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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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).[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

Trajectory Model Selection				
Model	n	BIC	AIC	Entropy
3-Trajectory	598	-31,669	-31,634	0.962
4-Trajectory	598	-30,919	-30,873	0.974
5-Trajectory	**598**	**-30,234**	**-30,177**	**0.964**
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

5 Trajectory Model Characteristics				
Pattern	n	Average Posterior Probabilities (APP)	Odds of Correct Classification (OCC)	Total Probability
G1 - Inadequate, decreasing ARV MA and CMA	68	0.99	946	0.114
G2 - Inadequate, increasing ARV MA and decreasing CMA	66	0.98	360	0.109
G3 - Inadequate, increasing ARV MA and CMA	182	0.97	83	0.308
G4 - Inadequate decreasing ARV MA and adequate, increasing CMA	36	~1.0	37,283	0.060
G5 - Adequate, increasing ARV MA and CMA	246	0.98	68	0.408

- 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.

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Questions?

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