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Research Article

An Evaluation of Knowledge, Attitude, and Behavior Amongst Patients Regarding Antibiotic Use and Misuse in South Africa

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Abstract

Background: Antibiotic misuse is a global problem that is a threat to public health. Antibiotic misuse and overuse are responsible for the increase and spread of antibiotic resistance. The community plays a fundamental role in the appropriate antibiotic use and the increase and spread of antibiotic resistance. Hence, public knowledge and attitude regarding antibiotic use are imperative to inform educational interventions.

Method: A quantitative approach was performed using a descriptive cross-sectional design. The data were collected by a self-administered questionnaire completed by patients accessing the pharmacy. The data was analysed using descriptive statistics, namely Microsoft Excel and the Statistical Package for the Social Sciences (SPSS).

Results: From a total of 135 respondents, the majority (n = 108; 80%) of the respondents were aware that different antibiotics were needed to treat different diseases. Over two-thirds (n = 98; 73%) of the respondents agreed that antibiotics are effective against viruses. More than half of the respondents (n = 82; 61%) considered that antibiotic resistance is a global problem. The vast majority of the sample population (n = 104; 77%) agreed that the pharmacists often tell them how to use their antibiotics during the dispensing process. Also, a high number of respondents (n = 97; 72%) agreed that doctors take time to inform them during the consultation on using the antibiotics that s/he prescribed.

Conclusion: Multifaceted educational interventions and patient-healthcare provider communication tools seems to be working in some cases. However, attention should be paid to increasing knowledge on those conditions where antibiotics are not required or are ineffective. Community-based interventions may help prevent the development of antibiotic resistance, cross-resistance and possible future events of treatment failure.

Keywords: knowledge, attitude, behaviour, antibiotic use, antibiotic misuse, antibiotic resistance, self-medication, South Africa

Introduction

Antibiotics are among the most commonly purchased medicine worldwide [1]. Antibiotics are substances produced to inhibit the growths of microorganisms and are produced solely from other microorganisms, or of biological origin [2,3]. Antibiotics can function by killing microorganisms (bactericidal) or by inhibiting the growth or multiplication of microorganisms (bacteriostatic). The body's immune system also acts to destroy them [4]. However, their increasing widespread misuse has resulted in the development of resistant microorganisms, reducing antibiotics' effectiveness, resulting in untreatable infectious

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diseases in the community and hospital settings, increased morbidity and mortality and higher healthcare costs [5]. Antibiotic resistance spread and the uncontrolled irrational use (misuse and overuse) poses a significant global public health problem [6,7].

South Africa (SA) faces a quadruple disease burden, with the HIV/AIDS epidemic, other infectious diseases, injuries, and non-communicable diseases [8,9]. The burden of infectious diseases is further exacerbated by limited access, availability and affordability of antimicrobials required to treat infections [8]. However, the full impact of antibiotic resistance on healthcare in SA is not known. Also lacking is insight into patients' knowledge and attitude on antibiotic use and misuse, and how these compare to other countries.

In Saudi Arabia, patient factors are one of the leading causes of antibiotic misuse [10]. The patient factors affecting the misuse or overuse of antibiotics include psychosocial factors such as behaviours, beliefs and attitudes regarding self-medication and over-the-counter medication, the pressure put on doctors, demographic characteristics, namely socioeconomic status, education levels and lack of health education. In SA the importance of such factors may vary amongst the public and private healthcare systems. The patient factors that influence antibiotic prescription and consumption in SA include symptoms and medical history, socioeconomic factors (access and availability in terms of distance from the healthcare facilities, whether the patient is a one-time or regular patient, cash or medical aid payment method), sociocultural, economic and systems factors [8,9].

Additional factors include the inappropriate household use of antibiotics, taking an insufficient dose or not completing the antibiotic course, storage of antibiotics, sharing antibiotics and taking antibiotics for the wrong indications such as viral infection and inflammation. Many antibiotics are erroneously used to treat flu or common cold symptoms [11].

Self-medication with antibiotics almost always involves avoidable, inadequate and ill-timed dosing, creating the best environment for microbes to adapt rather than be eradicated. Besides, noncompliance occurs when the patients forget to take their medication, prematurely discontinue the medicine as they start to feel better or cannot afford a full course of therapy [12]. The knowledge individuals have regarding antibiotics, and their use is essential with regards to the misuse. The development of antibiotic resistance has overtaken the speed with which the newer antibiotics are emerging into the pharmaceutical market; thus, there is a necessity to assess the public awareness and attitude towards antibiotic use and misuse [13].

The economic impact of antimicrobial resistance is a worry to patients, physicians, pharmaceutical producers, healthcare administrators and the population [14]. The socioeconomic impact requires more attention from government agencies, non-governmental organisations, pharmaceutical industries, pharmacists, healthcare professionals and workers, and patients. Also, strategies need to be formulated to manage the current problems associated with antibiotic resistance. Above all, perception, attitude and behaviour change is paramount to preventing antibiotic misuse in communities [15].

Although many studies, [16-22] have determined the use of antibiotics and accompanying knowledge, attitude, and behaviour of the population in several parts of the world, there is currently limited research in SA. Therefore, this study was designed to evaluate the impact of current knowledge, attitude and behaviour of patients regarding antibiotic use and misuse within a community pharmacy setting. It also explored the community's views on perceptions of healthcare professionals and the patient-prescriber relationship when prescribing antibiotics.

Method

Study Location

This study was conducted at a community pharmacy in Durban, KwaZulu-Natal. It is an independently managed retail pharmacy that provides for the healthcare needs of the community, serving a population of 176,989 (Population census, 2011).

Study Population

A convenience sampling method was used to select the sample. The principal investigator drew the sample from the sample population present at the dispensary waiting area during the study period. The questionnaire was administered to those patients that were readily available at the dispensary, willing to participate in the study and met the criteria for participation. The study population included all adult male and female patients above twenty-one years old and below sixty-five years old who received prescription antibiotics during the study period. The patients younger than twenty-one years old and greater than sixty-five years old and those who have not been prescribed antibiotics were excluded.

Sample Size

The sample size was determined using the Leslie Fischer's (1998) formula for sample size determination; n = Z2pq/d2, where; n = desired sample size population < 10000; Z = standard normal deviate set at 1, 96 at 95% confidence level and d = 0.05. The minimum sample size of 135 participants was calculated using this formula.

Study Design

This was a quantitative descriptive cross-sectional designed study.

Data Collection

The data was collected by the use of a self-administered semi-structured questionnaire. The survey was conducted over one month after the Biomedical Research Ethics Committee (BREC). A questionnaire from a previous study performed in Kuwait[17] and adapted from the studies in Sweden and the United Kingdom [23,24].

The researcher piloted the questionnaire before the commencement of the actual study to ensure the comprehension and applicability of the research items to suit the local study population and determine the duration of the questionnaire completion, as this tool was not used previously in this population. The questionnaire was designed in the English language only, and the necessary amendments were made to suit the local population.

The questionnaire comprised of four sections. Section 1 consisted of ten questions regarding the respondent's demographic information. Section 2 comprised of thirteen questions that aimed to evaluate the respondent's knowledge of antibiotics. Section 3 consisted of seven items that pertained to the respondent's attitude towards antibiotic use. Lastly, Section 4

consisted of five questions that looked at perceptions of doctor/patient relationship regarding antibiotics and their use. A five-point Likert scale ranging from strongly disagree, disagree, neutral, agree, and strongly agree was used to assess the responses.

Data Analysis

All questionnaires were manually sorted. The data were analysed using Microsoft Excel and the Statistical Package for the Social Sciences (SPSS) Version 23, in descriptive statistics, viz. frequencies and percentage proportions. The Cronbach Alpha test, Chi-Square test, and the multivariate analysis of variance and correlation testing were determined in this study.

Ethics Considerations

The ethics approval was sought from the Biomedical Research Ethics Committee at the University of KwaZulu-Natal (BE061/19). The site permission was obtained from the community pharmacy owner/manager/responsible pharmacist. The study respondents written informed consent was obtained before the administration of the questionnaire. All information collected was treated with strict confidentiality.

Results

A total of 135 questionnaires were distributed with a 100% response rate. The Cronbach's Alpha test was used to measure the reliability of the items through internal consistency. The Cronbach Alpha value is 0.752. The results show strong and positive internal consistency results for the scale utilised in the questionnaire with the sample's chosen size. Table 1 below provides information on the demographic characteristics of respondents.

Over half of the study respondents (n = 72; 53.3%) were females. The majority of the respondents (n = 52; 38.5%) were between 30 and 39 years old. More than half of the study population (n = 78; 57.8%) used antibiotics in the past six months. A vast majority of the respondents (n = 54; 40%) completed high school as the highest educational qualification, while some had furthered their studies. However, a small portion (n = 31; 23%) worked or studied in the healthcare environment. Table 2 depicts the results of the respondent's knowledge of antibiotics and their use.

Table 1: Sociodemographic characteristics of respondents (n=135).

Characteristics	Category	n (%)
Gender	Male	63 (46.7)
	Female	72 (53.3)
Age	21-29	32 (23.7)
	30-39	52 (38.5)
	40-49	31 (22.9)
	50-59	16 (11.9)
	≥60	4 (3.0)
Antibiotic use in past 6 months	Yes	78 (57.8)
	No	57 (42.2)
Do you work or study in the medical field?	Yes	31 (23)
	No	104 (77)
Educational Qualifications	Matric	54 (40)
	Certificate	23 (17)
	Diploma	15 (11.1)
	Degree	24 (17.8)
	Masters	5 (3.7)
	Doctorate	4 (3.0)
	Other	10 (7.4)

Note: n= frequency (number of respondents) and % = percentage

Table 2: Analysis of Respondents Knowledge on Antibiotics use.

Statements	Strongly Disagree (n; %)	Disagree (n; %)	Neutral (n; %)	Agree (n; %)	Strongly Agree (n; %)	Total n (%)
Different antibiotics are needed to cure different diseases	4 (3)	4 (3)	19 (14)	65 (48)	43 (32)	135 (100)
Antibiotics are effective against bacteria	7 (5)	5 (4)	15 (11)	63 (47)	45 (33)	135 (100)
Antibiotics can kill bacteria that normally lives on the skin and gut	2 (2)	7 (5)	17 (13)	67 (50)	42 (30)	135 (100)
Antibiotics speed up the recovery from coughs and colds	14 (10)	17 (13)	17 (13)	57 (42)	30 (22)	135 (100)
Antibiotics work on most coughs and colds	16 (12)	20 (15)	19 (14)	54 (40)	26 (19)	135 (100)
Antibiotics are effective against viruses	15 (11)	8 (6)	14 (10)	60 (45)	38 (28)	135 (100)
If you get side effects during a course of antibiotics, you should stop taking it	9 (6)	7 (5)	6(4)	60 (45)	53 (40)	135 (100)
If you get a skin reaction when using antibiotics, you should not use antibiotics again	2 (2)	12 (9)	13 (10)	59 (44)	49 (36)	135 (100)
Antibiotics can cause an imbalance in the body's own bacterial flora	4 (3)	7 (5)	32 (24)	49 (36)	43 (32)	135 (100)
The unnecessary use of antibiotics can increase the resistance of bacteria to them	6 (4)	7 (5)	23 (18)	54 (40)	45 (33)	135 (100)
Antibiotics resistance is a worldwide problem	9 (6)	11 (8)	33 (25)	46 (34)	36 (27)	135 (100)
Antibiotics use among animals can reduce the effects of antibiotics among humans	21 (16)	34 (25)	31 (23)	29 (21)	20 (15)	135 (100)
Humans can be resistant to antibiotics	6 (4)	12 (9)	20 (15)	49 (37)	48 (35)	135 (100)

Note: n= frequency (number of respondents) and % = percentage

The majority of the respondents (n = 108; 80%) stated that different antibiotics are needed to "cure" different diseases. Most of the sample (n = 108; 80%) knew that antibiotics are effective against bacteria. Almost two-thirds of the respondents believed that antibiotics speed up recovery from coughs and colds, and it works on most coughs and colds, respectively (n = 87; 64% and n = 80; 59%). Also, over two-thirds of the respondents (n = 98; 73%) stated that antibiotics are effective against viruses. However, most of the respondents (n = 113; 84%; n = 108; 80%) agreed that antibiotics should be stopped if side effects or a skin reaction were encountered during use, respectively. Table 3, below presents the results of the respondent's attitude towards antibiotic use.

A large percentage of the respondents (n = 114; 84%) admitted to always completing the course of treatment with antibiotics, even if they felt better. The majority (n = 101; 74%) disagreed that it is good to get antibiotics from family or friends without having to see a doctor. Just about a quarter of the respondents (n = 31; 23%) agreed that they sometimes stop their treatment course if they feel better. Table 4 outlines responses concerning the perceptions of healthcare professional's habits and health professional/patient relationships.

The vast majority of the sample population (n = 104; 77%) agreed that the pharmacists often tell them how to use their antibiotics during the dispensing process. Also, respondents (n = 97; 72%) agreed that the doctors usually take their time to inform them during the consultation on using the antibiotics that s/he prescribed, but this number is slightly lower when compared to the pharmacists. The majority of respondents (n = 107; 79%) stated that they trusted the doctor's decision not to prescribe antibiotics though many (n = 110; 82%) also believed that doctors often prescribed antibiotics because the patient expects it.

Table 3: Analysis of Respondents Attitude towards Antibiotic use.

Statements	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)	Total n (%)
I always complete the course of treatment with antibiotics even if I feel better	1 (1)	5 (4)	15 (11)	56 (41)	58 (43)	135 (100)
It is good to be able to get antibiotics from relatives or friends without having to see a doctor	64 (49)	37 (27)	6 (4)	22 (16)	6 (4)	135 (100)
I prefer to keep antibiotics at home in case there may be a need for it later	39 (30)	41 (31)	12 (8)	24 (17)	19 (14)	135 (100)
If I feel better, I sometimes stop taking my antibiotics before completing the course of treatment	44 (33)	36 (27)	11 (8)	54 (25)	10 (7)	135 (100)
I prefer to use antibiotics if I have a cough for more than a week	25 (18)	29 (21)	29 (21)	32 (26)	20 (14)	135 (100)
When I have a sore throat, I prefer to use antibiotics	30 (22)	44 (33)	21 (15)	28 (21)	12 (9)	135 (100)

Note: n= frequency (number of respondents) and % = percentage

Table 4: Analysis of Perception on Doctors Habits and health professional/Patient Relationship.

Statements	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)	Total n (%)
Pharmacists often tell you how to use antibiotics	3 (2)	11 (8)	17 (13)	51 (38)	53 (39)	135 (100)
Doctors often take time to inform patients during consult how to use antibiotics	4 (3)	8 (6)	26 (19)	55 (41)	42 (31)	135 (100)
I trust the doctor's decision if they decide not to prescribe antibiotics	5 (4)	8 (6)	15 (11)	65 (48)	42 (31)	135 (100)
Doctors often prescribe antibiotics because the patient expects it	3 (2)	3 (2)	19 (14)	66 (49)	44 (33)	135 (100)
Doctors often take time to carefully consider the need for antibiotics	10 (7)	7 (5)	24 (18)	56 (42)	38 (28)	135 (100)

Note: n= frequency (number of respondents) and % = percentage

In order to assess whether the socio-demographic factors have an impact on antibiotic use, Pearson's Chi-Square test of independence was performed to identify the association between two variables: age, gender, education, antibiotic use in the past six months, and job status and antibiotic use. The Phi and Cramer's V depicts the test of the association level between the variables. Overall, based on the Pearson's chi-square test results, apart from gender (p = 0.364), all other socio-demographic variables are associated with using antibiotics as the p-values were less than 0.05. Table 5 presents the results of multivariate analysis of variance.

A multivariate logistics regression was used to determine the relationship between socio-demographic variables and knowledge, attitude, and behaviour of patients regarding antibiotic use. The reference groups were chosen based on the group to which the researcher wanted to compare all other groups within the same category, thus interpretation of the results much easier. The males were less likely to have good knowledge, at-

Table 5: Summary of Multivariate analysis of Variance (MANOVA).

Factor	Category	Knowledge		Attitude		Behaviour	
Gender		P-Value					
	Male	0.051		0.118		0.068	
	Female	Reference Group					
	Overall	Chi-Square	Sig. Value	Chi-Square	Sig. Value	Chi-Square	Sig. Value
		3.020	.554	2.355	.671	1.520	.823
Age		P-Value					
	21 - 29	0.000		0.005		0.000	
	30 – 39	0.000		0.003		0.000	
	40 - 49	0.000		0.037		0.000	
	50 – 59	0.000		0.037		0.000	
	> 60	Reference Group					
	Overall	Chi-Square	Sig. Value	Chi-Square	Sig. Value	Chi-Square	Sig. Value
		10.640	.223	7.031	.533	6917.09	.000
Employment status		P-Value					
	Unemployed	0.000		0.037		0.000	
	Employed	Reference Group					
	Overall	Chi-Square	Sig. Value	Chi-Square	Sig. Value	Chi-Square	Sig. Value
		3.067	0.547	4.319	0.365	2.149	0.708
Educational Qualifications		P-Value					
	Matric	Reference Group					
	Certificate	0.565		0.560		0.974	
	Diploma	0.599		0.634		0.978	
	Degree	0.565		0.587		0.327	
	Masters	0.678		0.712		0.097	
	Doctor	0.713		0.761		0.097	
	Other	0.634		0.677		0.097	
	Overall	Chi-Square	Sig. Value	Chi-Square	Sig. Value	Chi-Square	Sig. Value
		18.104	0.947	13.422	0.859	14.104	0.825
Antibiotic usage in past 6 months		P -value					
	Yes	0.288		0.069		0.758	
	No	Reference Group					
	Overall	Chi-Square	Sig. Value	Chi-Square	Sig. Value	Chi-Square	Sig. Value
		1.581	0.812	1.679	0.795	1.147	0.887
Work in medical field		P-Value					
	Yes	0.002		0.005		0.034	
	No	Reference Group					
	Overall	Chi-Square	Sig. Value	Chi-Square	Sig. Value	Chi-Square	Sig. Value
		4.093	0.394	3.713	0.446	1.071	0.899

titude, and behaviour on antibiotic usage than the females. It can be seen in Table 5 that neither of the variables (p = 0.051, 0.118 and 0.068 respectively) are statistically significant, as the p = values are greater than the significance value 0.05.

The knowledge and behavioural aspects across all age groups presented p = 0.000 (p - values are less than 0.05). When considering the attitude component, age group 21-29 years scored p = 0.005, age group 30-39 years scored p = 0.003, age group 40-49 years and 50-59 years scored p = 0.037. Therefore, the respondents aged 21 – 29, 30 – 39, 40 – 49, and 50 – 59 years old were likely to have good knowledge, attitude, and behaviour of antibiotic usage. The associations were significant, which is different from the reference group.

Based on the survey responses (Table 5), both groups of respondents that used or not used antibiotics in the past six months differed in knowledge, attitude and behaviour regarding antibiotic usage, but these results are not statistically significant (knowledge p = 0.288, attitude p = 0.069 and behaviour p = 0.758).

Knowledge did not differ across all educational qualification groups towards antibiotic usage (p > 0.05). Furthermore, the respondents aged 21-29 years (14.8%), 30-39 years (17.8%), 40-49 years (12.6%) and 50-59 years (8.8%) were in disagreement with the use of antibiotics during a sore throat. However, a small percentage (2.3%) of those aged 60 years old agreed to use antibiotics during a sore throat. The majority of the respondents in the age group 21-29 years (16.3%), 30-39 years (21.5%), 40-49 years (11.8%) agreed that antibiotic resistance is a global problem.

Discussion

The results indicate that antibiotics are frequently used in the community. This study has identified gaps in patient knowledge regarding antibiotic use. The knowledge factor sought to determine what the patients knew about antibiotics, their use and side effects and antibiotic resistance. The majority of the patients (80%) were aware that different antibiotics treated different diseases, which is higher than that reported in Jordan (32.9%), lower than Kuwait (91.8%) and comparable to Malaysia

(76.7%) [17,21,22]. This study revealed that 73% of respondents agreed that antibiotics are effective against viruses, consistent with figures published from studies in Kuwait, Malaysia, and New Jersey [17,22,25]. Almost half of the respondents believed that antibiotics speed up the recovery from coughs and colds and work on most coughs and colds, lower than the reported figures in Kuwait and Jordan [17,21]. The attitude factor evaluated what the patients feel. A large proportion of the respondents (n = 52; 39% and n = 40; 30% respectively) agreed to use antibiotics in cases when a cough persists for more than a week and if they have a sore throat. In this study and Namibia, patients prefer antibiotics for common cold symptoms, including sore throat and cough [20]. The majority (n = 98; 73%) failed to identify that antibiotics have no significant therapeutic effects on viruses.

Antibiotics do not work against infections caused by viruses, for example, the common cold or flu and fungal infections [2]. Hence, most of the community will access antibiotics and self-medicate when they experience a cough, sore throat, flu or the common cold. These results suggest a lack of knowledge that will significantly influence the probability of antibiotic misuse. The attitude findings indicate apparent misunderstanding and confusion related to the antibiotics' role and their cause of the disease (bacterial or viral). An antibiotic cannot kill viruses because viruses and bacteria have different structure, mechanisms and machinery to survive and replicate. Therefore, the antibiotic has no role in a virus. The patient taking an antibiotic in the presence of a virus will not be cured of the infection or not feel better instead, it will lead to high cost, undesirable side effects, and may contribute to antibiotic-resistant bacteria.

A high proportion (61%) of the respondents believed that antibiotic resistance is a global problem. The prevalence of knowledge about antibiotic resistance is considerably lower than the rates in Kuwait and Malaysia [17,22]. These results build on existing evidence that patients are aware of antibiotic misuse that leads to resistance but still continue to practice self-medication.

This study found that patients sometimes stop taking their antibiotics if they feel better (33%), which is similar to Kuwait's findings [17]. However, most (84%) patients agreed that they complete their antibiotics course; this score is higher than in Kuwait [17]. This practice concerning antibiotic use may put the patient at risk of relapse with resistant bacteria. When the antibiotic does not function, this results in a more extended infection period, more complicated infection, increased costs (more doctor visits and the use of more potent and more expensive medicines) and eventually possible death.

Furthermore, compared to the proportionality (44.3%) reported in Kuwait, the current study revealed that a smaller portion (31.8%) of the respondents disclosed a negative attitude to keep left-over antibiotics at home for future use [17]. The present study revealed that other sources of obtaining antibiotics include family members and friends. Moreover, 23.3% of Kuwait respondents get antibiotics from family and friends without advice from a prescriber, similarly to this study (20.7%) [17]. These findings demonstrated that a portion of the South Africans share used antibiotics with others hence, exposing the local community to antibiotic misuse due to possible self-medication.

Some of the disadvantages to keeping left-over antibiotics for future use include the antibiotics may be readily accessible to children and if taken may result in death, inappropriate storage conditions may alter the antibiotic making it inactive, polypharmacy, drug interactions, misdiagnosis, incorrect choice of treatment, antibiotic misuse or dependence [17,20-22]. The behaviour component evaluated the current practices on antibiotic use. A higher proportion of the respondents affirmed that they obtained information on antibiotic use from pharmacists than doctors. This highlights that doctors and pharmacists play an essential role in patient counselling and public education related to knowledge and attitude towards rational antibiotic use. One of the limitations of this study is that the respondents were chosen by the convenience sampling method, in a single facility, in a defined geographical location in one province in SA. The principal investigator recruited participants based on the study's inclusion criteria from the convenient subset of the population at large. This convenience sample did not produce representative results when needed to extrapolate to the South African population.

Despite these limitations, the current findings of this study have important implications for providing additional insights to community knowledge and attitude on antibiotic use, misuse and resistance, and healthcare professionals behavioural patterns. To better understand the implications of these results, further studies should take into account social practices and cultural environments related to antibiotic use. Further research is needed to establish the relationship between age, gender, employment status and educational qualifications and antibiotic use.

Conclusion

This research aimed to evaluate the impact of current knowledge, attitude and behaviour of patients regarding antibiotic use within a community pharmacy setting in SA. Based on the quantitative analysis, it can be concluded that socio-demographic, socioeconomic and sociocultural factors are important patient factors to consider when designing and targeting appropriate educational interventions campaigns and patient-healthcare provider communication tools in addressing rational antibiotic use.

Author Statements

Conflicts of Interest

The authors have declared that no competing interest exist.

Author Contributions

FS and SB conceptualised the study. SB conducted the research. SB drafted the first draft and contributed to the writing of the article. FS reviewed the data and the drafts and final manuscript.

Data Availability Statement

The data is available upon request from the authors.

Informed Consent

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

Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

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