**Project Plan**

**Student:** Magster

**Supervisors:**

**Title:** Predicting Psychotic Symptoms in Adolescents

**Research objective:**

Assessing mental health conditions can be approached through various methods, each with its strengths and limitations. This thesis aims to use extensive data from the Adolescent Brain Cognitive Development (ABCD) study to investigate how different assessment methods influence the accuracy of predicting the development of psychotic symptoms in adolescence. By focusing on various contributing factors and their interactions, our goal is to predict responses on the Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS) questionnaire (Geller et al., 2001). Specifically, we will assess how the inclusion of additional data—such as MRI scans, hormonal information, and cognitive assessments—affects the accuracy of predicting psychotic symptomatology on the KSADS.

**Background:**

Schizophrenia is a complex mental disorder with symptoms that typically originate during adolescence, a critical period marked by significant changes in brain structure and function, hormonal fluctuations, and psychosocial environments (Gilmore et al., 2018; Patel et al., 2021). Although schizophrenia is not directly fatal, individuals with the disorder face a higher risk of premature death, often due to elevated rates of suicide and lifestyle-related health issues (Harkavy-Friedman, 2006). Therefore, identifying at-risk individuals efficiently and cost-effectively is crucial. Existing research emphasizes the multifaceted influences on the development of schizophrenia. Psychosocial stressors such as social adversity, isolation, and bullying during adolescence are linked to schizophrenia and can disrupt brain development (Lay et al., 2000; Makinodan et al., 2012) Hormonal shifts during puberty, involving changes in gonadal hormones (testosterone and estrogen) and stress hormones (cortisol), play a crucial role in neurodevelopment (Peper & Dahl, 2013). Furthermore, biological mechanisms like accelerated synaptic pruning and impaired myelination significantly impact brain structure and function (Caballero et al., 2016; Paus, 2010). Finally, genetic factors are also critical, as twin and family studies have demonstrated a substantial hereditary component in the disorder's etiology (Rees et al., 2015).

Together, these factors illustrate the complexity of schizophrenia's developmental origins and highlight the importance of understanding the multifaceted influences on its onset. While traditional statistical techniques primarily detect group-level effects, machine learning (ML) offers promise in creating individualized predictions by integrating diverse data types and optimizing multivariate brain patterns (Abi-Dargham & Horga, 2016). This approach aims to transform group-level findings into clinically relevant individual predictions, ultimately improving prediction accuracy and possibly informing effective intervention strategies for schizophrenia.

**Methodology:**

The ABCD study provides a comprehensive dataset including 12,000 children aged 9-10 years from 21 research sites across the United States (Karcher & Barch, 2021). The study includes neuroimaging, cognitive assessments, psychosocial surveys, and hormonal measurements. This thesis aims to evaluate the impact of incorporating biological and psychosocial assessments on predictive accuracy of the model and assess the cost-effectiveness of each measurement modality. This includes assessing the marginal benefits of adding each additional measurement to standard evaluation protocols. Additionally, we will assess whether longitudinal data from multiple timepoints can increase the accuracy compared to a model based solely on data from a single timepoint.

**Research Question:**

How do different data modalities complement each other in predicting phenotype symptom severity ahead of time?

**Ethical considerations and applications:** The data will be stored on UiO’s TSD (Tjeneste for Sensitive Data). Access to TSD (project p23) and computing resources for running machine learning models, provided by the Center for Lifespan Changes in Brain and Cognition.

**Timetable with deliverables / milestones (i.e. data collection, finishing data analyses, writing of article):**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | September | October | November | December | January | March | April | May |
| Literature review and planning |  |  |  |  |  |  |  |  |
| Data preprocessing/ cleaning |  |  |  |  |  |  |  |  |
| Data analysis |  |  |  |  |  |  |  |  |
| Outline | |  |  |  |  |  |  |  |  |
| Model evaluation |  |  |  |  |  |  |  |  |
| Results |  |  |  |  |  |  |  |  |
| Writing |  |  |  |  |  |  |  |  |
| First draft |  |  |  |  |  |  |  |  |
| Final draft |  |  |  |  |  |  |  |  |

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