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Acceptability of text messages and knowledge change for cervical cancer screening: a Tanzanian mixed methods study

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ABSTRACT

Objectives To investigate the acceptability of a text message intervention and evaluate if text messages could increase knowledge of cervical cancer and screening.

Design This study was a substudy of a randomised controlled trial that used a mixed methods research design combining a quantitative questionnaire dataset and qualitative interview data. A before and after assessment was made of questionnaire responses. Acceptability was measured on a 6-point Likert scale and knowledge was measured through 16 binary true/false knowledge questions concerning cervical cancer and screening. Qualitative data were coded using a combined inductive–deductive approach.

Setting Ocean Road Cancer Institute in Dar es Salaam as well as Kilimanjaro Christian Medical Center and Mawenzi Regional hospital in the Kilimanjaro Region in Tanzania.

Participants Human papillomavirus (HPV) positive women who had been randomised to the intervention group and received educative and reminder messages. Qualitative interviews were conducted with a subgroup of women in the intervention group.

Interventions 15 one-way educative and reminder text messages.

Results A total of 115 women in the intervention group responded to both the baseline and follow-up questionnaire. Overall, women found it highly acceptable to receive text messages, and there was a trend towards acceptability rising between baseline and follow-up (mean: 0.22; 95% CI 0.00 to 0.44; p=0.05; t-statics=1.96). A significant increase in acceptability was found among the lowest educated and those who had not previously been screened. The qualitative interviews showed that the underlying reasons for the high acceptability rate were that the women felt someone cared for them and that the text messages were for their own benefits. The text messages did not improve the women's knowledge on cervical cancer and screening.

Conclusions Educative and reminder text messages are highly acceptable among HPV-positive Tanzanian women; however, they do not increase the women's knowledge of cervical cancer and screening.

Trial registration number clingov (NCT02509702).

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This is the first mixed method study in Africa that investigates the acceptability and knowledge levels among cervical cancer screening clients who have received one-way text messages.
⇒ The mixed method approach allows for the qualitative data to provide an in-depth understanding of the quantitative results on acceptability.
⇒ The knowledge questionnaire was developed with inspiration from other similar studies and pretested on health personnel prior to the study starting but were not validated.
⇒ Few women responded to follow-up questionnaire, which led to a high amount of missing data that weakened the data analyses.

INTRODUCTION

Globally, cervical cancer is the fourth most common type of cancer with approximately 600 000 new cases in 2020. Further, more than 340 000 women die from cervical cancer every year, and more than 85% of these deaths occur in low-income and middle-income countries.[1] Cervical cancer is a major health issue in Tanzania and the most common type of cancer. A total of 40.7% of all new cancer cases were cervical cancer cases among Tanzanian women in 2020 with an age-standardised incidence and mortality rate of 62.5 and 42.7.[2]

To obtain a form of cervical cancer control, prevention is needed. Primary prevention of cervical cancer includes vaccination against high-risk human papillomavirus (HPV), secondary prevention is early accurate detection of the illness through screening and treatment of precancerous lesions, while tertiary prevention includes correct and effective treatment and medicine against the disease.[3]

Primary prevention is still a relatively new concept in Tanzania and since 2018, 9–14 year-old girls have been offered the

quadrivalent vaccine.[4] Hence, most Tanzanian women still depend on secondary prevention through screening programmes.[5] However, due to lack of knowledge and misconceptions about cervical cancer and HPV, most Tanzanian women do not attend screening programmes.[6] Further, women who do attend screening find it challenging to attend follow-up examinations. A qualitative study from 2019 found that women who had tested HPV-positive in relation to a patient-initiated screening found it challenging to attend a follow-up examination due to time constraints caused by infrastructural challenges and waiting time at the clinic, the preventive nature of the screenings, financial aspects and the gynaecological examination.[7]

Today, most of the Tanzanian population have access to a mobile phone and in 2019, there were 82.2 mobile subscriptions per 100 capita in Tanzania.[8] One way to increase screening uptake and attendance to follow-up screening among women at risk of the disease could be to increase women's knowledge of cervical cancer through educational and reminder text messages.[9] Text messaging is an easy and affordable way to reach the women and inform them of upcoming appointments and provide basic health information so that they can better understand the importance of screening attendance and follow-up examinations.[10] However, it is unclear if women, who attend a sensitive appointment such as cervical cancer screening, find it acceptable to use their mobile phones as such a health tool.

Therefore, the aim of this study was to investigate the acceptability of receiving one-way educative and reminder text messages for a follow-up appointment among HPV-positive Tanzanian women. Further, the study aimed to investigate if such messages could increase the level of knowledge regarding cervical cancer and screening.

METHODS

This study is a substudy of the randomised controlled trial 'Connected2Care' (NCT02509702) where HPV-positive women were randomised to a text messages intervention or standard care (control). The main objective of Connected2Care was to assess the effect of text messages on attendance to a follow-up cervical cancer screening appointment in Tanzania, these findings have been published elsewhere.[11] Further, a qualitative study was conducted post trial among women in the intervention group to investigate (1) the causes of (non)attendance to a follow-up screening, and (2) how women perceived the text message intervention. The qualitative findings on causes to non-attendance have previously been published in this journal.[7] This study concerns the remaining qualitative data and combines it with a quantitative questionnaire dataset collected at baseline and follow-up among the women in the intervention group through a mixed methods research design.

Data collection

The quantitative data were obtained from the *Connected2care* trial,[11 12] which is a substudy of the Comprehensive Cervical Cancer Prevention in Tanzania (CONCEPT) cohort study.[13] The data consisted of questionnaire data collected at enrolment (baseline), where the women were screened for cervical cancer, and at a follow-up appointment scheduled for 14 months post enrolment. *Connected2care* was an unblinded, multicentre, parallel-group randomised controlled trial that enrolled women, who participated in patient-initiated cervical cancer screening at three different screening clinics in Tanzania: (1) Ocean Road Cancer Institute (ORCI) in Dar Salaam, (2) Kilimanjaro Christian Medical Center, and (3) Mawenzi Regional Hospital in Moshi. Eligible women for the trial were 25–60 years of age who tested high-risk HPV-positive at the enrolment screening. HIV positive women were over sampled due to other objectives in the cohort study.[13] Women were excluded from the overall CONCEPT cohort, if they were pregnant or menstruating on the day of enrolment, had previously had a hysterectomy, cervical cancer or precancerous lesions. Further women were excluded explicitly from the *Connected2Care trial* if they did not own a private mobile phone, had provided an invalid phone number, or were not informed about their positive HPV test result. The intervention group received standard care plus one-way text messages while the control group only received standard care. An example of an educational text message was, 'Hello! We are here to help you. Cervical cancer is the most common type of cancer and the main cause of cancer-related death among women in Tanzania. Often women cannot feel cervical cancer and it shows no signs at an early stage. Therefore, it is important to attend screening even though you do not feel sick or have symptoms of cervical cancer. Thank you for reading our message'. An example of a reminder text message was, 'Hello! It is time for your screening appointment. Go to your health clinic tomorrow. When you go to your screening appointment it will help you stay healthy and free of cervical cancer. We are here to help you. Thank you for reading our message'. A detailed description of the trial methodology can be read elsewhere.[11 12] The intervention group was sent 15 text messages over a period of 10 months; there were five appointment reminders and 10 health educative messages. The reminder messages were sent 14, 7, and one day before the appointment for the follow-up screening and one and 7 days post this appointment. The health educative messages were sent once per month and contained information regarding symptoms of cervical cancer, screening and risk factors for cervical cancer.[11 12] At baseline, the participants were asked a series of 16 true or false knowledge questions through a questionnaire, which were repeated at their follow-up appointment (online supplemental file 1). The questionnaire was answered during a structured interview with a study nurse. The knowledge questionnaire only provided a 'true/false' option and not a category for 'I do not know'. However, in practice, the study nurses allowed

the respondents to answer 'I do not know' by leaving the item empty. Further, the questionnaire also contained a 6-point Likert scale where the participants were asked to rate how acceptable they found it to receive one-way text messages. Additionally, the follow-up questionnaire contained elaborative questions concerning acceptability and recommendations for future text message studies (online supplemental file 1).

The qualitative study was an interview-based study that consisted of semistructured individual interviews. The interviewees were (1) a subgroup of participants from the trial intervention group, who were interviewed after the intervention period had finished, and (2) cervical cancer screening nurses from ORCI. The interviews were conducted by a female researcher (DSL). The screening nurses were interviewed in English, and the screening clients were interviewed in Swahili with direct translation from Swahili to English through a female translator. The interview guide consisted of 30 questions concerning the acceptability of receiving text messages and causes for attending cervical cancer screening (online supplemental file 2). The setting for the interviews was based according to the preferences of the screening clients and was either a private room at the ORCI or the women's homes. If the interview was conducted at ORCI, participants were compensated financially for transport expenses. All interviews were tape-recorded and afterwards transcribed by a professional Tanzanian transcriber, who also served as validator for the translation of the interviews.[7]

Data analysis
The quantitative data was analysed using STATA IC V.16.1[14] and there was access to all raw data. Participants in the intervention group, who did not respond to follow-up questionnaire, were excluded from the analysis. Descriptive characteristics of participants who responded to the questionnaires and participated in the interviews were summarised. The difference between the responses to the knowledge questions pre intervention and post intervention was compared using the McNemar's test. As missing items were equivalent to 'I do not know' in the knowledge questionnaire, missing values were recategorised into the wrong answer (ie, if the correct answer was 'true', missing was categorised as 'false'). Further, one questionnaire item was excluded from the analysis as the question was ambivalent (Q11: You can get cervical cancer through sexual intercourse). Further, the acceptability Likert scale scores pre/post intervention were compared using a paired t-test. Additionally, explorative analyses were conducted on the association between change in acceptability score and sociodemographic characteristics. Additional data on other types of acceptability were summarised.

The qualitative data were analysed using NVivo12 (www.qsrinternational.com). Grounded theory was used as a guidance tool for the analysis, and data were coded using combined inductive–deductive coding. The main themes were deducted from the interview guide and supplemented with themes that inductively arose from the transcripts. The transcripts were anonymised and during analysis each transcript ID was replaced by the top 17 names for women in Tanzania. Further, 'she' was replaced by 'I'.

This study is reported according to the Mixed Methods Article Report Standards.

Patient and public involvement
Clients were not involved in the design or conception of the study.

RESULTS
A total of 358 women were randomised to the text message intervention group. Of these, 275 attended their follow-up appointment, yet only 84 women attended their follow-up appointment within the trial period while the remaining attended their follow-up appointment after being traced using various tracing strategies (figure 1). Among the women who attended the follow-up appointment, 160 women did not respond to the questionnaire items on knowledge and acceptability, leaving 115 women eligible for the quantitative analysis.

The mean age among participants was 39.4 years (SD 8.3); 65% (n=75) were Christian, 34% (n=39) Muslim and 1% (n=1) did not reveal their religion. Further, 57% (n=66) of the women were married or cohabiting. The
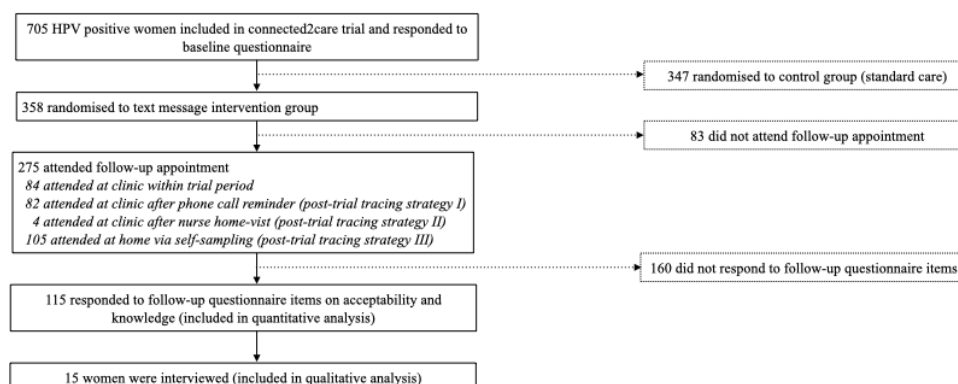
Figure 1 Flow chart of the mixed method study. HPV, human papillomavirus.

Table 1 Baseline characteristics of participants

Characteristics	Questionnaire data (n=115) n (%)	Qualitative data (n=15) n (%)
Age		
Mean	39.4	38.6
Max.	60	27
Min.	25	55
Region		
Dar es Salaam	61 (53.0)	15 (100)
Kilimanjaro	54 (47.0)	–
Education		
Primary education	73 (63.5)	10 (66)
Secondary education	32 (27.8)	4 (27)
University/college	10 (8.7)	1 (7)
Religion		
Christian	75 (65.1)	5 (33)
Muslim	39 (33.9)	9 (60)
Missing	1 (1.0)	1 (7)
Marital status		
Married/cohabiting	66 (57.4)	12 (80)
Single	22 (19.0)	1 (7)
Divorced/widow	26 (22.6)	2 (13)
Missing	1 (1.0)	–
Previously screened for cervical cancer		
Yes	37 (32.2)	3 (20)
No	78 (67.8)	12 (80)
HIV		
Positive	47 (41.0)	5 (33)
Negative	68 (59.1)	10 (66)

majority had primary education 64% (n=73) and 68% (n=78) had never been screened prior to the start of this study. A total of 73% (n=84) were HIV negative while 27% (n=31) were HIV positive (table 1).

Fifteen women were interviewed for the qualitative study and the characteristics of this subpopulation were similar to the overall intervention group, yet all of them resided in Dar es Salaam and more women were Muslim. Among the interviewees, 33% (n=5) were Christian, 60% (n=9) were Muslim and 7% (n=1) did not reveal her religion. The majority had primary education (66%), and most women were married or cohabiting 80% (n=12). Eighty per cent (n=12) had never been screened prior to the study and 33% (n=5) were HIV positive (table 1). The average interview lasted 36 min.

Acceptability of text messages

Overall women found it highly acceptable to receive educative and reminder text messages both prior to receiving the messages (baseline) and after receiving them (follow-up) (table 2). The primary analysis of change in acceptability score over time showed that the acceptability of receiving one-way educative and reminder text messages increased from baseline to follow-up, though the association was not significant (mean: 0.22; 95% CI 0.00 to 0.44; t=1.96) (table 3). Hence, women found it even more acceptable after receiving the messages compared with how they rated them prior to receiving them. When exploring the change in acceptability score according to sociodemographic characteristics, it was found that acceptability increased significantly between baseline and follow-up among women with the lowest education level (mean: 0.33; 95% CI 0.06 to 0.60; t=2.5) while this was not the case for women with higher education levels (table 3). Further, acceptability also increased among women from Dar es Salaam (mean: 0.26; 95% CI 0.01 to 0.52; t=2.05), Muslim women (mean: 0.38; 95% CI 0.03 to 0.73; t=2.20), single women (mean: 0.55; 95% CI 0.06 to 1.03; t=2.32), and women who had not previously been screened for cervical cancer (mean: 0.26; 95% CI 0.01 to 0.50; t=2.11) (table 3).

At follow-up, the women were also asked additional questions to further estimate the level of acceptability (online supplemental file 1), and the women's responses supported the notion that acceptability was high. Most women responded that they would like to continue to receive health education on their mobile phone (86%), that their husband/family were happy about them receiving health education on their mobile phone (77%), and that they would recommend a friend/family member to receive health education on their phone (85%) (online supplemental file 2).

Table 2 Comparison of acceptability Likert scores between baseline and follow-up

Baseline Follow-up	I do not like it at all	I do not like it	It is not okay	It is okay	I like it	I like it very much	Total
I do not like it at all	0	0	0	0	0	0	0
I do not like it	0	0	0	0	0	1	1
It is not okay	0	0	0	0	0	2	2
It is okay	0	0	0	1	15	10	26
I like it	0	1	2	5	17	15	40
I like it very much	0	0	2	3	11	30	46
Total	0	1	4	9	43	58	115

Table 3 Change in acceptability score between baseline and follow-up

Primary analysis	Mean (95% CI)	P value	t-Statistic
Change in acceptability between baseline and follow-up	0.22 (0.00 to 0.44)	0.05	1.96
Secondary analyses: change in acceptability according to sociodemographic characteristics	Mean (95% CI)	P value	t-Statistic
Age			
25–34	0.32 (−0.16 to 0.80)	0.18	1.36
35–44	0.14 (−0.16 to 0.43)	0.35	0.94
45–54	0.22 (−0.06 to 0.86)	0.08	1.79
<60	−0.4 (−2.28 to 1.48)	0.59	−0.59
Region			
Dar es Salaam	0.26 (0.01 to 0.52)	0.04	2.05
Kilimanjaro	0.17 (−0.21 to 0.54)	0.38	0.89
Education			
Primary education	0.33 (0.06 to 0.60)	0.01	2.5
Secondary education	0.03 (−0.44 to 0.50)	0.89	0.14
University/college	0 (−0.95 to 0.95)	1	0
Religion			
Christian	0.13 (−0.15 to 0.42)	0.36	0.92
Muslim	0.38 (0.03 to 0.73)	0.03	2.2
Marital status			
Married/cohabiting	0.29 (−0.01 to 0.59)	0.06	1.91
Single	0.55 (0.06 to 1.03)	0.03	2.32
Divorced/widow	−0.19 (−0.64 to 0.25)	0.38	−0.89
Previously been screened			
Yes	0.14 (−0.34 to 0.61)	0.57	0.58
No	0.26 (0.01 to 0.50)	0.04	2.11
HIV status			
Positive	0.17 (−0.16 to 0.50)	0.31	1.03
Negative	0.25 (−0.05 to 0.55)	0.1	1.66

During the interviews, the women were asked how they perceived receiving health information and appointment reminders as text messages on their private mobile phone. Four women did not explicitly state how they felt about receiving such messages while one woman, Happy, stated that she liked it because '[…]all the messages I received were useful to me'. Most women (n=10) stated that they felt very good when they received the text messages. Gladness elaborated and said that '[…] It was a big relief. I felt good [ed. about the text messages]' while Irene said that, 'I felt good because I wanted to know my health and understand the ways of caring about my health'. Further, some women felt that the text messages were a sign that the clinic staff cared and were concerned about them. For example, Winnie stated that

[…] It is for my benefit [ed. the text messages]. […] [ed. the appointment/screening] is for my own benefit because when you receive treatment there are two things: whether you have the disease or you don't have it. So, if you have cancer, you will be helped.

[…] I learned [ed. from the text messages] that this institution and the people care about us. (Winnie)

While Grace stated that, 'I felt well [ed. about the text messages] because I had the feeling that people are concerned about my health'. *(Grace)*

Knowledge about cervical cancer

Despite the screening clients expressing positive attitudes about receiving the messages, the statistical analyses showed that the text messages did not increase their knowledge about cervical cancer and screening, when comparing knowledge data from baseline to follow-up. More women answered item 5 (it is possible to prevent cancer), item 8 (a cervical infection can lead to cervical cancer) and item 16 (a virus called HPV causes cervical cancer) correct at follow-up compared with baseline. Yet, there was no change between baseline and follow-up for six other items and significantly more women who answered incorrect at follow-up compared with baseline for the remaining six items (table 4).

Table 4 Change in knowledge between baseline and follow-up

	Baseline		Follow-up				
	Correct n (%)	Incorrect n (%)	Correct n (%)	Incorrect n (%)	χ^2	P value	Direction of change*
Malaria (mosquito) causes cervical cancer (*false*)	101 (87.8)	14 (12.2)	109 (94.8)	6 (5.2)	3.56	0.06	🟡
Pain during urination can be a sign of cervical cancer (*false*)	72 (62.6)	43 (37.4)	39 (33.9)	76 (66.1)	16.3	<0.001	🔴
Q3: Cervical cancer is the most common cancer disease among Tanzanian women (*true*)	106 (92.2)	9 (7.8)	104 (90.4)	11 (9.6)	0.2	0.64	🟡
Q4: You can get cervical cancer from deep kissing (*false*)	101 (87.8)	14 (12.2)	52 (45.2)	63 (54.8)	38.1	<0.001	🔴
Q5: It is possible to prevent cervical cancer (*true*)	64 (55.6)	51 (44.3)	95 (82.6)	20 (17.4)	19.6	<0.001	🟢
Q6: Vaginal bleeding is the most common sign of cervical cancer (*true*)	68 (59.1)	47 (40.9)	69 (60.0)	46 (40.0)	0.0	0.89	🟡
Q7: Too much sun can lead to cervical cancer (*false*)	91 (79.1)	24 (20.9)	54 (47.0)	61 (53.0)	22.4	<0.001	🔴
Q8: A cervical infection can lead to cervical cancer (*true*)	83 (72.2)	32 (27.8)	105 (91.3)	10 (8.7)	12.7	<0.001	🟢
Q9: HIV-positive women have higher risk of developing cervical cancer (*true*)	93 (80.9)	22 (19.1)	97 (84.4)	18 (15.6)	0.5	0.47	🟡
Q10: Cervical cancer is often found at an early stage due to obvious symptoms (*false*)	32 (27.8)	83 (72.2)	12 (10.4)	103 (89.6)	9.1	0.00	🔴
Q12: Screening can detect cervical infections, so they do not develop into cancer (*true*)	105 (91.3)	10 (8.7)	105 (9.3)	10 (8.7)	0.0	1.00	🟡
Q13: Cervical cancer is the main cause of cancer-related death among Tanzanian women (*true*)	107 (93.0)	8 (7.0)	105 (91.3)	10 (8.7)	0.3	0.62	🟡
Q14: Cervical cancer is most common for women in the 20's (*false*)	36 (31.3)	79 (68.7)	14 (12.2)	101 (87.8)	11.0	<0.001	🔴
Q15: Itchiness in the vaginal area can be a sign of cervical cancer (*false*)	66 (57.4)	49 (42.6)	29 (25.2)	86 (74.8)	21.7	<0.001	🔴
Q16: A virus called 'human papillomavirus' (HPV) causes cervical cancer. (*true*)	65 (56.5)	50 (43.5)	98 (85.2)	17 (14.8)	23.2	<0.001	🟢

*Green=significantly more women answered item correct; yellow=no difference; red=significantly more women answered item incorrect.

Additional findings

At follow-up, women were also asked questions concerning mobile literacy and whether they shared the health education, which they received on their phone (online supplemental file 2). Overall, the women found the information in the messages easy to understand (88%), though 25% needed help from others to read the content. Most women knew how to read text messages on the phone (89%) and often sent and receive mobile messages (78%). Further, 70% stated that they shared the health education, which they received on their phones with others (online supplemental file 2). This topic was also discussed during the interviews, where approximately half the women (n=8) said that they shared the information with friends and relatives. Additionally, one stated that she did not share the information but told other women that they should go for screening. For example, Martha said that she shared the information with, 'My mother [and] my younger sisters. […] When I told them, my mother came for screening' while Happy stated that

> I didn't give them my phone to read the messages, but I shared the information by a word of mouth. I was telling and encouraging women to come for

check-up because early diagnosis is better because you can get cured. So, I used to share the information. [...] Friends, relatives, and my husband. (Happy)

Editha elaborated on how she thinks the awareness about the cervical cancer screenings could be increased. This should not only be through text messages but also through word by mouth

I think we, the women who come here for treatment, need to convince our fellow women to come here for screening because the longer they stay the bigger the problem grows to the extent that the situation becomes difficult to handle. [...] Slowly, they will understand and agree—especially if there is at least one person in a household who would convince her relatives. [...] We can use the women who come here to increase awareness to their neighbours. (Editha)

DISCUSSION

This study found that there was high acceptability about receiving one-way text messages that contained health information concerning cervical cancer and reminders for follow-up appointments among HPV-positive women. Further, acceptability rose after receiving the messages among women with the lowest education level, and women who had not previously been screened, which indicated that these types of messages may be most helpful to these groups of women. The main reasons for the high acceptability level were that the women wanted to learn how to protect their health and felt like the health personnel cared about them and their health. However, the study also found that text messages did not improve the women's knowledge about HPV and cervical cancer.

Strengths and limitations

A strength of this study is that it combines qualitative and quantitative data. The qualitative data give a greater explanatory depth to the findings in the quantitative data while the quantitative data generalise the in-depth findings of the interviews to a larger group of women. For example, we measured acceptability quantitatively through a Likert scale, which is a unidimensional and simplified method of measuring the concept, but we got an in-depth understanding of acceptability through our interviews and thereby understood the underlying reasons for why the women found text messaging an acceptable health tool. Another strength of this study is that the knowledge questionnaire was developed with inspiration from other similar studies on cervical cancer knowledge and pretested on health personnel, yet a limitation is that it was not validated or tested on screening clients prior to the study starting. Further, we did not pretest whether the women preferred one-way text messages or two-way messages. If that had been done prior to the study starting, we may have had a better understanding of how to remind and educate women best through text messages

and if for example, quizzes with knowledge questions that provide the women with the correct answers would have been more helpful in improving their knowledge. We recommend doing this in future studies.

Another limitation of this study is that few women returned for their follow-up appointment within the trial period; hence, most women participated in the follow-up through self-sampling in their homes (figure 1), which may explain why many of the women did not respond to the follow-up questionnaire on acceptability and knowledge as they may not have felt they had the time or were uncomfortable responding in their private homes. Women who did not respond to the follow-up questionnaire were excluded from this study, and the high loss to follow-up weaken the final analyses and calculations, due to more missing data and more statistical uncertainty. It is plausible that had more women responded to the follow-up questionnaire, the overall positive trend towards increasing acceptability of text messages after having received them would have would have become significant. Despite the interviewees overall were comparable to the intervention group, all interviewees were residing in Dar es Salaam; hence, the qualitative findings are only representative for the study population residing in Dar es Salaam. Finally, we had to rely on an interpreter for the interviews, and this may have limited the depth of the knowledge that were collected through interviewing.

Comparison with other literature

A recent trial from Ghana that investigated if text message interventions could improve reproductive health knowledge in adolescent girls found that educational messages that also contained a quiz—where the correct answer was sent after responding to the quiz—led to a 24% higher knowledge score among the intervention group compared with the control group. Further, the study found that the educational messages including the quiz led to a 11% higher knowledge score than educational one-way text messages that did not contain a quiz.[15] This indicates that text messages that aims to improve knowledge may be more effective if the participants are tested and given the correct answer afterwards instead of only sending one-way education as done in this study.

In line with our study, other studies have also found that text messaging is highly acceptable. A South African study from 2019 that investigated the acceptability of receiving a supportive text message for adherence to treatment for HIV among adolescents showed that 65% of the participants were willing to receive the text messages.[16] A Nigerian study found that 90.5% of their participants found it acceptable to receive text message reminders.[17] Additionally, a study from 2016, where they educated Bolivian farmers from a village in pesticide usage, found that the farmers newly acquired knowledge spread to farmers in the neighbouring villages.[18] Further, our qualitative findings showed that part of the reason why women found the text messages acceptable was because they perceived them as the clinic caring for their health. This is in line

with what was found in a qualitative study conducted as part of a text message trial in South Africa among patients with diabetes. The text messages did not lead to change in health outcomes, yet the patients found the messages to be acceptable and expressed that they perceived them as a source of support and care.[19] This may indicate that despite text messages not leading to a measurable effect in health outcomes, they may still have supportive function, which healthcare clients find useful.

Future perspectives

This study helps to understand how Tanzanian women perceive and feel about receiving health information and appointment reminders in the form of one-way text messages. It shows that the use of technology in the form of mobile health (mHealth) interventions could be a possible way to spread information faster and more broadly in a cheap and convenient way. Even though we did not find that the intervention increased cervical cancer-related knowledge, it showed that screening clients found them acceptable and as a way for the clinic to show that they cared for their health. Hence, we suggest that future mHealth studies do not solemnly measure the effect of mHealth in a quantitatively manner but also incorporate psychological and social aspects when judging the prospective and effects of such interventions.

When the interview participants were asked if they shared any of the health information they had received with anyone, several of the participants told that they did. The fact that the women shared the health information they received with other women could lead to more community awareness of the importance of the screening programmes. This is an aspect, which was out of the scope of this study to address, yet we recommend other mHealth studies to investigate this matter.

CONCLUSION

One-way text messages did not increase cervical cancer-related knowledge, yet Tanzanian women found it highly acceptable to receive such messages as they perceived it as a way of the health clinic to care for their health. It is plausible that use of validated knowledge questions and a text messaging system that allows women to test their knowledge and get the correct answer sent to their phone would be more effective in increasing women's cervical cancer knowledge. This should be investigated in future studies.

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