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Early adversity, psychopathology, and latent class profiles of global physical health from preschool through early adolescence

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Abstract

Objective—The purpose of the present report was to describe the longitudinal trajectories of physical health beginning during preschool and continuing into early adolescence, explore whether these trajectories were predicted by psychosocial adversity, family income-to-needs ratio, and psychiatric disorders occurring during the preschool period, and determine whether psychiatric disorders mediated these relations.

Methods—Participants included 296 children participating in a longitudinal study of early-onset psychopathology spanning ten years. Semi-structured clinical interviews were conducted with caregivers to determine children’s psychiatric diagnoses between ages 3–6. Caregivers also completed annual assessments of their child’s physical health problems (ages 3–13), as well as reported on the family’s income and indicators of psychosocial adversity.

Results—Growth mixture modeling revealed two trajectories of physical health problems: a stable, low group ($n = 199$) and a high, increasing group ($n = 57$) indicating linear increases in physical health problems from ages 3–13. Preschool psychiatric diagnoses ($Est = 0.05$, $p < .001$), family income-to-needs ratio ($Est = -0.01$, $p = .012$), and psychosocial adversity ($Est = 0.02$, $p = .015$) predicted membership in the high, increasing trajectory of physical health problems. Early-onset psychopathology mediated relations between psychosocial adversity and physical health problems ($\alpha\beta = 0.31$, $p = .050$) and between income-to-needs ratio and physical health problems ($\alpha\beta = -0.29$, $p < .021$).

Conclusions—These findings indicate the importance of early indicators of risk: low income-to-needs ratios, high psychosocial adversity, and psychiatric disorders occurring during the preschool period for contributing to increasing physical health problems from preschool through early

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adolescence. Early-onset psychiatric disorders also mediated relations between psychosocial adversity, income-to-needs ratio, and physical health problems.

Keywords

physical health; adversity; childhood; mental health; growth mixture modeling

Introduction

Numerous longitudinal studies have linked adversity experienced during childhood with poor mental and physical health outcomes in adulthood. Adversity includes experiences involving deprivation and/or threat, such as abuse, neglect, and poverty^{1,2}. Children raised in poverty^{3,4}, those who are physically and emotionally maltreated^{5,6}, and/or separated from primary caregivers for extended periods of time⁷ are at an increased risk for poor health outcomes ranging from depression and substance abuse, to heightened levels of inflammation and cancer. In order to link different types of adversity to child outcomes, as well as identify developmental mechanisms explaining multifinality of such outcomes¹, it is crucial for longitudinal work to measure multiple domains of adverse environmental experiences. Thus, the purpose of the current paper was to examine whether: financial advantage/disadvantage and psychosocial adversity predicted longitudinal trajectories of physical health beginning during preschool and continuing into early adolescence and whether these relations were mediated by early-onset psychiatric disorder.

In the current paper, adversity is defined as, “exposure during childhood or adolescence to environmental circumstances that are likely to require significant psychological, social, or neurobiological adaptation by an average child”¹. We further distinguish between *financial advantage/disadvantage*, which includes income and SES-type indicators as a proxy for poverty⁸ and family resources from *psychosocial adversity*, which includes specific, measureable instances of child experiences of adversity such as abuse, foster care placement, and caregiver arrest. We also recognize that types of adversity are often intertwined and occur in tandem. Our decision to distinguish financial advantage/disadvantage from psychosocial adversity was guided by recent work highlighting the need for additional research that measures multiple domains of adversity in order to uncover common and specific underlying mechanisms linking adversity to psychopathology¹.

While concurrent relations between adversity and physical health problems are well documented in childhood, there have been fewer longitudinal studies linking early childhood adversity (occurring prior to age 6) with physical health difficulties in later childhood and adolescence^{9,10}. This work is crucial because early exposure to financial advantage/disadvantage and psychosocial adversity may begin to shape physical health much earlier than the longitudinal evidence from adulthood indicates¹¹. For example, Vella and colleagues¹² used growth mixture modeling to identify trajectories of children’s health-related quality of life from ages 4–13. 15% of children were shown to be at risk for poor health-related quality of life over time, and these children were also more likely to be from homes with lower household incomes. In addition, a recent meta-analysis found only nine studies that investigated the impact of early childhood financial adversity on physical health

in later childhood and adolescence⁹. These nine studies varied broadly in terms of the measures of financial adversity that were used (e.g., income-to-needs, neighborhood income, cumulative disadvantage, low family income) as well as the physical health outcomes that were investigated (e.g., BMI, asthma, maternal reports of health status, hospital inpatient admissions). Despite the varying measures and outcomes used findings appear to be consistent: exposure to financial adversity early in life predicts a range of physical health difficulties later in childhood.

Likewise over the past decade, a growing body of evidence has demonstrated longitudinal relations between psychosocial adversity in childhood and physical health across life. The Consortium for LONGitudinal Studies of Child Abuse and Neglect (LONGSCAN) has prospectively assessed and linked psychosocial adversity with health outcomes during early¹³ and middle childhood¹⁴, as well as adolescence¹⁰ and adulthood¹⁵. For example, psychosocial adversity occurring by age four was shown to be predictive of child physical health at age 6, such that children with more psychosocial adversity also had greater odds of poor health and physical illnesses requiring professional care¹⁶. Furthermore, in the same sample, experiencing psychosocial adversity prior to age six was associated with somatic complaints and complaints of poor health at age 12¹⁴. Both sets of findings held even after adjusting for family income/poverty, suggesting that psychosocial adversity is important for health outcomes over and above the influence of poverty.

Many mechanisms have been proposed to explain the relations between early adversity and later physical health, including health problems present from birth¹⁷, chronic stress and neuroimmune network dysfunction¹⁸, lack of access to healthcare and proper nutrition¹⁹, and poor parenting practices²⁰, among others²¹. For example, using data from the National Longitudinal Survey of Children and Youth, Ferro and colleagues^{22,23} found that: (1) family functioning was found to mediate the association between maternal depressive symptoms (one type of psychosocial adversity) and adolescent depressive symptoms, particularly among adolescents with a chronic physical health condition²² and (2) the association between maternal depressive symptoms and adolescent psychosocial functioning was moderated by the presence of chronic physical health conditions in the adolescents²³. Little work, however, has considered early-onset psychiatric disorders as a potential mechanism that may explain (at least in part) the link between adversity and physical health problems. Early-onset psychiatric disorders are important to consider and have not been accounted for in many studies given that many have only recently been validated and recognized. Given the robust associations between early adversity, both financial and psychosocial, and later psychopathology, accounting for early onset psychopathology is a key area for exploration^{24–26}. The high rates of co-occurrence between mental and physical disorders further underscores the importance of this construct²⁷.

In one study, family adversity (e.g., parental education, income, and single-parent-status) during early adolescence had a strong influence on both physical and mental health during the transition to adulthood, approximately 6–8 years later¹⁹. Other work in older children and adolescents suggests that chronic physical illnesses present during late childhood predicted increases in symptoms of depression and anxiety over the course of five years²⁸. Two recent meta-analyses show that children and adolescents with physical health problems

have higher levels of depressive, internalizing, and externalizing symptoms^{29,30}. However, the authors also note that many of the studies included were cross-sectional and that more longitudinal studies are needed that can analyze the impact of psychological symptoms on the course of physical health problems. Psychiatric disorders may also predict physical health difficulties in children³¹. For example, a recent meta-analysis found that clinically depressed adolescents have lower resting state heart rate variability than healthy adolescents, an indicator of a poorly functioning anti-inflammatory reflex and physical health problems³². Given that both financial disadvantage and psychosocial adversity have been shown to predict psychiatric disorders, and that psychiatric disorders have been associated with physical health problems, investigations of whether psychiatric disorders may mediate relations between adversity and physical health problems are now needed. These kinds of longitudinal relations between mental and physical health remain to be explored in younger children when both psychiatric disorders and physical health problems can emerge and set the stage for high-risk health trajectories^{33,34}.

The purpose of this study was to investigate the roles of early psychosocial adversity, financial advantage/disadvantage, and early-onset psychopathology on trajectories of physical health from preschool through early adolescence. We applied growth mixture modeling (GMM) to physical health problems endorsed by children and/or their caregivers in a ten-year longitudinal dataset spanning from preschool into early adolescence to create trajectories of physical health over time. GMM offers several advantages when compared to other longitudinal analyses, such as the ability to create unique trajectories of physical health for different groups of children as well as highlight differences in trajectories across time. There have been no studies to our knowledge that have used GMM to establish trajectories of physical health problems in children; therefore we did not hypothesize a specific number of trajectories. Early psychosocial adversity and financial advantage/disadvantage were included in the GMM as predictors of latent class membership. Finally, we explored whether early-onset psychiatric disorders predicted latent class membership and mediated relations between early psychosocial adversity and trajectories of physical health, as well as financial advantage/disadvantage and trajectories of physical health.

Methods

Participants were from the Preschool Depression Study (PDS), a prospective longitudinal investigation of preschoolers and their families conducted at the Washington University School of Medicine (WUSM³⁵). The current study reports on 348 children from the PDS, who across a ten-year period completed at least three behavioral assessments out of a possible eight assessments (Figure 1; due to the grant funding cycle, a larger gap occurred between the third and fourth possible assessment). Parental written consent and child assent were obtained prior to participation and the WUSM Institutional Review Board approved all procedures. Details of recruitment have been previously reported^{35,36}. In brief, from 2003–2005, 3–6 year olds were recruited from primary care practices and preschools/daycares throughout the Saint Louis metropolitan region using a validated screening checklist (Preschool Feelings Checklist; PFC³⁷) to oversample preschoolers with symptoms of depression and healthy controls. Previous studies have indicated that a PFC score of > 3 maintained high sensitivity and specificity for the diagnosis of depression. Thus, children

with scores ≥ 3 were invited to participate and those with scores of ≤ 3 were also included to establish an adequate healthy comparison group.

Materials and Measures

Early Psychosocial Adversity

Seven social risk factors (described below) were assessed during each child's baseline assessment (e.g. prior to age 6) via caregiver report. Cumulative social adversity/risk scores (occurring prior to age six) were created by summing the dichotomous indicators (0 'not present,' or 1 'present') of each of the seven social risk factors below³⁸. The cumulative social adversity/risk score ranged from 0–7. This variable was used as a predictor of latent class trajectory membership in later analyses. Psychosocial adversity risk variables included: 1. Living in a single-caregiver household, 2. Maternal psychopathology (Axis I psychiatric disorders excluding eating disorders which were not assessed), 3. Parental arrest, 4. Foster care placement of the child, 5. Physical abuse of the child, 6. Sexual abuse of the child, and 7. Caregiver report of being unable to meet the families financial needs. 32 children did not have complete data on all seven risk factors and were excluded from any analyses that included early adversity. There were no socioeconomic differences between children with and without complete data on this scale. Internal consistency of the psychosocial adversity items was $\alpha=0.382$, however a confirmatory factor analysis (CFA) supported a single factor and with acceptable model fit ($\chi^2=24.804$, $p=0.037$; RMSEA=0.051; CFI=0.938). Psychosocial adversity ranged from 0 to 5 in this sample, with a mean (SD) of 0.72 (0.89).

Income-to-Needs ratio

Mothers reported family income at each assessment. The early income-to-needs ratio (e.g., between ages 3–6) was computed as the total family income at baseline divided by the federal poverty level, based on family size, at the time of data collection³⁹. This measure of early financial advantage/disadvantage was used as a predictor of latent class trajectory membership in later analyses. In this sample the mean (SD) was 2.13 (1.19), range 0 – 4.17, indicating relatively low levels of income-to-needs (and high poverty). An income-to-needs ratio of 1 indicates that the family was living at the poverty threshold. 26% of the sample fell below the federal poverty limit.

Physical Health Problems

Mothers completed the MacArthur Health and Behavior Questionnaire⁴⁰ at each behavioral assessment. The Global Physical Health subscale was used in the current report to create latent class trajectories. This five-item composite score assesses indicators of poor health and difficulties stemming from physical health problems (e.g., missing school) in youth with higher scores indicating worse physical health. Parents are asked to answer questions such as, "in general, would you say your child's physical health is excellent, good, fair, or poor?" and "how often in an average month does your child stay home or come home from school or childcare because of illness?". Internal consistency of this scale ranged from adequate to good ($\alpha=0.686-0.778$) across the waves of data collection.

Preschool-onset Psychiatric Symptoms

Psychiatric diagnoses were assessed at each assessment wave using the Preschool Age Psychiatric Assessment (PAPA^{41,42}) when participants were between the ages of 3–6. Children could have been assessed 1–3 times during this age range, with the mean rating being used in the current paper. The PAPA consists of a series of developmentally appropriate questions assessing the DSM-IV criteria for childhood disorders with information being obtained from parents. For the purpose of the present report, meeting DSM-IV criteria for the following disorders was assessed: depression modified for preschool onset³⁵ ($\kappa = 1.0$; ICC = 0.98), externalizing (attention deficit disorder, oppositional defiant, and/or conduct disorder), and internalizing (post traumatic stress disorder, generalized anxiety and separation anxiety). Psychiatric symptoms (combining all disorders listed above) were used as a predictor of latent class membership and as a mediator in later analyses. Consistent with the sampling strategy described above, 50.4% of the sample had an early-onset psychiatric disorder; 29.3% had depression, 35.5% had externalizing disorders, and 28.5% had internalizing disorders.

Statistical Analyses

As recommended by Jung & Wickrama⁴³, prior to beginning the GMM's, a latent class growth analysis (LCGA) was conducted. The LCGA allows for the identification of distinct classes prior to conducting the GMM. Results from the LCGA of physical health problems indicated 2 distinct classes, which led us to move to a GMM approach to further test our hypotheses and model the unique estimates of variances and covariances. Beginning during the preschool period, participants were classified into subgroups based on physical health problem scores across the longitudinal study using growth mixture modeling⁴⁴ in Mplus version 7.3⁴⁵. Mplus utilizes full information maximum likelihood (FIML) estimation under the assumption of data missing at random (MAR) with robust standard errors (called the MLR estimator in Mplus). Multiple imputation was not used since the standard FIML estimation used in our analyses corrects for selective attrition⁴⁶ and recent work suggests that the parameter estimates obtained using FIML approaches are not significantly different than those using multiple imputation⁴⁷. This GMM model estimated unique variables of intercept and slope for each class (e.g. within-class variance was freely estimated). Specifically, physical health problem scores were calculated at each of the eight annual assessment waves. Quadratic growth mixture models with these scores as the dependent variables were used to determine categorical latent class variables for grouping participants with similar physical health trajectories. In each of these models, the participants' probability of belonging to each of the latent classes was evaluated, and participants were assigned to the latent class with the greatest probability.

To be included in the quadratic growth mixture models, participants needed to have completed at least three annual assessments (out of a possible eight). Of the N=264 participants included in the growth mixture modeling, 183 (69%) completed at least six, 96 (36%) completed at least 7, and 26 (10%) completed all eight of the possible assessments. When compared to children/families who completed fewer than 6 assessments, children/families who completed 6 or more assessments were equivalent to children/families who

completed less than 6 assessments in terms of child sex, ethnicity, maternal education, child psychiatric diagnostic status, maternal history of affective disorder, and family income-to-needs ratio. Several growth mixture models with varying numbers of classes (1–3 classes) for physical health were compared. The model with the best fit according to a combination of the Bayesian Information Criterion (BIC), the Lo-Mendell-Rubin adjusted likelihood ratio test (LRT), and sample size of the resulting classes was selected^{43,48–50}.

In order to determine whether early-onset psychiatric diagnoses partially explain the relations between income-to-needs and physical health problems, and early psychosocial adversity and physical health problems, mediation analyses were conducted using the PROCESS macro for SAS^{51,52}. When warranted, the Monte Carlo simulator was used to test the statistical significance of the indirect, or mediating effect. The Monte Carlo method is a form of bootstrapping, which simulates random draws from the distributions of each path in the model to estimate a 95% confidence interval around the indirect effect. Bootstrapping is generally preferred over more traditional methods of calculating mediation⁵¹.

Results

Fit statistics for the growth mixture models with latent class variables with 1, 2, and 3 classes were compared (Table 1). The 3-class model had the lowest BIC and fit significantly better than the 2-class model according to the Lo-Mendell-Rubin adjusted LRT. However, there were only 8 youth in one of the classes, which would have prevented additional analyses from being conducted with this class. These 8 youth showed initially high levels of physical health problems that declined over time. Therefore, the 8 subjects in this class were excluded from further analyses and the growth mixture models were re-run using the other remaining participants. In these models, the 2-class solution provided the lowest BIC and best fit (Table 1). The probabilities of being included in each latent class were: low 0.98 (0.07) and high 0.95 (0.10).

Details of the growth mixture models are shown in Table 2 and the trajectories of latent classes are graphed in Figure 2. The growth mixture model revealed that the latent class with more physical health problems had an intercept significantly different from zero, indicating differences in physical health problems at the first assessment, as well as significant linear slope components, indicating significant changes (increases) in the course of physical health problems across time. The quadratic slope for the class with more physical health problems was not significant. The latent class with few physical health problems evidenced significant linear and quadratic slopes, indicating an initial significant decline in the course of physical health problems, followed by a later increase in physical health problems across time.

Correlations between baseline predictors and global physical health scores across time are presented in Table S1 (Supplemental Digital Content 1). Additional descriptive statistics for participants are presented in Table 3 as well as χ^2 and t-tests that examined group differences between the low and high latent classes.

Influence of Early Psychosocial Adversity, Income-to-Needs, and Psychiatric Disorders on Latent Class Membership

Family income-to-needs ratio and early psychosocial adversity were included as predictor variables in the GMM's⁵³. Family income-to-needs ratio during the preschool period differentiated the high, increasing trajectory class of physical health problems from the low class of physical health problems ($\chi^2_{(1)} = 4.391, p=.036$), such that children in the low latent class had families with greater incomes relative to needs ($M= 2.226$; $SE= 0.083$) compared to children in the high latent class ($M=1.809$; $SE= 0.176$). In addition, early psychosocial adversity, experienced before age 6 was a significant predictor of latent class membership ($\chi^2_{(1)} = 4.246, p=.039$). Children in the high, increasing trajectory of physical health problems were more likely to experience adversity prior to age 6 ($M= 0.956$; $SE= 0.133$) compared to children in the low latent class ($M= 0.649$; $SE= 0.062$).

The presence of psychiatric disorders during the preschool period significantly predicted membership in the high, increasing trajectory of physical health problems ($\chi^2_{(1)} = 9.17, p=.003$).

Influence of the Predictors on Individual Intercepts and Slopes from Growth Mixture Models of Physical Health Problems

As noted above, the individuals in the high, increasing trajectory both started with higher physical health problems (higher intercept) and showed a steeper increase over time (steeper slope). Thus, we wished to determine whether early psychosocial adversity, income-to-needs, and psychiatric disorders were related to both the intercepts and slopes of the growth mixture models. Early psychosocial adversity, income-to-needs, and psychiatric disorders each predicted the individual intercepts of the growth mixture models (Table 4). Individual slopes were not significantly predicted by early psychosocial adversity, income-to-needs, or psychiatric disorders after adjusting for individual intercepts.

Mediation Analyses

As shown in Figure 3, income-to-needs ratio significantly predicted more psychiatric symptoms during preschool (path *a*). In turn, psychiatric symptoms predicted membership in the high, increasing latent class of physical health problems (path *b*). The relation between income-to-needs and latent class membership (path *c*) was also significant, with lower income-to-needs predicting membership in the high, increasing latent class. Path *c'* was non-significant and there was a significant effect for the mediational path via calculation of the indirect effect, $a*b$ (Figure 2; $\beta= -0.29, p<.021$).

The mediation model for early psychosocial adversity was also significant (Figure 4). Greater psychosocial adversity predicted more psychiatric symptoms during preschool (path *a*). In turn, psychiatric symptoms predicted membership in the high, increasing latent class of physical health problems (path *b*). The relation between early psychosocial adversity and latent class membership (path *c*) was also significant, with greater psychosocial adversity predicting membership in the high, increasing latent class. The *c'* prime path was non-

significant. The indirect effect ($a*b$) was significant (Figure 3; $\beta= 0.31$, $p=.050$), indicative of mediation.

Discussion

There has been little research examining early-onset psychiatric disorders as a mechanism associated with physical health problems throughout childhood^{29,54–56}. By extending the literature on relationship of early adversity to the trajectories of physical health problems assessed from preschool to early adolescence, these findings indicate the importance and predictive power of early financial advantage/disadvantage, psychosocial adversity, and psychiatric disorders occurring during the preschool period for contributing to increasing physical health problems from preschool through early adolescence. The analyses distinguished between financial advantage/disadvantage, which includes income and SES-type indicators as a proxy for poverty⁸ from *psychosocial adversity*, which includes specific, measureable instances of how a child experiences adversity such as abuse, foster care placement, and caregiver arrest, yet findings were similar across types of adversity. The findings from this study suggest that the co-occurrence between early physical and mental health problems, as well as early adversity may be of significant public health importance, particularly given the rise in prevalence rates for chronic health problems in children⁵⁷. Further, the results highlight the key role of early mental health problems in predicting later physical health, a finding that has not yet been reported in the literature and has yet to be emphasized by public policy.

Using growth mixture modeling to create latent class trajectories of physical health problems, a two-class solution provided the best balance between statistical indices of fit and the number of children in each trajectory class. A low latent class was comprised of youth whose physical health problems were minimal and remained stable and low throughout the duration of the study. On the other hand, during the preschool period, children in the high latent class were reporting almost twice the number of physical health concerns as children in the low latent class. Thus, differences in physical health problems were evident even among the youngest ages assessed in the sample, suggesting that physical health concerns may begin at a very young age for some children. The youth in the low physical health problems latent class evidenced a significant quadratic slope over time, indicating that these youth initially showed a decline in physical health problems, followed by a rise in later years. Further, the youth in the high latent class showed a significant positive linear slope, signifying a faster rate of increase in physical health problems from preschool through early adolescence. These trajectories offer unique insights into the course of physical health concerns beginning during preschool and the continuation of these early-onset problems into adolescence, in a sample of youth who were not recruited on the basis of physical health problems.

Both high financial disadvantage and high levels of early psychosocial adversity predicted membership in the increasing class of physical health problems from preschool through early adolescence. While at first glance these concepts may seem similar, and they are indeed related, they actually refer to two different processes: family financial strain versus the experience of specific psychosocial stressors. In this study, both appear to be influencing

physical health problems in children. These findings replicate work with adults showing that childhood socioeconomic status and poverty predicts adult physical health problems^{58–60}. However, our findings focus specifically on the childhood period, suggesting that the relationship between early adversity and physical health problems often seen in the adult literature may begin much earlier than previously recognized. Furthermore, our measures of family income-to-needs ratios and psychosocial adversity were only assessed between the ages of 3–6, and it is striking that these early measures of risk exerted such a strong influence on latent class trajectory membership through age 13. These empirical findings are consistent with a model proposed by Miller and Chen suggesting that early adversity affects behaviors that then affect health trajectories^{34,61}.

These findings link work from two existing areas in the literature, studies that have focused on the impact of poverty on physical health⁹ as well as studies that have focused on the impact of adverse child experiences on physical health¹⁴. This represents an advance from prior studies, as most have not assessed or examined the role of co-morbid, early-occurring mental health problems. Of greater interest is that early-onset psychiatric disorders mediated relations between psychosocial adversity and physical health problems, as well as between financial advantage/disadvantage and physical health problems. Thus, early-onset psychiatric disorders accounted for much of the relation between early psychosocial adversity and later physical health problems and financial advantage/disadvantage and later physical health problems. The similar impact of early financial advantage/disadvantage and psychosocial adversity on physical health may have great public health significance. In this study, both financial advantage/disadvantage and psychosocial adversity occurred early in the child's life (between ages 3–6), when children depend on caregivers to respond and tend to their physical and mental health complaints. Caregivers experiencing high levels of adversity may fail to recognize early indicators of poor physical and mental health, increasing the likelihood for more serious, chronic conditions to emerge.

In fact, the number of children with chronic health conditions has increased dramatically over the past four decades and increased health care utilization and costs⁵⁷. In addition, increasing evidence supports a close relationship between physical and mental health problems, as well as the development of new models of care to address both in tandem^{62,63}. By assessing both mental and physical health problems in the same sample, across time, researchers can begin to uncover the complex interplay between mental and physical health as well as determine any underlying physiological processes that may promote risk for both types of conditions^{18,64}. Further, the recognition and treatment of mental health problems in early childhood remains a highly neglected area and these findings suggest that greater attention to treatment of these disorders may have broader health effects downstream.

While this study has strength in the use of a relatively large sample of youth followed longitudinally across a span of ten years, the sample is on the smaller side for conducting more complex GMM's and therefore has reduced power to detect additional distinctions (e.g., sex) between trajectory classes. Detailed clinical interviews were conducted with all youth during the preschool period, however our measurement of physical health problems was limited by the use of a parent-report questionnaire. Additionally given that maternal/caregiver report was used for assessment of psychiatric symptoms, physical health, and

adversity, social desirability bias may need to be considered when evaluating the validity of these reports. In particular, it is likely that caregivers may underreport their children's exposure to adversity. Future work may wish to include more detailed and objective measurements of physical health problems. We are currently collecting follow-up assessments of this sample through later adolescence and including more objective and specific assessments of physical health (e.g. use of accelerometers/sedentary behavior) that will be important to investigate fluctuations in physical health trajectories over time. Rather than including a single predictor of psychosocial risk, such as parental education or income, this study is also strengthened from creating a cumulative variable encompassing seven indicators of psychosocial risk. However, the levels of exposure to psychosocial adversity in this sample were slightly lower than the rates of exposure seen in past work that has specifically recruited children at high-risk for child abuse and neglect. This composite variable also had low internal consistency reliability in the current study, limiting the interpretations that can be drawn from these findings. The inclusion of additional predictive and mediating variables, such as familial and/or biological indices could further elucidate trajectories of physical health problems throughout childhood.

The findings from this study suggest that early-onset psychiatric disorders may alter the course of physical health problems since children with early onset disorders were more likely to have increasing physical health problems over time. Children presenting with early-onset psychopathology and early psychosocial adversity may need to be more carefully screened for physical health difficulties, as these results suggest that this co-occurrence may increase the likelihood and severity of physical health problems later in childhood and adolescence. These results indicate that the regular screening of physical health problems for children presenting with mental health problems, and screening for mental health problems among children presenting with physical health problems may be needed and decrease the likelihood for negative health trajectories and high rates of co-morbidity. From a public health standpoint, these findings raise concern about the nature and course of both physical and mental health problems in very young children, as physical health problems are most often assessed as an outcome later in life and not as a phenomenon that may be altered earlier in development. Earlier intervention addressing psychosocial and physiological indices in children facing both early adversity and preschool psychopathology may be warranted. For example, children whose families have lower income-to-need ratios and early-onset psychiatric disorders are at greater risk for increasing physical health problems and may benefit from earlier interventions aimed at decreasing the influence their symptoms may have on their physical health during early childhood.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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List of Abbreviations used in Text

SES	socioeconomic status
BMI	body mass index
GMM	growth mixture modeling
PDS	preschool depression study
WUSM	Washington University School of Medicine
PFC	Preschool Feelings Checklist
CFA	confirmatory factor analysis
PAPA	Preschool Age Psychiatric Assessment
FIML	full information maximum likelihood
MAR	missing at random
BIC	Bayesian Information Criterion (BIC)
LRT	likelihood ratio test

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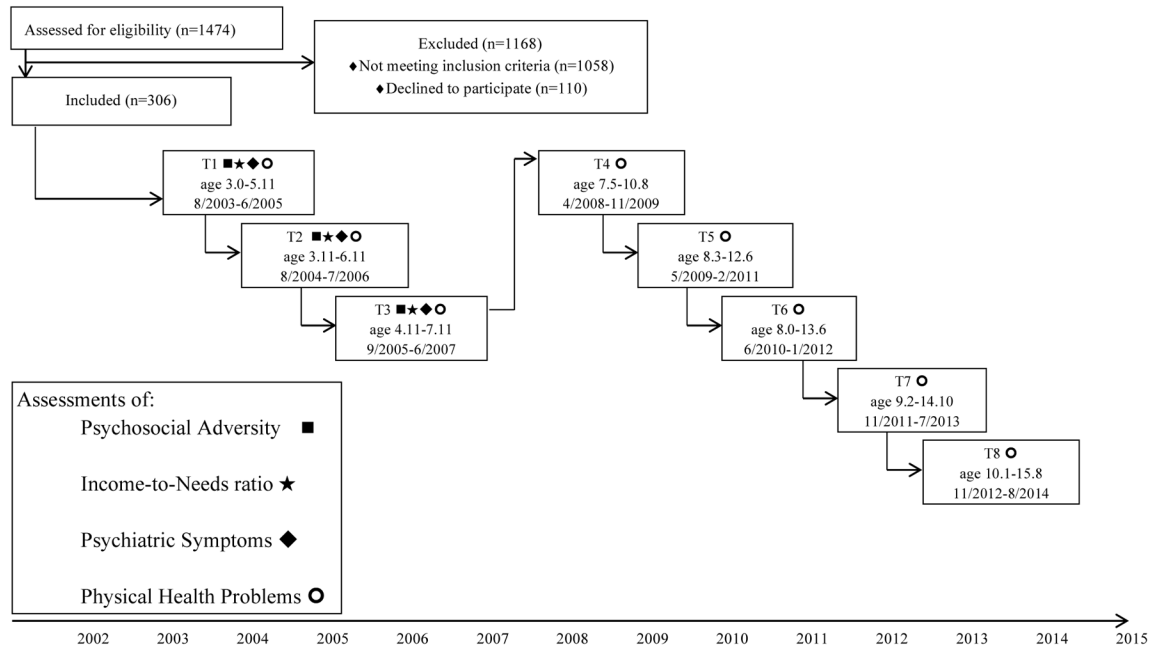


Figure 1.
 Preschool Depression Study Assessment Schedule

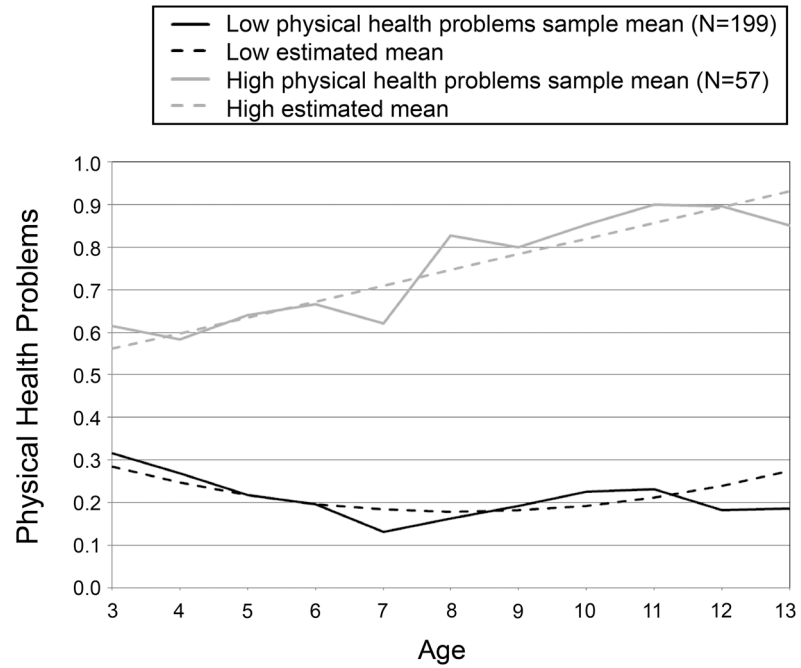


Figure 2. Latent class trajectories of global physical health problems from preschool through early adolescence

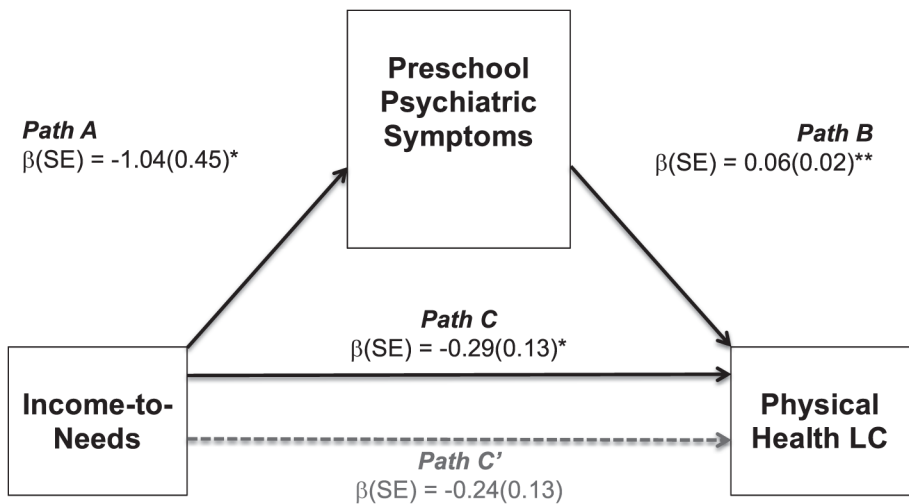


Figure 3. Indirect effect of total preschool depression, externalizing, and internalizing symptoms in the relation between income-to-needs and latent class of physical health problems

LC = latent class

Indirect effect of adversity on high LC = 95% CI: -0.142 to -0.011

Direct effect of adversity on high LC = 95% CI: -0.493 to 0.018

Total effect of adversity on high LC = 95% CI: -0.543 to -0.044

*p<.05, **p<.001

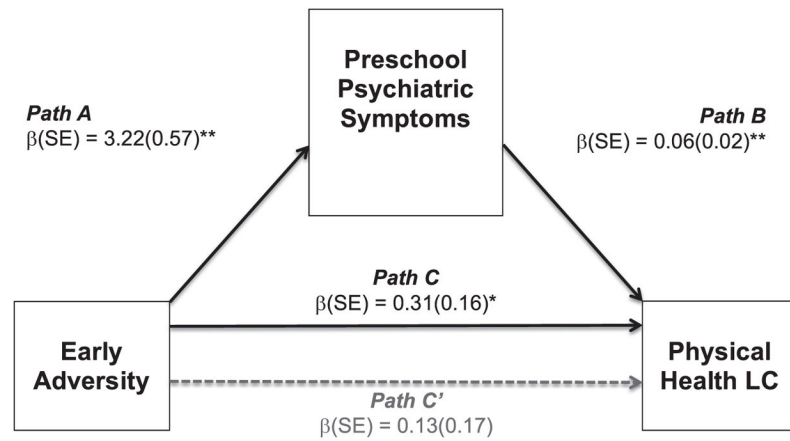


Figure 4.

Indirect effect of total preschool depression, externalizing, and internalizing symptoms in the relation between early adversity and latent class of physical health problems
LC = latent class

Indirect effect of adversity on high LC = 95% CI: 0.061 to 0.336

Direct effect of adversity on high LC = 95% CI: -0.208 to 0.470

Total effect of adversity on high LC = 95% CI: 0.001 to 0.620

* $p < .05$, ** $p < .001$

Table 1

Fit statistics of growth mixture models with one to three latent classes

N=256

N Latent Classes	AIC	BIC	Log-Likelihood	Entropy	L-M-R ALRT p	Class N's
1	1311.8	1361.5	-641.9	--	--	256
2	853.9	914.2	-410.0	0.905	0.0039	57, 199
3	764.0	842.0	-360.0	0.830	0.1861	31, 60, 165

AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; L-M-R ALRT p = Lo-Mendell-Rubin Adjusted Likelihood Ratio Test p-value

Table 2

Estimates from growth mixture model of physical health problems

Model:	Estimate	SE	Z	Two-tailed <i>p</i>
Low physical health problems				
Intercept	0.284	0.027	10.404	<0.001
Linear Slope	-0.041	0.014	-2.942	0.003
Quadratic	0.004	0.002	2.256	0.024
High physical health problems				
Intercept	0.561	0.081	6.953	<0.001
Linear Slope	0.037	0.017	2.113	0.035
Quadratic	*	*	*	*

* quadratic term non-significant, so removed from model

Table 3

Demographic characteristics of participants

	<u>Low GPH (N=199)</u>		<u>High GPH (N=57)</u>		<u>Low vs. High</u>	
	%	N	%	N	χ^2	<i>p</i>
Sex						
Male	51.8	103	54.4	31	0.12	0.7268
Female	48.2	96	45.6	26		
Race						
White	60.3	120	47.4	27	3.00	0.0833
Non-White	39.7	79	52.6	30		
Psychiatric Diagnosis at Age 3–6	45.2	90	68.4	39	9.17	0.0025
	Mean	SD	Mean	SD	t	<i>p</i>
Income-to-needs ratio	2.23	1.14	1.79	1.28	2.51	0.0127
Early psychosocial adversity	0.66	0.86	0.93	0.98	-2.03	0.0429

Table 4

Potential Predictors of Individual Intercepts from GMM of Physical Health in Univariate Linear Regression Models

	Estimate	SE	t	p
Income-to-needs ratio	-0.014	0.006	-2.53	0.0120
Early psychosocial adversity	0.019	0.008	2.45	0.0151
Psychiatric Diagnoses at Age 3–6	0.049	0.013	3.64	<0.001

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