Real-time antiretroviral treatment monitoring among HIV-positive individuals in southern China: early experiences with ‘Wisepill’

Lora Sabin,1 Mary Bachman DeSilva,1 Christopher J Gill,1 Zhong Li,2 Taryn Vian,1 Xie Wubin,2 Cheng Feng,3 Xu Keyi,4 Jessica Haberer,5 David Bangsberg,5 Allen L. Gifford1,6

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1Boston University, Boston, MA, USA
2FHI 360, Beijing, China
3Global Health Strategies, Beijing, China
4Ditan Hospital, Beijing, China
5Massachusetts General Hospital, Boston, MA, USA
6Edith Nourse Rogers Memorial VA Hospital, Bedford, MA, USA

Abstract #369
Background
HIV treatment in China

- China: new infections still increasing
  - Current estimate: 780,000 PLWHA
  - Border epidemics still growing most rapidly
- Rapid scale-up of ART
  - In 2002 – China implements national free HIV treatment
  - By Sept 2011, ≈109,000 on ART
  - By March 2014, ≈287,000 on ART
- Among Chinese patients on ART
  - Non-adherence appears common
  - Non-adherence contributes to drug resistance
  - Interventions to improve adherence urgently needed

Sources: China MoH (2011), China CDC (2013)
Using new technologies to improve adherence

- Increasing interest in mHealth as an adherence tool
- Enter Wisepill
  - Electronic Drug Monitor with wireless capability
  - Cellular chip embedded in device linking to a central server
  - Monitors adherence in real time
  - Server can be programmed to send message to a phone or email when a scheduled opening fails to occur
The China Adherence Through Technology Study (CATS)

- CATS tested whether real-time, triggered SMS text reminders, combined with counseling, would improve adherence.
- In this presentation, we present foundational results regarding the feasibility and acceptability of this technology among Chinese HIV patients.
Methods
CATS study team

- **BU CGHD**
  - Lora Sabin (PhD)
  - Mary Bachman DeSilva (ScD)
  - Allen Gifford (MD)
  - Christopher Gill (MD)
  - Taryn Vian (PhD)
  - Ariel Falconer (MPH(c))

- **FHI 360/China**
  - Zhong Li (MS)
  - Cheng Feng (PhD) (former China Country Director)
  - Xie Wubin (MPH)

- **Guangxi Provincial CDC ART Clinic (Nanning)**
  - Lan Guanghua (MD)
  - All clinic staff members

- **Ditan Hospital**
  - Xu Keyi (MD)

- **Harvard University/Mass General Hospital**
  - David Bangsberg (MD)
  - Jessica Haberer (MD)

**Funding:** National Institute for Drug Abuse
Procedures

Enrollment:

• 120 adult patients recruited Dec 2012-April 2013
• Currently on or about to start ART
• Deemed at risk for poor adherence

Wisepill use:

• Patients given Wisepill for one ART medication and monitored for 3 months
Procedures

Data collection:
• Socio-demographic and self-reported adherence collected at enrollment
• Signal lapses of ≥48 hours or more investigated
• After 3 months, collected quantitative and qualitative data on Wisepill experiences

Quantitative Measures:
• % technical failures (e.g. battery failures) among lapses
• % subjects that report Wisepill is convenient/easy
• % subjects that report a serious concern
Results
## Baseline characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N (%) or Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=120</td>
<td></td>
</tr>
<tr>
<td>Gender (female)</td>
<td>43 (35.8)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>37.7 (10.4)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
</tr>
<tr>
<td>Never married</td>
<td>33 (27.5)</td>
</tr>
<tr>
<td>Married</td>
<td>63 (52.5)</td>
</tr>
<tr>
<td>Divorced/widowed/other</td>
<td>24 (20.0)</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
</tr>
<tr>
<td>Primary only</td>
<td>27 (22.5)</td>
</tr>
<tr>
<td>Middle/secondary school</td>
<td>70 (58.3)</td>
</tr>
<tr>
<td>Beyond Secondary School</td>
<td>23 (19.2)</td>
</tr>
<tr>
<td>Currently employed (yes)</td>
<td>66 (55.5)</td>
</tr>
<tr>
<td>Monthly income (yuan) (n=105)</td>
<td>2982 (4411)</td>
</tr>
</tbody>
</table>

### HIV and Health History

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N (%) or Mean (SD)</th>
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<tbody>
<tr>
<td>CD4 count at baseline</td>
<td>377 (171)</td>
</tr>
<tr>
<td>UDVL at baseline (N=119)</td>
<td>96 (80.7)</td>
</tr>
<tr>
<td>Time on ART (months)</td>
<td>31.3 (30.0)</td>
</tr>
<tr>
<td>Used injectable street drug</td>
<td>15 (12.5)</td>
</tr>
<tr>
<td>Used non-injectable drug</td>
<td>17 (14.2)</td>
</tr>
<tr>
<td>Heroin (smoked)</td>
<td>13 (10.9)</td>
</tr>
<tr>
<td>Methadone</td>
<td>4 (35.0%)</td>
</tr>
</tbody>
</table>
Patients’ adherence, Months 1-3 (pre-intervention period)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Adherence Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reported adherence at baseline (Visual Analog Scale (VAS)) (N=115)</td>
<td>98.1 (3.5)</td>
</tr>
<tr>
<td>Adherence from Wisepill device (Months 1-3)</td>
<td></td>
</tr>
<tr>
<td>Proportion of doses taken</td>
<td>93.8 (9.7)</td>
</tr>
<tr>
<td>On-time measure</td>
<td>89.8 (14.2)</td>
</tr>
</tbody>
</table>
Early experiences using Wisepill: technical feasibility (Months 1-3)

Lapses

- In Months 1-3, 18,701 total prescribed openings
- Total lapses=55, missed openings=460 (2.5%)
- Mean duration of lapse: 8.5 doses

Technical reasons (n=9)
- Low battery (5)
- Device malfunction (1)
- Other (3)

Behavioral reasons (n=42)
- Intentional non-use (37)
- Hospitalization of subject, with ART interruption (2)
- Subject forgot (1)
- No drug available (1)
- Incarceration; patient not allowed to use device (1)

Unclear reasons (n=4)
Acceptability of Wisepill

• 86.5% reported a very or somewhat positive overall experience with Wisepill:

It is good in general. The pillbox itself could remind me to take my drugs on time.

Compared with pill bottles, [Wisepill] is easier to open.

• 55.9% found device ‘very easy’ to use
• 40.7% found device ‘easy’ to use
Yet reservations voiced...

- 58.8% said the device was inconvenient or very inconvenient to carry [break this out]

  *It is big and conspicuous; it is inconvenient to carry.*

  *The pillbox is too thick and it makes it inconvenient to carry.*

- 58.0% were very or somewhat worried that using Wisepill would disclose their HIV status; no disclosures were reported.

  *[when] someone is beside me, I feel really uncomfortable opening the pillbox.*
Positive reaction to being monitored...

- 95.8% felt very or somewhat positive about someone monitoring their adherence.

Knowing someone is looking helps me take my medication better

It is very good to have someone monitor how I take my ARVs every day. Just by looking at the pillbox, it could remind me to take my medicines on time.

Before I used the pillbox, I sometimes took my ARVs at the wrong time, but now I am more aware of my dose timing.
Conflicting views?

The pillbox is rather a burden to me, but the pillbox itself is also a good reminder so that I won’t forget to take my meds.
Conclusions

- ART patients in China are generally positive about using a real-time, web-linked adherence monitoring device.
- Real-time monitoring is feasible technically.
- Concerns about convenience and potential stigma need further exploration.
- Results suggest real-time monitoring holds potential for interventions that provide rapid adherence feedback directly to patients.
Thank you!

Questions?