Poverty and Early Childhood Outcomes

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abstract

BACKGROUND: Children born into poverty face many challenges. Exposure to poverty comes in different forms, and children may also transition into or out of poverty. In this study, we examine the relationships among various outcomes and different levels of poverty (household and/or neighborhood poverty) at different points during a child's first 5 years.

METHODS: We used linkable administrative databases, following 46 589 children born in Manitoba, Canada, between 2000 and 2009 to age 7. Poverty is defined as those receiving welfare and those living in low-income neighborhoods. Four outcomes are measured in the first 5 years (placement in out-of-home care, externalizing mental health diagnosis, asthma diagnosis, and hospitalization for injury), with school readiness assessed between ages 5 and 7.

RESULTS: Children born into poverty had greater odds of not being ready for school than children not born into poverty (adjusted odds ratio = 1.54, 1.59, 1.26 for children born in household and neighborhood poverty, household poverty only, and neighborhood poverty only, respectively; all significant at $P < .05$). Similar patterns were seen across outcomes. For those born into neighborhood poverty, the odds of school readiness were higher only if children moved before age 2.

CONCLUSIONS: The level of poverty (household or neighborhood) and its duration modify the relationship between early poverty and childhood outcomes. Covariate adjustment generally weakens but does not eliminate these relationships.

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WHAT'S KNOWN ON THIS SUBJECT: Past research revealed children born into poverty are less ready for school and have worse health and social outcomes. It is also known that moving out of poverty in childhood leads to better long-term outcomes.

WHAT THIS STUDY ADDS: Household poverty is associated with worse early childhood outcomes than neighborhood poverty. Links between school readiness and moving into or out of neighborhood poverty are only seen if moving happened before the child's second birthday.

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The early life course has been seen as of particular importance; children born into poverty face significant challenges.[1,2] Family difficulties are likely to result in poor educational, social, and health outcomes.[3,4] Poverty is associated with various factors leading to poor academic achievement, including atypical structural brain development,[5] limited language development,[6] and a greater likelihood of experiencing food insecurity.[7,8] Lack of school readiness predicts later cognitive problems and adult psychosocial adjustment.[9–11] Higher household family incomes and neighborhood socioeconomic status have been linked with greater school readiness in vocabulary, communication, numeracy knowledge, and attention.[12,13] Furthermore, poverty is associated with placement of children into out-of-home care.[14] Poverty may also lead to important problems, including externalizing mental conditions, asthma, and injuries resulting in hospitalization. Childhood attention-deficit/hyperactivity disorder and conduct disorder start early and predict disruptive behavior in later childhood and adolescence.[15–17]

The relationships among levels of poverty, timing and duration of poverty, and various types of behavior have been difficult to investigate.[18,19] Several American studies have suggested that both household and neighborhood poverty negatively affect longer-term educational achievement and social mobility. Poor neighborhoods can have multigenerational effects on residents' cognitive development,[20] whereas moving to a higher income neighborhood appears to generate beneficial long-term effects.[21] Population-level information from the Canadian province of Manitoba allows tracking individuals' poverty experiences from birth to compare children raised under different levels of poverty (household and neighborhood) with those experiencing more advantageous circumstances. By using these data, the following questions were examined: How are household and neighborhood-level poverty associated with early childhood outcomes (school readiness, externalizing mental health, asthma, injuries) differently? To what extent is transitioning out of (neighborhood and/or household) poverty associated with these outcomes? Does the timing of that move matter? Identifying how level of poverty at birth and the duration of poverty are linked to a range of early childhood outcomes can provide insight into who might benefit most from support and when that support should be provided.

METHODS

Setting and Data

Manitoba is reasonably representative of Canada as a whole, generally ranking in the midrange of a series of indicators of health status and health care expenditures.[22,23] In 2011, the provincial population was 1.2 million, with more than half (n = 730 018) living in Winnipeg, Canada's eighth largest metropolitan area.[24] Located near Canada's geographic center, Manitoba has a comparatively large aboriginal population (14%).[25] Manitobans score slightly below the national average on standardized educational tests administered internationally (although Canadians do somewhat better than Americans).[26] School readiness testing has shown ~30% of Manitoba's 5-year-olds to be vulnerable in at least 1 area of development; this exceeded the Canadian average of 26%.[27]

We used administrative data in the Population Research Data Repository housed at the Manitoba Centre for Health Policy. A scrambled personal health number allowed linking across multiple deidentified data sets; information on linkage methods, confidentiality and privacy, and validity is reviewed elsewhere.[28,29] Data from the population registry are combined with individual-level information from hospital discharge abstracts (containing International Classification of Diseases [ICD] diagnosis codes; *International Classification of Diseases, Ninth Revision, Clinical Modification* [ICD-9-CM] codes before April 1, 2004, and *International Classification of Diseases, 10th Revision, Canada* [ICD-10-CA] codes after April 1, 2004), physician visits (ICD-9-CM codes), the Early Development Instrument, Families First screens (filled in during routine home visits by Public Health Nurses for most births and include information on the mother's social circumstances), children in out-of-home care and families receiving protection services by Child and Family Services, monthly receipt of Employment and Income Assistance data (basically welfare), and the Canadian Census (neighborhood-level median income).

Ethics Approval

This study was approved by the University of Manitoba Health Research Ethics Board (H2016:182) and the Health Information Privacy Commission at Manitoba Health, Seniors and Active Living (2016/2017-09). Using deidentified administrative data files did not require participants' informed consent.

Poverty at Birth

Household poverty at birth is defined as a mother receiving Employment and Income Assistance (analogous to welfare) in the month of birth. Such assistance provides help to Manitobans having no other way to support themselves or their

families.[30] Living in a neighborhood with median income in the lowest quintile specifies neighborhood poverty. Neighborhoods have been ranked from 1 (lowest income) to 5 (highest income); created separately for rural and urban Manitoba, quintiles are based on census dissemination areas including ~400 individuals.[31]

Poverty at birth is described by using 4 categories: (1) both household and neighborhood poverty (receiving welfare and resided in the lowest income quintile neighborhood), (2) just household poverty (receiving welfare but resided in neighborhoods having higher median incomes: quintiles 2 through 5), (3) just neighborhood poverty (resided in the poorest neighborhoods but did not receive welfare), and (4) no poverty (living in neighborhoods having higher median incomes and not receiving welfare).

Cohort Formation

Because performance on the Early Development Instrument (generally administered biannually) is a primary outcome, cohort selection began with all children enrolled in kindergarten the year each Early Development Instrument was administered: 2005–2006, 2006–2007, 2008–2009, 2010–2011, 2012–2013, and 2014–2015. Of these 84 598 students, 65 895 (77.9%) had completed the Instrument. To ensure the completeness of early childhood information, we excluded children not living in Manitoba from birth to age 5, those missing key variables, and those not completing a Families First screen. The final cohort consisted of 46 589 children, of whom 11 619 (24.9%) were born in poverty (Su pplemental Fig 1).

Early Childhood Outcomes

We looked at school readiness and 4 other outcomes before age 5: placed in out-of-home care, externalizing mental conditions diagnosis, asthma diagnosis, and hospitalization for injury. The Early Development Instrument is used to assess each of 5 developmental domains when a child has enrolled in kindergarten: physical health and well-being, social competence, emotional maturity, language and cognitive development, and communication skills and general knowledge. This index has acceptable interrater reliability and high internal consistency.[32] A child is considered not ready for school if scoring in the lowest 10th percentile according to national norms in 1 or more developmental areas.[32,33]

Children in care have been removed from their original families because authorities have deemed their family unable or unfit to look after them properly. Placement in care of Child and Family Services for at least 1 day before age 5 indicated "placed in out-of-home care." Externalizing mental conditions, asthma, and hospitalization for injuries are key childhood conditions defined by using ICD codes (see Supplemental Table 6).[15]

Trajectories of Poverty

Trajectories into and out of different levels of poverty are examined before age 5, with changes classified as occurring before or after age 2. We defined 3 levels of poverty: household poverty, neighborhood poverty (but not household poverty), and no poverty. Four trajectories are examined: (1) born into household poverty and transitioned out of poverty; (2) born into neighborhood poverty and moved out of poverty; (3) not born into poverty and moved into neighborhood poverty; and (4) not born into poverty and transitioned into household poverty. Individuals not falling into 1 of the 4 trajectories were excluded. Supplemental Figure 2 presents these trajectories.

Covariates

Early childhood outcomes have been associated with both maternal and child characteristics.[34] We examined a series of maternal characteristics during pregnancy: whether she changed residence, received services from Child and Family Services, used drugs or alcohol, smoked, had a mood or anxiety disorder, or received inadequate prenatal care. A change in 6-digit postal code defined change of residence. The attention of Child and Family Services during pregnancy could mean several things: adolescent mothers may access expectant parent services during pregnancy; for older mothers, services could include protection or support intended to resolve family matters, including counseling, guidance, education, and emergency shelter services.[35,36] The Families First screen provided information on drug and/or alcohol use and on smoking during pregnancy. The parental care utilization index measures adequacy of care by examining child's gestational age, trimester of first prenatal care, and total number of prenatal visits during pregnancy.[37]

Several maternal variables before and at the child's birth were also included: education (did not graduate from high school, graduated from high school), age at first birth (<20, 20–29, 30+), and neighborhood location. Maternal education from the Families First screen is missing for ~14% of mothers. Location is specified as urban (any neighborhood in Winnipeg or Brandon) or rural (other Manitoba neighborhood). The Families First screen provided information on social isolation and lone parent status. Characteristics of the child at birth include the following: birth order (1, 2, 3+), sex (male or female), and whether the child was of low birth weight (<2500 g) or preterm (<27 weeks). The Supplemental Information present relevant ICD codes.

Statistical Analysis

We first compared characteristics of children born into poverty and those not born into poverty using χ^2 tests. Next, we examined the odds of each outcome for individuals in the 4 groups of poverty (born into household and neighborhood poverty, born into household poverty only, born into neighborhood poverty only, and not born in poverty) using unadjusted and adjusted logistic regression models. The adjusted models include all maternal and child covariates before and at the birth of the child.

Odds of school readiness were first compared between children moving out of different levels of poverty and children remaining in poverty in their first 5 years. We then looked at the odds of school readiness for children transitioning into different levels of poverty and those for children remaining out of poverty. Finally, the relationships between trajectories of poverty and other childhood outcomes between birth and age 5 were examined. Data management, programming, and analyses were performed by using SAS version 9.4 (SAS Institute, Inc, Cary, NC).[38]

RESULTS

Household and Neighborhood Poverty at Birth

Of the 46 589 children in the cohort, 11 619 (24.9%) were born in poverty. Of those born in poverty, 2951 (25.4%) experienced both types of poverty, 2766 (23.8%) only household poverty, and 5902 (50.8%) only neighborhood poverty. Table 1 highlights the association of poverty with events suggesting family difficulties. The combination of household and neighborhood poverty generated the strongest relationships with residential mobility, receiving services from Child and Family Services, and having inadequate prenatal care. Drug and/or alcohol use, smoking, low maternal education, and social isolation were highest among mothers experiencing household poverty (with or without neighborhood poverty).

Children born into both household and neighborhood poverty had the highest percentage of placement in out-of-home care (Table 2 and Supplemental Table 7). The "household and neighborhood poverty" and "household poverty only" categories differed only slightly for school readiness and problems with mental and physical health. Children experiencing "neighborhood poverty only" showed frequencies on the indicated measures between their counterparts born into household poverty and those not born into poverty. Children with low family income showed more externalizing behavior.[19]

Children born in poverty (household and/or neighborhood) were less likely to be ready for school than those not born poor (Table 2). Two levels of poverty (household and neighborhood) led to the highest rates of placement in out-of-home care (24.2%); rates for household poverty (17.4%) were considerably greater than those for neighborhood poverty (3.1%). Household poverty was associated with higher odds of externalizing mental conditions and asthma, but neighborhood poverty was not. Finally, children born into both household and neighborhood poverty were more likely to be hospitalized for an injury (2.1%) than their more affluent counterparts (0.6%) (Table 2).

In Table 3, we summarize the odds of each outcome for individuals in the 4 groups of poverty (born into household and neighborhood poverty, born into household poverty only, born into neighborhood poverty only, and not born in poverty) using unadjusted and adjusted logistic regression models. Supplemental Ta bles 8 through 10 present details on school readiness.

Trajectories Into and Out of Poverty Before Age 5

The relationship between transitioning into and out of different levels of poverty before age 5 and school readiness builds on a simplified cohort. This cohort included only children who either did not change poverty level or changed poverty once before age 5 (n = 42 170). Most of those born into household poverty remained in such poverty to age 5 (84.7%). Only 45.2% of children born in neighborhood poverty remained there to this age; over 90.0% of children not born in poverty stayed out of poverty to age 5. Supplemental Tables 11 and 12 provide detailed information.

For children born in household poverty, transitions out of poverty were associated with a lower probability of not being ready for school (adjusted odds ratio [aOR] = 0.58 for transitions before age 2; aOR = 0.75 for those after age 2) (Table 4). School readiness was significantly higher only if children left neighborhood poverty before age 2 (aOR = 0.73). Among children born outside of poverty, moving into neighborhood poverty before age 2 was associated with a greater likelihood of not being ready for school (aOR = 1.30); moving into household poverty either before or after age 2 was associated with not being ready (aORs = 1.71 and 1.68, respectively). Overall, household poverty was linked with worse outcomes; changes before age 2 reveal the largest differences. Supplemental Tables 13 and 14 provide additional statistics.

Table 5 presents relationships between type of poverty and outcomes before age 5. Placement in out-of-home care revealed dramatic differences (from 23.9% to 0.2% across these categories). Placement rates were highest among children remaining in household poverty and those living in such poverty before

TABLE 1 Children Born Into Different Levels of Poverty (n = 46 589)

Covariates	Group 1A: Household and Neighborhood Poverty at Birth (n = 2951)	Group 1B: Household Poverty Only at Birth (n = 2766)	Group 1C: Neighborhood Poverty Only (n = 5902)	Group 2: Not Born in Poverty (n = 34 970)
	n (%)	n (%)	n (%)	n (%)
Maternal covariates during pregnancy				
Moved	940 (31.9)[a]	700 (25.3)[a]	1155 (19.6)[a]	5605 (16.0)
Received services from CFS	2350 (79.6)[a]	1962 (70.9)[a]	1364 (23.1)[a]	4457 (12.8)
Drug or alcohol use	736 (24.9)[a]	693 (25.1)[a]	633 (10.7)[a]	2932 (8.4)
Smoking	1513 (51.3)[a]	1403 (50.7)[a]	1143 (19.4)[a]	4192 (12.0)
Mood or anxiety disorder	469 (15.9)[a]	517 (18.7)[a]	715 (12.1)	4046 (11.6)
Inadequate prenatal care	921 (31.2)[a]	705 (25.5)[a]	989 (16.8)[a]	4525 (12.9)
Maternal covariates before and at birth of child				
Less than grade 12 education	1603 (54.3)[a]	1369 (49.5)[a]	1071 (18.2)[a]	3240 (9.3)
Social isolation	671 (22.7)[a]	623 (22.5)[a]	483 (8.2)[a]	1374 (3.9)
Lone parent	1566 (53.1)[a]	1515 (54.8)[a]	606 (10.3)[a]	1511 (4.3)
Age of mother at first birth				
<20	1890 (64.1)[a]	1696 (61.3)[a]	1361 (23.1)[a]	4072 (11.6)
20–29	995 (33.7)[a]	1004 (36.3)[a]	3666 (62.1)	21 932 (62.7)
≥30	66 (2.2)[a]	66 (2.4)[a]	875 (14.8)[a]	8966 (25.6)
Urban neighborhood at birth of child	2601 (88.1)[a]	1642 (59.4)	3918 (66.4)[a]	20 659 (59.1)
Child covariates at birth				
Birth order				
1	814 (27.6)[a]	906 (32.8)[a]	2669 (45.2)[a]	14 746 (42.2)
2	841 (28.5)[a]	753 (27.2)[a]	1862 (31.6)[a]	12 909 (36.9)
3+	1296 (43.9)[a]	1107 (40.0)[a]	1371 (23.2)[a]	7315 (20.9)
Male	1475 (50.0)	1394 (50.4)	3033 (51.4)	17 714 (50.7)
Low birth wt (<2500 g)	164 (5.6)[a]	166 (6.0)[a]	308 (5.2)[a]	1597 (4.6)
Preterm (<37 wk)	244 (8.3)[a]	237 (8.6)[a]	445 (7.5)[a]	2326 (6.7)

CFS, Child and Family Services.
[a] Significantly (at $P < .05$) different from Group 2.

age 2. Asthma diagnoses ranged markedly (from 30.5% to 18.1%). Externalizing mental health conditions varied substantially but rather irregularly, with injury hospitalization rates low among all groups.

DISCUSSION

We have considered household and neighborhood poverty from several perspectives. Examining the length of exposure among both children transitioning out of poverty and those transitioning into poverty goes beyond most studies. Children growing up in poverty must deal with a home environment less supportive of school readiness and overall health than those leaving poverty early in life. Moreover, mothers transitioning out of poverty when the child was >2 showed fewer risk factors than those leaving when the child was older. The number of years of childhood poverty and the lack of school readiness are clearly linked. The association of different types of poverty with various outcomes (school readiness, placement in out-of-home care, and indicators of physical and mental health) has emphasized the importance of household poverty.

TABLE 2 Early Childhood Outcomes by Different Levels of Poverty at Birth (n = 46 589)

Outcomes	Group 1A: Household and Neighborhood Poverty at Birth (n = 2951)	Group 1B: Household Poverty Only at Birth (n = 2766)	Group 1C: Neighborhood Poverty Only (n = 5902)	Group 2: Not Born Into Poverty (n = 34 970)
	n (%)	n (%)	n (%)	n (%)
Not ready for school (EDI) on 1 or more domain	1499 (50.8)[a]	1348 (48.7)[a]	1754 (29.7)[a]	7740 (22.1)
Before age 5				
Placed in out-of-home care	713 (24.2)[a]	482 (17.4)[a]	181 (3.1)[a]	269 (0.8)
Diagnosed with externalizing mental condition	233 (7.9)[a]	204 (7.4)[a]	237 (4.0)[a]	1222 (3.5)
Diagnosed with asthma	934 (31.7)[a]	799 (28.9)[a]	1239 (21.0)[a]	6797 (19.4)
Hospitalized for an injury	62 (2.1)[a]	44 (1.6)[a]	56 (1.0)[a]	220 (0.6)

EDI, early development instrument.
[a] Significantly (at $P < .05$) different from Group 2.

TABLE 3 Odds Ratios for School Readiness for Children Born Into Poverty, by Trajectories of Type of Poverty

School Readiness (EDI)	Trajectory 1: Household Poverty to No Poverty		Trajectory 2: Neighborhood Poverty to No Poverty		Trajectory 3: No Poverty to Neighborhood Poverty		Trajectory 4: No Poverty to Household Poverty	
	Unadjusted OR (95% CI)	aOR[a] (95% CI)	Unadjusted OR (95% CI)	aOR[a] (95% CI)	Unadjusted OR (95% CI)	aOR[a] (95% CI)	Unadjusted OR (95% CI)	aOR[a] (95% CI)
Not ready on physical well-being domain								
No change[b]	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Before age 2[c]	0.43 (0.32–0.58)[d]	0.51 (0.37–0.69)[d]	0.59 (0.48–0.72)[d]	0.77 (0.62–0.95)[d]	1.60 (1.31–1.94)[d]	1.40 (1.14–1.72)[d]	3.71 (3.01–4.58)[d]	1.72 (1.36–2.18)[d]
After age 2[e]	0.62 (0.48–0.81)[d]	0.69 (0.53–0.90)[d]	0.73 (0.59–0.91)[d]	0.89 (0.70–1.11)	1.07 (0.85–1.33)	0.91 (0.72–1.14)	3.89 (3.10–4.88)[d]	2.06 (1.61–2.63)[d]
Not ready on social competence domain								
No change[b]	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Before age 2[c]	0.63 (0.47–0.84)[d]	0.71 (0.53–0.96)[d]	0.57 (0.46–0.70)[d]	0.70 (0.56–0.87)[d]	1.38 (1.12–1.71)[d]	1.26 (1.02–1.57)[d]	3.03 (2.43–3.79)[d]	1.57 (1.23–2.02)[d]
After age 2[e]	0.86 (0.66–1.11)	0.92 (0.70–1.21)	0.79 (0.64–0.98)[d]	0.92 (0.73–1.15)	1.07 (0.86–1.35)	0.94 (0.75–1.19)	2.34 (1.79–3.05)[d]	1.32 (0.99–1.75)
Not ready on communication and general knowledge domain								
No change[b]	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Before age 2[c]	0.48 (0.35–0.66)[d]	0.53 (0.38–0.74)[d]	0.58 (0.47–0.71)[d]	0.73 (0.59–0.90)[d]	1.61 (1.32–1.98)[d]	1.40 (1.13–1.72)[d]	2.57 (2.03–3.27)[d]	1.54 (1.18–2.01)[d]
After age 2[e]	0.53 (0.39–0.72)[d]	0.56 (0.41–0.76)[d]	0.77 (0.62–0.96)[d]	0.89 (0.71–1.11)	1.11 (0.89–1.40)	0.96 (0.76–1.21)	2.16 (1.63–2.84)[d]	1.39 (1.04–1.88)[d]
Not ready on emotional maturity domain								
No change[b]	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Before age 2[c]	0.65 (0.48–0.88)[d]	0.73 (0.53–1.01)	0.62 (0.50–0.76)[d]	0.74 (0.60–0.93)[d]	1.08 (0.87–1.34)	0.97 (0.78–1.20)	2.40 (1.91–3.01)[d]	1.37 (1.07–1.77)[d]
After age 2[e]	1.15 (0.89–1.49)	1.23 (0.94–1.61)	0.76 (0.61–0.95)[d]	0.86 (0.68–1.09)	1.08 (0.88–1.34)	1.00 (0.80–1.25)	1.84 (1.40–2.42)[d]	1.14 (0.85–1.52)
Not ready on language and cognitive development domain								
No change[b]	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Before age 2[c]	0.48 (0.36–0.64)[d]	0.54 (0.40–0.73)[d]	0.59 (0.48–0.72)[d]	0.76 (0.61–0.94)[d]	1.43 (1.15–1.78)[d]	1.24 (0.99–1.55)	3.57 (2.87–4.45)[d]	1.84 (1.44–2.35)[d]
After age 2[e]	0.61 (0.47–0.80)[d]	0.66 (0.50–0.86)[d]	0.72 (0.58–0.90)[d]	0.86 (0.68–1.08)	1.23 (0.99–1.54)	1.07 (0.95–1.34)	3.21 (2.51–4.12)[d]	1.81 (1.39–2.37)[d]
Placed in out-of-home care, 0–5								
No change[b]	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Before age 2[c]	0.18 (0.12–0.29)[d]	0.35 (0.22–0.59)[d]	0.12 (0.06–0.24)[d]	0.30 (0.14–0.65)[d]	3.36 (1.33–8.49)[d]	1.52 (0.57–4.03)	75.01 (49.70–113.21)[d]	9.14 (5.67–14.73)[d]
After age 2[e]	0.44 (0.32–0.61)[d]	0.67 (0.47–0.94)[d]	0.20 (0.10–0.39)[d]	0.39 (0.18–0.83)[d]	2.54 (0.91–7.06)	1.39 (0.49–3.98)	44.19 (26.99–72.36)[d]	6.37 (3.73–10.86)[d]
Externalizing mental condition diagnosis, 0–5								
No change[b]	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Before age 2[c]	0.67 (0.42–1.09)	0.78 (0.48–1.28)	1.17 (0.85–1.60)	1.35 (0.96–1.89)	0.92 (0.64–1.33)	0.95 (0.66–1.39)	1.55 (1.03–2.32)[d]	1.21 (0.72–1.74)

TABLE 3 Continued

School Readiness (EDI)	Trajectory 1: Household Poverty to No Poverty		Trajectory 2: Neighborhood Poverty to No Poverty		Trajectory 3: No Poverty to Neighborhood Poverty		Trajectory 4: No Poverty to Household Poverty	
	Unadjusted OR (95% CI)	aOR[a] (95% CI)	Unadjusted OR (95% CI)	aOR[a] (95% CI)	Unadjusted OR (95% CI)	aOR[a] (95% CI)	Unadjusted OR (95% CI)	aOR[a] (95% CI)
After age 2[e]	1.34 (0.93–1.92)	1.39 (0.96–2.01)	0.67 (0.44–1.03)	0.74 (0.48–1.15)	0.87 (0.60–1.25)	0.86 (0.59–1.25)	1.41 (0.89–2.24)	1.10 (0.68–1.78)
Asthma diagnosis, 0–5								
No change[b]	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Before age 2[c]	0.76 (0.59–0.98)[d]	0.91 (0.70–1.18)	0.81 (0.69–0.94)[d]	0.84 (0.71–0.99)[d]	0.99 (0.84–1.17)	1.02 (0.87–1.20)	1.30 (1.05–1.60)[d]	1.08 (0.87–1.36)
After age 2[e]	1.01 (0.80–1.28)	1.07 (0.84–1.36)	0.82 (0.69–0.98)[d]	0.84 (0.70–1.01)	0.94 (0.80–1.11)	0.95 (0.81–1.12)	1.28 (1.01–1.61)[d]	1.13 (0.89–1.44)
Injury hospitalization, 0–5								
No change[b]	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Before age 2[c]	0.41 (0.13–1.31)	0.69 (0.21–2.24)	0.52 (0.26–1.05)	0.54 (0.26–1.11)	0.37 (0.09–1.49)	0.33 (0.08 1.34)	1.83 (0.75–4.48)	1.06 (0.40–2.76)
After age 2[e]	0.53 (0.19–1.46)	0.71 (0.26–1.97)	0.35 (0.14–0.90)[d]	0.35 (0.14–0.93)[d]	1.93 (1.05–3.57)[d]	1.63 (0.88–3.04)	1.32 (0.42–4.16)	0.83 (0.25–2.69)

CFS, Child and Family Services; CI, confidence interval; EDI, early development instrument; OR, odds ratio.

[a] Adjusted for maternal covariates during pregnancy (moved, received services from CFS, mood and anxiety disorders, drug and/or alcohol use, smoking, prenatal care use), maternal covariates at the index date (education, social isolation, lone parent, age, neighborhood location), and child covariates at birth (birth order, sex, birth wt, gestational age).

[b] No change in poverty level and/or type before age 5.

[c] Change in poverty level and/or type between birth and age 2.

[d] $P < .05$.

[e] Change in poverty level and/or type between age 2 and age 5.

Adjustment for other factors (themselves linked to poverty) weakens the relationships between poverty and the various outcomes. Household poverty remained a statistically significant predictor after controlling for numerous covariates (although odds ratios were typically reduced). After adjustments, neighborhood poverty was generally less predictive of childhood mental health, asthma, and hospitalization for injuries.

Our information provides a baseline for additional research. For example, educational performance (grade 3) and our childhood measures can help assess changes by age 10. More generally, having relevant outcomes at several developmental stages aids in judging the significance of early life conditions and events. Not only poverty but such "shocks" as prenatal and early life maternal stress might well affect adolescent and adult outcomes.[39] Large databases can operationalize such characteristics as social isolation, death of a close relative, domestic violence, and maternal drug and/or alcohol use. Our findings also support Bronfenbrenner's[40] ecological systems theory postulating mother-child interactions to be strong predictors of child development; constructive mother-child bonds are more difficult for mothers having drug or alcohol problems. Overcoming such factors among the disadvantaged may be more difficult than among the more affluent, and interventions to increase human capital might prove more valuable among the poor. Information on several such programs (nurse visiting, maternal income supplements) are being incorporated into Manitoba analyses.[34]

This article's limitations include those associated with observational studies. Receipt of welfare was used to define household poverty because access to information on household income is lacking. Our definition may

TABLE 4 Odds Ratios for Not Being Ready For School, Trajectories by Type of Poverty

Not Ready on 1 or More Domain (EDI)	Unadjusted OR (95% CI)	aOR[a] (95% CI)
Trajectory 1: born in household poverty (n = 4610)		
Stayed in household poverty to age 5 (n = 3904)	Reference	Reference
Transitioned out of poverty before age 2 (n = 347)	0.49 (0.39–0.61)[b]	0.58 (0.46–0.75)[b]
Transitioned out of poverty after age 2 (n = 359)	0.67 (0.54–0.83)[b]	0.75 (0.60–0.94)[b]
Trajectory 2: born in neighborhood poverty (n = 5070)		
Stayed in neighborhood poverty to age 5 (n = 2290)	Reference	Reference
Moved out of poverty before age 2 (n = 1656)	0.59 (0.51–0.68)[b]	0.73 (0.63–0.86)[b]
Moved out of poverty after age 2 (n = 1124)	0.80 (0.68–0.94)[b]	0.94 (0.80–1.11)
Trajectory 3: not born in poverty (n = 31 581)		
Stayed out of poverty to age 5 (n = 29 561)	Reference	Reference
Moved into neighborhood poverty before age 2 (n = 981)	1.45 (1.25–1.67)[b]	1.30 (1.12–1.51)[b]
Moved into neighborhood poverty after age 2 (n = 1039)	1.17 (1.01–1.36)[b]	1.02 (0.88–1.19)
Trajectory 4: not born in poverty (n = 30 470)		
Stayed out of poverty to age 5 (n = 29 561)	Reference	Reference
Transitioned into household poverty before age 2 (n = 497)	3.27 (2.74–3.91)[b]	1.71 (1.40–2.09)[b]
Transitioned into household poverty after age 2 (n = 412)	2.89 (2.37–3.52)[b]	1.68 (1.35–2.08)[b]

CFS, Child and Family Services; CI, confidence interval; EDI, early development instrument; OR, odds ratio.

[a] Adjusted for maternal covariates during pregnancy (moved, received services from CFS, mood and anxiety disorders, drug and/or alcohol use, smoking, prenatal care use), maternal covariates at the index date (education, social isolation, lone parent, age, neighborhood location), and child covariates at birth (birth order, sex, birth wt, gestational age). These variables are used for adjustment in all tables.

[b] $P < .05$.

underestimate such poverty. Canada has no official poverty line; however, households having incomes less than half of the median household income (for a family of a given size) are considered low income.[41] Manitoba Employment and Income Assistance (and other benefits) generally pay less than this amount. Manitoba's average total income of households was below the Canadian national average in 2015 (Manitoba $85 373; Canada $92 764).[42] The Canadian Income Survey data suggested that Manitoba's median employment income was consistently lower than the Canadian national median from 2012 to 2015.[43] In 2015, Manitoba's prevalence of low income based on the low-income cutoff after tax was 9.9%, which was slightly higher than the national prevalence (9.2%).[42] Additionally, although children are clustered within neighborhoods, we did not account for this in our analysis (ie, use a multilevel model). This was done because in many cases, children lived in >1 neighborhood between birth and age 5, with the amount of time spent in each neighborhood varying by child, children would often belong in several clusters over time.

Because the poverty variable could not be manipulated in experimental or quasi-experimental fashion, causality cannot be ascertained. Selective movement out of poverty by less challenged families (or into poverty by their more challenged counterparts) might be responsible

TABLE 5 Proportion of Population With Childhood Outcomes Before Age 5, by Trajectories and Type of Poverty

	Placed in Out-of-Home Care	Externalizing Mental Condition Diagnosis	Asthma Diagnosis	Injury Hospitalization
Trajectory 1: born in household poverty (n = 4610)				
Stayed in household poverty to age 5 (n = 3904)	23.9	7.9	30.5	2.1
Transitioned out of poverty before age 2 (n = 347)	5.5	5.5	25.1	0.9
Transitioned out of poverty after age 2 (n = 359)	12.3	10.3	30.6	1.1
Trajectory 2: born in neighborhood poverty (n = 5070)				
Stayed in neighborhood poverty to age 5 (n = 2290)	4.0	3.8	22.3	1.3
Moved out of poverty before age 2 (n = 1656)	0.5	4.4	18.8	0.7
Moved out of poverty after age 2 (n = 1124)	0.8	2.6	19.3	0.4
Trajectory 3: not born in poverty (n = 31 581)				
Stayed out of poverty to age 5 (n = 29 561)	0.2	3.3	19.0	0.6
Moved into neighborhood poverty before age 2 (n = 981)	0.5	3.1	18.9	0.2
Moved into neighborhood poverty after age 2 (n = 1039)	0.4	2.9	18.1	1.1
Trajectory 4: not born in poverty (n = 30 470)				
Stayed out of poverty to age 5 (n = 29 561)	0.2	3.3	19.0	0.6
Transitioned into household poverty before age 2 (n = 497)	10.3	5.0	23.3	1.0
Transitioned into household poverty after age 2 (n = 412)	6.3	4.6	23.1	0.7

for the findings. Moreover, the range of our income measures is limited. Transition out of poverty (whether household or neighborhood) is unlikely to be associated with substantial income changes. Movement out of the lowest income quintile (defining neighborhood poverty) is primarily to quintile 2 (43.7%) and quintile 3 (23.4%) neighborhoods.

Finally, the absolute and relative importance of poverty in Canada, compared with in the United States, is intriguing. Neighborhood variation and the role of neighborhood characteristics appear greater in the United States.[44] Canada's safety net is more extensive than those in the United States and the United Kingdom.[45,46] Seven-country comparisons have noted steep American socioeconomic status gradients along several dimensions of well-being (including cognitive and socioemotional).[47] More detailed study of these gradients might draw on our analyses.

CONCLUSIONS

Children growing up in poverty must deal with more risk factors for poor outcomes than those never experiencing poverty or experiencing poverty for a short time. Children born into household poverty have much worse early outcomes than those born into neighborhood poverty. Support for children whose families are receiving welfare to transition out of poverty when the child is young could yield the greatest benefit.

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In recognition of the high proportion of the children in care being of First Nations descent, the larger program of research using Child and Family Services data has been presented to several general and First Nations audiences.

ABBREVIATIONS

aOR: adjusted odds ratio
ICD: *International Classification of Diseases*
ICD-9-CM: *International Classification of Diseases, Ninth Revision, Clinical Modification*
ICD-10-CA: *International Classification of Diseases, 10th Revision, Canada*

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