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Original article

# Childhood Socioeconomic Status and Depressive Symptom Trajectories in the Transition to Adulthood in the United States and Canada

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 A B S T R A C T

**Purpose:** We examined whether young people in the U.S. and Canada exhibit similar depressive symptom trajectories in the transition to adulthood and compared the effect of childhood socioeconomic status on trajectory membership.

**Methods:** We used the American National Longitudinal Survey of Youth 1979 Child/Young Adult (n = 6,315) and the Canadian National Longitudinal Survey of Children and Youth (n = 3,666). Depressive symptoms were measured using five items from the Center for Epidemiological Studies on Depression scale. Latent trajectories of depressive symptoms from ages 16–25 years were identified using growth mixture models. We estimated the effect of childhood family income, parental education, and parental unemployment on trajectory membership using multivariable Poisson regression models with robust variances.

**Results:** We identified four similar trajectories in the two countries: (1) low stable; (2) mid-peak; (3) increasing; and (4) decreasing. Relatively more Americans were in the low-stable trajectory group than Canadians (77.6% vs. 64.9%), and fewer Americans were in the decreasing group (7.1% vs. 19.1%). In the U.S., childhood family income in the bottom two quartiles was related to higher rates of increasing trajectory membership compared with income in the top quartile (incidence rate ratios: 1.59–1.79, *p* < .05), but not in Canada. In the U.S., parental education at a high school level was associated with higher rates of decreasing trajectory membership compared with higher education (incidence rate ratio = 1.45, confidence interval: 1.10–1.91; *p* = .01), but not in Canada.

**Conclusions:** Depressive symptoms may take a similar course in the transition to adulthood within these two countries. Country differences may modify the degree to which childhood socioeconomic status determines trajectory membership.

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 IMPLICATIONS AND CONTRIBUTION

Young people's depressive symptoms follow similar trajectories between the ages of 16 and 25 years in the U.S. and Canada. However, childhood socioeconomic status differently affects trajectory membership in these countries, supporting the hypothesis that country-level institutional differences (e.g., in taxes and transfers and education systems) may modify the effect of low childhood socioeconomic status.

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**Conflicts of interest:** The authors have no conflicts of interest to disclose.

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Depression during the transition to adulthood is a serious public health concern [1,2]. In 40% of cases of major depressive disorder, the first episode occurs by the age of 20 years [3]. Depression during this transition presents risks for later social

problems, including school dropout and joblessness [4]. Prevention is essential for both individual future health and well-being and for its economic and societal benefits [5].

The resources and opportunities associated with childhood socioeconomic status (SES) are important entry points for public policy, given the ample evidence that low childhood SES increases the risk of depression over the life course [6]. Low childhood SES increases the risk of chronic exposure to adverse experiences, which may elevate stress reactivity and impair neurobiological systems that increase vulnerability to future stressors [7,8]. Furthermore, low childhood SES shapes the social and health trajectories playing out in the transition to adulthood [9]. Young people with few family resources may become marginalized as they navigate the school-to-work transition and financial independence. How young people react to economic difficulty, however, depends on the available institutional resources and cultural values [9]. The institutional environment, broadly defined by the design and implementation of welfare state policies, can mitigate the effect of low childhood SES by providing material resources and improving the psychosocial context for low-SES families [9–12].

Although the U.S. and Canada, both liberal market welfare states, share similar institutional environments [10,13], key differences suggest that the American institutional environment may be less effective at mitigating the effects of low childhood SES. For example, in the U.S., school quality and funding are more unequal [14,15], and monetary transfers to families are less generous and less universal, compared with Canada [14,16]. Young people from low-SES families in the U.S. may be expected to have a higher risk of depression in the transition to adulthood than their counterparts in Canada.

Whether young people in the U.S. and Canada exhibit similar longitudinal patterns or trajectories of depressive symptoms in the transition to adulthood is unclear, as is the influence of childhood SES. Examining dynamic trajectories of depressive symptoms, rather than single instances of disorder, is important for prevention purposes, as both subclinical psychiatric symptoms and clinical levels of disorder before the age of 18 years equally predict poor outcomes in psychiatric morbidity and health service use in adulthood [17]. Evidence of differences between depressive symptom trajectories are also consistent with developmental theories on the joint influence of individual and environmental factors on the course of psychopathology from childhood to adolescence [18]. Put simply, particular combinations of personal and environmental characteristics may result in differently shaped trajectories.

Research suggests that between 5% and 15% of people display persistent depressive symptoms across adolescence and young adulthood, whereas others show changes over time [19,20]. Yet, it is unclear how the number and shape of depressive symptom trajectories compares across countries because of differences between studies in the underlying populations (e.g., age groups) and measures (e.g., Center for Epidemiological Studies of Depression scale vs. Youth Self-Report). In addition, few studies examine whether and how differences in social, educational, and economic policies modify the influence of childhood SES on when and how depressive symptoms develop in the transition to adulthood [12]. Only one study has examined the effect of macrosocial determinants on mental health inequalities in adolescents [12]. This study, which compared psychological complaints for 11-, 13-, and 15-year-olds across 27 European countries, found that greater social protections, particularly with

regard to family benefits, were linked to better overall mental health among young people [21].

Given existing evidence on depressive symptom trajectories [19,20], we expect between three and seven trajectory groups in both the U.S. and Canada. Given country-level differences in their institutional arrangements and population health, we further expect a stronger association between low childhood SES and depressive symptoms in the U.S. than in Canada. Our study aims to (1) examine whether young people in the U.S. and Canada exhibit comparable depressive symptom trajectories in the transition to adulthood and (2) compare the association between childhood SES and depressive symptom trajectory membership across these two countries.

## Methods

### Data sources and study sample

We used [1] the National Longitudinal Survey of Youth 1979 Children/Young Adult (NLSY79 Children/YA, 1986–2014;  $n = 11,521$ ) in the U.S. and [2] Cycles 4–8 of the longitudinal cohort of the National Longitudinal Survey of Children and Youth in Canada (2002–2009,  $n = 16,125$ ). These longitudinal surveys collect information biennially from national samples of children. The target population for the NLSY79 Children/YA were American children of the NLSY79 females, enrolled from 1986 onward. These data were then linked to information on the children's mothers from the main NLSY79 survey. The target population for the longitudinal cohort of the National Longitudinal Survey of Children and Youth was noninstitutionalized children aged between 0 and 11 years in 1994 from 10 provinces of Canada. We included individuals who had at least three time points of data on their depressive symptoms between the ages 16 and 25 years (U.S.:  $n = 6,135$ ; Canada:  $n = 3,666$ ). Young people entered the cohort at age 16–17 years, which was from 1994 to 2006 in the American cohort and from 2000 to 2003 in the Canadian cohort (Cycles 4 and 5).

### Measures

**Depressive symptoms.** Depressive symptoms were measured using a sum score (range 0–15) of five items from the Center for Epidemiological Studies on Depression scale that appeared in both data sources: (1) I did not feel like eating; my appetite was poor; (2) I had trouble keeping my mind on what I was doing; (3) I felt depressed; (4) I felt that everything I did was an effort; and (5) My sleep was restless [22,23]. Respondents rated the frequency of their symptoms with higher scores indicating greater risk of depression. Confirmatory factor analyses for the five items in this study supported a single-factor model at each age in both cohorts (confirmatory factor index: .942–.998, Tucker-Lewis Index: .884–.997, root mean square error of approximation: .011–.075) [24]. The internal reliability (Cronbach's alpha) ranged from .55 to .60, which is an acceptable range, given the number of items [25].

**Childhood SES.** Three aspects of childhood SES were measured at the ages of 10–11 years: relative family income, parental education, and parental unemployment. *Relative family income* was measured according to the income quartile of the family relative to the national sample. *Parental education* was measured using the highest parental educational achievement, grouped into

three categories: (1) less than high school; (2) high school diploma; and (3) beyond high school. *Parental unemployment* was measured as a binary variable indicating whether the child's parent(s) did or did not work at all over 12 months.

**Covariates.** We derived individual and structural characteristics related to both childhood SES and depressive symptoms: gender, race, mother's immigration history, single-parent household, mother's age, region of residence, and urbanicity. [Supplemental Table A1](#) contains details about variable derivation.

### Analyses

We examined the comparability of the sample characteristics of the American and Canadian cohorts. Depressive symptom trajectories between the ages of 16 and 25 years in the American and Canadian cohorts were then identified using growth mixture modeling (GMM), a method that examines the presence of multiple heterogeneous trajectories of change rather than an overall mean trajectory [26]. See the [Appendix](#) in the online version of this article for details. Briefly, missing data were handled using full information maximum likelihood with robust errors [26]. Decisions about the number of classes to model were based on a priori expectations, model parsimony, overall model fit calculated using the Bayesian information criterion, group size of at least 5%, and average posterior probabilities (the probability of belonging in each class) [26]. Young people were then categorized into the trajectory group where they had the highest probability of membership, based on their posterior probabilities. Owing to administrative limitations, data from the two cohorts were not merged to statistically compare cross-national differences. Instead, we analyzed the cohorts separately and compared the results via inspection.

To examine the relationship between childhood SES and trajectory membership in the depressive symptom trajectories in Canada and the U.S., we first conducted chi-square tests. Multivariable Poisson regressions were then used to estimate the association between childhood SES and depressive symptom trajectory group membership while accounting for all other covariates [27]. We reported incidence rate ratios (IRR) with their 95% confidence intervals (CIs) and exact *p* values. The rates of partial nonresponse were 19.8% in the U.S. and 9.5% in Canada. Nonresponse was related to male gender and lower parental educational achievement in the U.S. and to parental unemployment in Canada. Missing values on the covariates were imputed for the American cohort using multiple imputation by chained equations [28]. We performed 30 imputations on four covariates—relative family income (19.5% missing), parental unemployment (3.8% missing), single parent status (3.6% missing), and rural residence (.6% missing)—using binary and ordered logistic regression models to impute categorical variables and linear regression for continuous variables. Imputation models were based on all analytic variables of interest and additionally included data on each imputed variable from survey years 1986–2014. Given that family income data had already been imputed in the Canadian data set and that nonresponse was lower than in the American dataset, multiple imputation was not deemed necessary.

All analyses used sampling weights to account for survey design. GMM was performed in Mplus version 7 and regression analyses in Stata versions 12 (the U.S.) and 13 (Canada). Study

procedures were approved by the University of British Columbia Behavioural Research Ethics Board (H18-0049).

## Results

### Sample characteristics

The two cohorts differed in their baseline characteristics ([Table 1](#)). The American cohort had a lower median childhood relative income and lower parental education than the Canadian cohort. The American cohort also had fewer migrant mothers, more single parents, and more rural residents.

### Depressive symptom trajectories in the U.S. and Canada

In both cohorts, we found that a four-class model with random intercepts was best fitting and most parsimonious ([Table 2](#)).

Four qualitatively similar trajectories were identified in each cohort ([Figure 1](#)): (1) a low-stable depressive symptom trajectory characterized by low symptom frequency throughout; (2) a mid-peak symptom trajectory characterized by a peak between the ages 19 and 21 years; (3) an increasing symptom trajectory; and (4) decreasing symptom trajectory ([Supplemental Table A1](#)).

The distribution of the trajectories differed across cohorts, with 77.6% of Americans and 64.9% of Canadians classified into the low-stable trajectory. Compared with 7.9% of Americans, 19.1% of Canadians were classified into the decreasing trajectory. Finally, 9.3% and 5.5% of Americans were classified into the increasing and mid-peak trajectory groups, compared with 9.3% and 6.7% of Canadians, respectively.

The association between childhood SES and depressive symptom trajectory membership.

In both the American and Canadian cohorts, the increasing trajectory group had a lower average childhood family income compared with the low-stable group ([Table 3](#)). In the U.S. but not

**Table 1**  
Characteristics of the American and Canadian cohorts

Variable	The U.S. (n = 6,135)		Canada (n = 3,666)	
	%	n	%	n
Relative family income (median percentile)	58.2	4,944	62.9	3,598
Parental educational achievement (%)		6,135		3,665
Less than high school	8.3		5.0	
High school graduation	41.3		8.9	
Beyond high school	50.4		86.1	
Parental unemployment (%)		5,899		3,553
No	76.8		79.2	
Yes	23.2		20.8	
Gender (%)		6,135		3,666
Male	51.7		48.8	
Female	48.3		51.2	
Mother born in the U.S. or Canada (%)		6,135		3,466
No	4.3		15.0	
Yes	95.7		85.0	
Single parent status (%)		5,916		3,666
No	74.5		85.6	
Yes	25.5		14.4	
Rural residence (%)		6,101		3,666
No	76.7		84.0	
Yes	23.3		16.0	
Mother's age (median)	36	6,135	38	3,577

**Table 2**  
Results from growth mixture modeling information criteria

Classes	AIC	BIC	BIC (sample size adjusted)	Entropy
<b>The U.S.</b>				
1	123,027.4	123,161.9	123,098.3	NA
2	106,878.6	107,006.3	106,945.9	.58
3	106,296.9	106,458.2	106,382.0	.70
4	105,936.5	106,131.4	106,039.3	.70
5 <sup>a</sup>	105,828.2	106,056.7	105,948.7	.73
<b>Canada</b>				
1	63,766.4	63,884.3	63,824.0	NA
2	63,075.7	63,193.7	63,133.3	.47
3	62,670.2	62,812.9	62,739.9	.64
4	62,402.0	62,569.6	62,483.8	.64
5 <sup>a</sup>	62,298.2	62,490.6	62,392.1	.65

AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; NA = not applicable.

<sup>a</sup> Deemed to be less parsimonious because the model included a group with fewer than 5% of the sample. We also tested the fit of models of between six and eight classes but did not report the fit statistics because all resulted in computation issues, included small group sizes, or were less parsimonious.

in Canada, both the decreasing and mid-peak groups had a lower average childhood family income than the low-stable group. In the U.S. but not in Canada, trajectory groups also differed by parental education and parental unemployment.

In the U.S., childhood family income in the lowest and the second quartiles was associated with 1.82 (95% CI: 1.23–2.68) and 1.59 times (95% CI: 1.11–2.27) higher rates of increasing trajectory membership compared with the top income quartile (Table 4). Childhood family income in the lowest quartile also showed a trend toward higher rates of membership in the decreasing (IRR = 1.51, 95% CI: .99–2.33) and mid-peak trajectories in the U.S. (IRR = 1.66, 95% CI: 1.00–2.77). In Canada, the lowest income quartile was associated with higher rates of membership in the increasing (IRR = 1.51, 95% CI: .88–2.60) and

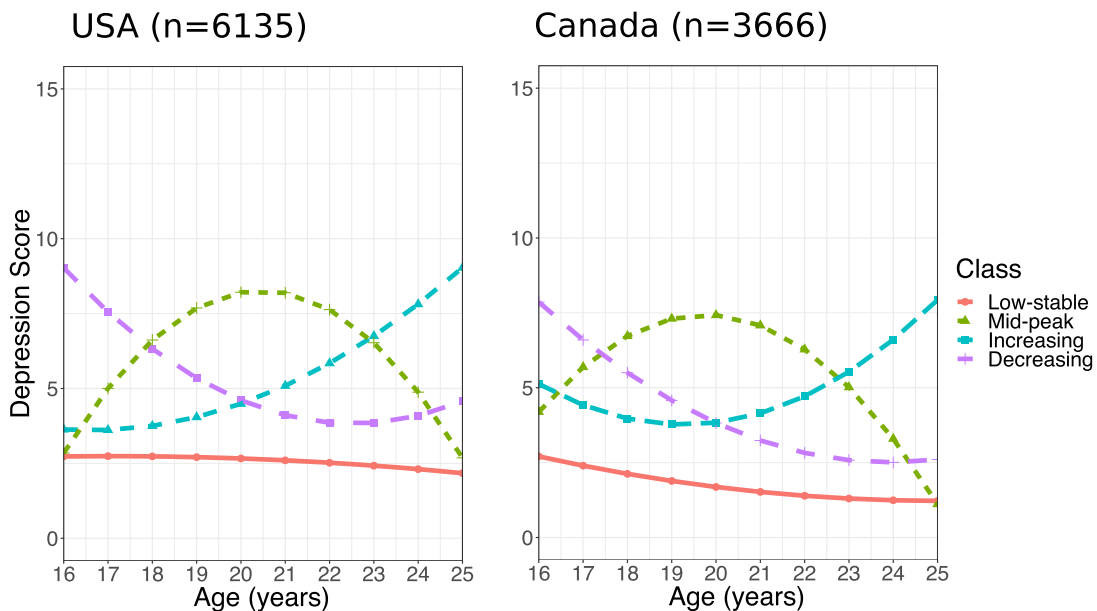
mid-peak trajectories (IRR = 1.57, 95% CI: .87–2.83), but the 95% CIs included the null.

In the U.S. but not in Canada, having a parent with only high school graduation was associated with 1.42 times (95% CI: 1.08–1.87) higher rates of decreasing trajectory membership compared with having a parent with more than high school education.

Finally, the associations with family unemployment differed between the U.S. and Canada. Although 95% CIs were inclusive of the null, estimates in both countries suggested a trend whereby parental unemployment was associated with higher rates of increasing trajectory membership (U.S.: IRR = 1.18, 95% CI: .92–1.52; Canada: IRR = 1.39, 95% CI: .92–2.12). Parental unemployment in the U.S. also showed a trend toward higher rates of membership in the decreasing trajectory (IRR = 1.22, 95% CI: .94–1.59), whereas in Canada, it was associated with lower rates of membership in the decreasing trajectory relative to the low-stable trajectory (IRR = .76, 95% CI: .59–.98).

**Discussion**

This study compares the association between depressive symptom trajectories in the transition to adulthood in the U.S. and Canada and childhood SES. We found similarities between the two countries in the number and shape of trajectories between ages 16 and 25 years but differences in the relative share of trajectories. Lower childhood family income in the U.S. is related to higher rates of membership in the increasing depressive symptom trajectory. Lower parental education in the U.S. is related to higher rates of decreasing trajectory membership. In contrast, we did not find an association between childhood family income or parental education and depressive symptom trajectory membership in Canada. There was some evidence that parental unemployment during childhood was associated with a



**Figure 1.** Four estimated trajectories of depressive symptomatology in the United States (left) and Canada (right). CES-D, Center for Epidemiologic Studies Depression Scale.

**Table 3**  
Group differences between depressive symptom trajectory groups in the U.S. and Canada

Variable	The U.S.					Canada						
	Low stable	Increasing	Decreasing	Mid-peak	n	p	Low stable	Increasing	Decreasing	Mid-peak	n	p
Percent	77.6	9.3	7.9	5.2	6,135		64.9	9.3	19.1	6.7	3,666	
Relative family income <sup>a</sup> (median percentile)	60.9	45.8	48.2	53.8	4,944	***	65.9	57.9	62.8	62.9	3,598	*
Parental educational achievement (%)					6,135	***					3,665	
Less than high school	7.3	12.3	11.8	9.9			4.9	8.7	3.1	6.5		
High school graduation	39.3	50.2	49.7	43.5			9.4	7.9	8.4	7.9		
More than high school	53.4	37.5	38.5	46.6			85.7	84.2	88.4	83.4		
Parental unemployment (%)					5,899	*					3,553	
No	78.1	71.0	71.2	76.4			78.8	72.5	83.4	81.3		
Yes	21.9	29.0	28.8	23.6			21.2	27.5	16.6	18.7		
Gender (%)					6,135	***					3,666	***
Male	53.8	48.6	38.1	46.0			54.40	41.7	38.7	33.3		
Female	46.2	51.4	61.9	54.0			45.60	58.3	61.3	66.7		
Mother born in the U.S. or Canada (%)					6,135						3,466	
No	4.5	3.2	5.2	2.6			14.7	13.6	14.8	20.5		
Yes	95.5	96.8	94.8	97.4			85.3	86.4	85.2	79.5		
Single parent status (%)					5,916	***					3,666	
No	76.3	70.4	67.7	66.4			87.0	84.4	84.4	77.4		
Yes	23.7	29.6	32.3	33.6			13.0	15.6	15.6	22.6		
Rural residence (%)					6,101						3,666	
No	76.6	76.7	77.3	76.9			82.9	87.8	85.6	84.0		
Yes	23.4	23.3	22.7	23.0			17.1	12.2	14.4	16.0		
Mother's age (median)	35	33	34	35	6,135	***	38	38	38	36	3,577	*

\* $p < .01$ , \*\* $p < .001$ , and \*\*\* $p < .0001$  based on chi-square tests of differences in proportion.

<sup>a</sup> 2018 equivalized income using the 2018 American and Canadian consumer price indices and reported in USD and CAD, respectively (gross family income in the U.S., and net household income in Canada).

lower likelihood of being in the decreasing trajectory membership in Canada but not in the U.S.

The similarities observed between the depressive symptom trajectories in the U.S. and Canada suggest that depressive symptoms may follow consistent patterns in the transition to adulthood. As in other studies, we found that a low-stable trajectory with few to no symptoms was most common in both countries [19,20]. We also showed that both increasing and decreasing symptom trajectory groups exist in the U.S. and Canada, but the proportion of young people within trajectory groups varies. Of note, the entropy for the latent trajectory solutions was lower in Canada, that is, differential misclassification needs to be considered when comparing across countries. As we only included five depressive symptoms items, we may not observe the high-persistent trajectory found in other studies [20]. An expanded set of items may be necessary to establish a core set of depressive symptom trajectories among young Americans and Canadians.

Our finding that there was an association between low family income and young people's depressive symptom trajectories in the U.S., with less support for the same association in Canada, is consistent with cross-national research documenting the relationship between greater income inequality in the U.S. and correspondingly worse child and adolescent outcomes [14,29,30]. We found a particularly strong association between low childhood family income and the increasing trajectory in the U.S. These results suggest that in the U.S., the relative income level of the family in childhood may be important for determining symptoms later in the transition to adulthood.

We also observed that low parental educational achievement predicted depressive symptom trajectory membership in the U.S. but not in Canada. These findings are consistent with evidence showing that comparatively weaker protections for

lower educated families in the U.S. are associated with worse child and adult well-being compared with other similar countries [14,31].

Finally, parental unemployment in childhood was associated with lower membership rates in the decreasing trajectory than the low-stable symptom trajectory in Canada. This finding contrasts with evidence from Canada that parental unemployment predicts worse depressive symptom trajectories [32]. Others have shown, however, that the effect of parental unemployment on child mental health depends on which parent was unemployed, whether joblessness was voluntary, and on the age of the child when their parents experienced unemployment [33]. A study of British children between the ages of 11 and 15 years found that parental unemployment had a positive influence on children's happiness if it occurred when children were young but had either a negative or nonsignificant effect if unemployment occurred later in a child's life [33]. Unemployed parents have also been shown to spend more time on parenting and childcare [34], which may translate to benefits for child mental health. Taken together, our study suggests that after accounting for family income and parental education, parental unemployment in childhood may protect young Canadians from having higher depressive symptom levels at the start of the transition to adulthood.

Childhood parental unemployment was not associated with a lower likelihood of membership in the decreasing trajectory relative to the low-stable trajectory in the U.S., which may reflect the greater generosity of unemployment insurance systems and other forms of social benefits available to families in Canada compared with the U.S. The loss of employment, after accounting for the influence of family income and parental education, may come with comparatively fewer stressors in Canada than in the U.S.

**Table 4**  
Results of the multivariable Poisson regressions with robust variances on the U.S. sample using the low-stable trajectory as the reference group

	The U.S. (n = 6,135)												Canada (n = 3,320)											
	Increasing				Decreasing				Mid-peak				Increasing				Decreasing				Mid-peak			
	IRR	LCI	UCI	p	IRR	LCI	UCI	p	IRR	LCI	UCI	p	IRR	LCI	UCI	p	IRR	LCI	UCI	p	IRR	LCI	UCI	p
<b>Relative family income</b>																								
In bottom income quartile	1.82	1.23	2.68	.00	1.51	.98	2.33	.06	1.66	1.00	2.77	.13	1.51	.88	2.60	.14	1.18	.84	1.67	.34	1.57	.87	2.83	.13
In 25th–50th percentile	1.59	1.11	2.27	.01	1.19	.82	1.73	.35	1.41	.88	2.25	.99	1.31	.81	2.11	.26	1.16	.88	1.53	.30	1.00	.58	1.70	.99
In 50th–75th percentile	1.06	.76	1.50	.72	.91	.64	1.31	.63	1.27	.83	1.93	.68	1.13	.71	1.81	.61	.96	.73	1.26	.76	.89	.51	1.57	.68
In top 25th percentile (ref)	1.00				1.00				1.00				1.00				1.00				1.00			
<b>Parental education</b>																								
Less than high school	1.31	.90	1.91	.16	1.36	.91	2.02	.14	1.09	.64	1.85	.75	1.03	.47	2.24	.94	.74	.50	1.09	.13	.47	.21	1.04	.06
High school graduation	1.21	.93	1.58	.15	1.42	1.08	1.87	.01	.99	.71	1.39	.96	.88	.55	1.43	.61	.87	.65	1.17	.34	.66	.35	1.24	.19
More than high school (ref)	1.00				1.00				1.00				1.00				1.00				1.00			
<b>Parental unemployment</b>																								
No (ref)	1.00				1.00				1.00				1.00				1.00				1.00			
Yes	1.18	.92	1.52	.19	1.22	.94	1.59	.13	.97	.68	1.39	.89	1.39	.92	2.12	.12	.76	.59	.98	.03	.82	.55	1.22	.33
<b>Gender</b>																								
Male (ref)	1.00				1.00				1.00				1.00				1.00				1.00			
Female	1.22	.99	1.52	.06	1.78	1.41	2.25	.00	2.00	1.36	2.97	.00	1.65	1.17	2.32	.00	1.68	1.36	2.07	.00	2.00	1.36	2.97	.00
<b>Mother born in the U.S.</b>																								
No	1.42	.81	2.49	.23	.79	.46	1.34	.37	1.46	.60	3.54	.40	.97	.51	1.86	.93	.98	.68	1.12	.92	1.48	.78	2.85	.23
Yes (ref)	1.00				1.00				1.00				1.00				1.00				1.00			
<b>Single parent status</b>																								
No (ref)	1.00				1.00				1.00				1.00				1.00				1.00			
Yes	.80	.61	1.05	.11	1.15	.86	1.54	.36	1.42	.85	2.40	.18	.96	.64	1.45	.84	1.14	.84	1.54	.39	1.42	.85	2.40	.18
Mother's age	.95	.93	.97	.00	.98	.95	1.01	.14	1.01	.97	1.04	.71	.99	.96	1.02	.54	.98	.96	1.00	.11	.96	.92	1.01	.10
<b>Rural residence</b>																								
Urban (ref)	1.00				1.00				1.00				1.00				1.00				1.00			
Rural	.95	.72	1.25	.71	.92	.69	1.22	.56	.96	.66	1.40	.85	.70	.50	.99	.04	.88	.71	1.10	.27	1.06	.73	1.55	.74

All analyses have also been adjusted for the age at which individuals enter into the cohort, race, and region of residence.  
IRR = incidence rate ratio; LCI/UCI = lower and upper bounds of 95% confidence interval; p = p value for z test; ref = reference.

This study has a number of strengths. We used the largest available national cohorts of young people in the U.S. and Canada. Using equivalent measures and the same modeling technique across cohorts, we were able to compare the longitudinal patterns in depressive symptoms in the transition to adulthood in both countries and their relationship to childhood SES.

This study also has numerous limitations. First, we used self-reported data, which may have biases including recall bias and underreporting. Second, although we included a number of covariates to control for potential confounding, residual confounding may be present as some measures were poorly defined (e.g., race and family educational attainment). Third, the American and Canadian cohorts were more socioeconomically advantaged compared with their respective populations [35,36]. The findings may thus underestimate the association between childhood SES and depressive symptom trajectories. Fourth, there are some limitations associated with GMM. GMM may be vulnerable to errors in the specification of the underlying latent structure (i.e., the number of classes and growth factors), which may result in overextraction of trajectory groups [37]. Parameter estimates may also be biased and standard errors underestimated because of the categorization of individuals into their most probable trajectory groups [38]. Our findings should, therefore, be replicated with alternative parametric approaches [39], and classification uncertainties should be accounted for. Finally, the Canadian cohort had a smaller sample size than the American cohort, suggesting that the Canadian analyses may be relatively underpowered.

Limitations notwithstanding, our findings have implications for policy and research. The results imply that depressive symptoms may follow consistent patterns in the transition to adulthood but that country-level differences in the institutional and policy landscape may affect how they are distributed within a population. Future research may replicate this study by examining whether similar trajectories exist in countries with similar economic and educational institutions, but differences in the relative progressiveness of their taxation and transfer systems and in the provision of social benefits. Replication of our findings using representative samples, harmonized data, and/or matching techniques are also warranted. Our findings further suggest that country-level differences modify the effect of childhood SES, and that effects differ by trajectory type. Policy makers should attend to institutional barriers to addressing social inequalities across childhood and young adulthood. Child benefit programs, for example, are an important aspect of the social safety net for disadvantaged children and families that may be leveraged for prevention. Canadian benefits are mostly universal, whereas in the U.S., child benefits have work requirements and are not universal, limiting the support available for low-SES families [16]. Compared with Canada, there is also greater inequality in the American school system, with funding for schools being more localized, leading to greater variability in school-level resources at the neighborhood or city level [14,15]. Future research may examine whether improving taxes and transfers, school quality, and resource allocation helps to mitigate mental health problems associated with low childhood SES and at what point in the transition to adulthood they are most effective. Study findings also have implications for the design of targeted depression prevention programs. Targeted prevention programs have been shown to be more effective than universal programs [40]. Our findings show that such strategies are particularly important in the U.S., where low childhood SES is a

greater risk for depressive symptoms in the transition to adulthood. Our findings also indicate that such programs attend to the relationship between childhood SES and the timing and course of depressive symptoms during this period.

In conclusion, this study showed that while depressive symptom trajectories during the transition to adulthood follow consistent patterns in the U.S. and Canada, institutional differences may matter for their population distribution. In Canada, a country with stronger social protections for families and less unequal education compared with the U.S., the risk of depressive symptom trajectories marked by increasing and decreasing symptoms depend less on childhood family income and parental education. The effects of parental unemployment in childhood on depressive symptoms may also differ between the two countries. This study finds evidence to support the idea that even in countries with similar institutions, country-level differences (e.g., in the taxation and transfer system and education systems) may have profound implications for how childhood SES influences the risk of depressive symptoms in the transition to adulthood.

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### Supplementary Data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jadohealth.2020.05.033>.

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### References

- [1] Kessler RC, Berglund P, Demler O, et al. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry* 2005;62:593–602.
- [2] Patten SB, Williams JVA, Lavorato DH, et al. Descriptive epidemiology of major depressive disorder in Canada in 2012. *Can J Psychiatr* 2015;60:23–30.
- [3] Eaton WW, Shao H, Nestadt G, et al. Population-based study of first onset and chronicity in major depressive disorder. *Arch Gen Psychiatry* 2008;65: 513–20.
- [4] Veldman K, Reijneveld SA, Ortiz JA, et al. Mental health trajectories from childhood to young adulthood affect the educational and employment status of young adults: Results from the TRAILS study. *J Epidemiol Community Health* 2015;69:588–93.
- [5] McDaid D, Park AL, Wahlbeck K. The economic case for the prevention of mental illness. *Annu Rev Publ Health* 2019;40:373–89.
- [6] Starfield B, Riley AW, Witt WP, et al. Social class gradients in health during adolescence. *J Epidemiol Community Health* 2002;56:354–61.
- [7] Willner P, Scheel-Kruger J, Belzung C. The neurobiology of depression and antidepressant action. *Neurosci Biobehav Rev* 2013;37:2331–71.
- [8] Bradley RH, Corwyn RF. Socioeconomic status and child development. *Annu Rev Psychol* 2002;53:371–99.



- [9] Schoon I, Bynner J. Entering adulthood in the great recession: A tale of three countries. In: Elder JGH, Parke RD, eds. *Children in Changing Worlds: Sociocultural and Temporal Perspectives*. Cambridge: Cambridge University Press; 2019:57–83.
- [10] Esping-Andersen G. *The three worlds of welfare capitalism*. Cambridge, UK: Polity Press; 1990.
- [11] Bergqvist K, Yngwe MA, Lundberg O. Understanding the role of welfare state characteristics for health and inequalities - an analytical review. *BMC Public Health* 2013;13:1234.
- [12] McAllister A, Fritzell S, Almroth M, et al. How do macro-level structural determinants affect inequalities in mental health? - a systematic review of the literature. *Int J Equity Health* 2018;17:180.
- [13] Huber E, Stephens J. Welfare state and production regimes in the era of retrenchment. In: Piersin P, ed. *The New Politics of the Welfare State*. Oxford: Oxford University Press; 2001.
- [14] Bradbury B, Corak M, Waldfogel J, et al. Too many children left behind: The U.S. Achievement gap in comparative perspective. New York: Russel Sage Foundation; 2015.
- [15] OECD. *Lessons from PISA for the United States, strong performers and successful reformers in education*. Paris: OECD Publishing; 2011.
- [16] Hoynes H, Stabile M. How do the US and Canadian social safety nets compare for women and children? *J Labor Econ* 2019;37:S253–88.
- [17] Wesselhoeft R, Sorensen MJ, Heiervang ER, et al. Subthreshold depression in children and adolescents - A systematic review. *J Affect Disord* 2013; 151:7–22.
- [18] Magnusson D. Implications of an interactional paradigm for research on human development. *Int J Behav Dev* 1985;8:115–37.
- [19] Shore L, Toumbourou JW, Lewis AJ, et al. Review: Longitudinal trajectories of child and adolescent depressive symptoms and their predictors - A systematic review and meta-analysis. *Child Adol Ment H-uk* 2018;23:107–20.
- [20] Schubert KO, Clark SR, Van LK, et al. Depressive symptom trajectories in late adolescence and early adulthood: A systematic review. *Aust Nz J Psychiat* 2017;51:477–99.
- [21] Rathmann K, Pfortner TK, Osorio AM, et al. Adolescents' psychological health during the economic recession: Does public spending buffer health inequalities among young people? *BMC Public Health* 2016;16.
- [22] Radloff LS. The use of the Center for Epidemiologic Studies Depression scale in adolescents and young-adults. *J Youth Adolescence* 1991;20:149–66.
- [23] Poulin C, Hand D, Boudreau B. Validity of a 12-item version of the CES-D used in the national longitudinal study of children and Youth. *Chronic Dis Can* 2005;26:65–72.
- [24] Gardner PL. Measuring attitudes to science: Unidimensionality and internal consistency revisited. *Res Sci Education* 1995;25:283–9.
- [25] Dall'Oglio AM, Rossiello B, Coletti MF, et al. Developmental evaluation at age 4: Validity of an Italian parental questionnaire. *J Paediatr Child Health* 2010;46:419–26.
- [26] Berlin KS, Parra GR, Williams NA. An introduction to latent variable mixture modeling (part 2): Longitudinal latent class growth analysis and growth mixture models. *J Pediatr Psychol* 2014;39:188–203.
- [27] Zou G. A modified Poisson regression approach to prospective studies with binary data. *Am J Epidemiol* 2004;159:702–6.
- [28] White IR, Royston P, Wood AM. Multiple imputation using chained equations: Issues and guidance for practice. *Stat Med* 2011;30:377–99.
- [29] Pickett KE, Wilkinson RG. Child wellbeing and income inequality in rich societies: Ecological cross sectional study. *BMJ* 2007;335:1080.
- [30] Elgar FJ, Garipey G, Torsheim T, et al. Early-life income inequality and adolescent health and well-being. *Soc Sci Med* 2017;174:197–208.
- [31] McLaughlin KA, Breslau J, Green JG, et al. Childhood socio-economic status and the onset, persistence, and severity of DSM-IV mental disorders in a US national sample. *Social Sci Med* 2011;73:1088–96.
- [32] Ferro MA, Gorter JW, Boyle MH. Trajectories of depressive symptoms in Canadian emerging adults. *Am J Public Health* 2015;105:2322–7.
- [33] Powdthavee N, Vernoit J. Parental unemployment and children's happiness: A longitudinal study of young people's well-being in unemployed households. *Labour Econ* 2013;24:253–63.
- [34] Knabe A, Ratzel S, Schob R, et al. Dissatisfied with life but having a good day: Time-use and well-being of the unemployed. *Econ J* 2010;120:867–89.
- [35] Statistics Canada. *Census program data viewer, 2016 Census*. Feb. 20, 2019 edition. Ottawa, Canada: Statistics Canada; 2019.
- [36] National Center for Education Statistics. *Table 104.70 number and percentage distribution of children under age 18, by parents' highest level of educational attainment, child's age group and race/ethnicity, and household type: 2010 and 2017*. Washington, DC: Digest of Education Statistics; 2018.
- [37] Sterba SK, Bauer DJ. Matching method with theory in person-oriented developmental psychopathology research. *Dev Psychopathol* 2010;22: 239–54.
- [38] Kamata A, Kara Y, Patarapichayatham C, et al. Evaluation of analysis approaches for latent class analysis with auxiliary linear growth model. *Front Psychol* 2018;9:130.
- [39] Sterba SK. Modeling strategies in developmental psychopathology research: Prediction of individual change. In: Lewis M, Rudolph KD, eds. *Handbook of Developmental Psychopathology*. Boston, MA: Springer US; 2014:109–24.
- [40] Werner-Seidler A, Perry Y, Calear AL, et al. School-based depression and anxiety prevention programs for young people: A systematic review and meta-analysis. *Clin Psychol Rev* 2017;51:30–47.