A novel tool to monitor adherence to oral oncolytics: a pilot study

Background
- Non-adherence is an important issue in cancer care
- Accurately measuring adherence is challenging
- Nomi “smart” bottles record real-time medication taking behavior via changes in weight of bottle contents
- Nomi sends adherence data to providers via an interactive dashboard, and can send text messages to patients in cases of non-adherence

Aim: Assess the functionality of Nomi in monitoring capецitabine adherence & intervening with text notifications

Methods
- N = 28 patients were prescribed capецitabine for breast, colorectal, pancreatic, or biliary cancer, with planned duration of therapy >= 12 weeks, 21- or 28-day cycles
- Patients were enrolled via Outpatient Pharmacy Services at Yale New Haven Health, where capецitabine was filled
- Pre-intervention: cycles 1 + 2, patients were monitored only
- Post-intervention: cycles 3 +/4, text messaging enabled
- Adherence = # correct doses / total prescribed doses
- Conversion: patient takes dose after text message reminder

Patient demographics

<table>
<thead>
<tr>
<th>N total</th>
<th>N (%)</th>
<th>N (%)</th>
<th>N (%)</th>
<th>N (%)</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity</td>
<td>Race</td>
<td>Stage</td>
<td>Malignancy</td>
<td>Age</td>
<td>Income</td>
</tr>
<tr>
<td>Caucasian</td>
<td>Not reported</td>
<td>Localized</td>
<td>Metastatic</td>
<td>Not reported</td>
<td>Not reported</td>
</tr>
<tr>
<td>Hispanic</td>
<td>Not reported</td>
<td>Adjuvant</td>
<td>Switched</td>
<td>28 day</td>
<td>21 day</td>
</tr>
<tr>
<td>Others</td>
<td>Not reported</td>
<td>Breast</td>
<td>NSA</td>
<td>28 day</td>
<td>21 day</td>
</tr>
<tr>
<td>Black</td>
<td>Not reported</td>
<td>Breast</td>
<td>NSA</td>
<td>28 day</td>
<td>21 day</td>
</tr>
<tr>
<td>Not reported</td>
<td>27 (96)</td>
<td>23 (82)</td>
<td>45 (51)</td>
<td>40 (84)</td>
<td>1 (4)</td>
</tr>
</tbody>
</table>

Analyses
- We identified three categories/phenotypes of patients by examining patterns in % change in adherence from pre to post-intervention:
  - Category 1 (>8%)
  - Category 2 (2-8%)
  - Category 3 (<2%)

Category 1
- Most demonstrated a conversion rate of >35%
- Tended to live in regions with the highest average household income (Mean = $91.0 k)

Category 2
- Tended to live in regions with the lowest average household income (Mean = $58.9 k)

Category 3
- Tended to live in regions with the highest average household income (Mean = $58.9 k)

Results

Conclusions
- Nomi can monitor and intervene in real-time for patients taking capецitabine
- Adherence overall was high, and some patients appeared to benefit more from text message interventions
- Future work should focus on patients deemed high risk for non-adherence ("Category 1" patients)

Patient feedback/Technical considerations
- 60% of feedback survey respondents indicated desire to continue using Nomi
- 80% indicated that they would recommend it to others
- Bottle was difficult to open and close for some participants
- Incorrect timing of texts after shift in cycle/dosage change
- Bottle connectivity was poor in some regions
- Bottle ran out of battery for some patients; replacement needed to be sent

Limitations
- Confounds of hospitalizations, disease progression, medication toxicity.
- Technical difficulties with bottle
- Difficult to elicit feedback from patients during the study

Income and Adherence by Category

<table>
<thead>
<tr>
<th>Category 1</th>
<th>Category 2</th>
<th>Category 3</th>
<th>Pre-Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>5</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Income ($)</td>
<td>$58,000 (29,750)</td>
<td>$77,000 (34,250)</td>
<td>50,000 (23,350)</td>
</tr>
<tr>
<td>Post-Pre Adherence (%)</td>
<td>46 (1)</td>
<td>12 (2)</td>
<td>32 (3)</td>
</tr>
</tbody>
</table>

Total Overall Adherence (%) | 94 (15) | 89 (12) | 83 (12) |
Post-Pre Adherence (%) | 79 (10) | 93 (6) | 95 (5) |
AM Adherence (%) | 72 (12) | 92 (6) | 93 (5) |
PM Adherence (%) | 72 (12) | 95 (6) | 97 (3) |
Weekday Adherence (%) | 71 (17) | 93 (6) | 96 (4) |
Weekend Adherence (%) | 75 (0) | 95 (5) | 93 (7) |
Total Adherence (%) | 89 (4) | 92 (5) | 83 (4) |
AM Adherence (%) | 91 (3) | 92 (7) | 83 (6) |
PM Adherence (%) | 91 (3) | 94 (6) | 84 (6) |
Weekday Adherence (%) | 90 (0) | 94 (7) | 91 (3) |
Weekend Adherence (%) | 81 (15) | 90 (6) | 66 (22) |

Pre vs. Post Adherence by Patient

Adherence PRE Intervention vs. Adherence POST Intervention

Adherence (%)

Income ($)

N = 28 patients were prescribed capecitabine for breast, colorectal, pancreatic, or biliary cancer, with planned duration of therapy >= 12 weeks, 21- or 28-day cycles

Confounds of hospitalizations, disease progression, medication toxicity.
Technical difficulties with bottle
Difficult to elicit feedback from patients during the study

Study Schema

Nomi can monitor and intervene in real-time for patients taking capецitabine
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