

Understanding Precision Medicine through the NIH All of Us Research Program and NCI Cancer Research Data Commons

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Background

- The National Institutes of Health (NIH) All of Us (AoU) Research Program is collecting vast electronic health record (EHR) data from 1 million+ patients across the country to catalyze the practice of precision medicine.¹
- The National Cancer Institute (NCI) Cancer Research Data Commons (CRDC) is a cloud-based data ecosystem containing both cancer-related data and analytics tools to catalyze large-scale precision oncology.²
- Focusing on cancer patients, this study investigates the current state of precision medicine and precision oncology by leveraging both the NIH AoU program and NCI CRDC.

Methods

- Data source:** most recent (December 2020) release of the AoU dataset, made available to researchers as Registered Tier data following the OHDSI OMOP Common Data Model
- Cancer cohort:** any patient reporting at least 1 cancer diagnosis in their Medical History survey, and grouped following NCI Surveillance, Epidemiology and End Results (SEER) site classifications
- Genomic testing:** defined by list of relevant LOINC codes focused on assessing human genetic or genomic information
- Cloud-based Jupyter Notebook (R 4.0.3) in the NCI Cancer Research Data Commons created all cancer definitions and mapping files
- Cloud-based Jupyter Notebook (python 3.7) in AoU Researcher Workbench used for data extraction, integration, and analysis
- Full biomedical informatics pipeline described in Figure 1

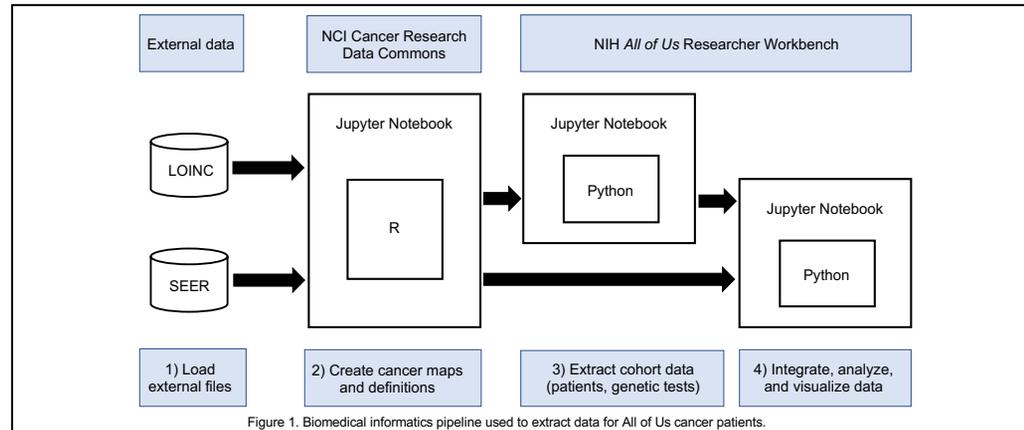


Figure 1. Biomedical informatics pipeline used to extract data for All of Us cancer patients.

Results

- 20,333 cancer patients with diverse cancers (Figure 2)
 - Female (60.4%), Male (38.7%), Not Specified/Other (0.9%)
 - Asian (1.0%), Black or African American (3.4%), White (89.5%), Not Specified/Other (6.0%)
 - Hispanic or Latino (3.6%), Not Hispanic or Latino (94.3%), Not Specified/Other (2.1%)
- Genomic testing
 - 622 (3.2%) of cancer patients received some form of genomic testing
 - Most common testing categories:
 - Gene mutations (945 tests, 416 patients)
 - Molecular pathology (403 tests, 164 patients)
 - Gene translocation (288 tests, 42 patients)
 - Most common genes:
 - HBB, F5, F2, JAK2, MTHFR, CFTR, HFE

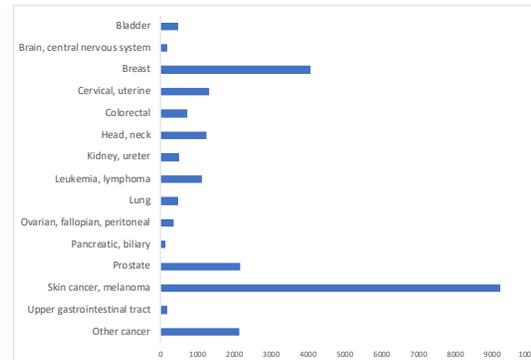


Figure 2. Distribution of AoU participant-reported cancer diagnoses.

Summary and Conclusions

- Biomedical informatics pipelines can extract, integrate and analyze cancer-related data from diverse cloud-based platforms for precision medicine research.
- More researchers are needed to leverage federal cloud-based precision medicine resources in order to realize the full potential of precision medicine.

For more information or to request access to data and/or cloud-based tools:

- NCI Cancer Research Data Commons
 - <https://datascience.cancer.gov/>
- NIH All of Us Research Program
 - <https://www.researchallofus.org/>

References

- Ramirez AH, Gebo KA, Harris PA. Progress With the All of Us Research Program Opening Access for Researchers. JAMA. 2021;June 11.
- Hinkson I V., Davidsons TM, Klemm JD, Kerlavage AR, Kibbe WA. A comprehensive infrastructure for big data in cancer research: Accelerating cancer research and precision medicine. Front Cell Dev Biol. 2017;5(83). doi:10.3389/fcell.2017.00083

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