

The Impact of Short Message Service on Intestinal Coccidian Infection Treatment in Adult Malaria Patients in the Funding Health District, Northwest Region, Cameroon: A Prospective Single Centered Cohort study

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Abstract

Malaria patients are on an increased risk of developing opportunistic intestinal coccidian co-infections, making effective diagnosis and treatment of the utmost importance in clinical practice. In Cameroon the effectiveness of the diagnosis in this population is still not clear. This study aimed at testing the efficacy of motivational text messages in improving adherence to coccidian infection treatment in adult malaria patients attending health facilities in Funding Health District, Northwest, and Cameroon.

Methods: This was a prospective, cross-sectional, single centre study that included malaria patients co-infected with coccidian parasitic diseases-Cryptosporidiosis, Isosporiasis and Cycloisporiasis between April and December, 2022. Exclusion criteria were patients diagnosed with malaria infection only, and those who had been on anti-malaria and/or anti-parasitic drugs two weeks prior to consultations. Sixty-four (64) patients drawn from 16 health facilities were enrolled into the study, identified by demonstrating the presence of the Plasmodium parasite in Giemsa blood stained and observed under the microscope. They provided stool samples which were further subjected to wet preparation and formol-ether concentration technique to detect opportunistic intestinal parasites.

The intervention phase consisted of a using short message service (SMS) communication with malaria patient co-infected with intestinal coccidian infection. The cohort was then followed up at three intervals before the final evaluation on the 14th-day. Follow up with SMS and phone calls was done after 12 hours, 48 hour and at two weeks (day 14). Two outcome variable measures were: treatment compliance and medication adherence and the overall health status. Both assessments were based on patient self-report. Pearson's Chi-Square (χ^2), student t-test and binary logistic regression were performed as part of the statistical analysis. Statistical significance was set a P-value<0.05.

Results: A total of 64 patients were included in this study. The median age was (N=64, 41.22±16.570) years, with females (n=45, 70%), more than males (n=19, 30%). Among those that received the text message, 52% (33/64) replied to the SMS within 12 hours, 31% (20/64) reacted within 48 hours, 11% (7/64) after 48 hours, and 8% (4/64) were lost to follow up. Replying to short message service was significantly associated with (P=0.024) with medication adherence. At the end of the study, the rate of medication adherence was 44/64(69%) in the study participants. Good medication adherence was observed only in the 56-65 (91.7%) years. Suboptimal adherence was observed in the age groups 26-35 years 6/10 (60%), >21≤ 25 (78.6%), 36-45(53.8%), and 56-55(54.5%).Poor medication adherence was observed in the ≥ 66 (25%) age group. However, poor medication adherence was observed only in the ≥ 66 (25%) age groups. Reasons for non-medication adherence significantly affected treatment (P-value=0.006) outcomes, with migration being the most prevalent (16%) factor affecting medication adherence.

On assessing treatment outcomes in relation to socio-demographic factors, males were more likely to have their health conditions improved compared to females, the skilled participants were also more likely to have clinical outcomes improved compared to the unskilled, those not married were equally more likely than the married and as well as those who have had a least primary level of education compared to those who did not attend primary school. Participant's ≤ 45 years were more likely to improve compared to those > 45 years of age.

After adjusting for cohort of participants whose clinical conditions improved as confounder, results showed marital status significantly decreased in association between medication adherence and non-resolution of symptoms among the cohort of participants whose clinical condition did not improved after completing treatment; AOR 0.202(95% CI: 0.048-0.854) P-value=0.030. Adherence and compliance to treatment showed a significant association with a reduction in coccidian infection χ^2 (df) 9.876(2), P-value 0.007.

Conclusion: The use of ehealth services in patient care improves medication adherence hence health outcomes in adult patients with multiple infections. Marital status or family support should be considered as a key determinant factor when providing counselling services aimed at improving medication adherence.

Keywords: Text messages, adherence, treatment outcomes, coccidian infection, adult malaria patients.

Introduction

The use of new technologies where short message serve (SMS) in healthcare delivery has been one of the priority recommendations of the World health Organization [1]. This is important in settings where many factors such as distance, cultural events, prevents many from accessing essential drug compliance and adhering to treatment, making parasite resistant to drug even more challenging. Drug resistant to malaria treatment in association with other parasitic co-infections have been among those faced with this problem. Treatment of malaria patients co-infected with intestinal coccidian parasitic infections in humans have emerged and with it diseases clinically characterized by diarrhea which can be self-limiting or life threatening in certain circumstances. Initially these parasites were recognized as a major cause of diarrhea in immune-comprised host have been associated with zoonotic and waterborne transmissions [2]. Diarrhea diseases that have frequently been associated with malaria infections are cryptosporidiosis, isosporiasis and cyclosporiasis and the risk morbidity and mortality are high with Human Immune deficiency virus (HIV) infected individuals at much higher risk than Non-HIV individuals [3].

More than 6 billion incident diarrhea episodes were reported in 2017, with 1.5 million deaths making it the 5th leading cost of years of life lost [4]. Diarrhea remains the 3rd leading cause of death in children with nearly half a million attributable deaths yearly [5]. In the past two decades however, diarrhea has been on the gradual decline thanks to public health advances including vaccines and improved water and sanitation [6]. Disease burden caused by opportunistic intestinal parasites globally have been underestimated [3] as just about 1% of over 700,000 cases that occur annually in the in the United States of America (USA) are reported. However, recent studies using advanced techniques are able to detect 15-20%, especially *Cryptosporidium* in childhood diarrhea [7]. Enteric micro-organisms such as bacteria, viruses and protozoan induced diarrhea that can be successfully managed. Others are often characterized by clinical symptoms whereby pathogen-specific treatment is indicated [8]. Coccidian parasites develop within small intestine but may also be found throughout the gastro-intestinal tract. Symptoms of watery diarrhea and malabsorption increase electrolyte lost due to increase intestinal permeability and the severity of the diseases correlates with altered intestinal permeability [9]. Being HIV and AIDs, cancer, the elderly, pregnant women, have an increase susceptibility to coccidian parasitic infection [10-13]. As such, patients with malaria and these additional conditions are not only at a greater risk for severe forms of coccidian infection but are also associated with higher mortality rates [14-17]. However, no data is available on the number of malaria patients with coccidian co-infections. In Cameroon treatment for malaria is administered following WHO recommendations of 2011[18], and adopted by the Cameroon Government in 2013 [19].

For the treatment of coccidian infection a range of therapeutic treatments are available [20]. Nitaxoxanide is use in treating Cryptosporidiosis, viral, and bacterial infections, though its effectiveness is still questionable [21]. Alternative drugs have been proposed and cotrimoxazole and ciprofloxacin have been widely used for the treatment of symptoms associated with *Isospora*, and *Cyclospora* infections.

The purpose of this work is to evaluate the effectiveness of mobile phone short message service (SMS) on two health outcomes among adult malaria patients placed on intestinal coccidian parasite treatment. The outcome variables of interest are medication adherence and perceived clinical outcomes.

Material and methods

Study area

Fundong is one of the eighteen (18) health districts (HD), in the Northwest Region of Cameroon. It is located between latitude 6° 4' and 6°23' to the North of the equator and longitude 10° and 10° 33' to the East of the Greenwich Meridian and its attitude ranges from (800-2500m) above sea level [22]. Fundong Health District has twenty one health areas, and is located on the western slopes of Kilum-Ijim forest reserve in Mount Oku with a population estimated at about 232,963 inhabitants with HIV, malaria and intestinal diseases being major health concern of Public Health Authorities [23]. Sixteen (16) health facilities located in the Health District were involved in data collection for this study.

Study design

This was a prospective, cross-sectional, single centre study approved by the Institutional Ethics Committee of the Faculty of Health Sciences University of Buea, Southwest Region Cameroon. The reference number was 2022/1614-01/UB/SG/IRB/FHS, of 26th January, 2022. The study was carried out between April and December 2022. Malaria patients provided stool samples and were tested for the presence of opportunistic coccidian parasites. Coccidian parasite infection was confirmed by the presence of oocysts in stool sample. Patients were followed up with short message services and assessed for medication adherence and perceived clinical outcome.

The study population

Adult malaria patients were recruited into the study. Voluntary counseling's and testing for HIV and AIDs was also offered as an additional package for the study. Malaria patients co-infected with HIV were referred for follow up tests at the appropriate referral treatment centre and would usually return for renewal of highly active anti-retroviral therapy (HAART) every two-three months.

Study assessment and outcome measures

It Pretested questionnaire ensured the data collected was consistent and accurate. Onsite training ensured the consulting nurse administered the questionnaires to eligible and consenting participants who fulfilled the inclusion criteria. Each survey questionnaire took approximately 5-7 minutes to complete. Information was recorded on the following: demographic factors, malaria status, coccidian result and type, patient travel history in the last two weeks prior to consultation were explored.

Sampling techniques and data description

A convenient sampling technique was used to recruit participants visiting health units across the 16 different sites. The 16 health units were operational each day of the week from Mondays to Sundays receiving and treating patients for various illnesses including malaria. The number of study sites were selected in each health area based on health area population using probability proportionate to sample size. Health facility in each area were selected consecutively based patient consultations. The first being the one with the highest patient

consultations per month in the health area, the second being the one with second highest consultations in the health area until the required number of health facilities was attained.

Consecutively participants who fulfilled the inclusion criteria were selected. Overall, 330 malaria patients were recruited into the first phase of the study. Among the 330 malaria diagnosed cases, 64 were eligible for the study with confirmed positive intestinal coccidian parasite infection. The 64 constituted the cohort for the intervention study after the cross sectional survey. Their intervention package consisting of standard care and SMS. Those diagnosed of malaria test result only received standard care but not SMS and were therefore not eligible for the intervention.

As soon a positive coccidian test result was confirmed, the patient was sent a text message through their mobile phone number they provided at the outpatient department. The message informed patients of the confirmed coccidian parasites infection in their stool samples, encouraged the patient to engaged, comply and complete treatment. The patient was then followed up at three intervals during duration of treatment to assess outcomes of the two variables of interest. The study intervention which consisted of three stages:

Pre-intervention stage

The baseline data was collected upon the first contact with malaria patient using a socio-demographic questionnaire. Data on age, gender, education, residence and telephone numbers were recorded. Counselling was then provided on malaria and intestinal parasite prevention and control. Participants were then instructed on how to collect stool samples for coccidian parasite examination.

Intervention stage

On declaration a positive intestinal coccidian test for a patient, an SMS was sent to the patient diagnosed with intestinal infection in the stool sample between 8.a.m and 2.p.m each working day of the week in English. Each SMS contained laboratory results, type of intestinal infection, where to access treatment, and the importance of strictly adhering to treatment as prescribed. Issues related to HIV infection were addressed by trained counsellors. The two-way communication between the patient and research team made no mention of HIV status, but encouraged participants to flash back or ‘beep’ to acknowledge receipt of the SMS to broader the conversation. Reminder SMS and calls were done at four intervals during the course of treatment for each participant recruited into the study: Twelve (12) hours, forty eight (48) hours and on the next day following expected the date of completing treatment usually day fourteen (14th) for most of the participants. The two-weeks follow up ensured the patients understood the message, was involved in the conversation, and was engaged, compliant and seeking treatment.

Post intervention stage

The evaluation of the effect of the SMS on access and medication adherence involved two outcome variables completed treatment, where the patient answered either “yes” or “No” after complete follow up; Clinical outcomes was also based on patient self-report and was either reported as ‘improved’ or ‘did not improved’ after completing treatment. Each patient was followed up for 14 days duration in which they were expected to complete any treatment of opportunistic

intestinal coccidian infection. It was also a duration in which the effect of the intervention (SMS and its content) is expected to have been fully established in the patient. Factors that served as hindrance to their effective compliance to treatment as described in [24] were also assessed. Perceived health condition was recorded as a) improved b) not improved as similarly described in [25].

All 16 health facilities involved in the study employed two algorithms for *Plasmodium* specie identification. Microscopy and RDTs) as recommended by WHO using accredited standard operating procedure for detection of the malaria parasite [26]. Malaria test results were declared on the site and treatment initiated. Intestinal coccidian tests results were communicated via a mobile phone. All laboratory preparation techniques were performed by designated laboratory scientists, who also interpreted the results for intestinal coccidian parasites using a CDC assisted art gallery images [27]. They ensured the accredited standard procedures for collection, storage and transportation of stool samples were respected. All data from the 16 different health units were merged into one database and explored. The data was analyzed without distinction with regards to health facility in which the stool samples were generated.

Statistical analysis

Data analysis was done using Statistical Package for the Social Sciences (SPSS) Statistics version 26 (IBM Corp., Armonk, NY, USA). Frequency tables were generated for relevant variables, Categorical variables were analyzed using Pearson’s Chi-Square (χ^2) test. A binary logistic regression was used to calculate odds ratio (OR) and 95% confident interval (CI) was used to estimate risk factors. Descriptive statistics for all continuous variables were reported as mean (standard deviation). Statistical significance was set a P -value <0.05 .

Results

A total of 64 malaria patients co-infected with intestinal parasites were recruited. Shows. The mean age (\pm SD) of participant infected with coccidian parasite was 37.02(\pm 15.235) years. *Cryptosporidium hominis* had the highest prevalence of 13.9%, *Cycloisospora cayetanensis* 3.9% and *Isospora belli* 1.5%. Females participants were more infected 70% compared to males 30%. The highest intestinal coccidian infection 22%, was found in the <25 years old age group, and the lowest 6% in the >66 years and older age group.

Results showed, ($n=50$ (78%), of the participants completed their chemotherapy. $n=8$ (13%) were still undergoing treatment and, $n=6$ (9%) were lost to follow up. A majority 64% had their overall health status significantly improved, χ^2 (df) 6.751(6), P -value 0.045. Treatment was significantly associated with reduction in coccidian infection χ^2 (df) 6.751(6) P -value=0.007. Perceived clinical outcomes after treatment showed $n=32$ (64%), had significantly improved, $n=16$ (32%), χ^2 (df) 6.751(6) P -value=0.045

Assessing outcomes in relation to socio-demographic factors, results showed males were more likely to have the health conditions improved compared to females, the skilled participants were also more likely to have clinical outcomes improved compared to unskilled, those not married were equally

more likely than the married and as well as those who have had a least primary education (PE) level compared to those who had a Non formal education (NFE). Malaria patients on intestinal coccidian treatment who were 45 years and below were more likely to improve compared to those above 45 years of age. After adjusting for cohort of participants whose clinical conditions improved as confounder, results showed marital status

significantly influenced medication adherence for the cohort of participants whose clinical condition did not improved with AOR 0.202 (95%CI:0.048-0.854)P=0.030. The adherence to intestinal coccidian parasite medications among malaria patients was observed significantly associated with a reduction in coccidian infection χ^2 (df) 9.876 (2), P-value 0.007(Table 1).

Table 1: Effect of (SMS) on medication adherence and treatment outcomes on malaria patients co-infected with coccidian diseases (N=64).

Variable	Sub-variable	COR	95%CI	AOR	95% CI (For the cohort=did not improve)	P-value
Sex	Male	1.711	0.731-4.007	3.227	0.656-15.865	0.149
	Female	.806	0.577-1.126			
Occupation	Skilled	2.100	0.728-6.057	2.371	0.475-11.835	0.292
	Unskilled	0.817	0.618-1.079			
Marital status	Married	0.609	0.049-0.906	0.202	0.048-0.854	0.030
	Not married	2.800	1.172-6.692			
Education	NFE	0.817	0.341-1.957	1.822	0.375-8.855	0.457
	At Least PE	1.073	0.790-1.458			
Age group	21-45 years	1.528	0.963-2.424	0.238	0.567-8.840	0.250
	≥46 years	0.513	0.254-1.036			

Among the patient based factors affecting adherence to treatment, migration was advanced as the most prevalent accounting for 10 (16%). Among the health facility and program based factors, lack of e-health services was identified as the predominant hindrance factor 8(13%) among others such as

supply chain and proximity. Communication problems were identified as the main societal factors affecting medication adherence in malaria patients in the Fundong health District accounting for 7(12%). (Table 2).

Table 2: Reasons for delayed or non-adherence to intestinal coccidian parasite treatment in malaria patients in FHD, 2022.

Variables	Total(n)	%
Patient based factors		
Pregnancy	2	3
Travelling/Migration	10	16
Treatment cost	5	8
Loss of interest in treatment	1	2
Resolution of symptoms	3	5
Health facility and program based factors		
Proximity	4	6
Supply chain	1	2
Lack of e-health services	8	13
Societal based factors		
Communication problems	7	12
Literacy and economic problems	5	8

Discussion

There is an increased uptake and dependence on the mobile phones and it has an enormous potential to improve health outcomes. In the last two-decades, studies have investigated the use of text messaging to improve access, adherence and treatment compliance in the field of HIV and AIDs and other chronic conditions with varied result obtained [28-30]. Medication adherence to malaria and coccidian treatments using e-health can be improved in healthcare setting and in the community. Improving and providing counselling services can play an important role in reducing malaria and intestinal coccidian co-infection morbidity and mortality related illnesses leading to a reduction in the occurrence of drug resistant strains and waste of medications.

Malaria and the three emerging coccidian diseases are treatable [31]. The Centre for Diseases Control and Prevention (CDC), and the World Health Organization (WHO), and the Government of Cameroon have developed guideline for the case management of patients suffering from malaria and intestinal parasitic infections. However, these guidelines are rarely implemented specifically for intestinal coccidian parasite identification which are mostly of zoonotic origin [32] due to neglect. Cameroon is currently not implementing an integrated programme for malaria and intestinal coccidian parasites control. For treatment to be effective against the control of these diseases it has to be holistic in nature and backed up by health prevention and health promotional activities at level of primary

healthcare and in the community. Activities on prevention of re-infection, advice on drug adherence, followed by implementation of a series of behaviour changes approaches can sustain a healthy living in the population.

A tri-therapy Artemisinin-based combination therapies (ACT), Cotrimoxazole, and Nitazoxanide treatments, are used in treating malaria in the case of co-infection with coccidian diseases. Each patient receives trimethoprim-sulameththoxazole (TM P/SMX) as prophylaxis at a doses of one double-strength tablet (160mg of TMP and 800 mg of SMX mg SMX) three times a week for 7 days for those suffering from Cystoisosporiasis and Cyclosporiasis.

TMP/SMX is also sold under the trade names Bactrim, Septa and Cotrimoxazole. Patients infected with Cryptosporidiosis can be treated with nitaxoxanide or Amoxicillin or paromomycin [3, 8].

Although treatment with SMX can evidently cured these protozoans, however, TMP-SMX have been reported in clinical trials not suitable for patients having sulfonamide intolerance. In such cases ciprofloxacin have been recommended as a good alternative.

In our study, treatment significantly improved health condition of 32(64%), of the patients with a statistical significant difference observed ($P=0.05$) between medication adherence and perceived health outcomes $P\text{-value} < 0.05$. Elsewhere in Cameroon studies have equally shown that using ehealth services in healthcare delivery can improve medication adherence and treatment outcomes in patients [33-34]. These studies showed a significant relationship between medication adherence level and perceived good health of the respondents. Similarly, in Spain-based study (68%) of women attended breast screening cancer exams because they were sent a text reminder three days before. This was higher when compared to those that were sent a physical letter [35]. In a systemic literature review article in [36] in which 162 articles met the inclusion criteria, the study found that all SMS reminder studies helped improved patient medical compliance and appointment reminders. The respondent realization of the usefulness of medication by heeding to the counselling instruction provided by pharmacist, prior to initiation into treatment. In our study some of the patients testified that they have been well informed about their disease conditions as result of using the mobile phone. One patient commented:

'I have googled to learn more about the disease that affected me on the internet and am now much aware of how I can avoid reinfection with the same disease in future. Through counselling I have learned some of the poor behaviour practices that exposed me in the past to the disease to get infected with the disease'.

An ethnographic study carried out across West Africa by Ware *et al.* [37] showed, the high perception of wellbeing has been the main driver for sustained medication adherence and quality of life. Providing counselling and other support services using cell phones have been successfully used at national level to support young people cope with unplanned pregnancies [38] in Canada.

Access to medication and subsequent treatment were largely successful because of the availability of the electronic devices

that facilitated communications with patients after consultation and subsequent follow up in the community after discharge. Our intervention was centred on Health Belief Model of behaviour change [39] whereby, providing health advice to patients remained the keystone in behaviour change communication and in patient recovery. This helps the patient avoid actions that could lead to reinfection and reduce multiple hospital visits. Several models have been developed to demonstrate the effectiveness of patient counselling in facilitating access to medication and improving on treatment outcomes such as the Knowledge-Attitude-Behaviour and the Bio-psychosocial models [40-41]. They have been useful in improving the health status of patients suffering from chronic illnesses. Failure in communication between healthcare provider and the patient can have a negative effect on access to and subsequent failure in completing treatment. Our study deployed a two-way communication strategy to encourage patients to have a feeling of concern of the healthcare provider towards their health thus making them feel valued [42]. This is similar to evidence in a meta-analysis which enhanced engagement of patients with healthcare provider with great influenced on treatment outcomes. Greater engagements ensures recipient acknowledge the receipt of the message or reply to the sender [42].

Age is a patient related factor that had no significant relationship ($P\text{-value}=0.447$) on treatment adherence in this study. The result are similar to the finding reported ($P\text{-value}=0.555$) in Nigeria by Bello [43] where age did not have a significant influence on medication adherence. In our study completing treatment and subsequent improvement in clinical outcome was significantly influenced by patient's marital status $P\text{-value}=0.030$. In a systemic review and meta-analysis Gast & Mahtes reported marital status and social support as significant predictors to medication adherence [44]. In our study migration related acquired co-infection was (27/64, 42.2%). The socio-political crisis that hit the area in 2016, caused mass movement of the population to escape violence confrontation between security forces and separatist fighters. The population was displaced to area where the risk of infection with intestinal parasites or acquiring diarrhoea diseases was high.

Furthermore, in decreasing order, migration was observed as the most prevalent patient based factor that significantly affected adherence to treatment (16%) ($P\text{-value} = 0.001$). This was followed by health facility or program based factors in which lack of e-health services was the most prevalent affecting 8(13%) of patients and societal based factor in which problems link to communication were the most prevalent accounting for 12%. Aminde *et al.* [45] reported different higher rates such as forgetfulness (55.6%), lack of finances (38.2%), and disappearance of symptoms (14.2%), among non-adherence in adult patients in Cameroon. Similarly, Adidja *et al* [46] reported forgetfulness, multiple daily doses, financial constraints and adverse drug effects as predictors to non-adherence. In some health facilities the drug of treatment was sometime unavailable in the drug store causing some of the patients to delay coming back and subsequently abandoning treatment. Nitaxonanide use for the treatment of Cryptosporidial infections was largely unknown and absent in most Health facilities. These problems linked to supply chain and awareness of the diseases adversely affected the control of co-infection in the Health district. The chief of a health centre in an interview said:

“We have never bothered in making request for medications specific to coccidian treatment because we do not have adequate knowledge on it nor the diseases condition to treat. However, for malaria because it’s very common and widely known the treatment drugs are available”. The other host specific factors affecting treatment included pregnancy and financial constraint and also the HIV status. A woman was only required to take cotrimoxazole in the first trimester of pregnancy otherwise, wait until after giving birth.

More than twenty five percent (25.9%) of respondent were diagnosed HIV positive. Stigma associated with HIV, is one of the causes of poor medication adherence as indicated in two separate studies [47-48]. Confidentiality issues related to HIV and disclosure were not up held in this study, might have prevented participants not to return for medication as have been described in [43]. Sixty nine 44/64(69%) percent of the patients completed their treatment within specified duration. This was suboptimal compared to the World Health Organization recommended $\geq 80\%$ threshold mark as described in Baumgartner et al. [49]. It is estimated that more than half of the patients in Africa do not adhere to their medication prescriptions, the consequences are poor health outcomes, increased healthcare costs, and even preventable deaths.

Sixty nine 44/64(69%) percent of the patients completed their treatment within specified duration. This showed a suboptimal medication adherence rate in the study participants. It is estimated that more than half of the patients in Africa do not adhere to their medication prescriptions, the consequences are poor health outcomes, increased healthcare costs, and even preventable deaths.

Rates of medication ranges from 21 to 71% across different treatment and conditions [49-50]. In Africa a systemic review and meta-analysis between 2010 and 2021 revealed a medication non-adherence rate as high as 62.5% [51], In South-western Vietnam a study showed a higher medication adherence rate of 75.7% [52], whereas the global medication adherence rate remains at 45.3% [53]. Our estimates relied on patient self-reporting which might be prone to patient overestimation of adherence. Other methods such as pill counts, or direct observations of patients are expensive and laborious. The methods of estimation, and the target population accounts for the differences in rates obtained.

Our study showed that treatment correlated positively with a reduction in intestinal coccidian infection in the respondents. This similar to what was obtained in [8]. Sixteen (16) health facilities were involved in the study with quality of healthcare services provided different from one health setting to another. For example charging different fee for the same drug could affect patients facing financial constraints. The study site is located in the Region that is among the poorest in the country [54]. Similar studies have associated low economic status with lower adherence rates [43, 56]. Close proximity could be viewed as a factor that enhance access hence facilitating medication adherence, but it could also serve a cause of non-adherence [37]. This is especially for patients whose health status disclosure could be an issue such as HIV and AIDs. However, long distance also hinder adherence by 6%, especially if the patient had to revisit the same health facilities to access medication and could even be greater on adherence if the symptoms were not life threatening as was reported by 5% of the respondents [54].

Conclusion

The use of short message service reminders improves medication adherence and significantly improves perceived health outcomes in adult patients with multiple emerging infectious diseases. Health facilities do not need big budgets to include their communication strategy in order to build trust and confident with their users. This can be achieve by tailoring the technology to address the gap between the needs of thee client on hand and needs of the healthcare provider especially in the way that they operates.

Competing interest

The authors declared that they have no competing interests.

Ethic approval and consent to participate

The study protocol was approved by the Faculty of Health Sciences Institutional Review Board (FHS IRB). Administrative authorization was gotten from the Regional Delegation of Public Health for the North West Region, the District Medical Officer (DMO) for Fundong Health District and Chiefs of centre for the various health facilities where data was collected.

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Authors’ contributions

ANL conceived designed and coordinated the study. JFA, participated in the design of the study, review statistical analysis and revised the paper, BPT, participated in the design of the study, review statistical analysis and revised the paper, FPA participated in data collection, took part in the analysis and interpretations, and conducted the literature search and review and wrote the final draft of the paper. All authors read and approved the final paper.

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