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Expectancy and Achievement Gaps in Educational Attainment and Subsequent Adverse Health Effects among Adolescents with and without Chronic Medical Conditions

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Abstract

Purpose—While education-based disparities in health are common, the extent to which chronic conditions contribute to education gaps and to consequent health disparities is not fully understood. As such, we sought to investigate educational aspirations, expectations, and attainment among youth with and without chronic conditions, and to determine if these relationships mediated subsequent disparities in health and wellbeing.

Methods—Longitudinal data on 3518 youth are from the 1997–2013 Panel Study of Income Dynamics (PSID), a population-based survey. Multivariate regression was used to assess disparities in educational aspirations, expectations, and attainment by chronic conditions and the subsequent effects on health and wellbeing, adjusting for important potential confounders.

Results—Youth with chronic medical conditions (YCMC) did not report significantly lower educational *aspirations* than their healthy peers; however, YCMC reported lower *expectations* for their educational attainment and fewer YCMC had earned their desired degree by the end of follow-up (e.g., bachelor's degree: 19.9% for YCMC vs 26.0% for peers, $p < 0.05$). YCMC reported significantly worse general health, lower life satisfaction, and lower psychological wellbeing in young adulthood than did their healthy peers. These disparities persisted after adjustment for confounders; the association between chronic disease and health was partially, but significantly, mediated by actual educational attainment.

Conclusions—Findings suggest an important risk mechanism through which YCMC may acquire socioeconomic disadvantage as they develop and progress through educational settings.

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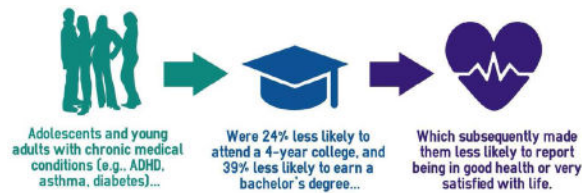
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Disproportionate lags in education, from expectation to attainment, may in turn increase YCMC's susceptibility to poor health and wellbeing in the future.

Graphical Abstract



Keywords

Adolescent; Young Adult; Education; Educational Activities; Educational Attainment; Chronic Disease; Health; Wellbeing; Resilience; Psychological

Introduction

The prevalence of pediatric-onset chronic medical conditions, such as type 1 diabetes and asthma, has been steadily rising over the past several decades, leading to an unprecedented number of youth, over 1-in-4, who must manage their condition¹ and cope with the associated financial and psychosocial burdens.² For youth with chronic medical conditions (YCMC), disease burden may interfere with normal developmental processes and negatively affect near-term as well as subsequent health and wellbeing. While psychosocial and health decrements are commonly observed among YCMC during emergent adulthood,^{3–10} mechanisms are unclear.

Life-course theory and a multiple determinants of health model highlight the importance of considering the dynamic circumstances and developing socioeconomic contexts bearing on youth as they mature into adulthood.^{11–13} Educational attainment, a critical component of socioeconomic status, has been shown to affect several health outcomes.^{14–16} Education-based gradients in health likely operate by affecting individuals' ability to obtain and apply health-related knowledge, access health services, and regulate exposure to various health risks, all of which are especially critical for successful disease self-management among YCMC.^{17,18} There is some evidence to suggest that YCMC may experience gaps in educational attainment,^{19,20} although there is a paucity of evidence about longitudinal processes linking chronic disease, education (from aspirations to attainment), and health.

To address this gap, we sought to quantify disparities in educational aspirations, expectations, and attainment as they manifest longitudinally among adolescents and young adults with and without chronic conditions; we further sought to determine if disparities in educational attainment in adolescence mediate subsequent disparities in health and wellbeing during emergent adulthood. If empirically validated, this model might help explain why 'down-stream' adverse health outcomes are common among YCMC during emergent adulthood and guide the design and application of supportive interventions targeting 'upstream' causes during adolescence.

Methods

Data Source and Sample

Data are from the Panel Study of Income Dynamics (PSID), a nationally representative, longitudinal household survey. In 1997, children from birth to age 12 years residing in PSID households were recruited into the Child Development Supplement (CDS); repeat waves of the CDS were administered in 2002/3 and 2007/8. CDS participants who graduated or dropped out of high school and were at least 18 years old were interviewed for the Transition into Adulthood (TA) survey in 2005, 2007, 2009, 2011, and 2013. Respondents were eligible for this study if they were interviewed in the initial 1997 CDS wave and responded to questions about educational and health outcomes in a subsequent interview (N=2555); additionally, another 963 CDS respondents had a parent or self-report of educational aspirations or expectations and were also included in analyses for those outcomes. As data were already collected and de-identified, this study was exempted from IRB approval.

Dependent Variables

Educational Outcomes—Both parents and youth reported on educational preferences/aspirations (respectively) and expectations in the CDS when youth were <18, and youth further reported on these outcomes in the TA. In the CDS, *parents* reported their preferences (“In the best of all worlds, how much schooling would you like [your child] to complete?”) and expectations (“Sometimes children do not get as much education as we would like. How much schooling do you expect that [your child] will really complete?”), regarding their child’s educational attainment. In the CDS and TA, *youth* (ages 12 and older) reported their aspirations (“How far would you like to go in school?”) and expectations (“Many people do not get as much education as they would like. How far do you think you will actually go in school?”) for their own educational attainment. These outcomes were classified as follows: 1) Graduate from high school or less; 2) Post-high school vocational training or some college; 3) Graduate from a 2-year college; 4) Graduate from a 4-year college; 5) Earn a graduate degree (e.g., Master’s, MD, JD, PhD); or 6) Don’t know (youth respondents could additionally report wanting to “do something else”).

Youth’s self-reported educational attainment (including college enrollment status, receipt of academic degrees, and dates of matriculation and completion) was assessed at each TA administration and used to construct time-varying summary variables for attainment (Did not graduate from high school or earn a GED; Graduated from high school or earned a GED; Post-high school vocational training or some college; Graduated from a 2-year college; Graduated from 4-year college; or Any graduate school), and conditional indicators of academic progression (e.g., matriculation into a 4-year college among anyone with a high school degree/GED; completion of a bachelor’s degree among anyone who attended a 4-year college).

Health & Wellbeing—Health status was measured as an ordinal variable using Likert-type responses from the following question: “Would you say your health in general is excellent, very good, good, fair, or poor?” A continuous measure for psychological wellbeing was

constructed by reverse coding Kessler-6 psychological distress scores.²¹ In the 2009–2013 administrations of the TA, respondents were asked to rate their life satisfaction on a Likert-scale: “How satisfied are you with [your life-as-a-whole]? Are you completely satisfied, very satisfied, somewhat satisfied, not very satisfied, or not at all satisfied?”

Independent Variables

Chronic Medical Conditions—Chronic conditions were conceptualized as those requiring regular, lifelong medical management with onset in childhood, and identified by report of ever being told by a doctor or other health professional that they had: ADHD/ADD; asthma; autism; birth defects; breathing problems; cancer; chronic hypertension (reported 2 times); diabetes; digestive problems; emotional or psychological problems; epilepsy; heart conditions; kidney disease; learning disability or developmental delays; migraines; orthopedic conditions; sickle cell anemia; skin disease; hearing, speech, or visual impairments; and other conditions. Youth who did not report any of the aforementioned chronic conditions or reported only acute or episodic conditions (e.g., allergies; jaundice) were considered to have no chronic conditions. Youth with a reported diagnosis of intellectual disability were excluded.

Reported age of diagnosis for each condition (or age at first report of each condition when age was missing) was used to construct time-varying indicators of chronic condition status at each follow-up survey. For descriptive purposes (i.e., Table 1), a summary of chronic condition status based on age of first diagnosis was used (any chronic condition diagnosed 14 years of age; any chronic condition diagnosed >14 years of age; no chronic conditions).

To assess if specific conditions demonstrated differential relationships with the dependent variables under investigation, we replicated analyses using four (non-mutually exclusive) chronic condition summary variables: 1) any emotional or psychological problems; 2) any learning disability, developmental delay, autism, or ADHD/ADD; 3) any sensory impairment (i.e., hearing, speech, or visual impairments); and 4) any of the other major medical conditions. We also investigated major medical conditions in (4) with an accompanying major activity limitation, defined by reports in the TA that selected conditions limit “normal daily activities” either “a lot” or “somewhat;” this follow-up limitation question was only asked for some conditions hence it may underestimate the prevalence of individuals with a limitation-causing condition.

Sociodemographic Factors—Data on child sociodemographic factors included: age (at each survey administration, treated as a time-varying covariate), sex (male vs female), and race/ethnicity (Hispanic; White, non-Hispanic; Black, non-Hispanic; Asian, non-Hispanic; Other, non-Hispanic). Several indicators of childhood socioeconomic status were constructed, including: 1) whether the mother participated in Women, Infants, and Children (WIC) or Aid to Families with Dependent Children (AFDC) programs during pregnancy; 2) whether or not both parents were present in the household in 1997; and 3) the highest educational attainment for either parent (less than high school degree/GED; high school degree or GED; some college or vocational school; and college graduate or beyond).

Statistical Analyses

Analyses were conducted using survey procedures from SAS version 9.4 (Cary, NC). The standard errors were corrected due to clustering within strata and the primary sampling unit, and PSID sampling weights were used to account for both attrition and the unequal household selection probabilities from the original PSID sampling frame. Statistical significance was considered at $p < 0.05$.

Summary statistics were generated to describe sample characteristics; chi-square and Kruskal-Wallis tests were used to determine significant differences in sociodemographic characteristics by chronic condition status and by highest reported educational attainment (among youth interviewed in the TA). Multivariate generalized linear mixed models (GLMM) were used to account for the correlated nature of the data (given repeated measures over 10+ years of follow-up). Educational outcomes were modeled using GLMM with a multinomial distribution and generalized logit link function, where the odds of each level of educational attainment is compared against () high school graduate/GED as the reference. General health and life satisfaction were treated as ordinal variables (higher values indicate better health, greater satisfaction) and modeled with a cumulative logit link function; psychological wellbeing was modeled with a Gaussian distribution.

Mediation of disparities by chronic condition status was evaluated with stepwise regression and application of the Sobel test.²² First, models adjusting only for age and chronic condition status were run (Model 1), followed by models additionally adjusting for sex, race/ethnicity, WIC/AFDC participation during pregnancy, parent marital status at baseline, and parental educational attainment (Model 2). For youth-reported educational attainment, Model 3 additionally adjusted for educational aspirations and expectations. For health and wellbeing outcomes, Model 3 additionally adjusted for actual educational attainment.

Results

Educational Outcomes

YCMC did not report significantly lower educational aspirations than their healthy peers (e.g., 83.1% of all youth reported aspiring to earn bachelor's degree; Table 1); however, compared to their counterparts, YCMC reported lower educational expectations (bachelor's degree: 76.3% of YCMC vs 78.0% of peers) and evidenced lower educational attainment by the end of follow-up (bachelor's degree: 19.9% of YCMC vs 26.0% of peers). Disparities in educational attainment persisted after adjustment for confounders, including aspirations and expectations; compared to their healthy peers, YCMC had: 24% lower odds of attending college, 24% lower odds of attending a 4-year college, and 39% lower odds of earning a bachelor's degree (all $p < 0.05$; Table 2, Model 3). Both aspirations and expectations were significant predictors of actual attainment (data not shown). Among those youth who dropped out of college prior to obtaining a degree, YCMC were more likely to cite personal/health reasons than their peers (19.0% vs 13.8%, $p = 0.04$; Figure 1).

Parents of YCMC reported similar preferences for their child's educational attainment as did parents of healthy youth (e.g., 87.6% preferred their child earn bachelor's degree; Table 1) yet reported lower expectations for their child (bachelor's degree: 78.0% of YCMC parents

vs 82.4% of peer parents). Among parents whose expectations for their child's education were less than their preferences, parents of YCMC were nearly five times as likely as parents of healthy youth to cite their child's health or a disability as the reason why they believed their child would achieve less (10.7% vs 2.4%, $p<0.01$) but were equally likely to cite as reasons their child's grades/ability (28.5%, $p=0.09$) or competing life goals (21.2%, $p=0.91$; Figure 1).

Health & Wellbeing

Compared to their peers, YCMC reported significantly worse general health in young adulthood ($p<0.001$), lower life satisfaction ($p<0.001$), and lower psychological wellbeing ($p<0.001$, Table 1); youth with lower educational attainment also reported significantly worse general health, lower life satisfaction, and lower psychological wellbeing ($p<0.01$). Disparities in health and wellbeing for YCMC persisted after adjustment for confounders (Table 3); these disparities were partially mediated by educational attainment (yet remain statistically significant) for all three health & wellbeing outcomes (Sobel test $p<0.05$).

Condition-Specific Analyses

Condition-specific analyses identified similar findings across all condition sub-types, including significant differences in odds of graduating high school or completing a GED for all condition categories except sensory impairments (Table 4). Youth with learning disabilities had the lowest odds of attending any or a 4-year college, youth with a limitation-causing condition had the lowest odds of completing a bachelor's degree and greatest health disparities, and youth with psychological conditions had the greatest wellbeing disparities.

Discussion

Despite observing no significant difference in educational aspirations for youth with and without chronic medical conditions, YCMC's expectations for their educational attainment and their actual attainment trailed behind their healthy peers during adolescence and emergent adulthood. Educational attainment was a strong predictor of later health and wellbeing, and gaps in attainment partially mediated the associations between having a pediatric-onset chronic condition and poor health/wellbeing later in life. Findings suggest an important mechanism through which medically vulnerable youth disproportionately acquire socioeconomic disadvantage as they mature, which in turn affects their future health and wellbeing. Both matriculation into college and completion of a bachelor's degree are specific junctures where expectation and attainment gaps widen and supportive interventions may be especially helpful.

Prior studies have investigated educational attainment for YCMC and found similar gaps in attainment,^{17,20,23–26} although few studies have been able to assess the extent to which these disparities stem from underlying differences in educational aspirations or expectations, or pinpoint where in the educational trajectory YCMC are most likely to fall behind their peers. We identified that even prior to completing high school, YCMC and their parents report lower expectations for attainment. Diminished expectations may reflect an accurate anticipation of likely challenges to attainment in the post-secondary school setting given

what may be a dearth of practical supports for managing symptoms, disease activity, treatment regimens, and other problems in the context of everyday demands for student life. Moreover, internalized expectations of low attainment, especially coupled with high aspirations, may additionally undermine academic success. Helpful interventions may involve provision of guidance and coaching in healthcare settings to help YCMC navigate educational environments, as well as developing plans to overcome likely challenges, including those stemming from the need to simultaneously balance academic and disease-specific demands. YCMC must constantly prioritize disease self-management to avoid adverse outcomes,^{13,27,28} yet competing life priorities may interfere with youth's ability to engage in routine self-care and self-regulation of risk behaviors. Additional policy and program interventions may be needed to ensure that features of educational settings enable YCMC to fully participate (e.g., exchange of health records, flexible class/exam schedules to accommodate treatment regimens, medical leave without academic or financial penalty, residential and nutritional accommodations).

We found that YCMC are significantly less likely than their healthy peers to complete a bachelor's degree after entering a 4-year college, and that earning a college degree is protective for future health and wellbeing. College constitutes a critical developmental opportunity for YCMC. This opportunity is precarious: College overlaps the period when transition from pediatric to adult-focused care is recommended,²⁹ and when youth are most likely to fall out of contact with their healthcare provider.³⁰ Movement away from established care relationships and supports, common for college attending youth, may undermine self-management and expose YCMC to environments conducive of risk behaviors;³¹⁻³³ yet, evidence suggests that many colleges are not well equipped to identify and support the medical needs of YCMC.^{34,35} Lacking access to preventive and specialty care during college may explain the observed lower graduation rates among the YCMC who make it to college. Alternatively, increased exposure to stressful environments and risk behaviors during college may exacerbate chronic disease symptoms, which in turn may impede this group's progression from matriculation to graduation. We currently have an incomplete understanding of the ways in which educational settings interact with the chronic illness experience to shape outcomes, but our findings suggest that inequalities build over various steps in the educational trajectory. Ensuring that YCMC are able to achieve their desired educational trajectory will likely require targeted efforts to support continued healthcare engagement throughout the transition period. For college-attending YCMC, additional structural supports may be needed to ensure access to necessary healthcare and other supportive services; ideally through creating a network of interconnected services and supports in order to eliminate administrative obstacles and facilitate shared information and responsibility.

Importantly, pediatric-onset chronic medical conditions were associated with subsequent worse general health, life satisfaction, and psychological wellbeing, while disparities in educational attainment appeared to partially mediate these associations. This pathway may stem from reinforcing vulnerability. For instance, impediments to disease self-management during college may explain why fewer college-attending YCMC complete a bachelor's degree whereas additional educational attainment might promote improved self-efficacy in disease self-management skills, with each step contributing to widening gaps in effective

self-care. For both YCMC and their healthy peers, college (and post-high school generally) is a time when youth develop increased autonomy and independence, skills that are important for all young adults but which may be particularly important for improved proficiency in self-care and the ability to self-advocate in the healthcare and broader social environments. Skills-based interventions may be one way to advance general competencies that could be doubly impactful for both scholastic and disease outcomes.^{36,37} Yet, addressing the intersection of education and health may require a broader, integrative approach.³⁸ For instance, policy levers have been implemented to avoid discrimination on the basis of disability (Americans with Disabilities Act) and to promote equal educational opportunity (Individuals with Disabilities Education Act);³⁹ such regulations have moved students toward parity in educational programs. Still, to identify and shrink lingering disparities there is a clear need to evaluate adequacy and variability in current practices for facilitating disease self-management and academic, social, and extracurricular engagement in educational settings. As well, it is worth considering how clinicians might help promote educational attainment of YCMC as a legitimate “health outcome.” Ultimately, because the burden of chronic disease appears to complicate and compound normal developmental needs for adolescents and young adults, interventions that buttress individual and system-level supports to address these life-course processes may strengthen youth resilience and maximize their potential to thrive.

This study contributes new information to the extant literature on developmental outcomes for YCMC. Longitudinal data allowed the examination of trajectories of educational attainment and health status over more than a decade of follow-up and the nationally representative cohort with high response rates and low rates of missing items enables generalizable estimates to US adolescents and young adult populations.⁴⁰ Several important limitations also apply. Parent/self-report of chronic disease diagnosis is not an ideal proxy for clinical report. The high prevalence of conditions among youth in PSID cohorts may stem from the broad definition of conditions with potential for false positives; if present, such misclassification would likely bias findings toward the null. We note that the study sample has a high degree of shared ancestry,³³ inflating the overall prevalence of youth with any condition. The low prevalence of many specific conditions precludes precise condition-specific estimates, a limitation, as is the lack of detailed information on condition severity or functional impairments. These issues should be priorities for future investigations. Many factors may contribute to education and health outcomes and while we adjusted for a number of established confounders, our estimates may still be subject to residual confounding. Finally, although 64.4% of youth included in the educational outcomes analyses were at least age 22 years at their last follow-up (38.2% were 25 years), many individuals obtain their terminal degrees later in life. Therefore, our view into lifetime educational attainment for a relatively young sample may be limited.

Conclusion

YCMC must navigate normal adolescent development in light of the burden of their disease and its treatment, but we have yet to fully understand the mechanisms through which developmental processes may be disrupted with consequences for health disparities. Findings from this study suggest an important mechanism through which YCMC are

susceptible to acquiring socioeconomic disadvantage as they progress through normal development. Specifically, as lags in educational expectations and attainment manifest, we see increased future susceptibility to diminished health and wellbeing. Clinicians have an important opportunity to provide supportive guidance to YCMC and triage at-risk youth to psychosocial interventions to help them anticipate and navigate educational environments in a fashion that protects attainment and health. Policymakers and program developers from education and health sectors may have a role too, in advancing structural supports. Additional work is warranted to understand the complex relationship between the myriad of risk and protective factors in this stage of development to guide intervention and response, including during high-risk periods of healthcare transition and emergent adulthood.

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Abbreviations

CDS	Child Development Supplement
CI	Confidence Interval
OR	Odds Ratio
PSID	Panel Study of Income Dynamics
SES	Socioeconomic Status
TA	Transition into Adulthood
YCMC	Youth with Chronic Medical Conditions

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Implications and Contribution: Findings suggest that youth with chronic conditions are susceptible to lower educational attainment, despite not having different educational aspirations from their healthy peers, and that these gaps in attainment partially contribute to the pathway leading from chronic disease to later adverse health and wellbeing.

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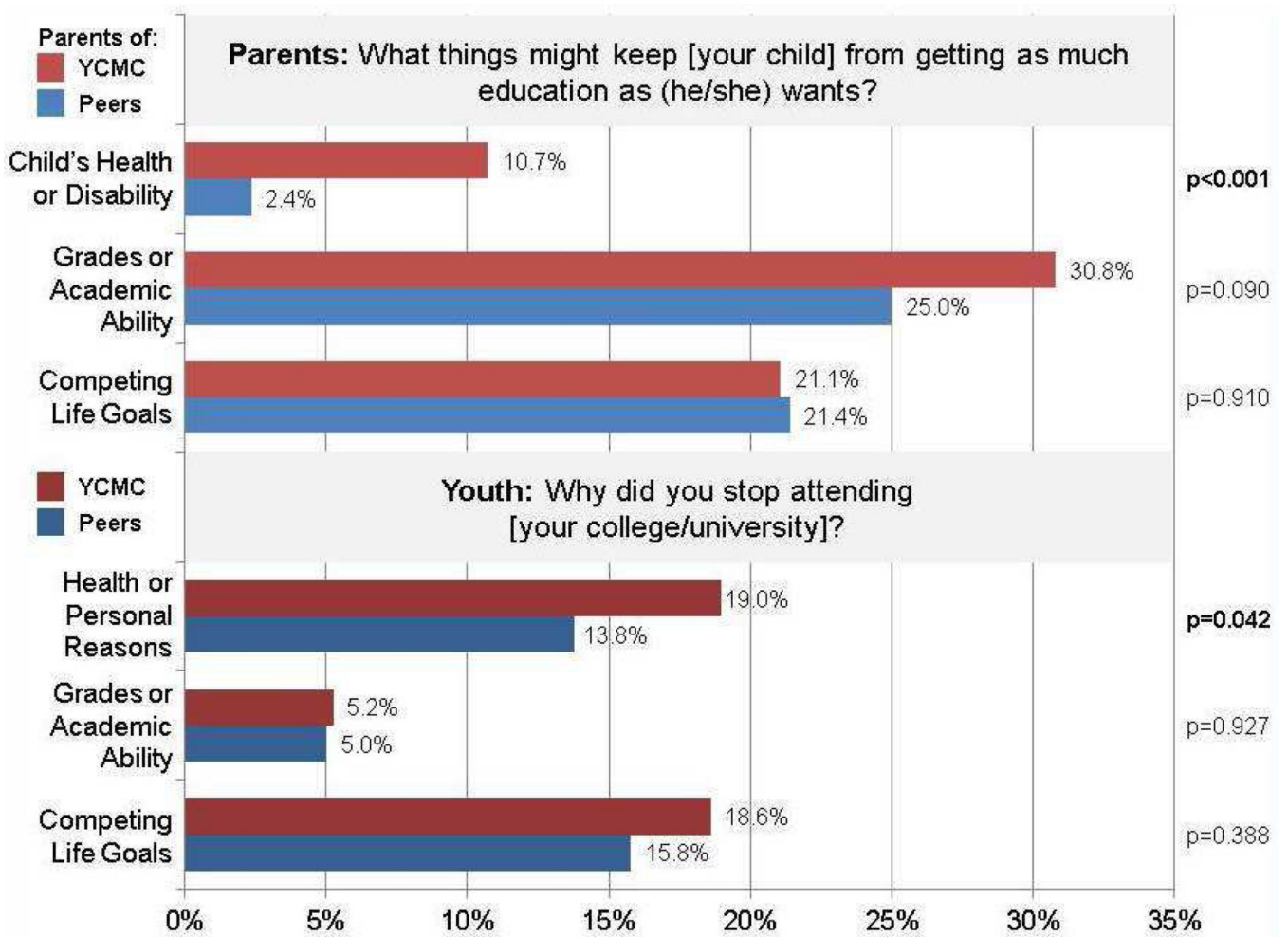


Figure 1. Parents who reported that their expectations for their child were less than their preferences were asked the follow-up question: “What things might keep (CHILD) from getting as much education as (he/she) wants?” Parents’ verbatim responses were assigned to one of 24 single categories by PSID staff. For this question, ‘Child’s Health or Disability’ included parent’s responses that were classified as: “Learning disability,” “Physical disability,” “Emotional disability/Mental health problems,” “Child’s health,” or “Disability - Not Specified.” The ‘Grades or Academic Ability’ category included: “Grades/Lack of studying/Doesn’t test well,” “(Lack of) Ambition/Motivation/Attitude/Focus/ Commitment,” or “Dropping out of high school.” The ‘Competing Life Goals’ category included: “Change in personal interests/goals,” “Marriage/relationship,” “Having children,” “Desire to travel,” “Gets a job instead/ Interested in non-academic fields.”

Youth who reported that they stopped attending a college/university without receiving a degree were asked the follow-up question: “Why did you stop attending this school?” Their verbatim responses were assigned to one of 11 single categories by PSID staff. For this question, ‘Health or Personal Reasons’ included responses that were classified as: “Personal reasons; health; pregnancy; marriage; substance use; family commitments.” The ‘Grades or

Academic Ability' category included: "Academic reasons: grades; too large a challenge."
The 'Competing Life Goals' category included: "Dissatisfied with school; bored; changed goals."

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Cross-Sectional Associations between Sociodemographic Characteristics, Educational Attainment, and Health Status

Table 1

	Chronic Condition Status ^d			Highest Educational Attainment ^d		
	Total	Dx 14	Dx > 14	Total	BA/BS	College
Total N (unweighted)	3,518	1,729	384	2,555	453	582
Total % (weighted)	50.0%	11.5%	38.5%	21.9%	58.2%	20.0%
Youth's Age in 1997						
Mean	6.28	6.22	8.09	7.42	9.58	7.00
Standard Deviation	3.78	3.64	2.90	3.25	1.85	3.53
Youth's Age at Last Follow-Up						
Mean	19.74	20.32	23.98	23.51	22.88	22.90
Standard Deviation	6.83	6.13	2.84	2.88	1.38	3.16
Sex						
Female	49.9%	42.4%	66.2%	51.4%	56.9%	41.7%
Male	50.1%	57.6%	33.8%	48.6%	43.1%	58.3%
Race/Ethnicity						
White, non-Hispanic	58.5%	59.4%	60.8%	55.7%	69.5%	54.8%
Black, non-Hispanic	14.6%	14.9%	10.5%	14.9%	7.4%	14.5%
Asian, non-Hispanic	3.3%	2.3%	2.5%	3.4%	5.0%	2.8%
Other, non-Hispanic	6.4%	7.2%	6.4%	7.7%	5.4%	8.0%
Hispanic	17.2%	16.2%	19.9%	18.3%	12.7%	19.8%
Prenatal WIC/AEFC Participation						
Yes	32.8%	36.5%	26.8%	31.1%	9.7%	56.7%
No	67.2%	63.5%	73.2%	68.9%	90.3%	43.3%
Parent's Marital Status in 1997						
Single Parent Household	22.6%	26.4%	16.6%	23.6%	13.3%	39.0%
Two Parent Household	77.4%	73.6%	83.4%	76.4%	86.7%	61.0%
Parental Education						
Less than high school/GED	22.3%	22.2%	15.5%	20.8%	4.1%	30.3%
High school graduate/GED	23.9%	24.6%	24.2%	22.7%	10.0%	22.3%
Some college	20.3%	20.4%	17.5%	18.5%	14.2%	19.9%

	Chronic Condition Status ^d				Highest Educational Attainment ^d				
	Total	Dx 14	Dx > 14	None	Total	BA/BS	College	HS	p-val
College graduate or more	33.5%	32.8%	42.8%	31.7%	38.0%	71.8%	34.0%	12.5%	
Educational Outcomes	N=								
Actual Education Attainment^d	2,555								0.001
Did not graduate high school/GED	5.0%	6.5%	2.7%	3.6%					
Graduated high school/GED	14.9%	17.2%	10.7%	13.2%					
Some college or vocational training	50.7%	50.0%	53.7%	50.2%					
Earned an associate's degree	7.5%	7.7%	8.0%	6.9%					
Earned a bachelor's degree	13.4%	12.0%	12.5%	16.0%					
Any graduate school	8.5%	6.4%	12.4%	10.0%					
Youth's Highest Expectations^d	2,807								0.030
Graduate high school/GED	2.5%	2.6%	1.3%	2.9%	1.1%	0.0%	0.3%	4.5%	<0.001
Some college or vocational training	6.3%	7.1%	3.8%	6.2%	5.3%	0.0%	3.6%	16.1%	
Earn an associate's degree	13.1%	14.5%	12.6%	11.1%	13.2%	0.0%	13.0%	28.2%	
Earn a bachelor's degree	35.9%	35.7%	33.5%	37.4%	36.1%	16.3%	42.9%	38.0%	
Earn a graduate degree	40.9%	39.0%	48.7%	40.7%	43.6%	83.7%	40.0%	10.4%	
Don't know/Do something else	1.2%	1.2%	0.0%	1.8%	0.6%	0.0%	0.1%	2.9%	
Youth's Highest Aspirations^d	2,807								0.242
Graduate high school/GED	2.2%	2.1%	1.2%	2.7%	1.1%	0.0%	0.2%	4.8%	<0.001
Some college or vocational training	4.3%	5.1%	2.3%	3.8%	3.4%	0.0%	2.4%	10.1%	
Earn an associate's degree	8.9%	9.3%	9.5%	7.8%	8.7%	0.0%	8.0%	20.4%	
Earn a bachelor's degree	33.5%	34.2%	29.7%	34.2%	33.3%	12.5%	38.6%	40.5%	
Earn a graduate degree	49.6%	47.9%	56.3%	49.3%	52.7%	87.5%	50.6%	20.7%	
Don't know/Do something else	1.6%	1.4%	1.0%	2.1%	0.8%	0.0%	0.2%	3.5%	
Parent's Highest Expectations^d	3,518								<0.001
Graduate high school/GED	10.2%	12.8%	5.9%	8.1%	9.7%	1.9%	6.7%	27.1%	
Some college or vocational training	4.2%	4.2%	4.8%	4.0%	3.9%	0.6%	3.0%	10.3%	
Earn an associate's degree	5.7%	6.0%	5.2%	5.5%	5.4%	2.2%	5.5%	8.8%	
Earn a bachelor's degree	53.9%	50.1%	55.3%	58.6%	53.5%	54.3%	56.8%	43.0%	
Earn a graduate degree	25.8%	26.7%	27.9%	23.8%	27.1%	40.3%	27.8%	10.6%	

	Chronic Condition Status ^d				Highest Educational Attainment ^d				
	Total	Dx 14	Dx > 14	None	Total	BA/BS	College	HS	p-val
Don't know	0.2%	0.3%	0.8%	0.0%	0.3%	0.6%	0.2%	0.3%	<0.001
Parent's Highest Preference^d	<i>2,999</i>								0.051
Graduate high school/GED	4.9%	5.9%	3.8%	3.7%	5.0%	1.9%	2.4%	16.0%	
Some college or vocational training	3.3%	3.6%	1.3%	3.6%	3.3%	1.2%	3.1%	5.8%	
Earn an associate's degree	4.1%	4.7%	4.0%	3.4%	4.6%	1.6%	3.7%	10.1%	
Earn a bachelor's degree	51.8%	48.9%	54.4%	55.2%	52.0%	46.6%	54.0%	51.7%	
Earn a graduate degree	35.7%	36.9%	36.1%	33.8%	35.1%	48.8%	36.5%	16.3%	
Unsure	0.1%	0.0%	0.3%	0.3%	0.1%	0.0%	0.2%	0.0%	
Health & Wellbeing Outcomes	<i>N=</i>								
Health Status^d	<i>2,555</i>								<0.001
Excellent	22.3%	19.5%	18.3%	28.8%	22.3%	30.7%	19.9%	20.1%	
Very Good	42.6%	41.1%	47.0%	42.8%	42.6%	49.5%	42.9%	34.1%	
Good	26.8%	29.4%	23.4%	24.1%	26.8%	16.0%	28.9%	32.3%	
Fair	7.4%	8.5%	10.1%	4.2%	7.4%	3.8%	7.1%	12.2%	
Poor	1.0%	1.5%	1.2%	0.0%	1.0%	0.0%	1.2%	1.3%	
Life Satisfaction^d	<i>2,483</i>								<0.001
Completely satisfied	17.7%	19.2%	11.1%	18.5%	17.7%	17.7%	18.1%	16.6%	
Very satisfied	48.3%	44.6%	51.7%	52.7%	48.3%	55.0%	48.9%	38.7%	
Somewhat satisfied	30.8%	32.1%	33.0%	27.4%	30.8%	25.4%	30.5%	37.7%	
Not very satisfied	2.6%	3.5%	2.4%	1.3%	2.6%	1.7%	1.9%	5.9%	
Not at all satisfied	0.6%	0.6%	1.8%	0.1%	0.6%	0.2%	0.6%	1.2%	
Psychological Wellbeing^d	<i>2,555</i>								0.002
Mean	19.15	18.83	18.67	19.94	19.15	19.63	19.20	18.52	
Standard Deviation	3.68	3.79	3.72	3.27	3.70	2.83	3.70	4.56	

Data are from the Panel Study of Income Dynamics, Child Development and Transition to Adulthood Supplements (1997–2013). Unweighted Ns and weighted percentages and means are presented.

^dNote that cross-sectional summaries of longitudinal/time-varying variables are presented and do not reflect the full distribution of responses across multiple assessments.

Table 2

Effects of Chronic Condition Status on Educational Outcomes

<i>Estimates for the Effect of Any Chronic Condition (vs None)</i>	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
<i>Conditional Analyses</i>						
High School Grad/GED	0.55	(0.30–1.02)	0.57	(0.30–1.11)	0.61	(0.31–1.23)
Any College High School Grad/GED	0.69	(0.54–0.88)	0.69	(0.55–0.88)	0.76	(0.59–0.97)
Earned a Degree Any College & Age 20 years	0.75	(0.58–0.97)	0.69	(0.53–0.89)	0.68	(0.51–0.90)
Any 2-year College High School Grad/GED	1.01	(0.82–1.25)	1.04	(0.84–1.28)	1.04	(0.81–1.33)
Earned Associate's Attended 2-year College	0.91	(0.61–1.37)	0.84	(0.56–1.26)	0.86	(0.53–1.39)
Attended 4-year College High School Grad/GED	0.73	(0.60–0.89)	0.71	(0.57–0.88)	0.76	(0.60–0.95)
Earned Bachelor's Attended 4-year College	0.69	(0.49–0.97)	0.62	(0.45–0.87)	0.61	(0.44–0.84)
Any Graduate School Earned Bachelor's	1.04	(0.64–1.70)	1.02	(0.66–1.59)	0.98	(0.59–1.63)
<i>Longitudinal Analyses</i>						
Youth's Actual Educational Achievement						
Did not graduate high school/GED	1.58	(0.58–4.29)	1.46	(0.59–3.62)	1.63	(0.70–3.79)
Graduated high school/GED	<i>Reference</i>		<i>Reference</i>		<i>Reference</i>	
Some college or vocational training	0.72	(0.49–1.06)	0.73	(0.50–1.07)	0.81	(0.56–1.16)
Earned an associate's degree	1.10	(0.37–3.29)	1.10	(0.38–3.21)	1.05	(0.38–2.88)
Earned a bachelor's degree	0.29	(0.13–0.64)	0.27	(0.13–0.58)	0.38	(0.21–0.67)
Any graduate school	0.23	(0.04–1.17)	0.32	(0.08–1.30)	0.29	(0.12–0.74)
Youth's Educational Expectations						
Graduate high school/GED	<i>Reference</i>		<i>Reference</i>		<i>Reference</i>	
Some college or vocational training	0.79	(0.53–1.18)	0.79	(0.54–1.15)		
Earn an associate's degree	0.86	(0.56–1.32)	0.82	(0.55–1.23)		
Earn a bachelor's degree	0.63	(0.42–0.94)	0.66	(0.45–0.97)		
Earn a graduate degree	0.62	(0.39–1.00)	0.64	(0.41–1.01)		
Youth's Educational Aspirations						
Graduate high school/GED	<i>Reference</i>		<i>Reference</i>		<i>Reference</i>	
Some college or vocational training	0.97	(0.64–1.48)	0.93	(0.62–1.41)		
Earn an associate's degree	0.86	(0.55–1.33)	0.82	(0.53–1.26)		
Earn a bachelor's degree	0.70	(0.48–1.02)	0.72	(0.49–1.05)		

<i>Estimates for the Effect of Any Chronic Condition (vs None)</i>	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Earn a graduate degree	0.76	(0.49–1.18)	0.82	(0.53–1.26)		
Parent’s Expectations for Child						
Graduate high school/GED	<i>Reference</i>		<i>Reference</i>			
Some college or vocational training	0.71	(0.52–0.97)	0.76	(0.56–1.02)		
Earn an associate’s degree	0.75	(0.54–1.05)	0.80	(0.59–1.09)		
Earn a bachelor’s degree	0.47	(0.38–0.60)	0.57	(0.45–0.71)		
Earn a graduate degree	0.61	(0.44–0.84)	0.77	(0.56–1.04)		
Parent’s Preference for Child						
Graduate high school/GED	<i>Reference</i>		<i>Reference</i>			
Some college or vocational training	0.62	(0.35–1.08)	0.67	(0.35–1.29)		
Earn an associate’s degree	0.53	(0.31–0.90)	0.57	(0.32–1.02)		
Earn a bachelor’s degree	0.40	(0.26–0.61)	0.48	(0.31–0.73)		
Earn a graduate degree	0.54	(0.34–0.85)	0.67	(0.42–1.08)		

Data are from the Panel Study of Income Dynamics, Child Development and Transition to Adulthood Supplements (1997–2013).

OR (odds ratio) refers to the effect of having a chronic condition (versus not) on the odds of each educational outcome, relative to the identified reference group. 95% Confidence Intervals (CI) are presented. Conditional analyses model the odds that an individual achieved each educational outcome, conditional on achieving the prior level of education (e.g., the odds of earning a bachelor’s degree among those who matriculated into a 4-year college). Longitudinal analyses present the estimates derived from the multivariate multinomial GLMM, which model highest reported educational attainment at each interview.

Model 1 adjusts for chronic condition status and age.

Model 2 additionally adjusts for sex, race/ethnicity, and socioeconomic status (AFDC/WIC participation; parent marital status; parent education).

Model 3 additionally adjusts for youth’s reported educational aspirations and expectations.

Table 3

Effects of Chronic Condition Status and Educational Attainment on Health & Wellbeing

	Model 1		Model 2		Model 3		% Attenuation & Sobel Test
	OR	95% CI	OR	95% CI	OR	95% CI	
<u>(Better) Health Status</u>							
Chronic condition status							
Any prior diagnosis	0.42	(0.33–0.53)	0.40	(0.32–0.50)	0.42	(0.34–0.52)	5.87%
No prior diagnoses		<i>Reference</i>		<i>Reference</i>		<i>Reference</i>	Z = 2.85
Educational attainment							
Did not graduate high school/GED			0.65	(0.39–1.10)			p = 0.002
Graduated high school/GED				<i>Reference</i>			
Some college or vocational training			1.51	(1.13–2.02)			
Earned an associate's degree			1.40	(0.92–2.14)			
Earned a bachelor's degree			3.03	(2.04–4.50)			
Any graduate school			3.23	(1.93–5.41)			
<u>(Higher) Life Satisfaction</u>							
Chronic condition status							
Any prior diagnosis	0.64	(0.51–0.81)	0.65	(0.51–0.82)	0.67	(0.53–0.84)	7.73%
No prior diagnoses		<i>Reference</i>		<i>Reference</i>		<i>Reference</i>	Z = 1.96
Educational attainment							
Did not graduate high school/GED					0.81	(0.46–1.45)	p = 0.025
Graduated high school/GED						<i>Reference</i>	
Some college or vocational training					1.43	(1.01–2.03)	
Earned an associate's degree					2.14	(1.29–3.54)	
Earned a bachelor's degree					1.75	(1.11–2.75)	
Any graduate school					2.31	(1.30–4.08)	
<u>Psychological Wellbeing</u>							
Chronic condition status							
Any prior diagnosis	-1.13	0.17	-1.18	0.17	-1.14	0.17	3.68%
No prior diagnoses		<i>Reference</i>		<i>Reference</i>		<i>Reference</i>	Z = 2.30
Educational attainment							
Did not graduate high school/GED					-0.47	0.36	p = 0.011
							0.200

(Better) Health Status	Model 1		Model 2		Model 3		% Attenuation & Sobel Test
	OR	95% CI	OR	95% CI	OR	95% CI	
Graduated high school/GED							
Some college or vocational training					0.56	0.20	0.005
Earned an associate's degree					0.90	0.28	0.001
Earned a bachelor's degree					0.85	0.27	0.002
Any graduate school					0.52	0.37	0.160

Data are from the Panel Study of Income Dynamics, Child Development and Transition to Adulthood Supplements (1997–2013).

OR (odds ratio) refers to the effect of having a chronic condition or educational attainment on the cumulative odds (across a 5-point Likert scale) of better general health (7,076 observations, 2,555 subjects) and higher life satisfaction (5,220 observations, 2,483 subjects), derived from the multivariate ordinal GLMM. 95% Confidence Intervals (CI) are presented. β refers to the effect of having a chronic condition or educational attainment on the continuous psychological wellbeing scale (higher values indicate greater wellbeing; 7,080 observations, 2,555 subjects).

Standard errors (S.E.) and the associated p-values for the point estimates are presented.

Model 1 adjusts for chronic condition status and age.

Model 2 additionally adjusts for sex, race/ethnicity, and socioeconomic status (AFDC/WIC participation; parent marital status; parent education).

Model 3 additionally adjusts for youth's own educational attainment.

Attenuation was determined as the percent change in the coefficient for chronic condition status from model 2 to model 3; the Sobel test was used to evaluate mediation of the effect of chronic condition status on each health outcome by educational attainment.

Table 4

Investigation of Education and Health Outcomes by Chronic Condition Categories

Any [condition] vs none	All conditions	Psychological/ emotional problem	Developmental/ Learning disability	Sensory impairment	Major medical condition	Major medical w/ activity limitation
Total with any diagnosis	N = 2,113 OR (95% CI)	N = 490 OR (95% CI)	N = 596 OR (95% CI)	N = 634 OR (95% CI)	N = 1,584 OR (95% CI)	N = 320 OR (95% CI)
Educational Outcomes						
Graduated high school or completed a GED	0.57 (0.30–1.11)	0.32 (0.15–0.68)	0.30 (0.13–0.70)	0.53 (0.21–1.36)	0.54 (0.29–0.999)	0.33 (0.16–0.68)
Any college high school grad or GED	0.69 (0.55–0.88)	0.54 (0.37–0.80)	0.44 (0.30–0.64)	0.57 (0.42–0.76)	0.71 (0.54–0.92)	0.56 (0.38–0.83)
Attended 4-year college high school grad or GED	0.71 (0.57–0.88)	0.58 (0.41–0.82)	0.36 (0.27–0.48)	0.75 (0.56–0.98)	0.72 (0.56–0.92)	0.63 (0.44–0.89)
Earned bachelor's Attended 4-year college	0.62 (0.45–0.87)	0.47 (0.30–0.74)	0.41 (0.24–0.69)	0.62 (0.41–0.95)	0.68 (0.48–0.96)	0.37 (0.22–0.63)
Health Outcomes						
(Better) Health status	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
(Higher) Life satisfaction	0.40 (0.32–0.50)	0.20 (0.15–0.27)	0.36 (0.26–0.50)	0.45 (0.32–0.62)	0.35 (0.28–0.45)	0.12 (0.08–0.17)
Psychological wellbeing	0.65 (0.51–0.82) β (S.E.; p-value)	0.31 (0.22–0.44) β (S.E.; p-value)	0.60 (0.43–0.84) β (S.E.; p-value)	0.62 (0.45–0.87) β (S.E.; p-value)	0.68 (0.53–0.87) β (S.E.; p-value)	0.36 (0.25–0.53) β (S.E.; p-value)
	-1.18 (0.17; <0.01)	-2.69 (0.23; <0.01)	-1.82 (0.25; <0.01)	-1.34 (0.24; <0.01)	-1.21 (0.18; <0.01)	-2.59 (0.30; <0.01)

Data are from the Panel Study of Income Dynamics, Child Development and Transition to Adulthood (TA) Supplements (1997–2013).

For each outcome, six models are run, each isolating the effect of a distinct (non-mutually exclusive) chronic condition category:

1. all chronic conditions (these models are identical to those presented as Model 2 in Tables 2 and 3);
2. any psychological or emotional problem;
3. any developmental delay, learning disability, autism, or ADHD/ADD;
4. any sensory impairment (i.e., hearing, speech, or visual impairments);
5. any of the other major medical conditions not included in (2), (3), or (4); and
6. selected conditions identified in (5) for which the individual reported in the TA that their normal activities were “a lot” or “somewhat” limited by their condition.

All presented estimates thus compare each chronic condition type versus no condition of any kind, adjusting for age, sex, race/ethnicity, and socioeconomic status (AFDC/WIC participation; parent marital status; parent education).

For educational outcomes, results from multivariate conditional analyses are shown.

For health outcomes, results from multivariate ordinal GLMM are shown for health status and life satisfaction and results from multivariate Gaussian GLMM are shown for psychological wellbeing.