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Older marijuana users' marijuana risk perceptions: associations with marijuana use patterns and marijuana and other substance use disorders

Namkee G. Choi, Diana M. DiNitto and C. Nathan Marti

School of Social Work, University of Texas at Austin, 1925 San Jacinto Blvd, Austin, TX, 78712, USA

ABSTRACT

Background: Compared to their non-using age peers, older marijuana users are known to have lower marijuana risk perceptions. We examined associations of older marijuana users' risk perceptions with their marijuana use patterns and substance use disorders.

Methods: Data are from 2013 to 2015 National Survey of Drug Use and Health (N = 24,057 respondents aged 50+ years). Bivariate logistic regression was used to compare risk perceptions among never users, former users, and past-year users aged 50+ years. Multivariable logistic regression was used to test associations between risk perception and marijuana use status and between risk perception and marijuana use patterns.

Results: Among the total sample, former (AOR = 0.30, 95% CI = 0.27–0.32) and past-year (AOR = 0.05, 95% CI = 0.04–0.06) marijuana users had significantly lower odds of moderate/great risk perception (as opposed to no/slight risk perception) than never users. Among past-year users, odds of moderate/great risk perception were lower among those who used marijuana more frequently (AOR = 0.14, 95% CI = 0.07–0.28 for 300+ days of use compared to 1–11 days of use) and who reported any medical marijuana use (AOR = 0.27, 95% CI = 0.14–0.51). However, those who had marijuana use disorder were 3.5 times more likely to report moderate/great risk perception (AOR = 3.50, 95% CI = 1.62–7.58). Those who had a college education, had higher incomes, and resided in states with medical marijuana laws also had lower risk perceptions.

Conclusions: Public health education on scientific evidence about marijuana's benefits and harms and age-appropriate treatment for older adults with substance use problems are needed. Research on risk perception formation using longitudinal data among older adults is also needed.

Key words: older adults, marijuana risk perception, marijuana use disorder, medical marijuana use, frequency of marijuana use

Introduction

Risk perceptions about marijuana use have changed over the past decade in the USA. Data from the 2002 to 2014 US National Survey on Drug Use and Health (NSDUH) show that the proportion of adult respondents (aged 18+ years) who perceived regular (once or twice a week) marijuana use as having great risk of harm decreased from 50.4% in 2002 to 33.3% in 2014 (Compton *et al.*, 2016). Another study based on 2002–2012 NSDUH data found that the decrease in risk perception was significant regardless of past-year marijuana use/non-use, but past-year non-daily and daily use were negatively associated with perceived great risk of regular cannabis use (Pacek *et al.*, 2015). Lower risk perceptions may be due to marijuana's changing legal status (29 US states had laws allowing marijuana use for at least some medical purposes, and eight states and Washington, DC, had laws allowing marijuana use for recreational purposes in 2017), increased marijuana availability due to commercialization, increasing numbers of marijuana users, increased medical marijuana registration (a significant share by older adults), and increased frequency of use among users (Schuermeyer *et al.*, 2014; Okaneku *et al.* 2015; Wen *et al.*, 2015; Compton *et al.*, 2016; Fairman, 2016; Martins *et al.*, 2016; Hasin *et al.*, 2017).

Correspondence should be addressed to: Namkee G. Choi, PhD, University of Texas at Austin School of Social Work, 1925 San Jacinto Blvd, Austin, TX, 78712, USA. Phone: 512-232-9590. Email: nchoi@austin.utexas.edu.
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Among adolescents, lower marijuana risk perception was found to be associated with a higher use rate and intention to use in the near future (Lopez-Quintero and Neumark, 2010). Marijuana use has also been found to contribute to incrementally lower risk perceptions among adolescents over time, showing a possible reappraisal of risk perception among users (Grevenstein *et al.*, 2015). A qualitative study of marijuana risk perception formation among substance using veterans (aged 24–65 years) also found that (1) these adults based their risk perceptions on personal experience rather than scientific knowledge; (2) a majority viewed marijuana as significantly different from other drugs because they saw it as safe, non-addictive, lacking physical withdrawal symptoms, and as having less overt behavioral effects; and (3) only a minority recognized marijuana's capacity to cause negative social consequences; act as a precursor to other, more harmful substance use; and cause paranoia or worsen psychosis (Wilkinson *et al.*, 2016).

Over the past decade, marijuana use has increased among all age groups of adults, especially older adults, in the USA (Hasin *et al.*, 2015; Compton *et al.*, 2016). From 2003 to 2014, NSDUH shows that past-year use rates rose from 2.95% to 9.08% among the 50–64 age group and from 0.15% to 2.04% among the 65+ age group (Salas-Wright *et al.*, 2017). Though use rates among the 50+ age group have increased, more of those aged 50+ years than younger adults still perceive marijuana use as having great risk of harm (Okaneku *et al.*, 2015; Pacek *et al.*, 2015). However, risk perceptions differ substantially between older marijuana users and non-users. NSDUH data from 2006 to 2013 show that only 5.0% of past-year marijuana users aged 50+ years perceived regular marijuana use to be of great risk (Han *et al.*, 2017). A qualitative study of baby boomer (1946–1964 birth cohort) marijuana users also found that these users consider marijuana to be a safer alternative to other substances and that they used harm-reduction strategies (e.g. moderation of quantity and frequency of use) to minimize negative effects on their social functioning (Lau *et al.*, 2015).

With increasing marijuana use among those aged 50+ years, more research is needed to examine whether older marijuana users' risk perceptions are associated with their use patterns (e.g. use frequency, medical vs. recreational use), marijuana use disorder, other substance use/use disorders, and experience of other problems (e.g. driving under the influence (DUI)) associated with marijuana use. A majority of older marijuana users are long-term users who initiated use early in life, and they are also more likely than non-users to have had mental and substance use disorders (Choi *et al.*, 2016a). Following alcohol, marijuana is the second most frequently used substance by older adults who report DUI (Choi *et al.*, 2016b). Older marijuana users have a higher rate of overall injury than non-users, leading to a higher rate of emergency department (ED) visits (Choi *et al.*, 2017). Older ED trauma patients who screened positive for marijuana (or cocaine) also had significantly higher odds of intensive care admission and surgery than those who screened negative (Lank and Crandall, 2014).

In the present study, we examined marijuana use risk perception among (1) the general population aged 50+ years and (2) past-year marijuana users aged 50+ years. As used in other studies, drug outcome expectancy theory (Leventhal and Schmitz, 2006) provides a conceptual framework for this study. Outcome expectancy theory posits that drug-taking behavior is motivated by the desire to attain particular outcomes associated with drug consumption. For example, people use marijuana expecting to enhance positive outcomes (e.g. feeling, a sense of relaxation, pleasure, cognitive enhancement, stress, and pain relief) and to cope with and attenuate negative emotions (e.g. depression and anxiety). Older adults who attribute these positive outcomes to marijuana use may be those who continue to use it, use it more often, and are not likely to perceive great risk from using it. On the other hand, marijuana users who may have experienced negative outcomes (e.g. from marijuana use disorder or other marijuana-attributable dangerous behaviors like DUI) may be more likely to perceive risk of using it. Study hypotheses were: (H1) Compared to never marijuana users, prior to past-year users and past-year users will be less likely to perceive moderate/great risk from regular marijuana use; and (H2) among past-year users, those with marijuana use disorder will be more likely, while frequent users and medical marijuana users (who tend to be more frequent users (Choi *et al.*, 2017)), will be less likely to perceive moderate/great risk. Based on significant correlates of marijuana use and risk perception in previous studies (e.g. Pacek *et al.*, 2015; Han *et al.*, 2017), covariates were sociodemographic factors, including residence in states with medical marijuana laws (MLL); past-year other substance use/use disorders; major depressive episode (MDE); self-rated health; and past-year DUI. This study's findings may provide further insights into correlates of marijuana risk perception among the 50+ age group, the age cohort with the highest increase in marijuana use rates.

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Methods

Data and sample

Data are from 2013 to 2015 NSDUH public use files. The annual NSDUH series measures the prevalence of substance use among the civilian, non-institutionalized, US population aged 12+ years (Inter-university Consortium for Political and Social Research (ICPSR), 2016). Questions about substance use and mental disorders and related treatment are also asked of respondents aged 18 years and older. A detailed description of NSDUH's complex multi-stage stratified sampling design is available from Center for Behavioral Health Statistics and Quality (2016). Survey respondents were interviewed in private at their place of residence using audio computer-assisted self-interview, computer-assisted personal interview, and computer-assisted self-interview to provide respondents with highly private and confidential means of responding to questions and to increase the level of honest reporting of illicit drug use and other sensitive behaviors (ICPSR, 2016).

To increase the study's power to detect low frequency events (e.g. great risk perception among marijuana users), we combined three years of data. While some questions in the 2015 NSDUH regarding some substances were changed from those asked in 2013 and 2014 (e.g. subtypes of hallucinogens, inhalants, and prescription drugs, definition of misuse of prescription drugs), the variables selected for this study were the same for all three survey years—marijuana use, risk perception, first age of use, and use frequency; marijuana and alcohol abuse or dependence; and nicotine dependence.

The total number of respondents completing the survey was 55,160 in 2013, 55,271 in 2014, and 57,146 in 2015. The present study focused on the 24,057 respondents aged 50+ years from these three years, of whom 14,454 were 50–64 years and 9,603 were 65+ years. (The NSDUH public use data files do not provide chronological age to protect respondents' anonymity.)

Measures

Marijuana risk perception: All respondents were asked: *"How much do people risk harming themselves physically and in other ways when they smoke marijuana (1) once a month and (2) once or twice a week?"* Response categories were no risk, slight risk, moderate risk, and great risk. We describe risk perceptions for using once a month (occasional use) and once or twice a week (regular use) but focused on regular use in multivariable analysis.

Marijuana use status was measured with questions about lifetime use ("*have you ever, even once, used*"), leading to identification of never users, prior-to-past-year users (former users), and past-year (within the past 12 months) users. For marijuana use patterns, we examined age of first use, frequency of use (total number of days used in the past 12 months), and *any medical marijuana use* ("*Was any of your marijuana use in the past 12 months recommended by a doctor or other healthcare professional?*").

Past-year marijuana and alcohol abuse or dependence were determined using *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition (DSM-IV) criteria. *Nicotine dependence* was determined based on Fagerström test scores (Heatherton *et al.*, 1991).

Other covariates: *Sociodemographic characteristics* included age group (50–64 years and 65+ years), gender, race/ethnicity, marital status, educational level, income, and residence in MML states at the time of interview. *Health status* was measured with self-ratings of health (excellent/very good, good, or fair/poor). *Past-year* MDE was assessed with DSM-IV criteria during the worst/most severe period of time, lasting two weeks or longer, in the past 12 months (yes = 1, no = 0). *Lifetime MDE* (including past-year episode) was also determined using DSM-IV criteria. For past-year DUI, respondents were asked, "*During the past 12 months, have you driven a vehicle while you were under the influence of (1) a combination of alcohol and illegal drugs used together, (2) alcohol/alcohol only; or (3) illegal drugs only?"* An affirmative answer to any of these questions was coded as 1 (= yes vs. 0 = no to all).

Analysis

All analyses were conducted with Stata/MP 15's svy function to account for NSDUH's multi-stage, stratified sampling design. For this study, adjusted person-level analysis weights were created by dividing the final person-level analysis weights by the number of years of pooled data (three in the current study) following NSDUH guidelines for combining sampling weights across multiple survey years. All estimates presented in this study are weighted except sample sizes. First, χ^2 tests and bivariate logistic regression were used to compare never users, former users, and past-year users aged 50+ years on their sociodemographic and clinical characteristics and their marijuana risk perceptions. Second, χ^2 tests and bivariate logistic regression was used to compare risk perceptions of non-medical versus medical users. Third, multivariable logistic regression analysis was used to test H1 (associations between risk perceptions and marijuana use status) and H2 (associations between

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risk perceptions and marijuana use patterns and problems). While previous studies have focused on great risk, we dichotomized the outcome variable into moderate/great risk versus no/slight risk for multivariable analyses. Given that only 58 marijuana users aged 50+ years (including only two men and three women aged 65+ years) perceived great risk, using great risk as a separate category would have fallen below a recommended 10:1 threshold for outcomes to variable ratios outlined in Hosmer *et al.* (2013). Our sensitivity analysis with moderate and great risk perceptions as separate categories showed that the pattern of results for the moderate and great risk responses were generally consistent. Potential significance of the survey year (2013, 2014, or 2015) was tested in preliminary models, but finding no significant effect, it was excluded from the final models. Logistic regression results are presented in odds ratios (OR) or adjusted odds ratios (AOR) and 95% confidence intervals (CI). Statistical significance was set at $p < 0.05$.

Results

Sample characteristics by marijuana use status

Table 1 shows that of those aged 50+ years, 34.8% were former and 5.8% were past-year marijuana users. (Past-year use rates increased from 4.9% in 2013 to 6.1% in 2014 and 6.3% in 2015, $F[2.00, 219.85] = 4.48$, $p = 0.012$). Compared to never users, former and past-year users were less likely to be in the 65+ age group, female, racial/ethnic minorities, and widowed; however, they were more likely to be divorced or never married, have had higher education, have income above 200% of poverty, and live in MML states. Former and past-year users were also more likely than never users to have alcohol abuse/dependence and nicotine dependence, had past-year/lifetime MDE, and reported DUI. Former users were less likely but past-year users were more likely to have rated their health fair/poor. Compared to former users, past-year users were less likely to be in the 65+ age group, female, and to have had higher education and income higher than poverty; however, they were more likely to be divorced or never married, live in MML states, and to have alcohol abuse/dependence and nicotine dependence, and reported DUI.

Risk perception by marijuana use status

Table 2 shows that compared to 3.1% of never users and 13.0% of former users, 44.2% of past-year users perceived no risk from regular use. On the other hand, compared to 56.8% of never users and 23.6% of former users, only 3.9% of past-year users perceived great risk from regular use. Additional analysis showed that the 3.9% rate of great risk perception among past-year users aged 50+ years was higher than the 2.9% and 3.1% rates of great risk perception among past-year users in the 18–24 and 25–34 age groups, respectively, but it was not significantly higher than the 3.4% rate of past-year users in the 35–49 age group ($p = 0.068$). Table 2 also shows that compared to 10.4% of former marijuana users, 23.3% of past-year users began using on/before age 14.

Table 3 shows that of past-year users, medical users (i.e. those who reported using all or any marijuana recommended by healthcare professionals; 15.6% of past-year users) were significantly less likely than non-medical users to perceive moderate and/or great risk. Further analysis also showed that higher frequency users had lower risk perceptions, though risk perceptions did not differ between those with and without marijuana use disorder. However, larger proportions of high-frequency users with marijuana use disorder (14.4% of the 300+ day users and 23.2% of 100–199 day users) than high-frequency users without the disorder (3.1% of the 300+ day users and 5.9% of 100–199 day users) had moderate/great risk perception ($p < 0.001$).

Of all past-year users, 42.4% used on 100+ days, with medical users having significantly higher odds of having used on 100+ days than non-medical users. Medical and non-medical users did not differ on their marijuana initiation ages or on rates of marijuana use disorder (5.6% for all past-year users). Further analysis also showed that those who reported all their use to be medical (70.7% of any medical users and 11% of past-year users) did not significantly differ from the rest of the users on marijuana initiation ages and rates of marijuana use disorder. In addition, medical and non-medical users did not differ on past-year nicotine dependence. As expected, higher proportions of those with marijuana use disorder than those without used on 300+ days (36.6% vs. 15.7%, $p < 0.001$) and had alcohol abuse/dependence (24.3% vs. 13.3%, $p = 0.016$), were dependent on nicotine (17.4% vs. 12.6%, $p < 0.001$), and reported DUI (48.9% vs. 29.9%, $p = 0.011$).

Correlates of risk perception

The second column of Table 4 shows that compared to never users, former users (AOR = 0.30, 95% CI = 0.27–0.32) and past-year users

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Table 1 Sociodemographic, health, and mental health characteristics of the 50+ age group by marijuana use status (%)

	PERCENTAGE DISTRIBUTION				BIVARIATE LOGISTIC REGRESSION RESULTS		
	NEVER USER $N = 14,214$ (59.44%)	FORMER USER $N = 8,388$ (34.76%)	PAST-YEAR USER $N = 1,455$ (5.80%)	P	FORMER USER VERSUS NEVER USER OR (95% CI)	PAST-YEAR USER VERSUS NEVER USER OR (95% CI)	PAST-YEAR USER VERSUS FORMER USER OR (95% CI)
Age group (yrs)				<0.001			
50–64	44.22	76.43	85.16		Ref.	Ref.	Ref.
65+	55.78	23.57	14.84		0.24 (0.22–0.27)***	0.14 (0.11–0.17)***	0.57 (0.47–0.68)***
Gender				<0.001			
Male	40.85	54.07	62.48		Ref.	Ref.	Ref.
Female	59.15	45.93	37.52		0.59 (0.54–0.63)***	0.41 (0.36–0.48)***	0.71 (0.61–0.81)***
Race/ethnicity				<0.001			
Non-Hispanic White	69.92	80.43	78.61		Ref.	Ref.	Ref.
Non-Hispanic Black	10.48	9.75	11.59		0.81 (0.71–0.91)**	0.98 (0.81–1.19)	1.22 (0.99–1.49)
Hispanic	12.25	6.36	5.52		0.45 (0.39–0.52)***	0.40 (0.29–0.56)***	0.89 (0.62–1.27)
Asian/Pacific Islander	5.98	1.52	1.11		0.22 (0.17–0.29)***	0.16 (0.08–0.34)***	0.75 (0.35–1.60)
Native American/Alaska Native	0.43	0.41	0.50		0.82 (0.55–1.24)	1.02 (0.61–1.71)	1.24 (0.72–2.14)
Multiple race	1.24	1.52	2.67		1.06 (0.77–1.46)	1.92 (1.15–3.20)*	1.80 (1.09–2.97)*
Marital status				<0.001			
Married	62.00	63.32	51.10		Ref.	Ref.	Ref.
Widowed	16.88	5.97	6.33		0.35 (0.31–0.39)***	0.46 (0.34–0.60)***	1.31 (0.98–1.76)
Divorced/separated	14.91	22.17	30.10		1.50 (1.35–1.65)***	2.45 (2.09–2.87)***	1.64 (1.38–1.94)***
Never married	6.21	7.95	12.47		1.25 (1.09–1.44)**	2.44 (1.91–3.10)***	1.94 (1.53–2.47)***
Education				<0.001			
<High school	18.40	7.87	12.22		Ref.	Ref.	Ref.
High school	31.56	26.88	29.88		1.99 (1.73–2.29)***	1.43 (1.16–1.75)**	0.72 (0.58–0.89)**
Some college	22.62	29.55	27.55		3.06 (2.71–3.450***	1.85 (1.51–2.26)***	0.60 (0.49–0.75)***
College degree or higher	27.43	35.70	30.15		3.04 (2.69–3.45)***	1.66 (1.33–2.07)***	0.54 (9.43–0.69)***

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Table 1. Continued

	PERCENTAGE DISTRIBUTION				BIVARIATE LOGISTIC REGRESSION RESULTS		
	NEVER USER $N = 14,214$ (59.44%)	FORMER USER $N = 8,388$ (34.76%)	PAST-YEAR USER $N = 1,455$ (5.80%)	p	FORMER USER VERSUS NEVER USER OR (95% CI)	PAST-YEAR USER VERSUS NEVER USER OR (95% CI)	PAST-YEAR USER VERSUS FORMER USER OR (95% CI)
Income				<0.001			
≤poverty	10.76	7.89	14.80		Ref.	Ref.	Ref.
>poverty to 2x poverty	21.75	13.49	19.40		0.85 (0.73–0.98)*	0.65 (0.52–0.81)***	0.77 (0.60–0.97)***
>2x poverty	67.49	78.63	65.80		1.59 (1.41–1.79)***	0.71 (0.59–0.85)***	0.45 (0.37–0.54)***
Military service	15.95	17.14	17.10	0.468	1.09 (1.00–1.19)	1.09 (0.91–1.29)	1.00 (0.83–1.20)
Vietnam veteran	5.99	8.14	7.31	<0.001	1.39 (1.22–1.59)***	1.24 (0.98–1.55)	0.89 (0.71–1.11)
Resident of state with medical marijuana law	37.23	43.93	51.25		1.32 (1.21–1.43)***	1.77 (1.52–2.06)***	1.34 (1.16–1.56)***
Past-year substance use/use disorder							
Marijuana use disorder			5.61	n/a			
Alcohol use disorder	1.36	5.66	13.92	<0.001	4.35 (3.56–5.31)***	11.72 (8.66–15.86)***	2.69 (2.14–3.39)***
Nicotine dependence	5.37	13.24	28.21	<0.001	2.69 (2.40–3.020***	6.93 (5.79–8.29)***	2.57 (2.18–3.03)***
Self-rated health status				<0.001			
Excellent/very good	47.03	54.90	43.65		Ref.	Ref.	Ref.
Good	31.44	28.89	31.14		0.79 (0.72–0.86)***	1.06 (0.89–1.26)	1.35 (1.13–1.61)**
Fair/poor	21.52	16.21	24.91		0.65 (0.59–0.71)***	1.24 (1.01–1.52)*	1.92 (1.54–2.30)***
Major depressive episode							
Past-year	3.27	7.61	8.42	<0.001	2.44 (2.10–2.82)***	2.71 (2.09–3.53)***	1.12 (0.86–1.45)
Lifetime	6.83	16.47	18.06	<0.001	2.70 (2.40–3.02)***	3.01 (2.47–3.66)***	1.12 (0.92–1.35)
Past-year driving under the influence of alcohol or drugs	2.61	12.39	30.93	<0.001	5.28 (4.46–6.25)***	16.70 (13.72–20.33)***	3.17 (2.68–3.75)***

Note: Probability values for percentage differences in percentage distributions among never users, former users, and past-year users were calculated using design-based F tests (i.e. a corrected, weighted χ^2).
***p < 0.001; **p < 0.01; *p < 0.05.

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Table 2. Marijuana use risk perceptions among the 50+ age group by marijuana use status

	PERCENTAGE DISTRIBUTION				BIVARIATE LOGISTIC REGRESSION RESULTS		
	NEVER USER $N = 14{,}214$ (59.44%)	FORMER USER $N = 8{,}388$ (34.76%)	PAST-YEAR USER $N = 1{,}455$ (5.80%)	P	FORMER USER VERSUS NEVER USER OR (95% CI)	PAST-YEAR USER VERSUS NEVER USER OR (95% CI)	PAST-YEAR USER VERSUS FORMER USER OR (95% CI)
Occasional use (once a month)				<0.001			
No risk	4.51	19.59	52.64		Ref.	Ref.	Ref.
Slight risk	17.03	36.14	34.42		0.49 (0.43–0.56)***	0.17 (0.15–0.20)***	0.35 (0.30–0.42)***
Moderate risk	26.53	26.64	8.75		0.23 (0.20–0.17)***	0.03 (0.02–0.04)***	0.12 (0.09–0.16)***
Great risk	48.23	16.37	3.47		0.08 (0.07–0.09)***	0.01 (0.00–0.01)***	0.08 (0.06–0.11)***
Don't know/refused	3.70	1.26	0.72		0.08 (0.06–0.10)***	0.02 (0.01–0.04)***	0.21 (0.08–0.57)**
Regular use (1–2 times per week)				<0.001			
No risk	3.07	13.03	44.17		Ref.	Ref.	Ref.
Slight risk	12.18	30.98	40.82		0.59 (0.50–0.71)***	0.23 (0.19–0.28)***	0.39 (0.33–0.47)***
Moderate risk	24.32	30.84	10.07		0.30 (0.26–0.34)***	0.03 (0.02–0.04)***	0.10 (0.08–0.12)***
Great risk	56.78	23.63	3.85		0.10 (0.08–0.11)***	0.00 (0.00–0.01)***	0.05 (0.03–0.07)***
Don't know/refused	3.65	1.41	1.09		0.09 (0.07–0.11)***	0.02 (0.01–0.05)***	0.23 (0.11–0.50)***
First age of marijuana use (former users and past-year users)				<0.001			
≤14 years		10.42	23.34				Ref.
15–17 years		29.68	36.45				0.55 (0.45–0.67)***
≥18 years		59.91	40.21				0.30 (0.25–0.36)***

Note: Probability values for differences in percentage distributions among never users, former users, and past-year users were calculated using design-based F tests (i.e. a corrected, weighted χ^2).
***p < 0.001; **p < 0.01; *p < 0.05.

Table 3. Marijuana use risk perceptions and use patterns of past-year marijuana users aged 50+

	PERCENTAGE DISTRIBUTION			BIVARIATE LOGISTIC REGRESSION RESULTS
	NON-MEDICAL USE N = 1,238 (84.44%)	ANY MEDICAL USE N = 217 (15.56%)	P	ANY MEDICAL USE VERSUS NON-MEDICAL USE OR (95% CI)
Occasional use (once a month)			0.002	
No risk	51.14	60.77		Ref.
Slight risk	34.86	32.0		0.77 (0.47–1.28)
Moderate risk	9.89	2.56		0.22(0.08–0.58)**
Great risk	3.76	1.89		0.42 (0.14–1.27)
Don't know/refused	0.34	2.77		6.79 (1.03–44.76)*
Regular use (1–2 times per week)			0.007	
No risk	42.41	53.70		Ref.
Slight risk	41.02	39.72		0.76 (0.47–1.24)
Moderate risk	11.48	2.41		0.17 (0.07–0.42)***
Great risk	4.24	1.70		0.32 (0.10–0.99)*
Don't know/refused	0.84	2.46		2.33 (0.42–12.90)
First age of marijuana use			0.405	
≤14 years	23.00	25.22		Ref.
15–17 years	37.46	30.97		0.75 (0.47–1.21)
≥18 years	39.55	43.81		1.01 (0.60–1.71)
Past-year marijuana use frequency			<0.001	
1–11 days	29.64	13.99		Ref.
12–49 days	20.06	12.68		1.34 (0.65–2.75)
50–99 days	12.32	7.00		1.20 (0.62–2.36)
100–299 days	24.24	32.76		2.86 (1.77–4.64)***
300+ days	13.74	33.56		5.17 (3.24–8.26)***
Past-year marijuana use disorder	5.31	7.22	0.232	1.39 (0.80–2.41)

Note: Probability values for differences between medical and non-medical users were calculated using design-based F-tests (i.e. a corrected, weighted χ^2).
***p < 0.001; **p < 0.01; *p < 0.05.

(AOR = 0.05, 95% CI = 0.04–0.06) had significantly lower odds of moderate/great risk perception (as opposed to no/slight risk perception). Of significant covariates, the 65+ age group, women, Hispanics, and Asians had higher odds of moderate/great risk perception, while divorced/never married individuals and those with a college degree, income >2 times poverty, good or fair/poor self-rated health, residence in MML states, past-year nicotine dependence, and past year DUI had lower odds of moderate/great risk perception.

The third column of Table 4 shows that among past-year users, higher marijuana use frequency (AOR = 0.14, 95% CI = 0.07–0.28 for 300+ days of use compared to 1–11 days of use) and any medical marijuana use (AOR = 0.27, 95% CI = 0.14–0.51) were associated with lower odds of moderate/great risk perception, while past-year marijuana use disorder (AOR = 3.50, 95% CI = 1.62–7.58) and alcohol use disorder (AOR = 1.82, 95% CI = 1.03–3.23) were associated with higher odds. Marijuana initiation age was not a significant factor in risk perception. Sociodemographic characteristics and other covariate were not significant.

Discussion

Given increasing numbers of older-adult marijuana users, this study examined whether US older adults' marijuana risk perceptions are associated with their marijuana use status, use patterns, and related problems. Multiple data sources have shown that risk perceptions are higher among older than younger adults in the general population and lower among marijuana users than non-users. Our findings confirmed that marijuana use, either prior to past year or in the past year, and more frequent use among users were associated with lower odds of moderate/great risk perception among the 50+ age group. However, of past-year users aged 50+ years, those with marijuana use disorder were three times more likely than those without the disorder to perceive moderate/great risk. These findings mostly support study hypotheses.

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Table 4. Correlates of marijuana risk perception of the 50+ age group

	ALL	PAST-YEAR USERS
	MODERATE/GREAT RISK VERSUS NO/SLIGHT RISK AOR (95% CI)	MODERATE/GREAT RISK VERSUS NO/SLIGHT RISK AOR (95% CI)
Marijuana use status		
(Never user)		
Used more than 12 months ago	0.30 (0.27–0.32)***	
Past-year user	0.05 (0.04–0.06)***	
Age of first marijuana use		
(≥14 years old)		
15–17 years old		0.75 (0.45–1.26)
18+ years old		0.82 (0.50–1.34)
Past-year marijuana use frequency		
(1–11 days)		
12–49 days		0.51 (0.29–0.90)*
50–99 days		0.36 (0.18–0.74)**
100–299 days		0.18 (0.10–0.31)***
300–365 days		0.14 (0.07–0.28)***
Past-year medical marijuana use		0.27 (0.14–0.51)***
Past-year marijuana use disorder		3.50 (1.62–7.58)**
Past-year alcohol use disorder	0.88 (0.69–1.12)	1.82 (1.03–3.23)*
Past-year nicotine use disorder	0.71 (0.62–0.82)***	0.67 (0.41–1.09)
65+ years	1.19 (1.07–1.32)**	0.60 (0.30–1.20)
Female	1.37 (1.27–1.48)***	1.24 (0.76–2.04)
Race/ethnicity		
(Non-Hispanic White)		
Non-Hispanic Black	1.08 (0.97–1.22)	1.75 (0.98–3.12)
Hispanic	1.49 (1.25–1.79)***	1.60 (0.68–3.77)
Asian/Pacific Islander	2.04 (1.56–2.67)***	
Native American/Alaska Native	1.26 (0.81–1.95)	
Multiple race	1.09 (0.82–1.45)	
Other than non-Hispanic White and Black, and Hispanic[a]		1.23 (0.56–2.73)
Marital status		
(Married)		
Widowed	0.95 (0.82–1.11)	2.14 (0.94–4.89)
Divorced/separated	0.74 (0.67–0.82)***	0.98 (0.57–1.66)
Never married	0.72 (0.61–0.84)***	1.06 (0.53–2.10)
College degree or higher	0.86 (0.79–0.95)**	0.81 (0.49–1.33)
Income >2x poverty	0.88 (0.79–0.98)*	0.79 (0.50–1.26)
Resident of state with medical marijuana law	0.80 (0.72–0.88)***	0.98 (0.62–1.53)
Self-rated health		
(Excellent/very good)		
Good	0.90 (0.82–0.98)*	1.30 (0.85–1.98)
Fair/poor	0.86 (0.77–0.96)**	1.53 (0.87–2.70)
Past-year major depressive episode	0.88 (0.73–1.04)	0.56 (0.29–1.08)
Past-year driving under the influence of alcohol and/or drugs	0.67 (0.57–0.80)***	0.65 (0.38–1.09)
N	23,435 F (21, 90) = 72.91, design df = 110, p < 0.001	1,445 F (25, 86) = 4.86, design df = 110, p < 0.001

[a]Because the number of Asian/Pacific Islanders, Native American/Alaska Natives, and people of multiple races were too small to calculate odds separately, we combined these groups.
***p < 0.001; **p < 0.01; *p < 0.05.

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Lower risk perceptions among older-adult marijuana users than non-users may stem from the following: (1) Older users tend to be long-term users, and their low risk perception may result from their experience as such. (2) Long-term users may have learned how to use harm reduction strategies such as moderating use to minimize harms (Lau *et al.*, 2015). (3) Older frequent users may consciously or unconsciously minimize negative effects to rationalize their frequent use. Although support for legalizing marijuana use is up to 60% among all US adults, the rate among the 55+ age group is 45% (Swift, 2016). Older users may still be sensitive to negative reactions to their use from their non-using peers and other non-users and may remain cautious about disclosing their use to them (Lau *et al.*, 2015). At the same time, the baby boom generation's greater exposure to and more liberal attitudes toward psychoactive drugs than prior generations likely accounts for their overall low risk perception (Black and Joseph, 2014).

Perhaps the most important study finding is that users with past-year marijuana use disorder were 3.5 times more likely than users without the disorder to perceive high risk from marijuana use. Although more frequent users had lower risk perception, a larger proportion of frequent users with marijuana disorder than frequent users without the disorder had higher risk perception. Those with marijuana use disorder may be cognizant of marijuana's negative effects on their life. Given their higher rates of alcohol and nicotine use disorders and DUI, those with marijuana use disorder may also perceive the negative effects of polysubstance use, including more harmful substances (Wilkinson *et al.*, 2016).

Though the proportion of older marijuana users with marijuana use disorder was small, their personal experience may have converged with the current state of knowledge that marijuana's deleterious effects generally outweigh beneficial effects in all age groups (National Academies of Sciences, Engineering, and Medicine, 2017). Marijuana may be safer than alcohol and other drugs (Nutt *et al.*, 2010), and low-dose medical marijuana has been found effective in easing refractory neuropathic pain in conjunction with traditional analgesics, although trials are limited by short duration, variability in tetrahydrocannabinol dosing and strength, and lack of functional outcome measures (Deshpande *et al.*, 2015). A systematic review of the efficacy and safety of medical cannabinoids in older adults also found limited efficacy (van den Elsen *et al.*, 2014).

The lower odds of high risk perception among residents of MML states and medical marijuana users were expected. However, the findings indicate that a substantial proportion of medical marijuana users in the 50+ age group are long-term marijuana users who initiated use at a young age and used for non-medical purposes before using for medical purposes. Medical marijuana users also used marijuana far more frequently than those who use it for recreational purposes only. Researchers should examine the extent to which these medical users also use prescribed medications and whether their non-prescription substance use interferes with the effects of prescribed medications.

The study also shows that those with a college degree (likely a reflection of their younger ages) and higher income are less likely to have high risk perceptions, while Hispanics and Asians are more likely than non-Hispanic whites to have high risk perceptions. These findings align with US public opinion polls regarding marijuana legalization where support is higher among those with higher education and non-Hispanic Whites (Geiger, 2016). Taken together, this study's findings and public opinion polls suggest that lower risk perception is likely associated with legalization support or vice versa.

The study has some limitations due to NSDUH data constraints. First, the measure of risk perception included "*physically and in other ways.*" Physical health, mental/cognitive health, social/interpersonal, and other effects may be perceived differently. Because marijuana remains a Schedule 1 controlled substance in US federal law, legal problems/risks from using marijuana (e.g. loss of social standing or a professional practice license) are also important considerations that may have affected respondents' risk perceptions regardless of their views about physical or mental health effects. Separating effects in different domains could aid in more accurate analysis. Second, the reliability and validity of respondents' self-report of medical marijuana use and DUI may have been affected by social desirability bias. Third, despite pooling three years of data, the small proportion of older adults with marijuana use disorder hampered more in-depth analysis (e.g. determining interactions between the disorder and physical and mental health). Also, the 5.6% marijuana use disorder rate among the 50+ age group is substantially lower than the 17.5% rate among the same age group reflected in 2012/2013 National Epidemiologic Study on Alcohol and Related Problems (NESARC) (Choi *et al.*, 2016a). The discrepancy between NSDUH and NESARC in marijuana use disorder prevalence may be due to different diagnostic instruments used in the two surveys (Hasin *et al.*, 2015).

The findings have the following implications for research and clinical practice. First, while very

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low risk perceptions among older marijuana users appear to be based largely on personal experiences, research evidence on marijuana's benefits is slim at best. To better educate the public about marijuana's benefits versus harms, more scientific evidence is needed. Second, longitudinal research on marijuana use risk perception formation among older adults is also needed. Third, older adults with marijuana use disorder need appropriate treatment, preferably interventions designed especially for older adults. Fourth, healthcare providers should be careful about recommending medical marijuana for older adults, especially those with long-term problematic use patterns and marijuana use disorder or who are at risk for developing such problems.

Conflict of interest

None.

Author contributions

All three authors conceptualized the study. NGC conducted statistical analysis and drafted the paper; CNM provided statistical consultation; and DMD reviewed and edited it.

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