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Integrating HealthKit and OMOP CDM V5.0 for Precision Medicine mHealth Research for Alzheimer’s Disease

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Abstract

Alzheimer’s disease is a serious form of dementia characterized by severe cognitive impairment affecting millions of patients, particularly women and the elderly, and which is expected to be a significant source of morbidity and mortality in the future. Precision medicine is a major initiative to recruit 1 million patients and combine their mobile health and other data for new insights into patient health. This project describes one important use case (Alzheimer’s disease) for how mobile phones and the OMOP common data model can be used to provide a practical, scalable solution to address mHealth data collection and standardization for precision medicine research.

Introduction

Alzheimer’s disease is a serious form of dementia characterized by severe cognitive impairment affecting millions of patients, particularly women and the elderly, and which is expected to be a significant source of morbidity and mortality in the future. We recently performed and published an integrated “big data” analysis of Alzheimer’s disease, looking at over 24,000 patients with varying levels of cognitive impairment¹. The findings from this study provide the motivation and foundation for developing new technologies capable of enabling research in precision medicine for Alzheimer’s disease.

Precision medicine is a major healthcare initiative that was announced by the President just last year as a national priority. A key goal is to recruit at least 1 million patients nationwide and use their clinical, genomic, and mobile health (mHealth) data to gain dramatic insight into how this data could impact health². While clinical and genomic data have very standardized data collection approaches, the collection of mHealth data has not yet been well-defined. Our project proposes to leverage the iPhone HealthKit framework to overcome existing barriers to precision medicine and make scalable mHealth data collection possible for Alzheimer’s disease research.

Methods

The recently published National Institutes of Health (NIH) Precision Medicine Initiative Working Group Report to the Advisory Committee to the Director identified the Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM) as one strong candidate framework for the Precision Medicine Initiative Cohort Program³. As a result, the developed Precision Medicine Alzheimer’s Disease mHealth Research App is a mobile health adoption of the OMOP Common Data Model Version 5.0, an open source health informatics standard widely used by industry, government, and academic organizations (<http://omop.org>) with potential applications to precision medicine research initiatives. Using our previously published Alzheimer’s disease analytical model and the associated clinical, medical, genetic, and behavioral factors as a guide, we adapted OMOP CDM Version 5.0 for the HealthKit framework using the Swift programming language¹. The current version of the app was reviewed, approved, and officially released to the App Store on October 31, 2015.

Results

The Precision Medicine Alzheimer's Disease mHealth Research App works as follows: Academic organizations, research institutions, and other organizations interested in precision medicine research for Alzheimer's disease reach out to interested participants. Interested users then 1) visit the Apple App Store and download/install the Precision Medicine mHealth Alzheimer's Research App for iPhone, 2) open the app on their device, 3) press the "Share My Data" button, and 4) grant the app permission to access the prompted HealthKit data they feel comfortable sharing for Alzheimer's disease research. The user is required to explicitly approve/deny access to each data field from the displayed list of HealthKit variables relevant for Alzheimer's disease research. Approved health data elements will then be extracted from the encrypted HealthKit database, standardized into structured files consistent with OMOP CDM V5.0, and sent to research organizations selected by the user. A privacy policy explains the app does not collect, analyze, or store any data, but simply allows users to donate standardized health data for research purposes.

Conclusion

The NIH Precision Medicine Initiative emphasizes that large de-identified mHealth databases spanning multiple medical centers and institutes can be used to answer questions about human disease, treatment, and prevention. This project focuses on one important use case (Alzheimer's disease) and describes how mobile phones and the OMOP CDM can be used to provide a practical, scalable solution to address mHealth data collection and standardization for precision medicine research.

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Author declares no conflicts of interest. Apple, the Apple logo, and iPhone are trademarks of Apple Inc., registered in the U.S. and other countries. App Store is a service mark of Apple Inc.

References

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