

across gestational ages (18 weeks to 30 weeks) collected at our institution. **DISCUSSION/SIGNIFICANCE OF IMPACT:** Quantitative estimates of brain volume, and deviations from normative data, would be a major advancement in objective clinical assessments of fetal MRI. Such data can currently only be obtained through laborious manual segmentations; automated deep learning methods have the potential to reduce the time and cost of this process.

4420

Characterizing medical comorbidity prior to autism diagnosis in children before age two.

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OBJECTIVES/GOALS: Autism spectrum disorder (ASD) is a developmental disorder with a high financial and personal burden. Individuals with ASD experience significant comorbid medical conditions. We identified conditions that appear prior to ASD diagnosis in order to potentially improve early screening practices. **METHODS/STUDY POPULATION:** We used electronic health record data from an anonymized database at Vanderbilt University Medical Center for individuals with ASD and matched controls to analyze comorbid conditions prior to an ASD diagnosis. Data were censored to include only individuals who first appeared in the database prior to two years of age ($n_{\text{total}} = 1551$, $n_{\text{controls}} = 976$, $n_{\text{ASD}} = 575$). Comorbidities (~1800 conditions) were compared between the ASD and matched control group using a novel tool (pyPheWAS) to examine presence, count, and duration of comorbidities that occurred between 0-2 years old and before ASD diagnosis. **RESULTS/ANTICIPATED RESULTS:** Convulsions ($p = 0.000404$, $\beta = 0.807$), constipation ($p = 0.000789$, $\beta = 0.894$), and strabismus ($p = 0.00243$, $\beta = 1.155$) were the most significant comorbid conditions prior to age 2 in individuals who would later be diagnosed with ASD. The group with ASD also had more visits associated with convulsions ($p = 0.00511$, $\beta = 0.195$), diseases of the esophagus ($p = 0.0117$, $\beta = 1.675$), and allergic reactions to food ($p = 0.0119$, $\beta = 0.540$) prior to their diagnosis. The ASD group was also seen for a longer duration regarding convulsions ($p = 0.000273$, $\beta = 0.695$), constipation ($p = 0.00157$, $\beta = 0.712$), and malaise and fatigue ($p = 0.00188$, $\beta = 0.903$) before ASD diagnosis. **DISCUSSION/SIGNIFICANCE OF IMPACT:** Precise comorbid condition profiles in early childhood may help uncover biomarkers leading to better prediction of a future ASD diagnosis. Medical conditions that precede the onset of measurable behavioral symptoms may enhance early screening, treatment, and intervention in ASD.

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Closing the cross-institutional referral loop: Applying human factors to improve consultations

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OBJECTIVES/GOALS: Although referrals for specialty consultations are a core clinical process, they are prone to coordination and communication breakdowns that have led to adverse clinical outcomes. This project's objective is to improve timely documentation, transmission, access, and quality of consultation notes across

healthcare systems. **METHODS/STUDY POPULATION:** There are two specific aims for this project. In Aim 1, we will characterize clinical workflows and information flow during cross-institutional referrals. In Aim 2, we will develop and test a prototype leveraging electronic health information exchange (HIE) to increase closing the loop for cross-institutional referrals and improve the quality of consultation notes. To accomplish these aims, we will use human factors methods, including data analytics, medical-record reviews, semi-structured interviews of consultants, rapid prototyping, and usability evaluations. **RESULTS/ANTICIPATED RESULTS:** Results will inform the design and integration of clinician-facing technologies into clinical workflows to close the referral loop and improve diagnostic processes. Aim 1 will provide quantitative evidence about the quality of cross-institutional referrals, inform the eventual implementation of our prototype, and identify user interface features required for successful electronic health information exchange. Based on the results from Aim 1, reports and visual representations will be generated to illustrate information flows and clinical workflows. This will prioritize design efforts for the intervention's prototype. Aim 2 will translate clinicians' requirements into prototype features and assess clinicians' experience with the prototype. **DISCUSSION/SIGNIFICANCE OF IMPACT:** The use and usefulness of HIE has been limited due to usability and implementation issues. Cross-institutional referrals are complex and dependent on HIE due to EHRs' lack of interoperability. This project will provide evidence-based recommendations for the use of Fast Healthcare Interoperability Resources (FHIR) to improve HIE during referrals.

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Collecting, Interpreting and Utilizing Retrospective Clinical Data from Data Warehouses

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OBJECTIVES/GOALS: Utilizing clinical electronic health record (eHR) data pulled *en masse* from data warehouses provides unique challenges when applying it to retrospective studies. Use of this data in conjunction with metabolomic and genomic results to predict response to lisinopril or ondansetron has been completed. **METHODS/STUDY POPULATION:** Study population consists of >2000 subjects recruited from the Emergency Medicine Specimen Bank at University of Colorado Denver (UCD). All patients presenting to the emergency department are approached to participate which significantly increases demographic diversity of our study populations. Clinical data is pulled from Health Data Compass (data warehouse at UCD that collects all electronic health record (EHR) data to be able to deliver de-identified). Effectiveness of lisinopril and ondansetron were investigated using metabolomic data collected via ultra-high performance liquid chromatography mass spectrometry and genomic data from Illumina chip technology to find relevant correlations. **RESULTS/ANTICIPATED RESULTS:** Obtaining retrospective clinical data from data warehouses comes with significant challenges to be addressed. Verifying all clinical variables from patient EHRs is a crucial step that requires extensive quality control steps. As well, ensuring data validity, appropriateness of data points pulled as relate to the study criteria and identifying alternate EHR data points is needed. Chart review is a critical step necessary to surmount these challenges. Additionally, use of retrospective EHR data often necessitates the development of novel definitions of clinical effectiveness that can be abstracted from the EHR—such as how to determine decrease in nausea without a visual analogue scale. **DISCUSSION/SIGNIFICANCE OF IMPACT:** Utilizing