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Cost of resilience: Childhood poverty, mental health, and chronic physiological stress

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ABSTRACT

Childhood poverty is associated with elevated internalizing symptoms. Nevertheless, some children exposed to poverty evince remarkable resilience, demonstrating lower than expected levels of psychological distress. However, recent work suggests that coping with adversity can lead to undesirable physical health consequences. Specifically, successful adaptation in the context of early adversity, including socioeconomic disadvantage, appears to be associated with elevated chronic physiological stress and ill health. The current study adds to this emerging literature by examining in a longitudinal context whether low levels of internalizing symptoms in the face of childhood poverty is accompanied by elevated chronic physiological stress (allostatic load) during childhood, as well as over time from childhood to adulthood. Results (n = 341; M = 9.2 years, 49 % female; 94 % Caucasian) show that childhood poverty was prospectively associated with higher allostatic load during adolescence, controlling for baseline allostatic load. Furthermore, greater duration of childhood poverty led to steeper, more elevated allostatic load trajectories from childhood to adulthood, for youth with lower levels of internalizing symptoms. Efforts to manage adverse sequelae of early adversity likely yield a complex array of benefits and costs.

"The aspect of the problem of adaptation that is probably the most disturbing is paradoxically the very fact that human beings are so adaptable. This very adaptability enables them to become adjusted to conditions and habits which will eventually destroy the values most characteristic of human life." – Rene Dubos, *Man Adapting*.

Exposure to poverty during childhood is robustly associated with internalizing symptoms, such as anxiety, depression, and withdrawal (Costello et al., 2010; Najman et al., 2010; Slopen et al., 2010; Wadsworth et al., 2016). However, there is considerable heterogeneity in the association between poverty exposure and compromised mental health, with some youth exhibiting remarkable outcomes despite early life adversity. For example, low income youth with higher levels of self-control and self-esteem, as well as youth who receive more engaged parenting, show normal psychological adjustment (Buckner et al., 2003; Li et al., 2007). These findings emphasize the possibility of resiliency, defined as adapting successfully to disturbances that would otherwise threaten system functionality, viability, or development (Masten, 2014). Indeed, the child development literature abounds with studies on resilient youth who, in the face of adverse early environments, develop little to no mental health difficulties and or do well academically.

Nevertheless, adverse environments inflict high levels of stress on an organism and behavioral mobilizations and physiological adaptations made to cope with these stressors have downstream effects on wellbeing more broadly (Cohen et al., 1986; Evans and Cohen, 2004). In a classic example of this phenomenon, Frankenhaeuser (Frankenhaeuser, 1986) demonstrated in a series of laboratory experiments that under high levels of acute stress, most people can maintain optimum task performance for short periods of time but do so at a cost of elevated physiological stress. However, those instructed to relax and not worry about task performance show lower levels of performance under stress but with no such cost to stress biomarkers.

Applied to the broader domain of child development, it is important to consider that child development reflects a complex overlay of psychological, social, and physiological functioning. Resiliency research has tended to focus on a single aspect of child wellbeing, thereby limiting our understanding of how adversity impacts a more holistic

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interpretation of a child's healthy development. In other words, resilience in one domain may exert costs in another. Data suggest that a subset of disadvantaged children and youth revealing outward signs of resiliency, such as high levels of academic success, self-control, and low levels of mental health symptomology, appear to do so while exacting a significant toll to their physical health (Hostinar and Miller, 2019).

For example, low-income youth who do well in school (Brody et al., 2016; Brody et al., 2013; Chen et al., 2015; Gaydosh et al., 2018), and score highly in conscientiousness (Chen et al., 2020), or self-control (Brody et al., 2013; Miller et al., 2015) are also more likely to suffer from physical health maladies. Across multiple studies, Brody and colleagues have found that youth from low-income families who were identified as psychologically resilient, as indexed by self-control, academic achievement, social competence, or good psychological adjustment, have the highest levels of allostatic load, an index of chronic physiological stress (Brody et al., 2013; Chen et al., 2015). Similarly, studies have shown that higher levels of academic achievement among youth from disadvantaged backgrounds was associated with worse physical health, including Type 2 Diabetes (Brody et al., 2016), higher levels of the metabolic syndrome (Gaydosh et al., 2018), greater vulnerability to upper respiratory infection (Miller et al., 2016), and accelerated epigenetic aging (Miller et al., 2015). Among monozygotic twins raised together in poverty, individuals higher in conscientiousness have elevated inflammatory symptoms, suggesting that at least for this aspect of resiliency, costs of resiliency to childhood disadvantage cannot be exclusively attributed to shared genetic or environmental factors (Chen et al., 2020).

The current study adds to the burgeoning literature on costs of coping or adjustment to childhood poverty in three important ways. First, the current study conceptualizes poverty as the proportion of a child's life that was spent in poverty. The majority of studies have thus far relied solely on snapshot assessments of poverty, indicating whether or not a child was living in adverse circumstances at a single point in time. We speculate that the cost of resiliency is likely cumulative, in that being exposed to poverty for a small portion of childhood is less physiologically taxing than coping with life in poverty for an entire childhood (Evans and Kim, 2007; Evans and Kim, 2012; Evans and Schamberg, 2009). Therefore, we examine whether the cost of resiliency is linked to the proportion of a child's life spent in poverty.

Second, the current study assesses the moderating influence of internalizing symptoms on the association between poverty exposure and allostatic load. Allostatic load is a cumulative index of physiological wear and tear on the body due to chronic mobilization of resources to meet changing environmental demands, rather than a single aspect of physical health. Allostatic load reflects the degree of co-ordination among multiple physiological response systems as they adapt to environmental demands (Ganzel et al., 2010; McEwen, 1998; Seeman and McEwen, 1996), and composite indices of allostatic load across multiple physiological response systems predict morbidity and mortality better than any singular biomarker of chronic stress (Juster et al., 2010; McEwen, 1998; McEwen and Gianaros, 2010; Seeman et al., 2010). While a host of studies have included allostatic load as an outcome of interest, attention to this important composite of physical health during childhood is relatively novel (Doan, 2021).

Finally, while many studies examining the physiological toll of psychological resilience have relied on single assessments of physical health (Brody et al., 2020; Chen et al., 2020) or short-term longitudinal data (Brody et al., 2015; Chae et al., 2020; Chen et al., 2019), the current study makes use of longitudinal data that spans nearly 20 years. We are therefore able to examine the moderating role of internalizing symptoms on the association between childhood poverty exposure and a) subsequent allostatic load, controlling for prior allostatic load levels, and b) growth curves of allostatic load development from childhood to young adulthood. These long-term, longitudinal analyses of change in allostatic load provide a novel contribution to the field, and allow for a more rigorous assessment of the long-term effects of resiliency in the face of poverty.

1. Method

1.1. Participants

Participants included 341 eight and nine-year-old's ($M = 9.2$ years, 49 % female; 94 % Caucasian) and their families who were recruited for a long-term study of childhood poverty, cumulative risk exposure, and well-being. Follow up data were collected at ages 13, 17 and 24. Families resided in rural areas in the Northeastern United States and were recruited from public schools, Co-Operative Extension, 4-H, and various anti-poverty programs including Headstart, WIC, Food Pantries, and housing assistance programs. Families were informed that the study was about how stress affects child development without specific reference to poverty. Parental informed consent and child assent were obtained at each wave until the participant reached 18 years of age at which point informed participant consent was obtained.

Low-income families were over-sampled with approximately 45 % of the sample from households at or below the federal poverty threshold of 1.0 income-to-needs. Income-to-needs is an annually adjusted per capita poverty index based upon the number of children and adults in the household. The other half of the sample was 2–4 times the federal poverty line, the income level of most American families. The mean income to needs ratio of the sample at Wave 1 was ($M = 1.67$, $SD = 1.10$). Among the parents of the children in the current study, 7 % reported high school dropout, 12 % graduated college. Moreover, 42 % of nine-year-old's were living with a single parent.

1.2. Procedure

All data were collected with a standardized protocol in the participant's residence by two experimenters working independently with the child and the child's mother until Wave 4 when only the participant provided data.

2. Measures

2.1. Poverty exposure

Income-to-needs values, an annually adjusted per capita poverty index based upon the number of children and adults in the household, were calculated for each family at Wave 1. The federal poverty threshold of an income-to-needs score of 1.0 was utilized to identify families in poverty. Starting with these values and utilizing a personally informed calendar (e.g., maternal birthdate, children's birthdates, important family holidays, major family transitions) the interviewer and the child's mother worked backwards in time from Wave 1 to the target child's birth to estimate duration of exposure to poverty in six-month blocks. The child's mother was queried about any changes in financial support (e.g., job change, entry or exit of maternal partner) in relation to the current (i.e., age 9) household income. When a change in finances occurred, she was asked about changes in the magnitude of income. Precise dollar figures were not queried, instead we ascertained whether income went up or down and whether this was a typical yearly increase or a larger raise with parallel probes for income loss. The event history calendar methodology was initially designed by researchers to help respondents gain better access to long-term memory by presenting temporal anchoring points and sequencing within life events or episodes (Glasner and van der Vaart, 2009). Previous examinations of this methodology have demonstrated that it enhances retrieval strategies and improves data quality (Belli et al., 2004), and also leads to high-quality retrospective reports even after retention intervals of several years (Belli, 1998). In the current study, the duration of childhood poverty exposure was defined as the proportion of life from birth to wave 1 in poverty.

2.2. Internalizing symptoms

Internalizing was determined by assessing internalizing symptoms at Wave 1 using the Child Behavior Questionnaire (Rutter et al., 1970). The child's primary caregiver rated whether specific behavioral symptoms described the participant (0 = not true – 2 = very true). Internalizing symptoms included measures of depression (e.g., "I feel lonely") and anxiety (e.g., "I worry a lot"). This standardized measure of psychological development has been widely used across heterogenous sociodemographic samples with excellent psychometric properties. Indices of internal consistency for Internalizing symptoms at Wave 1 was adequate, $\alpha = 0.64$.

2.3. Allostatic load

Allostatic load was assessed at all waves of data collection (Waves 1–4) and is a composite index of chronic physiological stress consisting of cardiovascular, neuroendocrine, and metabolic biomarkers of bodily responses to chronic environmental demands. Resting diastolic and systolic blood pressure were measured at each wave of data collection with an automated blood pressure monitor (Dinamap Pro-100) while seated at rest and reading in a quiet room in the home with only one experimenter present. The means of readings 2–7 were incorporated into the allostatic load composite (Kamarck et al., 1992; Krantz and Falconer, 1995). Overnight urinary epinephrine and norepinephrine (Riggin and Kissinger, 1977) and cortisol (Contreras et al., 1986) with a creatinine control were analyzed. All voids from bedtime to morning were collected at home, kept on dry ice and then in the morning immediately transferred and stored at −80 °C until assay. BMI (kg/m^2) was assessed at each wave at home by the experimenter. For each biomarker at each wave, participants in the upper quartile of the distribution were scored a 1 and values below the upper quartile scored as 0. Allostatic load was the sum of these six binary values (0−6).

2.4. Data analysis plan

In order to evaluate our hypothesis that youth from low income households with lower internalizing symptoms would reveal a biological stress cost, we ran two models. First, we assessed whether Internalizing Symptom scores at Wave 1 moderated the association between the duration of poverty exposure at Wave 1 with Allostatic Load at Wave 2. This model allows us to confirm whether our data are consistent with previous, single time point assessments of the cost of resilience, despite using a different measure of poverty exposure. The MPlus software (Muthen and Muthen, 2018) was used to run a moderated regression analysis. In order to provide a more rigorous test of our hypothesis, Wave 2 Allostatic Load was first regressed onto Wave 1 Allostatic Load, allowing for a prediction of the residuals of Allostatic Load scores. Next, Wave 2 Allostatic Load was regressed onto Wave 1 Poverty, Wave 1 Internalizing Symptom scores, and their interaction term. Wave 1 Poverty and Wave 1 Internalizing Symptom scores were grand-mean centered. This analysis allows us to determine if the association between poverty exposure and allostatic load system development in the short term is contingent on internalizing symptomology.

For our second model, we sought to test whether these initial prospective, longitudinal results would generalize to allostatic growth curves from age 9 through age 24. We therefore tested whether Wave 1 Internalizing Symptom scores moderated the association between duration of childhood poverty (Wave 1) and trajectories of Allostatic Load development from childhood to early adulthood (Waves 1 – 4) by running a moderated multilevel model analysis in MPlus. Wave 1 Poverty and Internalizing Symptoms were again grand-mean centered. Random slopes and intercepts were generated for each participant, allowing for individualized trajectories of Allostatic Load growth over time. At Level 1 (within level), Allostatic Load was regressed onto Wave (ages 9, 13, 17, 24) to predict a growth curve for each participant. Wave was recoded to allow for a Wave 1 intercept (0, 1, 2, 3). At Level 2 (between level), the slope of Allostatic Load was regressed onto Poverty Exposure, Internalizing Symptoms, and their interaction term. This analysis allows us to assess the extent to which internalizing symptomology influenced the association between the proportion of an individual's childhood spent in poverty and the rate of Allostatic Load change over time.

3. Results

Due to the longitudinal nature of the current study, the data contained missing data (Time 1 n = 341, Time 2 n = 226, Time 3 n = 229, Time 4 n = 245). Little's missing-completely-at-random (MCAR) test was conducted to assess whether values were missing completely at random. The test was not significant ($\chi^2 = 149.78$, $p = .20$), indicating that values were missing completely at random. As a result, multiple imputation was used on all study variables to account for the missing values using SPSS's multiple imputation command, averaging across 5 iterations of imputed values. All study variables had acceptable levels of skew and kurtosis ($< |1.9|$). Table 1 provides zero-order correlations, means, standard deviations, and sex differences on all study variables. Significant sex differences were not found for any study variables with the exception of Wave 4 Allostatic Load, which was significantly higher for female participants ($t = 2.21$, $p = .03$).

3.1. Model 1: wave 2 allostatic load

The model fit the data well (RMSEA = 0, CFI = 1.0, SRMR = 0), as expected for a just-identified model. The main effect of duration of childhood poverty exposure on increased Allostatic Load from Wave 1 to Wave 2 was significant ($B = 0.13$, $p < .001$), suggesting that children who spent more time in poverty from birth to Wave 1 demonstrated significantly higher increases in Allostatic Load scores from childhood to early adolescence. Moreover, while Wave 1 Internalizing Symptoms were not significantly associated with Wave 2 Allostatic Load ($B = -0.03$, $p = .53$), the interaction between Poverty and Internalizing Symptoms was significant ($B = -0.09$, $p = .02$).[1] See Table 2 for full model results.

Fig. 1 shows a Johnson-Neyman style visualization of this interaction effect. The graph demonstrates that approximately 0.60 standard deviations above the mean value of Internalizing scores, the association between Poverty and Wave 2 Allostatic Load is no longer significant. The interaction was also investigated by examining the association between Wave 1 Poverty and Wave 2 Allostatic Load at one and two standard deviations below and above the mean of Wave 1 Internalizing Symptoms, controlling for Wave 1 Allostatic Load. At both one and two standard deviations below the mean of Internalizing Symptoms, Poverty was significantly associated with Wave 2 Allostatic Load ($Bs > 0.22$, $ps < 0.001$); however, at both one and two standard deviations above the mean of Internalizing Symptoms, Poverty was not significantly associated with Wave 2 Allostatic Load ($Bs < 0.04$, $ps > 0.44$). Therefore, Poverty Exposure was associated with significantly higher levels of Allostatic Load only at low levels of Internalizing symptomology.

3.2. Model 2: allostatic load slopes

A baseline model was run and demonstrated that the residual variance of the Allostatic Load was significant (0.07, $p < .001$). Furthermore, the intraclass correlation (ICC) of Allostatic Load slopes were assessed to determine if there was enough within-person consistency to warrant a multi-level approach. The model produced an ICC value of

[1] Both sets of models were rerun to include sex as a covariate. The pattern of results was unchanged, and therefore only the models that do not include sex are presented herein.

Table 1
Intercorrelations, means, standard deviations, and sex differences for all study variables.

	Poverty (Birth to W1)	Wave 1 Internalizing Symptoms	Wave 1 Allostatic Load	Wave 2 Allostatic Load	Wave 3 Allostatic Load	Wave 4 Allostatic Load
Poverty (Birth to W1)	1					
Wave 1 Internalizing Symptoms	.07	1				
Wave 1 Allostatic Load	.09	-.06	1			
Wave 2 Allostatic Load	.18**	-.07	.68**	1		
Wave 3 Allostatic Load	.17**	-.08	.50**	.74**	1	
Wave 4 Allostatic Load	.23**	-.01	.33**	.49**	.65**	1
Mean	0.49	0.43	0.44	1.06	1.80	2.74
SD	0.47	0.34	0.65	0.91	0.99	1.13
Sex Differences (0 = male)	0.15	-0.48	1.63	1.9	1.92	2.21*

Note. *$p < .05$, **$p < .01$

Table 2
Moderated regression results for Allostatic Load wave 2.

Independent Variables	Allostatic Load Wave 2
Allostatic Load Wave 1	0.66***
Poverty	0.13***
Internalizing Symptoms	-0.03
Interaction term:	-0.09*
Poverty* Internalizing Symptoms	
R^2	0.48

Note. Results are standardized regression betas. *$p < .05$, **$p < .01$, ***$p < .001$.

0.294, indicating that a considerable proportion of variance was accounted for within individuals, thus confirming the appropriateness of intraindividual modeling. The average Allostatic Load slope value was 0.76. For additional information about the trajectories of Allostatic Load over time see (Evans & De France, 2021).

Multilevel results show that the main effect of duration of childhood poverty exposure on Allostatic Load slopes was significant (b=0.16, $p < .001$), suggesting that children who spent a greater proportion of their childhood in poverty demonstrated steeper, more positive slopes of Allostatic Load development from childhood into early adulthood. Moreover, while Internalizing Symptoms scores at Wave 1 ($b = -0.01$, $p = .82$) were not significantly associated with Allostatic Load slopes, the interaction between Wave 1 Poverty and Internalizing Symptoms was ($b = -0.23$, $p = .03$; see Table 3). See Fig. 2 for a Johnson-Neyman style visualization of this interaction effect. The graph shows that approximately 0.25 standard deviations above the mean value of Internalizing scores, the association between Poverty and Allostatic Load slopes is no longer significant. Furthermore, the interaction was

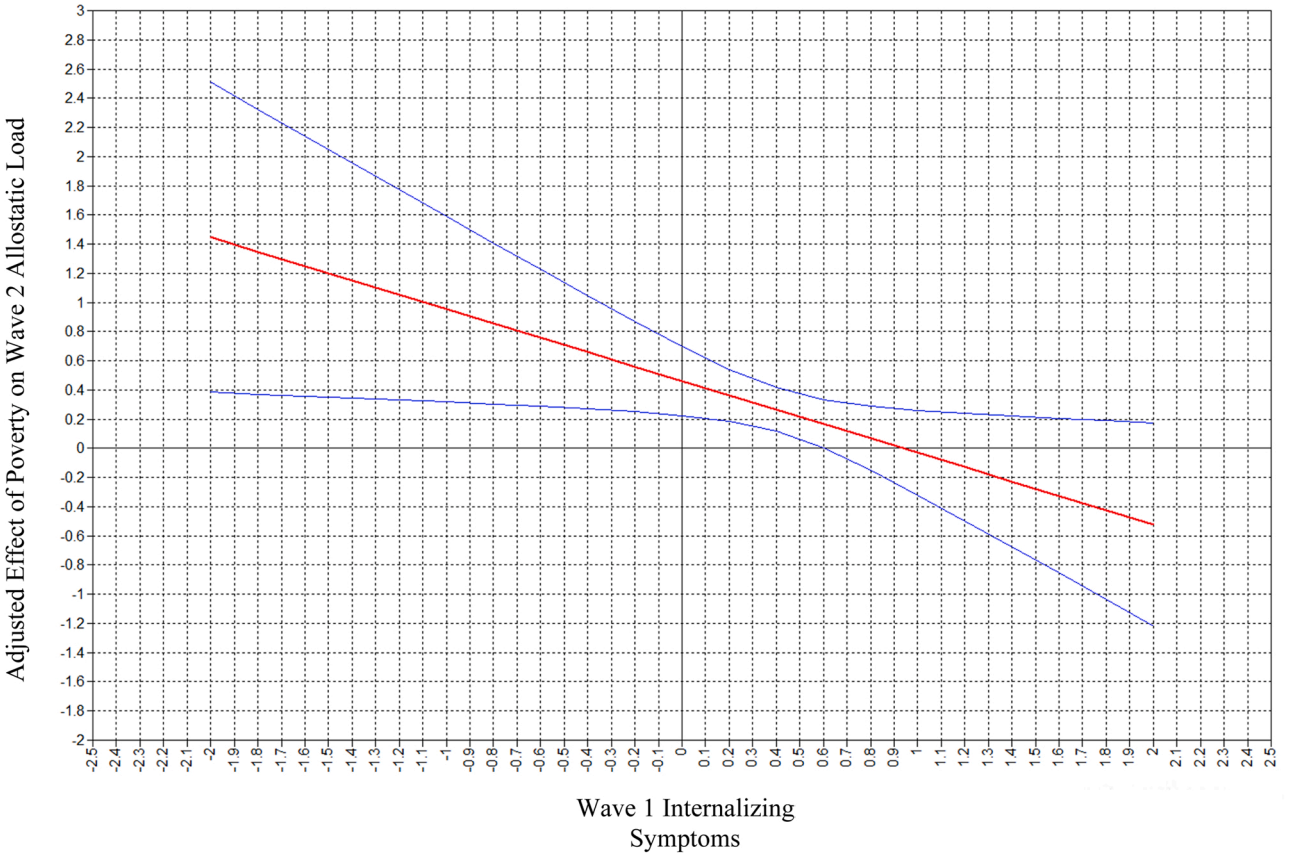

Fig. 1. Adjusted association between poverty exposure and wave 2 allostatic load scores at various levels of internalizing scores, controlling for wave 1 allostatic load scores. Internalizing scores variable is group-mean centered. The red line represents values of the adjusted effect of poverty on allostatic load at various levels of internalizing scores. The blue curved lines represent 95 % confidence intervals around the adjusted effect.

Table 3
Moderated regression results for allostatic load slope.

Independent Variables	Allostatic Load Slope (Wave 1–4)
Poverty	0.16***
Internalizing Symptoms	-0.01
Interaction term:	-0.23*
Poverty* Internalizing Symptoms	

Note. Results are unstandardized regression betas.
*$p < .05$, **$p < .01$, ***$p < .001$

investigated further by specifically examining the association between Poverty and Allostatic Load slopes at one and two standard deviations below and above the mean of Internalizing. Consistent with the Wave 2 Allostatic Load moderation results, Poverty was only associated with Allostatic Load slopes when Internalizing Symptoms was one (b= 0.24, $p < .001$) or two standard deviations (b= 0.31, $p < .001$) below the sample average. At above average Internalizing Symptoms, Poverty showed no association with Allostatic Load slopes ($bs < 0.08$, $ps > 0.14$).

As a sensitivity analysis, we reran this model including the intercept (Wave 1) Allostatic Load scores as a predictor of Allostatic Load slopes. Of interest, the Wave 1 Allostatic Load values did not show a significant association with Allostatic Load slopes (b= 0.01, p = .82). Furthermore, the overall pattern of results was unchanged. The main effect of duration of childhood poverty exposure (b= 0.15, $p < .001$) maintained a significant association with Allostatic Load slopes, while the main effect of Internalizing Symptoms maintained a non-significant association with Allostatic Load slopes (b= −0.01, p = .88). The interaction between poverty exposure and Internalizing symptoms (b= −0.22, p = .04) also maintained a significant association with Allostatic Load slopes.

4. Discussion

In the present study, we examine longitudinal relations between childhood poverty, internalizing symptoms, and changes in allostatic load from 9 to 24 years of age. Specifically, we hypothesized that youth who spent a greater proportion of life in poverty would have higher levels of allostatic load. We also investigated whether low-income children who were psychologically resilient, noted by low levels of internalizing symptoms, also developed higher levels of physiological indices of chronic stress over time. Consistent with our hypotheses, prospective, longitudinal analyses reveal that youth who spent a significant portion of their early life in poverty and who also demonstrate psychological resilience did so at a cost to their physical health. Youth who grew up in poverty have greater increases in allostatic load, but this is particularly true for the subset of them who did not develop internalizing symptoms. Furthermore, the same pattern of results emerges when predicting trajectories of allostatic load throughout development. Children in poverty with low levels of internalizing symptoms show elevated symptom increases of allostatic load in early adolescence, as well as steeper, more positive slopes of allostatic load growth from childhood to adulthood.

These findings replicate a growing body of literature on the costs of resilience for children growing up in poverty (Hostinar and Miller, 2019). Moreover, we extend this work in several respects. First, by using a comprehensive index of physiological functioning (allostatic load), rather than a single index of physical health, we add to a small body of evidence suggesting that allostatic load may represent a broader mechanism contributing to the reductions in physical health (Brody et al., 2016; Brody et al., 2013; Chen et al., 2015). Allostatic load represents a comprehensive picture of the physiological wear and tear on the body due to chronic mobilization of resources to meet environmental demands (Doan, 2021), and as such signifies a broad picture of the physical toll of managing environmental stressors. Given that

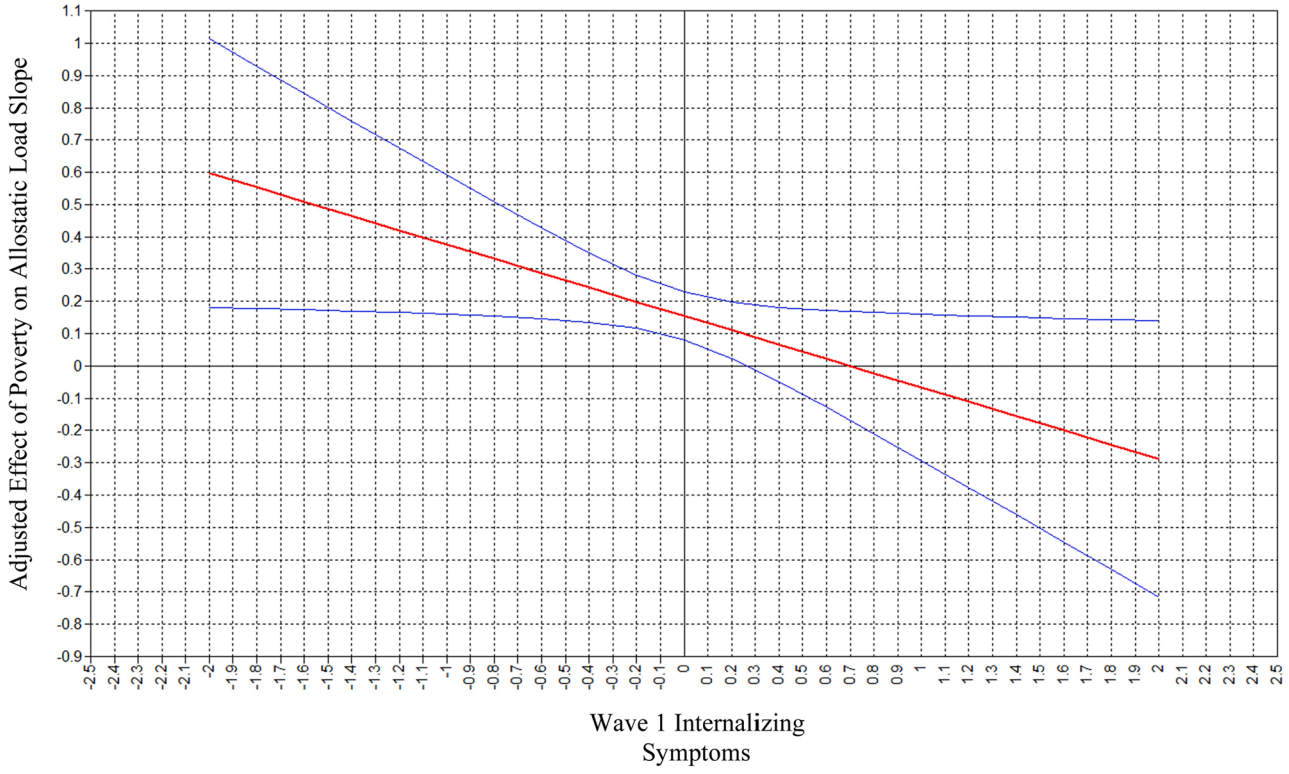

Fig. 2. Adjusted association between poverty exposure and slopes of allostatic load at various levels of internalizing scores. Internalizing scores variable is group-mean centered. The red line represents values of the adjusted effect of poverty on allostatic load slopes at various levels of internalizing scores. The blue curved lines represent 95 % confidence intervals around the adjusted effect.

heightened allostatic load predicts morbidity and mortality better than any singular biomarker of chronic stress (Beckie, 2012; Edes and Crews, 2017; Juster et al., 2010; Mauss et al., 2015; McEwen, 1998; McEwen and Gianaros, 2010; Seeman et al., 2010), this growing body of evidence suggests that increased allostatic load symptoms may represent a powerful pathway through which resiliency in the face of poverty disrupts children's physical health development on a broader scale. We also show this pattern of results in a prospective, longitudinal analysis examining changes in allostatic load during childhood as a function of the interaction of psychological adjustment and childhood poverty. Prior work has largely been cross sectional and relatively little work has been prospective, longitudinal in design.

We then extend these findings by reporting on the cost of resilience for developmental trajectories of chronic, physiological stress. In line with multiple theoretical accounts of child development, such as the Developmental Psychopathology model (Cicchetti, 2010) and the Organizational Model of Development (Sroufe, 1979), poverty exposure sets children on a trajectory of mental and physical health development that is distinct from the trajectories of youth in higher income families (Evans and De France, 2021). Herein we demonstrate that the added stress of psychologically coping with growing up in poverty sets children on particularly elevated and steep trajectories of allostatic load development. Given that it becomes less likely for an individual to deviate from a given course of development the longer that they are on that pathway (Cicchetti, 1993; Sroufe, 1997; Yates et al., 2003), it is important to recognize that these trajectories of allostatic load development likely become more entrenched and difficult to alter over time, significantly bolstering the importance of identifying efficacious prevention and intervention efforts early in a child's life.

The present study also contributes to the field as we used an economically diverse sample in contrast to prior studies on this topic that have examined tradeoffs in developmental outcomes only for those who are disadvantaged. Importantly, the pattern of results for the low-income children are in stark contrast to the youth in this sample who had not been exposed to poverty. For children who had not been exposed to poverty, higher levels of internalizing symptoms and allostatic load appear to develop in parallel, which is in line with a larger literature of comorbidities between mental and physical health among the general population (Hays et al., 2009; Ferketich et al., 2000). The contrasting pattern of results for youth in and out of poverty highlight the importance of centering child SES in studies of child development, as these results suggest that health disparities may emerge in a complex manner.

4.1. Limitations and future directions

The current study is not without limitations. Like most research on the influence of social factors on health disparities, the design is nonexperimental and therefore alternative causal explanations, and additional interpretations of the results are possible. Second, as we define poverty exposure as a proportion of time from birth to age 9, we lose the ability to examine the precise developmental timing of poverty exposure during childhood. Third, we do not have data reflecting whether, or to what extent, families accessed anti-poverty services and supports that may function to mitigate the effects of poverty on child development, and therefore obscure investigations into the cost of resilience. Fourth, our internalizing symptoms survey relied on maternal assessment, and the reliability estimate was lower than ideal. Future studies that are able to access multiple informants or perhaps make use of clinical interviews would add considerably to the field. Fifth, as demonstrated previously (e.g., Chae et al., 2020) exposure to racial discrimination functions as its own form of adversity for youth with important consequences for physical health, and therefore likely exacerbates the costs of resilience for youth in low-income families. Extending the findings of the current study to a racially diverse sample would add considerably to the field. Finally, identifying specific mechanisms or pathways through which the interaction between poverty and internalizing symptoms influences physiological development was beyond the scope of this initial investigation. Follow-up research that is able to identify specific coping styles of youth who grow up in poverty and who evince low levels of internalizing problems and low vs high levels of allostatic load would have important implications for research and clinical practice.

Examinations of the cost of resilience are relatively nascent, and many important questions remain to be tested. First, the majority of studies, including our own, rely on linear associations between study variables. Development, particularly into and across adolescence, is unlikely to occur in a strictly linear manner. Future studies that are able to incorporate more sophisticated modelling of various patterns of the effects tested herein would provide substantial benefit. Furthermore, the quantity and strength of results in support of cost of resilience for children in poverty are strong and accumulating. Future studies that are able to directly assess the mechanisms that create physiological vulnerabilities for psychologically resilient children would advance the field considerably. Moreover, in line with life-course models of disease, the costs of resilience may be affected by the timing and duration of experience with stressors, and particularly the accumulation of stressors endemic to life in poverty. Examinations of this phenomenon that are able to parse the effects of timing, intensity, and duration of poverty would add considerably to our understanding. Finally, although our index of allostatic load contains six biomarkers of physiological stress, it does not contain an assessment of inflammation or immune system functioning. Future investigations that make use of wider array of allostatic load indices would represent a significant contribution to the field.

5. Conclusion

Despite an abundance of evidence of the deleterious impacts of childhood poverty, nearly 40 % of children in the United States live in poor or near-poor households (Child Trends Databank, 2018). Although attention and resources are being devoted to protective factors that boost psychological resiliency in youth placed at risk because of poverty, a closer examination of the costs of resiliency suggests that these efforts have important limitations. First the salugenic effects of interventions to provide children at risk with a better chance to thrive pale in comparison to removing exposure to the risks in the first place. Several studies show that risk out-predicts resilience in determining developmental outcomes (Evans et al., 2013). Second, although human beings have remarkable adaptive capabilities, mobilization of resources to help offset environmental demands comes with its own costs (Cohen et al., 1986; Evans and Cohen, 2004). Coping with childhood adversity while certainly helpful in some respects likely has unintended and, for the most part, unexamined negative physical and psychological consequences. The present findings contribute to a burgeoning literature that encourage researchers and policy makers alike to think more critically about our perceptions and expectations of resiliency among youth in poverty.

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Declaration of Competing Interest

None.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.psyneuen.2022.105872.

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