the heart of the HIV/AIDS pandemic lies in regions traditionally lacking in modern infrastructures. Mobile/cellular telephone networks are breaking that pattern. Cell phone access and use is increasing in sub-Saharan Africa faster than anywhere else in the world. The United Nations has recognized that placing more cell phones in people's hands leads to economic empowerment and can even increase gross domestic product (GDP). Access to health care should also benefit from this trend. We have previously shown, however, that although access to mobile telephone services was very high among patients attending two comprehensive care clinics (CCC) in Nairobi, Kenya, the phones were rarely used for health-care services. Meanwhile, the global effort to improve access to life-saving antiretroviral (ARV) drugs for the treatment of HIV/AIDS is progressing as human resource and infrastructural challenges remain daunting. We believe that strategic use of mobile telephony can enhance the efficiency, effectiveness and durability of ARV programmes, particularly in resource-limited settings.

Perhaps one of the greatest challenges of ARV scale up will be the maintenance of drug adherence. Life-long adherence to the medications is required at near-perfect levels (>95%), to ensure durable responses and to prevent drug-resistance from developing. Indeed, several studies have shown that adherence is as good as, or better in Africa than in western countries, yet optimal adherence still remains a challenge, especially in long term follow-up. We believe that frequent and open communication between patients and their healthcare providers is crucial to optimal adherence and reporting of side-effects. We therefore strategized a way to integrate mobile telephony into the health management of subjects receiving ARV medications. We designed the study as a randomized controlled trial to assess health, social, and economic outcomes.

SMS-based protocol

The protocol was designed by the investigators and clinic staff in consultation with patients. It was intended to be a low-cost, clinic-based intervention providing support through regular clinic-initiated communications. We strived to achieve a balance between the intensive support of frequent ‘reminders’ to take medications on time, and an acceptable frequency of communications in terms of privacy and logistical issues, such as maintaining phone battery charge.
and network credit. Shared phones could be used belonging to spouses or other willing treatment assistants. A pilot study helped identify a ‘best protocol’ for the initial study as follows:

- A weekly SMS (text message) is sent by clinic nurse to each enrolled patient “Mambo?” (Kiswahili for “how are you?”) using the send-to-many phone function
- Each patient has two days to respond how they are doing: “Sawa” (OK) or “Shida” (Problem)
- Patients who respond “Shida” and non-responders are followed up with a call from the clinic nurse to identify and triage any problems.

As part of support, the intent is to identify potential medicine intolerances, adverse events, or any breeches in adherence earlier than through conventional means. The active communication protocol should also enhance follow-up. Medical emergencies are to be handled as per usual community resources. A written log is kept by the nurse of all communications and advice given in the protocol. An automated low-bandwidth-requiring computer platform is currently being developed in conjunction with the “Phones for Health” initiative to help manage larger patient numbers.

### Setting and study design

The study involves two sub-studies in Nairobi, Kenya, and two surrounding districts. The first sub-study evaluates subjects newly starting ARV medications and is a randomized controlled trial. The second sub-study is a 6-month ‘before and after’ trial to assess the effect of the SMS protocol in subjects who have already been taking ARVs for at least a year and who may therefore be experiencing chronic medication-taking fatigue. The study sites include a broad range of socio-economic urban and rural communities. Two study sites are within Nairobi, including a high density lower socio-economic market area of the city, and two are in vast rural districts. The Kajiado district CCC, for instance, serves a region which encompasses largely pastoral Maasai communities that must travel large distances on limited road networks, while the other district is largely agricultural.

### Early findings and lessons learnt

Baseline data from the first 118 subjects screened for the combined study were analysed. Significant time and cost are often incurred for patients to personally attend the clinics (Table 1); however, the majority of subjects screened reported being comfortable with using cell phones for communicating their health issues (Figure 1). Note that the average travel cost to attend the clinic was US$3.00 (return). The current cost of an SMS is US$0.08 and a one

| Table 1. Travel investment by participants to attend the clinic (each way) |
|-----------------|-------|-------|-------|
| N               | Minimum | Maximum | Mean |
| Distance (km)   | 118    | 0.5    | 300   | 27.64 |
| Time (minutes)  | 118    | 5      | 360   | 65.13 |
| Cost (USD)      | 118    | $0     | $9.23 | $1.50 |

An estimated 1000 consecutive patients will be screened for eligibility including adults who are HIV infected, taking ARVs, and have adequate access to a cell phone to complete the protocol. The primary outcome is self-reported adherence in 6-month follow-up. Hard outcomes include suppression of viral load at 6 months, clinical outcomes, as well as social and economic indicators.

Baseline demographic data, attitudinal data and logistical benefits and challenges are being assessed in all participants throughout the study. In-depth, semi-structured interviews are being held to provide insight into development of new best protocols.
minute voice call is US$0.23. The most positive feedback from early enrollees in the SMS-protocol is that the participants feel “like someone cares”. Many participants suggested that they would prefer more frequent SMS reminders; however the most common barrier to responding to the clinic SMS on time is lack of network credit at the time they are intended to respond. Overall, the once weekly protocol appears agreeable to most. Several instances of health problems have already been identified by the protocol and hence triaged by the nurse.

**Discussion and way forward**

The SMS protocol appears to be working and appears acceptable to participants receiving ARV medications. The major subjective benefit is that participants who receive the weekly SMS reminders from the clinic feel like someone is actively caring for them. It is too early to clearly report differences in study outcomes but a formal report will be compiled at the study completion. In addition to improvements in study outcomes, we intend to use the data and lessons learnt from this study to optimize mobile telephony protocols to best suit patients’ and health-care workers’ needs to improve access and quality of care in the scale up towards universal access to ARVs.

**References**


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