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# Real-time HIV Antiretroviral Therapy Adherence Monitoring Among Adults and Children in Rural Uganda

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*(presenting on behalf of Jessica Haberer, Julius Kiwanuka, Conrad Muzoora, Denis Nansera, Peter Hunt, Jeff Martin, David Bangsberg)*

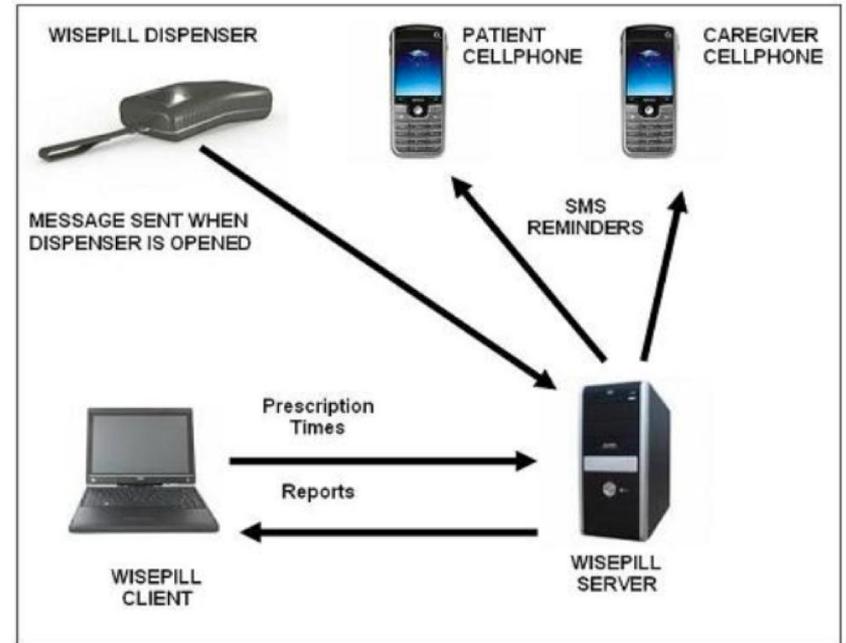
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I have no conflicts of interest to declare

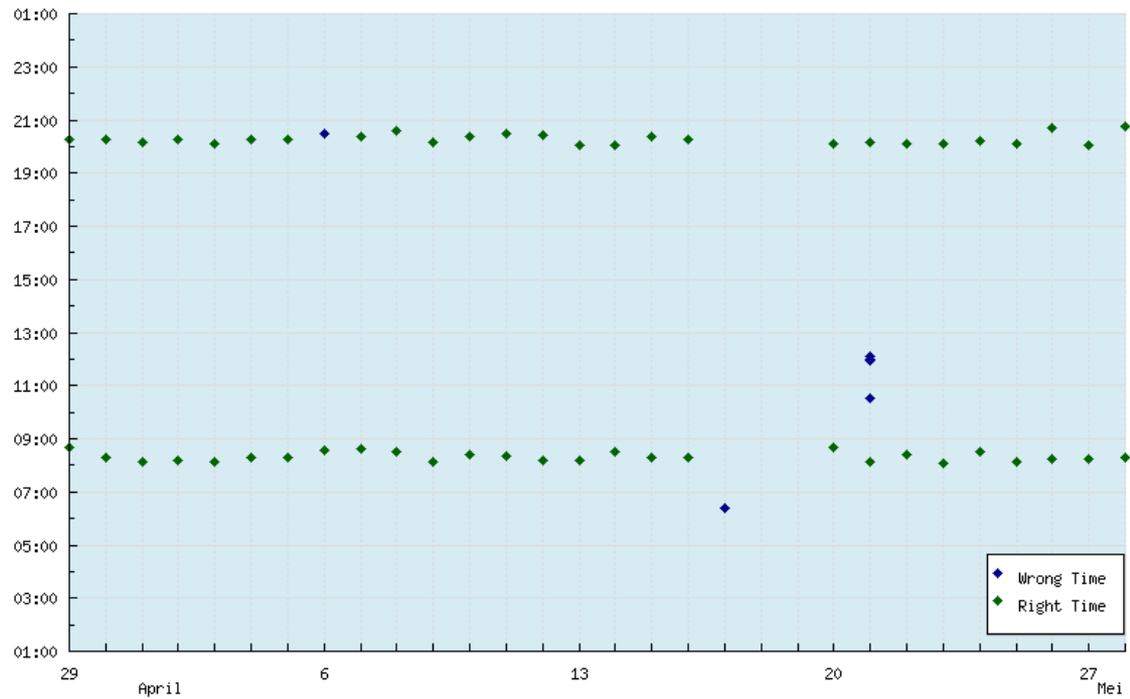
# Background

- Current ART adherence assessments typically detect missed doses long after HIV viral suppression is lost, and often after drug resistance develops
- Real-time, wireless monitoring strategies may enable prevention of treatment failure, thus sustaining the effectiveness of inexpensive and available first-line regimens

# Wisepill™



- Daily signal to confirm battery and device functionality
- Flash memory to send signals if travel out of network
- Data transmitted to a server by GPRS with back up SMS
- May be coupled with SMS reminders





# Methods

- Adherence measures:
  - Wisepill
  - Weekly self-report of adults and caregivers of children by Interactive Voice Response and SMS
    - Participant choice of method, using study phones
    - PIN -> #doses missed over 7 or 30 days
    - IVR repeated up to 3x/day over 3 days/week
    - SMS repeated up to 1x/day over 3 days/week
  - Monthly unannounced pill counts in adults for 3 months for validation

# Methods

- 48+ hour gaps in Wisepill assessed  
*(time likely needed for viral replication to begin)*
- HIV RNA was determined every 3 months in adults
- Wisepill acceptability assessed after 1 month

# Results

- Follow-up
  - Adults: 53.6 person-years follow-up  
(median 14 months/participant)
  - Children: 19.8 person-years follow-up  
(median 5 months/participant)

# Wisepill adherence measures

- Median adherence
  - Adults: 89.0% (IQR 83.7%-91.9%)
  - Children: 91.4% (IQR 89.2%-94.1%)
- Number of gaps of 48+ hours
  - Adults
    - Total: 0.4 gaps per person-month
    - Median: 3 (IQR 2-7) gaps per participant
  - Children
    - Total: 0.2 gaps per person-month
    - Median: 2 (IQR 1-2) gaps per participant

# Reported causes of Wisepill gaps

- 64 interruptions (~25%) investigated
  - 41 did not know why the gaps occurred
    - Possible technical problem or lack network (esp. with travel)
    - Possible unreported missed doses
  - 9 doses forgotten or “taken late”
  - 4 pocket doses
  - 3 unexpected travel without device
  - 1 device locked in house
  - 2 intentional non-dosing (e.g. stigma)
  - 2 hospitalizations
  - 2 temporary changes in caregiver

# Correlations among measures

- Median unannounced pill count adherence among adults during the first 3 months was 98.0% (IQR 91.9-99.8%)
- Unannounced pill count did not correlate with concurrent Wisepill data ( $r=0.13$ ,  $p=0.46$ ) or HIV RNA ( $r=-0.26$ ,  $p=0.23$ )
  - *May reflect unplanned pharmacy manipulation*
- Wisepill data did correlate with HIV RNA ( $r=-0.44$ ,  $p=0.01$ )

# Acceptability

- All but 2 participants (97%) reported Wisepill was “easy/very easy” to use
- All stated they “liked/really liked” being monitored

# IVR and SMS surveys

	N	Median # attempts/wk (IQR)	Median % surveys successful (IQR)	Median reported adherence (IQR)
<b>IVR</b>				
Caregivers	30	2.3 (1.8-2.9)	76.2% (50.8%-88.3%)	100% (99.8%-100%)
Adults	39	1.8 (1.6-2.8)	65.0% (10.8%-94.9%)	99% (96.5%-100%)
<b>SMS</b>				
Caregivers	16	2.9 (1.8-3.3)	94.7% (82.3%-100%)	100% (99.1%-100%)
Adults	5	3.8 (3.4-3.8)	93.5% (87.5%-100%)	100% (99.6%-100%)

# IVR and SMS surveys

- SMS was more successful, but IVR was more “popular”
- Most IVR participants (90%) had problems with the PIN
- Unable to assess PIN problems with SMS (due to system specifications)
- Challenges with IVR, but overall much improved over initial attempts (Haberer, *AIDS and Behav*, 2010), likely due to better training
  - Just in time approach
  - Staff more experienced
  - Visual aids for participants

# Conclusions

- Real-time adherence monitoring is feasible beyond the pilot stage
- Wisepill adherence correlates with HIV RNA
- Careful coordination is needed to act on real-time information in real-time
- Self-report by cell phone is feasible (SMS>IVR), but not very informative

# Next steps

- Wisepill currently in use by 348 adults
- Technical function and monitoring capacity of Wisepill devices now refined
- Systems for real-time action on real-time data are in place
- Assessing behavior and biology during interruptions
- Stay tuned...

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