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## Substance Use Patterns Through Early Adulthood:

### Results for Youth With and Without Chronic Conditions

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### Abstract

**Introduction**—Adolescence and emergent adulthood are periods of peak prevalence for substance use that pose risks for short- and long-term health harm, particularly for youth with chronic medical conditions (YCMC) who are transitioning from adolescence to adulthood. As there have been no nationally representative studies of substance use during this period for these medically vulnerable youth, the authors sought to examine onset and intensification of these behaviors for a national sample of youth with and without chronic conditions.

**Methods**—Longitudinal data are from 2,719 youth between the ages of 12 and 26 years interviewed from 2002 to 2011 for the Panel Study of Income Dynamics, Child Development, and Transition to Adulthood Supplements, a nationally representative, population-based survey. Multivariate generalized linear mixed models were used to estimate patterns of alcohol, tobacco, and marijuana use during adolescence and emergent adulthood for youth with and without chronic conditions, adjusting for potential confounders.

**Results**—Overall, 68.8%, 44.3%, and 47.8% of youth reported ever trying alcohol, tobacco, and marijuana, respectively. Among users, 42.2%, 73.4%, and 50.3% of youth reported binge drinking, regular cigarette use, and recent marijuana use, respectively. YCMC were more likely to engage in any and heavier substance use; transition years and early adulthood were periods of peak risk for YCMC compared with their healthy peers.

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**Conclusions**—Substance use among YCMC during adolescence and emergent adulthood is a substantial concern. Increased prevention and case detection are in order to address these behaviors and promote optimal health outcomes for medically vulnerable youth.

## Introduction

Adolescence and emergent adulthood are periods of peak risk for onset and intensification of substance use behaviors that pose risks for short- and long-term health harm.<sup>1–6</sup> Although substance use behaviors comprise health risks for all youth, these behaviors may uniquely undermine health status and disease management of youth with chronic medical conditions (YCMC), such as diabetes, asthma, and heart disease, and directly cause physiologic harm.<sup>7–14</sup> For YCMC, alcohol may negatively interact with over-the-counter and prescription medications,<sup>15</sup> and alcohol and other substance use may impact treatment adherence: A recent investigation found that the risk for medication non-adherence among YCMC who drink compared with those who do not was nearly double.<sup>16</sup> Moreover, substance use carries risks for poor sleep, unhealthy diet, and unprotected sex with attendant risks from sexually transmitted disease and pregnancy,<sup>17–19</sup> particularly devastating for youth taking immune-suppressing or teratogenic medications. Both substance use and chronic disease impose heavy morbidity burdens on the unfolding lives of young people, including during periods of added vulnerability when they are transitioning care.<sup>20</sup> Hence, intervening early to detect and deter the negative compounding influence of these behaviors on the health and well-being of adolescents and young adults may be especially important.

Although many chronic diseases have roots in substance use,<sup>21</sup> to date, there have been no nationally representative, longitudinal studies of substance use conducted among youth who already have a chronic disease. The authors sought to estimate incidence and prevalence of substance use (both lifetime and heavier use) among a national sample of youth with and without chronic conditions as they transition from adolescence to adulthood. Quantification of substance use prevalence among chronically ill and healthy youth and elucidation of differences across groups by behavior and condition have implications for implementation of substance use screening programs, early intervention, and prevention in primary and subspecialty care.<sup>8,22–24</sup>

## Methods

### Data Source and Sample

Data are from the Panel Study of Income Dynamics (PSID), a nationally representative, longitudinal household survey.<sup>25,26</sup> 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 2002–2003 and 2007–2008. CDS participants who graduated or dropped out of high school and were aged 18 years were interviewed for the Transition into Adulthood (TA) survey in 2005, 2007, 2009, and 2011.

Respondents were eligible for this study if they were interviewed in the initial 1997 CDS wave and subsequently interviewed in at least one CDS or TA survey between the ages of 12 and 26 years and did not have missing information for any of the primary study measures

(N=2,719). As data were already collected and de-identified, this study was exempted from IRB approval.

## Measures

Respondents were asked about their experience with alcohol, tobacco, and marijuana; as question content and phrasing varied between the CDS and TA, efforts were made to reconcile responses across questions to construct similar measures for both surveys (Appendix 1). For each substance, measures of lifetime use and heavy/regular/recent use were assessed. Additional details regarding the methods can be found in the technical Appendix.

Lifetime use of alcohol was defined by reports of ever drinking beer/wine/liquor when not with their parents or other adults in their family in the CDS or ever drinking beer/wine/liquor in the TA. “Heavy use” of alcohol was characterized by report of binge drinking, specifically reporting monthly frequency of drinking four (for women)/five (for men) or more drinks in one occasion (CDS or TA), or being “very drunk” in the CDS. Lifetime use of tobacco was defined by the report of ever trying cigarettes in either the CDS or TA. “Regular use” was characterized by report of smoking at least one cigarette every day for 30 days. Lifetime use of marijuana was defined by reports of ever trying marijuana. “Recent use” was characterized by any past-month marijuana use without the consent of a doctor.

Substance use summary variables for incidence and prevalence were constructed separately for each survey administration; respondents completed an average of 3.3 additional assessments after the 1997 CDS administration. Earliest reported age of use or age at survey administration for first report of lifetime use (when reported age of initiation was missing) was used to determine incidence of lifetime use. Period prevalence of heavier use was constructed from point-in-time reports of substance use behavior; estimates for period prevalence were thus conditional on lifetime use.

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: attention deficit/hyperactivity disorder; asthma; autism; birth defects; breathing problems; cancer; chronic hypertension (reported two or more 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, tonsillitis) were considered to have no chronic conditions. Youth with a reported diagnosis of intellectual disability were excluded.

Age at diagnosis was reported for most conditions but age at first report of each condition was used as a proxy when these data were missing. Youth with onset of a chronic condition after reported initiation of a substance were counted as not having the condition until they were diagnosed. In sensitivity analyses, these youth were excluded and models were re-run; results from the restricted and unrestricted samples were consistent.

Data on child sociodemographic factors included: age in 1997, sex, and race/ethnicity (Hispanic, non-Hispanic white, non-Hispanic black, non-Hispanic Asian, non-Hispanic other). Several indicators of childhood SES were constructed, including:

1. whether the mother participated in the Special Supplemental Nutrition Program for Women, Infants, and Children or Aid to Families with Dependent Children 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).

Psychological distress was assessed at each interview using the Kessler 6 (range, 0–24; higher scores indicate greater distress).<sup>27</sup>

### Statistical Analysis

Analyses were conducted using survey procedures from SAS, version 9.3. The SEs were corrected for clustering within strata and the primary sampling unit, and CDS 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 between youth with and without any chronic conditions, and to assess differences in substance use behaviors for youth with and without any chronic conditions. Multivariate generalized linear mixed models with a binomial distribution were used to model lifetime and heavier use of substances; sex, race/ethnicity, Special Supplemental Nutrition Program for Women, Infants, and Children or Aid to Families with Dependent Children participation during pregnancy, parent marital status at baseline, and parental educational attainment were treated as time-invariant covariates whereas chronic condition status, psychological distress, and age were treated as time-varying covariates. As the risk of substance use was not assumed to be constant through adolescence and young adulthood, natural cubic splines (with evenly spaced quintile knots) were utilized to model age; models also included an interaction between the spline for age and a time-varying indicator of chronic condition status to allow the effect of chronic condition status to vary non-linearly across age. Likelihood ratio tests suggested that in all cases the trajectory of substance use behaviors across age was significantly different for YCMC compared with their healthy peers. Average marginal predicted probabilities of substance use were calculated by age and chronic condition status. Models for heavier use of substances were conditional on reported lifetime use.

### Results

Compared to their healthy peers, YCMC (64.3% of the sample) were older and more likely to be male, have lower SES, and have more psychological distress. Overall, 74.7% of all

youth reported some form of substance use, and 47.7% of all youth reported heavier use (Table 1). There was variation in the initiation and prevalence of some substance use behaviors for youth with and without conditions (Figure 1) and across the range of assessed conditions (Table 2, Appendix 2).

For all youth, alcohol use initiation rose steadily after pre-adolescence (age 14 years) and peaked in early adulthood (age 21–23 years), with 68.8% of youth reporting having ever tried alcohol during the study period (71.7% for YCMC vs 63.7% for healthy youth,  $p<0.001$ , Figure 1). Among youth who used alcohol, YCMC had higher rates of binge drinking during pre-adolescence (7.9% vs 2.1% for healthy youth,  $p<0.001$ ).

Adjusted generalized linear mixed models identified that the relative risk (RR) of alcohol use for YCMC compared with their peers was greatest at age 14.5 years (3.7% vs 2.7%,  $RR=1.4$ ) but the greatest difference in absolute risk (AR) occurred at age 20.25 years (74.3% vs 67.3%,  $AR=6.9\%$ , Figure 2). The RR and AR of binge drinking were greatest for YCMC prior to age 17 years.

Tobacco use initiation peaked in adolescence (age 15–17 years) and YCMC exhibited higher rates of tobacco use initiation in pre-adolescence than did their healthy counterparts (17.1% vs 11.3% for healthy youth,  $p=0.004$ , Figure 1), with higher rates of any tobacco use among YCMC (46.8% vs 39.7% for healthy youth,  $p=0.016$ ). Among smokers, YCMC were consistently more likely to report regular cigarette smoking than their healthy peers.

Adjusted analyses suggested that YCMC experienced a modest elevation in RR around age 14 years (1.1% vs 0.7%,  $RR=1.7$ ) but that both relative and absolute risk of tobacco use were amplified in early adulthood (Figure 2). Among smokers, YCMC had consistently higher risk for engaging in regular smoking across all ages.

Marijuana use initiation peaked in adolescence and YCMC had higher rates of initiation in pre-adolescence and adulthood but somewhat lower rates in the years between (Figure 1, Appendix 3). Among marijuana users, YCMC were more likely to report past-month marijuana use, especially in early adulthood (51.3% vs 39.6%,  $p=0.002$ , Figure 1) and adulthood (54.7% vs 41.4%,  $p<0.001$ ).

Adjusted models identified that YCMC were approximately as likely as their peers to use marijuana through adolescence (Figure 2), and displayed reduced risk thereafter. Among marijuana users, YCMC displayed the highest RR and AR for recent marijuana use in pre-adolescence ( $RR=4.1$ ,  $AR=9.0\%$  at age 12 years) and in early adulthood ( $RR=2.2$ ,  $AR=9.5\%$  at age 24 years).

## Discussion

Substantial percentages of YCMC reported using alcohol, tobacco, and marijuana during adolescence and emergent adulthood. Both lifetime and heavier use of substances appeared to be similar or elevated for YCMC compared with their healthy counterparts, though some differences were modest. YCMC's risk of substance use was most consistently elevated during older adolescence and early adulthood, periods when transition from pediatric to

adult-focused care is recommended,<sup>20</sup> but when youth are most likely to fall out of contact with a healthcare provider.<sup>28</sup> Healthcare interactions may help stimulate health-promoting behaviors and improve detection/reduction of risky ones, making it particularly important to develop strategies that support continued healthcare engagement throughout the transition period.

The present estimates are similar to other national surveys of adolescents, including the most recent estimates from the 2013 Youth Risk Behavior Surveillance System, which reports that among 12th graders, 75.6% ever tried alcohol (29.2% binged in the past 30 days), 48.1% ever tried cigarettes (12.2% were ever regular smokers), and 48.6% ever used marijuana (27.7% used marijuana in the past 30 days).<sup>29</sup> However, Youth Risk Behavior Surveillance System data suggest that the prevalence of cigarette use has decreased dramatically over the decade in which the present data were collected (from 71.1% in 2001 to 54.5% in 2011) and other nationally representative surveys suggest that alcohol use among U.S. teens may also be declining.<sup>30</sup> Some variability in prevalence estimates across existing population based surveys may be expected given that timeframes during which substance use is reported differ (e.g., past 30-day use versus lifetime use, point versus period prevalence) with potential for differential recall associated with these varying time periods. Despite this, substance use behaviors are prevalent among both healthy and medically vulnerable youth in the PSID and comprise a common, concerning, and modifiable behavioral risk.

Findings have important implications for clinical practice. Many providers only sporadically screen young patients for substance use,<sup>31</sup> or may not rely on validated screening tools,<sup>32</sup> a substantial missed opportunity for detection and intervention of modifiable behavioral risks, which may also contribute to underestimating the scope of and harms associated with substance use.<sup>33,34</sup> Increasing provider awareness about substance use among YCMC and advancing use of tailored screening tools that can identify and appropriately triage medically vulnerable youth to services may augment primary and subspecialty care practice and improve outcomes.<sup>35,36</sup> However, subspecialty providers who treat YCMC may assume that their patients know about the potential for complications and disease exacerbation resulting from substance use, and may presume that screening is unnecessary or occurring in primary care. The converse may be true for primary care providers interacting with these youth: Fragmentation across providers and absence of coordinated care cloud this picture and may impede effective preventive services.<sup>37</sup> Further, as YCMC may be engaging in substance use as a form of self-medication for disease symptoms or comorbid depression or anxiety,<sup>12,38-41</sup> integration of mental health services may be critically important for providing comprehensive preventive care. Given that alcohol use among YCMC is associated with medication non-adherence and poor knowledge about interactions between alcohol and medications/laboratory tests,<sup>16</sup> implementing screening and preventive action around substance use will likely also be important for improving both preventive and chronic disease care.<sup>34,35,42,43</sup>

The evolving policy context around adolescent/young adult health is an opportunity to address risk behaviors among chronically ill and healthy youth. Prior to the implementation of the Affordable Care Act, adolescents and young adults had the highest rates of uninsurance and correspondingly low rates in access to care.<sup>44</sup> Policy changes, such as



dependent coverage expansion and expanded coverage for preventive services such as smoking cessation, together with integration of behavioral health into the medical home, may yield expanded access to care for youth during this time,<sup>45–49</sup> and associated spillover effects on health behaviors. Policy reforms hold promise for improving the health of adolescents and young adults and may provide a context for integrating screening and brief intervention into practice, to address the alarmingly high rates of substance use among medically vulnerable youth.<sup>34,50</sup> Life course outcomes for chronically ill youth are imperiled without effective disease management,<sup>51–53</sup> and substance use may adversely affect self-care and interrupt disease management habits. Early identification and response to ameliorate substance use among YCMC, using a model that appropriately considers this group's heightened risk for health harm, are critical for protecting health and preventing complications and exacerbations. Efforts to improve screening using standardized and tailored tools are an indispensable part of this picture.<sup>54,55</sup>

### Limitations

This study contributes new information to the extant literature on substance use during adolescence and emerging adulthood, comparing behaviors for youth with and without chronic diseases. Longitudinal data allow examination of trajectories of substance use behaviors and estimation of onset and intensification of three common substances over a decade of follow-up. The nationally representative cohort with high response rates and very low rates of missing items enables generalizable estimates to U.S. adolescents and young adult populations.<sup>26</sup> 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 suggests potential for false positives, albeit misclassification would likely bias findings toward the null. Additionally, prevalence of inheritable chronic conditions in the CDS sample may be inflated, as the CDS allowed the inclusion of up to two children from eligible families. Survey administration began in 2002, prior to the popularization of e-cigarettes or the recent liberalization of marijuana; hence, estimates of these risk behaviors may be conservative. Despite having a relatively large sample, parsimonious models were constructed to preserve power for rare outcomes and these estimates may be subject to residual confounding as a result. Data for this study were collected primarily before health reform. Follow-up work is needed to investigate changes in health behaviors among adolescents and young adults after health reform to determine if expanded access to care translates into quantifiable behavior change.

### Conclusions

Although substance use among all U.S. youth remains a major public health problem, findings that YCMC may be more likely than their healthy peers to engage in heavy use of alcohol, tobacco, and marijuana are concerning in light of the potential for disease exacerbation and health harm. Additional work is warranted to understand risk factors for substance use initiation and escalation among this group to guide early intervention and response, including during high-risk periods of healthcare transition. For medically vulnerable youth, expansion of specialty care services to include prevention-oriented education that conveys condition-specific dangers of substance use in combination with

screening and case detection may be necessary to optimize physical and mental health outcomes across the life course.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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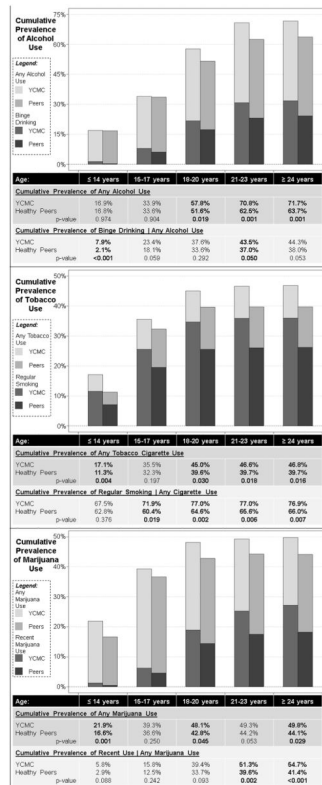
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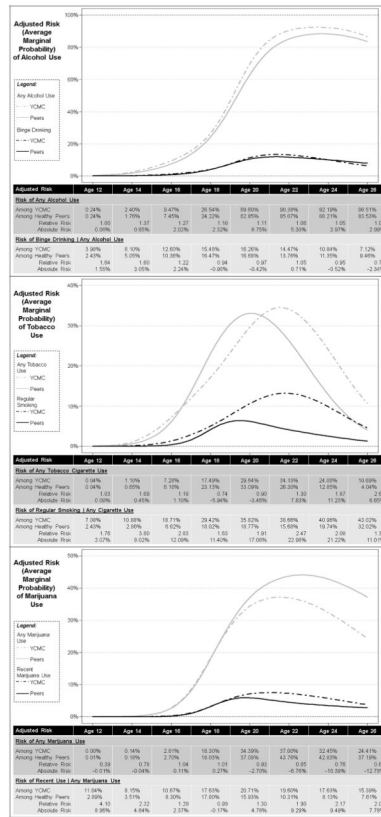
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**Figure 1. Cumulative prevalence of substance use among youth with chronic medical conditions (YCMC) and their healthy peers**  
 Stacked bar charts show the unadjusted cumulative prevalence of alcohol, tobacco, and marijuana use by age and chronic condition status. Panels depict the unadjusted cumulative prevalence of lifetime use (lighter, taller bars) and heavier/regular/recent use (darker, shorter bars) by age for YCMC and their healthy peers; these estimates and *p*-values for the comparison between YCMC and their healthy peers are also described in the tables below the charts. (Appendix 3 shows initiation and period prevalence estimates)



**Figure 2. Adjusted risk of substance use behaviors by age and chronic conditions**  
 Figures show the adjusted risk of use of alcohol, tobacco, and marijuana by age and chronic condition status, derived as the average marginal probabilities as predicted by the multivariate generalized linear mixed models. The inset tables shows the adjusted risk at given ages for youth with chronic medical conditions (YCMC) and their healthy peers, as well as the relative risk and absolute risk difference of use for YCMC compared to their peers. Note that for heavier use, risk depicted in the tables has a denominator of lifetime users and thus is larger than risk graphed on the figures, which depicts the overall risk among the entire sample at a given age (derived as [risk of heavier use | any use] \* risk of any use).

**Table 1**

Sample Sociodemographic Characteristics by Chronic Condition Status

	Total	Any condition	No condition	p-value
<b>Total N (unweighted)</b>	2,719	1,701	1,018	
<b>Total % (weighted)</b>		64.3%	35.7%	
<b>Mean age at diagnosis (SD)</b>	-	9.93 (5.13)	-	-
<b>Child's age in 1997 (SD)</b>	7.25 (3.30)	7.39 (3.17)	6.98 (3.52)	<b>0.019</b>
<b>Sex</b>				<b>0.001</b>
Male	49.9%	52.7%	44.8%	
Female	50.1%	47.3%	55.2%	
<b>Race/Ethnicity</b>				0.121
White, non-Hispanic	57.7%	58.6%	56.1%	
Black, non-Hispanic	14.9%	14.3%	15.9%	
Asian, non-Hispanic	3.2%	2.6%	4.4%	
Other, non-Hispanic	6.9%	7.7%	5.4%	
Hispanic	17.3%	16.8%	18.2%	
<b>Prenatal WIC/AFDC participation</b>				<b>0.023</b>
Yes	30.6%	32.5%	27.1%	
No	69.4%	67.5%	72.9%	
<b>Parent's marital status in 1997</b>				<b>0.047</b>
Two parent household	76.9%	75.5%	79.6%	
Single parent household	23.1%	24.5%	20.4%	
<b>Parental education</b>				0.325
Less than high school	12.6%	11.6%	14.6%	
High school degree	24.8%	24.9%	24.5%	
Some college	22.0%	22.3%	21.5%	
College grad or more	40.6%	41.2%	39.3%	
<b>Psychological distress (SD)</b>	4.55 (2.73)	4.88 (2.76)	3.96 (2.54)	<b>&lt;0.0001</b>
<b>Substance use</b>				
<b>Lifetime use of any substance</b>	74.7%	77.0%	70.5%	<b>0.004</b>
Use of one substance	21.6%	21.0%	22.6%	
Use of two substances	20.0%	20.7%	18.7%	<b>0.014</b>
Use of three substances	33.1%	35.3%	29.2%	
<b>Heavier use of any substance</b>	47.7%	51.7%	40.4%	<b>&lt;0.001</b>
Heavier use of one substance	20.4%	21.2%	19.1%	
Heavier use of two substances	16.6%	17.8%	14.4%	<b>&lt;0.001</b>
Heavier use of three substances	10.7%	12.8%	6.9%	
<b>Mean age of initiation (SD)</b>				
Any alcohol use	17.49 (3.51)	17.99 (3.33)	16.80 (3.65)	<b>&lt;0.001</b>
Any tobacco use	15.73 (2.69)	15.88 (2.62)	15.54 (2.76)	0.073
Any marijuana use	15.32 (2.73)	15.39 (2.67)	15.24 (2.79)	0.386

<sup>a</sup>Unweighted Ns and weighted percentages and means (SDs) are presented.

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<sup>b</sup>Chronic conditions include: attention deficit/hyperactivity disorder; asthma; autism; birth defects; breathing problems; cancer; chronic hypertension; 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.

<sup>c</sup>WID/AFDC - Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and Aid to Families with Dependent Children (AFDC) programs

<sup>d</sup>Mean Kessler 6 score from administrations during ages 12–26. Higher scores indicate more distress.

<sup>e</sup>Data are from the Panel Study of Income Dynamics, Child Development and Transition to Adulthood Supplements (2002–2011).

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**Table 2**

Chronic Conditions with the Lowest ( 20<sup>th</sup> percentile) and Highest ( 80<sup>th</sup> percentile) Incidence and Prevalence of Substance Use Behaviors

	Pre-adolescence (<14 yrs)		Adolescence (15–17 yrs)		Transition (18–20 yrs)		Early adulthood (21–23 yrs)		Adulthood (24+ yrs)		
	20 <sup>th</sup> %ile	80 <sup>th</sup> %ile	20 <sup>th</sup> %ile	80 <sup>th</sup> %ile	20 <sup>th</sup> %ile	80 <sup>th</sup> %ile	20 <sup>th</sup> %ile	80 <sup>th</sup> %ile	20 <sup>th</sup> %ile	80 <sup>th</sup> %ile	
<b>Lifetime use of alcohol</b>											
<b>Initiation of use</b>	Autism Cancer Diabetes Kidney disease	Epilepsy Heart condition Migraines Psychiatric	ADHD/ADD Diabetes Kidney disease Migraines	Autism Cancer Epilepsy Heart condition	Cancer Diabetes Kidney disease Learning disab.	Asthma Autism Epilepsy Migraines	Cancer Heart condition Learning disab. Visual impair.	Autism Hearing Impair. Kidney disease Migraines	Hearing Impair. Heart condition Migraines Visual Impair.	Diabetes Epilepsy Orthopedic Psychiatric	<b>53.3%</b>
Incidence	<b>1.8%</b>	<b>22.4%</b>	<b>17.9%</b>	<b>40.4%</b>	33.7%	<b>48.7%</b>	<b>54.2%</b>	<b>91.7%</b>	<b>6.8%</b>		
<b>Cumulative prevalence of use</b>	Autism Cancer Diabetes Kidney disease	Epilepsy Heart condition Migraines Psychiatric	ADHD/ADD Autism Diabetes Kidney disease	Epilepsy Heart condition Hypertension Learning disab.	Autism Diabetes Kidney disease Speech impair.	Epilepsy Heart condition Hypertension Migraines	Autism Learning disab. Speech impair. Visual impair.	Epilepsy Hypertension Kidney disease Migraines	Autism Hearing Impair. Speech impair. Visual impair.	Cancer Hypertension Kidney disease Migraines	<b>84.2%</b>
Prevalence	<b>1.8%</b>	<b>22.4%</b>	<b>28.8%</b>	<b>40.4%</b>	50.2%	<b>65.7%</b>	67.2%	<b>81.5%</b>	65.2%		
<b>Binge drinking alcohol   Ever use of alcohol</b>											
<b>Period prevalence of use</b>	Diabetes Heart condition Hypertension Visual impair.	ADHD/ADD Epilepsy Migraines Orthopedic	Cancer Epilepsy Kidney disease Migraines	Autism Diabetes Heart condition Speech impair.	Asthma Autism Kidney disease Visual impair.	Diabetes Hearing Impair. Heart condition Migraines	Cancer Kidney disease Orthopedic Visual impair.	Autism Diabetes Epilepsy Hypertension	Autism Cancer Diabetes Kidney disease	Epilepsy Hearing Impair. Hypertension Speech impair.	<b>37.0%</b>
Prevalence	0.0%	<b>15.1%</b>	15.2%	<b>46.6%</b>	<b>26.3%</b>	<b>47.9%</b>	<b>23.6%</b>	<b>47.2%</b>	<b>7.0%</b>		
<b>Cumulative prevalence of use</b>	Diabetes Heart condition Hypertension Visual impair.	ADHD/ADD Epilepsy Migraines Orthopedic	Cancer Kidney disease Migraines Visual impair.	Autism Diabetes Heart condition Speech impair.	Asthma Autism Kidney disease Visual impair.	Diabetes Epilepsy Hearing Impair. Learning disab.	Kidney disease Migraines Orthopedic Visual impair.	Autism Diabetes Hearing Impair. Hypertension	Cancer Kidney disease Migraines Visual impair. Psych condition	Autism Diabetes Hypertension Psych condition	<b>50.0%</b>
Prevalence	0.0%	<b>15.1%</b>	13.7%	<b>36.1%</b>	<b>27.7%</b>	<b>46.8%</b>	<b>33.6%</b>	<b>54.0%</b>	<b>28.7%</b>		
<b>Lifetime use of tobacco cigarettes</b>											
<b>Initiation of use</b>	Autism Cancer Kidney disease Migraines	Epilepsy Learning disab. Other condition Psych condition	Cancer Diabetes Kidney disease Orthopedic	Autism Epilepsy Hypertension Psych condition	Diabetes Epilepsy Heart condition Hypertension	ADHD/ADD Autism Kidney disease Psych condition	Autism Cancer Epilepsy Kidney disease	ADHD/ADD Heart condition Migraines Speech impair.	Learning disab. Orthopedic Psych condition Visual impair.	Asthma Hypertension Other condition Speech impair.	

	Pre-adolescence (<14 yrs)		Adolescence (15–17 yrs)		Transition (18–20 yrs)		Early adulthood (21–23 yrs)		Adulthood (24+ yrs)	
	20 <sup>th</sup> %/ile	80 <sup>th</sup> %/ile	20 <sup>th</sup> %/ile	80 <sup>th</sup> %/ile	20 <sup>th</sup> %/ile	80 <sup>th</sup> %/ile	20 <sup>th</sup> %/ile	80 <sup>th</sup> %/ile	20 <sup>th</sup> %/ile	80 <sup>th</sup> %/ile
Incidence	3.0%	23.4%	16.9%	37.4%	10.3%	30.2%	0.0%	9.8%	0.0%	0.6%
<b>Cumulative prevalence of use</b>	Autism Kidney disease Migraines	Epilepsy Learning disab. Other Psych condition	Autism Cancer Kidney disease Orthopedic	Epilepsy Hypertension Other condition Psych condition	Autism Diabetes Kidney disease Orthopedic	ADHD/ADD Hypertension Other condition Psych condition	Autism Diabetes Kidney disease Orthopedic	Hypertension Migraines Other condition Psych condition	Autism Diabetes Kidney disease Orthopedic	Hypertension Migraines Other condition Psych condition
Prevalence	3.0%	23.4%	27.2%	45.5%	37.3%	55.6%	38.4%	57.3%	38.2%	57.5%
<b>Regular use of tobacco cigarettes   Ever use of tobacco cigarettes</b>										
<b>Period prevalence of use</b>	Cancer Hearing Impair. Migraines Visual impair.	Asthma Diabetes Other Psych condition	Autism Hearing Impair. Heart condition Orthopedic disease	Cancer Diabetes Hypertension Kidney	ADHD/ADD Asthma Cancer Speech impair.	Epilepsy Hearing Impair. Kidney disease Migraines	Epilepsy Hearing Impair. Kidney disease Visual impair.	Autism Cancer Diabetes Migraines	ADHD/ADD Diabetes Heart condition Kidney disease	Cancer Learning disab. Migraines Orthopedic
Prevalence	39.3%	77.4%	67.5%	94.1%	87.2%	99.1%	87.2%	100.0%	84.3%	98.1%
<b>Cumulative prevalence of use</b>	Cancer Hearing Impair. Migraines Visual impair.	Asthma Diabetes Other Psych condition	Autism Hearing Impair. Heart condition Visual impair.	Cancer Diabetes Hypertension Kidney disease	Autism Heart condition Orthopedic Visual impair.	Diabetes Hypertension Kidney disease Psych condition	Autism Heart condition Orthopedic Visual impair.	Diabetes Hypertension Kidney disease Psych condition	Autism Cancer Heart condition Visual impair.	Diabetes Hypertension Kidney disease Psych condition
Prevalence	39.3%	77.4%	59.6%	91.5%	69.5%	88.6%	70.2%	87.8%	68.3%	86.6%
<b>Lifetime use of marijuana</b>										
<b>Initiation of use</b>	Autism Kidney disease Orthopedic	Heart condition Hypertension Other condition Psych condition	Diabetes Kidney disease Orthopedic Visual impair.	ADHD/ADD Epilepsy Hypertension Other condition	Autism Kidney disease Visual impair.	Epilepsy Hearing Impair. Heart condition Learning disab.	Autism Cancer Diabetes Epilepsy	ADHD/ADD Heart condition Kidney disease Migraines	ADHD/ADD Asthma Orthopedic Visual impair.	Hypertension Migraines Psych condition Speech impair.
Incidence	10.5%	32.4%	21.1%	34.5%	2.0%	24.7%	0.0%	8.6%	0.0%	11.2%
<b>Cumulative prevalence of use</b>	Autism Kidney disease Orthopedic	Heart condition Hypertension Other condition Psych condition	Autism Kidney disease Orthopedic Visual impair.	Epilepsy Hypertension Other condition Psych condition	Autism Kidney disease Orthopedic Visual impair.	Cancer Epilepsy Hypertension Psych condition	Autism Orthopedic Speech impair. Visual impair.	Cancer Hypertension Other condition Psych condition	Autism Orthopedic Speech impair. Visual impair.	Epilepsy Hypertension Other condition Psych condition

	Pre-adolescence (<14 yrs)		Adolescence (15–17 yrs)		Transition (18–20 yrs)		Early adulthood (21–23 yrs)		Adulthood (24+ yrs)	
	20 <sup>th</sup> %/ile	80 <sup>th</sup> %/ile	20 <sup>th</sup> %/ile	80 <sup>th</sup> %/ile	20 <sup>th</sup> %/ile	80 <sup>th</sup> %/ile	20 <sup>th</sup> %/ile	80 <sup>th</sup> %/ile	20 <sup>th</sup> %/ile	80 <sup>th</sup> %/ile
Prevalence	10.5%	32.4%	29.4%	49.8%	35.5%	61.8%	41.1%	60.5%	41.4%	61.3%
<b>Recent use of marijuana (without doctor recommendation)   Ever use of marijuana</b>										
<b>Period prevalence of use</b>	Diabetes Hearing Impair. Heart condition Hypertension	ADHD/ADD Epilepsy Learning disab. Orthopedic	Asthma Cancer Diabetes Visual impair.	Autism Heart condition Kidney disease Learning disab. Migraines	Cancer Hypertension Learning disab. Migraines	Heart condition Kidney disease Orthopedic Visual impair.	Cancer Diabetes Heart condition Kidney disease	ADHD/ADD Autism Other condition Visual impair.	Cancer Diabetes Hearing Impair. Heart condition	ADHD/ADD Autism Epilepsy Kidney disease
Prevalence	0.0%	11.1%	13.9%	38.1%	25.3%	46.8%	26.1%	43.4%	16.1%	53.2%
<b>Cumulative prevalence of use</b>	Diabetes Hearing Impair. Heart condition Hypertension	ADHD/ADD Epilepsy Learning disab. Orthopedic	Cancer Diabetes Other condition Visual impair.	Autism Epilepsy Heart condition Kidney disease	Cancer Diabetes Hypertension Migraines	Autism Heart condition Kidney disease Orthopedic	Cancer Diabetes Hypertension Kidney disease	Asthma Autism Orthopedic Psych condition	Cancer Diabetes Hypertension Visual impair. condition	Autism Heart condition Kidney disease Psych condition
Prevalence	0.0%	11.1%	10.4%	36.1%	27.5%	52.3%	40.9%	53.9%	44.7%	62.0%

<sup>a</sup>Incidence was determined by new reporting of substance use behaviors among those who reported no use in the prior period. Values in bold represent statistically significant differences ( $p < 0.05$ ) comparing youth with a diagnosis of any of the listed conditions to those without.

<sup>b</sup>Prevalence refers to the cumulative or period reporting of use behaviors among those followed through each period. Values in bold represent statistically significant differences ( $p < 0.05$ ) comparing youth with a diagnosis of any of the listed conditions to those without.

<sup>c</sup>Chronic conditions include: attention deficit/hyperactivity disorder (ADHD/ADD); asthma; autism; birth defects; breathing problems; cancer; chronic hypertension; 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. Conditions that were too rare to yield stable estimates (i.e., birth defects, digestive problems, sickle cell anemia, and skin disease) are not shown.

<sup>d</sup>Data are from the Panel Study of Income Dynamics, Child Development and Transition to Adulthood Supplements (2002–2011).