

Supplemental Text.

Data analysis plan for:

Estimating the Joint Association of Adverse Childhood Experiences and Asthma with Subsequent Depressive Symptoms: A Marginal Structural Modeling Approach

1. Background and Objectives

Many adults in the US have experienced adverse childhood experiences (ACEs), linked to many diseases including depression. Therefore, scrutinizing pathways from ACEs to depression is crucial for lifelong prevention. Besides, asthma, a common stress-related chronic disease, is influenced by ACEs and is suggested to be associated with depression. Thus, asthma, occurring early in life, is likely to be an optimal target for interventions to mitigate ACEs' impact on depression. However, the effect modification by asthma in the ACEs-depression relationship remains unclear, with few studies considering risk factors for both asthma and depressive symptoms induced by ACEs.

Aim: We will investigate the joint association of ACEs and asthma with subsequent depressive symptoms, using nationwide surveys of US adults. To account for covariates that are probably affected by ACEs and are also confounders between asthma and subsequent depressive symptoms, we will employ marginal structural models (MSMs).

2. Data sources and Study population

We will use the data from the Behavioral Risk Factor Surveillance System 2010 (BRFSS 2010), a health-related telephone survey about US residents.¹ We will use the data of participants who were asked about ACEs, history of asthma, and depressive symptoms.

3. Variable definitions

3.1 Outcome

We will use the data of depressive symptoms evaluated by days version of the patient health questionnaire 8 (PHQ-8). We will define participants with over 55 depressive days as those with elevated depressive symptoms as the suggestion of a previous study.²

3.2 Exposure

ACEs were assessed through 11 questions regarding household dysfunction, physical, sexual, and emotional abuse.¹ We will define the exposure as a binary variable whether participants reported experiencing any ACE at least once or never.

3.3 Mediator

We will use the data of participants about whether they have ever been told by a doctor, nurse, or other health professional that they had asthma. This will be coded as a binary variable.

3.4 Covariates

Demographic, physical, and behavioral characteristics will be extracted from the BRFSS 2010. Demographic characteristics will include gender, race, ethnicity, state where participants live, educational attainment, annual household income, marital status, employment status, healthcare coverage, and social-emotional support. Physical and behavioral characteristics will include body mass index (BMI), smoking, and alcohol consumption.

4. Statistical analyses

First, we will employ multivariable logistic regression models to estimate the adjusted odds ratio (aOR) of elevated depressive symptoms according to ACEs and asthma, respectively. Second, we will apply MSMs with inverse probability of treatment weights (IPTW) to explore the association between ACEs and subsequent depressive symptoms, with accounting for the intermediary role of asthma.^{3,4} Furthermore, we will calculate the additive interaction using the relative excess risk due to interaction (RERI) as well as the multiplicative interaction between ACEs and asthma.⁵

All statistical analyses will be conducted using R version 4.2.0.

5. References

1. CDC - BRFSS 2010 Survey Data and Documentation. Published April 29, 2022. https://www.cdc.gov/brfss/annual_data/annual_2010.htm
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