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Poverty trajectories and child and mother well-being outcomes in Ireland: findings from an Irish prospective cohort

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► Additional supplemental material is published online only. To view, please visit the journal online (https://doi.org/10.1136/jech-2023-221794).

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Received 8 December 2023
Accepted 22 April 2024
Published Online First 30 April 2024

To cite: JO Driscoll D, Kiely E, O'Keeffe LM, *et al*. *J Epidemiol Community Health* 2024;**78**:409–416.

ABSTRACT

Background Poverty is associated with poor outcomes, yet exposure to distinct poverty trajectories in early childhood is not well understood.

Objective To understand the prevalence of different trajectories of household poverty and their association with mid-childhood and mother indicators of physical health and psychopathology in Ireland.

Methods We used a nationally representative, prospective cohort (Growing Up in Ireland–Infant Cohort). Household poverty included lowest third income decile, subjective poverty and material deprivation when children were aged 9 months, and 3, 5, 9 years. We used group-based multitrajectory cluster modelling to classify trajectories of poverty. Using multivariable logistic regression, adjusted with separate child and mother confounders, we assessed the association of poverty trajectories from 9 months to 9 years with child outcomes (overweight, any longstanding illness and psychopathology) at age 9 years and the same poverty trajectories over the same 9-year period with mother outcomes (overweight, any longstanding illness and depression).

Results Of 11 134 participants, 4 trajectories were identified: never in poverty (43.1%), material/subjective>monetary poverty (16.1%), monetary>material poverty (25.6%) and persistent poverty (15.2%). Children in persistent poverty compared with those in never in poverty experienced higher odds of being overweight at 9 years (adjusted OR (aOR) 1.70, 95% CI 1.34, 2.16), having a longstanding illness (aOR 1.51, 95% CI 1.20, 1.91), and psychopathology (aOR 2.06, 95% CI 1.42, 2.99). The outcomes for primary parents (99.7% were mothers) were as follows: having higher odds of being overweight (aOR 1.49, 95% CI 1.16, 1.92), having a longstanding illness (aOR 2.13, 95% CI 1.63, 2.79), and depression (aOR 3.54, 95% CI 2.54, 4.94).

Conclusions Any poverty trajectory was associated with poorer psychopathology and physical well-being in late childhood for children and their mothers in Ireland.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Poverty is understood as having both objective (eg, low household income) and subjective dimensions (eg, perception of being poor relative to others, poverty-related anxiety). Evidence highlights the association between child poverty exposure and child and mother well-being outcomes.

WHAT THIS STUDY ADDS

⇒ Our study examined predicted trajectories of multidimensional poverty and child and mother outcomes using a large national cohort. We identified that experiencing any poverty trajectory in childhood had higher odds of being associated with poor well-being outcomes.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study highlights the need for strategies to ameliorate any poverty exposure as all poverty trajectories resulted in poorer well-being outcomes. Strategies should be considered to ameliorate any poverty exposure in early childhood (eg, school-based resourcing).

INTRODUCTION

Adverse childhood experiences (ACEs) are a public health concern.[1] Early-life experience of ACEs (eg, violence, abuse, neglect) are associated with poorer child outcomes (eg, education attainment, mental and physical ill-health).[2] Poverty is an ACE and there is growing evidence that children in poverty also experience other clustered childhood adversities.[3] Moreover, children in poverty may experience adverse outcomes in childhood and during the life course into adulthood.[4]

Any investigation of poverty and health outcome must be interpreted with caution due to the complexity in terms of causality, especially when investigating a longitudinal association. In particular, this is due to the changing mediators that may influence a household's poverty status over time (eg, change of occupation, moving location, change of household composition, mental health of main income provider, etc).

It is challenging to determine the potential causal mechanisms that allow us to understand how poverty adversity may be associated with child and parent outcomes. In the literature, there is an acknowledgement that there may be direct (eg, lack of housing or access to healthcare) and indirect effects (eg, parental stress).[5 6] Children or adults who experience poverty may have lower educational attainment with different social implications (eg, lower employment achievement, low income). Children who experience poverty may have a higher likelihood of having low birth weight or being exposed to smoking during gestation with resultant risk of later-life health conditions (eg, high

blood pressure, cardiovascular disease, being overweight).[7–9] Lone-parent families and households with a high child-to-parent ratio are associated with a higher risk of being in poverty. Moreover, households experiencing poverty may reside in areas of geographical deprivation where there may be a lack of resources to target criminality or substance misuse, which in turn, may result in higher socioemotional stress for children and their parents.[10 11]

Poverty is often assessed using monetary metrics (eg, <60% median income).[12–14] Yet, poverty is challenging to define, conceptualise and measure, especially in a high-income country.[15–17] Hence, there is a need for a broader definition encompassing a multidimensional approach to poverty in public health research and health outcomes.[18] Poverty may also be subjectively experienced or it may be a measure of inability to afford items that in turn contribute to material deprivation. It is unclear from a trajectory perspective if certain children are experiencing different types of poverty trajectories (eg, subjective, material, monetary or persistent poverty) and whether there are differences in outcomes in later childhood. Group-based multitrajectory modelling has been used to identify such trajectories, yet there is a need to use a broadened definition of child poverty in the literature.[3 13] By isolating clusters of children who share common trajectories of poverty across childhood, we may be able to target them more effectively for developmentally appropriate public policy interventions.[19]

A public policy initiative to ameliorate the impact of educational inequality for children in families from lower socioeconomic backgrounds has been in place in Ireland since 2005 called the Delivering Equality of Opportunity in Schools (DEIS) Programme.[20–22] It provides additional support to schools that are located in areas of deprivation. This support is in the form of grant aids, funding, staffing, home schooling community liaison services, a school meal programme, priority access to professional development support and a school completion programme designed to discourage early school leaving. There is a need to understand if a poverty trajectory outcome has different stratification by DEIS school attendance for both a child and/or their parents. An educational system has a broader responsibility to offset the effects of poverty to improve child and parent outcomes (eg, emotional well-being).

We hypothesise that children in a high-income country (eg, Ireland) experience distinct trajectory clusters of household poverty during the first 9 years of childhood and that these trajectories are associated with child and mother health outcomes. Moreover, that attendance at a DEIS school may change this association.

Using a nationally representative prospective cohort, we identified trajectories of multidimensional household poverty during the childhood life course. We then examined the association between these trajectories from 9 months to 9 years of age and (1) child outcomes at 9 years of age (psychopathology, overweight and longstanding illness), (2) parent (mother) outcomes (mean (SD) age was 41.1 (5.3) years) after 9 years when their child is 9 years of age (depression, overweight and longstanding illness), and (3) child sex and attendance at a resourced school (eg, DEIS) for families experiencing poverty by stratification analysis.

METHODS

Data

Data were used from the Infant Cohort as part of the Growing Up in Ireland (GUI) Study.[23 24] The Infant Cohort is estimated to represent one in nine children born in 2008 in Ireland (n=11, 194). Using the National Child Benefit Register as a sampling frame, the Infant Cohort was recruited in 2008 (at 9 months (n=11 134)) and followed up at 3 (n=9793), 5 (n=9001) and 9 (n=8032) years of age. Data at 7 years of age were excluded in this study as they were a postal questionnaire instead of an in-person interview and they did not contain the relevant exposure variables. The primary caregivers (PCGs) (referred to as mothers now as the cohort at 9 months and 9 years was primarily mother (>99.7%)) were interviewed face-to-face using computer-aided personal interviewing by trained interviewers. Quail *et al* provide a detailed description of the study procedure.[23 24] The teacher of each child participant was interviewed at 5 years and 9 years of age in the Infant Cohort.

Household poverty exposure trajectories

Using a similar approach to a GUI report, the inputs to compute predicted household poverty exposure trajectories included three components (monetary poverty, subjective sense of poverty and material poverty) from each wave of the Infant Cohort (age 9 months, 3, 5, 9 years). More information is available in online supplemental figure 1 and online supplemental table 1.[25]

Child outcomes at 9 years of age

Strengths and Difficulties Questionnaire

The Strengths and Difficulties Questionnaire (SDQ) was devised to identify emotional difficulties, hyperactivity, conduct behaviour, peer problems and prosocial issues in children.[26] Each question item has a 3-point scale: 'not true', 'somewhat true' or 'certainly true', and each subscale has a total score (0–10). The SDQ has been validated in many jurisdictions.[27 28] The SDQ has strong psychometric properties and is used in many longitudinal cohorts.[29–31] We were interested in total difficulties scores (psychopathology). We categorised the continuous scale into a binary variable (≥17). The mother and teacher completed the SDQ at 9 years of age.

Body mass index

An interviewer measured the weight and height of each child at 9 years of age to derive body mass index (BMI). A Leicester portable height measure was used to obtain height (to the nearest mm). A SECA 761 flat mechanical scale (class IIII medically approved scale) was used to obtain weight (to the nearest kg). BMI=weight (kg)/height^2 (m) was categorised based on international guidelines as per the WHO (normal <25, overweight 25–30 and obesity >30).[32] A score of overweight or obese was categorised as overweight for poor health outcome.

Longstanding illness

At 9 years of age, a mother was asked if their child had 'any ongoing chronic physical or mental health problem, illness or disability'. A 'yes' response indicated a poor health outcome.

Mother outcomes after 9 years when their child was 9 years of age (mother mean (SD) age was 41.1 (5.3) years)

Centre for Epidemiological Studies Depression Scale (eight items)

The eight-item Centre for Epidemiological Studies Depression Scale (CESD-8) is a shorter version of the widely used self-report (CES-D) screen tool for depression.[33] It has been shown to discriminate children and adults with depressive disorder. The CESD-8 is highly correlated with the full version that has 20 items (r=0.93). Participants are asked eight questions and

a composite score ≥7 indicates a depressive score (see online supplemental table 2 for CESD-8 questions).

Body mass index

Similar to child BMI outcome method, a mother's BMI was measured.

Longstanding illness

A mother was asked about themselves if they had 'any ongoing chronic physical or mental health problem, illness or disability'. A 'yes' response indicated a poor health outcome.

Potential confounders

Each potential confounder was measured prior to poverty trajectory exposure. Additional information is available in the online supplemental material and illustrated in two directed acyclic graphs (online supplemental figure 3 (child outcomes) and online supplemental figure 4 (mother outcomes)).

Statistical analysis

Group-based trajectory

The optimal number of trajectory group members was determined by estimating models with increasing latent class trajectories (group-based modelling of longitudinal data).[34] A description of the group-based trajectory method is available in the online supplemental material and includes adequacy, selection, probability and classification of model.[34–36] We tabulated model selection results and model adequacy for transparency. This analysis was performed using the Stata TRAJ package. Full-information maximum likelihood was used to account for missing data and longitudinal weights were used to account for representative bias and attrition.

Primary analyses

We described the characteristics of the cohort participants across poverty trajectories. The association between poverty trajectories and child/mother outcomes was examined using multivariable logistic regression and presented as ORs with 95% CIs. Unadjusted and adjusted models were reported.

Sensitivity analyses

We described in tabulation form input exposure variables and group-based trajectory subgroups to illustrate construct validity. We repeated our main analysis and examined if the effect of a poverty trajectory differs by DEIS school attendance (ie, extra resourced school (DEIS) in an area of deprivation) in child and mother outcomes. We repeated our main analysis and examined if the effect of poverty trajectory differs by child sex in child and mother outcomes. To assess robustness of results, we repeated the main analysis using multiple imputation chained equation (25 imputed datasets with results pooled using Rubin's rules), and imputed the missing child and mother outcomes. As the outcomes investigated are common health outcomes, we ran a sensitivity analysis by reporting the incidence risk ratio for child and mother outcomes using Poisson regression. We repeated our main results for child outcomes adjusting only for maternal age, maternal education and birth weight to investigate if some confounders were also potential mediators of the association.[37] All data analysis was carried out using the statistical software package Stata (V.18).

RESULTS

Poverty trajectories and demographics of Infant Cohort

A total of 11 134 participants (table 1) were included in the group-based trajectory analysis provided that input poverty exposures (table 2) were present in at least one wave and model entropy (online supplemental table 3), group membership (online supplemental table 4) and breakdown (online supplemental table 5). Four poverty trajectory clusters were identified: never in poverty (n=4804, 43.1%), vulnerable to poverty group 1 (n=1791, 16.1%), vulnerable to poverty group 2 (n=2851, 25.6%) and persistent poverty (n=1688, 15.2%) (table 1). Vulnerable to poverty group 1 had moderate subjective/material poverty and low monetary poverty (online supplemental figure 2). Vulnerable to poverty group 2 had both moderate perceived/material and monetary poverty (online supplemental figure 2). There was relatively equal male-to-female children, and most PCGs at 9 months were a parent and female indicating mothers (table 1). The persistent poverty group compared with never in poverty group had fewer mothers with a degree (n=224, 13.3%), lower home ownership (n=578, 34.2%), more one-parent households with 2+ children (n=342, 20.3%) and higher never worked status at all family social class (n=619, 36.7%).

Primary analyses

Child outcomes

Table 3, figure 1 and online supplemental figure 5 show the association of identified poverty trajectories and child outcomes at 9 years of age. In adjusted analysis, persistent poverty, compared with those never in poverty, was associated with higher odds (adjusted OR (aOR)) of psychopathology reported by mothers (aOR 2.06; 95% CI 1.42, 2.99) and teachers (aOR 1.99; 95% CI 1.50, 2.64), and higher odds of physical health problems (being overweight) (aOR 1.70; 95% CI 1.24, 2.16) or higher odds of having a longstanding health condition (aOR 1.51; 95% CI 1.20, 1.91). Vulnerable to poverty group 2 in comparison with never in poverty had lower odds of mother-reported (aOR 1.51; 95% CI 1.07, 2.12) and higher odds of teacher-reported (aOR 1.47; 95% CI 1.15, 1.88) psychopathology.

Mother outcomes

Table 4, figure 1 and online supplemental figure 6 show the association of identified poverty trajectories and mother outcomes when the child is 9 years of age. In adjusted analysis, persistent poverty, compared with those never in poverty, was associated with higher odds of raised depression scores (aOR 3.54, 95% CI 2.54, 4.94), of being overweight (aOR 1.49, 95% CI 1.16, 1.92) and of having a longstanding health condition (aOR 2.13, 95% CI 1.63, 2.79). Vulnerable to poverty group 1 in comparison with never in poverty had higher odds of raised depression scores (aOR 2.01, 95% CI 1.51 2.67), of being overweight (aOR 1.23, 95% CI 1.5, 2.17) and of having a longstanding health condition (aOR 1.60, 95% CI 1.31, 1.95).

Subgroup analyses

Attendance at an extra resourced school (DEIS) in an area of deprivation with child and mother outcomes

Children identified as being in persistent poverty and attend a DEIS school (extra resourced school (DEIS) in an area of deprivation) had attenuation of the odds of parent-reported (aOR 1.66, 95% CI 0.72, 3.81) or teacher-reported (aOR 1.78, 95% CI 0.91, 3.46) psychopathology, odds of being overweight (aOR 1.38, 95% CI 0.80, 2.41) or having a longstanding illness (aOR 0.95, 95% CI 0.56, 1.62) compared with children who attend a non-DEIS school

Table 1 Study description of poverty dynamic exposures and outcomes in the Irish Growing Up in Ireland Study–Infant Cohort up to age 9 years (wave 5)

	Never in poverty	Vulnerable to poverty 1*	Vulnerable to poverty 2†	Persistent poverty
	(n=4804)	(n=1791)	(n=2851)	(n=1688)
	n (%)	n (%)	n (%)	n (%)
Child covariates				
Gender (female)	2324 (48.4)	893 (49.9)	1422 (49.9)	816 (48.3)
Relationship to PCG (parent)	4804 (100)	1790 (99.9)	2851 (100)	1687 (99.9)
Low birth weight <2500 grams	253 (5.3)	98 (5.5)	187 (6.6)	134 (7.9)
Preterm <37 weeks	287 (6)	106 (5.9)	200 (7)	144 (8.5)
Extra resourced school (DEIS) in an area of deprivation	328 (6.8)	200 (11.2)	424 (14.9)	295 (17.5)
PCG covariates at 9 months				
Gender (female)	4784 (99.6)	1786 (99.7)	2846 (99.8)	1680 (99.5)
PCG age categories				
Less than 26 years	359 (7.5)	226 (12.6)	906 (31.8)	509 (30.2)
27–30 years	918 (19.1)	352 (19.7)	631 (22.1)	372 (22)
31–35 years	2063 (42.9)	711 (39.7)	748 (26.2)	431 (25.5)
36–39 years	1143 (23.8)	360 (20.1)	412 (14.5)	263 (15.6)
40+	321 (6.7)	142 (7.9)	154 (5.4)	113 (6.7)
Degree—yes	2507 (52.2)	745 (41.6)	555 (19.5)	224 (13.3)
Chronic health problem—yes	415 (8.6)	260 (14.5)	289 (10.1)	306 (18.1)
Raised depression score—yes	30 (0.6)	38 (2.1)	42 (1.5)	72 (4.3)
Overweight—yes	1887 (39.3)	796 (44.4)	1277 (44.8)	868 (51.4)
Household covariates at 9 months				
House owner (with or without mortgage)	4085 (85)	1403 (78.3)	1339 (47)	578 (34.2)
Family social class				
Professional/managerial	3471 (72.3)	1032 (57.6)	672 (23.6)	251 (14.9)
Other non-manual/skilled manual	1066 (22.2)	582 (32.5)	1195 (41.9)	528 (31.3)
Semiskilled/unskilled manual	214 (4.5)	130 (7.3)	442 (15.5)	290 (17.2)
Never worked at all	53 (1.1)	47 (2.6)	542 (19)	619 (36.7)
Equivalised household income				
4th–10th decile	4311 (89.7)	1578 (88.1)	820 (28.8)	351 (20.8)
1st–3rd decile	130 (2.7)	97 (5.4)	1782 (62.5)	1201 (71.1)
4-category household type				
One parent+1 child	69 (1.4)	74 (4.1)	276 (9.7)	171 (10.1)
One parent+>2 children	46 (1)	42 (2.3)	339 (11.9)	342 (20.3)
Two parents+1 child	2054 (42.8)	663 (37)	700 (24.6)	277 (16.4)
Two parents+>2 children	2635 (54.9)	1012 (56.5)	1536 (53.9)	898 (53.2)
Child outcomes at age 9				
Overweight	581 (12.1)	305 (17)	451 (15.8)	320 (19)
Longstanding illness	710 (14.8)	355 (19.8)	441 (15.5)	303 (18)
Total SDQ Difficulties‡—teacher	334 (7)	166 (9.3)	302 (10.6)	246 (14.6)
Total SDQ Difficulties‡—parent	130 (2.7)	107 (6)	158 (5.5)	147 (8.7)
Mother outcomes at age 9				
Raised depression score (>17 score)	168 (3.5)	147 (8.2)	182 (6.4)	215 (12.7)
Longstanding illness	481 (10)	333 (18.6)	364 (12.8)	326 (19.3)
Overweight	1515 (31.5)	702 (39.2)	911 (32)	608 (36)

*Vulnerable to poverty 1: material>income.
†Vulnerable to poverty 2: income>material.
‡SDQ >17 score indicates high risk.
DEIS, Delivering Equality of Opportunity in Schools; PCG, primary caregiver; SDQ, Strengths and Difficulties Questionnaire.

(parent-reported (aOR 1.76, 95% CI 1.10, 2.83) or teacher-reported (aOR 1.93, 95% CI 1.38, 2.70) psychopathology, being overweight (aOR 1.78, 95% CI 1.33, 2.36) and having a longstanding illness (aOR 1.67, 95% CI 1.26, 2.21)) (online supplemental table 6). Mothers in persistent poverty and their child attending a DEIS school had attenuation of the odds of having raised depression scores (aOR 2.60, 95% CI 1.20, 5.66) and being overweight (aOR 1.19, 95% CI 0.66, 2.13), in comparison with their child attending a non-DEIS school (raised depression scores (aOR 3.53, 95% CI 2.39, 5.21) and being overweight (aOR 1.45, 95% CI 1.09, 1.94)) (online supplemental table 7).

Child sex with child and mother outcomes

Female children identified as living in a persistent poverty trajectory had higher odds of psychopathology scores (aOR 2.22,

Table 2	Description of household poverty exposure variables
Monetary poverty	The monetary poverty variable obtained by parental interview included the three lowest deciles of household equivalised income (computed as three binary dummy variables).
Subjective sense of poverty	For the subjective sense of poverty, participants were asked 'concerning your household's total monthly or weekly income, with which degree of ease or difficulty is the household able to make ends meet?'. If a participant responded with great difficulty or difficulty, they were coded as having a high subjective sense of poverty.
Material poverty	For material poverty, participants were asked questions about household deprivation and could indicate three options in response to having a household item 'yes', or 'no', 'can't afford or no, other reason'. See online supplemental table 1 for material deprivation index survey questions. A total score was obtained of items to compute a material deprivation index. For group-based trajectory analysis, material deprivation was grouped into six categories of scores (0-1, 2, 3, 4, 5, 6+ score).

95% CI 1.2, 4.07) compared with boys (aOR 1.97, 95% CI 1.23, 3.15) (online supplemental table 8). Mothers with male children living in a persistent poverty trajectory had higher odds of raised depression scores (aOR 4.15, 95% CI 2.57, 6.69) and lower odds of being overweight (aOR 1.33, 95% CI 0.95, 1.87), compared with mothers with female children (raised depression scores (aOR 3.02, 95% CI 1.88, 4.83), being overweight (aOR 1.71, 95% CI 1.21, 2.43)) (online supplemental table 9).

Sensitivity analyses

The sensitivity analysis using imputed data showed similar patterns of associations as the main analysis (online supplemental tables 10 and 11). We continued to report ORs, as the incidence risk ratios of child and mother outcomes were marginally lower than reported ORs (online supplemental tables 12 and 13). Results from our sensitivity analysis adjusting only for maternal education, maternal age and child birth weight are comparable with our main analysis, which adjusted for all confounders. For persistent poverty and child psychopathology, there were some differences in the magnitude of the estimate but not the direction of the estimate comparing our fully adjusted model (aOR 2.06, 95% CI 1.52, 2.99) with the sensitivity analysis with more limited adjustment for confounders (aOR 3.31, 95% CI 2.42, 4.52) (online supplemental table 14).

DISCUSSION

To our knowledge, this is the first study to assess clustering of trajectories of multidimensional aspects of poverty from 9 months to 9 years and their association with child and mother outcomes using a large prospective representative Irish sample. We show that children who experience some trajectory of poverty have higher odds of being overweight, of having a longstanding illness and of having higher psychopathology scores by age 9 years. Similarly, mothers who experience some trajectory of poverty had higher odds of depression, being overweight and having a longstanding illness. Over 15% of children in our study had experienced a persistent poverty trajectory from 9 months to 9 years of age. Positively, children living in a household experiencing poverty who attended a DEIS school (extra resourced school in an area of deprivation) had lower odds of child and mother mental and physical health problems in comparison with children who did not attend a DEIS school.

We identified four distinct trajectories of poverty during childhood and found that any poverty trajectory was associated with increased risk of poor childhood outcome at 9 years of age. Similar to previous research, we showed that the persistent poverty trajectory is associated with worse outcomes in mid-childhood.[3 13] We illustrate a lower OR in our associations than previously published studies. This may be related to country differences and due to our approach to adjusting for potential confounders. Uniquely, we highlight that higher material poverty than monetary poverty is still associated with worse outcomes and that the additive monetary poverty appears to be cumulative with higher odds of poor mental and physical outcomes.

The most important finding of our study is that children and mothers experiencing any poverty trajectory have poorer outcomes, with persistent poverty having the worse outcomes in comparison with households never in poverty. From early childhood into adolescence is a critical time period for development, especially the development of mental disorders that may peak during adolescence, hence, the importance of focused policies that aim to intervene at not just the individual level but system

Table 3 Association of predicted poverty trajectories from 9 months to 9 years and child outcomes at 9 years using the Irish Growing Up in Ireland–Infant Cohort

		Vulnerable to poverty 1 (n=1791)		Vulnerable to poverty 2 (n=2851)		Persistent poverty (n=1688)	
	Never in poverty (n=4804)	OR	CI	OR	CI	OR	CI
Total SDQ Difficulties—parent							
UA	Ref	2.36	1.71, 3.26	2.47	1.85, 3.30	4.37	3.23, 5.92
A		2.00	1.45, 2.76	1.51	1.07, 2.12	2.06	1.42, 2.99
Total SDQ Difficulties—teacher							
UA	Ref	1.31	1.03, 1.67	1.94	1.57, 2.39	3.37	2.68, 4.24
A		1.24	0.97, 1.59	1.47	0.15, 1.88	1.99	1.50, 2.64
BMI—overweight							
UA	Ref	1.29	1.07, 1.54	1.66	1.40, 1.97	2.33	1.91, 2.85
A		1.18	0.98, 1.43	1.33	1.09, 1.62	1.70	1.34, 2.16
Longstanding health condition							
UA	Ref	1.34	1.13, 1.59	1.17	0.99, 1.38	1.64	1.35, 1.99
A		1.31	1.10, 1.56	1.17	0.97, 1.41	1.51	1.20, 1.91

A=adjusted for mother age, education (degree or higher qualification or no degree), health status at 9 months (chronic illness, BMI), depression status at 9 months (raised depression score), home ownership, household social class and composition, child birth weight (<2500 g (ie, low birth weight) or >2500g) and pregnancy gestation (<37 (ie, preterm) or >37 weeks)).
A, adjusted model; BMI, body mass index; CI, 95% Confidence Interval; OR, Odds Ratio; Ref, reference group (never in poverty); SDQ, Strengths and Difficulties Questionnaire; UA, unadjusted model.

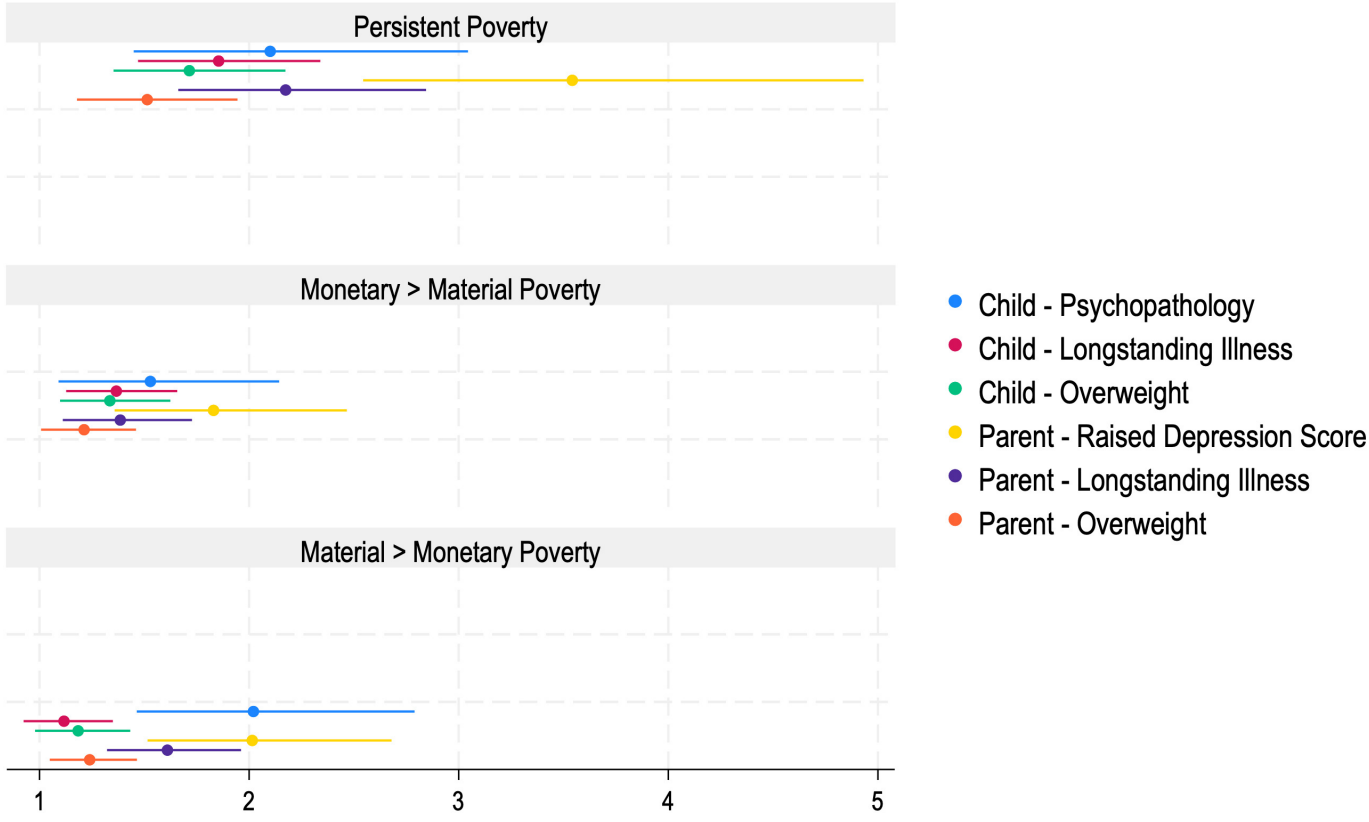

Figure 1 Association of poverty trajectories (persistent poverty, monetary>material poverty and material>monetary poverty) and child outcomes at 9 years of age (psychopathology measured by total difficulties by Strengths and Difficulties Questionnaire, having a longstanding illness and being overweight) and parent (mother) outcomes after 9 years (raised depression score, having a longstanding illness and being overweight). Child model adjusted for mother age, education (degree or higher qualification or no degree), health status at 9 months (chronic illness, BMI), depression status at 9 months (raised depression score), home ownership, household social class and composition, child birth weight (<2500 g (ie, low birth weight) or >2500 g) and pregnancy gestation (<37 (ie, preterm) or >37 weeks). Parent (mother) model adjusted for mother age, education (degree or higher qualification or no degree), health status when child 9 months (chronic illness, BMI), depression status when child 9 months (raised depression score), home ownership, household social class and composition. See online supplemental figures 5 and 6 for expanded figures including unadjusted and adjusted models. BMI, body mass index.

level (family, school). Strategies that target health outcomes (eg, mental health) without addressing child poverty will be challenged due to increased need for services arising out of rising incidence of poverty. In contrast, strategies that intervene at a system level (ie, school, community) to target or reach the individual level may have broader positive effects during the life course for many health outcomes.

Within the Irish context, there is evidence using the same cohort that high-income levels may be associated with better cognitive scores at 3 and 5 years of age.[38] Gibbons *et al* highlighted, using GUI data, that financial strain was associated with externalising difficulties in adolescents.[39] Similar to Sprong *et al*, we employed group-based multitrajectory modelling of household poverty using similar dimensions of poverty

Table 4 Association of predicted poverty trajectories and mother outcomes after 9 years using the Irish Growing Up in Ireland–Infant Cohort

		Vulnerable to poverty 1 (n=1791)		Vulnerable to poverty 2 (n=2851)		Persistent poverty (n=1688)	
	Never in poverty (n=4804)	OR	CI	OR	CI	OR	CI
Depression raised score							
UA	Ref	2.28	1.73, 2.99	2.47	1.89, 3.23	5.76	4.43, 7.49
A		2.01	1.51, 2.67	1.83	1.35, 2.47	3.54	2.54, 4.94
BMI—overweight							
UA	Ref	1.29	1.11, 1.51	1.42	1.22, 1.65	2.09	1.72, 2.54
A		1.23	1.04, 1.45	1.20	1.00, 1.45	1.49	1.16, 1.92
Longstanding health condition							
UA	Ref	1.81	1.50, 2.17	1.51	1.26, 1.82	2.92	2.39, 3.57
A		1.60	1.31, 1.95	1.37	1.10, 1.70	2.13	1.63, 2.79

A=adjusted for mother age, education (degree or higher qualification or no degree), health status at 9 months (chronic illness, BMI), depression status at 9 months (raised depression score), home ownership, household social class and composition.
A, adjusted model; BMI, body mass index; CI, 95% Confidence Interval; OR, Odds Ratio; Ref, reference group (never in poverty); UA, unadjusted model.

(ie, income, material deprivation and subjective poverty) except they used the Child Cohort (13–17/18 years) and did not longitudinally investigate child and parent outcomes.[40] Contrastingly, we were interested in early-life household poverty trajectories at key sensitive periods of development (ie, 9 months–9 years when children transition from living with family to preschool to their first formal education placement school). Moreover, the strengths of this study in comparison with existing GUI studies are that we categorised specific trajectories (eg, persistent poverty), performed robust confounding, addressed missingness and acknowledged within the context of ecosystems that investigating social exposures (ie, poverty) and child outcomes must be understood within the context of parent outcomes too.

Defining the correct measurement of poverty during the life course is subject to ongoing debate and may be dependent on country, regional area, social services availability and family factors. This means that there are no collectively agreed standard measures to facilitate comparability of findings. As authors, we argue for a multidimensional approach to measuring poverty in research that encompasses the material, monetary and subjective dimensions.

This study is the first to identify clustering of poverty trajectories across the early life course using a multidimensional poverty approach. While trajectories of a child's outcomes and poverty adversity may be connected during the life course, our approach takes into consideration a child's poverty adversity (ie, criterial developmental periods) over time. Poverty is an adversity, and emerging evidence suggests that multiple adversities may be synergistic.[3] As such, a public policy such as DEIS may be supporting households in poverty with funded support in education and have an unmeasured association with other adversities (eg, parental depression). Our study shows that mothers in any poverty trajectory have lower odds of depression and of being overweight if their child attends a DEIS school. DEIS schools' status in Ireland is dependent on the level of area of deprivation (based on national census data as represented by the Pobal HP Deprivation Index) in a geographical area and more recent models incorporate aspects of educational disadvantage and studies that represent members of the Travelling community or Roma community, experiencing homelessness or those in direct provision centres (eg, refugees) in Ireland. There is uneven provision of DEIS schools across Ireland, with a higher proportion of them in urban rather than rural areas. Better-off parents can enrol their children in a DEIS school for different reasons. We included covariates (eg, home ownership, household social class) in our model to appropriately adjust for varying household factors. In Ireland, parents make a decision as to what school their child enrols in and this decision may be influenced by many considerations including school reputation, convenience (eg, geographically close, reduced commute), judgement (eg, extra resources) and experience (eg, siblings or parents may have attended a particular school and want to continue the family tradition). As such, there is a bias in the form of non-random sampling in our study and our findings should be interpreted cautiously when being used as evidence for public policy interventions.

A main strength of the study is that we used a contemporary national representative Irish cohort that has generalisable properties to the Irish population and policy. We used a rigorous modelling technique to identify poverty trajectories that allowed clustering of at-risk poverty groups over time. This technique maximised the included sample size as it includes participants who have available data at a minimum of one time point. Our results were also similar when we did multiple imputation to account for missing data on outcomes.

Regardless of these strengths, this study must be understood with reference to the following limitations. First, there may be bias in the class estimates with outcomes and reduced SEs. This is due to the group-based trajectory modelling approach that assumes classes are independent and that all potential participants chart the same trajectory. Despite this, it is unlikely to influence the results as we were interested in the class membership and their association with outcomes rather than distinct shape of class of trajectory over time.

Second, the SDQ and CES-D outcomes are subjective measures. Both questionnaires have good correlation identifying at-risk participants.[28 31] Third, paternal outcomes were not investigated in this study and the authors are of the view this is a separate distinct study due to changes in secondary caregiver status, and the need for a separate conceptualising approach. Fourth, loss to follow in longitudinal studies may be higher in families with adversity and mental illness. Fifth, while our findings are similar to previous studies, we cannot state that particular poverty trajectories are causal of outcomes, and that there may be potential unmeasured confounding factors (eg, genetic risk factor). Sixth, while attendance at a DEIS school was associated with lower ORs of outcomes, our results warrant further large-scale studies to determine if DEIS school attendance with a randomised long-term follow-up has wider societal benefit, as DEIS school attendance may be a moderator and mediator concurrently. Finally, a potential limitation of our analysis is the measurement of some confounders at the time of exposure. Our goal was to estimate the total effect (via direct and indirect pathways) of poverty on child and parent outcomes. It is plausible that factors such as maternal depression in this context, given the timing of measurement, could be a potential mediator of the association of multidimensional household poverty and child/parent outcomes and that our main analysis inadvertently adjusts for mediators of the association. This presents two key issues including (a) attenuation of the total effect estimate given the adjustment for mediators of the association which account for the effect of poverty through those particular pathways, and (b) bias introduced by adjustment of mediators which may be colliders and introduce bias in associations reported. However, our sensitivity analysis adjusting only for maternal education, age and child birth weight was similar to our main analysis and this provides some reassurance that the confounders adjusted for in our main analysis (should they in fact be mediators) do not substantially influence the overall conclusions of the paper.

CONCLUSION

In this large prospective nationally representative cohort, we demonstrated that any predicted poverty trajectory was associated with adverse health outcomes at early childhood for children and their mothers. Moreover, policy initiatives to address educational disadvantage appeared to mitigate the effect of child poverty on both mother and child outcomes.

Acknowledgements We would like to thank the families who took part in the Growing Up in Ireland study, as well as the researchers and study personnel for of their hard work.

Contributors DOD—guarantor, conceptualisation, formal analysis, investigation, methodology, project administration, validation, writing (original draft preparation). EK—conceptualisation, methodology, investigation, project administration, supervision, visualisation, writing (review and editing). LMO'K—conceptualisation, methodology, formal analysis, investigation, project administration, supervision, visualisation, writing (review and editing). ASK—conceptualisation, methodology,

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Funding LMO'K is funded by a Health Research Board of Ireland Emerging Investigator Award (grant ref: EIA-FA-2019-007 SCaRLeT).

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval The authors received approval from the Central Statistics Office to use the AMF Infant Cohort dataset. The GUI Study received ethical approval from the Research Ethics Committee within the Irish Department of Health and Children, Ireland. All participants gave informed consent to enrol in the GUI Study. This study is in accordance with the ethical standards as per the Declaration of Helsinki (1964) and subsequent amendments. The present analyses did not require additional ethical approval.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available. The authors received approval from the Central Statistics Office to use the AMF Infant Cohort dataset.

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