Modeling Longitudinal Trajectories of Antiretroviral (ARV) Medication Adherence and Composite Medication Adherence for Non-HIV Chronic Conditions in People with HIV

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Continuum 2024 • June 9-11, 2024 • Puerto Rico
Background

- Medication adherence (MA) is often reported at the summary level over an aggregate period, which does not reflect the fluid, dynamic nature of medication-taking behavior over time.

- Condition-specific, summary MA measures do not represent the complexity medication-taking behavior from polypharmacy with chronic conditions.

- An alternative to traditional MA assessments is group-based trajectory modeling (GBTM), which has been used to characterize longitudinal medication adherence refill patterns (i.e., trajectories).\textsuperscript{1,2}
Objective

• Although GBTM has been used to study MA in a variety of chronic conditions, a recent systematic review did not identify any published studies with application in people with HIV with multiple chronic conditions.²

• Therefore, we applied GBTM to monthly medication refill data to identify longitudinal trajectories of medication adherence behavior for antiretroviral (ARV) medications and non-ARV medications in people with HIV with one or more additional chronic conditions.
Methods

Design:

• 37-month longitudinal retrospective observational cohort study between 9/2018 – 9/2021 (plus 6-month pre-observational period)
• 22,126 observation months

Sample:

• 598 Adult people with HIV with type 2 diabetes, hypertension, and/or hypercholesterolemia
• Continuously enrolled in a US mid-Atlantic integrated health system.
• Actively dispensed qualifying medication for each diagnosis in both the pre-observational and observational periods
• Exclusions: Cumulative institutional stays exceeding seven days in the pre- and post-3/2020 observational periods; diagnosis of end stage renal disease pre-3/2020*; death; or incomplete demographic information (n=2)

*Note that 3 incident cases of ESRD were identified between 11/2020 and 3/2021 and were retained as their inclusion did not affect interpretation of the results.
Methods

Measurements:

- Demographics
  - age, race/ethnicity, insurance type, comorbidities, COVID-19 interruption date

- Monthly proportion of days covered (PDC) was used to estimate both ARV medication adherence and non-ARV composite medication adherence (CMA)
  - non-ARV CMA included diabetes (T2DM), renin-angiotensin system antagonist (RASA), and statin medications during the observational period.
  - PDC is a consistent measure with CMS and health care quality organization standards.\(^3\)\(^-\)\(^5\)

- Monthly continuous measure (i.e., proportion) of PDC ranging from zero (complete non-adherence) to 1 (complete adherence) was used
Methods

Analyses:

• Univariate analyses used to describe the cohort characteristics.

• (Multi-trajectory) GBTM of ARV MA and CMA was used to identify dynamic MA trajectories over a 37-month observational period.⁶⁻¹⁰

• The optimal number of MA trajectories was selected using:
  – Bayesian Information Criterion (BIC)
  – Average posterior probabilities (APP) of trajectory membership >0.7
  – Odds of correct classification (OCC) >5
  – Interpretation of observed MA considering adequate thresholds (i.e., PDC≥0.80 for CMA, ≥0.90 for ARV medications).
Results

• A majority of the study cohort (n=598) was...
  – 51-64 years old (58%) and 65+ years old (19%)
  – Black (74%)
  – Male (69%)
  – Commercially insured (67%)

• In addition to HIV:
  – 62% of people with HIV had one of the 3 comorbidities
  – 30% had two comorbidities
  – 9% had three comorbidities

• Common non-ARV medication classes:
  – Statins (68%), RASA (55%), and T2DM (23%)

• Adequate medication adherence
  – ARV ≥90%: 76% of observed months
  – non-ARV CMA ≥80%: 71% of observed months
Results

• Trajectory Model Selection

<table>
<thead>
<tr>
<th>Trajectory Model Selection</th>
<th></th>
<th>BIC</th>
<th>AIC</th>
<th>Entropy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-Trajectory</td>
<td>598</td>
<td>-31,669</td>
<td>-31,634</td>
<td>0.962</td>
</tr>
<tr>
<td>4-Trajectory</td>
<td>598</td>
<td>-30,919</td>
<td>-30,873</td>
<td>0.974</td>
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<tr>
<td>5-Trajectory</td>
<td>598</td>
<td>-30,234</td>
<td>-30,177</td>
<td>0.964</td>
</tr>
</tbody>
</table>

BIC = Bayesian Information Criteria; AIC = Akaike Information Criterion

• Compared to 3-trajectory and 4-trajectory solutions, the 5-trajectory taxonomy had the preferred BIC and AIC.
  – Smaller value closer to zero
### Results

#### 5-Trajectory Model Characteristics

<table>
<thead>
<tr>
<th>Pattern</th>
<th>n</th>
<th>Average Posterior Probabilities (APP)</th>
<th>Odds of Correct Classification (OCC)</th>
<th>Total Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1 - Inadequate, decreasing ARV MA and CMA</td>
<td>68</td>
<td>0.99</td>
<td>946</td>
<td>0.114</td>
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<tr>
<td>G2 - Inadequate, increasing ARV MA and decreasing CMA</td>
<td>66</td>
<td>0.98</td>
<td>360</td>
<td>0.109</td>
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<tr>
<td>G3 - Inadequate, increasing ARV MA and CMA</td>
<td>182</td>
<td>0.97</td>
<td>83</td>
<td>0.308</td>
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<tr>
<td>G4 - Inadequate decreasing ARV MA and adequate, increasing CMA</td>
<td>36</td>
<td>~1.0</td>
<td>37,283</td>
<td>0.060</td>
</tr>
<tr>
<td>G5 - Adequate, increasing ARV MA and CMA</td>
<td>246</td>
<td>0.98</td>
<td>68</td>
<td>0.408</td>
</tr>
</tbody>
</table>

- The 5-trajectory taxonomy had average posterior probabilities ≥0.97 for all patterns, and odds of correct classification >5.
Results

• 40.8% of the cohort consistently had adequate, increasing ARV MA and CMA (G5)

• 16.9% of the cohort had discordant adherence trajectories for ARV MA and CMA (G2 and G4)

• 42.2% of the cohort had consistent, but inadequate ARV MA and CMA adherence trajectories (G1 and G3)
  • One directional pattern was negative (G1) while the other was positive (G3)
Limitations / Strengths

- Observational design and small sample
- Analysis of historical (secondary) data
- Applying a surrogate measure of adherence
  - Actual adherence not measured
- No clinical outcome assessment
- Potential development of other conditions that may influence adherence

- CMA more accurately reflects the collective nature of non-ARV medication adherence in people with HIV and other chronic conditions.
- Study of CMA over an extended 37-month observation period reflects the chronicity of disease in people with HIV to realistically represent medication taking behavior.
- GBTM identifies dynamic patterns of medication adherence not previously done in older people with HIV with other chronic conditions.
- Muti-trajectory GBTM describes ARV MA and non-ARV CMA simultaneously.
Conclusions

• Varying patterns of ARV MA and non-ARV CMA suggests unique medication adherence needs.
  – Follow-up, in-depth qualitative inquiry is needed to fully understand

• GBTM can be used to identify people with HIV with specific MA needs and align them with tailored intervention strategies.

• Next steps include:
  – Evaluate the relationship between medication adherence trajectories and treatment outcomes.
  – Develop deeper understanding of the interplay among social determinants of health, social-behavioral, economic, health system, comorbidity-, therapy-, and other patient-related factors that shape these unique medication adherence trajectories through qualitative inquiry to inform optimal, tailored interventions.


Questions?

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