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

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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.
• 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

• Goal: To explore real-time adherence monitoring beyond initial piloting (Haberer, AIDS Behavior, 2010)

• Study setting: Mbarara, Uganda

• Population:
  – 49 adults (UARTO cohort)
  – 46 children (CHARTA cohort; ages 2-11)
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 Wise pill data ($r=0.13$, $p=0.46$) or HIV RNA ($r=-0.26$, $p=0.23$)
  — May reflect unplanned pharmacy manipulation

• Wise pill 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

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Median # attempts/wk (IQR)</th>
<th>Median % surveys successful (IQR)</th>
<th>Median reported adherence (IQR)</th>
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<tbody>
<tr>
<td><strong>IVR</strong></td>
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<td></td>
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<tr>
<td>Caregivers</td>
<td>30</td>
<td>2.3</td>
<td>76.2% (50.8%-88.3%)</td>
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<td>(1.8-2.9)</td>
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<tr>
<td>Adults</td>
<td>39</td>
<td>1.8</td>
<td>65.0% (10.8%-94.9%)</td>
<td>99% (96.5%-100%)</td>
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<td>(1.6-2.8)</td>
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<td><strong>SMS</strong></td>
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<td>Caregivers</td>
<td>16</td>
<td>2.9</td>
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<td>Adults</td>
<td>5</td>
<td>3.8</td>
<td>93.5% (87.5%-100%)</td>
<td>100% (99.6%-100%)</td>
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<td>(3.4-3.8)</td>
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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 need 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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