Reducing the Effects of Adverse Drug Reactions: Assessing Knowledge and Attitudes of Nurses in Tamale, Ghana

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ABSTRACT---
Background: Detection and curtailment of probable ADR require decisive, continuous and close monitoring by knowledgeable health workers since ADRs have massive impact on both physical wellbeing and healthcare cost. This study assesses the knowledge and attitude of nurses towards ADRs

Method: Data was collected from 125 nurses from four major hospitals in Tamale, Ghana using a semi-structured questionnaire. Data was analyzed in GraphPad, Version 5.01.

Results: The overall knowledge score was 36.5% and an attitude score of 59.4%. Knowledge however had a positive correlation with attitude (r = 0.15, p = 0.0984).   Knowledge score on the definition of ADR was 21.9%,   but the worst scores were in relation to serious forms of ADR; Steven Johnson's Syndrome (13.3%) and Toxic Epidermal Necrosis (1.07%) with majority (> 75%) unable to list a single symptom of them. Male nurses exhibited a significantly higher knowledge (39.26% versus 32.2%, p = 0.0009) and a better attitude than their female counterparts (62.1% versus 55.1%). General nurses were significantly more knowledgeable than other categories of nurses and also have a better attitude (40.25%, p < 0.0001). A good proportion of nurses (42.4%) attributed their less encouraging attitude towards ADRs to lack of knowledge, with 51.2% suggesting in-service workshops to be the most appropriate strategy to increase their appreciation of ADRs. Nurses who had prior training had a significantly better knowledge than their untrained colleagues (47.11% versus 35.67%, p = 0.0047) and also exhibited a better attitude than those untrained (64.4% versus 59.0%, p= 0.5288).

Conclusion: The knowledge of nurses on ADRs was poor but they exhibited a good attitude. Knowledge had a positive correlation with attitude and therefore giving nurses more training on pharmacovigilance will greatly enhance their contribution towards detecting and reporting observed ADRs.

Keyword--- Nurses, adverse drug reactions, Steven Johnson Syndrome, Toxic Epidermal Necrosis
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1. BACKGROUND

The World Health Organization (WHO) defines Adverse Drug Reaction (ADR) as any noxious, unintended, and undesired effect of a drug, which occurs at doses used in humans for prophylaxis, diagnosis, or therapy. [1] Adverse reactions associated to drugs are known to be responsible for significant levels of mortality and morbidity with a massive negative impact on both health and healthcare costs across the world. [2, 3] In most developing countries, including Ghana, the impact of ADRs on both health and the economy has not been documented and most evidence comes from the developed world. For instance, according to a 2007 report of the Institute of Medicine, up to 450,000 preventable adverse drug events leading to 100,000 ADR induced deaths occurred annually in hospital in the United States, and also 7% of hospitalization in the US are also ADR related. [4 – 6] ADR is said to be the fourth cause of death and costs the US economy, an average of 3.5 billion dollars annually. [7] ADRs account for 6.5% and 6.89% of hospitalization in the UK and India respectively, and cost the UK National Health Service, 466 million pounds annually. [8, 9]

Up to 72% of ADRs can be avoided to ensure the well-being of the patient if health workers are able to recognize them. [8]   Detection of probable ADR requires a decisive, continuous and close monitoring of medicines use by knowledgeable health workers who also have the right attitude to report any suspected case since spontaneous reporting is critical for the curtailment of ADRs. [10] Low level of spontaneous reporting worldwide, has been identified as a limitation in the management of ADRs where under reporting has been estimated to be 90 – 95%. [11 – 13] Reasons for the poor reporting attitude of healthcare givers are varied and include lack of financial incentives, fear of litigation,

uncertainty of an ADR, lack of interest, lack of time and the assumption that all serious ADRs have already been well documented. [14]

Developing countries are known to be bearing about 90% of the global disease burden, however almost all of the medicines used in these countries were developed in the developed countries, where the incidence, pattern and severity of adverse reactions may differ markedly from those of developing countries due to local environmental and genetic factors. [15, 16]

Although it is the responsibility of all health care professionals to monitor the safety of all medicines and report ADRs, nurses as bedside caregivers and overseers of medication administration, have a unique opportunity to detect and spontaneously report all ADRs. [17, 18] Various studies showed that nurses when trained are capable of detecting and reporting adverse drug reactions in proportions comparable to the physicians. [19, 20] Safe drug monitoring should therefore be built around nurses who form the bulk of workers in the health sector of most countries.

Several studies have been conducted in developed and some developing countries to assess the knowledge and attitude of health professionals towards adverse drug reaction among health professionals but currently there is no reported study in Ghana. This study was therefore carried out to assess the knowledge, level of awareness and attitude of nurses in four public hospitals in Tamale, an urban set up in northern Ghana.

2. METHOD

Study design and setting
A structured questionnaire was used to gather information on respondents' knowledge on ADRs, their attitudes towards ADRs and any training needs. The questionnaire was administered to various categories of nurses working in four public hospitals in Tamale, namely Tamale Teaching Hospital (TTH), Tamale Central Hospital (TCH), SDA Hospital (SDA) and Tamale West Hospital (TWH).

Sample size determination and sampling procedure
A total of 125 respondents were sampled based on the Cochran's (1977) sample size formula. The sample size was estimated assuming a 9% ADR knowledge rate among using a confidence interval of 95% with an allowable error of 5% thus alpha level of 0.05 with an equivalent Z-value of 1.96. The proportionate sampling approach was used to allot appropriate numbers of respondents to each of the hospitals; TTH (55), TCH (30), TWH (29) and SDA (11) and simple random sampling technique was used to select participants. In each facility, only nurses who were willing to participate were included in the study.

Approval was obtained from the Ethics Committee of the School of Medicine and Health Sciences of the University for Development Studies before the commencement of the study. A research assistant with a nursing background and further trained in ADR issues did the pretesting of the questionnaire on 10 nurses. All comments from the pretest were incorporated and the final questionnaire was used to collect the data by the research assistant.

Study variable determination and measurements
The level of knowledge of respondents was determined using 14 questions, with eight of them being close ended questions requiring the ticking of a yes or no answer. The yes answers which were the most appropriate choices scored one or two marks based on the complexity, while a no answer, scored zero. The open ended questions which carried a maximum of 3 to 5 scores were scored by comparing the answers provided by the respondents with the standard answer from a reference source. Respondents' definitions of ADR were compared with that of the W.H.O and scored a mark for each of the following keywords: Responses to a drug; noxious; unintended; doses normally used and prophylaxis, diagnosis, therapy or modification of physiological properties. For the difference between ADR and Side Effect (SE), the respondents scored between 0 for incorrect answers and 1 or 2 depending on the presence of the key sentences; SE related to the pharmacological properties of the drug and SE can be useful or ADRs are always harmful. The symptoms of Steven Johnson's Syndrome (SJS) and Toxic Epidermal Necrosis (TEN) considered were cough; aching; headaches; feverishness; rashes; blisters from the rashes; inflammation of mucous surfaces; any two of above listed symptoms in addition, the peeling of skin should be less than 10% of body surface for SJS, and peeling of more than 10% of body skin for TEN.

Attitude was scored by assigning 2 scores each to respondents agreeing that all suspected ADRs are valuable and should be reported and also that respondents had seen or made effort to see ADR form. A respondent ever filling an ADR form following a case of ADR scored one mark.

In this study, both knowledge and attitude were assigned categorical variables as poor and good. A knowledge score of less than 50% was considered poor while 50% and above was classified as good. Also attitude was considered good when the score was 50% and above but poor for scores below 50%.

Statistical analysis

Data was analyzed using GraphPad Prism, Version 5.01 (GraphPad Software Inc., San Diego CA). Reliability of the questionnaire was assessed by Cronbach's alpha value. Relationships between participants' demographic characteristics and knowledge as well as attitudes scores were assessed using the Chi-square test and one-way Analysis of Variance (ANOVA). Pearson's correlation was used to determine any relationship between knowledge and attitude. Statistical significance was assumed at $p < 0.05$ and at a confidence interval of 95%. Categorical data were expressed as frequencies and percentages, whilst continuous data were expressed as means with standard deviations.

3. RESULTS

The Cronbach's alpha value for the questionnaire was 0.61. A greater proportion of the respondents 76 (60.8%) were males. Majority, 100 (80.0%) were in the 20 -29 years age category with 12 (9.6%) older than 40 years. In relation to the nursing category, general nurses who had diploma or degree were in the majority 76 (60.8%) while the combined group of Public Health Nurses and Psychiatry Nurses who are both post diploma specialized graduates made up the least of the respondents, 7 (5.6%). This study involved up to 108 (86.4%) nurses who have spent up to 5 years working in the nursing profession while a smaller number, 17 (13.6%) had worked for more than 5 years. Table 1 shows the demographic characteristics of the nurses involved in this study.

Table 1: Demographic characteristics of respondents (N = 125)

Item	Subgroup	Number	Percentage
Gender	Male	76	60.8
	Female	49	39.2
Age range/years	20-29	100	80.0
	30-39	13	10.4
	>40	12	9.6
Nursing category	General nurse	76	60.8
	Midwife	11	8.8
	PHN/PsyN[a]	6	4.8
	CHN/EN[a]	32	25.6
Years of service	≤ 5	108	86.4
	> 5	17	13.6
Hospital	TTH	55	44
	TWH	29	23.2
	TCH	30	24
	SDA	11	8.8

[a] PHN – Public Health Nurse, CHN – Community Health Nurse,
PsyN – Psychiatry Nurse, EN – Enrolled Nurse

The mean knowledge score for all the respondents was 36.45%. The nurses had high knowledge scores in relation to them knowing if ADRs could lead to hospitalization, 123 (98.4%) and whether ADR cause deaths in their hospitals, 108 (86.4%). The mean score for definition of ADR was 21.92% (SD= 1.035). There was a high score for agreeing that the ADR and SE are not the same (67.2%), however, there was inadequate detailed knowledge (4.4%). Nurses had a low knowledge score in relation to serious forms of ADR such as SJS and TEN. Scores of knowing or seeing or nursing cases of SJS and TEN were 24.8% and 4.8%, respectively with significantly lower values; SJS (13.3%) and TEN (1.07%) when the symptoms were to be listed by the nurses. Respondents scored averagely when they were required to tick risk factor of ADR (54.2%) and how nurses could manage ADRs (45.6%). Nurses' knowledge scores are presented in Table 2.

Table 2: Knowledge scores of respondents

Item (maximum score)	Mean score	Standard deviation	Mean score as percentage of maximum score
Definition of ADR (5)	1.096	1.035	21.92
Difference between ADR and SE? (1)	0.672	0.471	67.2
If difference, state it(2)	0.088	0.312	4.4
Risk factors of ADR *(4)	2.168	1.098	54.2
Can ADR lead to hospitalization? (1)	0.984	0.126	98.4
Longer stay at hospital increases risk of ADR (1)	0.408	0.493	40.8
ADR can cause death at your facility (2)	1.728	0.688	86.4
Can deterioration of client condition be due to the medicine? (1)	0.696	0.462	69.6
Patient's sudden deterioration of condition mostly likely due to the medication (1)	0.544	0.500	54.4
How can nurse manage ADR? (4)*	1.824	1.071	45.6
Knowledge on Serious ADRs: SJS and TEN			
Know/seen/nursed SJS? (1)	0.248	0.434	24.8
Symptoms of SJS (3)	0.4	0.803	13.3
Know/Seen/Nursed TEN? (1)	0.048	0.215	4.8
Symptoms of TEN (3)	0.032	0.218	1.07
Total (30)	10.936	3.546	36.45

*Respondents were to tick all the four options if they were applicable.

The overall mean attitude score of the respondents towards ADRs was 59.4%. There was an excellent appreciation, 118 (94.4%) of the fact that all ADRs are valuable and required to be reported. However, attitude towards making effort to see or seeking after the ADR form was low, 62 (49.6%). Of the total, only 11 (8.8%) of the nurse had filled an ADR form after an observed case of ADR. Attitude towards ADRs was measured with three items as shown in Table 3.

Table 3: Attitude score of respondents

Item (maximum score)	Subgroup	Number	Mean score	Standard deviation	Mean score as percentage of maximum score
All suspected cases of ADRs are valuable and should be reported (2)	Yes	118			
	No	7	1.888	0.462	94.4
Seen or made effort to see an ADR form (2)	Yes	62			
	No	63	0.992	1.004	49.6
Ever filled ADR form following an observed case of ADR? (1)	Yes	11			
	No	114	0.088	0.284	8.8
Total (5)			2.968	1.250	59.36

The male nurses exhibited a more significantly higher knowledge than the females (39.26% versus 32.2%, p = 0.0009). Male nurses also had better attitude than the females which was however not significant. There was a decline in the level of knowledge with increasing age of the respondents. There was also a decrease in knowledge but increasing in attitude with increasing period of service, all of which were however not significant. The hospital of practice of a nurse seems to

significantly affect both the knowledge and attitude. Nurses at SDA had the best knowledge (42.82%, p= 0.0427) while those at the TTH were best in attitude towards ADR (67.2%, p = 0.0083). A small number of the nurses, (7.2%) had ever had a formal training on ADR and were significantly more knowledgeable when compared to those who had no prior ADR training (47.1% versus 35.67%, p = 0.0047). Although the trained nurses had higher attitude (64.4%) than the untrained ones (59.0%), the difference was not significant. For those who had some prior training in less than a year, their knowledge score was higher than the untrained but their attitude was worse when compared with those whose training occurred more than a year. The comparison of the mean scores of knowledge of nurses on ADRs and their attitudes with demographic characteristics as well as effect of training on knowledge and attitude is shown in Table 4.

Table 4: Comparing mean percentage knowledge and attitude scores among respondent's demographic characteristics as well as effect of training on knowledge and attitude (N=125)

Item	Subgroup	Knowledge (100%)	P-value	Attitude (100%)	P-value
Gender	Male	39.26		62.1	
	Female	32.20	0.0009	55.1	0.1269
Age range/years	20 -29	37.28		58.8	
	30 -39	35.92		57	
	>40	31.00	0.1763	66.7	0.5531
Nursing category	General nurse	40.25		62.6	
	Midwife	30		61.8	
	PHN/PsyN	35.00		63.3	
	CHN/EN	30.00	<0.0001	50.0	0.1083
Years of service	≤ 5	37.00		58.0	
	> 5	33.92	0.3394	68.2	0.1158
Hospital	TTH	38.13		67.2	
	TWH	32.41		49.4	
	TCH	35.13		60	
	SDA	42.82	0.0427	54.4	0.0083
Prior training on ADR?	Yes (9)	47.11		64.4	
	No (116)	35.67	0.0047	59.0	0.5288
Number of years after last training	< 1 year (5)	52.7		64.0	
	> 1 year (4)	40.0	0.3597	65.0	0.9553

As shown in figure 1, respondents attributed the observed attitude of nurses towards ADR in practices to their lack of knowledge (42.4%). Other reasons included were ineffective monitoring (32.0%), failure of client to report ADRs (18.4%) and missed diagnoses (7.2%).
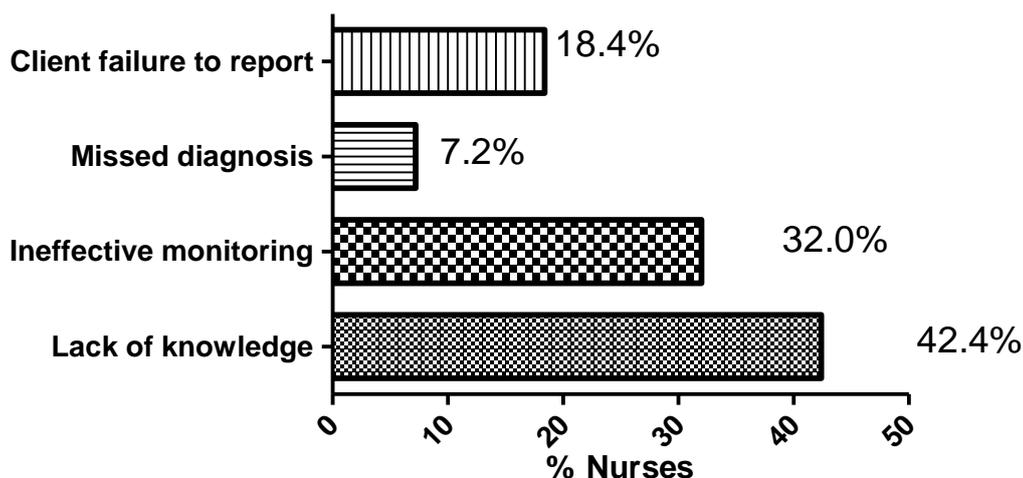
Figure 1: Bars represent percentage of nurses for corresponding reason for which they fail to take action on ADRs

Respondents suggested various ways of preventing or reducing ADR in nursing practice as shown in figure 2, with the most proposed method being the training of nurses on ADRs at in-service workshops, 64 (51.2%), followed by effective monitoring, 42 (33.6%) with the teaching of ADR at school scoring 19 (15.2%). This is as shown in figure 2.
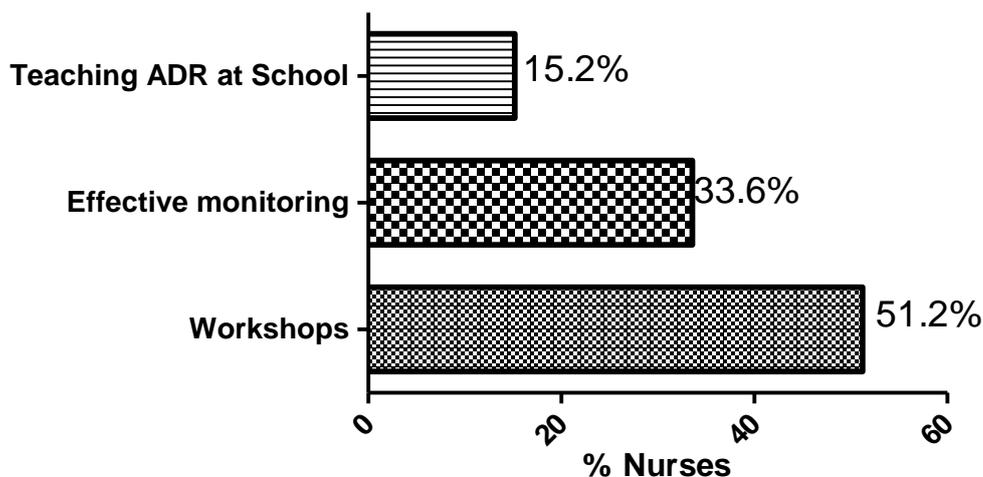

Figure 2: Bars represent percentage of nurses suggesting the most effective way to reduce ADR in practice

The correlation between knowledge and attitude of the respondents was determined by the Pearson's product moment correlation coefficient, recording a value of 0.15.

4. DISCUSSION

Nurses constitute the greatest proportion of healthcare professionals and are the closest to patients especially those on admission and must be involved in the monitoring of ADRs to reduce these untoward drug effects on individuals and economies of countries. [21] This study recorded a greater number of male nurses (60.8%) compared to the females which did not corroborate similar studies elsewhere, where the females nurses outnumber their male counterparts. [10, 22] One reason for the greater number of male respondents for this study was that the male nurses more readily accepted to be part of the research and completed the questionnaire in full and an increasing number of male nursing graduates in recent years in Ghana. [23]

In this study, knowledge of the nurses on ADRs was poor though their attitude was good. These results supported a similar study conducted in an Iranian hospital where the nurses exhibited better attitude though their knowledge levels were poor. [21]   Male nurses had significantly better knowledge on ADRs than their female counterparts. The attitude among the males was also higher which is in variance with results from Iran which saw female respondents having better attitude. [10] This study found a positive but weak correlation between knowledge and attitude, (r = 0.15). With the males in this study being more knowledgeable on ADR, it therefore explains why their attitude was better than the female. Studies in the United Arab Emirates and Nepal also recorded a positive correlation between knowledge and attitude. [22, 24]
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Respondents between ages 20 -29 years had better knowledge scores (37.28%) when compared with those above 40 years (31.0%). Respondents above 40 year however had better attitude (66.7%) than those between 20-29 (58.8%) and 30-39 (57.0%). Also nurses who had served up to 5 years had better knowledge (37.0%) than their colleagues who have been working for more than 5 years (33.92%). However, nurses who had served more than 5 years had better attitude than colleagues who had spent less than 5 years on the job (68.2% versus 58.2, p = 0.1158). It will be expected that older and longer serving nurses should be more knowledgeable and have better attitude towards ADRs as a results of increased chances of exposure to adverse drug events (ADE) over their period of service. Studies among hospital physicians and nurses, showed that older and longer serving health professionals have better attitude towards ADRs which this study had corroborated. [15, 25] The higher knowledge levels of younger and more recent serving nurses in this study could be due to the introduction of ADR related topics in their training curriculum and also they are more likely to assess information using modern information and communication technologies.

This study showed that the category of nurse and the place of work or hospital had a significant effect on the knowledge and attitude scores. General nurses were significantly more knowledgeable (40.25%, p= < 0.0001) and had better attitude (62.6%, p = 0.1083) to ADRs than other categories of nurses such as the combined group of Community Health Nurse and Enrolled Nurses. This could be explained by the composition of the general nurses, several of whom have graduated with first degree in nursing. Subsequently, this may be why the SDA hospital nurses recorded the highest knowledge score since that facility had the highest proportion (91%) of general nurses. The community health nurses and enrolled nurse are shorter period certificate programmes which does not have ADR related topics in their curriculum, which may have accounted for the lowest knowledge and attitude scores.

Prior training of nurses as shown in this study had significant effect on the knowledge of the nurses. Although, the trained nurses had a better attitude (64.4%) than their untrained counterparts (59.0%), this difference was not statistically significant. This result is similar to a study conducted by Hajebi et al who reported that nurses with prior familiarity with an ADR centre had greater knowledge and positive attitude towards ADR reporting. [10] The positive effect of training on health professionals' attitude can be measured by the number of cases reported post training and this showed in a report in Ghana where after training health workers on Pharmacovigilance, the number of ADR reports increased by 129% from a figure of 7 in the year 2008 to 16 in 2009. [26]   The low number of nurses who underwent training on ADR (7.2%) as reported in this study in Ghana seems to occur in other places. A study in United the Arab Emirate on reporting of ADRs among nurses indicated that only 13.2% were trained. [21]

The length of time since the last training on ADR had no significant effect on both knowledge and attitude of the nurse although those who had training less than a year prior to the study were more knowledgeable (52.7% versus 40.0%). It is more likely that with the passage of time, recall of knowledge become inhibited therefore continuous stimulation by several ways such as frequent in-service courses on ADR, alert letters, flyers, motivational packages, among others are required to sustain positive and excellent attitudes towards ADR.[27]

In the current study, nurses considered their lack of knowledge and ineffective monitoring as the main factors preventing them from giving ADR the best attention it deserved. These observations by the nurses corroborate other reports that found these factors together with others, to be militating against nurses' attitude towards ADRs. [10, 28, 29]

The best strategy proposed by the nurses to improve their knowledge and attitude in relation to ADRs was in-service training workshops (51.2%), a view that is supported in the study by Li et al. [28] Training increases knowledge and since attitude has been shown in some cases to be proportional to knowledge, therefore, in-service workshop training as suggested by the nurses should be considered by all national pharmacovigilance centers to roll out vigorous training sessions for all health workers including nurses. To increase attitude after the provision of knowledge through training, there will be the need for effective monitoring by hospital authorities as suggested by 33.6% of respondents in this study. The suggestion by 15.2% of respondents for the inclusion of ADRs topics in nursing curriculum is also appropriate and this will require national pharmacovigilance centers to lobby for the inclusion of ADRs issues in the curriculum of all health training institutions.

This study's results are being discussed within some limitations. The questionnaires were collected from respondents at least after three days and some respondents may refer to various sources of information on ADRs such as books, internet, and even ask some working colleagues. This could make the results higher than it would normally have been.

5. CONCLUSION

Although the nurses in this study had a good attitude towards ADR, they were deficient in knowledge on ADRs. The knowledge of the nurses on ADR is significantly influenced by gender and category of nurse with male and general nurses being more knowledgeable. Previous training on ADR saw a significant rise in knowledge among the nurses hence frequent in-service training on ADR should ensure better monitoring of medicines by health professionals. Knowledge and attitude towards ADRs had a positive correlation but gender, age, nursing category, and number of years of service did not significantly and positively impact on attitude towards ADR hence effective monitoring and other measures should be put in place to make the nurses see ADR reporting as part of their professional duty.

6. COMPETING INTEREST

Authors have no conflict of interests, and the work was not supported or funded by any person or organization.

7. AUTHORS' CONTRIBUTIONS

EPKA conceived the idea and participated in the design of the questionnaire and drafting of the manuscript. EPKA also supervised the research. BSM and AA also took part in the drafting of the manuscript. ASA worked on the questionnaire design, collected the data and performed the statistical analysis. All authors read and approved the final manuscript.

8. ACKNOWLEDGEMENT

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