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**Changing perspectives on marijuana use during early adolescence and young adulthood:
Evidence from a Panel of Cross-Sectional Surveys**

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Abstract

Introduction. Prior research has often overlooked potential cohort differences in marijuana views and use across adolescence and young adulthood. To begin to address this gap, we conduct an exploratory examination of marijuana views and use among American youth using a panel of cross-sectional surveys. **Method.** Findings are based on repeated, cross-sectional data collected annually from adolescents (ages 12-17; $n = 230,452$) and young adults (ages 18-21; $n = 120,588$) surveyed as part of the National Survey on Drug Use and Health between 2002 and 2014. For each of the birth years between 1986 and 1996, we combined a series of nationally representative cross-sections to provide multi-year data strings designed to approximate nationally representative cohorts. **Results.** Compared to youth born in the mid-to-late 1980s, youth born in the mid-1990s reported significantly *higher* levels of marijuana disapproval during the early adolescent years (Age 14: 1988 = 64.7%, 1994 = 70.4%) but *lower* levels of disapproval during the young adult years (Age 19: 1988 = 32.0%, 1994 = 25.0%; Age 20: 1988 = 27.9%, 1994 = 19.7%). **Moreover, the prevalence of marijuana use among youth born in 1994 was significantly lower—compared to youth born in 1988—at age 14 (1988: 11.39%, 1994: 8.19%) and significantly higher at age 18 (1988: 29.67%, 1994: 34.83%).** This pattern held even when adjusting for potential confounding by demographic changes in the population across the study period. **Conclusions.** We see evidence of changes in the perceptions of marijuana use among youth born during the late twentieth century.

Keywords: *marijuana; cannabis; substance use; adolescents; young adults; trends*

Recent years have witnessed tremendous change with respect to the perception and distribution of marijuana in the United States (US). In 1996, California became the first state to legalize the use of medical marijuana and, shortly thereafter, calls were made by *The New England Journal of Medicine* and the National Institutes of Health for research to reassess the classification of marijuana as a Schedule I drug (Kassirer, 1997; Volker, 1997). By 2008, more than a dozen states had legalized the use of marijuana for specific medical conditions and voters in Massachusetts approved an initiative to decriminalize the possession of small amounts of marijuana (Lee, 2012). At present, twenty-five states and the District of Columbia have medical marijuana laws, recreational marijuana use is legal in several states, and more than half of all American adults support legalization (Motel, 2015).

A bevy of recent studies have examined changes in the use and perception of marijuana among youth in the US. Trend studies conducted using data from the National Youth Risk Behavior Survey (YRBS), National Survey on Drug Use and Health (NSDUH), and Monitoring the Future (MTF) point to noteworthy changes in marijuana use among adolescents and young adults over the past few decades (Hasin et al., 2015; Johnson et al., 2015; Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2015; Salas-Wright, Vaughn, Todric, Córdova, & Perron, 2015; Substance Abuse and Mental Health Services Administration [SAMHSA], 2014). For instance, evidence from the NSDUH and MTF point to decreases in marijuana use among adolescents along with modest but significant increases in use and substantial decreases in disapproval among young adults (Johnston et al., 2015; Salas-Wright et al., 2015).

One important shortcoming, however, faced by all the aforementioned trend studies is a failure to account for cohort differences. For instance, Salas-Wright and colleagues (2015) provide a fine-grained assessment of trends in marijuana use and disapproval among

developmental subgroups (i.e., ages 12-14, 15-17, 18-25). While such an assessment provides insight into changes in prevalence among youth in particular developmental subsets, this approach overlooks the ways in which youth from particular cohorts may differ across the spectrum of adolescence and young adulthood (Keyes et al., 2011). Indeed, given the speed at which changes in marijuana policy have occurred—particularly during the latter half of the 2000s—it is reasonable to surmise that children who entered adolescence, for example, in the 1990s may be distinct from those who became teenagers in the mid-2000s.

The Present Study

Our objective is to extend findings from recent trend studies by examining the disapproval and use of marijuana using a panel of cross-sectional surveys. Specifically, we construct a series of analytic samples designed to approximate nationally representative cohorts of American youth from early adolescence to young adulthood. Notably, while our approach allows us examine marijuana-related trends using strings of data that are analogous to cohorts, we should be very clear that it is not possible to examine true cohorts using NSDUH data. Cognizant of this limitation, we conduct an exploratory study designed to examine changes in the prevalence of marijuana disapproval and use among American youth born between the mid-1980s and the mid-1990s.

Method

Sample and Procedures

Study findings are based on repeated, cross-sectional data collected annually as part of the NSDUH between 2002 and 2014. Each year the NSDUH provides estimates of substance use in the civilian, non-institutionalized population of the US on the basis of a new, non-overlapping national sample. Since 2002, a total of 723,283 respondents (including 230,452 adolescents and

120,588 young adults) have completed the NSDUH survey. The NSDUH design/methods are summarized briefly here; however, a detailed description of the study procedures is available elsewhere (SAHMSA, 2014).

Repeated, Cross-Sectional Data Constructed as Panels

In order to examine the changes from early adolescence to young adulthood among youth born in varying birth years (e.g., 1986, 1987, etc.), we utilized the “mutoscope” approach to analyzing repeated, cross-sectional data constructed as a panel (Frost, 1939; Seedall & Anthony, 2015). Specifically, for each of the birth years between 1986 and 1996, we combined a series of population-based cross-sections of youth to provide multi-year strings of data that approximate nationally representative cohorts (based on respondent age/survey year). For instance, for the 1994 data string, we began with a nationally representative sample of 12-year-olds in 2002 and, with each subsequent year, selected a refreshed and non-overlapping subsample of youth that corresponded in age to the original nationally representative sample from 2002 (e.g., 13-year-olds in 2003, 14-year-olds in 2004, and so on up to 20-years-olds in 2014). This approach is similar to that used in producing instruments such as pediatric growth charts (which are also based on a series of cross-sectional snapshots; Grummer-Strawn et al., 2010).

Measures

Marijuana use disapproval. Adolescents (ages 12-17) and young adults (ages 18-21) were queried about their views on marijuana use using two similarly-phrased questions. Adolescents were asked: “How do you feel about *someone your age* trying marijuana or hashish once or twice?” and young adults were asked “How do you feel about *adults* trying marijuana or hashish once or twice?” Youth reporting that they “strongly disapprove” were coded as 1 while

youth reporting more lenient views ("neither approve nor disapprove" or "somewhat disapprove") were coded as 0.

Marijuana use. Past 12-month marijuana use (0 = no, 1 = yes) was assessed by first asking participants, "Have you used marijuana or hashish during the past 12 months?"

Sociodemographic Factors. Sociodemographic variables include: gender (female, male), race/ethnicity (non-Hispanic white, African-American, Hispanic, Other), and total annual family income (less than \$20,000; \$20,000 to \$49,999; \$50,000 to \$74,999; \$75,000 or more).

Statistical Analyses

First, we analyze and report the prevalence estimates and corresponding 95% confidence intervals for marijuana disapproval and past year marijuana use among youth from varying birth years (i.e., 1986-1996) from early adolescence to young adulthood (i.e., ages 12-21). As is standard with NSDUH data, all prevalence estimates and 95% confidence intervals were adjusted for complex survey sampling design effects using Stata 14.1 MP software. However, in order to account for potential demographic shifts over the period of the study, we also computed prevalence estimates and confidence intervals that were adjusted for year-by-year data on gender, race/ethnicity, and family income among survey respondents. Although we present information for youth from all birth years between 1986 and 1996, we primarily emphasize the strings of data for youth born in 1988 and 1994. These birth years provided the optimal combination of spacing in years (i.e., a multi-year gap between each of the birth years) and inclusion of multiple ages (i.e., maximum coverage of ages 12-21).

Results

Marijuana Disapproval and Use

Marijuana Disapproval. Among all birth years/strings of data, we observed a clear reduction in the proportion of youth reporting “strong disapproval” of marijuana use as youth progressed from the early adolescent to young adult stage (see Table 1). However, closer inspection reveals important differences between youth born in 1988 and those born in 1994 (see Figure 1). Specifically, we see a pattern in which youth born in 1994 report significantly greater disapproval at age 14 (70.39, 95% CI = 67.9-72.8) as compared to youth born in 1988 at the same age (64.73, 95% CI = 62.4-66.3). Similar findings can be found by contrasting youth born in 1989 and 1995 during early adolescence (i.e. ages 13-14). However, during young adulthood we see that youth born in 1994 report significantly *lower* levels of disapproval at age 19 (1988: 32.00, 95% CI = 29.7-34.4; 1994: 24.99, 95% CI = 22.9-27.2) and 20 (1988: 27.93, 95% CI = 25.2-30.8; 1994: 19.69, 95% CI = 17.2-22.4) compared to youth born in 1988. We also observed non-overlapping confidence intervals in contrasting data strings from 1986-1987 with those from 1995-1996 at ages 18-19. Notably, this pattern held even when adjusting for potential confounding by demographic changes in the population across the study period.

Marijuana Use. We conducted a similar analysis of marijuana use (available upon request). Among all birth year strings, we observed a steady increase in the prevalence of past year marijuana use from age 12 to age 18 before leveling off during the young adult stage (i.e., ages 18-21). Similar to marijuana disapproval, we found that point estimates for marijuana use were, compared to youth born in 1988, *lower* among youth born in 1994 from ages 14 to 16, but then *higher* from ages 17 to 20. Adjusting for sociodemographic changes, these differences were significant at age 14 (1988: 11.39, 95% CI = 9.90-12.89; 1994: 8.19, 95% CI = 6.86-9.53) and 18 (1988: 29.67, 95% CI = 27.61-31.73; 1994: 34.83, 95% CI = 32.12-37.55).

Link between Marijuana Disapproval and Use

We conducted supplementary analyses to examine the cross-sectional association between marijuana disapproval and use among youth born in 1988 and 1994 (available upon request). Results revealed that the link between marijuana disapproval and use was consistently robust across the developmental spectrum of early adolescence and young adulthood for youth in all data strings. Specifically, with the exception of 12-year-olds born in 1994 (OR = 0.30, 95% CI = 0.07-1.26), the association between disapproval and use was uniformly significant with odds ratios tightly clustered between 0.08 and 0.14.

Discussion

We found that youth born in the mid-1990s—that is, those entering the teenage years in the latter half of the 2000s—appear to be distinct from those born in the mid-to-late 1980s with respect to the disapproval of marijuana use. In particular, we saw a pattern in which youth from earlier birth years reported relatively greater disapproval during early-to-mid adolescence in combination with increasingly lower disapproval during young adulthood.

This curious pattern of results begs the question: What may be influencing observed birth year differences in marijuana disapproval? One possibility is that incipient changes in marijuana policy taking place in the late 1990s / early 2000s—that is, efforts to medicalize and decriminalize marijuana in parts of the US—may have prompted parents and preventionists to be more proactive in educating young teens about the dangers of adolescent marijuana use (which had an effect during early adolescence that later “wore off” by young adulthood). It is also possible that, as the legal consequences of marijuana use have begun to change in many parts of the US, the later cohorts may have been differentially influenced (thereby reporting lower disapproval and more use during the emerging adult stage). Second, our findings seem to reflect

changes in the general population in the US (Hasin et al., 2015, 2016) as marijuana has become increasingly available in a legal and/or decriminalized form and approval for legalization has steadily increased (Salas-Wright & Vaughn, 2016a, 2016b).

While we observed birth year differences with respect to the perception of marijuana across the development spectrum, the prevalence of strong marijuana disapproval and marijuana use effectively mirror one another among youth from earlier and later birth years. Indeed, our analyses suggest a very consistent and robust relationship between disapproval and marijuana use across birth years and with age. This is noteworthy as results from the present study suggest invariance in the disapproval/marijuana use link across birth year data strings.

Several study limitations should be noted. First, the NSDUH data are cross-sectional. We constructed samples based on repeated cross-sections of data designed only to approximate longitudinal cohorts of youth. Such data do not allow us to assess within-person change or examine the prospective relationship between marijuana disapproval and use. Moreover, while we adjusted for sociodemographic factors across the study period, the NSDUH data are potentially vulnerable to year-to-year sociodemographic changes. For instance, it is possible that mean values for youth born in the same year may be different in a given survey year due to changes in the makeup of the sample rather than actual changes in views/use. Despite these limitations, exploratory findings suggest that changes in marijuana policy and public perception may be impacting the marijuana-related trajectories of youth coming-of-age in the early 2000s. We encourage researchers to build upon the present study by examining and deepening our understanding of potential cohort differences in marijuana use among American youth.

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Table 1.

Standard and demographically adjusted estimates and 95% confidence intervals for “strong disapproval” of marijuana use by age among selected birth cohorts of youth

Age	<i>Strongly Disapprove</i>	Year of Birth										
		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
12	Estimate					83.91 (82.0-85.6)	85.35 (83.6-86.9)	85.48 (83.9-86.9)	86.72 (85.0-88.2)	86.85 (85.1-88.4)	86.63 (84.7-88.3)	87.18 (85.3-88.8)
	Adjusted Estimate					84.33 (82.6-86.0)	85.85 (84.2-87.5)	86.62 (85.1-88.1)	87.51 (85.9-89.1)	87.65 (86.2-89.1)	86.87 (85.1-88.7)	87.85 (86.1-85.5)
	Yes					2594	2469	2407	2453	2367	2299	2243
	No					467	447	408	394	371	349	310
13	Estimate				75.49 (73.9-77.0)	77.21 (75.0-79.3)	78.17 (76.2-79.9)	77.47 (75.3-79.5)	78.77 (76.7-80.7)	82.34 (80.3-84.2)	81.72 (79.7-83.6)	80.68 (78.0-83.1)
	Adjusted Estimate				75.82 (74.2-77.4)	77.47 (75.4-79.5)	78.34 (76.5-80.1)	77.86 (75.8-79.9)	79.15 (77.2-81.1)	82.88 (80.9-84.9)	81.97 (80.0-83.9)	81.28 (78.9-83.7)
	Yes				2294	2361	2431	2382	2388	2313	2246	2176
	No				754	708	716	681	602	536	497	519
14	Estimate			64.37 (62.4-66.3)	65.58 (63.1-67.9)	65.62 (63.3-67.9)	67.11 (64.6-69.5)	71.19 (69.0-73.3)	71.52 (68.9-74.0)	70.39 (67.9-72.8)	71.33 (68.5-74.0)	70.07 (67.8-72.3)
	Adjusted Estimate			64.62 (62.6-66.6)	65.72 (63.4-68.0)	65.66 (63.4-67.9)	67.32 (64.9-69.7)	71.33 (69.2-73.5)	71.73 (69.3-71.4)	70.45 (68.0-72.8)	71.55 (68.9-74.2)	70.40 (68.2-72.6)
	Yes			1948	1948	2034	2109	2151	2043	2008	2047	2026
	No			1146	1044	1070	1020	912	797	835	819	907
15	Estimate		53.38 (50.7-56.0)	56.42 (53.4-59.4)	57.16 (54.5-59.8)	55.64 (53.4-57.8)	59.30 (56.8-61.7)	61.39 (59.3-63.4)	61.80 (59.3-64.2)	59.67 (57.7-61.6)	57.99 (55.8-60.2)	58.54 (56.2-60.9)
	Adjusted Estimate		53.44 (50.9-56.0)	56.55 (53.6-59.5)	57.26 (54.6-59.9)	55.73 (53.5-57.9)	59.38 (57.0-61.8)	61.53 (59.5-63.5)	61.98 (59.6-64.3)	59.81 (57.9-61.7)	58.12 (55.9-60.3)	58.62 (56.3-60.9)
	Yes		1489	1671	1774	1779	1842	1844	1844	1854	1785	1913
	No		1346	1373	1321	1427	1321	1199	1182	1226	1310	1299
16	Estimate	49.00 (47.1-50.9)	49.28 (47.2-51.3)	50.79 (48.5-53.0)	51.59 (49.3-53.9)	53.54 (50.9-56.1)	54.50 (52.4-56.5)	56.68 (53.6-59.7)	51.33 (48.9-53.7)	52.48 (49.7-55.1)	50.15 (48.1-52.2)	51.57 (49.3-53.8)
	Adjusted Estimate	49.00 (47.1-50.8)	49.28 (47.2-51.3)	50.85 (48.7-53.0)	51.62 (49.4-53.8)	53.59 (51.0-56.1)	54.60 (52.6-56.6)	56.81 (53.8-59.8)	51.41 (49.0-53.8)	52.58 (50.0-55.1)	50.22 (48.1-52.3)	51.61 (49.4-53.8)
	Yes	1333	1453	1470	1621	1677	1646	1770	1580	1655	1705	1542
	No	1431	1530	1519	1563	1458	1454	1391	1497	1512	1676	1495
17	Estimate	47.89 (45.4-50.3)	45.82 (43.6-48.0)	46.05 (43.5-48.6)	49.81 (47.3-52.3)	48.92 (46.5-51.3)	48.26 (46.1-50.4)	49.25 (47.0-51.5)	47.61 (45.3-50.0)	47.57 (45.3-49.8)	44.90 (42.8-47.0)	42.45 (39.8-45.1)
	Adjusted Estimate	47.88 (45.4-50.4)	45.79 (43.6-47.9)	46.00 (43.5-48.5)	49.82 (47.4-52.2)	48.93 (46.5-51.3)	48.25 (46.1-50.4)	49.28 (47.1-51.4)	47.57 (45.2-49.9)	47.55 (45.4-49.7)	44.85 (42.8-46.9)	42.30 (39.7-44.9)
	Yes	1379	1351	1403	1457	1486	1536	1494	1527	1556	1363	1229
	No	1623	1597	1624	1547	1524	1530	1626	1622	1754	1654	1734
18	Estimate	34.60 (32.4-36.9)	36.30 (33.7-38.9)	32.98 (30.5-35.5)	34.15 (31.8-36.6)	34.28 (31.7-36.9)	31.18 (28.6-33.9)	29.24 (27.0-31.5)	30.48 (28.0-33.1)	28.29 (25.9-30.8)	27.44 (25.2-29.8)	25.50 (22.7-28.5)
	Adjusted Estimate	32.23 (32.0-36.4)	36.09 (33.4-38.7)	32.42 (30.0-34.8)	33.72 (31.3-36.1)	33.90 (31.4-36.4)	30.89 (28.3-33.5)	28.94 (26.6-31.2)	30.18 (27.7-32.7)	27.91 (25.6-30.2)	26.79 (24.5-29.1)	24.96 (22.2-27.6)
	Yes	928	899	851	873	932	835	812	812	712	640	422

	No	1726	1630	1645	1688	1852	1815	1797	1794	1737	1665	1216
19	Estimate	30.38 (28.1-32.8)	32.36 (30.3-34.5)	32.00 (29.7-34.4)	30.11 (27.8-32.5)	27.71 (25.7-29.8)	30.29 (27.9-32.8)	27.69 (24.8-30.8)	25.99 (23.1-29.1)	24.99 (22.9-27.2)	21.12 (18.3-24.2)	
	Adjusted Estimate	29.99 (27.7-32.2)	31.90 (29.8-34.0)	31.66 (29.4-33.9)	29.69 (27.4-31.9)	27.04 (25.0-29.1)	29.75 (27.2-32.3)	27.36 (24.5-30.3)	25.65 (22.8-28.5)	24.73 (22.6-26.9)	20.52 (17.5-23.5)	
	Yes	724	725	743	764	706	710	650	576	510	332	
	No	1641	1529	1607	1669	1785	1721	1673	1615	1586	1178	
20	Estimate	29.87 (27.5-32.3)	31.38 (29.0-33.9)	27.93 (25.2-30.8)	27.78 (25.4-30.2)	26.55 (24.1-29.1)	25.48 (23.0-28.1)	24.17 (21.8-26.7)	22.21 (20.0-24.6)	19.69 (17.2-22.4)		
	Adjusted Estimate	29.57 (27.1-32.0)	30.91 (28.5-33.3)	27.59 (24.8-30.3)	27.27 (25.0-29.6)	26.10 (23.5-28.7)	24.54 (22.2-26.8)	23.54 (21.0-26.0)	21.68 (19.6-23.8)	19.14 (16.5-21.8)		
	Yes	640	704	638	615	635	618	569	506	322		
	No	1482	1528	1622	1647	1717	1782	1670	1702	1283		
21	Estimate	28.27 (25.6-31.0)	29.25 (26.5-32.2)	25.02 (23.1-27.1)	26.37 (23.6-29.3)	24.06 (21.5-26.9)	25.94 (23.4-28.6)	22.54 (20.4-24.9)	19.95 (17.2-23.0)			
	Adjusted Estimate	27.32 (24.8-29.8)	29.05 (26.2-31.9)	24.16 (22.3-26.0)	25.42 (22.7-28.1)	25.42 (22.7-28.1)	25.32 (22.8-27.8)	21.84 (19.7-24.0)	19.01 (16.4-21.6)			
	Yes	642	667	583	568	568	580	485	302			
	No	1592	1648	1701	1779	1851	1750	1704	1277			

Note: Standard and adjusted estimates in bold represent significant differences between the 1988 and 1994 cohorts. Standard estimates are adjusted for the complex sampling design only. Estimates specified as "adjusted" were calculated to account for [1] the complex sampling design of the National Survey on Drug Use and Health and [2] potential year-to-year differences in key sociodemographic factors (i.e., gender, race/at the city, and family income).

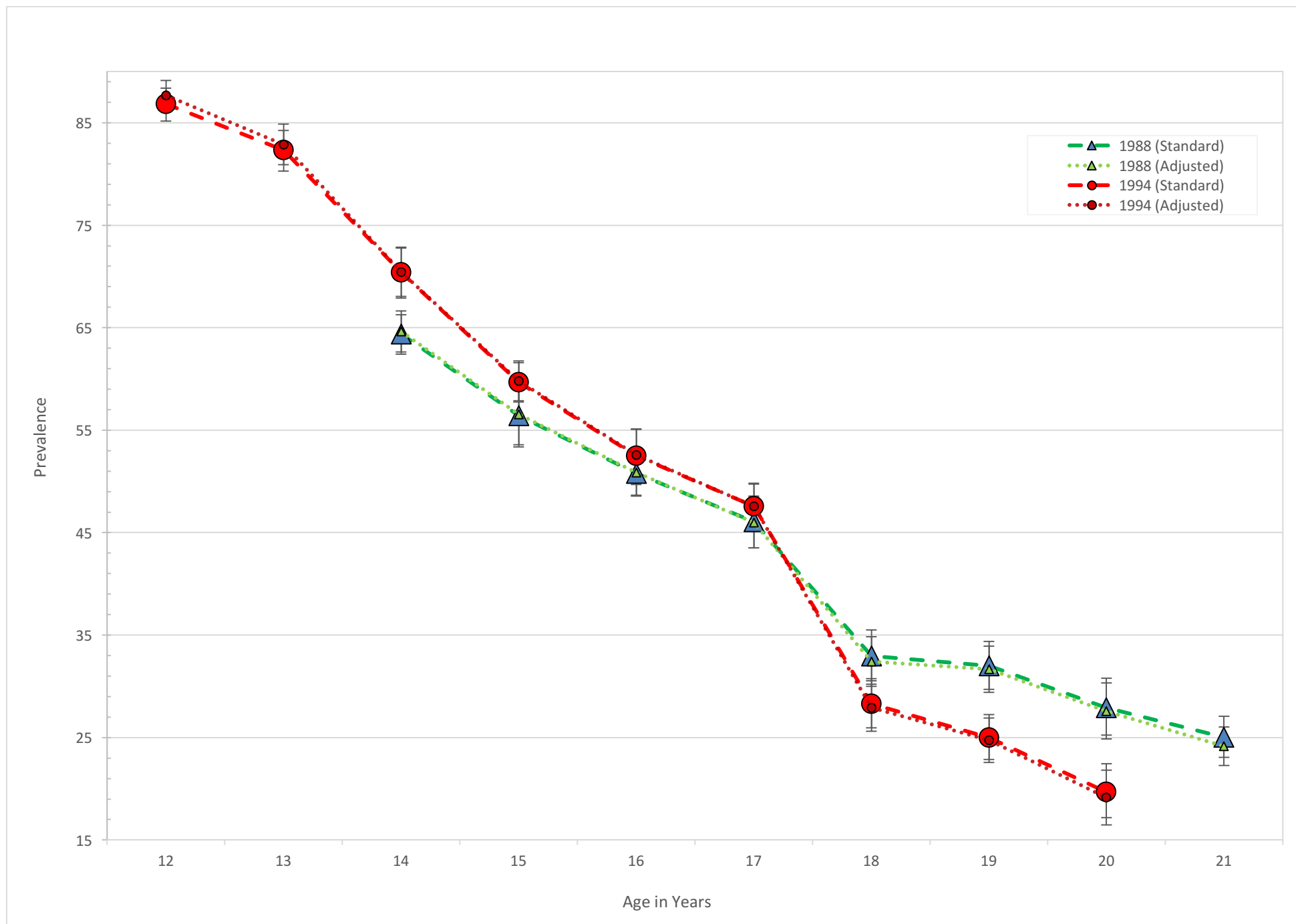


Figure 1. Prevalence estimates and 95% confidence intervals for “strong disapproval” of marijuana use by age among selected birth cohorts of youth in the United States. Estimates specified as “adjusted” were calculated to account for [1] the complex sampling design of the National Survey on Drug Use and Health and [2] potential year-to-year differences in key social demographic factors (i.e., gender, race/ethnicity, and family income). All other prevalence estimates are adjusted for the complex sampling design only.