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Impact of parental socioeconomic status on offspring's mental health: protocol for a longitudinal community-based study

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ABSTRACT

Introduction Socioeconomic status (SES) affects physical and mental health and cognitive functioning. The association between SES changes (SES mobility) and health has ethical and political implications in that the pernicious effects of inequality and the differential impact on social classes of economic and social policies. There is a lack of research conducted to explore the intergenerational transmission of parental SES changes on the offspring's mental health and cognitive functioning. We aim to fill this gap and identify roles of parental SES changes in offspring's mental health and cognitive outcomes.

Methods and analysis This study will be based on a longitudinal cohort from the most populous municipality in the Canadian province of Quebec. Participants and their biological offspring will be invited to this study. For those with informed consent, we will collect their information on mental health, psychiatric disorders, cognitive functioning and early life experiences for offspring. Latent class growth analysis will be used to identify parental SES mobility groups. Multivariate regression analyses will be used to explore the roles of early life stress, parental SES mobility and their interactions in psychiatric disorders and cognitive functioning. Subgroup analyses (males and females) are also planned.

Ethics and dissemination This study has been given ethical approval by the Research Ethics Board of the Douglas Mental Health University Institute (IUSMD-18/17). Each participant will provide informed consent on participation. We will disseminate research findings through publication in peer-reviewed academic journals and presentations at conferences. Lay summaries of major research findings will also be shared annually with our partners in the health system and community agencies located in the catchment area.

Strengths and limitations of this study

► This longitudinal cohort study offers an exceptional opportunity to examine the underlying mechanisms of intergenerational transmission of parental socioeconomic status (SES) onto offspring's mental and cognitive outcomes.
► Data collection includes a wide range and good quality of scales for both parents and their offspring.
► This study aims to explore the roles of parental SES in offspring's mental health and cognitive functioning.
► The research findings may not be able to generalise to a larger population, as the target population of the study is from a specific geographical location.

Early life SES is closely related to subsequent cognitive functioning (eg, memory, executive function).[5 6] Relationships between IQ, language, executive function, school achievement, socioemotional functioning and poverty have consistently been reported.[6–8] Two major hypotheses (health selection and social causation) are widely used to infer causal directions of the SES–health relationship.[9] Low income increases the likelihood of one's exposure to other health risk factors, such as poor nutrition, poor housing and less access to necessary health services.[10 11] Additionally, economically disadvantaged populations often experience higher levels of stress created by striving to meet basic needs (food, shelter) and awareness of the gap between available resources and the resources that are seen as essential according to industrial societies' cultural model of well-being.[12] The occurrence of stressful events and precarious living conditions (i.e., housing, financial, employment and relationship conditions) increase the risk of mental disorders.[13 14]

Many interdisciplinary studies have found an association between SES mobility and

INTRODUCTION

Socioeconomic status (SES) is a measure of a combination of education, income, and occupation.[1] It has effects on physical and mental health and cognitive functioning.[2] There is a growing body of literature that links SES with cognitive functioning and its underlying neurobiological underpinning.[3 4]

health.[15–24] SES mobility is a change in SES relative to one's original social status within a given society. Changes in SES have been associated with changes in working memory.[6] Studies have suggested that upwards SES mobility is associated with better health outcomes, such as reduced mortality,[25 26] reduced morbidity,[27] improved cognitive functioning,[28] healthy behaviours[29] and overall physical and psychological health,[30] whereas downwards SES mobility increases the risk of physical and mental health problems.[30 31]

Impacts of SES mobility on individuals' mental and physical outcomes and cognitive functioning have been well supported.[5 32–35] In contrast, only a few studies focus on its impacts on the next generation's mental and physical health.[36–38] There is a paucity of studies examining the effects of socioeconomic policies on child and family health outcomes.[39] Research is urgently needed to understand the extent to which social contexts (living conditions in homes and communities, as well as the economic resources available to the household) affect health.[40]

Although the literature suggests that the intergenerational transmission of parental SES changes on offspring's health might partially explain the occurrence of mental disorders and cognitive dysfunction among offspring,[41–44] the underlying mechanisms are not sufficiently understood. A recent review integrating sociological, neuroscience, epigenetic and psychological evidence proposes a theoretical model of how early-childhood exposures contribute to the subsequent health problems among offspring.[45] Research is needed to fully understand the pathways by which social status affects health.[40] Specifically, there is no consensus regarding underlying mechanisms that explain the effects of parental SES mobility on offspring's health.[46]

Inspired by the above-mentioned literature on the intergenerational trasmission of parental SES changes in offspring's health, we aim to explore the roles of parental SES in offspring's mental health and cognitive functioning in a longitudinal population-based cohort. We also want to identify the roles of other important psychosocial factors, such as early life stress (childhood maltreatment), and their interactions in this intergenerational transmission. Given that many psychiatric disorders, such as anxiety disorders, bipolar disorder, depression, eating disorder, psychosis and substance abuse, most likely emerge during adolescence and early adulthood, due to brain and neural systems changes,[47 48] we target both adolescent and adult offspring.

METHODS AND ANALYSIS
Study cohort and setting
The Zone d'Épidémiologie Psychiatrique du Sud-Ouest de Montréal (ZEPSOM) cohort is a large-scale, longitudinal, community-based, population cohort from the Southwest of Montreal, Canada.[49] In 2007, a total of 2433 participants (aged 15–65) were randomly selected to assess the prevalence and incidence of psychological
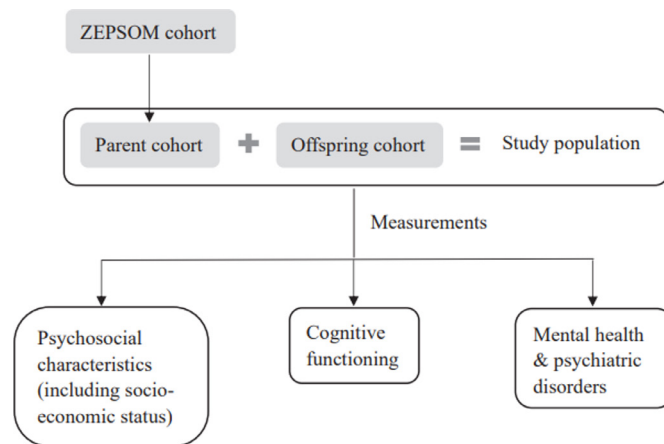

Figure 1 Flowchart of recruitment and measurements in this study.

distress, psychiatric disorders and quality of life and to understand the impact of the social, economic and physical aspects of neighbourhoods on mental health.[49] The cohort represented a mixed Francophone and Anglophone population of 269 720 living in the five neighbourhoods of Montreal in 2007.

This initial cohort was followed through five cycles (2007–2018). A second cohort compensating for attrition of the first cohort (N=1000) was followed through three cycles (2011–2018). Both cohorts have had multiple data collections on a wide range of measurements of psychosocial risk factors, psychological distress, psychological well-being and other mental health measurements. The ZEPSOM was further extended in 2016 to include biospecimen data (genetic variations and genome-wide DNA methylations) and detailed measures of early childhood experiences.

In this proposed study, we examine psycho-social predictors of mental health, psychiatric disorders and cognitive functioning across two generations. Figure 1 illustrates a flowchart of recruitment and measurements in this study. To our best knowledge, there are few longitudinal population-based cohorts with such rich information on psychosocial information over two generations. This work will be based at the Douglas Research Centre (DRC).

Eligibility and recruitment
ZEPSOM participants with biological offspring are eligible for this proposed study. Eligibility criteria include: (1) ZEPSOM participants should have lived or lived with their children from 2007 to 2018. (2) Eligible participants and their offspring aged 15 years and over will be contacted to participate in this proposed intergenerational study. If two or more siblings agree to participate, only one will be considered for this study to maintain the comparability between groups/families. The preference will be given the sibling who had the longest stay with their parents. (3) Given the changes in the family composition, household structure, work–life balance and the increased labour market participation of mothers, this study will include parents of both genders. (4) Only participants currently

living in Canada are eligible for this proposed study. Participants will be asked to provide online informed consent and complete online self-reported questionnaires and cognitive tests.

Instruments

We will continue the use of questionnaires and scales from the previous ZEPSOM data collection phases in order to maximise comparability over time. Literature and our previous studies have demonstrated the validity of these questionnaires.[49] Briefly, previous ZEPSOM participants (parents' generation) will need to complete measurements on SES and cognitive functioning to fill out the study's data requirements. For new participants (offspring's generation), we will have a full data collection on all questionnaires. The name of scales and concepts/variables measured to be collected is detailed in online supplemental appendix 1. All study subjects will also be asked to provide additional informed consent to access their provincial healthcare utilisation data, such as physician service use and hospital stays. Table 1 shows the data that will be available for both parents and offspring.

Psychiatric disorders

Psychiatric disorders will be assessed by the Canadian Community Health Survey (CCHS) 1.2 version of the Composite International Diagnostic Interview.[50 51] This is a structured tool that generates psychiatric diagnoses according to the definitions and criteria of International Classification of Diseases, ICD-10 and Diagnostic and Statistical Manual of Mental Disorders, DSM-IV. Both lifetime and past 12-month diagnoses of psychiatric disorders can be directly derived from the interview using the algorithms provided by Statistics Canada. The diagnostic modules for major depression, mania, post-traumatic stress disorder, panic disorder, social phobia, agoraphobia, alcohol dependence and drug dependence will be used.

Cognitive functioning

We will use the Cambridge Neuropsychological Test Automated Battery (CANTAB) to examine participants' cognitive functioning.[52 53] This is a computer-based battery of neuropsychological tests designed to measure the key domains of *attention, memory, executive function, emotion and social cognition and psychomotor speed*. It is developed and validated with state-of-the-science methodology and has good psychometric properties,[54 55] and is well suited for measuring outcomes in population studies. There are English and French language versions of the test battery. We will use CANTAB to test motor screening, reaction time, rapid visual information processing, paired associates learning, spatial working memory, as well as the Cambridge gambling task, to evaluate their cognitive functioning.

Objective SES

Objective SES is widely measured by occupation, education and income.[56] Objective SES will be measured using

Table 1 A list of dependent and independent variables in this study

| Time points | ZEPSOM participants (parents) | | | | | | Offspring | | | | | |
	Socioeconomic status	Cognitive functioning	Psychiatric disorders	Mental health	Other factors		Socioeconomic status	Cognitive functioning	Psychiatric disorders	Mental health	Other factors
2007/8	√A	√A	√A,B	√A	√A				√B		
2009/10	√A	√A	√A,B	√A	√A				√B		
2012/13	√A	√A	√A,B	√A	√A				√B		
2014/15	√A	√A	√A,B	√A	√A				√B		
2017/18	√A	√A	√A,B	√A	√A				√B		
The current study	√*	√*	√B		√*		√*	√*	√*	√*	√*

Other factors are listed in online supplemental appendix 1.
√A already collected through previous data collections.
√* to be collected in this research program.
√B is available through Quebec administrative health care data access.
ZEPSOM, Zone d'Épidémiologie Psychiatrique du Sud-Ouest de Montréal.

the Canadian Community Health Survey: Mental Health (CCHS 1.2)—sociodemographics module. This objective SES measure has been collected since the first data collection. All SES data collected overtime will be merged to plot the trajectory of parental SES change. As in Hoebel *et al.*[57] study, objective SES will be determined using a composite index based on education, income and occupation. The three single dimensions (occupation, education, household income) of the objective SES index will also be used individually.

Procedures
Data Collection
Data collection will be carried out from 2020 to 2021. Eligible ZEPSOM participants will be invited to participate in this intergenerational study. Personalised web links will be sent to participants' email accounts for online surveys. For those who cannot or do not prefer completing the questionnaires online, telephone interviews will be conducted. Online questionnaires will be conducted through Ethica Data (https://ethicadata.com), which is a mature, secure web application for building and managing online surveys and databases.[58] It offers a flexible platform that has been applied for many scientific studies with different study designs.[59] Based on our previous experience, participants will take from 1.5 to 2 hours to complete all assessments. A total of $30 compensation will be provided to participants for their participation.

Statistical analysis
First, descriptive analyses will be used to calculate the prevalence of psychiatric disorders in the offspring cohort and its subgroups (age, sex and SES groups). Likewise, the prevalence of life satisfaction, self-perceived mental health, psychological well-being and cognitive functioning will also be calculated (see online supplemental appendix 1 for measurement instruments). Official recommended scoring and cut-offs will be used for categorisation. Second, latent class growth analysis (LCGA) will be used to model the trajectories of parental SES changes. LCGA extends the basic latent curve model by relaxing restrictions of a homogeneous population and invariant intercepts, slopes and functional forms of the growth trajectory.[60] Case-level posterior probabilities of membership in each latent group will be used to define the trajectory group to which each respondent is most likely to belong. The number of latent trajectory groups will be chosen by a combination of both statistical and theoretical criteria: the Bayesian Information Criteria, classification quality (assessed by posterior probability plot) and substantive usefulness.[61] We will begin with two classes and add one class at a time. At least three trajectory groups (upward SES, downward SES and stable SES) should be identified. We will also plot the latent trajectories for males and females to determine whether there is a significant difference between sex. Sex-specific analyses will be done when differences are found. It is expected that the membership

of different trajectories will be associated with other psychosocial characteristics. Multivariate logistic regressions will be used to investigate the relationships between parental SES mobility groups and offspring's psychiatric disorders (presence or absence, individual disorder or combined as any psychiatric disorder, this depends on the number of people with psychiatric disorders) in total and by subgroups. Third, multivariate regression analysis will then be used to explore roles of offspring childhood maltreatment, parental SES mobility groups and their interactions (if any) in the prediction of psychiatric disorders and cognitive functioning. Other psychosocial factors, such as number of lifetime stressful events will be considered in the modelling process. Subgroup analyses based on sex will be conducted to test whether sex have a role in the association.

Estimated sample size and statistical power
The target sample for this study is based on the fifth data collection time point (2018). A total of 1406 participants who completed the fifth data collection and are potentially eligible for this study. Based on previous family information collected, a total of at least 300 participants (parents) having at least one biological offspring met our inclusion criteria. We will also screen their contact information to identify potential eligible participants and maximise the pool of parents and offspring. Based on our previous data collections responses (global attrition rate ~25%), this study will yield around 470 respondents (235 parent–offspring pairs, one parent and one offspring from a family).

We calculated the required sample size by using childhood maltreatment as the predictor and depression as the outcome. Based on our previous systematic review on the association between maltreatment and subsequent depression, the incidence rate of depression in the maltreated group is 0.171 and 0.099 in the non-maltreated group.[62] To calculate the sample size, we set the parameters as following: the alpha is 0.05 and the power is 0.8. Then, the required sample size is 158 (parent–offspring pairs). Therefore, our anticipated sample size will have sufficient power in latent class analyses[63] and be able to detect the impact of independent variables in regression models.

Patient and public involvement
Although participants were not directly involved in the design stage of this proposed study, their feedback on the data collection was collected and directed modifications for the online questionnaire and data collection procedures. Pamphlets with a summary of the main findings will be available to our participants. The lay research findings will also be shared with the public through our partners in the health system and community agencies located in the catchment area, as well as be available online on the DRC's website, the ZEPSOM study's homepage and the McGill University's Department of Psychiatry website.

ETHICS AND DISSEMINATION

This study has been given ethical approval by the Research Ethics Board of the Douglas Mental Health University Institute (IUSMD-18/17). Each participant will provide informed consent on participation. We will disseminate research findings through publication in peer-reviewed academic journals and presentations at conferences. Lay summaries of main research findings will be shared annually with our partners in the health system and community agencies located in the catchment area.

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Contributors XM, KO and JC developed the concept for the study and study design, as well as oversaw the whole project. XM, ML, KO and CD contributed to the development of questionnaires, recruitment and data collection. ML and XM prepared the first draft and all authors have checked and approved the final version of the manuscript to be published.

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