improve the accuracy of the EEG interpretations.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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Socio-Economic Disparities in Under-Five Child Malnutrition in Nigeria

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Abstract

Introduction: Recent attention over the health, wellbeing and nutritional intake of children below five years of age has grown tremendously. This is mainly because these years are crucial to a child's survival, growth and development; and if not handled properly could unfavorably affect the well-being status and efficiency of the child in later adult life. The study focused on malnutrition of children under the age of five in relation to their socio-economic status. It was measured by stunting, wasting and underweight.

Methodology: Data from the Living Standards Measurement Study (LSMS)/General Household Survey (GHS) 2015/2016 Nigeria was used for analysis. Malnutrition was measured using the three anthropometric measures which are expressed in terms of Z-scores namely: Stunting: height-for-age (HAZ), Wasting: weight-for-height (WHZ) and Underweight: weight-for-age (WAZ). The socioeconomic disparities in malnutrition were checked according to gender, place of residence and geo-political zones in Nigeria. While the concentration index and curves were used to check for the magnitude of inequality in malnutrition ascribable to the socio-economic status.

Results: The percentage of children stunted was the highest with 37.8 percent, followed by the percentage of children underweight to be 20.25 and children wasted was 9.63 percent. The percentage of stunting, wasting and underweight were considerably greater in male children compare to the female children. Stunting and underweight were responsive to the household socioeconomic status. A higher percentage of children below five years of age who were stunted, wasted and underweight lived in the rural areas of Nigeria compare to the children living in the urban areas. The rate of stunting was highest in the North West with a 52.91 percent, followed by North East with 43 percent, and lowest in the South South with 20.67 percent. The concentration indices analysis revealed that stunting, wasting and underweight all had negative signs signifying concentration among the poor household children. Finally, as one moves up the ladder of the socioeconomic status, a significant fall in the rate of stunting is witnessed. Therefore, increasing the income of the poorest in a society is a sound strategy to curb the high rates of stunting in the socio-economically deprived segments of the country.

Keywords: under-five children, malnutrition, stunting, underweight, wasting, concentration index and curve

1. Introduction

Over time, there has been an increased attention in the area of socio-economic injustices in health with individual countries and international groups renewing their efforts to restitute the wellbeing of the less fortunate and vulnerable in the society (Wagstaff, 2000; Gwatkin, 2000).

The children, especially under-fives in Nigeria are vulnerable to many conditions and diseases which eventually lead to mortality due to their socio-economic status. The reason is not far-fetched from the inequality in socioeconomic status among Nigerians and low immune system. Some common conditions in children below five years include: Chronic Diarrhea which affects close to 1.3 million episodes. Worldwide, close to 4 million people die due to preventable conditions. Over 80% deaths occur in Sub-Saharan countries. Worldwide 300 -500 million clinical cases of malaria are reported annually, which accounts for 80% occurring in Africa alone, resulting in about 0.7 – 2.5million deaths in Sub-Saharan Africa. It is disheartening to note that Nigeria ranks among the top 45 nations that contribute to 94% of the global life losses due to measles.

In Nigeria, measles has a dominance of 1.3-5.1% of all pediatric records. However most of these diseases and sicknesses are linked to malnutrition cases (Saleh, 2013). Poverty is a major cause of malnourishment, which has its roots from the socioeconomic status of individuals and households.

Studies have shown the existence of an inverse relationship between socio-economic status and malnutrition, sickness, and mortality (Chaturvedi, Jarrett, Shipley, & Fuller, 1998). There is a sizable literature documenting socioeconomic inequality in malnutrition. Zere and McIntyre (2003), carried out a research to ascertain and quantify the prevalence of inequalities in below-five baby's malnourishment, especially those attributable to socio-economic conditions in South Africa. Results showed that stunting was the major prevailing type of under-nutrition in South Africa. Its rate was found to be highly prevalent in Eastern Cape as well as some sections of the North – provinces that have highest intensity of poverty. They also found a significant pro-rich unfairness in the allocation of stunting and underweight cases. Nevertheless, wasting showed no gradients attributed to socio-economic standing. They therefore concluded that there were significant differences in under-five child malnutrition (stunting and underweight) that favored the wealthy in the society; which are unnecessary, avoidable and unjust.

Poel et al. (2007) did a study in Ghana with the aim of analyzing inequalities in children's height-for-age z-scores across the entire socioeconomic distribution and decomposes this inequality into different contributing factors using a concentration index. Findings show that malnourishment is connected to poverty, mother's education, health care and family planning and regional characteristics. Socioeconomic inequality in malnutrition is mainly associated with poverty, health care use and regional disparities. Child malnutrition in Ghana is said to be a multi-sectorial problem. The factors associated with average malnutrition rates are not necessarily the same as those associated with socioeconomic inequality in malnutrition.

Bangladesh has malnutrition as one of the principal causes of child mortality. Islam et al., (2013) did a study on Bangladesh with the aim of demonstrating the applicability of the generalized Poisson regression (GPR) model as an alternative of other statistical methods and to find some predictors of malnutrition. The study identified several significant predictors of the outcome variable namely mother's education, father's education, wealth index, sanitation status, source of drinking water, and total number of children ever born to a woman. Rahman et al., (2016) examined the association between low birth weight (LBW) and malnutrition with findings revealing that the prevalence of malnutrition was remarkably higher in children with LBW than those with normal birth-weights. While, Thang and Popkin (2003) showed that children from rural homes, poor families, and cultural inferior backgrounds were considerably more probable to be under-nourished as equated to those residing in the urban parts and the babies of the rich families.

Kandala et al., (2011) gave a different twist to the study of undernourishment in the DRC by examining spatial variation in under-five malnutrition with flexible geo-additive semi-parametric mixed model while simultaneously controlling for spatial dependence and possibly nonlinear effects of covariates within a simultaneous, coherent regression framework based on Markov Chain Monte Carlo techniques. Results showed that malnutrition was significantly higher in rural areas compared to urban centers and this difference persisted after multiple adjustments. Also childhood malnutrition was more pronounced in all provinces of the DRC, after accounting for the location's effects, geographic differences were significant.

Poel et al., (2008) carried out a study involving 47 developing countries, Nigeria included. They aimed at evaluating the socioeconomic imbalances in malnourishment of babies, to provide proof for correlation between socioeconomic imbalance and the mean level of under-nutrition, and to attract attention to diverse trends of socioeconomic unfairness in malnourishment. They utilized data from the 47 DHSs that had data on the nutritional cases of minors not exceeding 5 years. Results showed that in nearly every country, stunting had disproportionate impacts on the poor. The concentration index was notable in every country, except Madagascar. Socioeconomic unfairness in stunting was highest in the Latin America as well as the Caribbean region. Wasting was overlay concentrated in the poorest regions. However, socioeconomic imbalance was less as compared with stunting. For nearly 1/3 of nations, socioeconomic imbalance was negligible. A comparison of the mean stunting and wasting cases were made in relation to WHO child development standards and NCHS development standards. For the two pointers of malnourishment, the mean rate was more when the new WHO basic guidelines were adhered to. Nonetheless, socioeconomic imbalance was fairly comparable with the two distinct development standards.

A similar study by Uthman (2009) was carried out in Nigeria to determine the magnitude of inequalities for below-five years suffering from malnutrition, which is as a result of socio-economic status. The data on 4187 babies below 5 years came from the Nigeria Demographic and Health Survey (2003). The study used family possession index as a proxy of the socio-economic situation. Socio-economic variation in acute minority malnutrition evaluated through the application of the "extended illness concentration and achievement indices". The findings showed significant pro-rich unfairness in spreading stunting. The South-East (SE) and South West (SW) regions recorded few mean rates of childhood malnourishment; however, large disparities occurred among

the poor families versus the rich. Comparatively, North-east (NE) and North West (NW) recorded narrow gaps among the poor versus the rich on childhood malnourishment. He concluded that, there were substantial contrasts in malnutrition of children below 5 years that favor the rich in the society in every geopolitical locality.

Uthman (2009) also did another study with an objective to measure and decompose the socio-economic unfairness in under-nutrition of minors in Nigeria. Personal statistical records were formulated to represent a national sample of 4187 babies below five years in Nigeria. The family's socio-economic condition was determined by applying the principal component evaluation technique. The concentration index (CI) of under-nourishment in babies determined the socio-economic injustices and dissembled into its causal variables. The enormous contributors of inequality in malnourishment of children were family's economic conditions (31%), healthcare service indicator (17%), motherly education (13%) as well as appropriate hygiene at 11%. The findings further showed that lactation length (8%), geopolitical areas (8%) and place of living (5%) additionally proved to be reasonable cause of the assessed inequality. Therefore, in its conclusion, socio-economic disparity in childhood malnourishment in Nigeria was caused by health logistics and variables outside the jurisdiction of health authorities and care delivery system.

Therefore, findings form the existing evidence show that the prevalence of under-nutrition among under-five children was significantly high and varied widely and, malnutrition has been identified as one of the principal causes of child mortality. This study therefore employed the use of Z-Score to evaluate the anthropometric status of the under-five children, while the concentration curve and index were adopted to evaluate the prevalence of inequalities in malnutrition ascribable to socioeconomic rank of under-five children in Nigeria.

In other words, malnutrition, illness and mortality increases as there is a decrease in the socio-economic status level. This is as a result of the inequality in socio-economic status, hence unfairness in healthcare sector within or amongst countries.

One indicator used by WHO for household wellbeing and determination of child survival is the diet of children under the age of five (Thomas, Strauss, & Henriques, 1990). Infant dietary deficiency is among the leading causes of children mortality (Pelletier, Frongillo, Schroeder, & Habicht, 1995). Infant malnourishment is a predominant community wellbeing concern in growing nations, like those in the sub-Saharan region of Africa (De Onis, 2000; Stevens et al., 2012). There are 17.6 million babies in this African region suffering from chronic malnourishment (World Bank Data, 2016). In 2015, about 7.7% of babies were lost to malnutrition globally, 24.5% had under-heights whereas 15% had low weight. Sub-Saharan region and part of South-East Asia have reported many instances of malnutrition, with the former accounting for about 39.4% of under-heights, 24.9% of low weight and 10.3% lost babies below-5 years (World Health Organization [WHO], 2016).

In Nigeria, close to 2.5 million children suffer from chronic malnourishment. Statistics showed that about 7.2% of children were wasted, 32.9% were stunted, and 19.4% were underweight (UNICEF statistical data, 2016). Thus, given the high level of inequalities among its states and provinces, it is not unanticipated that there will exist mortality and morbidity differentials which are related to socio-economic status.

As pointed out earlier, Nigeria is made up of six main geo-political zones, and they are diverse in economic development. According to Uthman (2009) "The North East and North West regions are largely agrarian and predominantly rural. The population level of education is low. The North Central region is one-third urbanized. The South East region is slightly more urbanized than the northern regions. The South West region, which includes Lagos, the former capital is the most urbanized of the six regions. The South South region is the least urbanized of the three southern regions". Therefore the widely varied under-five malnutrition disparities found in this study is not unexpected. The southern areas of Nigeria collects around double the yearly rainwater of the north areas; hence rainfall becomes scarcer as you move up north (Kandala, Ji, Stallard, Stranges, & Cappuccio, 2007). This informs the type of agricultural activities practiced in the various regions, with intensive farming found in the southern part of the country, while childhood malnutrition is worse in the Northern region because of the Saharan drought. The western region which is the most urbanized has the lowest rates of malnutrition. This is probably due to the level of education of parents who are likely to be more knowledgeable in child health care, enjoy better living conditions, have access to better agricultural produce, and have access to better medical care, which could translate into a lower prevalence of under-five malnutrition.

To reduce these health inequalities, the federal, state and local governments have to formulate policies authorities have to come up with policies that will help eradicate or reduce health inequalities to the barest minimum. Analysis from this study seeks to add to the existing literature by looking at disparities in under-five children in Nigeria by determining the severity of these inequalities in malnourishment of children below-five years of age which emanate from socio-economic status.

1.1 Objectives and Aim of the Study

The overall purpose of the study is to find out the extent of disparities in malnutrition among children below five years of age across the country, which is related to socio-economic status and to recommend policy solutions based on findings.

2. Theoretical Review

A model that explains child malnutrition (under nutrition) is reviewed in this section, the framework proposed by UNICEF (1990).

2.1 Model: United Nations Children's Fund (UNICEF) Malnutrition Framework (1990)

Unlike Davison & Birch (2001) who focused on overweight (even though the principles apply to other forms of malnutrition), the focus here was underweight malnutrition using the conceptual framework developed by UNICEF (1990).

Therefore, UNICEF (1990) defines malnourishment/under nutrition as what happens when nutritional intake is insufficient and health unpleasant. The structure shows that the bases of malnutrition are multi-divisional, embracing caring practices, health, and food .They are also categorized as immediate, underlying, and basic, where elements at one level impact other levels.

The model showed that causes of malnutrition are related to national and community status; underlying causes includes the families and household characteristics, and the immediate causes are the individuals. Therefore these causes of malnutrition are categorized as follows: (i) Basic causes: this includes - Household access to adequate quantity and quality of resources: land, education, employment, income, technology; Inadequate financial, human, physical and social capital, Sociocultural, economic and political context; (ii) Underlying bases include: Household foodstuff uncertainty, insufficient care and nutritional practices, Unwholesome family setting and insufficient health facilities and (iii) Immediate causes include: Insufficient nutritional consumption, and Illness.

The model Sshows interplay between the variables that could lead to malnutrition. The process begins with the basic causes which include the outside or external factors such as the economic and political ideologies and influences that have impact on households and the various affairs and activities that they engage in such as the choice of health care services for the children and family as a whole, access to food that makes an household amongst others; these are summed up and categorized as underlying causes. The underlying causes in turn influence the immediate causes which are inadequate dietary intake by the children and Diseases the children are affected by. Finally, all these causes lead to a manifestation of malnutrition in children.

The UNICEF (1990) model describes causes of childhood malnutrition and that malnutrition occurs as a result of a compilation of factors including inadequate dietary intake by the child, which is due to household or family level factors such as insufficient access to food and poor water sanitation, which themselves occur as a result of societal level factors such as a lack of potential resources and limits in technology. Ultimately, the model acknowledges that people and environmental resources, economic structures, and political variables are basic contributors to malnutrition. Just like other developing countries, Nigeria has her own share of malnutrition problems, and the malnutrition situation in Nigeria tilts towards under- nutrition, hence the UNICEF (1990) framework is applicable.

2.2 The Model

Following the model by Rosenzweig and Schultz (1982), and UNICEF (1990) with a slight modification to the models, we assume that the child well-being production is entrenched in a utility maximizing conduct of the mother.

Therefore, the following utility function is assumed:

$$U = U (X, Y, H) \qquad (1)$$

Where:

X = a good that produces utility, but is not directly related to well-being of the child, also known as well-being neutral good, e.g. a child's school uniform, the mother's clothing;

Y = a well-being-related good or behavior that produces utility to the mother and also affects the child's survival, e.g., antenatal, child delivery and post-natal care;

H = well-being status of a child.

The child well-being production function is given as:

$$H = F (Y, Z, \mu) \qquad (2)$$

Where:

Z = purchased market goods and services inputs that affect the child well-being directly, such as medical care services that affects a child's well-being directly;

μ = the component of a child's well-being that is due to environmental or genetic conditions which is not influenced by parental behavior and preferences.

The mother maximizes Equation (1) given (2) subject to the budget constraint given as in Equation (3)

$$I = XPx + YPy + ZPz \tag{3}$$

Where:

I = exogenous income;

Px = price of the well-being-neutral good, X,

Py = price of well-being-related consumer good, Y,

Pz = price of child investment good, Z.

It is important to note that from Equations (1) and (2) that the child investment good is assumed to be purchased only for the purpose of improving child health so that it enters a mother's utility function only through H.

As stated above, a mother's production of her child's health is described in Equation (2). The child health production function has the property that it is imbedded in the constrained utility maximization behavior of the mother (Equations 1 and 3). Expressions (1)-(3) can be manipulated to yield health input demand functions of the form

$$X = Dx\ (Px,\ Py,\ Pz,\ I,\ \mu) \tag{4.1}$$

$$Y = Dy\ (Px,\ Py,\ Pz,\ I,\ \mu) \tag{4.2}$$

$$Z = Dz\ (Px,\ Py,\ Pz,\ I,\ \mu) \tag{4.3}$$

The effects of changes in prices of the three goods on child health can be derived from Equations (4.1-4.3) since from Equation (2), a change in child health can be expressed as

$$dH = Fy \cdot dY + Fz \cdot dZ + F\mu \cdot d\mu \tag{5}$$

where,

Fy, Fz, Fμ are marginal products of health inputs Y, Z and μ, respectively.

From Equation (2), the change in child health can be related to changes in respective prices of health inputs as follows

$$dH/dPx = Fy \cdot dY/dPx + Fz \cdot dZ/dPx + F\mu \cdot d\mu/dPx \tag{6.1}$$

$$dH/dPy = Fy \cdot dY/dPy + Fz \cdot dZ/dPy + F\mu \cdot d\mu/dPy \tag{6.2}$$

$$dH/dPz = Fy \cdot dY/dPz + Fz \cdot dZ/dPz + F\mu \cdot d\mu/dPz \tag{6.3}$$

where

$d\mu/dPi = 0$, for i = x, y, z so that in equation (6), the terms $F\mu \cdot (.) = 0$, since μ is a random variable unrelated to commodity prices.

The equation above shows that goods prices are associated with the well-being status of a child. The signs and magnitudes of effects of goods prices on well-being rest on

(a) Degrees of changes in demand for health inputs following price changes and on

(b) Magnitudes of the marginal products of well-being inputs.

It is fascinating to see from Equation (4.1), that changes in prices of wellbeing-neutral goods also touch child well-being through the family budget constraint. Thus, policy -makers need to know the parameters of both the child well-being production technology and the associated well-being input demands to foretell well-being effects of variations in input prices. To obtain such information, health production and input demand parameters must be assessed concurrently.

2.3 Empirical Framework, Methodology and Estimation Techniques for Malnutrition

To analyze and check for these interplays of variables and different categories of causes and the effect/ influence they have on malnutrition of under five children stipulated by UNICEF (1990) model, we analyzed the occurrence

and magnitude of malnourishment in children below five years of age in Nigeria using the Z-score on anthropometric data, while the magnitude of malnutrition was analyzed by means of the concentration index.

2.3.1 The Concentration Index (C)

The concentration index which was developed by Kakwani 1977, 1980, is directly related to the concentration curve and it quantifies the degree of socioeconomic related inequality in a health variable (Kakwani, Wagstaff, & van Doorslaer, 1997; Wagstaff, van Doorslaer, & Paci, 1989).

Therefore following from Wagstaff et al. (1990), the concentration index is defined as:

$$C = 1 - 2 \int_0^1 L_h(p)dp \tag{7}$$

The index is bounded between -1 and 1. For a discrete living standards variable such as this study, the concentration index (C) formula can be written as:

$$C = \frac{2}{N\mu}\sum_{t=1}^{n} x_i r_i - 1 - \frac{1}{N}, \tag{8}$$

Where: C = Concentration index

x_i = the health sector variable

μ = it's mean

r_1 = i/N is the fractional rank of individual i in the living standards distribution, with i = 1 for the poorest and i = N for the richest.

Equation (8) can be further simplified as

$$C = \frac{2}{N\mu}\sum_{i=1}^{n} x_i R_i - 1 \tag{9}$$

Where: n = the sample size

x_i (i = 1,...n) = the malnutrition indicator of the *ith* under- five child;

μ = the mean level of malnutrition; and

Ri = represents the socioeconomic status rank of the *ith* under-five child.

It can also be written as (Jenkins 1988; Kakwani 1980; Lerman and Yitzhaki 1989):

$$C = \frac{2}{\mu}COV(h,r) \tag{10}$$

2.3.2 The Concentration Curve

The concentration curve plots the cumulative percentage of the health variable (y-axis) against the cumulative percentage of the population, ranked by living standards, beginning with the poorest, and ending with the richest (x-axis). According to Zere and McIntyre (2003), the concentration index (C) is determined from the curve of the concentration curve.

2.3.3 Concentration Curve and Index

To calculate the concentration index and curve we used the formula (Fuller and Lury 1977):

$$C = (p_1 S_2 - p_2 S_1) + (p_2 S_3 - p_3 S_2) + \ldots + (p_{T-1} S_T - p_T S_{T-1}) \tag{11}$$

Where: p_t = the cumulative percentage of the under-five children sample ranked by socio-economic status in group *t*; S_t = corresponding concentration curve ordinate

2.3.4 Standard Error

In many applications, the within-group variance is assumed to be unknown, and so for this analysis, we assume the same and the variance is set at zero. The standard error of the estimator of C was computed using the formula given in Kakwani, Wagstaff, and van Doorslaer (1997). We define f_t as the proportion of the sample in the *t*th group and the fractional rank of group *t* by

The variance of the estimator C is given by

$$VAR(\hat{C}) = \frac{1}{n}\left[\sum_{t=1}^{T} f_t a_t^2 - (1+C)^2\right] + \frac{1}{n\mu^2}\sum_{t=1}^{T} f_t \sigma_t^2 (2R_t - 1 - C)^2, \tag{12}$$

Given: *n* = the sample size, σ_t^2 = the variance of health variable in the *t*th group and, μ = it's mean. Therefore for

further statistical inference the standard error for C above was determined using the regression model below:

$$2\sigma_R^2 \left|\frac{x_i}{\mu}\right| = \beta_0 + \beta_1 R_i + \mu \tag{13}$$

Where: the variables still maintain the same definition as in Equation (12)

β_1 is equal to the C in Equation (7) above.

The general C was determined (i.e. for all children below 5 years in the sample), and C for certain immediate, underlying, and basic causes of malnutrition, including place of residence, zones, gender etc., and the spread of malnutrition across family wealth index quintiles is assessed for every socioeconomic sub-group.

2.3.5 The Z-Score

This is the anthropometric approach (WHO, 1986). Following the measurement stipulated by WHO (2006), Z-score, also known as Standard Deviation (SD) score is the measure of dispersion/relative deviance of the data from the mean/median value i.e. measure of the distance between the child's value and value of the reference population. This is also known as a normal distribution, sometimes called the bell curve.

The empirical rule tells you what percentage of your data falls within a certain number of standard deviations from the mean:

• 68% of the data falls within one standard deviation of the mean.

• 95% of the data falls within two standard deviations of the mean.

• 99.7% of the data falls within three standard deviations of the mean

After the analysis, this bell curve was used to present a graphical distribution of the results. The focus was on children that were below the -2 Z-score in the population sample.

Malnutrition is measured using the following key measurements, which were expressed in terms of Z-scores:

  i.   **Stunting**: height-for-age (HAZ) which is lower than the international standard value by more than two standard deviations;

 ii.   **Wasting**: weight-for-height (WHZ) lower than the international reference value by more than two standard deviations; and

iii.   **Underweight**: weight-for-age (WAZ) that is more than two standard deviations below the international reference value.

For the purpose of public health significance, health policy for a country, and policy implications for this study, it is important to know the prevalence ranges of malnutrition so as to assess the magnitude of a situation as the foundation for making health policies and public health decisions. These ranges could be low, medium, high, very high, acceptable, poor, serious, critical, and very high prevalence.

Estimation of the Z-score was done using the formula:

$$Z = \frac{X - \mu}{\sigma} \tag{14}$$

Where: Z = Z-score (HAZ, WHZ, WAZ)

   X = Measured Value

   μ = the mean or average value in the reference population

   σ = the standard deviation of the reference population (children under-five years in Nigeria)

Therefore in applying the Z-score to the measurement of malnutrition, the World Health Organization (WHO) gave the guideline in a form of reference table for the measurement of malnutrition using the Z-score as a value which is lower than the international standard value by more than two standard deviations.

2.3.6 Principal Component Analysis (PCA)

The socio-economic status was measured using the household wealth/asset index. The wealth index is a determinant of a family's aggregate living standard and was computed using the principal component analysis, which made use of the readily available information on a family's ownership (assets) of preferred resources like televisions and bicycles; materials used to construct a house; and types of water avenue and sanitation propensity.

Therefore the asset index for individual i is defined as:

$$A_i = \sum_k \left[f_k \frac{(a_{ik} - \bar{a}_k)}{s_k} \right] \tag{15}$$

Where:

a_{ik} = the value of asset k for household i

$\bar{a}_k$ = the sample mean

s_k = the sample standard deviation

The wealth index is therefore grouped quintiles (poorest, poorer, poor, rich, richer).

In summary, the three anthropometric measures of malnutrition: stunting, wasting and underweight were measured using the Z-score. The concentration index and curve were used to check for the inequality in malnutrition ascribable to the socio-economic status. On the other hand, wealth index was used for the socioeconomic status of the families, and this was done using the Principal Component Analysis (PCA).

2.4 Measurement and Definition of Variables

The Dependent Variable which is the nutritional status/Malnutrition was measured using the three anthropometric measures which are expressed in terms of Z-scores namely: Stunting: height-for-age (HAZ), Wasting: weight-for-height (WHZ) and Underweight: weight-for-age (WAZ). The independent variables included the Socio-economic status which is expressed as the wealth index. The socioeconomic disparities in malnutrition were checked according to gender, place of residence, and zones in Nigeria. Table 1 provides a summary of definitions and measurements of the variables used in the estimations

.

Table 1. Variable Definitions, Measurement and Expected Effects

Name of variable	Definition	Measurement	Expected effect
Nutritional status of Under-five	i. Stunting ii. wasting: iii. Underweight:	i. height-for-age ii. weight-for-height iii. weight-for-age	
Socio-economic status	This is the household assets index/ wealth index, which is used as the main gauge of socio-economic rank. This is constructed using the Principal Component Analysis.	Measured in quintiles, and categorized into: Poorest, Poorer, Average, Richer, Richest	
Socio-economic inequalities in malnutrition	The range of C if from -1 to +1	i. Negative value means malnutrition is concentrated among the poor. ii. Positive value means malnutrition is concentrated among the rich. iii. Zero value means both rich and poor suffer equally from malnutrition	Negative
Gender	Represents male or female	The male or female variable taking the value of 1 if malnourished, and 0 if otherwise.	Negative
Place of residence	Represents rural or urban	The Rural or urban variable taking the value of 1 if malnourished , and 0 if otherwise	Negative
Zones in Nigeria	Represents the six geo-political zones in Nigeria	Each zone taking the value of 1 if malnourished , and 0 if otherwise	Negative

Source: Author's Analysis.

2.5 Data Sources

Analysis of this study was done using data from the Living Standards Measurement Study (LSMS)/General Household Survey (GHS) 2015/2016 Nigeria data. The Nigerian General Household Survey (GHS) was implemented in collaboration with the World Bank Living Standards Measurement Study (LSMS) team as part of the Integrated Surveys on Agriculture (ISA) program and was revised in 2010 to include a panel component (GHS-Panel). The objectives of the GHS-Panel include the development of an innovative model for collecting agricultural data, inter-institutional collaboration, and comprehensive analysis of welfare indicators and socio-economic characteristics. The GHS-Panel is a nationally representative survey of 5,000 households, which are also representative of the geopolitical zones (at both the urban and rural level).

Data collection was done by groups comprising of two to four questioners, a person entering the data and a supervisor. Team number varied from state to state which was dependent on the size of the sample or the Enumeration areas chosen. It took between 20-30 days for the data collection by the teams for each of the post-planting and post-harvest visits. The data collection for the GHS-panel Wave three was done in two calls namely post=planting and post-harvest, while a tracking stage was conducted for those households that had moved from their previous locations after the preceding visit.

From the 36 states and the federal capital territory of Nigeria, sixty Enumeration Areas or primary sampling units were chosen, amounting to 2220 in total nationally, while using the multi-stage stratified sample design.

Every sampling unit had 10 families, thereby amounting to the sample size of 22,200 households. 5000 families were chosen from the 22,000 for the panel component, while 4916 families finished their interviews in the first wave. However, because some had relocated and were not reachable between the period of the first and the third wave visit, the sample size dropped slightly to 4581 families for wave 3being a panel survey by nature. Data on 4,561 children that were below five years of age (0-59 months) were derived from the household data. These were the figures used for analysis in this study.

3. Presentation of Results

3.1 Descriptive Statistics

After the construction of the PCA, the wealth group was organized into five quintiles, representing five socioeconomic groups in Nigeria namely; Poorest, Poorer, Average, Richer, Richest. The analysis showed that the poorest quintile was the largest group in Nigeria with 24.53 percent of the population. This was closely followed by the poorer quintile with 21.27 percent, while the poor which is like the average in the country were 19.73 percent of the population. The richer and richest households in Nigeria were on the other hand 16.78 percent and 16.68 percent respectively.

3.2 Malnutrition Z-Score Analysis

3.2.1 Analysis for Underweight, Stunting, and Wasting

The Z-score analysis found the percentage of children stunted (HAZ) to be the highest with 37.8 percent, while the percentage of children not stunted are 62.23 percent. This was followed by the number of children that were underweight (WAZ) with a percentage of 20.25 and 79.75 percent of the children not underweight. Wasting (WHZ) was the lowest category with 9.63 percent of children wasted and 90.37 percent of the children not wasted.

It was observed that the distribution on the bell curve is skewed more towards the left hand side of the mean, and a number of the under-five children fell below the -2 Z-score. This further confirmed the 37.8 percent of the stunted under-five children reported. The graph also showed the distribution of wasting in under-five children to be fairly normal, i.e. bell shaped, with majority of the children within the 95 percent bracket on the graph, and a few below the -2 Z-score. For the underweight, the bell curve showed the distribution of children below the age of five was skewed more towards the left side of the mean, and quite a number of the children fall below the -2 Z-score. This ascertained that the analysis of 20.25 percent of the under-five children were underweight.

Also going by the classification, we observed that the percentage of stunted children (37.77) percent fell in the category WHO interprets as high prevalence. In other words, Nigeria has a high prevalence of stunted children. Also, the percentage of children underweight (20.25 percent) fell under the classification of high prevalence, meaning also that there is a high incidence of underweight children in Nigeria. However, the 9.63 percent for wasted children fell on the borderline of poor and serious prevalence classification.

3.2.2 Analysis by Gender

The analysis showed that the percentage of stunting was considerably greater in male children compare to the

female children (39.88 vs. 35.59 percent; χ^2 = 6.1, p = 0.014). Also the rates of wasting were higher in male children compare to the female children with 10.37 vs. 8.87 percent (χ^2 = 3.7525; P = 0.053), and the same was the situation with underweight with males' rate higher than the females with 23.24 vs. 17.11 percent (χ^2= 17.5210, P = 0.000). Given the level of statistical significance, underweight was observed to be more statistically significant compare to wasting and stunting, which were significant at five and one percent levels.

3.2.3 Analysis of Malnutrition by Socio-Economic Quintiles

Further analysis of the three states of child malnutrition was done using the wealth quintiles the results revealed that stunting and underweight were responsive to the household socioeconomic status. The higher the wealth or the richer the household gets, the less stunted and underweight the children. However, wasting did not appear to be so sensitive to changes in the socioeconomic status. Majority of the children that were stunted and underweight fell within the first three poor wealth quintiles, while few fall among the last two wealth quintiles which were for the rich.

3.2.4 Analysis of Malnutrition by Place of Residence

Analysis of the three states of malnutrition by the areas or residence of the children showed that a higher percentage of children below five years of age who were stunted, wasted and underweight (40.41, 10.23, and 21.91 respectively) lived in the rural areas of Nigeria compare to the children living in the urban areas of the country (32.41, 8.45, 16.81 respectively).

The analysis of the three categories of malnutrition across the six geopolitical zones found in Nigeria showed that the rate of stunting was highest in the North West with a 52.91 percent, followed by North East with 43 percent, and lowest in the South South with 20.67 percent. The results also showed that North West had the highest number of children with wasting with a percentage of 11.99, followed by North East with a rate of 9.19 percent, and the lowest number of children with wasting were found in the North Central with 7.09 percent, South South 7.7 percent and South East 7.88 percent. Wasting however, did not show substantial socioeconomic differentials among the zones. Similarly, North West zone also had the highest percentage of underweight children with a rate of 28.8 percent, also closely followed by North East with a rate of 23.3 percent. Meanwhile the zones with the lowest rates were again the South South and the North Central with the rates of 10.7 and 11.2 percent respectively.

It is interesting to know that the rate of the three types of child malnutrition had a wide spread of geographical variations, with the highest found mostly in the North West and North East zones and sadly these are also the two zones with the highest poverty rates in the country, based on the poverty indicator of the country.

The general concentration results for stunting, wasting and underweight were -0.1217, -0.0938 and -0.1310 respectively. The three categories of child malnutrition indicated statistically significant inequalities which were pro-rich. This means that a greater burden of malnutrition was being bored by those children in the lowest socio-economic status. However, for wasting, this socioeconomic gradient was not witnessed, as it was not so responsive to changes in socioeconomic status.

3.2.5 Analysis of Malnutrition on Concentration Indices

The concentration indices analysis was done on stunting, wasting and underweight, and they all have negative signs signifying that stunting, wasting and underweight were concentrated among the poor household children. The standard errors for the three measures of malnutrition were small, indicating that their sample means were more accurate reflections of the actual population mean. The result also indicated that stunting, wasting and underweight were significant at one percent level.

This result from the indices were plotted and it was seen that the income-associated and socioeconomic-associated inequalities were the sturdiest in stunting because the stunting concentration curves were far from the equality line, which is an indication of long-lasting undernourishment that is often related with socioeconomic deprivation.

Furthermore it was observed that socioeconomic-related inequalities were strong in underweight, which is also an indication of long-lasting undernourishment that is often related with socioeconomic deprivation figure. However, as anticipated, no palpable socioeconomic inequalities were observed in wasting because the concentration curve almost overlapped with the equality line. This is because income has little effect on conditions that usually precipitate wasting, such as diseases and unexpected environmental factor.

3.2.6 Concentration Index Analysis by Geopolitical Zones

The results from the analysis showed that stunting has equal division among the zones, with half of the zones having stunting concentrated among the poor and half having stunting concentrated among the rich (which is against apriori knowledge). The pro-rich concentration indices were significant at 5 and 1 percent level of

significance, while South West zone was not significant, which showed that it did not exhibit income-related inequalities. The remaining three zones (South East, North East and North West) were concentrated among the rich. However, the pro-poor concentration indices were statistically not significant; in other words, they do not exhibit income-related inequalities.

Wasting was concentrated among the rich in the North Central, South East and South West zones; however, their concentration indices were also not statistically significant. While wasting was concentrated among the poor in the South South, North West, and North East with their concentration indices not statistically significant, except for the North West zone, which was significant at one percent level of significance, implying that the inequality was income-related.

Similarly, findings also revealed that underweight had an abnormally high concentration among the underprivileged in all zones; however, the pro-rich concentration indices were not statistically significant except for the South South zone which was significant at 10 percent level. This implies that the underweight concentration indices do not exhibit income-related inequalities.

3.2.7 Concentration Index Analysis by Place of Residence

Income-associated inequalities in stunting and underweight increased monotonically with the surge in the degree of urbanization of the family's area of dwelling. In other words, the rate of malnourished children was lower in the urban areas compare to the children living in the rural areas of the country. Wasting was also observed to have a higher concentration among rural area children compare with the urban area children, although the difference between the urban and rural was not as much as the ones observed in stunting and underweight. Between the two areas of residence –i.e. the rural and urban, the poorest bore the weightiest burden of stunting, wasting and underweight. For all population groups and places of residence, wasting did not show any gradients linked to socio-economic status. This was further clarified on the concentration curves.

4. Discussion of Results

This research examined the socio-economic disparities in health with distinctive reference to under-five child malnutrition. Child malnutrition is a challenge in Nigeria as it is in other countries especially in the developing countries. We observed that the percentage of stunted children derived from the study i.e. 37.77 percent fell in the category WHO interprets as high prevalence. In other words, Nigeria has a high prevalence of stunted children. This suggests that there should be targeted health policies to help reduce this high prevalence. The results is consistent with the study done by Uthman (2009), which observed that there was a high dominance of stunted children in Nigeria, and also observed that as one moves up the northern part of Nigeria, there is a remarkable increase in the proportion of stunted children. This was similar to the result observed in this study with the North West and North East zones having the highest rate of stunted children. Also, the percentage of children underweight (20.25 percent) fell in the classification of high prevalence. In other words, the occurrence of underweight children in Nigeria is high. This equally calls for targeted policies by the government and other relevant organizations to reduce this high prevalence of underweight in children. However, the 9.63 percent for wasted children fell on the borderline of poor and serious prevalence classification. This equally calls for attention by the policy makers, especially since wasting is known as the global acute malnutrition.

The result of the rate of stunting, wasting and underweight between the male and female under-five children is consistent with the result from Zere (2003), where the rate of underweight, stunting and wasting were found to be greater in the male children compare to the female children. This follows the trend that can be found in many African and developing countries, where stunting, underweight and wasting are still a challenge and especially a challenge with stunting being very slow on the decline.

For children being stunted and underweight, the socioeconomic status of a household is perceived to have a greatly substantial influence on the probability of the children. The inverse correlation that is seen between families' socioeconomic status and stunting has been well proven in the literature (Zere, 2003).

Taking a leave from other studies (Zere & McIntyre, 2003; Mosley & Chen, 1984), relying on global averages alone can conceal information and could be misleading when used to formulate policies. Therefore, breaking it down into various gauges by socio-economic status is very important for producing valued evidence for strategy decisions. When the different categories of under-five malnutrition is broken down by various indicators such as geographic, demographic and socio-economic status; asides from wasting, the rate of disparity in Under-five malnutrition is very much pronounced.

Disparities in the areas of residence is to some extent attributable to rural-urban differential in income disparities between places of residence, with greater rates of underweight and stunting in the rural than in the urban. The

concentration indices for underweight, stunting and wasting show that they are concentrated among the poor in both rural and urban areas of residence, even though the pro-rich indices were highest among the rural dwellers. However, it should be noted that while stunting and underweight were higher with the poor in the rural areas, the same goes for the poor in the urban areas. Therefore, there is a need for targeting policies and other ways of combating utter poverty in the urban areas, and not just focus on the rural areas alone. This finding is consistent with other research works (Menon, Ruel, & Morris, 2000; Bradley, Stephens, Harpham, & Cairncross, 1992; Haddad, Ruel, & Garrett, 1999; Basta, 1977; Zere, 2003) which found the existence of substantial concentration of ill-health amongst the metropolitan underprivileged. They found that even though "the urban population experience more variations in nutritional status, poverty, morbidity and mortality compared to rural populations, using global averages to characterize poverty and child malnutrition in urban areas may be misleading, because city averages do not capture the large heterogeneity found between social classes in urban areas". This is true for a country like Nigeria which has a high level of socioeconomic disparities.

Systematic disparities in long-established under-five undernourishment have extensive costs. Researches have shown that malnourishment contributes to a substantial decrease in lifetime earnings (Behrman & Hoddinott, 2001). Therefore, this is likely to prolong the now great levels of income disparity in the nation.

In addition, long-standing malnourishment, particularly during the pre-school age is likely to end in irremediable harms to the child's cerebral growth. Therefore, attention on this age set is vital, as it has a significant pay-off in the future.

5. Conclusion

As one moves up the ladder of the socioeconomic status, a significant fall in the rate of stunting is witnessed. This implies that improvement in household's socioeconomic status will likely bring about a reduction in the probability of stunting of children. This has been highlighted by several studies that indicated that increasing the income of the poorest in a society is a sound strategy to curb the high rates of stunting in the socio-economically deprived segments of the population (Sahu et al., 2015; World Bank, 1981). Therefore, to curb disparities in stunting and underweight among regions in a country, which are likely to continue the cycle of disparities in socioeconomic status in the future, the execution of income-creating ventures and direct transfers of earnings to the underprivileged are crucial actions that must be aggressively followed by a government or policy maker. Malnourishment, particularly stunting, has a more socio-economic measurement, and hence, should be perceived in a wider context and not merely in a narrow biomedical sense.

In summary, the study found significant disparities in under-five undernourishment (underweight and stunting) which favors the rich in the society which is unnecessary, unjust and avoidable. Just like other studies have pointed out, reliance on global averages alone can be misleading (Zere & McIntyre, 2003; Mosley & Chen, 1984), but when indicators are broken down, and analysis are conducted on specific and smaller indicators, the results are more reliable for policy formation and targets. Addressing malnutrition in under-five especially stunting, which is found to be somewhat responsive to improvement in socioeconomic status of households requires urgent attention from the policy makers or government to formulate policies that would help in improving the socioeconomic status of household, which in turn would help the reduction of malnutrition, therefore an initiative that surpasses the medical arena is needed. Finally, good nutrition is crucial to a child's survival, health and development, adversely will affect a child's survival negatively (Thomas, Strauss, & Henriques, 1990; Pelletier et al., 1995), which may also unfavorably affect well-being status and efficiency in later adult life (Thomas, Strauss, & Henriques, 1990). Therefore well-nourished children make better adults, who in turn make a strong and better nation.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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The Association of Household Garbage Management and Socioeconomic with Underweight in Children Under Five in Lebak District and Tangerang City, Banten, Indonesia

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Abstract

Underweight in infants and under-five children may cause growth and developmental disorders and it remains one of the major factors causing child mortality, illness and disability. Underweight is still one of the nutritional problems in Indonesia and the government is undertaking all efforts and drawing up effective strategies to reduce the prevalence of underweight in Indonesia. The purpose of this study was to see what factors were associated with underweight in under-five-year-old children in Lebak Regency and Tangerang City, Banten Province. The study applied the logistic regression method using the 2013 Basic Health Research. Underweight in children was calculated by converting the anthropometric measurements into a standardized value (Z-score), which was then presented in the index of body weight for age. The results obtained among 492 infants revealed there were 28.5% (about 75 children under five) with underweight status. Children from families who did not apply good sanitation by disposing of garbage in an unsanitary manner had a risk of 15.2 folds (OR = 15.2, 95% CI = 4.69-49.65) to be underweight compared with those who had good sanitation behaviors. Children under five from families with a low socioeconomic status had a risk of 2.5 folds (OR = 2.5, 95% CI = 1.12-5.53) to suffer from underweight compared to those who had a high socioeconomic status. The conclusion is sanitation and socioeconomic status are related to the underweight status of children under five in Lebak Regency and Tangerang City.

Keywords: children under five, garbage management, socioeconomic status, underweight

1. Introduction

Nutrition plays an important role throughout the human life cycle and is critical for both health and economic development. Today, the world faces a double burden of nutrition. In the same country, at the same time, people face the problems of malnutrition. Malnutrition refers to imbalances in a person's intake of energy or nutrients. It includes undernutrition (wasting, stunting, underweight), inadequate vitamins or minerals, overweight, obesity, and diet-related noncommunicable diseases. In fact, 1.9 billion adults are overweight or obese, while at the same time 462 million are underweight, plus 52 million children under five suffer from wasting (WHO, 2019). Around 45% of deaths among children under 5 years of age are linked to undernutrition (WHO, 2020). Underweight children are those with a low weight-for-age, who may be stunted, wasted, or both. It usually indicates recent and chronic or recurrent undernutrition. Underweight may also be associated with infectious diseases, poor socioeconomic conditions, poor maternal health and nutrition, and/or inappropriate infant and young child feeding and care in early life (Titaley, 2019). Those may increase the risk of death and hold children back from reaching their physical and cognitive potential (Prendergast, 2014; Woldehanna, 2017). This causes underweight as an important indicator that can be used as an initial measure of malnutrition in children.

Based on the results of the 2017 Indonesia Demographic and Health Survey (IDHS), conducted by the National Population and Family Planning Board (NPFPB) and the Central Bureau of Statistics (CBS), Indonesia's overall under-five mortality rate (UMR) remains high, at an estimated 32 deaths per 1000 live births (CBS, 2018). It is far

from the Sustainable Development Goals (SDGs) target of 25 deaths per 1000 live births (INFID, 2017) and would require extensive efforts from the Government of Indonesia (GOI). The Global Nutrition Report (GNR) 2020 reported that Indonesia is one of the 50 countries that have been on track for 1 target of 4 global nutrition targets (Mannar, 2020). Based on the results of the Basic Health Research (Riskesdas) undertaken by the National Institute of Health Research and Development (NIHRD) – Ministry of Health (MOH), the nutritional status of children has shown improvement. In the case of underweight, the improvement of nutrition is reflected in the reduction of underweight in under-fives from 19.6% in 2013 to 17.68% in 2018 (NIHRD, 2013; NIHRD, 2018). Indonesia's national midterm development plan has emphasized the importance of improving the quality of children and improving the quality of the environment in which the two are interconnected (BAPPENAS, 2019). In addition, the main priority of nutrition improvement efforts is the vulnerable group which is infants and children under five (RI, 2009). To improve health and nutrition in children under five, the GOI has implemented several activities, including the Supplementary Feeding for under-fives and Community-Based Total Sanitation activities (MOH, 2019).

A few studies have been conducted to evaluate the association of underweight in children under five and the influencing factors (Putri et al., 2015; Rapar et al., 2014; Nigatu et al., 2018; Tosheno et al., 2017; Adhikari et al., 2017). A quantitative study that examined factors associated with underweight among children under five in Padang found that mother's level of education and working status, as well as the socioeconomic level were significantly related to child underweight (Putri et al., 2015). Other evidence in Manado, North Sulawesi found that maternal parenting was associated with nutritional status of children under five (Rapar et al., 2014). Advanced maternal age (> 35 years), no antenatal care during pregnancy, rural residence (Nigatu et al., 2018), and maternal decision-making power (Tosheno et al., 2017) were found to be significant predictors of underweight children. In addition, there was an association of environmental sanitation and hygiene with underweight in children under five. Research in Nepal found that boiled water drinking practices and growth monitoring were significantly associated with childhood underweight (Adhikari et al., 2017) although the result is still weak.

Given the evidence gap surrounding the effect of sanitation and hygiene behaviour and nutritional status in children under five, this study aimed to see the relationship between underweight and parent's behavior related to sanitation and their socio-economic characteristics using the 2013 Riskesdas. The prevalence of underweight in children under five in Banten Province was 17.2%, almost the same as the national prevalence in 2013 (19.6%) (NIHRD, 2013). This shows that the problem of underweight in Banten Province is still a public health problem that needs attention. If seen further, the prevalence of underweight in Lebak Regency reaches 20.8%, which is higher than that of the national average. Meanwhile, the lowest prevalence of underweight in Banten Province is in Tangerang City (10.9%). Therefore, in this study, the two regions were selected to describe a comparison between those regions with the lowest and highest prevalence rates in Banten Province.

2. Method

2.1 Data Sources

This study used the data from the 2013 Basic Health Research (Riskesdas), which was carried out simultaneously in 33 provinces throughout Indonesia by the National Institute of Health Research and Development, the Indonesian Ministry of Health.

Riskesdas is a community-based survey conducted by the Ministry of Health to all regions in Indonesia. The purpose of conducting Riskesdas is as a tool to assess the achievement of health development outcomes every five years. Implementation every five years is considered as an actual interval to assess the development of public health status, risk factors and the progress of health development efforts. Data collection methods were undertaken through interviews, measurements, and examinations. Data collection was carried out by local enumerators with technical supervision by the researchers from the National Institute of Health Research and Development, the Ministry of Health, the Republic of Indonesia. In collecting data, 1 team was responsible for 11 to 12 census blocks. The Census Block is an area consisting of 10 households. This means that 1 enumerator team was responsible for 110 to 120 households. A list of census blocks and sample households were obtained from the Central Bureau of Statistics (CBS).

2.2 Data Collection Tools and Methods

Data collection began when the enumerator teams had received a copy of the census block list and sample households from CBS. Then, the teams identified the sample locations. Based on the identification, the enumerator teams had an overview of the sample locations so that a data collection schedule plan could be arranged, and the data collection strategies would be carried out to be efficient and effective.

The interviews used 2 instruments, namely: Household and Individual Questionnaires. The respondents for the Household Questionnaire were heads of families or housewives or household members who could provide information.

The respondents for the Individual Questionnaire comprised of every household member in various age groups. Specifically, for the household members who were less than 15 years old, and in sick condition, interviews were conducted with household members who are their companions.

The anthropometric measurements were carried out using several tools. The height data were measured with a multifunctional height measuring instrument with a measurement capacity of two meters and an accuracy of 0.1 cm. The weight data were measured by a digital scale "Fesco" brand weight, which was calibrated every day. The measurement of abdominal circumference and upper arm circumference used one tool with the brand "Medline". All anthropometric measurements were carried out using measurement guidelines. For blood pressure measurement, a digital "Omron" type IA1 was used, which was required to have its batteries replaced every time one census block had finished. This measurement was performed using the tension measurement guidelines.

Data processing started from editing the questionnaire and coding at the locations of the study conducted by the enumerators. After the questionnaires had been edited and coded correctly, the data were entered into a specified application. After the data were entered, the data were sent via email to the data management team of the National Institute of Health Research and Development for data integration and cleaning. Data cleaning paid attention to inconsistent data and outliers. Inconsistent data and outliers were traced back to the questionnaire to check the truth. The data that had been consistent and free from outliers were then given a weighting value by the Central Bureau of Statistics.

Only data that are clean and weighted by CBS that can be used for analysis. Analysis can use data modification, which is to composite several variables to answer the aim of the study. Variable composites are used for indicators of economic status by 5 quintiles. Indicators are measured through an index that is calculated using Principal Component Analysis (PCA), which is one statistical technique that unites several variables into a single indicator. The PCA method is used to simplify many variables into one by making scores of these variables. The variable scores are formed based on the strength of the correlation between variables.

The Central Bureau of Statistics chose the census block for Riskesdas 2013 based on the 2010 Population Census's frame sampling. The following 12,000 census block lists with 300,000 Census Building lists were completed with the names of the heads of households. The names of the household heads were updated by the enumerators before carrying out the survey. Renewal was intended to update the names of the heads of the households if there was a change, for example whether a household head had moved, died and others.

2.3 Population and Sample

The total population in Riskesdas 2013 is all households representing 33 provinces. The sample of households in Riskesdas 2013 was selected based on the 2010 Population Census listing. The household selection process is determined by the Central Bureau of Statistics, which provides a list of selected census buildings originating from the selected census block. Especially for this study, samples are all children under five in Banten Province from Riskesdas data. The unit of analysis of this study is children under five.

2.4 Variable Measures

The topic of environmental health in the 2013 Riskesdas aimed to evaluate existing programs, follow up on improvement efforts, and identify environmental risk factors for various types of diseases and health problems. With the environmental health data obtained, it is expected to be used as a basis for policies in an effort to control environmental based diseases.

Environmental health data include drinking water, sanitation (including latrine use and waste management), and housing health. Housing health data include the type of building material, the location of the house and the condition of the house space, the density of the house, the type of fuel for cooking, and the use or storage of pesticides / insecticides and chemical fertilizers in the house. In addition, data on household behavior in draining the bathtub is related to the risk of spreading vector-borne disease (dengue and malaria). Since the unit of analysis is the household, data collection was done by interviews using a household questionnaire and direct observation in the field.

Whereas the specific scope of water includes types of water sources for household and drinking purposes, average water usage per person per day, distance of drinking water sources to feces storage, distance and travel time to drinking water sources, household members who take drinking water, physical quality of drinking water, and

management (processing and storage) of drinking water. For access to drinking water, the survey referring to the 2006 WHO - Unicef JMP criteria. According to these criteria, households having access to improved drinking water sources are households with drinking water sources from tap water, bore wells / pumps, protected dug wells, springs protected, rainwater and bottled water (ONLY IF the source of water for other household uses is improved).

The scope of sanitation includes the use of defecation facilities, the type of place of defecation, the place of final disposal of feces, the type of waste water collection place, the type of garbage collection place, and the method of waste management. For access to defecation facilities, the 2006 WHO - Unicef JMP criteria were used. According to these criteria, households that have access to improved sanitation facilities are households that use their own open defecation facility, goose neck type for "jamban" or toilet, and landfill septic tank type for feces disposal.

Residential data collected are data on building ownership status, occupancy density, types of building material (ceiling, wall, floor), location of house, condition of house space (cleanliness, presence of windows, ventilation, and natural lighting), use of fuel for cooking, household behavior in draining the bathtub, and storing dangerous and toxic materials such as pesticides or insecticides and chemical fertilizers in the house.

Types of fuel use in households according to the Decree of the Minister of Health of the Republic of Indonesia, the types of fuel are grouped into two, which are "safe" meaning it does not have the potential to cause pollution (electricity and gas / LPG) and "unsafe" meaning it has the potential to cause pollution (kerosene, charcoal and firewood).

The dependent variable analyzed was underweight indicators (Index of Weight for Age). While the independent variables analyzed were age and sex of children under five, education and work status of father and mother, family socioeconomic status, the immunization status of children under five, presence of health facility, and environmental health aspects such as access to clean water and handling of family waste.

To assess the nutritional status of children under five, the body weight and age (in month) of each child under five was converted into a standardized value (Z-score) using the anthropometric standard WHO 2005. Furthermore, based on the Z-score the following restrictions were determined:

Classification of nutritional status based on Weight for Age index:

Severe Underweight: Z-score <-3.0

Underweight: Z-score ≥ -3.0 to Z-score <-2.0

Good Nutrition: Z-score ≥ -2.0

Regarding literature, the independent variables having associations with underweight are sex of children under five, age in month, education and work status of father and mother, family socioeconomic status, the immunization status of children under five, presence of health facility, and environmental health aspects such as access to clean water and handling of family waste.

Age variables were divided between two categories which were below 24 months and above 24 months. While education level of parents was divided into two categories as well, below junior high school and above senior high school. Thus, working status of parents was also categorized as working and not working. Meanwhile, children's immunization status was classified into completed and not completed. And, the presence of health facility was characterized as present and none. Then, access to clean water was considered easy when it was inside the house or affordable fast and difficult when it was outside the house or far away. While waste management was labelled as poor when it was dumped into the river or littered garbage, and good as it was handling by officers or made to composting.

2.5 Statistical Analysis

The data were coded and analyzed using SPSS version 15 package. This study adopted two ways of analyzing the data. Initially, the proportion of underweight, socio-demographic characteristics, immunization, availability of health care facilities, drinking water access and household waste management were evaluated. Missing data is not estimated. These factors were assessed using Pearson's chi-square test in bivariate analysis. Any potential confounders and explanatory variables that were significant at the 0.25 level based on the Wald test were retained and entered into the multivariate logistic regression model in the second step. In this step, the Enter method is used. Results from the regression analysis are presented as Exp(B) with 95% confidence intervals (CI) respectively. Sample weights were used to adjust for differences in the probability of selection between students (Kleinbaum, 1988).

3. Results

From the total samples of children in Banten Province out of 518 children under five, 6 children had to be eliminated because of incomplete data characteristics of children (age and anthropometric data), so the total samples were 512 children. Of these, 255 children were from Lebak District and 257 children were from Tangerang City. Besides, at the time of analysis, the authors excluded children who were overweight, so the total samples analyzed were 492 children under five, which includes normal weight.

As may be seen in Table 1 below there are 28.5% of children under five in Lebak Regency who are underweight, while in Tangerang City all children under five have a good nutritional status.

Table 1. Distribution of underweight and the social demographic characteristics of children under five in Lebak and Tangerang

No.	Variable	Children under five (N=492)					
		Underweight		Normal		Total	
		N	%	N	%	N	%
1	**Regency/city**						
	Lebak	75	28.5	188	71.5	263	100.0
	Tangerang	0	0.0	229	100.0	229	100.0
2	**Sex of children**						
	Boys	34	12.5	237	87.5	271	100.0
	Girls	40	18.2	180	81.8	220	100.0
3	**Age of children**						
	0-11 months	19	21.6	69	78.4	88	100.0
	12-23 months	12	12.5	84	87.5	96	100.0
	24-35 months	16	17.4	76	82.6	92	100.0
	36-47 months	13	12.9	88	87.1	101	100.0
	48-59 months	15	13.0	100	87.0	115	100.0

From Table 1, the percentage of underweight in infants (aged below 12 months) is 21.6%. This condition causes infants to become susceptible to infectious diseases and thus should obtain more attention. Based on the gender characteristics of children under five, it may be seen that there are more females with less nutritional status than males.

Table 2. The relationship between health services, environmental factors and socio-economic status with underweight in children under five in Lebak and Tangerang

No.	Variable	Children under five				P value
		Underweight		Normal		
		N	%	N	%	
1.	Completed immunization					
	Not completed / never	58	14.2	350	85.8	0.162
	Completed	17	20.2	67	79.8	
2.	The existence of health facilities					
	None	0	0	2	100	0.548
	Present	75	15.3	415	84.7	
3.	Easy access to water					
	Difficult	35	16.7	174	83.3	0.426
	Easy	40	14.1	243	85.9	

4.	Garbage management						
	Poor (dumped in river, etc)		72	25.7	208	74.3	0.000
	Good (handling by officers, made compost)		3	1.4	209	98.6	
5.	Father's education						
	Low (=Junior high school)		60	19.9	241	80.1	0.000
	High (=Senior high school)		15	7.9	176	92.1	
6.	Mother's education						
	Low (=Junior high school)		60	18.8	259	81.2	0.003
	High (=Senior high school)		15	8.7	158	91.3	
7.	Father's job						
	Not worked		5	29.5	12	70.6	0.198
	Work		64	17.2	308	82.8	
8.	Mother's job						
	Not worked		10	10.4	86	89.6	0.094
	Work		61	17.5	288	82.5	
9.	Economic status						
	Poor (Q1-Q2)		43	38.7	68	61.3	0.000
	Rich (Q3-Q5)		31	8.2	349	91.8	

From Table 2 it is known that children under five who had immunization would have a good nutritional status, compared with those who did not obtain immunization. Families who had access to clean water would have a good nutritional status than those who did not.

Table 2 shows parents who had a low education level had a statistically significant relationship with underweight in children under five. Likewise, in the group of father who did not work, then the proportion of underweight children would be higher compared to working father group. Household in quintile 1-3 which sometimes may be assumed as poor household, has related to higher proportion of underweight children.

Table 3. Multivariable determinant factors associated with underweight in children under five

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Completed immunization	-.265	.389	.464	1	.496	.767	.358	1.645
0. Not completed/ never								
1. Completed								
Garbage management	2.726	.602	20.517	1	.000	15.267	4.694	49.656
0. Bad								
1. Good								
Father's education	.876	.549	2.548	1	.110	2.401	.819	7.037
0. Low								
1. High								
Mother's education	-.717	.581	1.525	1	.217	.488	.156	1.524
0. Low								
1. High								
Father's job	1.019	.707	2.078	1	.149	2.771	.693	11.076
0. Jobless								
1. Had a job								

Mother's job	.089	.446	.040	1	.842	1.093	.456	2.618
0. Jobless								
1. Had a job								
Economic level	.912	.407	5.024	1	.025	2.491	1.121	5.531
0. Q1-3 (poor)								
1. Q4-5 (Rich)								
Constant	-.447	.812	.303	1	.582	.639		

From Table 3, there is a significant relationship between environmental health and socioeconomic status with the nutritional status of children.

Table 3 shows children who live in households that are good in handling household waste are up to 15 times more likely to have a normal weight compared to children who live in households with poor waste management (OR=15.267; 95%CI= 4.69-49.66). Likewise, under-fives from families with middle to upper socioeconomic levels have a 2.49 times chance of not being underweight compared to children with low socioeconomic status (OR=2.49; 95%CI=1.12-5.53).

4. Discussion

Those analyses show there is a relationship between environmental factors and the nutritional status of children, in this case, the behavior of disposing garbage with underweight in children under five. Unsanitary behavior such as disposing garbage into the river will increase the risk factors of vector-borne diseases such as diarrhea, cholera, or typhoid. Theoretically, this can be explained that re-current episodes of diarrhea and the likelihood of tropical or environmental enteropathy (where fecal contamination causes changes in the intestine that affect permeability and absorption) may inhibit the absorption of nutrients resulting in malnutrition. Improving water, sanitation, and hygiene, as well as housing and access to health services, will promote a healthy environment, will reduce the prevalence of infectious diseases and may affect the decreasing prevalence of malnutrition (UNICEF, 2015). The same results of the relationship between environmental factors and nutritional status of children under five were also found in the study of Manzomi et al and Kwami et al in 2019. Manzomi in Cambodia found that the composite of several factors of water, sanitation and hygiene (WASH) had a relationship with the prevalence of wasting and stunting. Types of water source and types of toilet are examples of environmental factors associated with the prevalence of malnutrition. While Kwami in Ethiopia examined the relationship between WASH and stunting, they found environmental factors, such as the behavior of the caregiver's handwashing and drinking water facilities had a close relationship with stunting (Manzoni et al., 2019; Kwani et al., 2019).

Underweight cases in children under five in Banten Province are quite similar to the study in Indonesia which was undertaken by Setyawati et al (2015). They reported a quite similar analysis result where garbage management has related to underweight. Setyawati has catagorized garbage management as good if garbage is collected and carried by officers or buried in the ground to be made into compost, as well as the analysis in Banten (Setyawati et al., 2015). One thing that should be noted is that Setyawati et. al. analyzed the 2013 Riskesdas data throughout Indonesia with the multi-level analysis method, while the analysis in this article only discusses Banten Province with logistic regression analysis method.

In addition to the environment, the results of this study also show the relationship between socioeconomic factors and underweight status in children under five. The lower the socioeconomic status is, the worse the children's nutritional status will be. This is closely related to the ability and purchasing power of the family. This is in line with the results reported by Santi et al (2012) in South Bengkulu that the higher the family income level is, the better the children's nutritional status will be (Santi et al., 2012). Several studies in other parts of Indonesia and abroad showed similar results of the relationship between poverty and malnutrition (Saputra et al., 2012; Suarni et al., 2016; Indarti, 2016; Chirwa et al., 2008; Busse et al., 2018; Abera et al., 2019). For example, studies in Malawi and Ethiopia report something similar to our results that children who come from economically capable households, in this case those having jobs or earning a living, tend to be more nutritious (Chirwa et al., 2008; Busse et al., 2018).

The relationship between economic status and nutritional status of children under five was also found in a study conducted by Titaley et al. In their publications, they describe the close relationship between the household wealth index and stunting. The wealth index is a composite of several variables of ownership or assets in the household, which is generally used to assess food security (Titaley, 2019).

Titaley et al also found a relationship between newborn weight and the nutritional status of children under five. The risk of stunting increases if children experienced low birth weight (LBW) at birth (<2500 grams). These findings are in line with several other studies in Indonesia (Rahayu et al., 2015; Dewi & Widari, 2018). Meanwhile, a study in Central Sulawesi reported that there was a significant relationship between LBW and the management of burned waste. Babies born in households that have a habit of burning garbage are born with LBW (<2500 grams) (Hidayangsih et al., 2014). This finding is also supported by a study in Ghana-Africa which indicated that babies born to mothers who reported burning waste in their homes during pregnancy had an increased risk of low birth weight (Amegah et al., 2012). This can be explained because garbage burning relates to dioxins, carbon monoxide (CO) and some particulates (PM) into the air. If humans inhale these harmful substances it would impair fetal growth. CO blends with hemoglobin to penetrate the placenta and reducing oxygen supply which limits the ability of the placenta to transfer nutrients to the fetus. PM decreases the lung function of the baby's mother and consequently reduces oxygen delivery to the fetus and causes cell damage. Fetal growth disorders may lead to an increased risk of LBW (Washam, 2018; Mishra, 2004; Smith et al., 2003). This finding requires further research to explain the relationship between waste management, the risk of LBW and then the nutritional status of children under five at the end.

5. Conclusion

Sanitation associated with waste management has a significant relationship with the prevalence of malnutrition in children under five. Unhealthy waste disposal, in this case incinerated, has the risk of causing malnutrition. In addition, the results of this study also found that socioeconomic status was associated with under-nutrition status in children under five. Poor families are at higher risk of experiencing poor nutritional status.

Parents must maintain a healthy home environment by managing their domestic waste disposal properly. Education on the importance of maintaining environmental sanitation and hygiene remains necessary.

The low socioeconomic level of the family may lead to reduce nutritional intake which in turn affects the nutritional status of children under five. Multi-sector collaboration and interdisciplinary interventions between nutrition and health, environment and economic sectors are recommended to address the problem of under-five nutrition in poor families.

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Prevalence and Determinants of Unintended Pregnancy among Women Receiving Antenatal Care Services: A Facility-Based Cross-Sectional Study in Ghana

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Abstract

Globally, unintended pregnancy represents an important public health challenge with significant social, economic and clinical repercussions which are worse in low-income and middle-income countries. Appropriate use of modern contraceptives averts significant proportions of unintended pregnancies and pregnancy complications. The objective of this study was to determine the prevalence and determinants of unintended pregnancy and explore modern contraceptive use among pregnant women

A cross-sectional study was conducted among pregnant women receiving antenatal care at Korle-Bu Teaching hospital in Ghana using a face-to-face structured interview. Descriptive analysis was performed and multivariable logistic regression was used to assess the determinants of unintended pregnancy.

Among the included 450 pregnant women receiving antenatal care, 155 (34.4%) had unintended pregnancy out of which 33 (21.3%) were using contraceptives prior to conception. In all, 14.2% (64/450) were using modern contraceptives. There was a significant difference between women and their partners regarding the perception of their index pregnancy as unintended (34.4% versus 31.6%, p-value <0.001). Significant determinants of unintended pregnancy include younger maternal age [aOR:5.706, 95%CI (1.860, 19.732)], unmarried status [aOR:5.238, 95%CI (2.882, 9.735)], previous childbirth [(aOR:2.376, 95%CI (1.460, 4.758], number of pregnancies ≥6 [aOR:2.640, 95%CI (1.210, 5.854)], number pregnancies ≤2 [aOR:0.417, 95%CI (0.252, 0.682)], previous caesarean birth [aOR:2.034, 95%CI (1.154, 3.306)] and contraceptive use prior to index pregnancy [aOR:2.305 95%CI (1.283-4.162)].

The prevalence of unintended pregnancy remains markedly high while prior contraceptive use was relatively low among women receiving antenatal care. Evidence-based interventions including specialized client education are vital in improving optimal use of contraceptive services. We recommend further research including community-based qualitative studies to better understand the factors associated with contraceptive uptake and outcomes of unintended pregnancy.

Keywords: unintended pregnancy, modern contraceptives, determinants, prevalence, Ghana

1. Introduction

Pregnancy that occurs sooner than expected (mistimed) and or when the woman has no desire to have more children at the time of conception (unwanted) are collectively referred to as unintended pregnancy (Santelli et al., 2003). Varying across countries, unintended pregnancy remains a subject of global concern because it is a major public health challenge with significant social, economic and clinical consequences. Global data analysis between 2010 and 2014 shows that 44% of pregnancies were unintended worldwide with greater proportion resulting in abortion (Bearak, Popinchalk, Alkema, & Sedgh, 2018). The magnitude of unintended pregnancy burden in low and middle-income countries (LMICs) is comparatively far higher compared to the high-income countries (Sedgh et al., 2014). In Ghana, the proportion of unintended birth declined marginally from 42% to 31% between the period of 1993 to 2014 (GHS and Ghana Statistical Service (GSS), 2015). The burden of unintended pregnancy remains unacceptably high considering the potential adverse effects and the associated economic ramifications

(Ghana Statistical Service (GSS), 2012).

Women with unintended pregnancies are more likely to delay or receive inadequate prenatal care with increased potential of health problems for the mother and unborn baby. Previous studies have shown that unintended pregnancies especially unwanted pregnancies are related to preterm delivery (Mohllajee et al., 2007; Orr et al., 2008) and premature rupture of membranes (Orr et al., 2008). Also, unintended pregnancy constitutes a specific risk factor for maternal mortality with far higher detriments in LMICs. Campbell and Graham demonstrated that about 25–40% of maternal deaths could be avoided if unwanted and unplanned pregnancies were prevented (Campbell & Graham, 2006). Unfortunately, there is a wide inequality in maternal mortality risk with apparent worse skewness to LMICs. Recent data from World health organization (WHO) indicates global lifetime risk of maternal death of 1 in 190 women with 1 in 5400 and 1 in 38 in the high-income regions and Sub-Saharan Africa respectively (WHO, 2019).

Globally, unintended pregnancies generally result in unplanned births or abortions. Recent global report indicates the about 59% and 55% of unintended pregnancies result in abortion in high and low income countries respectively (Bearak et al., 2018). Between 2010 and 2014, over 25 million unsafe abortions occurred annually with approximately 97% of these reported in the developing countries (Ganatra et al., 2017). Potentially, unsafe abortions are associated with multiple complications such as septic shock, post-abortal pelvic inflammatory disease and severe maternal morbidity and mortality (Melese et al., 2017). A related study in Ghana reported a 32.6% prevalence of unintended pregnancy occurred among women with pre-eclampsia, a leading cause of maternal death in most tertiary hospitals in the country, and about 57% were not on any modern contraceptives (Adu-Bonsaffoh & Seffah, 2015). Complications of induced abortions still accounts for significant proportion of maternal deaths in the country although there has been a significant reduction over the past decade (GHS and Ghana Statistical Service (GSS), 2018). Other untoward accompaniments of unintended pregnancies include considerable increase in economic constraints and stress on families and the society (Engstrand & Kallner, 2018; Sapkota et al., 2015).

Relatedly, 26% of women between the ages of 15–49 have unmet need for contraception in Ghana of which unmet need for limiting and spacing accounts for 10% and 16% respectively. On the other hand, national contraceptive prevalence rate is estimated as 34.7% which indicates more room for improvement in access to contraception (Ghana Statistical Service (GSS), 2012). Also, maternal mortality ratio (MMR) remains relatively high (308 per 100,000 live births) despite implementation of several national interventional programs to improve maternal health in the country (WHO, 2019). In Korle-Bu Teaching Hospital, the current study site, the MMR has not improved appreciably over the past decade with a recently reported figure of 915 per 100,000 livebirths (Adu-Bonsaffoh et al., 2013).

As part of the institutional effort to improve maternal health and reduce maternal morbidity and mortality in the tertiary facility and the country as whole, there is a need to explore the burden of unintended pregnancy in the hospital to provide evidence for improving the quality of reproductive health care. Although several institutional policies have been implemented to reduce pregnancy complications and maternal deaths the burden of unintended pregnancy has not been adequately explored. The objective of this study was to determine the prevalence and determinants of unintended pregnancy and explore modern contraceptive use among women attending antenatal clinic at a tertiary hospital in Ghana.

2. Materials and Methods

2.1 Study Design and Site

This was a cross sectional study conducted at the Korle Bu Teaching Hospital (KBTH) between 1st June and 31st July 2013. Korle Bu Teaching Hospital is the largest tertiary hospital in Ghana located in the capital, Accra. Serving a population of over three million people, this tertiary referral hospital supervises approximately 10,000 deliveries annually. The National health insurance free delivery scheme covers all deliveries at the hospital. The hospital serves about 120 pregnant women daily at the antenatal clinic.

2.2 Study Population and Sample size Calculation

Inclusion criteria consisted of pregnant women attending antenatal clinic and who provided informed consent to be included in the study. We excluded women in labor, those who presented with emergency conditions or complications and those who declined to be included in the study.

The sample size for this study was calculated based on the primary objective of determining the prevalence of unintended pregnancy among the pregnant women receiving antenatal care. In the calculation, the estimated proportion or prevalence of unintended pregnancies in Ghana of 40% (GHS and Ghana Statistical Service (GSS),

2009) was used with the coefficient of significance (1.96) for significance level (α) of 5% and the allowable error margin fixed at 5%. The minimum sample size required was 424 after 15% adjustment to cater for inconsistencies and incompleteness.

2.3 Ethics Approval and Consent to Participate

The study protocol was approved by the Ethical and Protocol Review Committee of the University of Ghana Medical School (Protocol ID Number: MS-Et/M.7-P4.7/2012-13). Written informed consent was granted by all the participants prior to collection of data.

2.4 Sampling Procedure and Recruitment

The study involved a face-to-face interview of women attending antenatal clinics based on a structured questionnaire. The study participants were recruited using convenient sampling. The study participants were interviewed after they had received antenatal care services and provided informed consent. This exit interview conducted after receiving antenatal care was to encourage the study participants to provide clearly objective responses to the questionnaire without fear of retribution. The interview usually took at most 30 minutes and all the study participants provided written informed consent prior to the data collection. The study participants were informed that participation in the study was purely voluntary and that failure to participate or discontinuation would not have any adverse effect on the quality of their medical care. In order to get the participants to respond to the sensitive questions and also for them to feel very comfortable, well trained female data collectors were used. The pregnancy intention was coded as intended or unintended. If the respondent was looking forward to the pregnancy or wanted it at the time of conception then it was considered intended. On the other hand, if the respondent, at the time of conception, would have wanted the pregnancy later on or did not want it at all, then it was considered unintended (Santelli et al., 2003).

2.5 Dependent and Independent Variables

The main primary outcome (dependent) variable was the prevalence of unintended pregnancy among pregnant women obtaining antenatal care services. Unintended pregnancy was defined as gestation occurring sooner than expected (mistimed) and or when the woman has no desire for more children at the time of conception (unwanted) (Santelli et al., 2003).

The independent variables in this study include socio-demographic characteristics such as maternal age, marital status (married/co-habitation, single) educational status and residence (urban, urban slums/rural). The obstetric independent variables were parity (previous births), gravidity (number of pregnancies), previous cesarean section and contraceptive use prior to index pregnancy.

2.6 Data Analysis

The data were entered into Microsoft Excel spread sheet and analyzed using SPSS version 22 and R (version 3.6.3). The outcome (dependent) variable was pregnancy intention which is dichotomous and coded as intended and unintended. Initial descriptive analyses were performed, and the results were presented in percentages. The effects of the various factors on the dependent variable were first determined using the bivariate logistic regression which involved fitting the dependent variable as a function of the individual independent variables. The multivariate logistic regression was then fitted to determine the significant determinants of unintended pregnancy. There was a significant interaction between parity and gravidity groups and the two variables were not included in the same logistic regression model. A significant result was considered at a p value of less than 0.05.
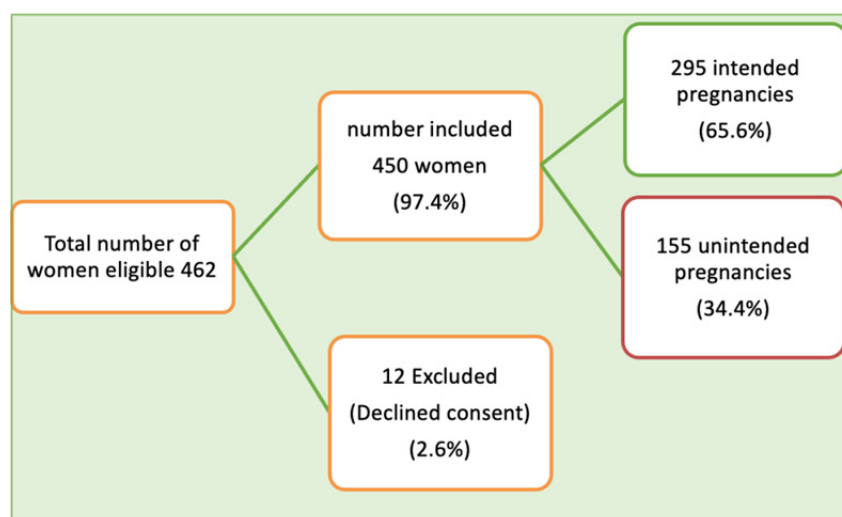
Figure 1. Flow chart showing recruitment of women with intended and unintended pregnancies

3. Results

In this study, 462 women were approached for inclusion out of which 450 consented and were included with 12 declining to take part in the study (Figure 1).

3.1 Background Characteristics

Table 1 shows the characteristics of women with intended and unintended pregnancies. Among the 450 antenatal clients included in the study, 335 (74.4 %) were between the ages of 20-34 with the mean maternal age of 30.6 ± 5.2 years. More than half of the respondents [282 (62.7%)] lived in the urban area. Also, 28.7% and 16.4% have had tertiary level and primary or no education respectively. Majority of the women (84.2%) were married or cohabitating. Among the study participants, 30% were nulliparous with 70% having a history of one or more childbirths (Table 1). Women of gravidity 1-2 and 6 or more represented 47.1% and 8% respectively with 78 (17.3%) having a history of previous induced termination of pregnancy. Also, 25.6% (115/450) of respondents had a history of previous cesarean. Majority of the participants (71.4%) had pregnancy interval of at least two years whereas 28.6% had pregnancy interval of less than two years.

Table 1. Characteristics of women with intended and unintended pregnancies

Variable	Total (N=450) n (%)	Intended Pregnancy n (%)	Unintended pregnancy n (%)	ρ value
Maternal Age				0.026
< 20	11 (2.4)	3 (27.3)	8 (72.7)	
20-34	335 (74.4)	223 (66.6)	112 (33.4)	
≥ 35	104 (23.1)	69 (66.3)	35 (33.7)	
Marital status				0.000
Married/cohabitation	379 (84.2)	269 (71.0)	110 (29.0)	
Single	71 (15.8)	26 (36.6)	45 (63.4)	
Education				0.027
Primary/None	74 (16.4)	**43 (58.1)**	**31(41.9)**	
Junior high school (JHS)	126 (28.0)	74 (58.7)	52 (41.3)	
Senior high school (SHS)	121 (26.9)	82 (67.8)	39(32.2)	
Tertiary	129 (28.7)	96 (74.4)	33 (25.6)	

Gravidity group				**0.000**
1-2	212 (47.1)	157 (74.1)	55 (25.9)	
3-5	202 (44.9)	122 (60.4)	80 (39.6)	
≥ 6	36 (8.0)	16 (44.4)	20 (55.6)	
Parity group				0.002
Nulliparous	135 (30.0)	103 (76.3)	32 (23.7)	
Previous birth (≥1 parity)	315 (70.0)	192 (61.0)	123 (39.0)	
Prior contraceptive use				0.003
Yes	64 (14.2)	31 (48.4)	33 (51.6)	
No	386 (85.8)	264 (68.4)	122 (31.6)	
Previous cesarean				0.043
Yes	115 (25.6)	66 (57.4)	49 (42.6)	
No	335 (74.4)	227 (68.4)	106 (31.6)	
Pregnancy interval^m				0.912
< 24 months	97 (28.6)	60 (61.9)	37 (38.1)	
≥ 24 months	242 (71.4)	153 (63.2)	89 (36.8)	

^{m}=missing values (not applicable to 111 participants).

3.2 Unintended Pregnancy and Contraceptive Use among Respondents

Unintended pregnancy was experienced by 34.4% out of 450 respondents with highest proportions recorded among women younger than 20 years (72.7%), women of gravidity of 6 and more (55.6%), those with parity 1-2 (65.3%) and JHS level of education (41.3%) as shown in Table 1. Similarly, high proportions of unintended pregnancy were reported by respondents living in the urban slums (38.7%), single women (63.4%), women with a history of previous cesarean sections (41.4%) and those with pregnancy intervals less than 24 months (37.5%). There was also higher frequency of unintended pregnancies among women who were using contraceptives before their index pregnancies compared to those who were not (51.6%) versus (31.6%). From the opinions of the male partners of respondents, 31.6% (n=142) out of 449 described the index pregnancies as unintended. There was a significant difference between women and their male partners regarding the perception of pregnancy as unintended at the time of conception (34.4% versus 31.6%, p-value <0.001)

Regarding contraception, 438 (97.3%) had heard about modern contraceptive and 110 (24.4%) had ever used contraceptives. Sixty-four (14.2%) women were using contraception prior to their index pregnancies out of which 33 (51.6%) reported unintended pregnancy. The use contraceptives before the index pregnancy was most prevalent among women aged 20-34 (22.3%), those with tertiary level of education (27.3%) and women of gravidity 6 or more (25.0%). Similarly, the frequencies of modern contraceptive use prior to index pregnancies were higher among single women (22.2%), those with no history of previous cesarean (25.2%) and those with pregnancy interval of less than 24 months (21.6%). Among the 64 women who used contraceptives before their current pregnancies, the pills were the most commonly used 38 (59.4%) followed by the injectables 16 (25.0%), implants 5 (7.8%), intrauterine device 3 (4.7%) and others 2 (3.1%). Among the women who experienced unintended pregnancy whilst using contraceptives, 20 (60.1%), 8 (24.2%) and 3 (9.1%) were using pills, injectables and implants respectively. There was no contraceptive failure among the respondents who used intrauterine device.

Table 2 shows the characteristics of women who experienced unintended pregnancy and had a prior modern contraceptive use. None of the independent variables showed statistically significant association with the use of contraceptive before index pregnancy.

Table 2. Characteristics of women with unintended pregnancy and modern contraceptive use

Variable	Modern contraceptive use prior to index pregnancy			
	No of UP (155)	No [n(%)]	Yes [n(%)]	ρ value
Maternal age (years)				1.00
< 20	8 (5.2)	7 (87.5)	1 (12.5)	
20-34	112 (72.3)	87(77.7)	25(22.3)	
≥ 35	35 (22.6)	28(80.0)	7(20.0)	
Marital status				0.856
Married/cohabitation	110 (71.0)	87 (79.1)	23 (20.9)	
Single	45 (29.0)	35 (77.8)	10 (22.2)	
Education				0.150
Primary/None	31 (20.0)	29 (93.5)	2 (6.5)	
Junior high school	52 (33.5)	40 (76.9)	12 (23.1)	
Senior high school	39 (25.2)	29 (74.4)	10 (25.6)	
Tertiary	33 (21.3)	24 (72.7)	9 (27.3)	
Gravidity group				0.535
1-2	55 (35.5)	46 (83.6)	9 (16.4)	
3-5	80 (51.6)	61 (76.2)	19 (23.8)	
≥ 6	20 (12.9)	15 (75.0)	5 (25.0)	
Parity groups				0.458
Nulliparous	32 (20.7)	24 (75.0)	8 (25.0)	
Previous birth (≥1 parity)	123 (79.3)	98 (79.7)	25 (20.3)	
Previous cesarean				0.073
No	107 (69.0)	80 (74.8)	27 (25.2)	
Yes	48 (31.0)	42 (87.5)	6 (12.5)	
Pregnancy interval^{m}				0.860
< 24	37 (29.4)	29 (78.4)	8 (21.6)	
≥ 24	89 (70.6)	71 (79.8)	18 (20.2)	

^{m}=missing values (not applicable to 29 participants).

3.3 Determinants of Unintended Pregnancy

The results of the bivariate analysis in Table 3 shows that maternal age, gravidity, parity (previous childbirth), marital status, education status and contraceptive use before index pregnancy were significantly associated with unintended pregnancy. The multivariate logistic regression showed that younger maternal age, unmarried status, previous childbirth, number of pregnancies ≥6, previous caesarean birth and contraceptive use prior to index pregnancy were significant factors influencing unintended pregnancy in this study. Previous number of pregnancies ≤2 was associated with reduced risk of unintended pregnancy.

Table 3. Bivariate and multivariate logistic regression of unintended pregnancy and determinant variables

Variable	OR	95%CI	ρ value	aOR[a]	95%CI	ρ value
Maternal age (years)						
<20	4.018	1.392, 13.164	0.013	5.706	1.860, 19.732	0.003
20-34	Ref			Ref		
≥ 35	1.019	0.634, 1.619	0.937	0.656	0.378, 1.116	0.126
Marital status						
Married/cohabitating	Ref			Ref		
Single	4.233	2.506, 7.281	0.000	5.238	2.882, 9.735	0.000
Education						
Primary/None	Ref			Ref		
Junior high school	0.975	0.545, 1.751	0.931	0.947	0.496, 1.814	0.868
Senior high school	0.660	0.362, 1.202	0.173	0.697	0.360, 1.350	0. 283
Tertiary	0.477	0.259, 0.875	0.017	0.786	0.388, 1.595	0.503
Gravidity group						
1-2	0.534	0.351, 0.867	0.003	0.417	0.252, 0.682	0.001
3-5	Ref			Ref		
≥ 6	1.906	0.905, 3.945	0.077	2.640	1.210, 5.854	0.015
Parity group[b]						
Nulliparous	Ref			Ref		
Previous birth (≥1 parity)	2.062	1.318, 3.292	0.002	2.376	1.460, 4.758	0.002
Previous cesarean						
No	Ref			Ref		
Yes	1.604	1.035, 2.477	0.034	2.034	1.154, 3.306	0.004
Prior contraceptive use						
No	Ref			Ref		
Yes	2.304	1.348, 3.947	0.002	2.305	1.283, 4.162	0.005

[a]adjusted for adjusted for all the variables in the table except parity group; [b]adjusted for all variables except gravidity group.

4. Discussion

In this study, the prevalence of unintended pregnancy determined among pregnant women receiving antenatal care was 34.4%. Contraceptive prevalence rate among women with unintended pregnancy was 21.3% and about 50% reported unintended pregnancy. There was a significant difference between women's and their male partners' perspectives regarding pregnancy intention (intended or unintended) at the time of conception. The main determinants associated with unintended pregnancies were younger maternal age, unmarried status, previous childbirth (parity) and number of pregnancies (gravidity), previous caesarean birth, and contraceptive usage prior to index pregnancy.

The prevalence of unintended pregnancy determined in this study is consistent with 33% reported for the African continent (Sedgh et al., 2014) but moderately lower than the prevalence 40% and 43.8% reported by Nyarko in Ghana (Nyarko, 2019) and Lawani et al in Nigeria (Lawani et al., 2018) respectively. The wide variations in the prevalence of unintended pregnancy determined in our study and the national figure reported by Nyarko relates to the different contexts of the two studies with the latter being a secondary analysis of countrywide national survey. In the tertiary centre, more complicated cases are referred for specialist care and it is likely that some of these clients may have received some form of fertility treatment accounting for the lower prevalence of unintended pregnancy.

Determinants of unintended pregnancy determined in our study were varied including younger maternal age (less than 20 years) compared to women between 20 and 34 years of age. The finding of significant association between younger maternal age and unintended pregnancy is consistent with other local and international studies from Kenya, Pakistan, Brazil, Papua New Guinea, Tanzania, Canada and Ghana (De Coelho et al., 2012; Exavery et al., 2014; Ghana Statistical Service (GSS), 2012; Habib et al., 2017; Oulman et al., 2015; Sanga et al., 2014), with contemporary adolescents becoming sexually active earlier than in the past (Maja, 2007). Adolescent relationships are likely to be short-lived and unstable. Moreover, couples in unstable relationships are less likely to plan sexual intimacy or childbirth (Loewenstein & Furstenberg, 1991). In Ghana, women less than 20 years are more likely to be in the senior high school or learning various vocations and pregnancies occurring at such times are most likely described as unexpected or mistimed (Ameyaw, 2018).

In this study, previous childbirth (≥1 parity) and high number of pregnancies (≥6) were found to be significantly associated with increased occurrence of unintended pregnancy whilst women with lower number of pregnancies (≤2) had a lower risk. Similarly, previous caesarean birth which is related to multiparity was found to be associated with increased frequency of unintended pregnancy. Women with previous births were at higher risks of experiencing unintended pregnancies compared to nulliparous women and this finding is comparable to other studies (Eliason et al., 2014; Fite, Mohammedamin, & Abebe, 2018; Habib et al., 2017; Johnson & Madise, 2011; Mohammed et al., 2016). This finding of significant association between previous birth and unintended pregnancy is partly because multiparous women might have attained the optimum family sizes required with minimal expectation of future childbearing. Also. The preference for a particular gender by a couple, for instance, a male child, might result in multiple childbirths than originally intended (Eliason et al., 2014). Also, there is a cultural belief among some tribes in Ghana which demands that another child must be born after the birth of twins, to ensure the optimal survival of twins or triplets. Hence, regardless of the number of children a couple already has, they are tempted to have another child after twin births and this indigenous culture partly increases the prevalence of unintended births. Similarly, women who have two or more children already are compelled in their new marriages to have at least a child to appease their in-laws or husbands and to secure their new marriages. This belief partly explains the significant difference in the prevalence of unintended pregnancy from the perspectives of women and their partners.

In our study, unmarried status was also significantly associated with occurrence of unintended pregnancy, consistent with other studies conducted in Ghana, Kenya, Ethiopia, Tanzania and other parts of the world (Agbeno et al., 2018; Eliason et al., 2014; Exavery et al., 2014; Fite et al., 2018; Haffejee et al., 2018; Johnson & Madise, 2011; Mohammed et al., 2016; Sanga et al., 2014). Most of the time, married or cohabiting women are in more stable relationships and so they are more likely to plan sexual intimacy. Divorced and single women are more likely to have coital activities for pleasure and not for procreation (Mohammed et al., 2016). Single women in some communities in Ghana do not feel comfortable going for contraceptives because they are afraid of being judged or labeled promiscuous. Therefore, any unplanned and unprotected sexual activities might result in unplanned pregnancy.

Intriguingly, women who reported contraceptive use before their index pregnancies were twice more likely to experience unintended pregnancy compared to those who were not using any contraceptives. Generally, non-use of contraceptives is associated with higher odds of experiencing unintended pregnancies (Habib et al., 2017; Sanga et al., 2014). In this study, the high frequency of unintended pregnancy in association with contraceptives use prior to their current pregnancies might partly be explained by contraceptive failure or inappropriate use of the contraceptives. Bradley et al reported contraceptive failure rates of 13.2%, 5.2%, 11.2% and 20.8% for Kenya, Malawi, Tanzania and Zimbabwe respectively (Bradley et al., 2011). However, our finding is consistent with the study by Polis et al (Polis et al., 2016) who reported wide variations in contraceptive failure rate in 43 countries. In their review, contraceptive failure was generally higher in younger women but older women in West Africa experienced higher failure rates for implants, pills and condoms. Globally, contraceptive failure is an important determinant for unintended pregnancy and this comprises both method-related and user-related failures (Polis et al., 2016).

In this study, 21.3% of the women with unintended pregnancy used contraceptives before their current pregnancies whilst 78.7% were not using any form of contraceptives. The low prevalence of contraceptive use may be due several factors including lack of sexually activity until pregnancy was desired, newly married couple who desire pregnancy and fear of side effects. In Ghana, the current contraceptive prevalence rate has been reported as 25% (GHS and Ghana Statistical Service, 2018) which is lower than 28.5% estimated for the African continent and far lower than the global figure of 57.4% (WHO, 2018). Appropriate goal-oriented education programs on contraceptives should have a more effective approach to adequately address specific needs of different phenotypes

of women who are at a greater risk of unintended pregnancy. A very friendly and warm approach in dealing with women of different socio-economic backgrounds are very influential in the choices of contraceptives, confidence of clients and use of contraceptives (Maja, 2007).

The strength of this study relates to its cross-sectional nature with an exit data collection component that encouraged the respondents to express their views without retribution or fear of not receiving the appropriate clinical care. The limitations of the study include the non-inclusion of the qualitative component which would have further explored the relativity of unintended pregnancy to contraceptive use and failure. Another limitation is related to the self-report approach in the data collection and possibility of recall bias. Also, the reasons for contraceptive failure including the challenges associated with typical use were not explored to provide further insight into to the high prevalence unintended pregnancy among women who used contraceptives prior to their index pregnancies, and this is considered a limitation of the study.

5. Conclusion

There is high prevalence of unintended pregnancy but relatively low prior contraceptive use among pregnant women receiving antenatal care at the tertiary hospital. Important determinants of unintended pregnancy include younger maternal age, unmarried status, previous childbirth and high number of pregnancies, previous caesarean birth and contraceptive usage prior to index pregnancy. Evidence-based interventions for prevention of unintended pregnancy including optimal client education and counselling, correct use of contraceptives should be consistently integrated and evaluated for continued uptake during the routing care for women especially during pre-conception care and the postpartum period. Further research with high methodological quality is recommended including qualitative data to better understand the interplay between unintended pregnancy and its determinants as well as typical use of contraception and the occurrence of unintended pregnancy. A more proactive approach in family planning education and counselling with specific emphasis on correct use of appropriate contraceptive methods is required to minimize the undesirable consequences of unintended pregnancy to the individuals, society and the country as a whole.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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