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Successful Automated Normalization of Cancer Outcomes for Half a Million Patients Across Four Disparate Health Systems

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Background
The lack of interoperability among different electronic medical record (EMR) systems remains a challenge to fulfilling the promises of precision oncology. Typically, cancer outcomes data is stored as unstructured information in a multitude of inconsistent fields across EMRs. This prevents the integration of outcomes into the treatment decision-making process. To overcome this challenge, we leveraged the Syapse ontology, a data model that unifies biomedical data. Here we report our successful efforts to unify outcomes data for systemic therapies across a large network of health systems.

Methods
Health system participants included Providence St. Joseph Health, Aurora Health Care, Henry Ford Health System, and University of Miami Sylvester Comprehensive Cancer Care. Data integration efforts were initiated with each health system between 1/2015 and 1/2018. Syapse was used to aggregate clinical data sources, integrate molecular data, and automate outcomes calculation. Source datasets within the health system included the EMR, enterprise data warehouse, tumor registry, and health system databases. Outcome measures included time on treatment, defined as the time between treatment start date and treatment end date; and overall survival, defined as the time between treatment start date and the patient’s date of death.

Results
Across these four health systems, as of 2/6/2018, 613,575 individual patient records were automatically extracted and normalized using Syapse. These patients include 178,333 males, 435,242 females and represent 70 anatomical cancer types. There were 35,850 patients with a recorded date of death, and 298,792 patients with medication order information. Overall survival, defined as time between treatment start date and date of death, was calculated for 15,968 cases, and time on treatment, defined as time between treatment start date and treatment end date, was calculated for 47,579 cases.

Conclusion
This collaboration represents one of the largest efforts to structure cancer outcomes data across health systems for clinical purposes in an automated fashion. Pursuant to data availability, this initiative will expand to other outcomes and will integrate outcomes information into clinical decision making.