

Adverse Childhood Experiences, Childhood Food Insecurity, and Academic Outcomes among Undergraduate Students: Evidence for a Cognitive Misattribution Pathway from a Mining-Community University in Ghana

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Abstract

This article examines the association between childhood food insecurity and academic outcomes among undergraduate students at the University of Mines and Technology (UMaT), Tarkwa, Ghana. Childhood food insecurity is operationalised through economic hardship and poverty-related neglect items from a culturally adapted adverse childhood experiences (ACE) instrument. The study uses a focused secondary analysis of an explanatory sequential mixed-methods study. Phase 1 surveyed 358 undergraduates (86.1% response rate) selected through stratified random sampling by faculty and study year. Data were collected using a culturally adapted 25-item ACE instrument, K10, and University Student Engagement Inventory and analysed using Pearson correlations, chi-square tests, independent-samples t tests, and multiple linear regression. A moderation model could not be estimated because economic adversity was almost entirely nested within high adversity burden, which was reported as a substantive finding. Phase 2 involved 23 semi-structured interviews with purposively selected students with elevated ACE burden, analysed using reflexive thematic analysis. Economic hardship and poverty-related neglect were reported by 63.1% of participants, while ACE total score was negatively associated with cumulative weighted average (CWA; $r = -.292$, $p < .001$); the association remained after adjustment for demographic and financial-support variables (standardised $\beta = -.31$). CWA declined monotonically with increasing adversity, with students reporting 11 or more adversity types averaging 6.4 percentage points below those reporting none or one. Interviews suggested that students may misattribute hunger-related concentration difficulties to intellectual inadequacy. Because cognitive functioning was not directly measured, this pathway remains theoretical. Universities should directly assess student food security and provide psychoeducation addressing adversity-related academic difficulties.

Key terms: Academic outcomes, adverse childhood experiences, childhood food insecurity, cognitive misattribution, Ghana.

1.0 INTRODUCTION

The relationship between adverse childhood experiences (ACEs) and cognitive and academic functioning is among the most robustly established findings in developmental science. Prolonged exposure to toxic stress dysregulates the hypothalamic-pituitary-adrenal (HPA) axis and compromises executive function, working memory, sustained attention, and impulse control (McEwen, 2008; Shonkoff et al., 2012)-precisely the capacities on which academic performance in higher education most depends. Cumulative exposure to four or more ACE types is associated with substantially elevated risk across a wide range of adult health and functional outcomes (Hughes et al., 2017).

However, this evidence base has been assembled overwhelmingly in high-income settings, and the gap identified in this article lies in what that concentration has left unexamined. Reviews of ACE research in low-and middle-income countries (LMICs) note both the scarcity of primary studies and the poor fit between the canonical ACE categories and the adversities that predominate in those settings (Ceccarelli et al., 2022). Where LMIC studies of university populations do exist, they seldom disaggregate poverty-related adversity as an analytic category or test it against institutional academic records: the largest African study of ACEs and academic performance to date measured performance with a single self-rated item and reported no association with cumulative ACE score (Muwanguzi et al., 2023). The cognitive and academic consequences of childhood food insecurity remain among the least examined pathways in these contexts, despite evidence from high-income settings that childhood food insufficiency predicts poorer school performance (Alaimo et al., 2001; Jyoti et al., 2005).

Food insecurity-defined as inconsistent access to adequate nutrition arising from economic constraint - constitutes both an independent adversity and a compounding feature of poverty-related household dysfunction (Chilton & Booth, 2007). Its effects on cognitive development are theorised to operate through acute impairment of the glucose-dependent processes on which sustained attention and executive control rely (Gailliot & Baumeister, 2007) and through chronic neurobiological alteration via sustained HPA activation (Cook et al., 2013; McEwen, 2008). The Tarkwa-Nsuaem Municipality of Ghana's Western Region presents an instructive case. Household income in the municipality is heavily dependent on the artisanal and small-scale mining (ASM) chain, from extraction through processing to sale, and is correspondingly exposed to its volatility (Baah-Ennumh & Forson, 2017; Baah-Ennumh et al., 2020). Food insecurity in such a setting is not readily interpretable as an isolated household misfortune; it is a community-level condition that tracks conditions in the mining economy. When children raised in this ecology reach university, this article argues, they carry not only the physiological sequelae of food insecurity but a particular interpretation of those sequelae.

This article addresses three research questions. First, what is the prevalence of childhood economic adversity and food insecurity among UMaT undergraduates? Second, what is the association between economic adversity, ACE burden, and academic outcomes as measured by cumulative weighted average (CWA), psychosocial wellbeing, and academic engagement? Third, what mechanisms do students describe when accounting for the relationship between childhood food insecurity and their academic functioning at university?

A scope clarification is warranted at the outset. This study did not administer a direct measure of cognitive functioning - no test of working memory, sustained attention, or executive control was included in the

parent study. The article's outcome variables are academic and psychosocial, and its treatment of cognition rests on participants' own accounts of concentration and cognitive self-assessment. Where an external judgement of a participant's ability is reported in Section 4, it is reported as that participant's account of a judgement made of him, not as an independent measurement. The article's theoretical contribution is accordingly framed as a proposition rather than a demonstration: that normalised cognitive misattribution constitutes a distinct pathway through which childhood food insecurity produces extended academic effects at university, beyond the direct neurobiological consequences documented in the existing literature. The remainder of the article presents the literature review, methodology, findings, discussion, and conclusions.

2.0 LITERATURE REVIEW

ACEs, Poverty, and Food Insecurity in LMIC Contexts

The canonical ACE framework developed by Felitti et al. (1998) identifies ten adversity categories across abuse, neglect, and household dysfunction domains. Still, it does not include poverty-related food insecurity as a discrete category. The framework's principal strength—the demonstration of a graded dose-response relationship between cumulative adversity and adult health—derives from a large, longitudinally traceable sample, and it is this strength that has driven its global adoption. Its principal weakness for present purposes derives from the same source: the original sample was drawn from insured members of a Californian health maintenance organisation, a population in which material deprivation was neither common nor sufficiently variable to register as an adversity dimension. Finkelhor et al. (2015) argue that this socioeconomic homogeneity is carried over wherever the instrument is transposed without modification. Ceccarelli et al. (2022), reviewing ACE evidence across global mental health settings, note that when economic adversity is the primary rather than secondary driver of family dysfunction, the conventional instrument is likely to understate the prevalence of the most common types of adversity. Finkelhor et al. (2015) accordingly include economic hardship as a structural adversity category, while Chilton and Booth (2007) argue that food insecurity should be conceptualised as a form of child neglect—the failure to provide adequate nutrition—and consequently as an ACE in its own right. The present study adopts the Chilton and Booth position, with the qualification that their argument rests on interpretive interview data from a small sample of African American women and has not been tested prevalence-wise in an African setting.

Evidence from Ghana is limited but consistent in direction. Afriyie et al. (2024) surveyed the parents and caregivers of 800 children and teens in the Cape Coast Metropolis using the Center for Youth Wellness ACE Questionnaire and found that 84.9 per cent of children had been exposed to at least one ACE, 69.1 per cent to two or more, and 51.8 per cent to three or more, with community violence the single most prevalent category at 50.2 per cent. That study's strength is its probability-based community sampling; its limitation for the present purposes is that it relies on parent report, which is known to under-capture experiences children do not disclose, and it does not include a poverty or food insecurity category, so the prominence of economic adversity in that population cannot be estimated from it. Among Ghanaian tertiary students, Adjorlolo et al. (2017) documented substantial childhood maltreatment and its associations with depression, self-efficacy, and life satisfaction in a university sample. Still, they examined maltreatment subtypes rather than economic adversity and did not measure academic outcomes. Neither Ghanaian study, therefore, disaggregates economic adversity as a distinct analytic category or links it to academic performance—the gap this article addresses.

Mining Economies, Household Income Volatility, and Childhood Food Insecurity in Ghana

The claim that mining-related economic conditions shape childhood food insecurity and, through it, educational outcomes requires evidence at each step. The first step is well documented. Baah-Ennumh and Forson (2017) and Baah-Ennumh et al. (2020), working from a survey of 400 household heads together with institutional and firm-level interviews in the Tarkwa-Nsuaem Municipality, establish that the ASM chain is the dominant source of household livelihood in the municipality and that this dependence is structurally precarious: land rendered unproductive by unreclaimed mining, an absence of skills-development pathways, and no diversification into modernised agriculture leave households with limited capacity to absorb income shocks. Their evidence is strongest on livelihood structure and weakest on measurement of consumption outcomes; neither study administers a food security instrument, so the transmission from income volatility to household food adequacy is inferred rather than measured.

The second step—from household food insecurity to educational outcomes—is supported by evidence from outside the mining context. Longitudinal work in the United States shows that food insecurity predicts poorer mathematics performance, weight gain, and social skills in school-age children (Jyoti et al., 2005), and cross-sectional work shows deficits in arithmetic scores and grade repetition among food-insufficient children (Alaimo et al., 2001). These studies are methodologically strong within their own setting but were conducted in a high-income country with an established school meals infrastructure, which limits direct transfer to a Ghanaian mining-belt context where no comparable safety net operates.

The third step—the interaction of the first two in an ASM economy specifically—is where the published record is thinnest. No study located for this review measures childhood food insecurity and educational attainment simultaneously in a Ghanaian mining community. This article does not close that gap, since it measures neither household income nor food security directly; it does, however, establish the prevalence of retrospectively reported economic adversity in a student population drawn substantially from that ecology, and documents how those students themselves connect the two.

Food Insecurity, Cognition, and Academic Performance: Three Mechanisms and the Empirical Record

Three distinct mechanisms have been proposed to link childhood food insecurity to impaired cognitive and academic functioning. The first is acute caloric impairment. Glucose is the primary metabolic substrate for neural activity, and reduced glucose availability impairs the self-regulatory and executive processes that depend on it (Gailliot & Baumeister, 2007). Studies with school-age children demonstrate that even mild hunger, including skipping breakfast, produces measurable deficits in sustained attention and short-term memory (Alaimo et al., 2001; Jyoti et al., 2005; Meyers et al., 1989). The strength of this literature lies in its experimental and quasi-experimental designs; its weakness is that effects are demonstrated over hours or days, so extrapolation to a persisting academic self-concept is not warranted from this evidence alone.

The second is chronic neurobiological alteration. Chronic food insecurity activates the HPA stress axis, elevating cortisol and producing impaired hippocampal neurogenesis, reduced prefrontal cortical volume, and dysregulated emotional-cognitive integration—the same neurobiological cascade documented for other ACE types (Chilton & Booth, 2007; McEwen, 2008). Cook et al. (2013) further show that even marginal food security, conventionally classified as food secure, predicts adverse health and developmental outcomes in young children and their caregivers, indicating that threshold-based

classifications understate the exposure gradient. The limitation of this strand for the present study is that its outcome measures are physiological and health-related rather than academic.

The third is cognitive misattribution, the mechanism this article develops. When children repeatedly experience hunger-induced concentration failure in communities where food insecurity is normalised, they may develop no interpretive framework for understanding those deficits as physiological and instead attribute concentration failure to personal intellectual inadequacy. Sustained over years of food-insecure schooling, such an attribution would produce persistent low academic self-efficacy carried into higher education as a self-limiting frame. The proposition is grounded in Weiner's (1985) attributional account of achievement motivation, which holds that students who attribute academic failure to stable, internal, and uncontrollable causes develop learned helplessness and diminished academic self-concept. It is analytically distinct from Bandura's (1997) self-efficacy theory, Goffman's (1963) stigma theory, and Steele's (1997) stereotype threat theory, none of which account for the physiological origin of the misattributed failure event or for the community-level normalisation that forecloses corrective attribution in high-prevalence food insecurity contexts. It should be stated plainly that no published study has tested this mechanism directly, and the present article does not test it either.

The empirical record linking ACEs to academic performance indicators is thinner and more equivocal than the mechanistic literature implies. Muwanguzi et al. (2023) surveyed 653 undergraduates at a public university in southwestern Uganda using the ACE International Questionnaire. They found that although cumulative ACE score predicted depression severity and suicidal ideation, it showed no association with academic performance. That null result is the strongest available counterweight to the present study's hypothesis and merits attention on its own terms; it is also, however, attributable in part to measurement, since academic performance was captured by a single self-rated item rather than by an institutional record. Maroto et al. (2015) provide the clearest positive evidence on the food insecurity side, finding that food-insecure community college students are significantly more likely to report grade point averages in the lowest band. However, their design is cross-sectional, and their setting is high-income. The present study contributes to this record by using CWA, the institutional performance metric in Ghanaian universities, and by examining economic adversity as a distinct predictor rather than folding it into a cumulative score.

Food Insecurity among University Students

Food insecurity among university students is a globally documented phenomenon. In the United States, Nazmi et al. (2019) synthesised eight studies representing 52,085 students. They reported an unweighted mean prevalence of 43.5 per cent (SD = 12.4), far above the national household rate, while Bruening et al. (2017) document associations with lower grade point average, reduced course completion, and elevated dropout risk. In sub-Saharan Africa, systematic evidence remains sparse. Still, structural conditions-limited student welfare provision, restricted bursary reach, and widespread expectations that students contribute financially to their households during study-suggest that prevalence is unlikely to be lower. No published study identified for this review has used a validated food security instrument among Ghanaian university students.

University-level and childhood food insecurity are theorised here to operate through different but compounding routes: childhood exposure is proposed to produce neurobiological alteration and cognitive misattribution. In contrast, contemporaneous food insecurity adds acute nutritional impairment to an

already compromised cognitive architecture (Maroto et al., 2015). This compounding claim is theoretical; no study has yet measured both exposures in the same sample.

Synthesis: The Identified Gap and Its Implications for Design

Three conclusions follow from this review, and together they specify both the gap and the design required to address it. First, the canonical ACE instrument omits the adversity most prevalent in LMIC settings, so prevalence work in Ghana requires a culturally adapted instrument that treats economic hardship and poverty-related neglect as measured categories rather than as background conditions. Second, the mechanistic literature linking food insecurity to cognition is strong on acute physiological effects and silent on how children interpret those effects. In contrast, the small empirical literature linking ACEs to academic performance in African universities is equivocal and limited by self-rated outcome measures. Third, no Ghanaian study links childhood economic adversity to an institutional academic record, and none examines the mining-belt ecology in which household food adequacy tracks a volatile commodity chain.

These gaps jointly justify an explanatory sequential mixed-methods design. A quantitative strand is required to establish whether economic adversity is prevalent in this population and whether it is associated with an objective institutional performance measure; a subsequent qualitative strand is required because the quantitative strand can establish association but cannot recover the interpretive process-how students themselves explain the relationship between childhood hunger and academic difficulty-which is precisely what the existing mechanistic literature omits. The sequence matters: the qualitative phase was designed to explain the quantitative associations, not to triangulate them.

3.0 METHODOLOGY

This article employed a focused secondary analysis of data from a completed explanatory sequential mixed-methods study examining ACEs and undergraduate student outcomes at UMaT, Tarkwa, Ghana. In an explanatory sequential design, a quantitative phase is conducted first, and its results are used to select participants for and shape the questions of a subsequent qualitative phase, whose function is to explain the quantitative findings. The design was chosen because the research questions are of two kinds: RQ1 and RQ2 concern prevalence and association and are answerable by survey, whereas RQ3 concerns the interpretive framework students bring to their own academic difficulty and is answerable only in participants' own terms. The secondary analysis reported here re-interrogates the existing dataset with childhood food insecurity as the organising construct, and re-analyses the interview corpus with a focused analytic question not asked of it in the parent study.

The study was conducted at UMaT, a specialist technical university in Tarkwa, in the Tarkwa-Nsuaem Municipality of Ghana's Western Region. UMaT's student body is drawn predominantly from the surrounding mining belt, a setting characterised by artisanal and small-scale mining activity, associated occupational hazards, environmental health burdens, household economic dependency on volatile commodity prices, and elevated rates of community violence. This ecological profile is the reason the site was selected and is integral to interpreting the findings.

The target population comprised all enrolled undergraduate students at UMaT. The required sample size was established by a priori power analysis for multiple linear regression-

(medium effect size, f -squared = 0.15, α = .05, power = 0.80), with a 20 per cent correction for non-response. Participants were recruited through stratified random sampling, with strata defined by academic faculty and year of study. 358 students returned usable responses, a response rate of 86.1 per cent. The achieved sample was distributed across years of study as follows: Year One, 27.1 per cent (n = 97); Year Two, 24.0 per cent (n = 86); Year Three, 21.5 per cent (n = 77); Year Four, 27.4 per cent (n = 98), consistent with the institutional enrolment profile.

The achieved response rate and the correspondence between the sample's year-of-study distribution and the institutional enrolment profile together support the sample's representativeness of the population from which it was drawn.

Phase 1 comprised 358 undergraduate students. Of these, 265 (74.0%) identified as male and 87 (24.3%) as female, consistent with UMaT's male-dominant enrolment profile; 3 participants (0.8%) identified as Other and a further 3 (0.8%) preferred not to state their gender. Participants ranged in age from 18 to 30 years (M = 23.7, SD = 3.8). Parents or guardians provided financial support to 57.0 per cent of the sample, other relatives to 9.5 per cent; 14.5 per cent held scholarships, 16.5 per cent were self-supporting or on student loans and 2.5 per cent reported another source of support. A substantial minority (28.8%) were in some form of paid employment alongside their studies.

Phase 2 comprised 23 participants purposively selected from the Phase 1 sample using criterion sampling (four or more ACE types endorsed) combined with maximum variation sampling across gender, academic discipline, socioeconomic background, and outcome profile. Sample sufficiency was determined through thematic saturation (Guest et al., 2006).

Adverse childhood experiences (ACEs) were measured using a culturally adapted 25-item instrument developed for the parent study in response to the documented limitations of the standard 10-item questionnaire in LMIC settings. The instrument extends the canonical Felitti et al. (1998) categories with adversity types identified as salient in the Ghanaian context: community violence, peer victimisation including bullying, child labour, poverty-related neglect, orphanhood, and caregiver migration. The adaptation drew on the Center for Youth Wellness ACE Questionnaire (Bucci et al., 2016) and the expanded taxonomy proposed by Finkelhor et al. (2015), was reviewed for cultural appropriateness by a panel of five Ghanaian mental health practitioners and educational researchers, and was piloted with 30 undergraduate students at a comparable institution. The pilot yielded a Cronbach's α of .81, with item-total correlations ranging from .31 to .67; two items with marginal loadings were revised before the main data collection. Internal consistency in the main sample was adequate (α = .84). Items were scored dichotomously (endorsed / not endorsed) and summed to produce an ACE total score. High ACE burden was defined as membership in the highest quartile of that distribution.

Childhood food insecurity was the article's core construct and requires precise statement. No dedicated food security instrument was administered. Childhood food insecurity was measured using the economic hardship and poverty-related neglect items of the adapted ACE instrument, which address insufficient food in the household during childhood, as well as other basic material needs that went unmet because the household could not afford them. These items formed one of the adversity categories added during the cultural adaptation described above, precisely because poverty-related deprivation is not represented in the canonical ten-item framework. Following the scoring convention used throughout the instrument, the

category was treated as endorsed when a participant reported any of its constituent experiences, and was analysed as a dichotomous exposure indicator rather than as a scale; therefore, no reliability coefficient is reported for it. The consequences of measuring the construct this way, rather than using a validated food security scale, are addressed in the Limitations sub-section.

Moreover, academic performance was measured by self-reported cumulative weighted average (CWA), the standard institutional performance metric in Ghanaian universities, expressed as a percentage. Similarly, psychosocial wellbeing was measured using the Kessler Psychological Distress Scale (K10; Kessler et al., 2002). The K10 is scored such that higher values indicate greater distress; positive correlations with the ACE total score reported in Section 4 therefore indicate poorer wellbeing with higher adversity burden and are described in those terms throughout. On the other hand, academic engagement was measured using the University Student Engagement Inventory (USEI) (Maroco et al., 2016), with higher values indicating greater engagement.

The parent study additionally administered measures of self-regulation, positive childhood experiences, and perceived social support. These were used in the parent study's moderation analyses and are not analysed here; they are noted so that readers of both papers can see which measures this article draws on and which it sets aside.

Because this article examines which specific facets of wellbeing and engagement covary with adversity burden rather than modelling either construct as a single latent score, the K10 and USEI items are analysed individually throughout Section 4, and scale-level composites are not computed.

Individual semi-structured interviews of 60 to 90 minutes were conducted with the 23 Phase 2 participants, guided by an instrument developed directly from the Phase 1 findings. This derivation of the interview guide from the quantitative results is the design-level integration point of the explanatory sequential approach (Fetters et al., 2013). Interviews were conducted in English or Twi according to participant preference, audio-recorded with consent, and transcribed verbatim. Transcripts were member-checked with a sub-sample of participants before analysis.

Transcripts were analysed using reflexive thematic analysis (Braun & Clarke, 2022) across six phases: familiarisation, generating initial codes, constructing themes, reviewing themes, defining and naming themes, and producing the analytic report. A codebook was developed inductively from the data while informed deductively by the study's conceptual framework. Trustworthiness was supported through member checking with a sub-sample of six participants, an audit trail maintained in NVivo, and ongoing documentation in the researcher's reflexivity journal. Consistent with the reflexive approach, themes were treated as analytic constructions rather than as categories awaiting discovery, and inter-rater reliability was accordingly not computed; it is not an appropriate quality criterion for this method. For the present article, a focused re-analysis of the existing corpus was conducted, interrogating all 23 transcripts for accounts of food insecurity, hunger, concentration, and cognitive self-assessment. Extracts that met these criteria were recoded and used to develop the analysis reported in Section 4.

Quantitative Analysis

The alpha level was set at .05 for all tests, two-tailed. The analyses reported here are additional to those presented in the parent study, which is cited as the source of the dataset. Pearson product-moment

correlations, a chi-square test of independence, an independent-samples t test, one-way analysis of variance with Tukey-corrected pairwise comparisons, and multiple linear regression were used, each described below in relation to the question it addresses. Pearson product-moment correlations were computed between ACE total score and each continuous outcome (CWA, psychosocial wellbeing items, academic engagement items). Linearity and bivariate normality were assessed by inspection of scatterplots and skewness and kurtosis values, with values within ± 2 treated as acceptable throughout.

An independent-samples t test compared ACE total scores between the 103 students (28.8%) in paid employment alongside their studies and the 255 who were not in paid employment. Levene's test indicated homogeneity of variance ($p = .888$), so the equal-variances statistic is reported. A multiple linear regression model was fitted with CWA as the dependent variable and ACE total score as the predictor of interest, entered alongside age, gender, year of study, faculty, and principal source of financial support as covariates. Both CWA and ACE total score were standardised so that the coefficient is interpretable as a standardised beta. Residual normality and homoscedasticity were assessed by inspection of residual plots. Finally, a moderated model testing the interaction between high ACE burden and exposure to economic adversity was specified but could not be estimated; the reason is reported in Section 4 and is itself a substantive finding.

Ethical Considerations

The study was conducted with the written authorisation of the Registrar of UMaT, who granted institutional permission for research involving the university's student population. Written informed consent was obtained from all participants, with explicit assurance that participation was voluntary and that withdrawal carried no academic or institutional penalty. Anonymity was maintained through participant codes. A distress protocol was operational throughout data collection. Every participant received a printed card carrying CSSU contact details and the Ghana national mental health helpline, and no data were retained from a participant who withdrew after expressing acute distress. Data were stored on encrypted institutional servers accessible only to named research team members. The secondary analysis reported here involved no further contact with participants.

4.0 RESULTS AND DISCUSSION

Prevalence of Economic Adversity and Food Insecurity

Overall ACE prevalence in the Phase 1 sample was 83.8 per cent, with 56.7 per cent of participants endorsing four or more types of adversity. Within that distribution, economic hardship and poverty-related neglect were endorsed by 63.1 per cent of participants ($n = 226$), constituting the second most prevalent adversity type after community violence (71.5%, $n = 256$) and ahead of parental conflict and intimate partner violence (54.7%), physical abuse (48.4%), caregiver emotional unavailability (44.2%), and parental separation or abandonment (39.5%). Notably, the expanded instrument items-community violence, child labour, and caregiver migration-were among the most frequently endorsed, which is itself evidence that the standard 10-item questionnaire is inadequate for this population.

Economic adversity in this sample is not an isolated exposure. The mean ACE total score was 5.95 ($SD = 5.28$) on the 25-item instrument, and effectively every participant in the highest quartile of that distribution also endorsed childhood economic adversity. Economic hardship therefore co-occurs with household

dysfunction, caregiver emotional unavailability, and community violence rather than standing apart from them, which is consistent with the argument advanced in Section 2 that in settings where material deprivation is widespread it operates as a structural condition rather than as one adversity among a list. The direction of the relationship cannot be established from cross-sectional data: the pattern is consistent with economic hardship generating other types of adversity, but equally with both arising from a common structural cause.

At university, 16.5 per cent of students ($n = 59$) were self-supporting or on student loans, and 28.8 per cent ($n = 103$) were in paid employment alongside their studies. The difference in ACE total scores between employed and non-employed students was not statistically significant, $t(356) = 0.196$, $p = .845$, indicating that employment while studying is broadly distributed across ACE burden levels rather than concentrated among the most adversity-exposed students.

ACE Burden, Economic Adversity, and Academic Outcomes

ACE total score was significantly and negatively associated with CWA ($r = -.292$, $p < .001$), indicating that higher cumulative adversity is associated with lower academic performance. It was significantly and positively associated with all ten K10 psychological distress items, $r = .307$ to $.469$, all $p < .001$ -the positive sign indicating greater distress, and therefore poorer psychosocial wellbeing, at higher adversity burden- and negatively associated with all fifteen USEI academic engagement items, $r = -.180$ to $-.300$, all $p < .001$.

In a multiple regression model adjusting for age, gender, year of study, faculty, and principal source of financial support, the association between ACE total score and CWA remained significant. It was slightly strengthened, standardised beta = $-.31$, 95 per cent CI $[-.41, -.21]$, $p < .001$, with the full model accounting for 14.4 per cent of the variance in CWA. The unadjusted bivariate association accounts for 8.5 per cent. Cumulative childhood adversity is therefore associated with a real but modest share of variation in academic performance, which is consistent with its being one contributor among many.

Table 1 presents mean CWA across bands of ACE total score.

Table 1: Mean Cumulative Weighted Average by Band of ACE Total Score (N = 358)

ACE total score	n	Mean CWA (%)	SD	Difference from reference
0-1 (reference)	99	59.6	8.1	-
2-3	56	58.5	7.5	-1.1 pp ($p = .843$)
4-10	103	56.5	8.2	-3.1 pp ($p = .020$)
11 or more	100	53.2	8.0	-6.4 pp ($p < .001$)

Note. CWA = cumulative weighted average. pp = percentage points. Bands correspond approximately to quartiles of the ACE total score distribution (25th percentile = 1, 50th = 4, 75th = 11). P values are Tukey-corrected pairwise comparisons against the reference band. There are no missing data; all 358 participants are included. Overall test: $F(3, 354) = 11.63$, $p < .001$.

The gradient is monotonic and statistically significant overall, $F(3, 354) = 11.63, p < .001$. Tukey-corrected pairwise comparisons show that the two highest bands differ significantly from the reference band (4 to 10 ACE types, $p = .020$; 11 or more ACE types, $p < .001$), whereas the 2-to-3 band does not ($p = .843$). Students endorsing 11 or more adversity types recorded a mean CWA 6.4 percentage points below students endorsing none or one. Defining the extremes as the parent study does, students in the Very High burden category (13 or more types, $n = 59$) recorded a mean CWA of 52.2 per cent ($SD = 7.5$) against 59.2 per cent ($SD = 7.9$) for the Low burden category (three or fewer types, $n = 155$), a gap of 7.0 percentage points.

A further model was specified to test whether childhood economic adversity moderates the association between overall adversity burden and CWA. That model could not be estimated, and the reason is itself a finding. Economic adversity is very nearly nested within high adversity burden in this sample: effectively all of the 100 participants in the highest ACE quartile also endorsed childhood economic adversity, leaving the comparison cell required by the model-high adversity burden without economic adversity-with too few cases to support estimation.

This is not a null result to be reported and set aside. It means that in this population, economic adversity and high cumulative ACE burden are not two exposures whose separate contributions can be weighed, but one exposure observed through two measures. That finding supports the article's argument more directly than the interaction model would: economic adversity is not an additional risk factor sitting alongside the canonical ACE categories; it is the structural condition within which the others occur.

The Cognitive Misattribution Pathway: Qualitative Accounts

The qualitative strand was designed to explain the associations reported above by recovering how students themselves account for the relationship between childhood hunger and academic difficulty. Across the corpus, a consistent structure emerged: attending school hungry, experiencing difficulty in following instruction and sustaining concentration, and attributing that difficulty to personal cognitive inadequacy rather than to physiological deprivation. Participants described this attribution as having been formed in childhood and as persisting into university.

One Year Three engineering student from a mining community gave the clearest statement of the pattern:

"There were times I went to school hungry and sat in class trying to follow what the teacher said. I did not know then that hunger affected concentration. I thought I just was not smart enough on those days" (P11).

Three features of this account are analytically significant. First, the concentration failure is episodic and covaries with hunger ("on those days"), which is the pattern a physiological explanation predicts. Second, the participant reports having had no access to that explanation at the time ("I did not know then"), which is the interpretive vacuum the misattribution proposition posits. Third, the attribution he did make was to a stable internal characteristic ("not smart enough") rather than to a transient state, which is precisely the attributional configuration Weiner (1985) associates with learned helplessness and diminished academic self-concept. P11's account is thus not a report of an unusual episode but a description of a recurrent experience that was normalised within his community to the point where no alternative interpretation was available to him until university.

The academic consequence P11 draws from this is recorded in his own words later in the same interview. He holds a CWA of 48 per cent and reports that his project supervisor had described his analytical work as among the best the supervisor had seen at UMaT:

"Forty-eight percent and among the best he's seen. Both things are true. That is not a small contradiction. That is the whole problem, in one sentence" (P11).

The evidentiary status of this extract should be stated exactly. It is P11's report of an assessment made of him, not an independently verified evaluation: no supervisor was interviewed, and no external rating instrument was administered. What it establishes is therefore not that P11's ability exceeds his CWA, but that P11 himself holds two incompatible readings of his own capacity simultaneously and cannot reconcile them. That irreconcilability is the phenomenon this article is about. His formal record supplies one attribution, his supervisor's remark another, and the childhood misattribution described above makes the first the more credible of the two to him.

A second participant described a related but distinct mechanism operating at university-not misattribution of the cause of difficulty, but institutional invisibility of the conditions under which work was produced:

"I was not sleeping properly, I was not eating properly, and I was not really present in my own work. The assignments came back with okay marks -not my best, but okay. And I remember thinking: nobody knows. Nobody in this department knows that I submitted those assignments under those conditions" (P04).

What P04's account demonstrates is the institutional counterpart of the childhood misattribution. The work was produced under conditions of nutritional and sleep deprivation; it was assessed without any record of those conditions; and the resulting mark therefore entered his academic record as a statement about his ability. The misattribution here is not only his own but also the institution's: a grade generated under deprivation is indistinguishable in the record from a grade generated under adequacy and is read as the former. P04 registers this precisely-his emphasis falls not on the marks themselves but on the fact that nobody knows how they were produced. This is the mechanism by which the childhood attributional structure is reproduced at university: the institution, like the child, has no information with which to attribute the performance to anything other than capacity. The concealment P04 describes is thus not simply reticence or reluctance to seek help; it is the condition that makes the institutional misattribution possible.

A third account describes a further route to nutritional deficit. P19, a Year Two student holding a partial scholarship that covers fees but is revocable if his CWA falls below a threshold, described losing approximately four kilogrammes across the three weeks between submitting his grades and receiving confirmation that the award would continue. He attributes the loss to sustained anxiety rather than to inability to obtain food. P19 is also the one participant in this group who is not from the mining belt, which makes the convergence instructive: food intake here was suppressed by academic precarity rather than by household poverty, and the resulting nutritional deficit is nonetheless real. Food insecurity at university is therefore not a single phenomenon but a family of related mechanisms - resource-driven, psychologically entangled, and stress-induced - each invisible to standard academic monitoring.

Food Insecurity as a Continuing Adversity Trajectory

For a substantial proportion of participants, the economic precarity of childhood did not end at secondary school. One Year Four engineering student from a mining-belt community described withdrawing from the university dining hall during periods of psychological distress:

"In those bad periods, I would stop eating at the dining hall, stop talking to my course mates. I told myself I was conserving energy. But I was disappearing. And because I was disappearing quietly, nobody raised an alarm" (P03).

Where P04's account turns on what the institution could not see, P03's turns on what he told himself. The formulation "conserving energy" reframes an involuntary deficit as a deliberate strategy, converting a physiological cost into a chosen response and thereby removing the grounds on which help might be sought. The structural parallel with the childhood misattribution is exact in form though different in content: in childhood, a physiological cause was reattributed to a stable personal deficiency; at university, a physiological cost is reattributed to personal agency. In both cases, the reattribution forecloses the response the situation warrants. P03's closing observation—that he was disappearing quietly and no alarm was raised—identifies the institutional consequence: a student who has narrativised deprivation as strategy will not present as needing support, and a monitoring system that waits for presentation will not detect him.

Altogether, these accounts describe a continuous trajectory rather than two separate exposures. Childhood food insecurity is reported to have generated both concentration difficulties and a particular explanation for them; university food insecurity, whether resource-driven, psychologically entangled, or stress-induced, is reported to reactivate that explanatory frame while adding a contemporaneous nutritional deficit.

Discussion

The evidence assembled in this article is organised into three distinct levels of warrant, and the discussion is organised accordingly. Conflating these levels has been a persistent weakness in the mixed-methods ACE literature, and it is deliberately avoided here.

What the Quantitative Data Demonstrate

The survey data establish three things. First, retrospectively reported economic hardship and poverty-related neglect are highly prevalent in this population, endorsed by 63.1 per cent of participants and second in prevalence only to community violence. Second, ACE total score is negatively and significantly associated with CWA and with academic engagement, and positively associated with the psychological distress measure (K10), indicating poorer psychosocial wellbeing at higher adversity burden. Third, students endorsing 11 or more adversity types recorded a mean CWA 6.4 percentage points below students endorsing none or one, and this difference is statistically significant ($p < .001$).

Three qualifications are integral to these findings rather than appended to them. The design is cross-sectional, so no causal ordering is established. Economic adversity and high ACE burden overlap substantially, so their contributions cannot be cleanly separated; the moderated model reported in Section 4 could not be estimated, and that non-estimability is a consequence of the overlap rather than an independent finding. In addition, the association with CWA is of moderate magnitude, accounting for a

minority of variance in academic performance, which is consistent with childhood adversity being one contributor among many.

In contrast to Muwanguzi et al. (2023), who found no association between cumulative ACE score and academic performance among Ugandan undergraduates, the present finding of a significant negative association with CWA is notable. The most economical explanation for the divergence is measurement: that study used a single self-rated performance item, whereas the present study used the institutional performance metric. This suggests that null findings in this literature may partly reflect outcome measurement, and that studies using institutional records are needed before the ACE-attainment relationship in African universities is treated as settled either way.

What the Qualitative Data Suggest

The interview data support a narrower, distinct set of claims. Participants describe attending school hungry; they describe difficulty concentrating on those occasions; they describe having interpreted that difficulty as evidence of limited intellectual capacity; and they report that this interpretation persisted into university. Participants also describe contemporaneous food deprivation at university arising from three distinct routes-material constraint, distress-related withdrawal, and anxiety-induced appetite suppression - and describe presenting none of them to the institution.

These are accounts, and their evidentiary status is that of accounts. They establish that this interpretive structure exists among students in this population and that participants themselves connect childhood hunger to their academic self-assessment. They do not establish that the interpretation is accurate, that the concentration difficulties were in fact caused by hunger, or that the resulting self-concept caused any part of the measured CWA gap. The sample was purposively selected for high ACE burden, so the prevalence of this interpretive structure in the wider student body cannot be estimated from these data.

What Remains a Theoretical Proposition

The cognitive misattribution pathway itself-the proposition that childhood food insecurity produces concentration deficits which, in communities where food insecurity is normalised, are attributed to stable intellectual inadequacy, and that this attribution persists as a self-limiting academic self-concept measurably affecting later performance-is not demonstrated by either strand of this study. It is a proposition constructed from three components: an established physiological mechanism (Gailliot & Baumeister, 2007), an established attributional theory (Weiner, 1985), and participants' accounts consistent with both. Its persistence over time, its causal contribution to the observed CWA gap, and its amenability to correction are all untested.

Stating this plainly is not a concession but a specification of what would test it. A direct test requires, at minimum, a validated measure of academic self-concept administered alongside a food security instrument and an institutional performance record, with a mediation analysis to determine whether self-concept accounts for any part of the food insecurity-performance association. A stronger test requires longitudinal data that track the attribution from secondary school to university. A test of correctability requires a controlled psychoeducational intervention with academic self-concept as the outcome. The proposition's value at this stage lies in being specified precisely enough to be tested and, if wrong, disconfirmed.

What can be said is that the proposition is distinguishable from adjacent accounts. Unlike Bandura's (1997) self-efficacy theory, it locates the origin of the low efficacy belief in a physiological event misread as a dispositional one. Unlike Steele's (1997) stereotype threat, it requires no salient group stereotype, only the absence of an alternative explanation. And unlike Goffman's (1963) stigma theory, the normalisation of food insecurity in the community removes rather than supplies the comparative frame that would make the deprivation visible as deprivation. If the pathway operates at the level of appraisal rather than neurobiology, it should in principle be more amenable to intervention than the neurobiological mechanisms documented by McEwen (2008) and Shonkoff et al. (2012)-a difference in tractability that is the practical reason for pursuing the proposition, and one that is itself testable.

The Ecological Specificity of the Mining-Community Context

Household livelihoods in the Tarkwa-Nsuaem Municipality depend heavily on the ASM chain and are structurally exposed to its volatility (Baah-Ennumh & Forson, 2017; Baah-Ennumh et al., 2020). If food adequacy in such households tracks that volatility, the resulting food insecurity would be neither episodic nor chronic in the forms that student welfare provision typically anticipates, but cyclical and externally driven.

Participants described this transmission directly, and with more specificity than the published literature offers. P11, asked about his childhood household, set out the full sequence unprompted:

"My father worked irregular hours. When he had work things were okay. When the gold price dropped or there was conflict at the site, we felt it immediately at home. Soup with no fish. School fees you couldn't pay on time" (P11).

The account names each link in the chain: a commodity price movement or a site disruption, an immediate contraction in household income, and two specific consequences-a reduction in the protein content of a meal, and school fees in arrears. The word doing the most work is "immediately", which is the claim about transmission speed that the earlier draft of this article asserted without support and that no published source establishes. It remains an account rather than a measurement and cannot demonstrate the mechanism. What it does establish is that students in this population understand their childhood nutritional adequacy as keyed to the mining economy rather than to household mismanagement-which is precisely the ecological understanding that the misattribution described in Section 4 forecloses at the moment of academic difficulty. Later in the same interview, the same participant identified the absence of that understanding in others as his reason for not approaching the counselling service. There is, he said, a difference between knowing the theory and knowing what it feels like when the soup has no fish because the gold price dropped.

The distinction has practical consequences: hardship funds designed around discrete crisis events and food banks designed around sustained need may both be poorly matched to a population whose experience of insufficiency is recurrent, expected, and therefore normalised. The present data are consistent with this reading but do not establish it, since neither household income nor food security was measured; the argument is advanced as a hypothesis warranting direct study rather than as a finding.

Implications for Educational Management

Four implications follow, each keyed to the level of evidence supporting it. First, and following directly from the prevalence findings, Ghanaian universities should assess students' current food security status using a validated instrument calibrated for a resident student population. No such instrument has been validated in the Ghanaian university context, and its development is a prerequisite for evidence-based provision rather than an optional refinement.

Second, and building on the qualitative accounts, psychoeducation on the cognitive effects of hunger should be integrated into academic orientation and advising. The rationale is modest and specific: students who have an alternative explanation available are better placed to interpret episodic academic difficulty accurately. This is a low-cost intervention requiring no additional infrastructure, and its effect on academic self-concept is an empirical question that its implementation would allow to be answered.

The parent study's qualitative corpus contains one account that bears directly on whether such provision could work. P15, a Year Three student, described acquiring a vocabulary for adversity through a psychology elective taken in Year Two:

"The lecturer was explaining trauma and the body. I thought: I know this. I have been living this. And for the first time I had language for it. I stopped thinking there was something wrong with me and started thinking something happened to me. Those are different things" (P15).

The distinction P15 draws-between something being wrong with her and something having happened to her-is the misattribution described in this article, stated by a participant and reported by her as revised. The mechanism of revision was ordinary curricular exposure rather than counselling or hardship provision. This is a single account from a purposively selected participant and cannot demonstrate that psychoeducation corrects the attribution at scale, nor that any such correction affects academic performance. It does, however, move the recommendation from pure inference to a proposal with at least one instance of the predicted effect, and it indicates the form a trial should take: curricular delivery to a whole cohort, with academic self-concept measured before and after.

Third, and following from P03's and P04's accounts in particular, institutional outreach must be proactive rather than responsive. Emergency hardship provision is structurally insufficient where the students most in need have narrativised their deprivation as strategy or concealed it entirely, since such students do not present. Detection mechanisms that do not depend on self-identification-routine screening at registration, for instance-are indicated.

Fourth, and following from the CWA gap, assessment practice should be understood as an equity question. Where adversity-related academic difficulty is not distinguishable in the record from academic incapacity, assessment systematically misattributes the former as the latter. This is the institutional analogue of the misattribution described at the individual level in the article, and it is the more tractable of the two.

Limitations

Several limitations require acknowledgement beyond those already integrated above. The parent study was cross-sectional, precluding causal inference. Childhood food insecurity was measured using items

embedded in a broader ACE instrument rather than a dedicated food security scale; a validated scale would yield more precise prevalence estimates and permit dose-response analysis. The absence of such a scale is the single most consequential measurement limitation of this study. Both childhood adversity and CWA were self-reported, introducing recall bias for the former and potential inaccuracy for the latter. However, the salience of CWA as the primary institutional metric in Ghanaian universities makes substantial error unlikely. The single-site design constrains transferability, though the ecological specificity of Tarkwa-Nsuaem is analytically productive for the questions asked. The qualitative sample of 23, purposively selected for high ACE burden, was sufficient for the analytic purpose but cannot represent the range of food insecurity experience across UMaT's student body.

A further consequence of normalised adversity, documented in the parent study's qualitative phase, is that participants who regard deprivation as the ordinary condition of their social world may systematically underreport on instruments that presuppose deviation from a non-adverse baseline, which means the prevalence figures reported here are likely to be conservative. Finally, the research team's institutional embeddedness within the Counselling and Student Support Unit may have shaped what participants chose to disclose, notwithstanding the mitigation described in Section 3; this was a live dynamic rather than a theoretical risk, with several participants challenging the feasibility of the role separation directly during their interviews.

5.0 CONCLUSION AND RECOMMENDATIONS

Conclusion: This article has examined the association between childhood economic adversity, food insecurity, and academic outcomes among undergraduate students at UMaT, Ghana. Therefore, the study concludes that economic hardship and poverty-related neglect are among the most prevalent forms of adversity in this population. This was endorsed by 63.1 per cent of the participants, and its co-occurrence with a high ACE burden and a burden of 11 or more adversity types is associated with a 6.4 percentage-point deficit in the cumulative weighted average relative to students endorsing none or one.

Recommendations: The study proposes that, on the cognitive misattribution pathway, childhood food insecurity generates concentration deficits which children, lacking any alternative explanatory framework, attribute to personal cognitive inadequacy, and that this attribution persists as a self-limiting academic self-concept. The qualitative accounts reported here are consistent with that proposition and show the attributional structure being reproduced at university, where deprivation is rationalised as strategy and remains invisible to institutional monitoring. The proposition is not thereby demonstrated, and Section 5 specifies what would demonstrate or disconfirm it.

If the pathway operates as proposed, it is correctable because an attribution can be revised, whereas a physiological alteration cannot. Revision requires that an alternative explanation be available, and the accounts reported here indicate that for these students it was not. Making it available is a low-cost institutional act. Establishing whether doing so changes anything is the research task this article sets.

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