A systematic review of patients who initiated antiretroviral therapy (ART) across sub-Saharan Africa found that approximately 25% were no longer in care one year after initiation, a figure rising to 40% after two years (Rosen et al. 2007). This challenge combined with the need for strict adherence to medications for HIV and other chronic diseases make the use of technologies to monitor and improve adherence a much needed effort.

GHDonline’s Adherence & Retention and Health IT communities organized a joint panel discussion on how implementers are using wireless technologies to improve adherence monitoring and interventions. Participants discussed limitations of the technological approach and under-explored opportunities, and expanded the discussion to address challenges and solutions in the delivery of Directly Observed Treatment Short course (DOTS) for tuberculosis.

Key Points

Technologies cited:

- **Interactive Voice Response (IVR)** systems that call patients or participants, or systems that rely on “flashing,” meaning that the patient dials a number to confirm medication was taken and hanging up before the call is answered costing nothing (e.g. Happypill).
- **Text messaging/Short Message Service (SMS)** are seeing an increase in popularity because of their compatibility: ARemind uses keywords for reminders or to see how the patient is doing while still protecting patient’s privacy; Frontline SMS.
- **Wireless adherence monitors** such as Wisepill: a pill container that creates a date and time stamp every time it is opened and transfers this information to the web via GPRS or SMS (noted by a panelist as “passive and objective method that allows for early identification of adherence lapses”), or lower-cost Radio Frequency Identification (RFID)-based pill caps (e.g. Med-ic ECM).
- **Cell-phone based monitoring systems** that automate collection and monitoring. This allows tracking and measuring indicators of patients, for example. Two systems mentioned were World Vision’s Core HIV and AIDS Response Monitoring System (CHARMS; see 2008 Report Summary, PDF) and Dimagi’s CommCare system.
- **Handheld biometrics with a cell phone**: A member in India shared that its treatment coordinators and program managers use a fingerprint reader, a laptop, and a dedicated cell phone with software developed with the help of Microsoft Research in the delivery of DOTS for TB in 17 centers in Delhi for more than 700 patients. Patients are identified in the system when they take a dose, or miss one, in their home setting.

Implementation:

- Human resource management: assigning staff to conduct investigations/interventions based on often unpredictable, real-time data requires trial and error in the ramp-up phase.
- Tracking interventions and linking data: each lapse in signal requires thinking through all the potential causes including technical (battery failure, delayed signal transmission), intentional (patient took out several doses at once to go on a trip), or behavioral/structural (the patient forgot or encountered a barrier).
- Unreliable or no connectivity/network: A new software, The Serval Project, creates a mesh-based phone network between Wi-Fi enabled mobile phones thus allowing communication where there are no mobile towers or network, which can be very helpful in implementing wireless technologies for monitoring and patient adherence in remote areas.
- Discussing her work in Uganda, Jessica Haberer, MD, MS, shared some lessons learned: keep questions short, ending with a clear description of what information is desired; make sure there is clear communication between the engineers who develop the technology and the team who will implement; try to make an estimate of cell phone ownership and network availability before implementing mobile phone technology as you may have to budget for cell phones donations to patients for example.
- The protection of patient privacy and other ethical issues, such as freedom of choice, were raised.
- A member working on adherence and retention at the University of Washington in Nairobi, Kenya shares how and why cell phone text messaging can strengthen and promote the therapeutic relationship between provider and patient.
Panelists commented on implementation in settings with irregular power: using solar chargers for phones (e.g. d.light); Wisepill batteries lasted 3 to 4 months though they lost many batteries due to power surges while recharging; and people's ability to develop local solutions such as using a communal car battery for charging once a week.

Cost issues:
- One member estimated that wireless adherence monitoring could be accomplished for US$20 to $30 per year. While not cheap, this is similar to the cost for CD4 monitoring.
- In 2009 in Zambia, average wireless communications costs for a mobile transaction was about US$0.15.
- Text reminders have lower costs and evidence is coming out on their effectiveness (see Lester 2010).
- Cost estimates are difficult to calculate given that the prices of SMS vary widely between countries and technology prices can drop by half or more in one year.

Key References
- Lester RT et al. Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya (WeiTel Kenya): a randomised trial. Lancet. 2010. (Full text to signed in users)
- Chi BH, Stringer JS. Mobile phones to improve HIV treatment adherence. Lancet. 2010 Nov 27;376(9755):1838-45. (Full text to signed in users)
- HUB database of applications where developers can post their application for peer review.
- ICT for Community Health Workers (ict4chw) is a Google group for those exploring the use of mobile phones and other computer technologies to support community health workers.

Enrich the GHDonline Knowledge Base
Please consider replying to this discussion with the following information
- If you work in an organization that uses mobile technology to monitor patients, please share your project and thoughts.
- Do you have suggestions or systems to improve patient adherence, in the delivery of ART, DOTS for TB, or any other chronic disease?