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

Lawrence Mbuagbaw,1,2 Pierre Ongolo-Zogo,1 Lehana Thabane2,3,4,5,6

ABSTRACT
Introduction: Mobile phone ownership and use are 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, research projects generating evidence for health interventions in developing countries are most often conducted using external funding sources, with limited sustainability and adoption by local governments following completion of the projects. Strong community participation driven by active outreach programmes and mobilisation of community resources are the key to successful adoption and long-term sustainability of effective interventions. Our aim was to develop a framework for community ownership of a text messaging programme to improve adherence to antiretroviral therapy; improve communication between patients and doctors and act 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 Yaoundé, Cameroon (6–10 participants/group). The second quantitative phase will involve a cross-sectional survey (n=402). In this study, 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: This study has been approved by the Yaoundé Central Hospital Institutional Review Board. The results of this paper will be disseminated as peer-reviewed publications at conferences and as part of a doctoral thesis.

ARTICLE SUMMARY

Article focus
- Text messaging to improve adherence to antiretroviral therapy and communication between patients and providers.
- Community ownership of supportive programmes.

Key messages
- Benefits and strengths of community ownership of programmes.
- Community readiness to own supportive programmes.

Strengths and limitations of this study
- Robust study design based on mixed methods.
- 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 HIV. Close to 70% of them live in sub-Saharan Africa, even though this region represents only 12% of the world’s population.1 However, there has been a steady decrease in AIDS-related deaths as free antiretroviral therapy (ART) has become more easily 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 (PLHIV), as well as minimal development of resistant strains.3–6

In recent years, 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 that 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. They are useful as appointment reminders and can improve communication between health personnel and patients. Patients who receive them also report high levels of satisfaction. These advantages, coupled with the rapid growth of mobile phone ownership and use in Africa, make SMS an important tool to improve care in 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 based) can influence the efficacy of mobile phone text messaging. There is a need for further research which responds to many of these unanswered questions.

Cameroon has the highest rate of HIV in West and Central Africa, with a 5.3% prevalence in the adult population, poor adherence rates and serious health system weaknesses that pose a threat to the management of HIV. Recent reports suggest that PLHIV would like to receive text messages. 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. Cameroon also has a high mobile phone penetration rate, with 52 mobile cellular subscriptions per 100 people in 2012. 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 min, respectively.

Most successful healthcare programmes are characterised by strong community participation. Community participation has played a major role in the control of the HIV epidemic. It should be encouraged because the participation has played a major role in the control of the epidemic. They are useful as appointment reminders and can improve communication between health personnel and patients. Patients who receive them also report high levels of satisfaction. These advantages, coupled with the rapid growth of mobile phone ownership and use in Africa, make SMS an important tool to improve care in 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 based) can influence the efficacy of mobile phone text messaging. There is a need for further research which responds to many of these unanswered questions.

Cameroon has the highest rate of HIV in West and Central Africa, with a 5.3% prevalence in the adult population, poor adherence rates and serious health system weaknesses that pose a threat to the management of HIV. Recent reports suggest that PLHIV would like to receive text messages. 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. Cameroon also has a high mobile phone penetration rate, with 52 mobile cellular subscriptions per 100 people in 2012. 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 min, respectively.

Most successful healthcare programmes are characterised by strong community participation. Community participation has played a major role in the control of the HIV epidemic. It should be encouraged because the participation has played a major role in the control of the epidemic. They are useful as appointment reminders and can improve communication between health personnel and patients. Patients who receive them also report high levels of satisfaction.
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.

The exploratory sequential design is preferred for this study because of the following reasons. First, 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. Second, 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. Third, 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 generalising qualitative research findings.23

![Diagram of procedures and products of different strands](image-url)

**Figure 1** Overview of procedures and products of different strands.
On the other hand, organising 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 (IRB) approval.32

**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 there is no guiding framework.33 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 programme.

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 the common themes that 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 programme. The methods used to initiate community ownership need to be well spelt 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**

Yaoundé is the capital city of Cameroon, a central African low-income country. The adult prevalence of HIV in Cameroon is 5.3%.1 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.33 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.

**Sampling**

The overall purpose of this sample is to address the research question in a generalisable way, using both purposeful and probabilistic techniques that ensure data collection in breadth and depth.34 This is a useful combination of sampling strategies that helps to generate items and variables for questionnaires, as well as to generate hypotheses.35

**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 programme.

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.34 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 prespecified criteria. This is typical case sampling, aimed at identifying representative cases.34 Consenting participants will be shown to a quiet nearby room prepared for the focus groups. Notes will be taken in writing by a note-taker using an audio recorder. No financial incentives shall be offered, but the 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.

**Quantitative strand**

All PLHIV attending the Yaoundé Central Hospital HIV clinic during the study period will be eligible for enrolment, provided they are aged 21 years or more and give consent. Sample size will be determined using the formula proposed by Cochran for surveys.36 Assuming an α level of 0.05, a 5% margin of error (for categorical data), an SD of 0.5 (for a primary outcome—community readiness measured as a binary variable) in a population of 6500 PLHIV at the Yaoundé Central Hospital, we arrived at a sample of 402, taking into account a ‘refusal to participate rate’ of 10%—documented in another text messaging study among PLHIV in this clinic.32 This sample is meant to be representative of the entire population of PLHIV attending the Yaoundé Central Hospital HIV clinic. We acknowledge considerable uncertainty in the variables that will be used in the quantitative phase of the study, but opt for a binary outcome in order to achieve a larger sample size.
Data collection
Prior to data collection, we will organise brief training sessions for the data collectors in the qualitative and quantitative strands. The purpose of this training will be to familiarise them with their working 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 box 1). It will contain basic sociodemographic 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 characterise acceptability and readiness.

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 maximise recruitment. Recruitment and data collection will continue until the required sample is achieved. The trained interviewers will employ the pretested questionnaire developed from the qualitative strand and existing frameworks 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 sociodemographic 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.

Box 1: Focus group discussion guide

Focus Group Discussion Guide
Preparatory steps
- Does the participant meet the criteria?
- Have they given written/verbal consent?
- Collect sociodemographic data (age, gender); note time; number of participants

On existing community activities
- What community initiatives/activities/organisations exist for people living with HIV?
- What community activity do you participate in?
- How do you benefit from these activities?

On a text messaging project
- 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 messaging project?
- Would you accept running or taking part in a text messaging project?
- What are the strengths of the community that can be used to run such a project?

- What are the weaknesses of the community that can hinder the project?
- What roles can the community play in such a project?
- On feasibility
  - How do you think the project should be financed?
  - Are you willing to pay to receive a text message?
  - 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?
- Are there any other issues that the participants would like to discuss?

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. 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 preset categories to guide the process, but emergent categories will also be noted. For example, preset 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 performed 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.

Quantitative analyses
Quantitative data will be analysed using using Statistical Package for Social Sciences (SPSS) V20.0 (SPSS, Inc, 2009, Chicago, Illinois, USA). Statistical significance will be set at α=0.05. Adjusted OR, 95% CI and p values will be presented. We will explore community readiness for ownership of a text messaging project as the binary
dependent independent variables include: sociodemographics, 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
Owing 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. Inferences will be drawn from both strands and across strands. These ‘meta-inferences’ will be used to draw conclusions. The qualitative and quantitative strands will be merged in a matrix to display how they are related to each other. Table 1 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.

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

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. Figure 2 demonstrates the steps we will follow for analysis and integration of data.

Validation checks and dealing with sources of bias
We will draw from published criteria for acritical appraisal of mixed-methods studies to validate our research, using items identified by as a cross-paradigm framework for trustworthiness and rigour.

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 comparing codes among several coders. 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 programme. 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 generalise our findings, so selection bias is unlikely to be significant. However, we will collect sociodemographic 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. 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.

External validity
The extent to which our findings can be generalised to the rest of the population of PLHIV at the Yaoundé Central hospital will be verified by using a large (predetermined) sample, comparing the sociodemographics of our sample to that of the parent population and by investigating any refusals to participate. In this way, we will be able to make statistical (external) generalisations. 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 programme among PLHIV at the Yaoundé Central Hospital.

Consistency
We will apply standardised qualitative (focus groups) and quantitative (survey) techniques (described above)

### Table 1 Mixed methods data matrix

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

Mbuagbaw L, Ongolo-Zogo P, Thabane L. BMJ Open 2013;3:e002816. doi:10.1136/bmjopen-2013-002816
Feasibility
This study will benefit from a number of characteristics that make it feasible. First, the study is situated in a very active HIV centre with a large potential for recruitment in both strands of the study. Second, 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. Third, surveys in this setting are relatively inexpensive to conduct. Finally, our host centre, the Centre for the Development of Best Practices in Health, has the infrastructure and experience for a research project of this scale and can provide administrative, logistic and communication support.

ETHICS AND DISSEMINATION
Ethics
Ethics approval has been obtained from the IRB of the Yaoundé Central Hospital (N°288L/MINSANTE/SG/DHCY/Stages on the 16 May 2013).

Dissemination plan for results
We plan to disseminate our results at public presentations to 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 Yaoundé Central Hospital IRB.

Author affiliations
1Centre for the Development of Best Practices in Health (CDBPH), Yaoundé Central Hospital, Yaoundé, Cameroon
2Department of Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Ontario, Canada
3Biostatistics Unit, Father Sean O’Sullivan Research Centre, St Joseph’s Healthcare, Hamilton, Ontario, Canada
4Departments of Paediatrics and Anaesthesia, McMaster University, Hamilton, Ontario, Canada
5Centre for Evaluation of Medicine, St Joseph’s Healthcare, Hamilton, Ontario, Canada
6Population Health Research Institute, Hamilton Health Sciences, Hamilton, Ontario, Canada

Contributors All three authors contributed to the conception of the study. LM developed the first draft of the manuscript. LT and PO-Z provided statistical and methodological input. All three authors read and edited several versions of the manuscript. Professor 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.

Competing interests None.

Ethics approval Yaoundé Central Hospital Institutional Review Board.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

REFERENCES
1. UNAIDS. Report on the Global AIDS Epidemic. Secondary Report on the Global AIDS Epidemic 2010. http://www.unaids.org/globareport/global_report.htm

Figure 2 Steps in data analysis and integration.
Community ownership of a text message programme

2. Boyer S, Protopopescu C, Marcellin F, et al. Performance of HIV care decentralization from the patient’s perspective: health-related quality of life and perceived quality of services in Cameroon. Health Policy Plan 2012;27:301–15.

3. Paterson DL, Swindells S, Mohr J, et al. Adherence to protease inhibitor therapy and outcomes in patients with HIV infection. Ann Intern Med 2000;133:21–30.

4. Gill CJ, Hamer DH, Simon JL, et al. No room for complacency about adherence to antiretroviral therapy in sub-Saharan Africa. AIDS 2005;19:1243–9.

5. Mannheimer S, Friedland G, Matts J, et al. Adherence to antiretroviral therapy predicts biologic outcomes for human immunodeficiency virus-infected persons in clinical trials. Clin Infect Dis 2002;34:1115–21.

6. Haubrich RH, Little SJ, Currier JS, et al. The value of patient-reported adherence to antiretroviral therapy in predicting virologic and immunologic response. California Collaborative Treatment Group. AIDS 1999;13:1099–104.

7. UNAIDS. Resource needs for an expanded response to AIDS in low- and middle-income countries. Secondary Resource needs for an expanded response to AIDS in low and middle-income countries. 2005. http://data.unaids.org/pub/Report/2005/jc1255_resource_ needs_en.pdf

8. Lester RT, Ritvo P, Mills EJ, et al. Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya (WitTel Kenya1): a randomised trial. Lancet 2010;376:1838–45.

9. Pop-Eleches C, Thirumurthy H, Habyarimana JP, et al. Mobile phone technologies improve adherence to antiretroviral treatment in a resource-limited setting: a randomized controlled trial of text message reminders. AIDS 2011;25:825–34.

10. Mukund Bahadur KC, Murray PJ. Cell phone short messaging program to enhance antiretroviral adherence. J Am Med Inform Assoc 2002;9:15–15.

11. Dunbar PJ, Madigan D, Grohskopf LA, et al. A two-way messaging system to enhance antiretroviral adherence. J Am Med Inform Assoc 2002;9:15–15.

12. Lester RT, Gelmon L, Plummer FA. Cell phones: tightening the communication gap in resource-limited antiretroviral programmes? AIDS 2006;20:2242–4.

13. Karanja S, Mbugua L, Ritvo P, et al. A workshop report on HIV mHealth synergy and strategy meeting to review emerging evidence-based mHealth interventions and develop a framework for scale-up of these interventions. Pan Afr Med J 2011;10:37.

14. Thirumurthy H, Lester RT. M-health for health behaviour change in Costa Rica: A methodology for designing evidence-based mHealth interventions for HIV/AIDS prevention. Intern Med Policy Plan 2010;25:301–10.

15. GIT ESTHER, UNICEF, WHO. Evaluation of ARV Procurement and Supply Management Systems in West and Central Africa Region. Secondary Evaluation of ARV Procurement and Supply Management Systems in West and Central Africa Region. 2008. http://www.unicef.org/wcaro/Wcaro_ARV_PSM_study_En_June_2008.pdf

16. Mbugua L, Bonono-Mommougui RC, Thabane L. Considerations in using text messages to improve adherence to highly active antiretroviral therapy: a qualitative study among clients in Yaounde, Cameroon. HIV/AIDS (Auck) 2012;4:45–50.

17. Mbugua L, Thabane L, Ongolo-Zogo P. Opening communication channels with people living with HIV using mobile phone text messaging: insights from the CAMPS trial. BMC Res Notes 2013;6:131.

18. The World Bank. World Development Indicators Secondary The World Bank, World Development Indicators. 2013. http://data.worldbank.org/indicator/IT.CEL.SETS.P2

19. Mbugua L, Shurik E. Community Participation in HIV/AIDS Programs. In: Barros E, ed. HIV-infection - Impact, Awareness and Prevention of HIV living with HIV/AIDS Tech. 2003;6:26–31.

20. Ramirez-Valles J. The protective effects of community involvement for HIV risk behavior: a conceptual framework. Health Educ Res 2002;17:389–403.

21. Morgan LM. Community participation in health: the politics of primary care in Costa Rica. Cambridge: Cambridge University Press, 1993.

22. Mbugua L, Thabane L, Ongolo-Zogo P, et al. The Cameroon Mobile Phone SMS (CAMPS) Trial: a randomized trial of text messaging versus usual care for adherence to antiretroviral therapy. PLoS ONE 2012;7:e46909.

23. Creswell JW, Plano Clark VL. Designing and conducting mixed methods research. 2nd edn. Thousand Oaks, CA: Sage, 2011.

24. Praditsathaporn C, Chandasanasoti P, Amnatsasuee K, et al. Mental health assessment tool for older Thai adults: development and psychometric testing. Southeast Asian J Trop Med Public Health 2011;42:744–53.

25. Hamshire C, Willgoose TG, Wibberley C. What are reasonable expectations? Healthcare student perceptions of their programmes in the North West of England. Nurse Educ Today 2013;33:173–9.

26. Jones-Harris AR. Are chiropractors in the UK primary healthcare or primary contact practitioners? A mixed methods study. Chiropr Osteopat 2010;18:28.

27. Stoller EP, Webster NJ, Bliexen CE, et al. Alcohol consumption decisions among nonabusing drinkers diagnosed with hepatitis C: an exploratory sequential mixed methods study. J Mix Methods Res 2009;3:65–86.

28. Giuliani KK, Mire OA, Jama S, et al. Tobacco use and cessation among Somalis in Minnesota. Am J Prev Med 2008;35(Suppl 6):S457–62.

29. O’Cathain A, Murphy E, Nicholl J. Why, and how, mixed methods research is undertaken in health services research in England: a mixed methods study. BMC Health Serv Res 2007;7:85.

30. O’Cathain A, Nicholl J, Murphy E. Structural issues affecting mixed methods studies in health research: a qualitative study. BMC Med Res Methodol 2009;9:82.

31. Johnson RB, Onwuegbuzie AJ, Turner LA. Toward a definition of mixed methods research. J Mixed Methods Res 2007;1:112–33.

32. Greene JC, Caracelli VJ, Graham WF. Toward a conceptual framework for mixed-methods evaluation design. Educ Eval Policy Anal 1989;11:265–74.

33. WHO. Yaoundé, Cameroon-HUG, Switzerland. 2010.

34. Teddile C, Yu F. Mixed methods sampling. J Mixed Methods Res 2007;1:77–100.

35. Sandelowski M. Combining qualitative and quantitative sampling, data collection, and analysis techniques in mixed-method studies. Res Nurs Health 2002;25:246–55.

36. Cochran WG. Sampling techniques. 3rd edn. New York: John Wiley & Sons, 1977.

37. Thomas T, Narayanana P, Wheeler T, et al. Designing a community of ownership and preparedness index: using data to inform the capacity development of community-based groups. J Epidemiol Community Health 2012;66(Suppl 2):i26–33.

38. Jamieson S. Likert scales: how to (ab)use them. Med Educ 2004;38:1217–18.

39. Bernard HR, Ryan GW. Analyzing qualitative data: systematic approaches. Thousand Oaks, CA: Sage, 2010.

40. Taylor-Powell ET, Renner M. Analyzing qualitative data. University of Winsconsin: Programme development and evaluation. Second Analyzing Qualitative data. University of Winsconsin: Programme development and evaluation. 2003. http://ecommerce.uwex.edu/pdfs/G3658_12.pdf

41. Teddile C, Tashakkori A. Foundations of mixed methods research: integrating quantitative and qualitative techniques in the social and behavioral sciences. Thousand Oaks, CA: Sage, 2009.

42. Castro FG, Kellison JG, Boyd SJ, et al. A methodology for conducting integrative mixed methods research and data analyses. J Mixed Methods Res 2010:4:342–60.

43. Pluye P, Grad RM, Levine A, et al. Understanding divergence of quantitative and qualitative data (or results) in mixed methods studies. Int J Mult Res Approaches 2009;3:56–72.

44. Onwuegbuzie AJ, Teddile C. A framework for analyzing data in mixed methods research. In: Teddile ATC, ed. Handbook of mixed methods in social and behavioral research. Thousand Oaks, CA: Sage, 2003:351–83.

45. Sale JEM, Brazil K. A strategy to identify critical appraisal criteria for primary mixed-method studies. Qual Quantitative 2004;38:351–65.

46. Lincoln Y, Guba E. Naturalistic inquiry. Newbury Park, CA: Sage, 1985.

47. Sandelowski M. Qualitative analysis: what it is and how to begin. Res Nurs Health 1989;12:380–9.

48. Kleinbaum DG, Morgenstern H, Kupper LL. Selection bias in epidemiologic studies. Am J Epidemiol 1981;113:452–63.

49. Combs JP, Onwuegbuzie AJ. Describing and illustrating data analysis in mixed research. Int J Educ Res 2010;2:E13.

50. Yin RY. Case study research: design and methods. Thousand Oaks, CA: Sage, 2009.

51. Mbugua L, Thabane L, Ongolo-Zogo P, et al. The challenges and opportunities of conducting a clinical trial in a low resource setting: the case of the Cameroon mobile phone SMS (CAMPS) trial, an investigator initiated trial. Trials 2011;12:145.