Determinants and persistence of medication adherence and its influence on health outcomes based on national health databases

Kerli Mooses¹, Marek Oja¹, Johannes Holm¹, Maarja Pajusalu¹, Hanna Keidong¹, Maria Malk¹, Sirli Tamm¹, Helene Loorents¹, Nikita Umov², Raivo Kolde^{1,*} ¹Institute of Computer Science, University of Tartu, Estonia ²The Institute of Family Medicine and Public Health, University of Tartu, Estonia * corresponding author: raivo.kolde@ut.ee

Background

Adherence to medications is crucial for achieving better health and clinical outcomes, which in turn reduces hospitalization and annual healthcare costs^{1,2,3,4}. There have been numerous studies on the determinants of medication adherence, however, the results are often conflicting, as the studies cover small populations and limited choice of medications^{5,6,7}. The population-based prescription databases linked with medical records allow larger scale studies into medication adherence and its determinants. Here we utilize a linked dataset of digital prescriptions and healthcare claims in OMOP CDM, to explore the patterns of medication adherence and systematically characterize its determinants across a wide variety of chronic medications.

Methods

The dataset utilized here, described 149 354 10% of Estonian population between 2012-2019 in OMOP CDM⁸. Out of these 64 837 had at least two continuous prescriptions of the same drug and thus had at least one adherence measurement. We concentrated 157 medications, identified independently to be chronic by two pharmacists among the 300 most common ingredients in the database.

For estimating medication adherence from prescription data, it is critical to have correct prescription durations on the record. We have systematically reviewed the prescription patterns for all medications used for chronic conditions and imputed the missing values based on the combination of existing prescription patterns in the data, clinical information and expert judgement.

For characterizing adherence, we calculated the Continuous multiple interval measure of Medication Acquisition (CMA) measure version 5. We calculated these values yearly for each and chronic medication combination. We have wrapped code from AdhereR R package⁹ to work on OMOP formatted databases for doing this calculation at scale on OMOP formatted databases.

To characterize the determinants of adherence we fitted a linear model to predict the adherence measure based on the patient demographics, medication, diagnosis, hospitalization and comorbidities information.

Results

The average CMA was 0.75 \pm 0.21. Traditionally, 0.8 is considered the threshold for good medication adherence, thus on average the adherence could be better. However, the adherence patterns vary considerably across medication. The CMA per ingredient ranged from 0.422 (albuterol, 95% CI 0.413...0.432) to 0.922 (warfarin, 95% CI 0.917...0.926).

In the linear mixed model, the fixed effects of demographics, comorbidities, diagnoses hospitalisation, ingredient and length of consecutive prescription described 11.6% percent of the variation. The ingredient had the largest effect with length of continuous prescription also describing significant amount of variance. While the proportion of variation explained was negligible for other effects, like demographics

or administration type, these were still statistically significant over our rather large sample. The effect sizes can be seen on Figure 1.

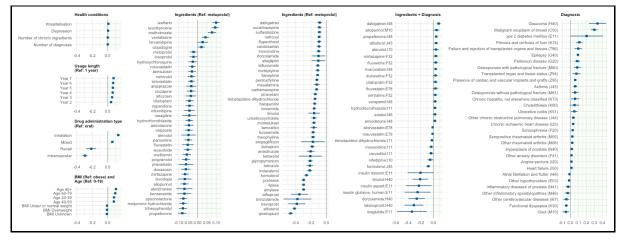


Figure 1. Statistically significant effect estimates for medication adherence determinants.

Conclusion

In this study of medication adherence, we were able to utilize a population level prescription database to systematically characterize the medication adherence across 157 chronic medications. Statistical modelling across all these medications and linked claims database allowed to characterize the determinants of the adherence behavior. Interestingly, traditional risk factors such as demographics and comorbidities described very little of the variation in the data, suggesting the behavior is influenced by a number of factors not measured in the data.

The study code is built upon OMOP CDM utilizing the standard concepts, allowing to expand the study to other sites where OMOP formatted population-based cohorts are available.

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