



**Investigating community ownership of a text message program to improve adherence to antiretroviral therapy and provider-client communication: a mixed methods research protocol**

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3 **Investigating community ownership of a text message program to improve adherence to antiretroviral**  
4 **therapy and provider-client communication: a mixed methods research protocol**  
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**ABSTRACT:****Introduction:**

Mobile phone ownership and use is growing fastest in sub-Saharan Africa, and there is evidence that mobile phone text messages can be used successfully to significantly improve adherence to antiretroviral therapy and reduce treatment interruptions. However, the effects of many mobile health interventions are often reduced by human resource shortages. Also, the research projects generating the evidence for health interventions in developing countries are most often conducted using external funding sources, with limited sustainability and adoption by local governments following the completion of the projects. Strong community participation driven by active outreach programs and mobilization of community resources are the key to successful adoption and long-term sustainability of effective interventions. Our aim is to develop a framework for community ownership of a text messaging program to improve adherence to antiretroviral therapy; improve communication between patients and doctors; and as a reminder for appointments.

**Methods and analysis:**

We will use the exploratory sequential mixed methods approach. The first qualitative phase will entail focus group discussions with people living with HIV at the Yaoundé Central Hospital in Yaounde Cameroon (6-10 participants per group). The second quantitative phase will involve a cross-sectional survey (n=402). Here polynomial multivariable regression techniques will be used to determine the factors associated with community readiness and acceptability of ownership. Data from both phases will be merged.

**Ethics and dissemination:**

1  
2  
3 Ethics approval will be obtained from the National Ethics Committee in Cameroon. Administrative  
4  
5 approval will be obtained from the Yaounde Central Hospital and the Ministry of Health. The results of  
6  
7 this paper will be disseminated as peer reviewed publications, at conferences and as part of a doctoral  
8  
9 thesis.  
10

### 11 12 13 **ARTICLE SUMMARY:**

#### 14 15 **Article focus:**

- 16  
17 • Text messaging to improve adherence to antiretroviral therapy and communication between  
18  
19 patients and providers  
20  
21
- 22  
23 • Community ownership of supportive programs  
24  
25

#### 26 27 **Key messages**

- 28  
29 • Benefits and strengths of community ownership of programs  
30  
31
- 32  
33 • Community readiness to own supportive programs  
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#### 35 36 **Strengths and limitations of study**

- 37  
38 • Robust study design based on mixed methods  
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- 41  
42 • Components of research unfold during the study and may affect initial planning  
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**INTRODUCTION:**

At the end of 2010 approximately 34 million people were living with the human immunodeficiency virus (HIV). Close to seventy percent of them live in sub-Saharan Africa even though this region represents only 12 percent of the world's population.[1] However, there has been a steady decrease in Acquired Immune Deficiency Syndrome (AIDS) related deaths as free antiretroviral therapy (ART) has become more available in recent years.[1] While governments and health systems in sub-Saharan Africa continue to invest in providing free access to ART, their efforts are hampered by health system weaknesses that prevent a continuous supply of ART and sub-optimal levels of adherence.[2] Relatively high levels of adherence are necessary to achieve the goals of ART such as viral suppression and immune reconstitution.[3] High levels of adherence will therefore lead to reduced morbidity and mortality in people living with HIV, and minimal development of resistant strains.[3-6]

In recent years the WHO has endorsed the use of cheap and effective technologies to improve health outcomes in low resource settings,[7] and there is emerging evidence on the role a mobile phone text message -short message service (SMS) can play in the management of HIV. Text messages can improve adherence to ART, reduce treatment interruptions and reduce viral load.[8 9] They are useful as appointment reminders and can improve communication between health personnel and patients.[10] Patients who receive them also report high levels of satisfaction.[8 11] These advantages, coupled with the rapid growth of mobile phone ownership and use in Africa,[12] make the SMS an important tool to improve care in people living with HIV (PLHIV). The research on mobile phone text messaging is somewhat nuanced by the complexity of the intervention. It is unclear how factors such as community phone ownership, content of message, timing of message; nature of message (two-way or one way) or source of the message (peers or hospital based) can influence the efficacy of mobile phone text messaging.[13] There is a need for further research for many of these unanswered questions.[14]

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2  
3 Cameroon has the highest rate of HIV in West and Central Africa, with a 5.3% prevalence in the adult  
4 population;<sup>[1]</sup> poor adherence rates and serious health system weaknesses that pose a threat to the  
5 management of HIV.<sup>[15]</sup> Recent reports suggest that PLHIV would like to receive text messages.<sup>[16]</sup> The  
6 communication channels opened by text messaging also serve as a platform to identify key individual  
7 and health system weaknesses that diminish the quality of care (Mbuagbaw L, Thabane L. Opening  
8 communication channels with people living with HIV using mobile phone text messaging: Insights from  
9 the CAMPS trial, 2013).

10  
11 Most successful health care programs are characterised by strong community participation.<sup>[17]</sup>  
12 Community participation has played a major role in the control of the HIV epidemic.<sup>[18]</sup> It should be  
13 encouraged because the programs will have better outreach; community contributions (money,  
14 manpower and material) can be mobilised and; more importantly, because communities have a right to  
15 take part in the decisions that affect their lives.<sup>[19]</sup> Community participation (in HIV programs) has  
16 often been limited to the less technical aspects. Apart from providing an organised front to defend the  
17 interests of PLHIV, they also take part in providing care, research, peer education and role  
18 modelling.<sup>[17]</sup> For newer interventions such as text messaging which is more structured and  
19 technologically oriented, the potential of community ownership needs to be explored.

20  
21 We expect to observe an overall acceptability and readiness to own a text messaging program but a lack  
22 of skills in how to manage one. Our findings will be used to inform initiatives aimed at up scaling the use  
23 of mobile phone technology to improve adherence to antiretroviral therapy and other chronic diseases  
24 in resource limited settings and how best community members can be involved in the process. At the  
25 end of the project we will develop a framework for transferring technology into the hands of the  
26 community and initiating a sustainable community-led project. The following groups of people will  
27 benefit from this project: PLHIV in resource limited areas; people living with other chronic diseases who

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3 can benefit from enhanced communication with the health system; and health workers and community  
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5 health workers who provide care for PLHIV.  
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9 The objective of this project is to determine how to set-up a community-owned text messaging program  
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11 by determining the readiness and acceptability of ownership among PLHIV at the Yaoundé Central  
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13 Hospital in Cameroon. We will proceed by collecting, analysing and comparing qualitative and  
14  
15 quantitative data. The findings from this mixed methods study will be used to establish a framework for  
16  
17 community ownership.  
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21 For the purposes of this paper, we define community ownership as a process in which the community  
22  
23 members design, manage and reap benefits from a project. We also acknowledge that in the course of  
24  
25 our research our definition may change.  
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29 The following research questions will guide the conduct of this study:  
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32 Qualitative research questions:  
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- 35 • Will PLHIV in Yaoundé, Cameroon accept community ownership of a text messaging program?
- 36  
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- 38 • How ready is the community of PLHIV in Yaoundé, Cameroon to take ownership of a text  
39  
40 messaging program?  
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42

43  
44 Quantitative research questions:  
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- 47 • What factors are associated with acceptability and readiness of community ownership of a text  
48  
49 messaging program among PLHIV in Yaoundé, Cameroon?
- 50  
51
- 52 • What proportions of PLHIV will accept and are ready to run a community owned text messaging  
53  
54 program?  
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Mixed methods research questions:

- Are the themes related to the opportunities and challenges involved in the community ownership of a text message project among PLHIV in Yaoundé, Cameroon generalizable to a larger sample of PLHIV in Yaoundé?
- In what ways do the qualitative and quantitative strands converge?

## **METHODS AND ANALYSIS:**

### **Study design:**

We will use an exploratory sequential design.[20] The exploratory sequential design is a two-phase design that starts with an initial qualitative phase followed by a quantitative phase. In the qualitative phase, we will identify individuals with experience in community ownership for in-depth interviews. The members of the associations of PLHIV and others with community level experience will be selected from the Yaoundé Central Hospital. This relatively small number of individuals will be interviewed to identify themes, ideas and concepts that will be used to guide the second quantitative phase. Data collected from the qualitative phase will be converted into variables that will be used on a much larger sample in order to generalise the findings to all the PLHIV in Yaoundé. This sample will be taken from the Yaoundé Central Hospital. See figure 1 for details on the procedures and products of the different strands of the study.

Figure 1: Overview of procedures and products of different strands

The exploratory sequential design is preferred for this study because of the following reasons. Firstly, the separation of the qualitative and quantitative phases makes it easier for our multidisciplinary team to work together and the separate methods and findings can be described easier. The anthropologists



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2  
3 and sociologists will be responsible for data collection and analysis in the qualitative strand. The themes  
4 that emerge from their analysis will be converted into variables and built into a questionnaire by both  
5  
6 groups. Secondly, the use of both qualitative and quantitative methods makes it more acceptable to  
7  
8 researchers from both domains. Even though the overarching goal is to merge and compare qualitative  
9  
10 and quantitative data, the findings from each domain still hold merit and can be interpreted separately.  
11  
12 Thirdly, it will be used to develop a measurement instrument. The data collection tool for the  
13  
14 quantitative phase will be developed from the qualitative strand. Items to measure community  
15  
16 readiness and acceptability of ownership will be framed based on the responses in the qualitative  
17  
18 strand. Lastly, it is a good design for generalizing qualitative research findings.[20]  
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25 On the other hand, organizing two separate strategies for data collection will be time-consuming.  
26  
27 Separate sampling techniques have to be applied for both strands: the sample of PLHIV for the  
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29 qualitative strand will be selected purposefully based on their experience with community activities,  
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31 while the quantitative strand will be probabilistic. Details on the quantitative phase will not be available  
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33 at the time of Institutional Review Board approval. The protocol we will submit to the National Ethics  
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35 Committee will contain explicit details about why the data collection tool for the quantitative strand is  
36  
37 unavailable.[20]  
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#### 42 **Rationale for design:**

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44 Despite these characteristics, the exploratory sequential design is the method of choice when the  
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46 variables that may come into play are unknown and when there is no guiding framework.[20] This  
47  
48 design has been used for complex research projects like mental health assessment in older adults,[21]  
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50 healthcare students' educational expectations,[22] health system research,[23] alcohol use among  
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52 people with liver disease and tobacco use.[24 25] Text messaging interventions are relatively new and to  
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3 the best of our knowledge community ownership has not been investigated for a text messaging  
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5 program.  
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9 In recent years, mixed methods research has emerged as a separate research paradigm-a seamless  
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11 blend of both qualitative and quantitative research methods. Even though it was not initially used on the  
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13 basis of its merits,[26] it is progressively gaining ground and acknowledgment in health research.[27] It  
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15 offers a “powerful third paradigm choice that often will provide the most informative, complete,  
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17 balanced and useful research results”. [28] In order to explore how PLHIV perceive text messages and  
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19 the eventuality of owning and managing a text message project we are going to use mixed methods to  
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21 identify common themes which arise and to subsequently generalise these findings to a larger sample.  
22  
23 The complex nature of the research question warrants the use of mixed methods to generate a rich and  
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25 complementary body of evidence to initiate a community-owned program. The methods used to initiate  
26  
27 community ownership need to be well spelled-out and should originate from a robust and expanded  
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29 body of evidence, which cannot be achieved by only qualitative or quantitative designs. We therefore  
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31 seek complementarity, initiation and expansion.[29] Figure 1 is a detailed flow diagram of the study  
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33 procedures.  
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39 **Study setting:**

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42 Yaoundé is the capital city of Cameroon, a central African low-income country. The adult prevalence of  
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44 HIV in Cameroon is 5.3%.[1] The Yaoundé Central hospital houses the largest HIV clinic in the country. It  
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46 has a capacity of 381 beds and is staffed by 95 doctors and 270 nurses.[30] In the HIV clinics, there are  
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48 6500 regular clients and approximately 40 new cases every week. This hospital is one of the pioneer  
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50 centres for HIV research in Cameroon, and offers a great potential for recruitment and data collection.  
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**Sampling:**

The overall purpose of this sample is to address the research question, in a generalizable way using both purposeful and probabilistic techniques that ensure data collection in breadth and depth.[31] This is a useful combination of sampling strategies that helps to generate items and variables for questionnaires; and to generate hypotheses.[32]

**Qualitative strand:**

A purposeful sampling strategy will be used to determine who will participate in the qualitative strand. PLHIV with relevant experience related to community activities shall be selected based on any of the following criteria:

- They should belong to an association of PLHIV (leaders or members)
- They are community health workers living with HIV
- They are willing to participate in a community owned text messaging program

Focus groups of 6-10 participants will be constituted consecutively until no new ideas emerge. We will focus on depth of information and narrative data obtained from the cases.[31] PLHIV will be recruited from the waiting rooms of the Yaoundé Central Hospital HIV clinic. They will be approached by the plain-clothed non-staff moderator to determine their interest in taking part in a group discussion and if they meet the pre-specified criteria. This is typical case sampling, aimed at identifying representative cases.[31] Consenting participants will be shown to a quiet nearby room prepared for the focus groups. No financial incentives shall be offered, but waiting times at the clinic will be reduced (in collaboration with the attending physician) after participation. The protocol will be presented to the hospital staff and the procedures for reducing waiting times will be discussed.

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3 Quantitative strand:  
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6 All PLHIV attending the Yaoundé Central Hospital HIV clinic during the study period will be eligible for  
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8 enrolment, provided they are aged 21 years or more and give consent. Sample size will be determined  
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10 using the formula proposed by Cochran for surveys.[33] Assuming an alpha level of 0.05; a 5% margin of  
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12 error (for categorical data); a standard deviation of 0.5 (for a primary outcome - community readiness  
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14 measured on a seven-point scale); in a population of 6500 PLHIV at the Yaoundé Central Hospital, we  
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16 arrived at a sample of 402; taking into account a “refusal to participate rate” of 10% documented in  
17  
18 another text messaging study among PLHIV in this clinic.[34] This sample is meant to be representative  
19  
20 of the entire population of PLHIV attending the Yaoundé Central Hospital HIV clinic.  
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25 **Data collection:**  
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28 Prior to data collection we will organise brief training sessions for the data collectors in the qualitative  
29  
30 and quantitative strands. The purpose of this training will be to familiarise them with their working  
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32 instruments and to standardise the procedure for participant invitation, obtaining consent and data  
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34 collection.  
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38 Qualitative strand:  
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41 Focus group discussions will be conducted using a pre-established interview guide (See Table 1). It will  
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43 contain basic socio-demographic information, a description of participant involvement in community  
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45 activities (eligibility criteria fulfilled), and specific themes related to the phenomenon under study. An  
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47 experienced moderator and note-taker will invite, request consent and enrol participants, in that order.  
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49 For each session, the data collectors will be dressed in plain clothes and use a separate room free from  
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51 distractions for the focus groups. The note taker will be responsible for noting the non-verbal cues  
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53 emanating from the participants and operating the audio-recorder. The audio recorder will be tested in  
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a mock session for clarity of recordings. Participants will be encouraged to speak in tones that can be recorded. The moderator will be responsible for keeping the discussions in line with the guide while exploring interesting dimensions that arise from the discussions. More importantly, the moderator will be responsible for gaining the trust of the participants and encouraging participation from all.

**Table 1: Focus group discussion guide**

<b>Focus Group Discussion Guide</b>
<b>Preparatory steps</b>
Does participant meet criteria?
Have they given written/verbal consent?
Collect socio-demographic data (age, gender); note time; number of participants
<b>On existing community activities</b>
What community initiatives/activities/organisations exist for PLHIV?
What community activity do you participate in?
How do you benefit from these activities?
<b>On a text messaging project</b>
The purpose of this project is to improve adherence to HIV medication and to foster communication with health workers. What other goals do you think can be achieved through text messaging?
Do you think you (as a community) are ready to run a text message project?
Would you accept to run or take part in a text messaging project?
What strengths does the community have that can be used to run such a project?
What weaknesses does the community have that can hinder the project?
<b>On feasibility</b>

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How do you think the project should be financed?
Are you willing to pay to receive a text messages?
Do you think the community is ready to run such a project?
Would you like health workers to be involved in the management of such a project?
<b>Any other issues participants would like to discuss</b>

#### Quantitative strand:

In the quantitative strand, patients will be approached at the clinic in various locations: the outpatient department, the pharmacy and the laboratory. Four interviewers will concurrently conduct the survey to maximize recruitment. Recruitment and data collection will continue until the required sample is achieved. The trained interviewers will employ the pre-tested questionnaire developed from the qualitative strand to collect data from all eligible participants. The data collection tool will be developed based on findings from the qualitative strand. It will contain basic socio-demographic data, adherence data, information related to participation in community activities and other variables generated from the themes identified in the qualitative strand. The questions will be closed-ended with simple “yes or no” responses. Complex items like readiness will be presented on a seven-point Likert scale.[35]

#### Data analyses:

##### Qualitative data analysis:

Qualitative data will be analysed by transcribing into text. Codes will be generated by looking for repetitions in the text.[36] These repetitions (codes) will be grouped based on their similarity into categories and the overarching themes will be identified. We will use a number of pre-set categories to guide the process, but emergent categories will also be noted.[37] For example pre-set categories like

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3 lack of familiarity with text messaging or lack of skills to run a text messaging project shall be identified.  
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5 This coding will be done by multiple researchers to determine if coders agree on the themes assigned to  
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7 a segment of text. The themes will be displayed visually in a conceptual model, showing how the themes  
8  
9 are linked to each other.[36]  
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11

#### 12 13 Quantitative analyses:

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16 Quantitative data will be analysed using using Statistical Package for Social Sciences (SPSS) Version 20.0  
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18 (SPSS, Inc., 2009, Chicago, IL, USA). Statistical significance will be set at alpha= 0.05. Adjusted odds ratios  
19  
20 (aOR), 95% confidence intervals (CI) and p-values will be presented. We will explore community  
21  
22 readiness for ownership of a text messaging project as the dichotomous dependent variable in a  
23  
24 multinomial logistic regression analysis. Potential independent variables include: socio-demographics,  
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26 familiarity with text messaging, level of adherence to medication, need for additional support, and level  
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28 of comfort with community management.  
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#### 33 Data integration:

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36 Due to the sequential design of the study, the qualitative and quantitative components will be analysed  
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38 separately in a sequential qualitative-quantitative analysis. This is the method of choice when the  
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40 analysis of one strand is necessary to inform the conduct of the next.[38] Inferences will be drawn from  
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42 both strands and across strands. These “meta-inferences” will be used to draw conclusions.[38] The  
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44 qualitative and quantitative strands will be merged in a matrix to display how they are related to each  
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46 other. Table 2 is a sample of how both strands of data will be put together, linking themes to thematic  
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48 variables and statistical analyses. This correlation matrix will help to identify relationships between  
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50 themes and thematic variables (statistical triangulation) and strong thematic variables (variables that  
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occur frequently). It will also show how the quantitative data expand on the qualitative findings. These techniques of data integration have been used previously and have been described in detail.[39]

**Table 2: Mixed methods data matrix**

Strand					
Qualitative		Quantitative			
Themes identified	Number of times mentioned n (%)	Thematic variable	Representativeness N (%)	Influence on community readiness	
				Univariate (OR, 95% CI; p)	Multivariable (aOR, 95% CI; p)

aOR: adjusted odds ratio; CI: confidence interval

In the qualitative strand, data will be analysed, reduced, displayed and transformed into quantitative variables. In the quantitative strand, data will be analysed, reduced and displayed. At the final stage (data mixing), data will be displayed, correlated and integrated.[40] Figure 2 demonstrates the steps we will follow for analysis and integration of data.

Figure 2: Steps in data analysis and integration



### Validation checks and dealing with sources of bias:

We will draw from published criteria for critical appraisal of mixed-methods studies to validate our research,[41] using items identified by as a cross-paradigm framework for trustworthiness and rigor.[42]

#### Internal validity:

In the qualitative strand, internal validation (credibility) will be performed by using an audio recording device to ensure accuracy; member-checking of collected data for general accuracy and accuracy of quotes; and by comparing codes among several coders.[20 43] In the quantitative strand we will limit information bias by pilot testing the questionnaire for clarity (participants understand the questions as they were meant to be understood) and using non-staff interviewers. We will also adjust for potential confounding during analysis. For example, participants who already participate in some community activities may be more likely to report readiness to participate in a text message program. We will try to capture this in our analyses.

Data will be collected from PLHIV at the Yaoundé Central Hospital, the population to whom we want to generalize our findings, so selection bias is unlikely to be significant. However, we will collect socio-demographic data from the participants who refuse to participate to see if they differ significantly from those who do. Selection bias can be avoided at the design and analytical stages of a project.[44] Data from the qualitative phase may help to identify variables that are associated with willingness to participate in the survey. These variables can be used to restrict participation or be measured accurately and used for adjusted analyses.[44]

#### External validity:

The extent to which our findings can be generalized to the rest of the population of PLHIV at the Yaoundé Central hospital will be verified by using a large (pre-determined) sample, comparing the socio-

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2  
3 demographics of our sample to the parent population and by investigating any refusals to participate. In  
4  
5 this way we will be able to make statistical (external) generalizations[45]. We also state the purpose of  
6  
7 our study, the setting, the data collection procedures and the outcomes we are measuring: community  
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9 readiness and acceptability of ownership of a text messaging program among PLHIV at the Yaounde  
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11 Central Hospital.  
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#### 13 14 15 16 Consistency:

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18 We will apply standardised qualitative (focus groups) and quantitative (survey) techniques (described  
19  
20 above) to ensure consistent results. A journal of study activities will be kept so that the study  
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22 procedures can be followed and replicated. Our data collection tools and techniques will be externally  
23  
24 audited by the Cameroon National Ethics Committee.[46]  
25  
26

#### 27 28 Feasibility:

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30 This study will benefit from a number of characteristics that make it feasible. Firstly, the study is situated  
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32 in a very active HIV centre with a large potential for recruitment in both strands of the study. Secondly,  
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34 we have a pre-existing multidisciplinary team with collective experience in other qualitative and  
35  
36 quantitative research projects. This team is made up of public health physicians, clinicians, sociologists,  
37  
38 anthropologists, health economists and public health administrators. Thirdly, surveys in this setting are  
39  
40 relatively inexpensive to conduct. [47] Finally, our host centre, the Centre for the Development of Best  
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42 Practices in Health (CDBPH) has the infrastructure and experience for a research project of this scale and  
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44 can provide administrative, logistic and communication support.  
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#### 50 51 ETHICS AND DISSEMINATION:

#### 52 53 Ethics:

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3 Ethical approval and administrative clearance will be obtained from the Cameroon National Ethics  
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5 Committee and the directorate of operational research in the Ministry of Health, respectively. These are  
6  
7 the only compulsory regulatory bodies in Cameroon. Prior to these, permission to conduct the study will  
8  
9 be obtained from the administration of the Yaoundé Central Hospital. We will use the focus group  
10  
11 guiding document to prepare a draft questionnaire for the quantitative strand. The Ethics Committee  
12  
13 will be informed that this document will be modified as the project unfolds.  
14  
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16

#### 17 18 **Dissemination plan for results:**

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21 We plan to disseminate our results at public presentations with stakeholders in Cameroon (Ministry of  
22  
23 health staff, journalists, PLHIV, clinicians, community health workers, social workers, mobile  
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25 communication operators); to publish the manuscript; and publicly present and defend our findings as  
26  
27 part of a doctoral thesis.  
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#### 31 **AUTHORS' CONTRIBUTIONS:**

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34 All three authors contributed to the conception of the study. LM developed the first draft of the  
35  
36 manuscript. LT and POZ provided statistical and methodological input. All three authors read and edited  
37  
38 several versions of the manuscript. Prof Mark Oremus provided input to this paper as part of the Mixed  
39  
40 Methods Research Designs for Health Services and Policy Research course (HRM/NUR 770) at McMaster  
41  
42 University.  
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47  
48  
49 This research received no specific grant from any funding agency in the public, commercial or not-for-  
50  
51 profit sectors.  
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#### 55 **COMPETING INTERESTS STATEMENT:**

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The authors declare none.

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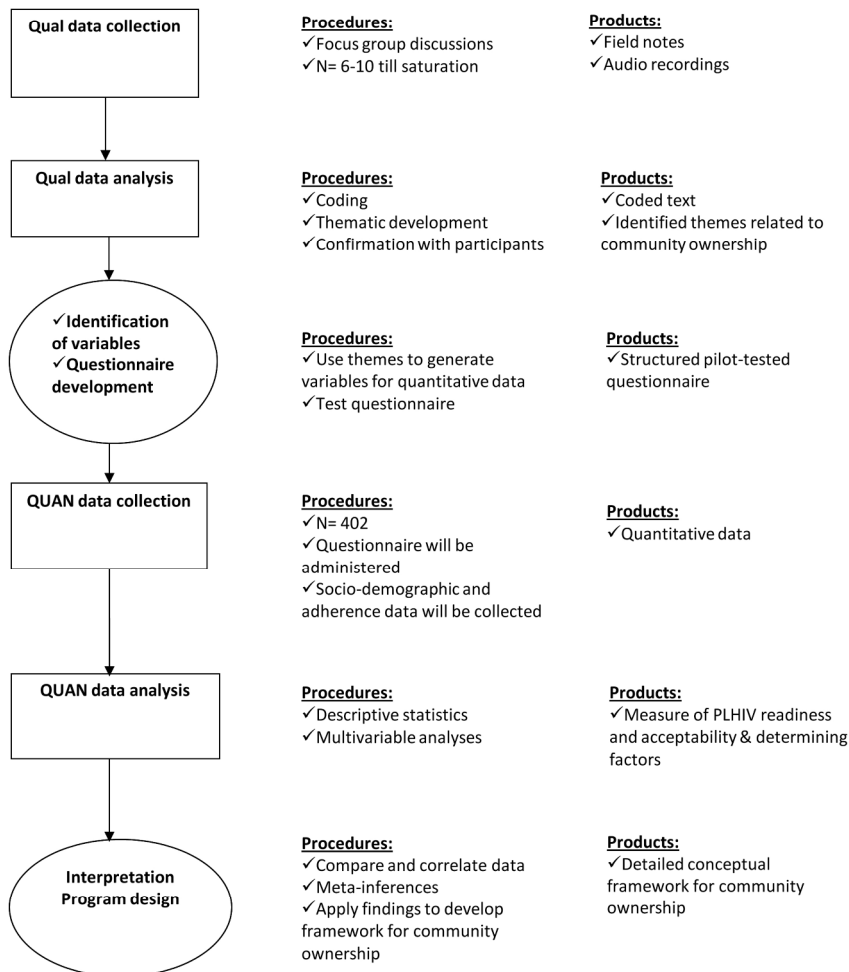


Figure 1: Overview of procedures and products of different strands  
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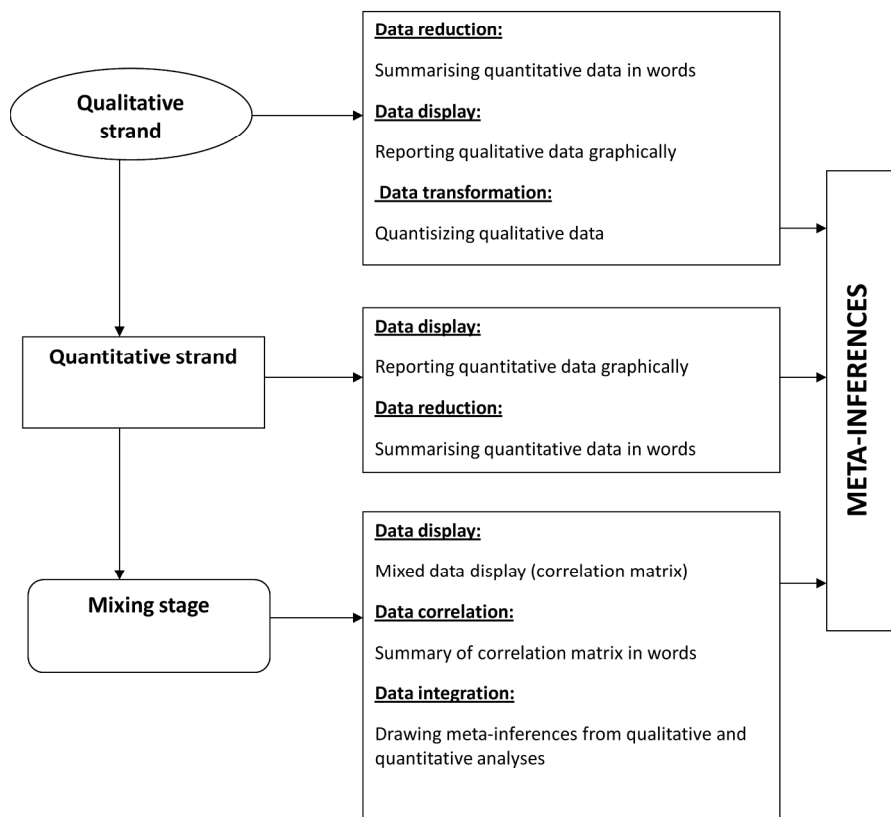


Figure 2: Steps in data analysis and integration  
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**Investigating community ownership of a text message program to improve adherence to antiretroviral therapy and provider-client communication: a mixed methods research protocol**

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<b>Primary Subject Heading</b>:	HIV/AIDS
Secondary Subject Heading:	Health services research, Qualitative research, Patient-centred medicine, Research methods
Keywords:	HIV & AIDS < INFECTIOUS DISEASES, Public health < INFECTIOUS DISEASES, QUALITATIVE RESEARCH, PRIMARY CARE

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3 **Investigating community ownership of a text message program to improve adherence to antiretroviral**  
4 **therapy and provider-client communication: a mixed methods research protocol**  
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8 **Authors:**  
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50 **Key words:**  
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53 Antiretroviral therapy, mobile phone, text messages, community ownership  
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55 **Word count: 3821**  
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**ABSTRACT:****Introduction:**

Mobile phone ownership and use is growing fastest in sub-Saharan Africa, and there is evidence that mobile phone text messages can be used successfully to significantly improve adherence to antiretroviral therapy and reduce treatment interruptions. However, the effects of many mobile health interventions are often reduced by human resource shortages. Also, the research projects generating the evidence for health interventions in developing countries are most often conducted using external funding sources, with limited sustainability and adoption by local governments following the completion of the projects. Strong community participation driven by active outreach programs and mobilization of community resources are the key to successful adoption and long-term sustainability of effective interventions. Our aim is to develop a framework for community ownership of a text messaging program to improve adherence to antiretroviral therapy; improve communication between patients and doctors; and as a reminder for appointments.

**Methods and analysis:**

We will use the exploratory sequential mixed methods approach. The first qualitative phase will entail focus group discussions with people living with HIV at the Yaoundé Central Hospital in Yaounde Cameroon (6-10 participants per group). The second quantitative phase will involve a cross-sectional survey (n=402). Here ordinal multivariable regression techniques will be used to determine the factors associated with community readiness and acceptability of ownership. Data from both phases will be merged.

**Ethics and dissemination:**

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3 Ethics approval will be obtained from the National Ethics Committee in Cameroon. Administrative  
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5 approval will be obtained from the Yaounde Central Hospital and the Ministry of Health. The results of  
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7 this paper will be disseminated as peer reviewed publications, at conferences and as part of a doctoral  
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9 thesis.  
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### 11 12 13 **ARTICLE SUMMARY:**

#### 14 15 **Article focus:**

- 16  
17 • Text messaging to improve adherence to antiretroviral therapy and communication between  
18  
19 patients and providers  
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- 22  
23 • Community ownership of supportive programs  
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#### 26 27 **Key messages**

- 28  
29 • Benefits and strengths of community ownership of programs  
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33 • Community readiness to own supportive programs  
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#### 35 36 **Strengths and limitations of study**

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38 • Robust study design based on mixed methods  
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- 41  
42 • Components of research unfold during the study and may affect initial planning  
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**INTRODUCTION:**

At the end of 2010 approximately 34 million people were living with the human immunodeficiency virus (HIV). Close to seventy percent of them live in sub-Saharan Africa even though this region represents only 12 percent of the world's population.[1] However, there has been a steady decrease in Acquired Immune Deficiency Syndrome (AIDS) related deaths as free antiretroviral therapy (ART) has become more available in recent years.[1] While governments and health systems in sub-Saharan Africa continue to invest in providing free access to ART, their efforts are hampered by health system weaknesses that prevent a continuous supply of ART and sub-optimal levels of adherence.[2] Relatively high levels of adherence are necessary to achieve the goals of ART such as viral suppression and immune reconstitution.[3] High levels of adherence will therefore lead to reduced morbidity and mortality in people living with HIV, and minimal development of resistant strains.[3-6]

In recent years the WHO has endorsed the use of cheap and effective technologies to improve health outcomes in low resource settings,[7] and there is emerging evidence on the role a mobile phone text message -short message service (SMS) can play in the management of HIV. Text messages (sending brief electronic messages to a mobile phone) can improve adherence to ART, reduce treatment interruptions and reduce viral load.[8 9] They are useful as appointment reminders and can improve communication between health personnel and patients.[10] Patients who receive them also report high levels of satisfaction.[8 11] These advantages, coupled with the rapid growth of mobile phone ownership and use in Africa,[12] make the SMS an important tool to improve care in people living with HIV (PLHIV). The research on mobile phone text messaging is somewhat nuanced by the complexity of the intervention. It is unclear how factors such as community phone ownership, content of message, timing of message; nature of message (two-way or one way) or source of the message (peers or hospital based) can

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3 influence the efficacy of mobile phone text messaging.[13] There is a need for further research for many  
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5 of these unanswered questions.[14]  
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9 Cameroon has the highest rate of HIV in West and Central Africa, with a 5.3% prevalence in the adult  
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11 population;[1] poor adherence rates and serious health system weaknesses that pose a threat to the  
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13 management of HIV.[15] Recent reports suggest that PLHIV would like to receive text messages.[16] The  
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15 communication channels opened by text messaging also serve as a platform to identify key individual  
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17 and health system weaknesses that diminish the quality of care. [17] Cameroon also has a remarkably  
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19 high mobile phone penetration, with a 270% increase in mobile subscriptions per annum between 2000  
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21 and 2005. [18]Most successful health care programs are characterised by strong community  
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23 participation.[19] Community participation has played a major role in the control of the HIV  
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25 epidemic.[20] It should be encouraged because the programs will have better outreach; community  
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27 contributions (money, manpower and material) can be mobilised and; more importantly, because  
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29 communities have a right to take part in the decisions that affect their lives.[21] Community  
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31 participation (in HIV programs) has often been limited to the less technical aspects. Apart from providing  
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33 an organised front to defend the interests of PLHIV, they also take part in providing care, research, peer  
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35 education and role modelling.[19] For newer interventions such as text messaging which is more  
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37 structured and technologically oriented, the potential of community ownership needs to be explored.  
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44 We expect to observe an overall acceptability and readiness to own a text messaging program but a lack  
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46 of skills in how to manage one. Our findings will be used to inform initiatives aimed at up scaling the use  
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48 of mobile phone technology to improve adherence to antiretroviral therapy and other chronic diseases  
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50 in resource limited settings and how best community members can be involved in the process. At the  
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52 end of the project we will develop a framework for transferring technology into the hands of the  
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54 community and initiating a sustainable community-led project. We will build upon previous research  
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3 using weekly motivational two-way text messaging to improve adherence to ART.[16 17 22] The  
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5 following groups of people will benefit from this project: PLHIV in resource limited areas; people living  
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7 with other chronic diseases who can benefit from enhanced communication with the health system; and  
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9 health workers and community health workers who provide care for PLHIV.  
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13 The objective of this project is to determine how to set-up a community-owned text messaging program  
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15 by determining the readiness and acceptability of ownership among PLHIV at the Yaoundé Central  
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17 Hospital in Cameroon. We will proceed by collecting, analysing and comparing qualitative and  
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19 quantitative data. The findings from this mixed methods study will be used to establish a framework for  
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21 community ownership.  
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25 For the purposes of this paper, we define community ownership as a process in which the community  
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27 members design, manage and reap benefits from a project. We also acknowledge that in the course of  
28  
29 our research our definition may change. All references to “community” are made in regards to PLHIV in  
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31 Yaounde, Cameroon.  
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35 The following research questions will guide the conduct of this study:  
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39 Qualitative research questions:  
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- 42 • Will PLHIV in Yaoundé, Cameroon accept community ownership of a text messaging program?
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- 44 • How ready is the community of PLHIV in Yaoundé, Cameroon to take ownership of a text
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- 46 messaging program?
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51 Quantitative research questions:  
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- 54 • What factors are associated with acceptability and readiness of community ownership of a text
- 55
- 56 messaging program among PLHIV in Yaoundé, Cameroon?
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- What proportions of PLHIV will accept and are ready to run a community owned text messaging program?

Mixed methods research questions:

- Are the themes related to the opportunities and challenges involved in the community ownership of a text message project among PLHIV in Yaoundé, Cameroon generalizable to a larger sample of PLHIV in Yaoundé?
- In what ways do the qualitative and quantitative strands converge?

## **METHODS AND ANALYSIS:**

### **Study design:**

We will use an exploratory sequential design.[23] The exploratory sequential design is a two-phase design that starts with an initial qualitative phase followed by a quantitative phase. In the qualitative phase, we will identify individuals with experience in community ownership for in-depth interviews. The members of the associations of PLHIV and others with community level experience will be selected from the Yaoundé Central Hospital. This relatively small number of individuals will be interviewed to identify themes, ideas and concepts that will be used to guide the second quantitative phase. Data collected from the qualitative phase will be converted into variables that will be used on a much larger sample in order to generalise the findings to all the PLHIV in Yaoundé. This sample will be taken from the Yaoundé Central Hospital. See figure 1 for details on the procedures and products of the different strands of the study.

Figure 1: Overview of procedures and products of different strands

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3 The exploratory sequential design is preferred for this study because of the following reasons. Firstly,  
4 the separation of the qualitative and quantitative phases makes it easier for our multidisciplinary team  
5 to work together and the separate methods and findings can be described easier. The anthropologists  
6 and sociologists will be responsible for data collection and analysis in the qualitative strand. The themes  
7 that emerge from their analysis will be converted into variables and built into a questionnaire by both  
8 groups. Secondly, the use of both qualitative and quantitative methods makes it more acceptable to  
9 researchers from both domains. Even though the overarching goal is to merge and compare qualitative  
10 and quantitative data, the findings from each domain still hold merit and can be interpreted separately.  
11 Thirdly, it will be used to develop a measurement instrument. The data collection tool for the  
12 quantitative phase will be developed from the qualitative strand. Items to measure community  
13 readiness and acceptability of ownership will be framed based on the responses in the qualitative  
14 strand. Lastly, it is a good design for generalizing qualitative research findings.[23]

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32 On the other hand, organizing two separate strategies for data collection will be time-consuming.  
33  
34 Separate sampling techniques have to be applied for both strands: the sample of PLHIV for the  
35 qualitative strand will be selected purposefully based on their experience with community activities,  
36 while the quantitative strand will be probabilistic. Details on the quantitative phase will not be available  
37 at the time of Institutional Review Board approval. The protocol we will submit to the National Ethics  
38 Committee will contain explicit details about why the data collection tool for the quantitative strand is  
39 unavailable.[23]

#### 40 41 42 43 44 45 46 47 48 **Rationale for design:**

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52 Despite these characteristics, the exploratory sequential design is the method of choice when the  
53 variables that may come into play are unknown and when there is no guiding framework.[23] This  
54 design has been used for complex research projects like mental health assessment in older adults,[24]

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3 healthcare students' educational expectations,[25] health system research,[26] alcohol use among  
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5 people with liver disease and tobacco use.[27 28] Text messaging interventions are relatively new and to  
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7 the best of our knowledge community ownership has not been investigated for a text messaging  
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9 program.  
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12  
13 In recent years, mixed methods research has emerged as a separate research paradigm-a seamless  
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15 blend of both qualitative and quantitative research methods. Even though it was not initially used on the  
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17 basis of its merits,[29] it is progressively gaining ground and acknowledgment in health research.[30] It  
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19 offers a “powerful third paradigm choice that often will provide the most informative, complete,  
20  
21 balanced and useful research results”. [31] In order to explore how PLHIV perceive text messages and  
22  
23 the eventuality of owning and managing a text message project we are going to use mixed methods to  
24  
25 identify common themes which arise and to subsequently generalise these findings to a larger sample.  
26  
27 The complex nature of the research question warrants the use of mixed methods to generate a rich and  
28  
29 complementary body of evidence to initiate a community-owned program. The methods used to initiate  
30  
31 community ownership need to be well spelled-out and should originate from a robust and expanded  
32  
33 body of evidence, which cannot be achieved by only qualitative or quantitative designs. We therefore  
34  
35 seek complementarity, initiation and expansion.[32] Figure 1 is a detailed flow diagram of the study  
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37 procedures.  
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#### 44 **Study setting:**

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47 Yaoundé is the capital city of Cameroon, a central African low-income country. The adult prevalence of  
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49 HIV in Cameroon is 5.3%.[1] The Yaoundé Central hospital houses the largest HIV clinic in the country. It  
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51 has a capacity of 381 beds and is staffed by 95 doctors and 270 nurses.[33] In the HIV clinics, there are  
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3 6500 regular clients and approximately 40 new cases every week. This hospital is one of the pioneer  
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5 centres for HIV research in Cameroon, and offers a great potential for recruitment and data collection.  
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### 8 9 **Sampling:**

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11 The overall purpose of this sample is to address the research question, in a generalizable way using both  
12  
13 purposeful and probabilistic techniques that ensure data collection in breadth and depth.[34] This is a  
14  
15 useful combination of sampling strategies that helps to generate items and variables for questionnaires;  
16  
17 and to generate hypotheses.[35]  
18  
19

### 20 21 22 **Qualitative strand:**

23  
24 A purposeful sampling strategy will be used to determine who will participate in the qualitative strand.  
25  
26 PLHIV with relevant experience related to community activities shall be selected based on any of the  
27  
28 following criteria:  
29

- 30  
31
- 32 • They should belong to an association of PLHIV (leaders or members)
  - 33  
34 • They are community health workers They are willing to participate in a community owned text  
35  
36 messaging program  
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40  
41 Focus groups of 6-10 participants will be constituted consecutively until no new ideas emerge. We will  
42  
43 focus on depth of information and qualitative data obtained from the cases.[34] PLHIV will be recruited  
44  
45 from the waiting rooms of the Yaoundé Central Hospital HIV clinic. They will be approached by the plain-  
46  
47 clothed non-staff moderator to determine their interest in taking part in a group discussion and if they  
48  
49 meet the pre-specified criteria. This is typical case sampling, aimed at identifying representative  
50  
51 cases.[34] Consenting participants will be shown to a quiet nearby room prepared for the focus groups.  
52  
53  
54 Notes will be taken in writing and using an audio recorder by a note taker. No financial incentives shall  
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1  
2  
3 be offered, but waiting times at the clinic will be reduced (in collaboration with the attending physician)  
4  
5 after participation. The protocol will be presented to the hospital staff and the procedures for reducing  
6  
7 waiting times will be discussed.  
8  
9

#### 10 11 Quantitative strand:

12  
13 All PLHIV attending the Yaoundé Central Hospital HIV clinic during the study period will be eligible for  
14  
15 enrolment, provided they are aged 21 years or more and give consent. Sample size will be determined  
16  
17 using the formula proposed by Cochran for surveys.[36] Assuming an alpha level of 0.05; a 5% margin of  
18  
19 error (for categorical data); a standard deviation of 0.5 (for a primary outcome - community readiness  
20  
21 measured on a seven-point scale); in a population of 6500 PLHIV at the Yaoundé Central Hospital, we  
22  
23 arrived at a sample of 402; taking into account a “refusal to participate rate” of 10% documented in  
24  
25 another text messaging study among PLHIV in this clinic.[22] This sample is meant to be representative  
26  
27 of the entire population of PLHIV attending the Yaoundé Central Hospital HIV clinic.  
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#### 33 Data collection:

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35 Prior to data collection we will organise brief training sessions for the data collectors in the qualitative  
36  
37 and quantitative strands. The purpose of this training will be to familiarise them with their working  
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39 instruments and to standardise the procedure for participant invitation, obtaining consent and data  
40  
41 collection.  
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#### 45 Qualitative strand:

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47 Focus group discussions will be conducted using a pre-established interview guide (See Table 1). It will  
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49 contain basic socio-demographic information, a description of participant involvement in community  
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51 activities (eligibility criteria fulfilled), and specific themes related to the phenomenon under study. An  
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53 experienced moderator and note-taker will invite, request consent and enrol participants, in that order.  
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For each session, the data collectors will be dressed in plain clothes and use a separate room free from distractions for the focus groups. The note taker will be responsible for noting the non-verbal cues emanating from the participants and operating the audio-recorder. The audio recorder will be tested in a mock session for clarity of recordings. Participants will be encouraged to speak in tones that can be recorded. The moderator will be responsible for keeping the discussions in line with the guide while exploring interesting dimensions that arise from the discussions. More importantly, the moderator will be responsible for gaining the trust of the participants and encouraging participation from all. The data collected from this strand will be used to formulate questions that best characterize acceptability and readiness.

**Table 1: Focus group discussion guide**

<b>Focus Group Discussion Guide</b>
<b>Preparatory steps</b>
Does participant meet criteria?
Have they given written/verbal consent?
Collect socio-demographic data (age, gender); note time; number of participants
<b>On existing community activities</b>
What community initiatives/activities/organisations exist for PLHIV?
What community activity do you participate in?
How do you benefit from these activities?
<b>On a text messaging project</b>
The purpose of this project is to improve adherence to HIV medication and to foster communication with health workers. What other goals do you think can be achieved through text messaging?

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4	Do you think you (as a community) are ready to run a text message project?
5	
6	Would you accept to run or take part in a text messaging project?
7	
8	What strengths does the community have that can be used to run such a project?
9	
10	What weaknesses does the community have that can hinder the project?
11	
12	What roles can the community play in such a project?
13	
14	
15	<b>On feasibility</b>
16	
17	How do you think the project should be financed?
18	
19	Are you willing to pay to receive a text messages?
20	
21	Do you think the community is ready to run such a project?
22	
23	Would you like health workers to be involved in the management of such a project?
24	
25	
26	
27	<b>Any other issues participants would like to discuss</b>
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Quantitative strand:

In the quantitative strand, patients will be approached at the clinic in various locations: the outpatient department, the pharmacy and the laboratory. Four interviewers will concurrently conduct the survey to maximize recruitment. Recruitment and data collection will continue until the required sample is achieved. The trained interviewers will employ the pre-tested questionnaire developed from the qualitative strand and existing frameworks,[37] to collect data from all eligible participants. The data collection tool will be developed based on findings from the qualitative strand. It will contain basic socio-demographic data, adherence data, information related to participation in community activities and other variables generated from the themes identified in the qualitative strand. The questions will be closed-ended with simple “yes or no” responses. Complex items like readiness will be presented on a seven-point Likert scale.[38]

**Data analyses:**

## Qualitative data analysis:

We will conduct a thematic analysis. Qualitative data will be analysed by transcribing into text. Codes will be generated by looking for repetitions in the text.[39] These repetitions (codes) will be grouped based on their similarity into categories and the overarching themes will be identified. We will use a number of pre-set categories to guide the process, but emergent categories will also be noted.[40] For example pre-set categories like lack of familiarity with text messaging or lack of skills to run a text messaging project shall be identified. This coding will be done by multiple researchers to determine if coders agree on the themes assigned to a segment of text. The themes will be displayed visually in a conceptual model, showing how the themes are linked to each other.[39]

## Quantitative analyses:

Quantitative data will be analysed using using Statistical Package for Social Sciences (SPSS) Version 20.0 (SPSS, Inc., 2009, Chicago, IL, USA). Statistical significance will be set at  $\alpha=0.05$ . Adjusted odds ratios (aOR), 95% confidence intervals (CI) and p-values will be presented. We will explore community readiness for ownership of a text messaging project as the ordinal dependent variable in a ordinal logistic regression analysis. Potential independent variables include: socio-demographics, mobile phone ownership, familiarity with text messaging, level of adherence to medication, need for additional support, and level of comfort with community management.

**Data integration:**

Due to the sequential design of the study, the qualitative and quantitative components will be analysed separately in a sequential qualitative-quantitative analysis. This is the method of choice when the analysis of one strand is necessary to inform the conduct of the next.[41] Inferences will be drawn from



both strands and across strands. These “meta-inferences” will be used to draw conclusions.[41] The qualitative and quantitative strands will be merged in a matrix to display how they are related to each other. Table 2 is a sample of how both strands of data will be put together, linking themes to thematic variables and statistical analyses. This correlation matrix will help to identify relationships between themes and thematic variables (statistical triangulation) and strong thematic variables (variables that occur frequently). It will also show how the quantitative data expand on the qualitative findings. These techniques of data integration have been used previously and have been described in detail.[42]

In the event that the qualitative and quantitative strands do not converge the data will be handled in one of four ways: firstly, the data may be re-analyzed through the lens of a different theoretical framework (reconciliation); secondly, the divergence may introduce new perspectives that generate new research questions (initiation); thirdly, irreconcilable differences may be viewed as best-case and worst-case scenarios (bracketing); and finally a complete re-appraisal of the body of evidence in terms of completeness and validity (exclusion).[43]

**Table 2: Mixed methods data matrix**

Strand				
Qualitative		Quantitative		
Themes identified	Number of times	Thematic variable	Representativeness N (%)	Influence on community readiness

	mentioned n (%)			Univariate (OR, 95% CI; p)	Multivariable (aOR, 95% CI; p)

aOR: adjusted odds ratio; CI: confidence interval

In the qualitative strand, data will be analysed, reduced, displayed and transformed into quantitative variables. In the quantitative strand, data will be analysed, reduced and displayed. At the final stage (data mixing), data will be displayed, correlated and integrated.[44] Figure 2 demonstrates the steps we will follow for analysis and integration of data.

Figure 2: Steps in data analysis and integration

#### **Validation checks and dealing with sources of bias:**

We will draw from published criteria for critical appraisal of mixed-methods studies to validate our research,[45] using items identified by as a cross-paradigm framework for trustworthiness and rigor.[46]

#### **Internal validity:**

In the qualitative strand, internal validation (credibility) will be performed by using an audio recording device to ensure accuracy; member-checking of collected data for general accuracy and accuracy of quotes; and by comparing codes among several coders.[23 47] In the quantitative strand we will limit information bias by pilot testing the questionnaire for clarity (participants understand the questions as they were meant to be understood) and using non-staff interviewers. We will also adjust for potential confounding during analysis. For example, participants who already participate in some community

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3 activities may be more likely to report readiness to participate in a text message program. We will try to  
4  
5 capture this in our analyses.  
6  
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8  
9 Data will be collected from PLHIV at the Yaoundé Central Hospital, the population to whom we want to  
10  
11 generalize our findings, so selection bias is unlikely to be significant. However, we will collect socio-  
12  
13 demographic data from the participants who refuse to participate to see if they differ significantly from  
14  
15 those who do. Selection bias can be avoided at the design and analytical stages of a project.[48] Data  
16  
17 from the qualitative phase may help to identify variables that are associated with willingness to  
18  
19 participate in the survey. These variables can be used to restrict participation or be measured accurately  
20  
21 and used for adjusted analyses.[48]  
22  
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26 External validity:

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29 The extent to which our findings can be generalized to the rest of the population of PLHIV at the  
30  
31 Yaoundé Central hospital will be verified by using a large (pre-determined) sample, comparing the socio-  
32  
33 demographics of our sample to the parent population and by investigating any refusals to participate. In  
34  
35 this way we will be able to make statistical (external) generalizations[49]. We also state the purpose of  
36  
37 our study, the setting, the data collection procedures and the outcomes we are measuring: community  
38  
39 readiness and acceptability of ownership of a text messaging program among PLHIV at the Yaounde  
40  
41 Central Hospital.  
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46 Consistency:

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49 We will apply standardised qualitative (focus groups) and quantitative (survey) techniques (described  
50  
51 above) to ensure consistent results. A journal of study activities will be kept so that the study  
52  
53 procedures can be followed and replicated. Our data collection tools and techniques will be externally  
54  
55 audited by the Cameroon National Ethics Committee.[50]  
56  
57

**Feasibility:**

This study will benefit from a number of characteristics that make it feasible. Firstly, the study is situated in a very active HIV centre with a large potential for recruitment in both strands of the study. Secondly, we have a pre-existing multidisciplinary team with collective experience in other qualitative and quantitative research projects. This team is made up of public health physicians, clinicians, sociologists, anthropologists, health economists and public health administrators. Thirdly, surveys in this setting are relatively inexpensive to conduct. [51] Finally, our host centre, the Centre for the Development of Best Practices in Health (CDBPH) has the infrastructure and experience for a research project of this scale and can provide administrative, logistic and communication support.

**ETHICS AND DISSEMINATION:****Ethics:**

Ethical approval and administrative clearance will be obtained from the Cameroon National Ethics Committee and the directorate of operational research in the Ministry of Health, respectively. These are the only compulsory regulatory bodies in Cameroon. Prior to these, permission to conduct the study will be obtained from the administration of the Yaoundé Central Hospital. We will use the focus group guiding document to prepare a draft questionnaire for the quantitative strand. The Ethics Committee will be informed that this document will be modified as the project unfolds.

**Dissemination plan for results:**

We plan to disseminate our results at public presentations with stakeholders in Cameroon (Ministry of health staff, journalists, PLHIV, clinicians, community health workers, social workers, mobile communication operators); to publish the manuscript; and publicly present and defend our findings as part of a doctoral thesis.

**AUTHORS' CONTRIBUTIONS:**

All three authors contributed to the conception of the study. LM developed the first draft of the manuscript. LT and POZ provided statistical and methodological input. All three authors read and edited several versions of the manuscript. Prof Mark Oremus provided input to this paper as part of the Mixed Methods Research Designs for Health Services and Policy Research course (HRM/NUR 770) at McMaster University.

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**COMPETING INTERESTS STATEMENT:**

The authors declare none.

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9 **Investigating community ownership of a text message program to improve adherence to antiretroviral**  
10 **therapy and provider-client communication: a mixed methods research protocol**

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12 **Authors:**

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46 **Key words:**

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48 Antiretroviral therapy, mobile phone, text messages, community ownership

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50 **Word count: 3821**

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60**ABSTRACT:****Introduction:**

Mobile phone ownership and use is growing fastest in sub-Saharan Africa, and there is evidence that mobile phone text messages can be used successfully to significantly improve adherence to antiretroviral therapy and reduce treatment interruptions. However, the effects of many mobile health interventions are often reduced by human resource shortages. Also, the research projects generating the evidence for health interventions in developing countries are most often conducted using external funding sources, with limited sustainability and adoption by local governments following the completion of the projects. Strong community participation driven by active outreach programs and mobilization of community resources are the key to successful adoption and long-term sustainability of effective interventions. Our aim is to develop a framework for community ownership of a text messaging program to improve adherence to antiretroviral therapy; improve communication between patients and doctors; and as a reminder for appointments.

**Methods and analysis:**

We will use the exploratory sequential mixed methods approach. The first qualitative phase will entail focus group discussions with people living with HIV at the Yaoundé Central Hospital in Yaounde Cameroon (6-10 participants per group). The second quantitative phase will involve a cross-sectional survey (n=402). Here ~~polynomial-ordinal~~ multivariable regression techniques will be used to determine the factors associated with community readiness and acceptability of ownership. Data from both phases will be merged.

**Ethics and dissemination:**

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9 Ethics approval will be obtained from the National Ethics Committee in Cameroon. Administrative  
10 approval will be obtained from the Yaounde Central Hospital and the Ministry of Health. The results of  
11 this paper will be disseminated as peer reviewed publications, at conferences and as part of a doctoral  
12 thesis.  
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#### 15 16 17 **ARTICLE SUMMARY:**

##### 18 19 **Article focus:**

- 20  
21 • Text messaging to improve adherence to antiretroviral therapy and communication between  
22 patients and providers  
23
- 24  
25 • Community ownership of supportive programs  
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##### 27 28 **Key messages**

- 29 • Benefits and strengths of community ownership of programs
- 30  
31 • Community readiness to own supportive programs  
32

##### 33 34 **Strengths and limitations of study**

- 35 • Robust study design based on mixed methods
- 36  
37 • Components of research unfold during the study and may affect initial planning  
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**INTRODUCTION:**

At the end of 2010 approximately 34 million people were living with the human immunodeficiency virus (HIV). Close to seventy percent of them live in sub-Saharan Africa even though this region represents only 12 percent of the world's population.[1] However, there has been a steady decrease in Acquired Immune Deficiency Syndrome (AIDS) related deaths as free antiretroviral therapy (ART) has become more available in recent years.[1] While governments and health systems in sub-Saharan Africa continue to invest in providing free access to ART, their efforts are hampered by health system weaknesses that prevent a continuous supply of ART and sub-optimal levels of adherence.[2] Relatively high levels of adherence are necessary to achieve the goals of ART such as viral suppression and immune reconstitution.[3] High levels of adherence will therefore lead to reduced morbidity and mortality in people living with HIV, and minimal development of resistant strains.[3-6]

In recent years the WHO has endorsed the use of cheap and effective technologies to improve health outcomes in low resource settings,[7] and there is emerging evidence on the role a mobile phone text message -short message service (SMS) can play in the management of HIV. Text messages [\(sending brief electronic messages to a mobile phone\)](#) can improve adherence to ART, reduce treatment interruptions and reduce viral load.[8 9] They are useful as appointment reminders and can improve communication between health personnel and patients.[10] Patients who receive them also report high levels of satisfaction.[8 11] These advantages, coupled with the rapid growth of mobile phone ownership and use in Africa,[12] make the SMS an important tool to improve care in people living with HIV (PLHIV). The research on mobile phone text messaging is somewhat nuanced by the complexity of the intervention. It is unclear how factors such as community phone ownership, [content of message, timing of message, nature of message \(two-way or one way\) or source of the message \(peers or hospital based\) can](#)

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9 influence the efficacy of mobile phone text messaging.[13] There is a need for further research for many  
10 of these unanswered questions.[14]

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13 Cameroon has the highest rate of HIV in West and Central Africa, with a 5.3% prevalence in the adult  
14 population;[1] poor adherence rates and serious health system weaknesses that pose a threat to the  
15 management of HIV.[15] Recent reports suggest that PLHIV would like to receive text messages.[16] The  
16 communication channels opened by text messaging also serve as a platform to identify key individual  
17 and health system weaknesses that diminish the quality of care. [17] Cameroon also has a remarkably  
18 high mobile phone penetration, with a 270% increase in mobile subscriptions per annum between 2000  
19 and 2005. [18](Mbuagbaw L, Thabane L. Opening communication channels with people living with HIV  
20 using mobile phone text messaging: Insights from the CAMPS trial, 2013).

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29 Most successful health care programs are characterised by strong community participation.[19][17]

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31 Community participation has played a major role in the control of the HIV epidemic.[20][18] It should be  
32 encouraged because the programs will have better outreach; community contributions (money,  
33 manpower and material) can be mobilised and; more importantly, because communities have a right to  
34 take part in the decisions that affect their lives.[21][19] Community participation (in HIV programs) has  
35 often been limited to the less technical aspects. Apart from providing an organised front to defend the  
36 interests of PLHIV, they also take part in providing care, research, peer education and role  
37 modelling.[19][17] For newer interventions such as text messaging which is more structured and  
38 technologically oriented, the potential of community ownership needs to be explored.

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46 We expect to observe an overall acceptability and readiness to own a text messaging program but a lack  
47 of skills in how to manage one. Our findings will be used to inform initiatives aimed at up scaling the use  
48 of mobile phone technology to improve adherence to antiretroviral therapy and other chronic diseases  
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in resource limited settings and how best community members can be involved in the process. At the end of the project we will develop a framework for transferring technology into the hands of the community and initiating a sustainable community-led project. [We will build upon previous research using weekly motivational two-way text messaging to improve adherence to ART.\[16 17 22\]](#) The following groups of people will benefit from this project: **PLHIV in resource limited areas; people living with other chronic diseases who can benefit from enhanced communication with the health system; and health workers and community health workers who provide care for PLHIV.**

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The objective of this project is to determine how to set-up a community-owned text messaging program by determining the readiness and acceptability of ownership among PLHIV at the Yaoundé Central Hospital in Cameroon. We will proceed by collecting, analysing and comparing qualitative and quantitative data. The findings from this mixed methods study will be used to establish a framework for community ownership.

For the purposes of this paper, we define community ownership as a process in which the community members design, manage and reap benefits from a project. We also acknowledge that in the course of our research our definition may change. [All references to "community" are made in regards to PLHIV in Yaounde, Cameroon.](#)

The following research questions will guide the conduct of this study:

Qualitative research questions:

- Will PLHIV in Yaoundé, Cameroon accept community ownership of a text messaging program?
- How ready is the community of PLHIV in Yaoundé, Cameroon to take ownership of a text messaging program?

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9 Quantitative research questions:

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- 12 • What factors are associated with acceptability and readiness of community ownership of a text  
13 messaging program among PLHIV in Yaoundé, Cameroon?
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  - 15 • What proportions of PLHIV will accept and are ready to run a community owned text messaging  
16 program?  
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20 Mixed methods research questions:

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- 22 • Are the themes related to the opportunities and challenges involved in the community  
23 ownership of a text message project among PLHIV in Yaoundé, Cameroon generalizable to a  
24 larger sample of PLHIV in Yaoundé?  
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  - 28 • In what ways do the qualitative and quantitative strands converge?  
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31 **METHODS AND ANALYSIS:**

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33 **Study design:**

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35 We will use an exploratory sequential design.<sup>[23][29]</sup> The exploratory sequential design is a two-phase  
36 design that starts with an initial qualitative phase followed by a quantitative phase. In the qualitative  
37 phase, we will identify individuals with experience in community ownership for in-depth interviews. The  
38 members of the associations of PLHIV and others with community level experience will be selected from  
39 the Yaoundé Central Hospital. This relatively small number of individuals will be interviewed to identify  
40 themes, ideas and concepts that will be used to guide the second quantitative phase. Data collected  
41 from the qualitative phase will be converted into variables that will be used on a much larger sample in  
42 order to generalise the findings to all the PLHIV in Yaoundé. This sample will be taken from the Yaoundé  
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Central Hospital. See figure 1 for details on the procedures and products of the different strands of the study.

Figure 1: Overview of procedures and products of different strands

The exploratory sequential design is preferred for this study because of the following reasons. Firstly, the separation of the qualitative and quantitative phases makes it easier for our multidisciplinary team to work together and the separate methods and findings can be described easier. The anthropologists and sociologists will be responsible for data collection and analysis in the qualitative strand. The themes that emerge from their analysis will be converted into variables and built into a questionnaire by both groups. Secondly, the use of both qualitative and quantitative methods makes it more acceptable to researchers from both domains. Even though the overarching goal is to merge and compare qualitative and quantitative data, the findings from each domain still hold merit and can be interpreted separately. Thirdly, it will be used to develop a measurement instrument. The data collection tool for the quantitative phase will be developed from the qualitative strand. Items to measure community readiness and acceptability of ownership will be framed based on the responses in the qualitative strand. Lastly, it is a good design for generalizing qualitative research findings. [23][20]

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On the other hand, organizing two separate strategies for data collection will be time-consuming. Separate sampling techniques have to be applied for both strands: the sample of PLHIV for the qualitative strand will be selected purposefully based on their experience with community activities, while the quantitative strand will be probabilistic. Details on the quantitative phase will not be available at the time of Institutional Review Board approval. The protocol we will submit to the National Ethics Committee will contain explicit details about why the data collection tool for the quantitative strand is unavailable. [23][20]

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**Rationale for design:**

Despite these characteristics, the exploratory sequential design is the method of choice when the variables that may come into play are unknown and when there is no guiding framework.<sup>[23][20]</sup> This design has been used for complex research projects like mental health assessment in older adults,<sup>[24][24]</sup> healthcare students' educational expectations,<sup>[25][22]</sup> health system research,<sup>[26][23]</sup> alcohol use among people with liver disease and tobacco use.<sup>[27\_28][24-25]</sup> Text messaging interventions are relatively new and to the best of our knowledge community ownership has not been investigated for a text messaging program.

In recent years, mixed methods research has emerged as a separate research paradigm—a seamless blend of both qualitative and quantitative research methods. Even though it was not initially used on the basis of its merits,<sup>[29][26]</sup> it is progressively gaining ground and acknowledgment in health research.<sup>[30][27]</sup> It offers a “powerful third paradigm choice that often will provide the most informative, complete, balanced and useful research results”.<sup>[31][28]</sup> In order to explore how PLHIV perceive text messages and the eventuality of owning and managing a text message project we are going to use mixed methods to identify common themes which arise and to subsequently generalise these findings to a larger sample. The complex nature of the research question warrants the use of mixed methods to generate a rich and complementary body of evidence to initiate a community-owned program. The methods used to initiate community ownership need to be well spelled-out and should originate from a robust and expanded body of evidence, which cannot be achieved by only qualitative or quantitative designs. We therefore seek complementarity, initiation and expansion.<sup>[32][29]</sup> Figure 1 is a detailed flow diagram of the study procedures.

**Study setting:**

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Yaoundé is the capital city of Cameroon, a central African low-income country. The adult prevalence of HIV in Cameroon is 5.3%.<sup>[1]</sup> The Yaoundé Central hospital houses the largest HIV clinic in the country. It has a capacity of 381 beds and is staffed by 95 doctors and 270 nurses.<sup>[33][30]</sup> In the HIV clinics, there are 6500 regular clients and approximately 40 new cases every week. This hospital is one of the pioneer centres for HIV research in Cameroon, and offers a great potential for recruitment and data collection.

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### Sampling:

The overall purpose of this sample is to address the research question, in a generalizable way using both purposeful and probabilistic techniques that ensure data collection in breadth and depth.<sup>[34][31]</sup> This is a useful combination of sampling strategies that helps to generate items and variables for questionnaires; and to generate hypotheses.<sup>[35][32]</sup>

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Qualitative strand:

A purposeful sampling strategy will be used to determine who will participate in the qualitative strand. PLHIV with relevant experience related to community activities shall be selected based on any of the following criteria:

- They should belong to an association of PLHIV (leaders or members)
- They are community health workers ~~living with HIV~~
- They are willing to participate in a community owned text messaging program

Focus groups of 6-10 participants will be constituted consecutively until no new ideas emerge. We will focus on depth of information and ~~narrative-qualitative~~ data obtained from the cases.<sup>[34][31]</sup> PLHIV will be recruited from the waiting rooms of the Yaoundé Central Hospital HIV clinic. They will be approached by the plain-clothed non-staff moderator to determine their interest in taking part in a group discussion

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9 and if they meet the pre-specified criteria. This is typical case sampling, aimed at identifying  
10 representative cases.<sup>[34][34]</sup> Consenting participants will be shown to a quiet nearby room prepared for  
11 the focus groups. Notes will be taken in writing and using an audio recorder by a note taker. No financial  
12 incentives shall be offered, but waiting times at the clinic will be reduced (in collaboration with the  
13 attending physician) after participation. The protocol will be presented to the hospital staff and the  
14 procedures for reducing waiting times will be discussed.  
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#### 20 Quantitative strand:

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22 All PLHIV attending the Yaoundé Central Hospital HIV clinic during the study period will be eligible for  
23 enrolment, provided they are aged 21 years or more and give consent. Sample size will be determined  
24 using the formula proposed by Cochran for surveys.<sup>[36][33]</sup> Assuming an alpha level of 0.05; a 5%  
25 margin of error (for categorical data); a standard deviation of 0.5 (for a primary outcome - community  
26 readiness measured on a seven-point scale); in a population of 6500 PLHIV at the Yaoundé Central  
27 Hospital, we arrived at a sample of 402; taking into account a “refusal to participate rate” of 10%  
28 documented in another text messaging study among PLHIV in this clinic.<sup>[22][34]</sup> This sample is meant to  
29 be representative of the entire population of PLHIV attending the Yaoundé Central Hospital HIV clinic.  
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#### 38 Data collection:

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40 Prior to data collection we will organise brief training sessions for the data collectors in the qualitative  
41 and quantitative strands. The purpose of this training will be to familiarise them with their working  
42 instruments and to standardise the procedure for participant invitation, obtaining consent and data  
43 collection.  
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#### 48 Qualitative strand:

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Focus group discussions will be conducted using a pre-established interview guide (See Table 1). It will contain basic socio-demographic information, a description of participant involvement in community activities (eligibility criteria fulfilled), and specific themes related to the phenomenon under study. An experienced moderator and note-taker will invite, request consent and enrol participants, in that order. For each session, the data collectors will be dressed in plain clothes and use a separate room free from distractions for the focus groups. The note taker will be responsible for noting the non-verbal cues emanating from the participants and operating the audio-recorder. The audio recorder will be tested in a mock session for clarity of recordings. Participants will be encouraged to speak in tones that can be recorded. The moderator will be responsible for keeping the discussions in line with the guide while exploring interesting dimensions that arise from the discussions. More importantly, the moderator will be responsible for gaining the trust of the participants and encouraging participation from all. [The data collected from this strand will be used to formulate questions that best characterize acceptability and readiness.](#)

**Table 1: Focus group discussion guide**

<b>Focus Group Discussion Guide</b>
<b>Preparatory steps</b>
Does participant meet criteria?
Have they given written/verbal consent?
Collect socio-demographic data (age, gender); note time; number of participants
<b>On existing community activities</b>
What community initiatives/activities/organisations exist for PLHIV?
What community activity do you participate in?

How do you benefit from these activities?
<b>On a text messaging project</b>
The purpose of this project is to improve adherence to HIV medication and to foster communication with health workers. What other goals do you think can be achieved through text messaging?
Do you think you (as a community) are ready to run a text message project?
Would you accept to run or take part in a text messaging project?
What strengths does the community have that can be used to run such a project?
What weaknesses does the community have that can hinder the project?
<u>What roles can the community play in such a project?</u>
<b>On feasibility</b>
How do you think the project should be financed?
Are you willing to pay to receive a text messages?
Do you think the community is ready to run such a project?
Would you like health workers to be involved in the management of such a project?
<b>Any other issues participants would like to discuss</b>

Quantitative strand:

In the quantitative strand, patients will be approached at the clinic in various locations: the outpatient department, the pharmacy and the laboratory. Four interviewers will concurrently conduct the survey to maximize recruitment. Recruitment and data collection will continue until the required sample is achieved. The trained interviewers will employ the pre-tested questionnaire developed from the qualitative strand and existing frameworks,[37] to collect data from all eligible participants. The data collection tool will be developed based on findings from the qualitative strand. It will contain basic

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socio-demographic data, adherence data, information related to participation in community activities

and other variables generated from the themes identified in the qualitative strand. The questions will be closed-ended with simple “yes or no” responses. Complex items like readiness will be presented on a seven-point Likert scale.<sup>[38][35]</sup>

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#### Data analyses:

Qualitative data analysis:

We will conduct a thematic analysis. Qualitative data will be analysed by transcribing into text. Codes will be generated by looking for repetitions in the text.<sup>[39][36]</sup> These repetitions (codes) will be grouped based on their similarity into categories and the overarching themes will be identified. We will use a number of pre-set categories to guide the process, but emergent categories will also be noted.<sup>[40][37]</sup>

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For example pre-set categories like lack of familiarity with text messaging or lack of skills to run a text messaging project shall be identified. This coding will be done by multiple researchers to determine if coders agree on the themes assigned to a segment of text. The themes will be displayed visually in a conceptual model, showing how the themes are linked to each other.<sup>[39][36]</sup>

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Quantitative analyses:

Quantitative data will be analysed using using Statistical Package for Social Sciences (SPSS) Version 20.0 (SPSS, Inc., 2009, Chicago, IL, USA). Statistical significance will be set at alpha= 0.05. Adjusted odds ratios (aOR), 95% confidence intervals (CI) and p-values will be presented. We will explore community readiness for ownership of a text messaging project as the ~~dichotomous-ordinal~~ dependent variable in a ~~multinomial-ordinal~~ logistic regression analysis. Potential independent variables include: socio-demographics, mobile phone ownership, familiarity with text messaging, level of adherence to medication, need for additional support, and level of comfort with community management.

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**Data integration:**

Due to the sequential design of the study, the qualitative and quantitative components will be analysed separately in a sequential qualitative-quantitative analysis. This is the method of choice when the analysis of one strand is necessary to inform the conduct of the next.<sup>[41][38]</sup> Inferences will be drawn from both strands and across strands. These “meta-inferences” will be used to draw conclusions.<sup>[41][38]</sup> The qualitative and quantitative strands will be merged in a matrix to display how they are related to each other. Table 2 is a sample of how both strands of data will be put together, linking themes to thematic variables and statistical analyses. This correlation matrix will help to identify relationships between themes and thematic variables (statistical triangulation) and strong thematic variables (variables that occur frequently). It will also show how the quantitative data expand on the qualitative findings. These techniques of data integration have been used previously and have been described in detail.<sup>[42][39]</sup>

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In the event that the qualitative and quantitative strands do not converge the data will be handled in one of four ways: firstly, the data may be re-analyzed through the lens of a different theoretical framework (reconciliation); secondly, the divergence may introduce new perspectives that generate new research questions (initiation); thirdly, irreconcilable differences may be viewed as best-case and worst-case scenarios (bracketing); and finally a complete re-appraisal of the body of evidence in terms of completeness and validity (exclusion).<sup>[43]</sup>

**Table 2: Mixed methods data matrix**

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Strand					
Qualitative		Quantitative			
Themes identified	Number of times mentioned n (%)	Thematic variable	Representativeness N (%)	Influence on community readiness	
				Univariate (OR, 95% CI; p)	Multivariable (aOR, 95% CI; p)

aOR: adjusted odds ratio; CI: confidence interval

In the qualitative strand, data will be analysed, reduced, displayed and transformed into quantitative variables. In the quantitative strand, data will be analysed, reduced and displayed. At the final stage (data mixing), data will be displayed, correlated and integrated.<sup>[44][40]</sup> Figure 2 demonstrates the steps we will follow for analysis and integration of data.

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Figure 2: Steps in data analysis and integration

#### Validation checks and dealing with sources of bias:

We will draw from published criteria for critical appraisal of mixed-methods studies to validate our research,<sup>[45][41]</sup> using items identified by as a cross-paradigm framework for trustworthiness and rigor.<sup>[46][42]</sup>

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Internal validity:

In the qualitative strand, internal validation (credibility) will be performed by using an audio recording device to ensure accuracy; member-checking of collected data for general accuracy and accuracy of

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9 quotes; and by comparing codes among several coders.<sup>[23-47][20-43]</sup> In the quantitative strand we will  
10 limit information bias by pilot testing the questionnaire for clarity (participants understand the  
11 questions as they were meant to be understood) and using non-staff interviewers. We will also adjust  
12 for potential confounding during analysis. For example, participants who already participate in some  
13 community activities may be more likely to report readiness to participate in a text message program.  
14 We will try to capture this in our analyses.

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21 Data will be collected from PLHIV at the Yaoundé Central Hospital, the population to whom we want to  
22 generalize our findings, so selection bias is unlikely to be significant. However, we will collect socio-  
23 demographic data from the participants who refuse to participate to see if they differ significantly from  
24 those who do. Selection bias can be avoided at the design and analytical stages of a project.<sup>[48][44]</sup>

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26 Data from the qualitative phase may help to identify variables that are associated with willingness to  
27 participate in the survey. These variables can be used to restrict participation or be measured accurately  
28 and used for adjusted analyses.<sup>[48][44]</sup>

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34 External validity:

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36 The extent to which our findings can be generalized to the rest of the population of PLHIV at the  
37 Yaoundé Central hospital will be verified by using a large (pre-determined) sample, comparing the socio-  
38 demographics of our sample to the parent population and by investigating any refusals to participate. In  
39 this way we will be able to make statistical (external) generalizations.<sup>[49][45]</sup> We also state the purpose  
40 of our study, the setting, the data collection procedures and the outcomes we are measuring:  
41 community readiness and acceptability of ownership of a text messaging program among PLHIV at the  
42 Yaounde Central Hospital.

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60**Consistency:**

We will apply standardised qualitative (focus groups) and quantitative (survey) techniques (described above) to ensure consistent results. A journal of study activities will be kept so that the study procedures can be followed and replicated. Our data collection tools and techniques will be externally audited by the Cameroon National Ethics Committee. [\[50\]](#)~~[46]~~

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**Feasibility:**

This study will benefit from a number of characteristics that make it feasible. Firstly, the study is situated in a very active HIV centre with a large potential for recruitment in both strands of the study. Secondly, we have a pre-existing multidisciplinary team with collective experience in other qualitative and quantitative research projects. This team is made up of public health physicians, clinicians, sociologists, anthropologists, health economists and public health administrators. Thirdly, surveys in this setting are relatively inexpensive to conduct. [\[51\]](#)~~[47]~~ Finally, our host centre, the Centre for the Development of Best Practices in Health (CDBPH) has the infrastructure and experience for a research project of this scale and can provide administrative, logistic and communication support.

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**ETHICS AND DISSEMINATION:****Ethics:**

Ethical approval and administrative clearance will be obtained from the Cameroon National Ethics Committee and the directorate of operational research in the Ministry of Health, respectively. These are the only compulsory regulatory bodies in Cameroon. Prior to these, permission to conduct the study will be obtained from the administration of the Yaoundé Central Hospital. We will use the focus group guiding document to prepare a draft questionnaire for the quantitative strand. The Ethics Committee will be informed that this document will be modified as the project unfolds.

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9 **Dissemination plan for results:**

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11 We plan to disseminate our results at public presentations with stakeholders in Cameroon (Ministry of  
12 health staff, journalists, PLHIV, clinicians, community health workers, social workers, mobile  
13 communication operators); to publish the manuscript; and publicly present and defend our findings as  
14 part of a doctoral thesis.  
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19 **AUTHORS' CONTRIBUTIONS:**

20  
21 All three authors contributed to the conception of the study. LM developed the first draft of the  
22 manuscript. LT and POZ provided statistical and methodological input. All three authors read and edited  
23 several versions of the manuscript. Prof Mark Oremus provided input to this paper as part of the Mixed  
24 Methods Research Designs for Health Services and Policy Research course (HRM/NUR 770) at McMaster  
25 University.  
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32 **FUNDING STATEMENT:**

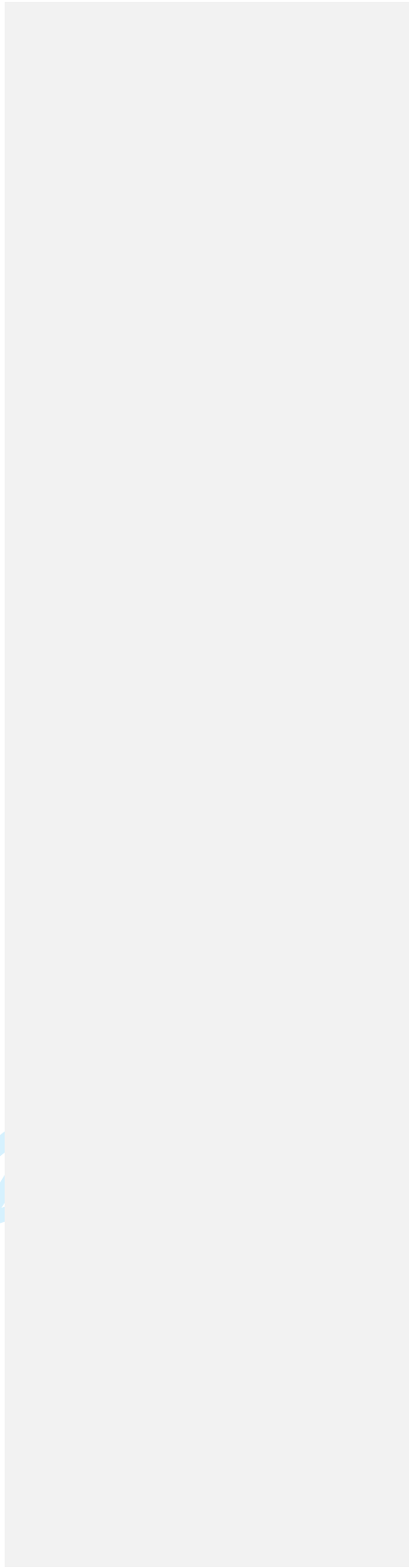
33  
34 This research received no specific grant from any funding agency in the public, commercial or not-for-  
35 profit sectors.  
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39 **COMPETING INTERESTS STATEMENT:**

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41 The authors declare none.  
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3 **Investigating community ownership of a text message program to improve adherence to antiretroviral**  
4 **therapy and provider-client communication: a mixed methods research protocol**  
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50 **Key words:**  
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53 Antiretroviral therapy, mobile phone, text messages, community ownership  
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55 **Word count: 3821**  
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**ABSTRACT:****Introduction:**

Mobile phone ownership and use is growing fastest in sub-Saharan Africa, and there is evidence that mobile phone text messages can be used successfully to significantly improve adherence to antiretroviral therapy and reduce treatment interruptions. However, the effects of many mobile health interventions are often reduced by human resource shortages. Also, the research projects generating the evidence for health interventions in developing countries are most often conducted using external funding sources, with limited sustainability and adoption by local governments following the completion of the projects. Strong community participation driven by active outreach programs and mobilization of community resources are the key to successful adoption and long-term sustainability of effective interventions. Our aim is to develop a framework for community ownership of a text messaging program to improve adherence to antiretroviral therapy; improve communication between patients and doctors; and as a reminder for appointments.

**Methods and analysis:**

We will use the exploratory sequential mixed methods approach. The first qualitative phase will entail focus group discussions with people living with HIV at the Yaoundé Central Hospital in Yaounde Cameroon (6-10 participants per group). The second quantitative phase will involve a cross-sectional survey (n=402). Here ordinal multivariable regression techniques will be used to determine the factors associated with community readiness and acceptability of ownership. Data from both phases will be merged.

**Ethics and dissemination:**

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3 Ethics approval will be obtained from the National Ethics Committee in Cameroon. Administrative  
4 approval will be obtained from the Yaounde Central Hospital and the Ministry of Health. The results of  
5 this paper will be disseminated as peer reviewed publications, at conferences and as part of a doctoral  
6 thesis.  
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### 11 12 13 **ARTICLE SUMMARY:**

#### 14 15 **Article focus:**

- 16  
17 • Text messaging to improve adherence to antiretroviral therapy and communication between  
18 patients and providers
- 19  
20 • Community ownership of supportive programs

#### 21 22 **Key messages**

- 23  
24 • Benefits and strengths of community ownership of programs
- 25  
26 • Community readiness to own supportive programs

#### 27 28 **Strengths and limitations of study**

- 29  
30 • Robust study design based on mixed methods
- 31  
32 • Components of research unfold during the study and may affect initial planning

**INTRODUCTION:**

At the end of 2010 approximately 34 million people were living with the human immunodeficiency virus (HIV). Close to seventy percent of them live in sub-Saharan Africa even though this region represents only 12 percent of the world's population.[1] However, there has been a steady decrease in Acquired Immune Deficiency Syndrome (AIDS) related deaths as free antiretroviral therapy (ART) has become more available in recent years.[1] While governments and health systems in sub-Saharan Africa continue to invest in providing free access to ART, their efforts are hampered by health system weaknesses that prevent a continuous supply of ART and sub-optimal levels of adherence.[2] Relatively high levels of adherence are necessary to achieve the goals of ART such as viral suppression and immune reconstitution.[3] High levels of adherence will therefore lead to reduced morbidity and mortality in people living with HIV, and minimal development of resistant strains.[3-6]

In recent years the WHO has endorsed the use of cheap and effective technologies to improve health outcomes in low resource settings,[7] and there is emerging evidence on the role a mobile phone text message -short message service (SMS) can play in the management of HIV. Text messages (sending brief electronic messages to a mobile phone) can improve adherence to ART, reduce treatment interruptions and reduce viral load.[8 9] They are useful as appointment reminders and can improve communication between health personnel and patients.[10] Patients who receive them also report high levels of satisfaction.[8 11] These advantages, coupled with the rapid growth of mobile phone ownership and use in Africa,[12] make the SMS an important tool to improve care in people living with HIV (PLHIV). The research on mobile phone text messaging is somewhat nuanced by the complexity of the intervention. It is unclear how factors such as community phone ownership, content of message, timing of message; nature of message (two-way or one way) or source of the message (peers or hospital based) can

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3 influence the efficacy of mobile phone text messaging.[13] There is a need for further research for many  
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5 of these unanswered questions.[14]  
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9 Cameroon has the highest rate of HIV in West and Central Africa, with a 5.3% prevalence in the adult  
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11 population;[1] poor adherence rates and serious health system weaknesses that pose a threat to the  
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13 management of HIV.[15] Recent reports suggest that PLHIV would like to receive text messages.[16] The  
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15 communication channels opened by text messaging also serve as a platform to identify key individual  
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17 and health system weaknesses that diminish the quality of care. [17] Cameroon also has a remarkably  
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19 high mobile phone penetration, with a 270% increase in mobile subscriptions per annum between 2000  
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21 and 2005. [18]Most successful health care programs are characterised by strong community  
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23 participation.[19] Community participation has played a major role in the control of the HIV  
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25 epidemic.[20] It should be encouraged because the programs will have better outreach; community  
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27 contributions (money, manpower and material) can be mobilised and; more importantly, because  
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29 communities have a right to take part in the decisions that affect their lives.[21] Community  
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31 participation (in HIV programs) has often been limited to the less technical aspects. Apart from providing  
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33 an organised front to defend the interests of PLHIV, they also take part in providing care, research, peer  
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35 education and role modelling.[19] For newer interventions such as text messaging which is more  
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37 structured and technologically oriented, the potential of community ownership needs to be explored.  
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44 We expect to observe an overall acceptability and readiness to own a text messaging program but a lack  
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46 of skills in how to manage one. Our findings will be used to inform initiatives aimed at up scaling the use  
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48 of mobile phone technology to improve adherence to antiretroviral therapy and other chronic diseases  
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50 in resource limited settings and how best community members can be involved in the process. At the  
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52 end of the project we will develop a framework for transferring technology into the hands of the  
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54 community and initiating a sustainable community-led project. We will build upon previous research  
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3 using weekly motivational two-way text messaging to improve adherence to ART.[16 17 22] The  
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5 following groups of people will benefit from this project: PLHIV in resource limited areas; people living  
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7 with other chronic diseases who can benefit from enhanced communication with the health system; and  
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9 health workers and community health workers who provide care for PLHIV.  
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13 The objective of this project is to determine how to set-up a community-owned text messaging program  
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15 by determining the readiness and acceptability of ownership among PLHIV at the Yaoundé Central  
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17 Hospital in Cameroon. We will proceed by collecting, analysing and comparing qualitative and  
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19 quantitative data. The findings from this mixed methods study will be used to establish a framework for  
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21 community ownership.  
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25 For the purposes of this paper, we define community ownership as a process in which the community  
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27 members design, manage and reap benefits from a project. We also acknowledge that in the course of  
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29 our research our definition may change. All references to “community” are made in regards to PLHIV in  
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31 Yaounde, Cameroon.  
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35 The following research questions will guide the conduct of this study:  
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39 Qualitative research questions:  
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- 42 • Will PLHIV in Yaoundé, Cameroon accept community ownership of a text messaging program?
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- 44 • How ready is the community of PLHIV in Yaoundé, Cameroon to take ownership of a text
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- 46 messaging program?
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51 Quantitative research questions:  
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- 54 • What factors are associated with acceptability and readiness of community ownership of a text
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- 56 messaging program among PLHIV in Yaoundé, Cameroon?
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- What proportions of PLHIV will accept and are ready to run a community owned text messaging program?

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Mixed methods research questions:

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- Are the themes related to the opportunities and challenges involved in the community ownership of a text message project among PLHIV in Yaoundé, Cameroon generalizable to a larger sample of PLHIV in Yaoundé?
  - In what ways do the qualitative and quantitative strands converge?

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## **METHODS AND ANALYSIS:**

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### **Study design:**

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We will use an exploratory sequential design.[23] The exploratory sequential design is a two-phase design that starts with an initial qualitative phase followed by a quantitative phase. In the qualitative phase, we will identify individuals with experience in community ownership for in-depth interviews. The members of the associations of PLHIV and others with community level experience will be selected from the Yaoundé Central Hospital. This relatively small number of individuals will be interviewed to identify themes, ideas and concepts that will be used to guide the second quantitative phase. Data collected from the qualitative phase will be converted into variables that will be used on a much larger sample in order to generalise the findings to all the PLHIV in Yaoundé. This sample will be taken from the Yaoundé Central Hospital. See figure 1 for details on the procedures and products of the different strands of the study.

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Figure 1: Overview of procedures and products of different strands

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3 The exploratory sequential design is preferred for this study because of the following reasons. Firstly,  
4 the separation of the qualitative and quantitative phases makes it easier for our multidisciplinary team  
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6 to work together and the separate methods and findings can be described easier. The anthropologists  
7  
8 and sociologists will be responsible for data collection and analysis in the qualitative strand. The themes  
9  
10 that emerge from their analysis will be converted into variables and built into a questionnaire by both  
11  
12 groups. Secondly, the use of both qualitative and quantitative methods makes it more acceptable to  
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14 researchers from both domains. Even though the overarching goal is to merge and compare qualitative  
15  
16 and quantitative data, the findings from each domain still hold merit and can be interpreted separately.  
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18 Thirdly, it will be used to develop a measurement instrument. The data collection tool for the  
19  
20 quantitative phase will be developed from the qualitative strand. Items to measure community  
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22 readiness and acceptability of ownership will be framed based on the responses in the qualitative  
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24 strand. Lastly, it is a good design for generalizing qualitative research findings.[23]  
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32 On the other hand, organizing two separate strategies for data collection will be time-consuming.  
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34 Separate sampling techniques have to be applied for both strands: the sample of PLHIV for the  
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36 qualitative strand will be selected purposefully based on their experience with community activities,  
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38 while the quantitative strand will be probabilistic. Details on the quantitative phase will not be available  
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40 at the time of Institutional Review Board approval. The protocol we will submit to the National Ethics  
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42 Committee will contain explicit details about why the data collection tool for the quantitative strand is  
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44 unavailable.[23]  
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#### 49 **Rationale for design:**

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51 Despite these characteristics, the exploratory sequential design is the method of choice when the  
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53 variables that may come into play are unknown and when there is no guiding framework.[23] This  
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55 design has been used for complex research projects like mental health assessment in older adults,[24]  
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3 healthcare students' educational expectations,[25] health system research,[26] alcohol use among  
4 people with liver disease and tobacco use.[27 28] Text messaging interventions are relatively new and to  
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6 the best of our knowledge community ownership has not been investigated for a text messaging  
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8 program.  
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13 In recent years, mixed methods research has emerged as a separate research paradigm-a seamless  
14 blend of both qualitative and quantitative research methods. Even though it was not initially used on the  
15 basis of its merits,[29] it is progressively gaining ground and acknowledgment in health research.[30] It  
16 offers a “powerful third paradigm choice that often will provide the most informative, complete,  
17 balanced and useful research results”. [31] In order to explore how PLHIV perceive text messages and  
18 the eventuality of owning and managing a text message project we are going to use mixed methods to  
19 identify common themes which arise and to subsequently generalise these findings to a larger sample.  
20 The complex nature of the research question warrants the use of mixed methods to generate a rich and  
21 complementary body of evidence to initiate a community-owned program. The methods used to initiate  
22 community ownership need to be well spelled-out and should originate from a robust and expanded  
23 body of evidence, which cannot be achieved by only qualitative or quantitative designs. We therefore  
24 seek complementarity, initiation and expansion.[32] Figure 1 is a detailed flow diagram of the study  
25 procedures.  
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#### 44 **Study setting:**

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47 Yaoundé is the capital city of Cameroon, a central African low-income country. The adult prevalence of  
48 HIV in Cameroon is 5.3%.[1] The Yaoundé Central hospital houses the largest HIV clinic in the country. It  
49 has a capacity of 381 beds and is staffed by 95 doctors and 270 nurses.[33] In the HIV clinics, there are  
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3 6500 regular clients and approximately 40 new cases every week. This hospital is one of the pioneer  
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5 centres for HIV research in Cameroon, and offers a great potential for recruitment and data collection.  
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### 8 **Sampling:**

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10 The overall purpose of this sample is to address the research question, in a generalizable way using both  
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12 purposeful and probabilistic techniques that ensure data collection in breadth and depth.[34] This is a  
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14 useful combination of sampling strategies that helps to generate items and variables for questionnaires;  
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16 and to generate hypotheses.[35]  
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### 20 **Qualitative strand:**

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22 A purposeful sampling strategy will be used to determine who will participate in the qualitative strand.  
23  
24 PLHIV with relevant experience related to community activities shall be selected based on any of the  
25  
26 following criteria:  
27  
28  
29

- 30  
31  
32 • They should belong to an association of PLHIV (leaders or members)
- 33  
34  
35 • They are community health workers
- 36  
37  
38 • They are willing to participate in a community owned text messaging program
- 39  
40

41 Focus groups of 6-10 participants will be constituted consecutively until no new ideas emerge. We will  
42  
43 focus on depth of information and qualitative data obtained from the cases.[34] PLHIV will be recruited  
44  
45 from the waiting rooms of the Yaoundé Central Hospital HIV clinic. They will be approached by the plain-  
46  
47 clothed non-staff moderator to determine their interest in taking part in a group discussion and if they  
48  
49 meet the pre-specified criteria. This is typical case sampling, aimed at identifying representative  
50  
51 cases.[34] Consenting participants will be shown to a quiet nearby room prepared for the focus groups.  
52  
53 Notes will be taken in writing and using an audio recorder by a note taker. No financial incentives shall  
54  
55  
56  
57

1  
2  
3 be offered, but waiting times at the clinic will be reduced (in collaboration with the attending physician)  
4  
5 after participation. The protocol will be presented to the hospital staff and the procedures for reducing  
6  
7 waiting times will be discussed.  
8  
9

#### 10 11 Quantitative strand:

12  
13 All PLHIV attending the Yaoundé Central Hospital HIV clinic during the study period will be eligible for  
14  
15 enrolment, provided they are aged 21 years or more and give consent. Sample size will be determined  
16  
17 using the formula proposed by Cochran for surveys.[36] Assuming an alpha level of 0.05; a 5% margin of  
18  
19 error (for categorical data); a standard deviation of 0.5 (for a primary outcome - community readiness  
20  
21 measured on a seven-point scale); in a population of 6500 PLHIV at the Yaoundé Central Hospital, we  
22  
23 arrived at a sample of 402; taking into account a “refusal to participate rate” of 10% documented in  
24  
25 another text messaging study among PLHIV in this clinic.[22] This sample is meant to be representative  
26  
27 of the entire population of PLHIV attending the Yaoundé Central Hospital HIV clinic.  
28  
29  
30  
31

#### 32 33 Data collection:

34  
35 Prior to data collection we will organise brief training sessions for the data collectors in the qualitative  
36  
37 and quantitative strands. The purpose of this training will be to familiarise them with their working  
38  
39 instruments and to standardise the procedure for participant invitation, obtaining consent and data  
40  
41 collection.  
42  
43  
44

#### 45 46 Qualitative strand:

47  
48 Focus group discussions will be conducted using a pre-established interview guide (See Table 1). It will  
49  
50 contain basic socio-demographic information, a description of participant involvement in community  
51  
52 activities (eligibility criteria fulfilled), and specific themes related to the phenomenon under study. An  
53  
54 experienced moderator and note-taker will invite, request consent and enrol participants, in that order.  
55  
56  
57  
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60

For each session, the data collectors will be dressed in plain clothes and use a separate room free from distractions for the focus groups. The note taker will be responsible for noting the non-verbal cues emanating from the participants and operating the audio-recorder. The audio recorder will be tested in a mock session for clarity of recordings. Participants will be encouraged to speak in tones that can be recorded. The moderator will be responsible for keeping the discussions in line with the guide while exploring interesting dimensions that arise from the discussions. More importantly, the moderator will be responsible for gaining the trust of the participants and encouraging participation from all. The data collected from this strand will be used to formulate questions that best characterize acceptability and readiness.

**Table 1: Focus group discussion guide**

<b>Focus Group Discussion Guide</b>
<b>Preparatory steps</b>
Does participant meet criteria?
Have they given written/verbal consent?
Collect socio-demographic data (age, gender); note time; number of participants
<b>On existing community activities</b>
What community initiatives/activities/organisations exist for PLHIV?
What community activity do you participate in?
How do you benefit from these activities?
<b>On a text messaging project</b>
The purpose of this project is to improve adherence to HIV medication and to foster communication with health workers. What other goals do you think can be achieved through text messaging?

1	
2	
3	
4	Do you think you (as a community) are ready to run a text message project?
5	
6	Would you accept to run or take part in a text messaging project?
7	
8	What strengths does the community have that can be used to run such a project?
9	
10	What weaknesses does the community have that can hinder the project?
11	
12	What roles can the community play in such a project?
13	
14	
15	<b>On feasibility</b>
16	
17	How do you think the project should be financed?
18	
19	Are you willing to pay to receive a text messages?
20	
21	Do you think the community is ready to run such a project?
22	
23	Would you like health workers to be involved in the management of such a project?
24	
25	
26	
27	<b>Any other issues participants would like to discuss</b>
28	
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Quantitative strand:

In the quantitative strand, patients will be approached at the clinic in various locations: the outpatient department, the pharmacy and the laboratory. Four interviewers will concurrently conduct the survey to maximize recruitment. Recruitment and data collection will continue until the required sample is achieved. The trained interviewers will employ the pre-tested questionnaire developed from the qualitative strand and existing frameworks,[37] to collect data from all eligible participants. The data collection tool will be developed based on findings from the qualitative strand. It will contain basic socio-demographic data, adherence data, information related to participation in community activities and other variables generated from the themes identified in the qualitative strand. The questions will be closed-ended with simple “yes or no” responses. Complex items like readiness will be presented on a seven-point Likert scale.[38]



**Data analyses:**

## Qualitative data analysis:

We will conduct a thematic analysis. Qualitative data will be analysed by transcribing into text. Codes will be generated by looking for repetitions in the text.[39] These repetitions (codes) will be grouped based on their similarity into categories and the overarching themes will be identified. We will use a number of pre-set categories to guide the process, but emergent categories will also be noted.[40] For example pre-set categories like lack of familiarity with text messaging or lack of skills to run a text messaging project shall be identified. This coding will be done by multiple researchers to determine if coders agree on the themes assigned to a segment of text. The themes will be displayed visually in a conceptual model, showing how the themes are linked to each other.[39]

## Quantitative analyses:

Quantitative data will be analysed using using Statistical Package for Social Sciences (SPSS) Version 20.0 (SPSS, Inc., 2009, Chicago, IL, USA). Statistical significance will be set at  $\alpha=0.05$ . Adjusted odds ratios (aOR), 95% confidence intervals (CI) and p-values will be presented. We will explore community readiness for ownership of a text messaging project as the ordinal dependent variable in a ordinal logistic regression analysis. Potential independent variables include: socio-demographics, mobile phone ownership, familiarity with text messaging, level of adherence to medication, need for additional support, and level of comfort with community management.

**Data integration:**

Due to the sequential design of the study, the qualitative and quantitative components will be analysed separately in a sequential qualitative-quantitative analysis. This is the method of choice when the analysis of one strand is necessary to inform the conduct of the next.[41] Inferences will be drawn from

both strands and across strands. These “meta-inferences” will be used to draw conclusions.[41] The qualitative and quantitative strands will be merged in a matrix to display how they are related to each other. Table 2 is a sample of how both strands of data will be put together, linking themes to thematic variables and statistical analyses. This correlation matrix will help to identify relationships between themes and thematic variables (statistical triangulation) and strong thematic variables (variables that occur frequently). It will also show how the quantitative data expand on the qualitative findings. These techniques of data integration have been used previously and have been described in detail.[42]

In the event that the qualitative and quantitative strands do not converge the data will be handled in one of four ways: firstly, the data may be re-analyzed through the lens of a different theoretical framework (reconciliation); secondly, the divergence may introduce new perspectives that generate new research questions (initiation); thirdly, irreconcilable differences may be viewed as best-case and worst-case scenarios (bracketing); and finally a complete re-appraisal of the body of evidence in terms of completeness and validity (exclusion).[43]

**Table 2: Mixed methods data matrix**

Strand					
Qualitative		Quantitative			
Themes identified	Number of times mentioned n (%)	Thematic variable	Representativeness N (%)	Influence on community readiness	
				Univariate (OR, 95% CI; p)	Multivariable (aOR, 95% CI; p)

1  
2  
3 aOR: adjusted odds ratio; CI: confidence interval  
4  
5  
6  
7

8 In the qualitative strand, data will be analysed, reduced, displayed and transformed into quantitative  
9  
10 variables. In the quantitative strand, data will be analysed, reduced and displayed. At the final stage  
11  
12 (data mixing), data will be displayed, correlated and integrated.[44] Figure 2 demonstrates the steps we  
13  
14 will follow for analysis and integration of data.  
15  
16

17  
18 Figure 2: Steps in data analysis and integration  
19  
20

### 21 **Validation checks and dealing with sources of bias:**

22

23  
24 We will draw from published criteria for critical appraisal of mixed-methods studies to validate our  
25  
26 research,[45] using items identified by as a cross-paradigm framework for trustworthiness and rigor.[46]  
27  
28

29 Internal validity:  
30

31  
32 In the qualitative strand, internal validation (credibility) will be performed by using an audio recording  
33  
34 device to ensure accuracy; member-checking of collected data for general accuracy and accuracy of  
35  
36 quotes; and by comparing codes among several coders.[23 47] In the quantitative strand we will limit  
37  
38 information bias by pilot testing the questionnaire for clarity (participants understand the questions as  
39  
40 they were meant to be understood) and using non-staff interviewers. We will also adjust for potential  
41  
42 confounding during analysis. For example, participants who already participate in some community  
43  
44 activities may be more likely to report readiness to participate in a text message program. We will try to  
45  
46 capture this in our analyses.  
47  
48  
49

50  
51 Data will be collected from PLHIV at the Yaoundé Central Hospital, the population to whom we want to  
52  
53 generalize our findings, so selection bias is unlikely to be significant. However, we will collect socio-  
54  
55 demographic data from the participants who refuse to participate to see if they differ significantly from  
56  
57

1  
2  
3 those who do. Selection bias can be avoided at the design and analytical stages of a project.[48] Data  
4  
5 from the qualitative phase may help to identify variables that are associated with willingness to  
6  
7 participate in the survey. These variables can be used to restrict participation or be measured accurately  
8  
9 and used for adjusted analyses.[48]  
10  
11

#### 12 13 External validity:

14  
15  
16 The extent to which our findings can be generalized to the rest of the population of PLHIV at the  
17  
18 Yaoundé Central hospital will be verified by using a large (pre-determined) sample, comparing the socio-  
19  
20 demographics of our sample to the parent population and by investigating any refusals to participate. In  
21  
22 this way we will be able to make statistical (external) generalizations[49]. We also state the purpose of  
23  
24 our study, the setting, the data collection procedures and the outcomes we are measuring: community  
25  
26 readiness and acceptability of ownership of a text messaging program among PLHIV at the Yaounde  
27  
28 Central Hospital.  
29  
30  
31

#### 32 33 Consistency:

34  
35  
36 We will apply standardised qualitative (focus groups) and quantitative (survey) techniques (described  
37  
38 above) to ensure consistent results. A journal of study activities will be kept so that the study  
39  
40 procedures can be followed and replicated. Our data collection tools and techniques will be externally  
41  
42 audited by the Cameroon National Ethics Committee.[50]  
43  
44  
45

#### 46 47 **Feasibility:**

48  
49 This study will benefit from a number of characteristics that make it feasible. Firstly, the study is situated  
50  
51 in a very active HIV centre with a large potential for recruitment in both strands of the study. Secondly,  
52  
53 we have a pre-existing multidisciplinary team with collective experience in other qualitative and  
54  
55 quantitative research projects. This team is made up of public health physicians, clinicians, sociologists,  
56  
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1  
2  
3 anthropologists, health economists and public health administrators. Thirdly, surveys in this setting are  
4 relatively inexpensive to conduct. [51] Finally, our host centre, the Centre for the Development of Best  
5 Practices in Health (CDBPH) has the infrastructure and experience for a research project of this scale and  
6  
7  
8 can provide administrative, logistic and communication support.  
9  
10  
11

#### 12 13 **ETHICS AND DISSEMINATION:**

##### 14 15 **Ethics:**

16  
17  
18 Ethical approval and administrative clearance will be obtained from the Cameroon National Ethics  
19 Committee and the directorate of operational research in the Ministry of Health, respectively. These are  
20 the only compulsory regulatory bodies in Cameroon. Prior to these, permission to conduct the study will  
21 be obtained from the administration of the Yaoundé Central Hospital. We will use the focus group  
22 guiding document to prepare a draft questionnaire for the quantitative strand. The Ethics Committee  
23 will be informed that this document will be modified as the project unfolds.  
24  
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##### 33 34 **Dissemination plan for results:**

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36  
37 We plan to disseminate our results at public presentations with stakeholders in Cameroon (Ministry of  
38 health staff, journalists, PLHIV, clinicians, community health workers, social workers, mobile  
39 communication operators); to publish the manuscript; and publicly present and defend our findings as  
40 part of a doctoral thesis.  
41  
42  
43  
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45  
46

##### 47 48 **AUTHORS' CONTRIBUTIONS:**

49  
50 All three authors contributed to the conception of the study. LM developed the first draft of the  
51 manuscript. LT and POZ provided statistical and methodological input. All three authors read and edited  
52 several versions of the manuscript. Prof Mark Oremus provided input to this paper as part of the Mixed  
53  
54  
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57

1  
2  
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4  
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6  
7

8  
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14  
15

16  
17 **COMPETING INTERESTS STATEMENT:**

18  
19 The authors declare none.  
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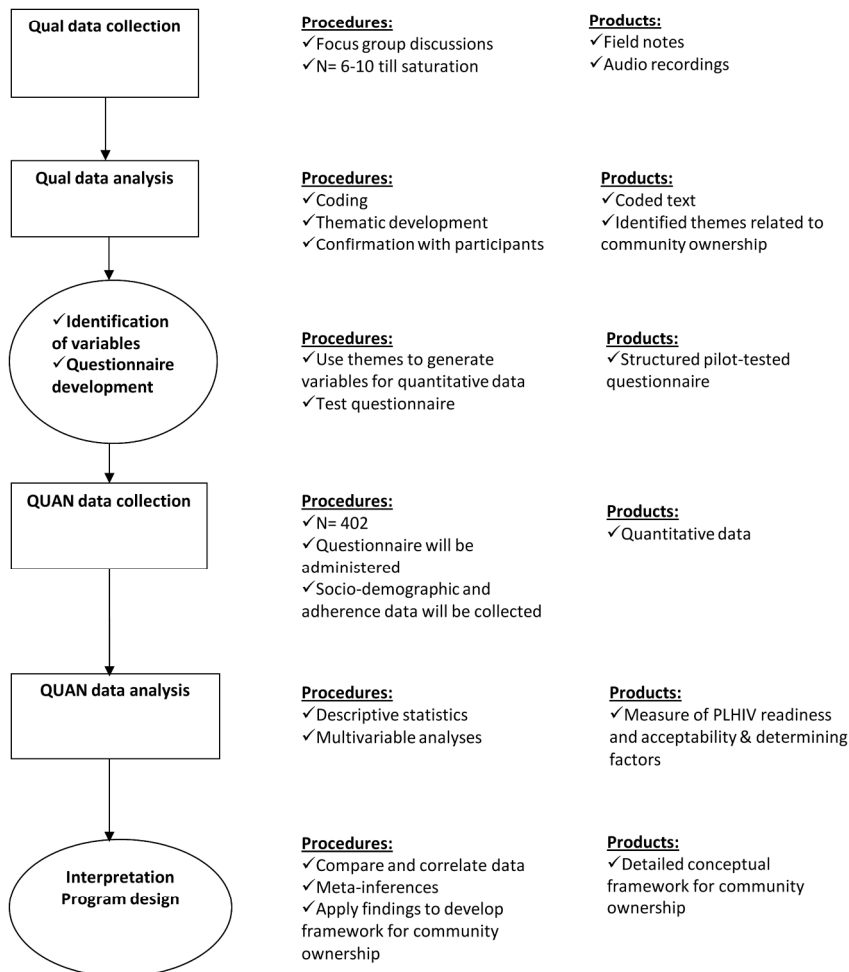


Figure 1: Overview of procedures and products of different strands  
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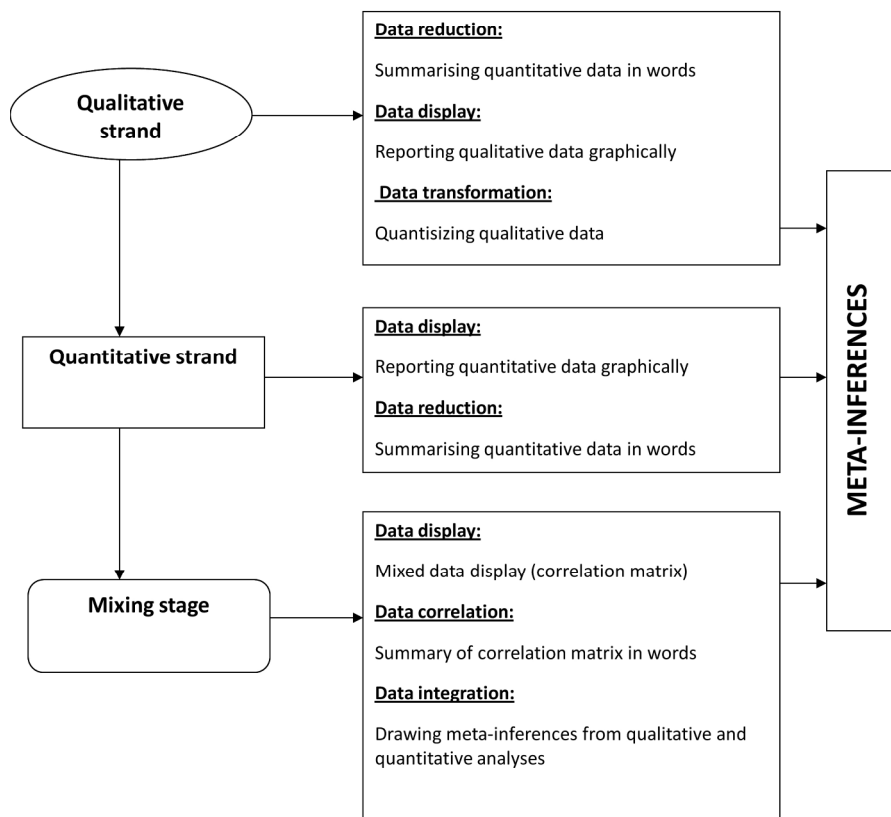


Figure 2: Steps in data analysis and integration  
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**Investigating community ownership of a text message program to improve adherence to antiretroviral therapy and provider-client communication: a mixed methods research protocol**

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2013-002816.R2
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<b>Primary Subject Heading</b>:	HIV/AIDS
Secondary Subject Heading:	Health services research, Qualitative research, Patient-centred medicine, Research methods
Keywords:	HIV & AIDS < INFECTIOUS DISEASES, Public health < INFECTIOUS DISEASES, QUALITATIVE RESEARCH, PRIMARY CARE

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3 **Investigating community ownership of a text message program to improve adherence to antiretroviral**  
4 **therapy and provider-client communication: a mixed methods research protocol**  
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7  
8 **Authors:**  
9

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50 **Key words:**  
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53 Antiretroviral therapy, mobile phone, text messages, community ownership  
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55 **Word count: 3821**  
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**ABSTRACT:****Introduction:**

Mobile phone ownership and use is growing fastest in sub-Saharan Africa, and there is evidence that mobile phone text messages can be used successfully to significantly improve adherence to antiretroviral therapy and reduce treatment interruptions. However, the effects of many mobile health interventions are often reduced by human resource shortages within health facilities. Also, the research projects generating the evidence for health interventions in developing countries are most often conducted using external funding sources, with limited sustainability and adoption by local governments following the completion of the projects. Strong community participation driven by active outreach programs and mobilization of community resources are the key to successful adoption and long-term sustainability of effective interventions. Our aim is to develop a framework for community ownership of a text messaging program to improve adherence to antiretroviral therapy; improve communication between patients and doctors; and as a reminder for appointments.

**Methods and analysis:**

We will use the exploratory sequential mixed methods approach. The first qualitative phase will entail focus group discussions with people living with HIV at the Yaoundé Central Hospital in Yaounde Cameroon (6-10 participants per group). The second quantitative phase will involve a cross-sectional survey (n=402). Here binary logistic regression techniques will be used to determine the factors associated with community readiness and acceptability of ownership. Data from both phases will be merged.

**Ethics and dissemination:**

1  
2  
3 This study has been approved by the Yaounde Central Hospital Institutional Review Board. The results of  
4  
5 this paper will be disseminated as peer reviewed publications, at conferences and as part of a doctoral  
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7 thesis.  
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#### 10 11 **ARTICLE SUMMARY:** 12

##### 13 14 **Article focus:** 15

- 16  
17 • Text messaging to improve adherence to antiretroviral therapy and communication between  
18 patients and providers  
19
- 20  
21 • Community ownership of supportive programs  
22  
23

##### 24 25 **Key messages** 26

- 27 • Benefits and strengths of community ownership of programs  
28
- 29 • Community readiness to own supportive programs  
30

##### 31 32 **Strengths and limitations of study** 33

- 34 • Robust study design based on mixed methods  
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- 36 • Components of research unfold during the study and may affect initial planning  
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**INTRODUCTION:**

At the end of 2010 approximately 34 million people were living with the human immunodeficiency virus (HIV). Close to seventy percent of them live in sub-Saharan Africa even though this region represents only 12 percent of the world's population.[1] However, there has been a steady decrease in Acquired Immune Deficiency Syndrome (AIDS) related deaths as free antiretroviral therapy (ART) has become more available in recent years.[1] While governments and health systems in sub-Saharan Africa continue to invest in providing free access to ART, their efforts are hampered by health system weaknesses that prevent a continuous supply of ART and sub-optimal levels of adherence.[2] Relatively high levels of adherence are necessary to achieve the goals of ART such as viral suppression and immune reconstitution.[3] High levels of adherence will therefore lead to reduced morbidity and mortality in people living with HIV, and minimal development of resistant strains.[3-6]

In recent years the WHO has endorsed the use of cheap and effective technologies to improve health outcomes in low resource settings,[7] and there is emerging evidence on the role a mobile phone text message -short message service (SMS) can play in the management of HIV. Text messages (sending brief electronic messages to a mobile phone) can improve adherence to ART, reduce treatment interruptions and reduce viral load.[8 9] They are useful as appointment reminders and can improve communication between health personnel and patients.[10] Patients who receive them also report high levels of satisfaction.[8 11] These advantages, coupled with the rapid growth of mobile phone ownership and use in Africa,[12] make the SMS an important tool to improve care in people living with HIV (PLHIV). The research on mobile phone text messaging is somewhat nuanced by the complexity of the intervention. It is unclear how factors such as community phone ownership, content of the message, timing of the message; nature of the message (two-way or one way) or source of the message (peers or hospital

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3 based) can influence the efficacy of mobile phone text messaging.[13] There is a need for further  
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5 research which responds to many of these unanswered questions.[14]  
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9 Cameroon has the highest rate of HIV in West and Central Africa, with a 5.3% prevalence in the adult  
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11 population;[1] poor adherence rates and serious health system weaknesses that pose a threat to the  
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13 management of HIV.[15] Recent reports suggest that PLHIV would like to receive text messages.[16] The  
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15 communication channels opened by text messaging also serve as a platform to identify key individual  
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17 and health system weaknesses that diminish the quality of care, and reduce the overall effects of text  
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19 messaging. For example, human resource shortages and medication stock-outs can limit the potential of  
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21 adherence enhancing mHealth interventions. [17] Cameroon also has a high mobile phone penetration  
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23 rate, with 52 mobile cellular subscriptions per 100 people in 2012. [18] Mobile text messaging and  
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25 phone calls are mostly affordable, and can be as little as 25FRS CFA (\$0.05) per message and 75 FRS CFA  
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27 (\$0.15) per minute, respectively.  
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33 Most successful health care programs are characterised by strong community participation.[19]  
34  
35 Community participation has played a major role in the control of the HIV epidemic.[20] It should be  
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37 encouraged because the programs will have better outreach; community contributions (money,  
38  
39 manpower and material) can be mobilised and; more importantly, because communities have a right to  
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41 take part in the decisions that affect their lives.[21] Community participation (in HIV programs) has  
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43 often been limited to the less technical aspects. Apart from providing an organised front to defend the  
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45 interests of PLHIV, they also take part in providing care, research, peer education and role  
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47 modelling.[19] For newer interventions such as text messaging which is more structured and  
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49 technologically oriented, the potential of community ownership needs to be explored.  
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3 We expect to observe an overall acceptability and readiness to own a text messaging program but a lack  
4 of skills in how to manage one. Our findings will be used to inform initiatives aimed at up scaling the use  
5 of mobile phone technology to improve adherence to antiretroviral therapy and other chronic diseases  
6 in resource limited settings and how best community members can be involved in the process. At the  
7 end of the project we will develop a framework for transferring technology into the hands of the  
8 community and initiating a sustainable community-led project. We will build upon previous research  
9 using weekly motivational two-way text messaging to improve adherence to ART.[16 17 22] The  
10 following groups of people will benefit from this project: PLHIV in resource limited areas; people living  
11 with other chronic diseases who can benefit from enhanced communication with the health system; and  
12 health workers and community health workers who provide care for PLHIV.  
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27 The objective of this project is to determine how to set-up a community-owned text messaging program  
28 by determining the readiness and acceptability of ownership among PLHIV at the Yaoundé Central  
29 Hospital in Cameroon. We will proceed by collecting, analysing and comparing qualitative and  
30 quantitative data. The findings from this mixed methods study will be used to establish a framework for  
31 community ownership.  
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40 For the purposes of this paper, we define community ownership as a process in which the community  
41 members design, manage and reap benefits from a project. We also acknowledge that in the course of  
42 our research our definition may change. All references to “community” are made in regards to PLHIV in  
43 Yaounde, Cameroon.  
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49 The following research questions will guide the conduct of this study:  
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52 Qualitative research questions:  
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- 55 • Will PLHIV in Yaoundé, Cameroon accept community ownership of a text messaging program?  
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- How ready is the community of PLHIV in Yaoundé, Cameroon to take ownership of a text messaging program?

#### Quantitative research questions:

- What factors are associated with acceptability and readiness of community ownership of a text messaging program among PLHIV in Yaoundé, Cameroon?
- What proportions of PLHIV will accept and are ready to run a community owned text messaging program?

#### Mixed methods research questions:

- Are the themes related to the opportunities and challenges involved in the community ownership of a text message project among PLHIV in Yaoundé, Cameroon generalizable to a larger sample of PLHIV in Yaoundé?
- In what ways do the qualitative and quantitative strands converge?

### **METHODS AND ANALYSIS:**

#### **Study design:**

We will use an exploratory sequential design.[23] The exploratory sequential design is a two-phase design that starts with an initial qualitative phase followed by a quantitative phase. In the qualitative phase, we will identify individuals with experience in community ownership for in-depth interviews. The members of the associations of PLHIV and others with community level experience will be selected from the Yaoundé Central Hospital. This relatively small number of individuals will be interviewed to identify themes, ideas and concepts that will be used to guide the second quantitative phase. Data collected from the qualitative phase will be converted into variables that will be used on a much larger sample in

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2  
3 order to generalise the findings to all the PLHIV in Yaoundé. This sample will be taken from the Yaoundé  
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5 Central Hospital. See figure 1 for details on the procedures and products of the different strands of the  
6  
7 study.  
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10  
11 Figure 1: Overview of procedures and products of different strands  
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14 The exploratory sequential design is preferred for this study because of the following reasons. Firstly,  
15  
16 the separation of the qualitative and quantitative phases makes it easier for our multidisciplinary team  
17  
18 to work together and the separate methods and findings can be described easier. The anthropologists  
19  
20 and sociologists will be responsible for data collection and analysis in the qualitative strand. The themes  
21  
22 that emerge from their analysis will be converted into variables and built into a questionnaire by both  
23  
24 groups. Secondly, the use of both qualitative and quantitative methods makes it more acceptable to  
25  
26 researchers from both domains. Even though the overarching goal is to merge and compare qualitative  
27  
28 and quantitative data, the findings from each domain still hold merit and can be interpreted separately.  
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30 Thirdly, it will be used to develop a measurement instrument. The data collection tool for the  
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32 quantitative phase will be developed from the qualitative strand. Items to measure community  
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34 readiness and acceptability of ownership will be framed based on the responses in the qualitative  
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36 strand. Lastly, it is a good design for generalizing qualitative research findings.[23]  
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42 On the other hand, organizing two separate strategies for data collection will be time-consuming.  
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44 Separate sampling techniques have to be applied for both strands: the sample of PLHIV for the  
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46 qualitative strand will be selected purposefully based on their experience with community activities,  
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48 while the quantitative strand will be probabilistic. Details on the quantitative phase will not be available  
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50 at the time of Institutional Review Board approval.[23]  
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**Rationale for design:**

Despite these characteristics, the exploratory sequential design is the method of choice when the variables that may come into play are unknown and when there is no guiding framework.[23] This design has been used for complex research projects like mental health assessment in older adults,[24] healthcare students' educational expectations,[25] health system research,[26] alcohol use among people with liver disease and tobacco use.[27 28] Text messaging interventions are relatively new and to the best of our knowledge community ownership has not been investigated for a text messaging program.

In recent years, mixed methods research has emerged as a separate research paradigm-a seamless blend of both qualitative and quantitative research methods. Even though it was not initially used on the basis of its merits,[29] it is progressively gaining ground and acknowledgment in health research.[30] It offers a "powerful third paradigm choice that often will provide the most informative, complete, balanced and useful research results". [31] In order to explore how PLHIV perceive text messages and the eventuality of owning and managing a text message project we are going to use mixed methods to identify common themes which arise and to subsequently generalise these findings to a larger sample. The complex nature of the research question warrants the use of mixed methods to generate a rich and complementary body of evidence to initiate a community-owned program. The methods used to initiate community ownership need to be well spelled-out and should originate from a robust and expanded body of evidence, which cannot be achieved by only qualitative or quantitative designs. We therefore seek complementarity, initiation and expansion.[32] Figure 1 is a detailed flow diagram of the study procedures.

**Study setting:**

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3 Yaoundé is the capital city of Cameroon, a central African low-income country. The adult prevalence of  
4 HIV in Cameroon is 5.3%.[1] The Yaoundé Central hospital houses the largest HIV clinic in the country. It  
5  
6 has a capacity of 381 beds and is staffed by 95 doctors and 270 nurses.[33] In the HIV clinics, there are  
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8  
9  
10 6500 regular clients and approximately 40 new cases every week. This hospital is one of the pioneer  
11  
12 centres for HIV research in Cameroon, and offers a great potential for recruitment and data collection.  
13

### 14 15 16 **Sampling:**

17  
18 The overall purpose of this sample is to address the research question, in a generalizable way using both  
19  
20 purposeful and probabilistic techniques that ensure data collection in breadth and depth.[34] This is a  
21  
22 useful combination of sampling strategies that helps to generate items and variables for questionnaires;  
23  
24 and to generate hypotheses.[35]  
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26

### 27 28 29 **Qualitative strand:**

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31 A purposeful sampling strategy will be used to determine who will participate in the qualitative strand.  
32  
33 PLHIV with relevant experience related to community activities shall be selected based on any of the  
34  
35 following criteria:  
36

- 37  
38 • They should belong to an association of PLHIV (leaders or members)
- 39  
40 • They are community health workers
- 41  
42 • They are willing to participate in a community owned text messaging program
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49 Focus groups of 6-10 participants will be constituted consecutively until no new ideas emerge. We will  
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51 focus on depth of information and qualitative data obtained from the cases.[34] PLHIV will be recruited  
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53 from the waiting rooms of the Yaoundé Central Hospital HIV clinic. They will be approached by the plain-  
54  
55 clothed non-staff moderator to determine their interest in taking part in a group discussion and if they  
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3 meet the pre-specified criteria. This is typical case sampling, aimed at identifying representative  
4 cases.[34] Consenting participants will be shown to a quiet nearby room prepared for the focus groups.  
5  
6 Notes will be taken in writing and using an audio recorder by a note-taker. No financial incentives shall  
7  
8 be offered, but waiting times at the clinic will be reduced (in collaboration with the attending physician)  
9  
10 after participation. The protocol will be presented to the hospital staff and the procedures for reducing  
11  
12 waiting times will be discussed.  
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#### 16 17 18 Quantitative strand: 19

20 All PLHIV attending the Yaoundé Central Hospital HIV clinic during the study period will be eligible for  
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22 enrolment, provided they are aged 21 years or more and give consent. Sample size will be determined  
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24 using the formula proposed by Cochran for surveys.[36] Assuming an alpha level of 0.05; a 5% margin of  
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26 error (for categorical data); a standard deviation of 0.5 (for a primary outcome - community readiness  
27  
28 measured as a binary variable); in a population of 6500 PLHIV at the Yaoundé Central Hospital, we  
29  
30 arrived at a sample of 402; taking into account a “refusal to participate rate” of 10% - documented in  
31  
32 another text messaging study among PLHIV in this clinic.[22] This sample is meant to be representative  
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34 of the entire population of PLHIV attending the Yaoundé Central Hospital HIV clinic. We acknowledge  
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36 considerable uncertainty in the variables that will be used in the quantitative phase of the study, but opt  
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38 for a binary outcome in order to achieve a larger sample size.  
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#### 45 Data collection: 46

47 Prior to data collection we will organise brief training sessions for the data collectors in the qualitative  
48  
49 and quantitative strands. The purpose of this training will be to familiarise them with their working  
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51 instruments and to standardise the procedure for participant invitation, obtaining consent and data  
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53 collection.  
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3 Qualitative strand:  
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6 Focus group discussions will be conducted using a pre-established interview guide (See Table 1). It will  
7  
8 contain basic socio-demographic information, a description of participant involvement in community  
9  
10 activities (eligibility criteria fulfilled), and specific themes related to the phenomenon under study. An  
11  
12 experienced moderator and note-taker will invite, request consent and enrol participants, in that order.  
13  
14 For each session, the data collectors will be dressed in plain clothes and use a separate room free from  
15  
16 distractions for the focus groups. The note taker will be responsible for noting the non-verbal cues  
17  
18 emanating from the participants and operating the audio-recorder. The audio recorder will be tested in  
19  
20 a mock session for clarity of recordings. Participants will be encouraged to speak in tones that can be  
21  
22 recorded. The moderator will be responsible for keeping the discussions in line with the guide while  
23  
24 exploring interesting dimensions that arise from the discussions. More importantly, the moderator will  
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26 be responsible for gaining the trust of the participants and encouraging participation from all. The data  
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28 collected from this strand will be used to formulate questions that best characterize acceptability and  
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30 readiness.  
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Table 1: Focus group discussion guide

<b>Focus Group Discussion Guide</b>
<b>Preparatory steps</b>
Does participant meet criteria?
Have they given written/verbal consent?
Collect socio-demographic data (age, gender); note time; number of participants
<b>On existing community activities</b>
What community initiatives/activities/organisations exist for PLHIV?
What community activity do you participate in?
How do you benefit from these activities?
<b>On a text messaging project</b>
The purpose of this project is to improve adherence to HIV medication and to foster communication with health workers. What other goals do you think can be achieved through text messaging?
Do you think you (as a community) are ready to run a text message project?
Would you accept to run or take part in a text messaging project?
What strengths does the community have that can be used to run such a project?
What weaknesses does the community have that can hinder the project?
What roles can the community play in such a project?
<b>On feasibility</b>
How do you think the project should be financed?
Are you willing to pay to receive a text messages?
Do you think the community is ready to run such a project?

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Would you like health workers to be involved in the management of such a project?
<b>Any other issues participants would like to discuss</b>

Quantitative strand:

In the quantitative strand, patients will be approached at the clinic in various locations: the outpatient department, the pharmacy and the laboratory. Four interviewers will concurrently conduct the survey to maximize recruitment. Recruitment and data collection will continue until the required sample is achieved. The trained interviewers will employ the pre-tested questionnaire developed from the qualitative strand and existing frameworks,[37] to collect data from all eligible participants. The data collection tool will be developed based on findings from the qualitative strand. It will contain basic socio-demographic data, adherence data, phone ownership and autonomy, information related to participation in community activities and other variables generated from the themes identified in the qualitative strand. The questions will be closed-ended with simple “yes or no” responses. Complex items like readiness may be presented on a seven-point Likert scale.[38]

**Data analyses:**

Qualitative data analysis:

We will conduct a thematic analysis. Qualitative data will be analysed by transcribing into text. Codes will be generated by looking for repetitions in the text.[39] These repetitions (codes) will be grouped based on their similarity into categories and the overarching themes will be identified. We will use a number of pre-set categories to guide the process, but emergent categories will also be noted.[40] For example pre-set categories like lack of familiarity with text messaging or lack of skills to run a text messaging project shall be identified. This coding will be done by multiple researchers to determine if

1  
2  
3 coders agree on the themes assigned to a segment of text. The themes will be displayed visually in a  
4  
5 conceptual model, showing how the themes are linked to each other.[39]  
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7

#### 8 9 Quantitative analyses:

10  
11 Quantitative data will be analysed using using Statistical Package for Social Sciences (SPSS) Version 20.0  
12  
13 (SPSS, Inc., 2009, Chicago, IL, USA). Statistical significance will be set at alpha= 0.05. Adjusted odds ratios  
14  
15 (aOR), 95% confidence intervals (CI) and p-values will be presented. We will explore community  
16  
17 readiness for ownership of a text messaging project as the binary dependent variable in a logistic  
18  
19 regression analysis. Potential independent variables include: socio-demographics, mobile phone  
20  
21 ownership, familiarity with text messaging, level of adherence to medication, need for additional  
22  
23 support, and level of comfort with community management.  
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#### 28 29 **Data integration:**

30  
31 Due to the sequential design of the study, the qualitative and quantitative components will be analysed  
32  
33 separately in a sequential qualitative-quantitative analysis. This is the method of choice when the  
34  
35 analysis of one strand is necessary to inform the conduct of the next.[41] Inferences will be drawn from  
36  
37 both strands and across strands. These “meta-inferences” will be used to draw conclusions.[41] The  
38  
39 qualitative and quantitative strands will be merged in a matrix to display how they are related to each  
40  
41 other. Table 2 is a sample of how both strands of data will be put together, linking themes to thematic  
42  
43 variables and statistical analyses. This correlation matrix will help to identify relationships between  
44  
45 themes and thematic variables (statistical triangulation) and strong thematic variables (variables that  
46  
47 occur frequently). It will also show how the quantitative data expand on the qualitative findings. These  
48  
49 techniques of data integration have been used previously and have been described in detail.[42]  
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In the event that the qualitative and quantitative strands do not converge the data will be handled in one of four ways: firstly, the data may be re-analyzed through the lens of a different theoretical framework (reconciliation); secondly, the divergence may introduce new perspectives that generate new research questions (initiation); thirdly, irreconcilable differences may be viewed as best-case and worst-case scenarios (bracketing); and finally a complete re-appraisal of the body of evidence in terms of completeness and validity (exclusion).[43]

**Table 2: Mixed methods data matrix**

Strand					
Qualitative		Quantitative			
Themes identified	Number of times mentioned n (%)	Thematic variable	Representativeness N (%)	Influence on community readiness	
				Univariate (OR, 95% CI; p)	Multivariable (aOR, 95% CI; p)

aOR: adjusted odds ratio; CI: confidence interval

In the qualitative strand, data will be analysed, reduced, displayed and transformed into quantitative variables. In the quantitative strand, data will be analysed, reduced and displayed. At the final stage (data mixing), data will be displayed, correlated and integrated.[44] Figure 2 demonstrates the steps we will follow for analysis and integration of data.

Figure 2: Steps in data analysis and integration

### Validation checks and dealing with sources of bias:

We will draw from published criteria for critical appraisal of mixed-methods studies to validate our research,[45] using items identified by as a cross-paradigm framework for trustworthiness and rigor.[46]

#### Internal validity:

In the qualitative strand, internal validation (credibility) will be performed by using an audio recording device to ensure accuracy; member-checking of collected data for general accuracy and accuracy of quotes; and by comparing codes among several coders.[23 47] In the quantitative strand we will limit information bias by pilot testing the questionnaire for clarity (participants understand the questions as they were meant to be understood) and using non-staff interviewers. We will also adjust for potential confounding during analysis. For example, participants who already participate in some community activities may be more likely to report readiness to participate in a text message program. We will try to capture this in our analyses.

Data will be collected from PLHIV at the Yaoundé Central Hospital, the population to whom we want to generalize our findings, so selection bias is unlikely to be significant. However, we will collect socio-demographic data from the participants who refuse to participate to see if they differ significantly from those who do. Selection bias can be avoided at the design and analytical stages of a project.[48] Data from the qualitative phase may help to identify variables that are associated with willingness to participate in the survey. These variables can be used to restrict participation or be measured accurately and used for adjusted analyses.[48]

#### External validity:

The extent to which our findings can be generalized to the rest of the population of PLHIV at the Yaoundé Central hospital will be verified by using a large (pre-determined) sample, comparing the socio-

1  
2  
3 demographics of our sample to the parent population and by investigating any refusals to participate. In  
4  
5 this way we will be able to make statistical (external) generalizations[49]. We also state the purpose of  
6  
7 our study, the setting, the data collection procedures and the outcomes we are measuring: community  
8  
9 readiness and acceptability of ownership of a text messaging program among PLHIV at the Yaounde  
10  
11 Central Hospital.  
12

#### 13 14 15 16 Consistency:

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18 We will apply standardised qualitative (focus groups) and quantitative (survey) techniques (described  
19  
20 above) to ensure consistent results. A journal of study activities will be kept so that the study  
21  
22 procedures can be followed and replicated. Our data collection tools and techniques will be externally  
23  
24 audited by the Cameroon National Ethics Committee.[50]  
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#### 27 28 **Feasibility:**

29  
30 This study will benefit from a number of characteristics that make it feasible. Firstly, the study is situated  
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32 in a very active HIV centre with a large potential for recruitment in both strands of the study. Secondly,  
33  
34 we have a pre-existing multidisciplinary team with collective experience in other qualitative and  
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36 quantitative research projects. This team is made up of public health physicians, clinicians, sociologists,  
37  
38 anthropologists, health economists and public health administrators. Thirdly, surveys in this setting are  
39  
40 relatively inexpensive to conduct. [51] Finally, our host centre, the Centre for the Development of Best  
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42 Practices in Health (CDBPH) has the infrastructure and experience for a research project of this scale and  
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44 can provide administrative, logistic and communication support.  
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#### 50 51 **ETHICS AND DISSEMINATION:**

#### 52 53 **Ethics:**

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3 Ethics approval has been obtained from the Institutional Review Board (IRB) of the Yaounde Central  
4 Hospital (N°288L/MINSANTE/SG/DHCY/Stages on the 16<sup>th</sup> May 2013).  
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9 **Dissemination plan for results:**

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11 We plan to disseminate our results at public presentations with stakeholders in Cameroon (Ministry of  
12 health staff, journalists, PLHIV, clinicians, community health workers, social workers, mobile  
13 communication operators); to publish the manuscript; and publicly present and defend our findings as  
14 part of a doctoral thesis. As part of the ethics approval agreement, a copy of this thesis will be submitted  
15 to the Yaounde Central Hospital IRB.  
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24 **AUTHORS' CONTRIBUTIONS:**

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27 All three authors contributed to the conception of the study. LM developed the first draft of the  
28 manuscript. LT and POZ provided statistical and methodological input. All three authors read and edited  
29 several versions of the manuscript. Prof Mark Oremus provided input to this paper as part of the Mixed  
30 Methods Research Designs for Health Services and Policy Research course (HRM/NUR 770) at McMaster  
31 University.  
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41  
42 This research received no specific grant from any funding agency in the public, commercial or not-for-  
43 profit sectors.  
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48 **COMPETING INTERESTS STATEMENT:**

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50 The authors declare none.  
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9 **Investigating community ownership of a text message program to improve adherence to antiretroviral**  
10 **therapy and provider-client communication: a mixed methods research protocol**

11  
12 **Authors:**

13  
14 Lawrence Mbuagbaw\*<sup>1,2</sup>, Pierre Ongolo-Zogo<sup>1</sup>, Lehana Thabane<sup>2,3,4,5,6</sup>

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45  
46 **Key words:**

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48 Antiretroviral therapy, mobile phone, text messages, community ownership

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50 **Word count: 3821**

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60**ABSTRACT:****Introduction:**

Mobile phone ownership and use is growing fastest in sub-Saharan Africa, and there is evidence that mobile phone text messages can be used successfully to significantly improve adherence to antiretroviral therapy and reduce treatment interruptions. However, the effects of many mobile health interventions are often reduced by human resource shortages [within health facilities](#). Also, the research projects generating the evidence for health interventions in developing countries are most often conducted using external funding sources, with limited sustainability and adoption by local governments following the completion of the projects. Strong community participation driven by active outreach programs and mobilization of community resources are the key to successful adoption and long-term sustainability of effective interventions. Our aim is to develop a framework for community ownership of a text messaging program to improve adherence to antiretroviral therapy; improve communication between patients and doctors; and as a reminder for appointments.

**Methods and analysis:**

We will use the exploratory sequential mixed methods approach. The first qualitative phase will entail focus group discussions with people living with HIV at the Yaoundé Central Hospital in Yaounde Cameroon (6-10 participants per group). The second quantitative phase will involve a cross-sectional survey (n=402). Here ~~ordinal binary multivariable regression~~ [logistic regression](#) techniques will be used to determine the factors associated with community readiness and acceptability of ownership. Data from both phases will be merged.

**Ethics and dissemination:**

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9 ~~Ethics approval will be obtained from the National Ethics Committee in Cameroon. Administrative~~  
10 ~~approval will be obtained from the Yaounde Central Hospital and the Ministry of Health~~ This study has  
11 ~~been approved by the Yaounde Central Hospital Institutional Review Board.~~ The results of this paper will  
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13  
14 be disseminated as peer reviewed publications, at conferences and as part of a doctoral thesis.  
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#### 17 **ARTICLE SUMMARY:**

##### 18 **Article focus:**

- 19 • Text messaging to improve adherence to antiretroviral therapy and communication between
- 20 patients and providers
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- 22 • Community ownership of supportive programs
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##### 27 **Key messages**

- 28 • Benefits and strengths of community ownership of programs
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- 30 • Community readiness to own supportive programs
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##### 33 **Strengths and limitations of study**

- 34 • Robust study design based on mixed methods
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- 36 • Components of research unfold during the study and may affect initial planning
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**INTRODUCTION:**

At the end of 2010 approximately 34 million people were living with the human immunodeficiency virus (HIV). Close to seventy percent of them live in sub-Saharan Africa even though this region represents

only 12 percent of the world's population.<sup>[1][4]</sup> However, there has been a steady decrease in Acquired Immune Deficiency Syndrome (AIDS) related deaths as free antiretroviral therapy (ART) has become more available in recent years.<sup>[1][4]</sup> While governments and health systems in sub-Saharan Africa continue to invest in providing free access to ART, their efforts are hampered by health system weaknesses that prevent a continuous supply of ART and sub-optimal levels of adherence.<sup>[2][2]</sup>

Relatively high levels of adherence are necessary to achieve the goals of ART such as viral suppression and immune reconstitution.<sup>[3][3]</sup> High levels of adherence will therefore lead to reduced morbidity and mortality in people living with HIV, and minimal development of resistant strains.<sup>[3-6][3-6]</sup>

In recent years the WHO has endorsed the use of cheap and effective technologies to improve health outcomes in low resource settings.<sup>[7][7]</sup> and there is emerging evidence on the role a mobile phone text message -short message service (SMS) can play in the management of HIV. Text messages (sending brief electronic messages to a mobile phone) can improve adherence to ART, reduce treatment interruptions and reduce viral load.<sup>[8-9][8-9]</sup> They are useful as appointment reminders and can improve communication between health personnel and patients.<sup>[10][10]</sup> Patients who receive them also report high levels of satisfaction.<sup>[8-11][8-11]</sup> These advantages, coupled with the rapid growth of mobile phone ownership and use in Africa,<sup>[12][12]</sup> make the SMS an important tool to improve care in people living with HIV (PLHIV). The research on mobile phone text messaging is somewhat nuanced by the complexity of the intervention. It is unclear how factors such as community phone ownership, content of the message, timing of the message; nature of the message (two-way or one way) or source of the message

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(peers or hospital based) can influence the efficacy of mobile phone text messaging.<sup>[13][13]</sup> There is a need for further research ~~for~~ which responds to many of these unanswered questions.<sup>[14][14]</sup>

Cameroon has the highest rate of HIV in West and Central Africa, with a 5.3% prevalence in the adult

population;<sup>[11][11]</sup> poor adherence rates and serious health system weaknesses that pose a threat to the

management of HIV.<sup>[15][15]</sup> Recent reports suggest that PLHIV would like to receive text

messages.<sup>[16][16]</sup> The communication channels opened by text messaging also serve as a platform to

identify key individual and health system weaknesses that diminish the quality of care, and reduce the

overall effects of text messaging. For example, human resource shortages and medication stock-outs

can limit the potential of adherence enhancing mHealth interventions. <sup>[17][17]</sup> Cameroon also has a

high mobile phone penetration rate, with 52 mobile cellular subscriptions per 100 people in 2012. <sup>[18]</sup>

Mobile text messaging and phone calls are mostly affordable, and can be as little as 25FRS CFA (\$0.05)

per message and 75 FRS CFA (\$0.15) per minute, respectively.

Most successful health care programs are characterised by strong community participation.<sup>[19][19]</sup>

Community participation has played a major role in the control of the HIV epidemic.<sup>[20][20]</sup> It should be

encouraged because the programs will have better outreach; community contributions (money,

manpower and material) can be mobilised and; more importantly, because communities have a right to

take part in the decisions that affect their lives.<sup>[21][21]</sup> Community participation (in HIV programs) has

often been limited to the less technical aspects. Apart from providing an organised front to defend the

interests of PLHIV, they also take part in providing care, research, peer education and role

modelling.<sup>[19][19]</sup> For newer interventions such as text messaging which is more structured and

technologically oriented, the potential of community ownership needs to be explored.

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We expect to observe an overall acceptability and readiness to own a text messaging program but a lack of skills in how to manage one. Our findings will be used to inform initiatives aimed at up scaling the use of mobile phone technology to improve adherence to antiretroviral therapy and other chronic diseases in resource limited settings and how best community members can be involved in the process. At the end of the project we will develop a framework for transferring technology into the hands of the community and initiating a sustainable community-led project. We will build upon previous research using weekly motivational two-way text messaging to improve adherence to ART. [\[16 17 22\]](#)~~[\[16 17 22\]](#)~~

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The following groups of people will benefit from this project: PLHIV in resource limited areas; people living with other chronic diseases who can benefit from enhanced communication with the health system; and health workers and community health workers who provide care for PLHIV.

The objective of this project is to determine how to set-up a community-owned text messaging program by determining the readiness and acceptability of ownership among PLHIV at the Yaoundé Central Hospital in Cameroon. We will proceed by collecting, analysing and comparing qualitative and quantitative data. The findings from this mixed methods study will be used to establish a framework for community ownership.

For the purposes of this paper, we define community ownership as a process in which the community members design, manage and reap benefits from a project. We also acknowledge that in the course of our research our definition may change. All references to “community” are made in regards to PLHIV in Yaounde, Cameroon.

The following research questions will guide the conduct of this study:

Qualitative research questions:

- Will PLHIV in Yaoundé, Cameroon accept community ownership of a text messaging program?

- How ready is the community of PLHIV in Yaoundé, Cameroon to take ownership of a text messaging program?

#### Quantitative research questions:

- What factors are associated with acceptability and readiness of community ownership of a text messaging program among PLHIV in Yaoundé, Cameroon?
- What proportions of PLHIV will accept and are ready to run a community owned text messaging program?

#### Mixed methods research questions:

- Are the themes related to the opportunities and challenges involved in the community ownership of a text message project among PLHIV in Yaoundé, Cameroon generalizable to a larger sample of PLHIV in Yaoundé?
- In what ways do the qualitative and quantitative strands converge?

### METHODS AND ANALYSIS:

#### Study design:

We will use an exploratory sequential design.<sup>[23][23]</sup> The exploratory sequential design is a two-phase design that starts with an initial qualitative phase followed by a quantitative phase. In the qualitative phase, we will identify individuals with experience in community ownership for in-depth interviews. The members of the associations of PLHIV and others with community level experience will be selected from the Yaoundé Central Hospital. This relatively small number of individuals will be interviewed to identify themes, ideas and concepts that will be used to guide the second quantitative phase. Data collected from the qualitative phase will be converted into variables that will be used on a much larger sample in

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order to generalise the findings to all the PLHIV in Yaoundé. This sample will be taken from the Yaoundé Central Hospital. See figure 1 for details on the procedures and products of the different strands of the study.

Figure 1: Overview of procedures and products of different strands

The exploratory sequential design is preferred for this study because of the following reasons. Firstly, the separation of the qualitative and quantitative phases makes it easier for our multidisciplinary team to work together and the separate methods and findings can be described easier. The anthropologists and sociologists will be responsible for data collection and analysis in the qualitative strand. The themes that emerge from their analysis will be converted into variables and built into a questionnaire by both groups. Secondly, the use of both qualitative and quantitative methods makes it more acceptable to researchers from both domains. Even though the overarching goal is to merge and compare qualitative and quantitative data, the findings from each domain still hold merit and can be interpreted separately. Thirdly, it will be used to develop a measurement instrument. The data collection tool for the quantitative phase will be developed from the qualitative strand. Items to measure community readiness and acceptability of ownership will be framed based on the responses in the qualitative strand. Lastly, it is a good design for generalizing qualitative research findings. [23][23]

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On the other hand, organizing two separate strategies for data collection will be time-consuming. Separate sampling techniques have to be applied for both strands: the sample of PLHIV for the qualitative strand will be selected purposefully based on their experience with community activities, while the quantitative strand will be probabilistic. Details on the quantitative phase will not be available at the time of Institutional Review Board approval. ~~The protocol we will submit to the National Ethics~~

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~~Committee will contain explicit details about why the data collection tool for the quantitative strand is unavailable.~~<sup>[23][23]</sup>

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#### Rationale for design:

Despite these characteristics, the exploratory sequential design is the method of choice when the variables that may come into play are unknown and when there is no guiding framework.<sup>[23][23]</sup> This design has been used for complex research projects like mental health assessment in older adults,<sup>[24][24]</sup> healthcare students' educational expectations,<sup>[25][25]</sup> health system research,<sup>[26][26]</sup> alcohol use among people with liver disease and tobacco use.<sup>[27-28][27-28]</sup> Text messaging interventions are relatively new and to the best of our knowledge community ownership has not been investigated for a text messaging program.

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In recent years, mixed methods research has emerged as a separate research paradigm—a seamless blend of both qualitative and quantitative research methods. Even though it was not initially used on the basis of its merits,<sup>[29][29]</sup> it is progressively gaining ground and acknowledgment in health research.<sup>[30][30]</sup> It offers a “powerful third paradigm choice that often will provide the most informative, complete, balanced and useful research results”.<sup>[31][31]</sup> In order to explore how PLHIV perceive text messages and the eventuality of owning and managing a text message project we are going to use mixed methods to identify common themes which arise and to subsequently generalise these findings to a larger sample. The complex nature of the research question warrants the use of mixed methods to generate a rich and complementary body of evidence to initiate a community-owned program. The methods used to initiate community ownership need to be well spelled-out and should originate from a robust and expanded body of evidence, which cannot be achieved by only qualitative or quantitative designs. We therefore seek complementarity, initiation and expansion.<sup>[32][32]</sup> Figure 1 is a detailed flow diagram of the study procedures.

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60**Study setting:**

Yaoundé is the capital city of Cameroon, a central African low-income country. The adult prevalence of HIV in Cameroon is 5.3%.<sup>[1][4]</sup> The Yaoundé Central hospital houses the largest HIV clinic in the country. It has a capacity of 381 beds and is staffed by 95 doctors and 270 nurses.<sup>[33][33]</sup> In the HIV clinics, there are 6500 regular clients and approximately 40 new cases every week. This hospital is one of the pioneer centres for HIV research in Cameroon, and offers a great potential for recruitment and data collection.

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**Sampling:**

The overall purpose of this sample is to address the research question, in a generalizable way using both purposeful and probabilistic techniques that ensure data collection in breadth and depth.<sup>[34][34]</sup> This is a useful combination of sampling strategies that helps to generate items and variables for questionnaires; and to generate hypotheses.<sup>[35][35]</sup>

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**Qualitative strand:**

A purposeful sampling strategy will be used to determine who will participate in the qualitative strand. PLHIV with relevant experience related to community activities shall be selected based on any of the following criteria:

- They should belong to an association of PLHIV (leaders or members)
- They are community health workers
- They are willing to participate in a community owned text messaging program

Focus groups of 6-10 participants will be constituted consecutively until no new ideas emerge. We will focus on depth of information and qualitative data obtained from the cases.<sup>[34][34]</sup> PLHIV will be recruited from the waiting rooms of the Yaoundé Central Hospital HIV clinic. They will be approached by

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9 the plain-clothed non-staff moderator to determine their interest in taking part in a group discussion  
10 and if they meet the pre-specified criteria. This is typical case sampling, aimed at identifying  
11 representative cases. ~~[34][34]~~ Consenting participants will be shown to a quiet nearby room prepared for  
12 the focus groups. Notes will be taken in writing and using an audio recorder by a note-taker. No  
13 financial incentives shall be offered, but waiting times at the clinic will be reduced (in collaboration with  
14 the attending physician) after participation. The protocol will be presented to the hospital staff and the  
15 procedures for reducing waiting times will be discussed.

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#### Quantitative strand:

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23 All PLHIV attending the Yaoundé Central Hospital HIV clinic during the study period will be eligible for  
24 enrolment, provided they are aged 21 years or more and give consent. Sample size will be determined  
25 using the formula proposed by Cochran for surveys. ~~[36][36]~~ Assuming an alpha level of 0.05; a 5%  
26 margin of error (for categorical data); a standard deviation of 0.5 (for a primary outcome - community  
27 readiness measured ~~on a seven-point scale~~ as a binary variable); in a population of 6500 PLHIV at the  
28 Yaoundé Central Hospital, we arrived at a sample of 402; taking into account a “refusal to participate  
29 rate” of 10% ~~—~~ documented in another text messaging study among PLHIV in this clinic. ~~[22][22]~~ This  
30 sample is meant to be representative of the entire population of PLHIV attending the Yaoundé Central  
31 Hospital HIV clinic. We acknowledge considerable uncertainty in the variables that will be used in the  
32 quantitative phase of the study, but opt for a binary outcome in order to achieve a larger sample size.

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#### Data collection:

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45 Prior to data collection we will organise brief training sessions for the data collectors in the qualitative  
46 and quantitative strands. The purpose of this training will be to familiarise them with their working  
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instruments and to standardise the procedure for participant invitation, obtaining consent and data collection.

Qualitative strand:

Focus group discussions will be conducted using a pre-established interview guide (See Table 1). It will contain basic socio-demographic information, a description of participant involvement in community activities (eligibility criteria fulfilled), and specific themes related to the phenomenon under study. An experienced moderator and note-taker will invite, request consent and enrol participants, in that order. For each session, the data collectors will be dressed in plain clothes and use a separate room free from distractions for the focus groups. The note taker will be responsible for noting the non-verbal cues emanating from the participants and operating the audio-recorder. The audio recorder will be tested in a mock session for clarity of recordings. Participants will be encouraged to speak in tones that can be recorded. The moderator will be responsible for keeping the discussions in line with the guide while exploring interesting dimensions that arise from the discussions. More importantly, the moderator will be responsible for gaining the trust of the participants and encouraging participation from all. The data collected from this strand will be used to formulate questions that best characterize acceptability and readiness.



Table 1: Focus group discussion guide

<b>Focus Group Discussion Guide</b>
<b>Preparatory steps</b>
Does participant meet criteria?
Have they given written/verbal consent?
Collect socio-demographic data (age, gender); note time; number of participants
<b>On existing community activities</b>
What community initiatives/activities/organisations exist for PLHIV?
What community activity do you participate in?
How do you benefit from these activities?
<b>On a text messaging project</b>
The purpose of this project is to improve adherence to HIV medication and to foster communication with health workers. What other goals do you think can be achieved through text messaging?
Do you think you (as a community) are ready to run a text message project?
Would you accept to run or take part in a text messaging project?
What strengths does the community have that can be used to run such a project?
What weaknesses does the community have that can hinder the project?
What roles can the community play in such a project?
<b>On feasibility</b>
How do you think the project should be financed?
Are you willing to pay to receive a text messages?
Do you think the community is ready to run such a project?

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Would you like health workers to be involved in the management of such a project?
<b>Any other issues participants would like to discuss</b>

#### Quantitative strand:

In the quantitative strand, patients will be approached at the clinic in various locations: the outpatient department, the pharmacy and the laboratory. Four interviewers will concurrently conduct the survey to maximize recruitment. Recruitment and data collection will continue until the required sample is achieved. The trained interviewers will employ the pre-tested questionnaire developed from the qualitative strand and existing frameworks,<sup>[37][37]</sup> to collect data from all eligible participants. The data collection tool will be developed based on findings from the qualitative strand. It will contain basic socio-demographic data, adherence data, phone ownership and autonomy, information related to participation in community activities and other variables generated from the themes identified in the qualitative strand. The questions will be closed-ended with simple “yes or no” responses. Complex items like readiness will may be presented on a seven-point Likert scale.<sup>[38][38]</sup>

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#### Data analyses:

##### Qualitative data analysis:

We will conduct a thematic analysis. Qualitative data will be analysed by transcribing into text. Codes will be generated by looking for repetitions in the text.<sup>[39][39]</sup> These repetitions (codes) will be grouped based on their similarity into categories and the overarching themes will be identified. We will use a number of pre-set categories to guide the process, but emergent categories will also be noted.<sup>[40][40]</sup> For example pre-set categories like lack of familiarity with text messaging or lack of skills to run a text messaging project shall be identified. This coding will be done by multiple researchers to determine if

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9 coders agree on the themes assigned to a segment of text. The themes will be displayed visually in a  
10 conceptual model, showing how the themes are linked to each other.<sup>[39][39]</sup>

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13 Quantitative analyses:

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15 Quantitative data will be analysed using using Statistical Package for Social Sciences (SPSS) Version 20.0  
16 (SPSS, Inc., 2009, Chicago, IL, USA). Statistical significance will be set at alpha= 0.05. Adjusted odds ratios  
17 (aOR), 95% confidence intervals (CI) and p-values will be presented. We will explore community  
18 readiness for ownership of a text messaging project as the ~~ordinal~~ binary dependent variable in a ~~ordinal~~  
19 logistic regression analysis. Potential independent variables include: socio-demographics, mobile phone  
20 ownership, familiarity with text messaging, level of adherence to medication, need for additional  
21 support, and level of comfort with community management.  
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#### 28 29 Data integration:

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31 Due to the sequential design of the study, the qualitative and quantitative components will be analysed  
32 separately in a sequential qualitative-quantitative analysis. This is the method of choice when the  
33 analysis of one strand is necessary to inform the conduct of the next.<sup>[41][41]</sup> Inferences will be drawn  
34 from both strands and across strands. These “meta-inferences” will be used to draw  
35 conclusions.<sup>[41][41]</sup> The qualitative and quantitative strands will be merged in a matrix to display how  
36 they are related to each other. Table 2 is a sample of how both strands of data will be put together,  
37 linking themes to thematic variables and statistical analyses. This correlation matrix will help to identify  
38 relationships between themes and thematic variables (statistical triangulation) and strong thematic  
39 variables (variables that occur frequently). It will also show how the quantitative data expand on the  
40 qualitative findings. These techniques of data integration have been used previously and have been  
41 described in detail.<sup>[42][42]</sup>  
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In the event that the qualitative and quantitative strands do not converge the data will be handled in one of four ways: firstly, the data may be re-analyzed through the lens of a different theoretical framework (reconciliation); secondly, the divergence may introduce new perspectives that generate new research questions (initiation); thirdly, irreconcilable differences may be viewed as best-case and worst-case scenarios (bracketing); and finally a complete re-appraisal of the body of evidence in terms of completeness and validity (exclusion).<sup>[43][43]</sup>

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**Table 2: Mixed methods data matrix**

Strand					
Qualitative		Quantitative			
Themes identified	Number of times mentioned n (%)	Thematic variable	Representativeness N (%)	Influence on community readiness	
				Univariate (OR, 95% CI; p)	Multivariable (aOR, 95% CI; p)

aOR: adjusted odds ratio; CI: confidence interval

In the qualitative strand, data will be analysed, reduced, displayed and transformed into quantitative variables. In the quantitative strand, data will be analysed, reduced and displayed. At the final stage (data mixing), data will be displayed, correlated and integrated.<sup>[44][44]</sup> Figure 2 demonstrates the steps we will follow for analysis and integration of data.

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Figure 2: Steps in data analysis and integration

### Validation checks and dealing with sources of bias:

We will draw from published criteria for critical appraisal of mixed-methods studies to validate our research,<sup>[45][45]</sup> using items identified by as a cross-paradigm framework for trustworthiness and rigor.<sup>[46][46]</sup>

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#### Internal validity:

In the qualitative strand, internal validation (credibility) will be performed by using an audio recording device to ensure accuracy; member-checking of collected data for general accuracy and accuracy of quotes; and by comparing codes among several coders.<sup>[23 47][23 47]</sup> In the quantitative strand we will limit information bias by pilot testing the questionnaire for clarity (participants understand the questions as they were meant to be understood) and using non-staff interviewers. We will also adjust for potential confounding during analysis. For example, participants who already participate in some community activities may be more likely to report readiness to participate in a text message program. We will try to capture this in our analyses.

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Data will be collected from PLHIV at the Yaoundé Central Hospital, the population to whom we want to generalize our findings, so selection bias is unlikely to be significant. However, we will collect socio-demographic data from the participants who refuse to participate to see if they differ significantly from those who do. Selection bias can be avoided at the design and analytical stages of a project.<sup>[48][48]</sup>

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Data from the qualitative phase may help to identify variables that are associated with willingness to participate in the survey. These variables can be used to restrict participation or be measured accurately and used for adjusted analyses.<sup>[48][48]</sup>

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#### External validity:

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The extent to which our findings can be generalized to the rest of the population of PLHIV at the Yaoundé Central hospital will be verified by using a large (pre-determined) sample, comparing the socio-demographics of our sample to the parent population and by investigating any refusals to participate. In this way we will be able to make statistical (external) generalizations<sup>[49][49]</sup>. We also state the purpose of our study, the setting, the data collection procedures and the outcomes we are measuring: community readiness and acceptability of ownership of a text messaging program among PLHIV at the Yaounde Central Hospital.

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Consistency:

We will apply standardised qualitative (focus groups) and quantitative (survey) techniques (described above) to ensure consistent results. A journal of study activities will be kept so that the study procedures can be followed and replicated. Our data collection tools and techniques will be externally audited by the Cameroon National Ethics Committee.<sup>[50][50]</sup>

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**Feasibility:**

This study will benefit from a number of characteristics that make it feasible. Firstly, the study is situated in a very active HIV centre with a large potential for recruitment in both strands of the study. Secondly, we have a pre-existing multidisciplinary team with collective experience in other qualitative and quantitative research projects. This team is made up of public health physicians, clinicians, sociologists, anthropologists, health economists and public health administrators. Thirdly, surveys in this setting are relatively inexpensive to conduct.<sup>[51][51]</sup> Finally, our host centre, the Centre for the Development of Best Practices in Health (CDBPH) has the infrastructure and experience for a research project of this scale and can provide administrative, logistic and communication support.

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**ETHICS AND DISSEMINATION:****Ethics:**

Ethical approval has been obtained from the Institutional Review Board (IRB) of the Yaounde Central Hospital (N°288L/MINSANTE/SG/DHCY/Stages on the 16<sup>th</sup> May 2013). ~~and administrative clearance will be obtained from the Cameroon National Ethics Committee and the directorate of operational research in the Ministry of Health, respectively. These are the only compulsory regulatory bodies in Cameroon. Prior to these, permission to conduct the study will be obtained from the administration of the Yaoundé Central Hospital. We will use the focus group guiding document to prepare a draft questionnaire for the quantitative strand. The Ethics Committee will be informed that this document will be modified as the project unfolds.~~

**Dissemination plan for results:**

We plan to disseminate our results at public presentations with stakeholders in Cameroon (Ministry of health staff, journalists, PLHIV, clinicians, community health workers, social workers, mobile communication operators); to publish the manuscript; and publicly present and defend our findings as part of a doctoral thesis. As part of the ethics approval agreement, a copy of this thesis will be submitted to the Yaounde Central Hospital IRB.

**AUTHORS' CONTRIBUTIONS:**

All three authors contributed to the conception of the study. LM developed the first draft of the manuscript. LT and POZ provided statistical and methodological input. All three authors read and edited several versions of the manuscript. Prof Mark Oremus provided input to this paper as part of the Mixed Methods Research Designs for Health Services and Policy Research course (HRM/NUR 770) at McMaster University.

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**COMPETING INTERESTS STATEMENT:**

The authors declare none.

For peer review only



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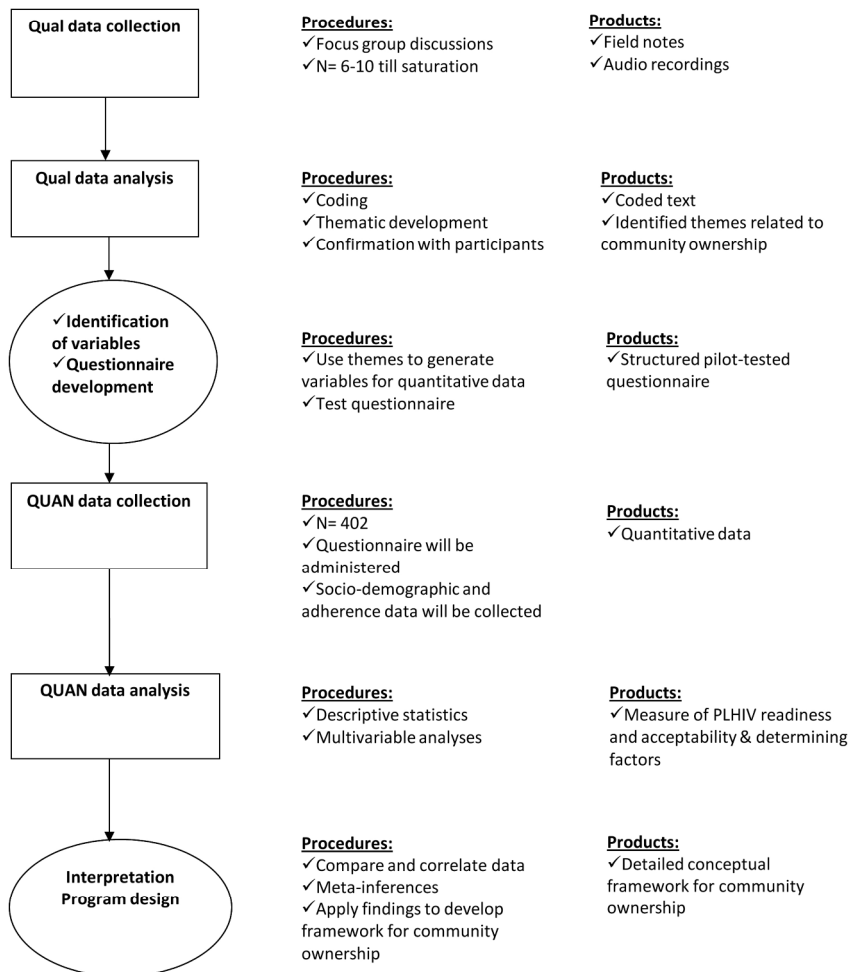


Figure 1: Overview of procedures and products of different strands  
254x338mm (300 x 300 DPI)



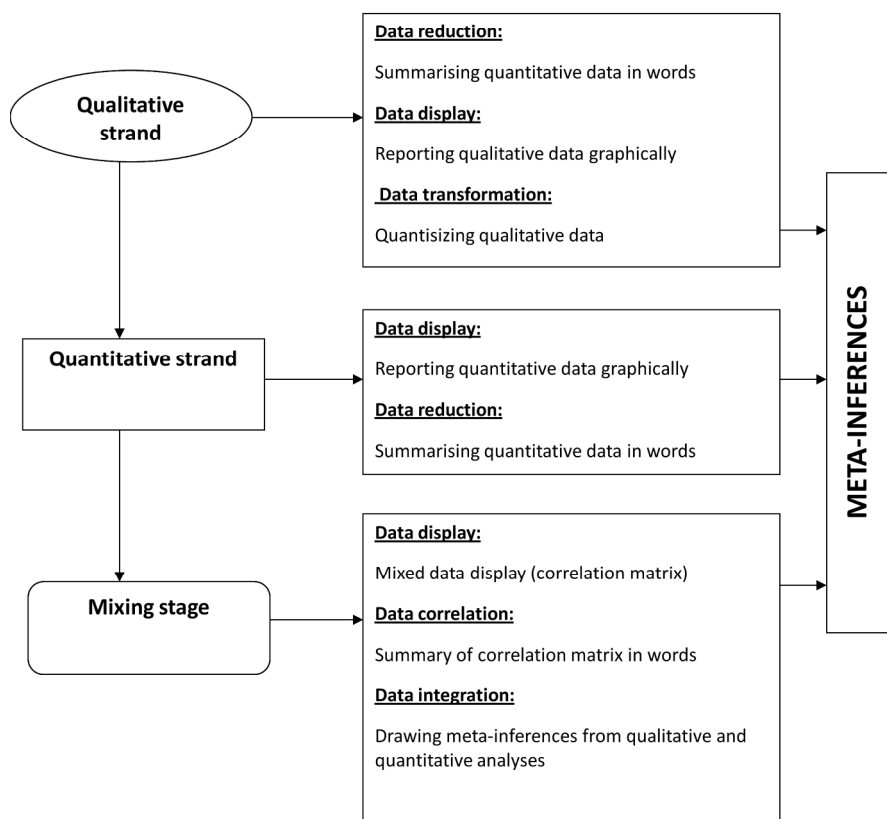


Figure 2: Steps in data analysis and integration  
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