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The charm of country life? Impact of rural childhood residence on physical and mental health in later life

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[Correction added on 02 June 2023, after first online publication: Abstract section has been added in this version.]

Abstract

Background: Most studies of geographic health disparities are focused on adult rural residence. However, previous studies have shown that the residential area in which one grows up during childhood has lasting impacts on adult health. In one of the only studies to date to examine the impact of rural childhood residence on mental health in middle-aged and older adults, Murchland and colleagues (2019) evaluated inequalities by childhood residence and noted elevated depressive symptoms were more common among those living in rural areas compared to those living in non-rural areas.

Aims: The current study expands the model proposed by Murchland and colleagues to include further antecedents related to rural childhood residence, and to include multiple outcomes of physical and mental health among middle-aged and older adults.

Method: Participants included 4614 individuals aged 40 or older recruited as part of the Midlife in the United States (MIDUS) study.

Results: Consistent with Murchland's model, childhood rurality played an important part in middle-aged and older adult's health, despite not having a direct influence. Rurality status was impacted by parental education level and SES during childhood, and was associated with the level of education obtained by the participants (and thus their occupation), which played a direct role in their current health status. Mental and physical health had differential predictors.

Limitations: The study was limited by its non-diverse sample and self-reported measures.

Conclusion: Further research into the impact of childhood rurality on health is needed, utilizing comprehensive self-reported and observed outcome measures.

INTRODUCTION

Health disparities affect numerous segments of the US population. Geographic health disparities may be associated with a higher burden of physical and mental illness, as well as injury, disability, and mortality.[1] Health disparities based on geographic residence (ie, rural, suburban, and urban), relevant to mental and physical health, result in significant health care utilization and economic burdens.[2] Therefore, the impact of geography on health in the United States posits a growing concern.

There are approximately 60 million people, or 1 in 5 Americans, living in rural areas,[3] which includes 13 million children under 18 years of age.[4] Notably, individuals living in rural areas are more likely to experience geographic health disparities. It has been recognized that people living in rural areas are one of the largest medically underserved populations.[4] In addition, residents living in rural areas have limited access to quality physical and mental health care,[5] all of which impact health. Some research suggests a higher prevalence of obesity, diabetes, stroke, and cancer and worse morbidity, diet, and mortality

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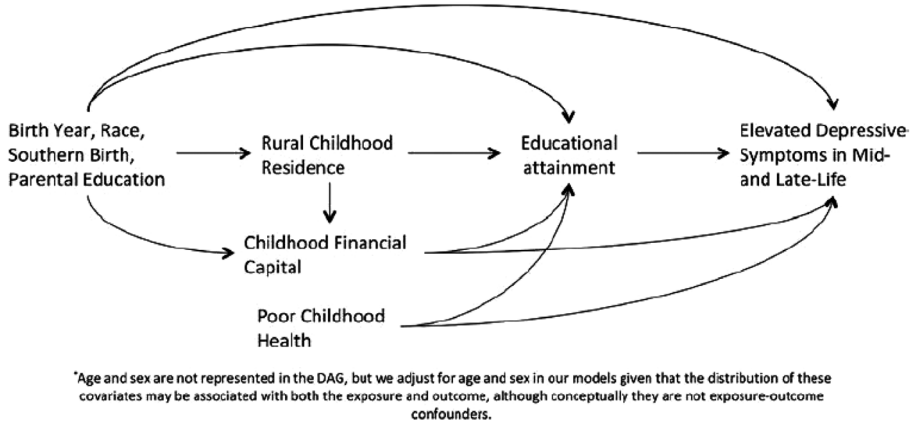

FIGURE 1 Murchland et al.'s model of the causal structure relating rural childhood residence and elevated depressive symptoms in older adults in the United States. Note: From "Inequalities in elevated depressive symptoms in middle-aged and older adults by rural childhood residence: The important role of education," by A.R. Murchland, C.W. Eng, J.A. Casey, J.M. Torres, & E.R. Mayeda, 2019, International Journal of Geriatric Psychiatry, 34, 1633–1641.

among individuals living in rural communities.[6–9] However, protective factors related to rural residence and health outcomes, such as strong community belonging and higher social support, have been identified.[10] Thus, it is not surprising that findings regarding associations between rurality and physical and mental health are mixed, as some research has demonstrated that those living in rural areas report better health outcomes, despite having access to fewer physical and mental health resources.[11,12]

Most studies of geographic health disparities are focused on the adult rural residence. However, previous studies have shown that the residential area in which one grows up during childhood has lasting impacts on adult health. Patterson and colleagues[13] reported more time living in a rural residence during childhood was positively associated with higher body mass index and incidence of obesity, leading to an increased risk of comorbid chronic medical conditions and all-cause mortality. In one of the only studies to date to examine the impact of rural childhood residence on mental health in middle-aged and older adults, Murchland and colleagues[2] evaluated inequalities by childhood residence and noted that elevated depressive symptoms were more common among those living in rural areas compared to those living in nonrural areas (Figure 1).

While this was an important first step, Murchland and colleagues examined only 1 aspect of mental health and did not account for physical health outcomes, which previous literature has also shown to be affected by rural childhood residence. Thus, more research into the determinants, covariates, and buffering effects of childhood rural residence on health is needed to increase understanding regarding potential geographic disparities and identify appropriate prevention and treatment efforts to improve physical and mental health functioning.

Current study

The current study expands the model proposed by Murchland and colleagues to include further antecedents related to rural childhood residence, and to include multiple outcomes of physical and mental health among middle-aged and older adults (Figure 2).

Hypotheses

Based on Murchland's theory,[2] the following hypotheses were made:

1. The demographic variables of age, race, sex, and parental education will contribute to middle-aged and older adults' current health both directly and via the pathways of their childhood socioeconomic status or via their education level (degree obtained).
2. Participants' likelihood to live in a rural area during childhood will influence their current health as an adult via the pathway of their education level obtained.
3. Participants' health as a teenager will affect their overall health as an adult both directly and via the pathway of education level obtained.

Statistical analysis plan

The necessary sample size was determined using Jackson's N:q Rule[14] recommended by Kline[15] as empirically valid for maximum likelihood-based structural equation models. The N:q Rule specifies an ideal sample size of 20:1 in terms of the ratio of cases to model parameters. In this case, a 20:1 ratio with 12 model parameters portends a necessary sample of at least 240 cases (well exceeded by our 4,614 participants). Structural equation modeling was conducted using Stata MP 16.0. The maximum likelihood method of covariance structure analysis was used, which employs a listwise deletion strategy for missing values of the involved variables. However, the sample size of all analyses employing listwise deletion was still well above the 240 necessary cases for adequate detection of effects. Hu and Bentler's[16] model fit criteria were used where the comparative fit index (CFI) and

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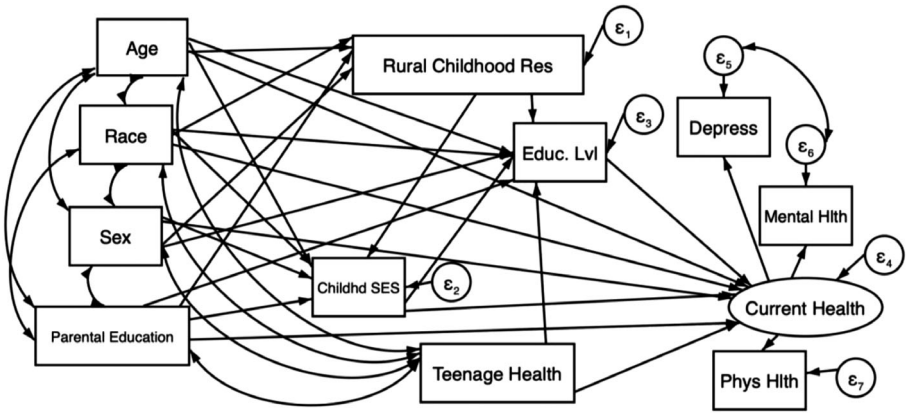

FIGURE 2 Originally tested model of the impact of rural childhood residence and related health determinants on middle-aged and older adults' physical and mental health, based upon Murchland and colleagues' 2019 theory.

Tucker-Lewis index (TLI) > 0.90 or 0.95 and standardized root mean square residual (SRMR) < 0.10 or 0.08 and root mean square error of approximation (RMSEA) < 0.08 or 0.05 indicate acceptable and good fit, respectively. However, as suggested by Marcoulides and Yuan,[17] the RMSEA and CFI were modified based upon T-size equivalence testing. Both the adjusted and original fit indices are reported, and the T-size equivalence testing adjusted values are interpreted based upon Hu and Bentler's criteria. Paths found in the structural model were used to test each hypothesis.

METHOD

Participants

Participants included 4,614 individuals aged 40 or older (*m* age = 53.86 year). Females accounted for 51.8% of the sample, and 92.1% of the sample identified as Caucasian, with 4.6% identifying as Black or African American. Most (28.4%) of the sample had completed high school as their highest level of education, with another 14.9% graduating with a bachelor's degree. Participants rated their current financial situation from 0 (worst) to 10 (best) with a mean value of 6.39 (SD = 2.15) out of 10.

Procedure

This study used data collected as part of the Midlife in the United States (MIDUS) study,[18] which is available for public use online. MIDUS data collection was reviewed and originally approved by the Education and Social/Behavioral Sciences and the Health Sciences IRBs at the University of Wisconsin-Madison. The current archival investigation is exempt from IRB approval as it is a secondary analysis of deidentified data. The surveys were administered over the phone and via self-administered questionnaires. All variables used in the current study were taken from the third wave of the MIDUS, administered in 2013, except for the Childhood Rurality Level question, which was administered only in Wave 1 (1994-1995), with those variables being merged by ID code into the Wave 3 datafile.

Measures

Childhood Rurality Level was assessed via a single question asking, "Which of the following best describes the area where you were raised during most of your childhood?" Choices included Rural (26.9% of the sample), Small Town (26%), Medium-sized Town (10.1%), Suburbs (12.7%), and City (20.2%).

Childhood Socioeconomic Status was assessed by a question asking, "Thinking back to your family's financial situation when you were growing up, was your family better off or worse off financially than the average family was at that time?" Choices included "A lot better off" (3.1%), "Somewhat better off" (10.6%), "A little better off" (12.5%), "Same as the average family" (42.7%), "A little worse off" (18.8%), "Somewhat worse off" (8.5%), and "A lot worse off" (3.8%).

Parental Education Level was assessed by averaging the answers to 2 questions asking, "What was the highest grade of school or year of college your [mother or father] completed?". The most frequently reported obtained degree for both parents was graduating from high school (37.7% of mothers and 27.3% of fathers), followed by graduating from 8th grade/junior high school (17.6% of mothers and 20.5% of fathers).

Teen Health was assessed by averaging the answers to 2 questions asking about participants' mental and physical health at the age of 16. Each was rated on a 5-point Likert scale, with most participants rating their health as "excellent" for both mental (49.5%) and physical (60.6%) health at the age of 16.

Current Health was assessed by creating a latent variable consisting of Depressive Symptoms, Mental Health, and Physical Health. **Depressive Symptoms** were assessed using the variable "A1PDEPRE" within the MIDUS. This variable combines items from a continuous 7-item depressed affect scale (featuring questions, such as "During two weeks in the past 12 months, when you felt sad, blue, or depressed,

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TABLE 1 Correlations among study variables

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Age	1										
2. Race	−.048**	1									
3. Sex	.030*	−.003	1								
4. Rural Childhood Residence	−.098**	.023	−.007	1							
5. SES as Child	.003	−.012	−.004	−.099**	1						
6.Education Level	−.131**	−.037*	−.117**	.157**	−.162**	1					
7. Parental Education Level	−.227**	−.033	−.038*	.231**	−.316**	.428**	1				
8. Health as a Teen	.054**	−.058**	−.043**	−.026	−.042**	.065**	.010	1			
9. Depress. Symptoms	−.117**	.037*	.086**	.011	.042**	−.050**	.005	−.054**	1		
10. Mental/Emotional Health	−.029	−.034*	−.040**	.050**	−.077**	.218**	.129**	.306**	−.285**	1	
11. Physical Health	−.122**	−.052**	−.018	.059**	−.069**	.262**	.179**	.198**	−.156**	.492**	1

Note: N = 3,976. All correlations are 2-tailed. For sex variable, 0 = males, 1 = females.
*= $P < .05$.
**= $P < .01$.

did you lose interest in most things?," "[…] have more trouble falling asleep than usual?," and "[…] think a lot about death?") with those from a continuous 6-item anhedonia scale. The anhedonia scale features dichotomous (yes/no) responses to the same questions included in the depressive symptoms scale, with the exception of the "lose interest in most things" item. The difference between the scales is in the prompt, which is worded, "During two weeks in the past 12 months, when you lost interest in most things, did you…". These combined responses range on an 8-point scale from 0 ("lowest depression") to 7 ("highest depression"). Most participants (86.5%) endorsed a value of 0. **Mental Health** was assessed via an item asking, "Would you say your mental or emotional health is excellent (24.7%), very good (33.2%), fair (7.4%), or poor (1.1%)?". **Physical Health** was assessed via an item asking, "In general, would you say your physical health is excellent (15.9%), very good (32.3%), good (35.2%), fair (12.8%), or poor (3.5%)?".

RESULTS

Model fit

Please see Table 1 for correlations across variables. The originally tested model based upon Murchland's theory (shown in Figure 2) resulted in adequate model fit (SRMR = 0.025; Conventional CFI = 0.955; T-size CFI in equivalence testing = 0.930; TLI = 0.888; Conventional RMSEA = 0.049; T-size RMSEA in equivalence testing = 0.056) but had 9 nonsignificant pathways. As the application of Murchland's theoretical model into a pathway analysis using these variables population remains largely exploratory, a new model was tested by dropping insignificant pathways that were superfluous to the original model, and comparing these results with the original model. Additionally, the directional pathway between rural childhood residence and childhood socioeconomic status (SES) was reversed, in accordance with modification indices suggestions. This directionality change also fits with previous literature, as housing prices are often cheaper in more rural areas, driving families with low SES to seek out homes in these areas.[19,20] The final model (shown in Figure 3) resulted in an excellent fit to the data with the following indicators: SRMR = 0.026; Conventional CFI = 0.955; T-size CFI in equivalence testing = 0.930; TLI = 0.925; Conventional RMSEA = 0.040; T-size RMSEA in equivalence testing = 0.046.

Hypothesis testing

The first hypothesis (that the demographic variables of age, race, sex, current SES, and parental education would contribute to participants' current health both directly and via the pathways of their childhood socioeconomic status or their education level) was partially supported. Within the final model, every demographic variable significantly contributed to middle-aged and older adults' overall health via one of the hypothesized pathways. However, only the demographic predictors of age and parental education level were directly related to current health. Childhood SES was affected by age, race, and parental education, while obtained education level was related to the demographic variables of sex and parental education level. The supported pathway in the model has participants' age, race, and their parent's education affecting their socioeconomic status during childhood. This childhood SES is further associated with their being more likely to live in a rural area. Their living in a rural area, in turn, impacts their education level, and ultimately, their current health. See Table 2 for standardized estimates in the structural and measurement models.

The second hypothesis (that participants' likelihood to live in a rural area during childhood would influence their health as middle-aged or older adult via the pathway of their education level obtained) was supported. The rurality level of participants' childhood homes contributed to their current health via the level of education they obtained. The rurality of childhood residence was also influenced

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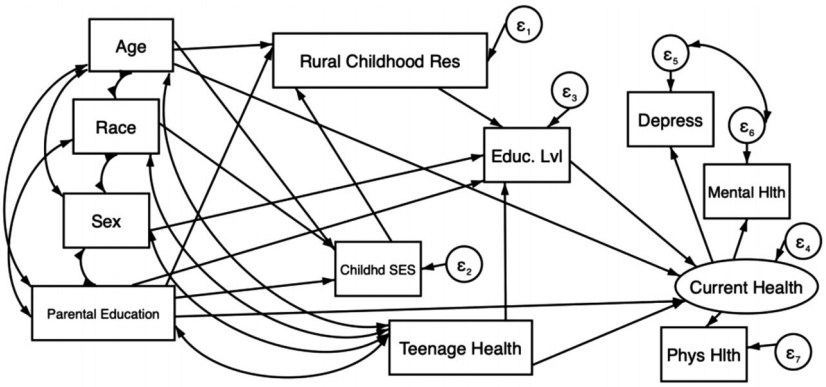

FIGURE 3 Final model of the impact of rural childhood residence and related health determinants on middle-aged and older adults' physical and mental health.

TABLE 2 Standardized estimates, z-scores, and *P*-values for the tested model

Variable	*b*	*z*	*P*
Measurement model			
Depressive Symptoms < Current Health	.175	7.12	.000
Mental and Emotional Health < Current Health	−.764	−35.26	.000
Physical Health < Current Health	−.656	−32.49	.000
Structural model			
Rural Childhood Residence < Childhood SES	−.055	−3.05	.002
Rural Childhood Residence < Age	−.068	−3.87	.000
Rural Childhood Residence < Parental Edu.	.199	10.90	.000
Childhood SES < Age	−.072	−4.26	.000
Childhood SES < Race	−.049	−2.96	.003
Childhood SES < Parental Education	−.336	−20.80	.000
Education Level < Rural Child. Residence	.076	4.69	.000
Education Level < Sex	−.105	−6.66	.000
Education Level < Parental Education	.394	26.20	.000
Education Level < Teen Health	.039	2.45	.014
Current Health < Education Level	−.224	−10.34	.000
Current Health < Age	.053	2.53	.011
Current Health < Parental Education	−.091	−4.13	.000
Current Health < Teen Health	−.360	−19.23	.000

Note: N = 3,243. Standardized betas may be used as a measure of effect size such that < 0.2 = weak, 0.21-0.5 = moderate, and > 0.5 = strong.[35]

by the variables of age, childhood SES, and parental education level. See Table 2 for standardized estimates in the structural and measurement models.

The third hypothesis (that participants' health as a teenager would affect their health as middle-aged or older adult both directly and via the pathway of education level obtained) was supported. Participants' self-reported retrospective mental and physical health at age 16 both directly contributed to their overall health as an adult, and also influenced their health via their obtained education level. See Table 2 for standardized estimates in the structural and measurement models.

DISCUSSION

The current study examines the impact of childhood rurality on current health in middle-aged and older adults, including the impact on physical health, overall mental health in general, and depression more specifically. The previous model by Murchland[2] and colleagues failed to account for physical health outcomes and examined only 1 aspect of mental health.

Our findings from the first hypothesis were partially supported. Our model suggests that age and parental education level are directly related to current health. Age is a well-known risk factor associated with several illnesses that become more prevalent among middle-aged and older adults.[21] In a study conducted with the 1998-2014 cohorts of the Health and Retirement Study,[22] 10 health conditions were evaluated to determine the disability-adjusted life years, a metric used to quantify the number of healthy years of life lost from the presence of a disease, disability, or injury,[23] for a nationally representative sample of adults aged 50 years and older in the United States. The burden of these health conditions (hip fractures, congestive heart failure, myocardial infarction, chronic obstructive pulmonary disease, stroke, cancer, diabetes, back pain, arthritis, and hypertension) accounted for an estimated 1,497,754 years of healthy life lost over the 20-year study period.

Studies also support our finding that a child's parental educational level has a direct impact on health later in life. In a study conducted by Monheit and Grafova,[24] researchers concluded that parental education beyond 12 years of schooling was associated with both an increase in health care spending and a decrease in the likelihood of poor health outcomes.

Our findings are consistent with previous studies that show intermediary predictors of current health, such as childhood SES, are impacted by race and parental education. For example, a study conducted by the National Center for Children in Poverty[25] reports that the likelihood that a child will live in poverty increases at lower levels of parental education. The study defined low-income families as those that live at 200% of the federal poverty threshold (FPT), and

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poor families as those that live below 100% of FPT. Among children who have at least 1 parent who has completed some college, the study found that 26% of children live in a low-income family, and 10% live in a poor family. When parents have less than a high school degree, these percentages increase to 77% and 44%, respectively. The study also found that the percentages of low-income and poor children vary by race and ethnicity with Black, Native American, and Latino children disproportionately living in families categorized as low-income or poor. In addition, there is growing evidence that families with lower incomes are living in more rural areas, which impacts child academic achievement.[20]

The second hypothesis (that participants' likelihood to live in a rural area during childhood would influence their health as middle-aged or older adult via the pathway of their education level obtained) was also supported. Mortality rates in rural areas are declining at a slower pace than are those in urban areas.[26] The disproportionate burden of mortality across rural areas of the United States is known as the Rural Mortality Penalty. Nowhere is this burden more evident than at the intersection between rurality and extreme poverty.[27] Rural areas also experience a greater burden of chronic diseases in general when compared to urban areas.[28]

The third hypothesis (that participants' health as a teenager would affect their health as middle-aged or older adult both directly and via the pathway of education level obtained) was supported. Participants' self-reported retrospective mental and physical health at age 16 both directly contributed to their overall health as an adult, and also influenced their health via their obtained education level. Other studies confirm the link between adolescent mental and physical health and health in later life. For example, 1 study[29] reported that even mildly elevated body weight in late adolescence may impact cardiomyopathy risk in adulthood. Another study found that adverse neighborhood conditions experienced in early life can result in greater depressive symptoms in adolescence and that these can persist throughout the life course.[30]

Limitations

Our model did not support a direct impact of race and sex upon current health. We know that there is a large body of literature that indicates overall health status is impacted by these 2 nonmodifiable risk factors.[31] It is possible that our sample's lack of diversity (92.1% of the sample was Caucasian) prevented these effects from emerging in the model. Research with more racially and ethnically diverse samples, such as the Jackson Heart Study[32] and others, is needed to further examine the potential role that race may play in regard to childhood factors and adult health outcomes. Our sample had nearly equal percentages of males and females, so we should have had adequate power to detect sex effects (unlike race), yet sex did not directly impact health as was hypothesized in Murchland's model. Rather, its impact was through the pathway of obtained educational level (and resultant occupational opportunity). Further, the mean age of our sample was 53.86 years of age, and 75% of the sample was 61 or younger. It is also possible that most participants in the sample were not yet old enough to experience sex-specific health effects. Cohort effects might also impact results as educational and occupational pathways for men and women differ significantly when compared to pathways that existed decades ago. Cohort effects could also possibly cause the results of our participants (who answered the survey in 2013) to differ from the way in which similarly aged adults would answer today. Further research is needed with an updated sample, and to test the original and modified models for replication within this age group and set of variables.

Rurality is defined by the US Census Bureau as "all population, housing, and territory not included within an urbanized area or urban cluster."[33] These designations are largely determined by population density with urbanized areas being areas with 50,000 or more people, and urban clusters are areas with at least 2,500 people but fewer than 50,000 people. In the MIDUS, participants self-report the category that best defines where they spent most of their childhood years as either Rural, a Small Town, a Medium-sized Town, in the Suburbs, or in a City. It is unclear as to how these designations compare to the US Census Bureau's approach to rural classification.

Health, mental health, and teen health outcomes were collected via self-report. Further, teen health outcomes were gathered retrospectively with the respondent being asked to recall their level of mental and physical health at the age of 16. Self-reported data are subject to several types of bias, notably recall bias and social desirability bias.[34] Recall bias can be introduced when respondents are asked to retrospectively recall a situation, event, or health status. Recall bias results in either the overestimation or underestimation of the true effect or association. Social desirability bias results when a question of a sensitive nature is asked, and the respondent feels internal pressure to answer a certain way to avoid judgment or to be seen in a more favorable light. Questions related to past experiences with depression may be sensitive topic areas for some individuals, making it more likely that they may enter responses that are less valid for those who are uncomfortable reporting the true extent of their experience. It is unclear from the MIDUS methodology whether or not questions were structured in such a way that the risk of these types of information bias occurring might be mitigated.

CONCLUSIONS

Even though childhood rurality does not have a direct influence on middle-aged and older adult's health status, rurality status is impacted by parental education level and SES during childhood. It goes on to play a part in the level of education obtained by participants, and thus influences occupational opportunities. The educational level obtained does play a direct role in current health status. The results of this study confirm that it is important to examine multiple components of health, as physical and mental health had different contributing antecedents, and measured depressive symptoms differed from participants' self-assessed perception of overall mental health. Future studies should continue to use multiple longitudinal measures of health, including both objective and self-assessed measures to continue to examine

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potential childhood determinants of health in adulthood to inform prevention and treatments to improve physical and mental health outcomes.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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