Journal of Psychiatric Research 166 (2023) 178–185

Contents lists available at ScienceDirect

Journal of Psychiatric Research

journal homepage: www.elsevier.com/locate/jpsychires

Influence of intrinsic and extrinsic religiosity on youth cannabis use: A structural equation modelling analysis on national survey on drug use and health (NSDUH) 2015–2019

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ARTICLE INFO

Keywords:
Cannabis abuse
Adolescence
Religion
Structural equation modelling

ABSTRACT

Religiosity may reduce the risk of substance use in adults and young people. However, religiosity is a complex construct, variously defined and assessed. We explored the role of different religious components: intrinsic (subjective), extrinsic-personal (service attendance) and extrinsic-social (church-based social activities) in deterring cannabis use among adolescents. Combining several years (2015–2019) of NSDUH data on 68,263 adolescents between 12 and 17 years, a structural equation modelling (SEM) approach was used to evaluate pathways from intrinsic and extrinsic components of religiosity to cannabis use. We analyzed the role of several covariates, including comorbid depression and secular volunteering activities. About 15% of participants said they had used cannabis at some level in the previous year. Some degree of intrinsic and of extrinsic-personal religiosity was reported by 66% and 25% of the sample. 57% were committed to at least one faith-based activity, while 74% reported participation in non-faith-based community activities. The SEM regression model -controlling for putative confounders- showed that both intrinsic and extrinsic-personal religious components reduced the likelihood of cannabis use (Cannabis use coeff.: −0.065, $p = 0.001$; coeff.: −0.176, $p < 0.001$, respectively). However, the extrinsic-social component had no effect on refraining from cannabis use, despite involvement in non-faith based volunteering activities was protectively associated. Support for secular volunteering programs may be a cost-effective mechanism for reducing cannabis use. Moreover, whilst promoting religiosity is beyond the scope of any preventive programs, religious practices should be considered relevant protective factors, deserving consideration and support in terms of public health.

1. Introduction

The World Drug Report 2021 (UNODC - United Nations Office on Drugs and Crime, 2021) has emphasized how the COVID-19 pandemic ramped up drug risks, in particular for young people, who often underestimate the consequences, particularly of cannabis, despite roughly a third of them report current use (UNODC - United Nations Office on Drugs and Crime, 2021; Hoots et al., 2023). This is causing substantial disease burden (Farhoudian et al., 2021) in relation to both physical and mental health harms (Schulte and Hser, 2014; Carrà et al., 2016). However, research has made clear that there are a number of different mental health morbidity trajectories which may lead to cannabis use. In particular, several, diverse risk and protective factors play a key role in determining these trajectories. This makes their identification crucial to informing prevention and treatment strategies (e.g., Solmi et al., 2021).

Among other putative features, a large body of evidence has shown that religiosity and spirituality reduce the risk of substance use and addiction in adults (e.g., Kendler et al., 2003; Geppert et al., 2007; Bonelli and Koenig, 2013; Galanter et al., 2021) and in young people (Yeung et al., 2009; Vaughan et al., 2011; Lee and Neblett, 2019; Saunders et al., 2021). Religiosity is meaningful and common to most people including adolescents from many western countries (de Bruin-Wassinkmaat et al., 2019). However, it is a complex, latent, construct, difficult to observe and assess, and it often has to be inferred from proxy characteristics (Miller and Thoresen, 2003). For example, research has crucially distinguished subjective religiosity, i.e.,

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https://doi.org/10.1016/j.jpsychires.2023.09.016
Received 7 March 2023; Received in revised form 11 July 2023; Accepted 15 September 2023
Available online 22 September 2023

individual religious experience (sometimes used interchangeably with the term "spirituality"), from extrinsic, regulated participation, in particular in terms of religious service attendance (Levin et al., 1995; Koenig, 2012). Thus, the multidimensional nature of religiosity renders complex a proper understanding of the mechanisms linking the various religious domains with the reduced risk of substance use. Indeed, in addition to the basic distinction between intrinsic (subjective) and extrinsic (institutionalized) religious involvement (Allport and Ross, 1967), also the extrinsic religious orientation can appropriately be subdivided into two subtypes, which probably persist across cultures (Brewczynski and MacDonald, 2006). The first (the *extrinsic-personal* subtype) comprises endeavours variously aimed at expanding personal relief or peace, through individual ritual prayers and religious service attendance (Kirkpatrick, 1989). The second, *extrinsic-social,* subtype, reflects a more sociocentric religious motivation (e.g., the development of meaningful social activities consistent with religion-based altruistic, values and principles). In particular, the motivation based on the extrinsic-social religious component involves the need to provide and receive reciprocal social support and the use of religion as a means toward social gain (Gorsuch, 1994). Unlike subjective religiosity, it seems reasonable that both these subtypes, even though to a different extent, may be appropriately considered in terms of preventive strategies also for youth substance use. Nonetheless there is the need to distinguish these components from prosocial behaviors like volunteering services to the community, which also may act as protective factors against cannabis and alcohol use, independent of any personal religious involvement (Carlo et al., 2011).

In sum, the religious domains involved appear extremely heterogeneous and possibly overlapping with some prosocial attitudes. This makes clear the need to identify the religious components with a protective role against substance and, in particular, cannabis use in young people, which may have a modifiable nature, relevant for preventive strategies (Davis et al., 2017).

Nonetheless, while a large body of literature reporting on religiosity and cannabis use has already accounted for individual-level sociodemographic (e.g., age, gender and socio-economic status) and clinical characteristics associated with cannabis use (Carrà et al., 2018, 2019), it has rarely considered alternative domains such as the different components of religiosity (Bonelli and Koenig, 2013; Livne et al., 2021). In addition, previous research has not considered so far the key role that mental (particularly depressive) disorders may play in the relationship between religiosity and cannabis abuse. Indeed, even though high levels of subjective religiosity are likely to reduce the risk of depression, this may not be true for moderate religiosity, particularly in the transition to adulthood (Braam and Koenig, 2019). Nevertheless, an association between cannabis use and the occurrence of depression has been extensively demonstrated in young people (e.g., Carrà et al., 2019). Thus, depressive disorders must be carefully and simultaneously considered when assessing the relationship between religiosity and cannabis use.

Finally, problematic cannabis use in adolescents widely varies in terms of frequency, dose, age of initiation, and psychosocial correlates, with a wide range of severity and consequences (Carrà et al., 2018). Despite potential risk and protective factors may well vary in relation to different intensity of cannabis use among young people, this has rarely been examined so far (e.g., Coffey and Patton, 2016; Dugas et al., 2019; Hammond et al., 2020).

In the light of these gaps in the literature, the current study was thus designed to explore the association between different, intrinsic and extrinsic, religious domains, and different levels, in terms of frequency, of cannabis use, while considering the role of several key confounders, i.e., non-religious, prosocial, attitudes, and concurrent depressive disorders.

We hypothesized that rates of past year cannabis use would be lower in young people reporting significant levels of religiosity. In addition, a data-driven approach was adopted in order to explore the relative role of different (i.e., intrinsic, extrinsic-personal and extrinsic-social) religious components. We combined multiple years of National Survey on Drug Use and Health (NSDUH) data, thereby allowing measurement of both religious domains and levels of cannabis use with a sample size large enough to establish estimates for both cannabis users and nonusers, while controlling for the influence of several key socio-demographic and clinical factors.

2. Material and methods

2.1. Sample and procedures

The current study is based on secondary analyses of publicly available data from the US NSDUH, collected from 2015 to 2019 and provided by the Substance Abuse and Mental Health Services Administration (CBHSQ, 2020a; SAMHSA - Substance Abuse and Mental Health Services Administration, 2022). The survey uses a state-based design, with an independent, multistage area probability sample of the civilian, noninstitutionalized US population, aged 12 years or older. The current study focusses on participants aged between 12 and 17 years, yielding a sample of 68,263 adolescents. They were interviewed in private at their place of residence using a computer-assisted interviewing methodology to increase the likelihood of valid respondent reports. A detailed description of relevant procedures is available elsewhere (CBHSQ, 2020b).

2.2. Measures

NSDUH records comprehensive socio-demographic information (e.g., sex, age, poverty status based on family income relative to the U.S. Census Bureau poverty thresholds) as well as a wide range of data about substance use. In our study we focussed on *cannabis use* as past-year use. Participants are also asked to report about the frequency (number of days) of past-year cannabis use, allowing subjects to be categorized into *occasional* (less than once a week), *weekly*, and *heavy* (between 5 and 7 days per week) cannabis use.

We distinguished religiosity into *intrinsic* (subjective) and *extrinsic* (institutionalized) domains. The intrinsic component was a latent variable based on three items on a 4-point Likert scale (ranging from strongly disagree to strongly agree) measuring aspects of religious beliefs. These were: i) importance "*My religious beliefs are very important*"; ii) decisions "*My religious beliefs influence my decisions*"; and iii) friendship "*It is important that my friends share my religious beliefs*". Thus, intrinsic religiosity was expressed as a combination of the mentioned items (i.e., a function of manifest variables) to capture uncertainty related to the hypothetical construct underlying observed indicators (Skrondal and Rabe-Hesketh, 2008; Galanter, 2010).

We explored the extrinsic component embodying both personal and social levels of religiosity through two distinct observed variables. These were i) church attendance in the past 12 months (i.e., *extrinsic-personal*), excluding special occasions such as weddings, funerals, and assuming at least twice per month as indicative of steady attendance of religious services; and ii) being involved in at least one church or faith-based activity (e.g., clubs, youth groups, Saturday or Sunday school, prayer groups, youth trips, service or volunteer activities) in the past 12 months (i.e., *extrinsic social*, consistent with religious-based, altruistic values and principles). The survey also provides information on community-based activities beyond the religious setting. We thus examined the potential confounding role of participation in at least one community-based activity (including volunteering activities involving sport, clubs, or groups activities) during the past 12 months.

The NSDUH interview also includes the assessment of major depressive episode (MDE), using specific questions for young people

adapted from the depression section of the National Comorbidity Survey—Adolescent (Harvard Medical School, 2005; Carrà et al., 2019). Adolescents were thereby classified as having lifetime MDE if they reported experiencing at least 5 out of the 9 relevant DSM-5 items (CBHSQ, 2020b).

2.3. Statistical analysis

We analyzed the 2015–2019 NSDUH pooled data with Stata (release 17; StataCorp, 2021) and Mplus (version 8; Muthén and Muthén, 2017) for descriptive and structural equation modeling (SEM) analyses, respectively. Complex survey design and sample weights were taken into account using the svy package in Stata and type complex and relevant options in Mplus.

Descriptive analyses summarized the individual characteristics of participants, providing standard statistics for continuous and categorical variables. Considering weighted data, a SEM approach based on the missing-at-random assumption was then chosen to test simultaneously the hypothesized pathways from the intrinsic and extrinsic components of the religiosity construct to the frequency of cannabis use, by using a maximum likelihood with robust standard errors (MLR) estimator. This approach allowed us to obtain robust estimates dealing with missing data. The measurement model was based on previous evidence providing an appropriate model fit in terms of standard goodness-of-fit-indices (Vaughan et al., 2011).

In the corresponding structural model, the frequency of past year cannabis use (y) was characterized by semi-continuous data with several observation units at one point because of significant clustering of non-users. It was therefore modelled as a censored inflated outcome, with a mixture of 0's and continuously distributed positive values. We used different regression equations modelling data for (past year) non-users and users (i.e., individuals above the censoring point). The regression analyses used therefore simultaneously encompassed i) a censored-normal (Tobit) model, *Cannabis use*, yielding a non-linear conditional expectation function for individuals above the censoring point (i.e., young people disclosing occasional, weekly, and heavy past year use), and ii) a logistic model, *No cannabis use*, for the probability of being in the class of individuals for whom $y = 0$ (i.e., no past year cannabis use) (Muthén et al., 2017).

We ran a preliminary model that included the paths leading to cannabis use from the variables supporting both the *intrinsic* (i.e., importance and related impact of religious beliefs) and the *extrinsic-personal* and *extrinsic-social* (i.e., attendance to religious services and involvement in at least one faith-based activity) components of religiosity. We then used a stepwise approach to assess all these relationships, taking into account the joint contribution of relevant covariates such as sex, a lifetime history of MDE, involvement in other, non-faith-based, community activities, and socio-economic standing. Statistical significance was set at $p < 0.05$.

Table 1
Sample characteristics by frequency of past year cannabis use*.

Characteristics	Total n = 68,263	No past year use n = 58,975 (86)	Occasional n = 5010 (7)	Weekly n = 2266 (3)	Heavy n = 1148 (2)
Sex					
Women	33,375 (49)	28,696 (49)	2703 (54)	1061 (47)	495 (43)
Age, *yrs.*					
12-13	21,850 (32)	21,338 (36)	273 (5)	90 (4)	20 (2)
14-15	23,307 (34)	20,448 (35)	1654 (33)	613 (27)	252 (22)
16-17	23,106 (34)	17,189 (29)	3083 (62)	1563 (69)	876 (76)
Poverty[a]					
Living in poverty	14,683 (22)	12,656 (21)	953 (19)	549 (24)	256 (22)
Income up to 2×	15,352 (22)	13,180 (22)	1085 (22)	537 (24)	330 (29)
Income > 2×	38,228 (56)	33,139 (56)	2972 (59)	1180 (52)	562 (49)
Intrinsic Religiosity					
Importance					
Strongly disagree	10,100 (15)	7805 (13)	1189 (24)	595 (26)	345 (30)
Disagree	10,465 (15)	8354 (14)	1125 (22)	544 (24)	288 (25)
Agree	25,342 (37)	22,253 (38)	1744 (35)	739 (33)	313 (27)
Strongly agree	20,076 (29)	18,560 (31)	862 (17)	313 (14)	155 (14)
Decisions					
Strongly disagree	11,454 (17)	8872 (15)	1351 (27)	671 (30)	383 (33)
Disagree	14,115 (21)	11,456 (19)	1448 (29)	662 (29)	353 (31)
Agree	24,507 (36)	21,679 (37)	1584 (32)	674 (30)	268 (23)
Strongly agree	15,866 (23)	14,895 (25)	547 (11)	195 (9)	99 (9)
Friends					
Strongly disagree	21,676 (32)	17,581 (30)	2256 (45)	1018 (45)	547 (48)
Disagree	25,001 (37)	21,664 (37)	1832 (37)	806 (36)	391 (34)
Agree	13,457 (20)	12,266 (21)	634 (13)	279 (12)	121 (11)
Strongly agree	5397 (8)	5001 (8)	205 (4)	92 (4)	46 (4)
Extrinsic Religiosity					
Involvement in faith-based activities					
Yes	39,196 (57)	34,752 (59)	2550 (51)	986 (44)	474 (41)
Religious services attendance					
> twice/month	16,927 (25)	15,529 (26)	915 (18)	272 (12)	94 (8)
Community-based activities					
Yes	50,786 (74)	44,202 (75)	3762 (75)	1534 (68)	709 (62)
Lifetime MDE					
Yes	13,017 (19)	9875 (17)	1798 (36)	741 (33)	390 (34)

Values in parentheses are percentages except as otherwise indicated.
*Unweighted data for NSDUH survey pooled years 2015–2019. MDE: Major Depressive Episode. Occasional: less than once a week; Weekly: once a week; Heavy: between 5 and 7 days per week.
<5% Missing values were detected (e.g., religiosity missing items: 3% of the sample).
[a] Family income relative to the U.S. Census Bureau poverty threshold (i.e., Living in poverty; Income up to 2× Federal Poverty Threshold; Income > 2× Federal Poverty Threshold).

3. Results

3.1. Sample characteristics

The sample comprised 68,263 adolescents (49% female) aged between 12 and 17 years old (12–13: 32%; 14–15: 34%; 16–17: 34%); 22% of the sample lived in poverty according to the US Census Bureau poverty threshold. Descriptive statistics about past year cannabis use, intrinsic and extrinsic religiosity, along with demographic and clinical information for unweighted data from the pooled 2015–2019 NSDUH survey years, are shown in Table 1.

The majority of participants (86%) reported no past year cannabis use, whilst others acknowledged occasional (7%), weekly (3%), and heavy (2%) cannabis use. In addition, a limited number of responders (1%) did not specify whether they used cannabis within the last 12 months or (0.5%) did not disclose frequency of use. About 31% of young people who reported past year cannabis use disclosed first use before 14 years of age.

High levels of intrinsic religiosity were reported by most of the sample, in relation to importance (66%) and influence on decisions (59%) of religious beliefs, while only 28% of participants said it was important that friends shared their religious beliefs.

Regular (twice a month or more in the past year) attendance at religious services was disclosed by 25% of participants, while 57% were committed to at least one church-based activity. However, a substantial number of adolescents (74%) reported participation in other, not faith-based, community activities. Frequency of religious service attendance, involvement in faith-based activities, and importance of religious and spiritual beliefs all varied in relation to past year cannabis use (Table 1). Finally, 19% of the sample suffered from a lifetime MDE, most frequently reported by those who had used cannabis use at any level in the previous year ($p < 0.001$).

3.2. Structural equation modelling

A cross-sectional, unadjusted SEM regression model was run to incorporate both intrinsic and extrinsic religiosity components as correlates of past year cannabis use. This showed that both personal religious beliefs and service attendance were associated with lower frequency of cannabis use (coeff.: −0.055, $p = 0.003$; coeff.: −0.195, $p < 0.001$, respectively). There were no statistically significant effects of participation in extrinsic-social (i.e., church or faith-based) activities on cannabis use. More specifically, young people who acknowledged high levels of religiosity, whether intrinsic, or extrinsic-personal in terms of service attendance, were less likely to report past year cannabis use (coeff.: 0.602, $p < 0.001$; coeff: 0.217, $p < 0.001$, respectively).

The final model taking into account the joint contribution of relevant covariates (i.e., community-based activities, lifetime MDE, sex, and poverty status) yielded similar results (Fig. 1). Table 2 shows the different unstandardized coefficients for all paths included in the model, controlling for putative confounders. Similarly protective roles from both intrinsic and extrinsic-personal religious components emerged. However, despite the protective effect of non-religious community activities in relation to past year cannabis use, no such effect was detected for faith-based extrinsic-social activities.

4. Discussion

We analyzed data from large repeated surveys that provided nationally representative estimates on the use of cannabis and different sorts of religious attributes in adolescents aged between 12 and 17 years. Building on previous work, we also controlled for the influence of major depression as a risk factor for substance use (Ford and Hill, 2012). Past-year cannabis use at various levels was endorsed by about 15% of participants. In addition, around two thirds reported elements of intrinsic religiosity, though the religiosity of friends was deemed

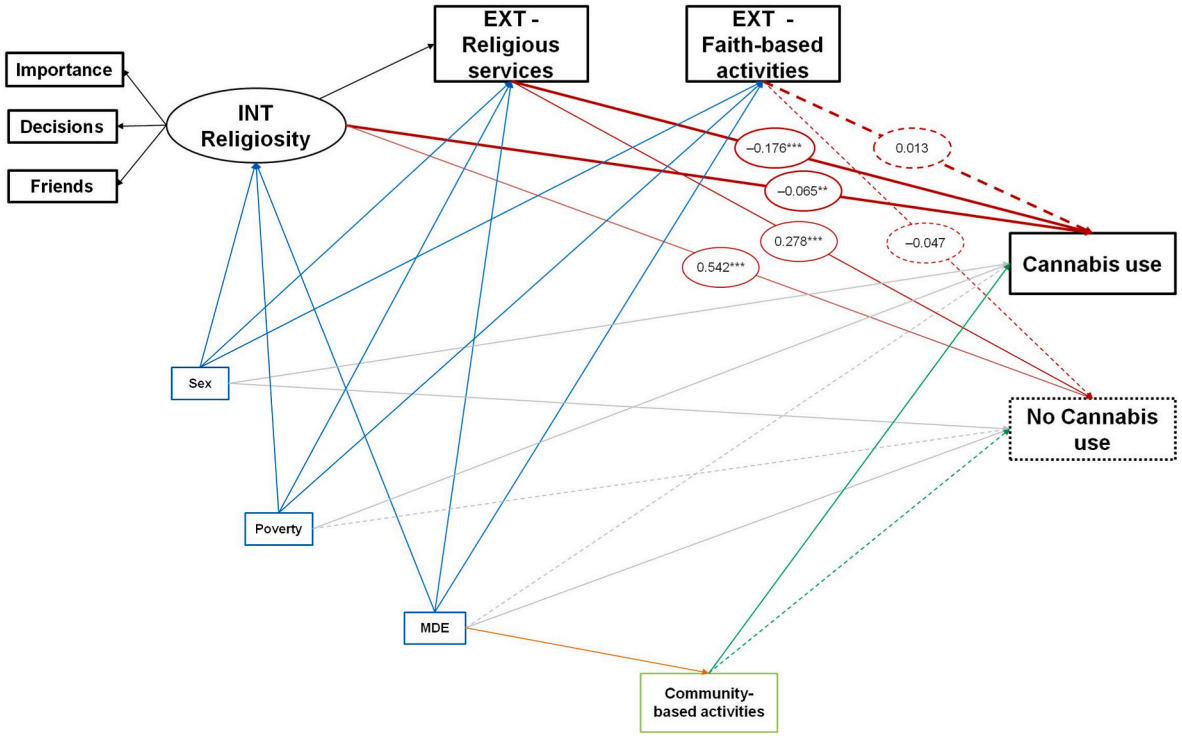

Fig. 1. Association between intrinsic and extrinsic religiosity and frequency of past year cannabis use as a censored inflated outcome (occasional, weekly, heavy vs. no past year use) *. *Unstandardized coefficients. INT: Intrinsic; EXT: Extrinsic Religiosity. Dashed lines indicate non-significant paths. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. Red and purple lines indicate primary paths between religiosity (i.e., intrinsic and extrinsic components) and cannabis use. Blue and gray lines indicate paths between covariates and both religiosity and cannabis use, respectively. Green lines indicate paths between community-based activities and cannabis use. Orange lines depict additional relevant paths.

Table 2
Unstandardized coefficients of SEM models testing the association between cannabis use and religiosity components.

Structural Equation Modelling (SEM) Paths			Model 1		Model 2		Model 3		Model 4		Model 5	
			Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Measurement model												
INT Religiosity	←	Importance	1.000	–	1.000	–	1.000	–	1.000	–	1.000	–
	←	Decisions	1.083	<0.001	1.083	<0.001	1.080	<0.001	1.079	<0.001	1.079	<0.001
	←	Friends	0.686	<0.001	0.686	<0.001	0.686	<0.001	0.685	<0.001	0.686	<0.001
Associations between religiosity components and frequency of Cannabis use												
Cannabis use	←	INT Religiosity	**−0.055**	**0.003**	**−0.060**	**0.001**	**−0.061**	**0.001**	**−0.058**	**0.002**	**−0.065**	**0.001**
	←	EXT Religiosity: Service Attendance	**−0.195**	**<0.001**	**−0.188**	**<0.001**	**−0.186**	**<0.001**	**−0.185**	**<0.001**	**−0.176**	**<0.001**
	←	EXT Religiosity: Faith-based activities	−0.046	0.071	0.010	0.703	0.013	0.630	0.016	0.572	0.013	0.643
No Cannabis use	←	INT Religiosity	**0.602**	**<0.001**	**0.604**	**<0.001**	**0.546**	**<0.001**	**0.543**	**<0.001**	**0.542**	**<0.001**
	←	EXT Religiosity: Service Attendance	**0.217**	**<0.001**	**0.215**	**<0.001**	**0.275**	**<0.001**	**0.275**	**<0.001**	**0.278**	**<0.001**
	←	EXT Religiosity: Faith-based activities	0.002	0.950	−0.013	0.718	−0.042	0.255	−0.046	0.221	−0.047	0.208
Covariates and additional paths												
EXT Religiosity: Service Attendance	←	INT Religiosity	1.410	<0.001	1.408	<0.001	1.435	<0.001	1.433	<0.001	1.474	<0.001
Cannabis use	←	Community-based	–	–	−0.163	<0.001	−0.164	<0.001	−0.158	<0.001	−0.14	<0.001
No Cannabis use	←	activities	–	–	0.064	0.115	0.053	0.206	0.049	0.244	0.056	0.200
INT Religiosity	←	Lifetime MDE	–	–	–	–	−0.327	<0.001	−0.360	<0.001	−0.358	<0.001
EXT Religiosity: Service Attendance	←		–	–	–	–	0.312	<0.001	0.286	<0.001	0.291	<0.001
EXT Religiosity: Faith-based activities	←		–	–	–	–	−0.338	<0.001	−0.417	<0.001	−0.420	<0.001
Cannabis use	←		–	–	–	–	−0.047	0.043	0.002	0.920	0.004	0.850
No Cannabis use	←		–	–	–	–	−0.823	<0.001	−0.845	<0.001	−0.844	<0.001
Community-based activities	←		–	–	–	–	−0.154	<0.001	−0.224	<0.001	−0.239	<0.001
INT Religiosity	←	Sex	–	–	–	–	–	–	−0.114	<0.001	−0.112	<0.001
EXT Religiosity: Service Attendance	←		–	–	–	–	–	–	−0.098	<0.001	−0.113	<0.001
EXT Religiosity: Faith-based activities	←		–	–	–	–	–	–	−0.274	<0.001	−0.277	<0.001
Cannabis use	←		–	–	–	–	–	–	0.142	<0.001	0.146	<0.001
No Cannabis use	←		–	–	–	–	–	–	−0.074	0.022	−0.073	0.024
Community-based activities	←		–	–	–	–	–	–	−0.245	<0.001	−0.259	<0.001
INT Religiosity	←	Income up to 2× Fed Pov	–	–	–	–	–	–	–	–	−0.009	0.487
EXT Religiosity: Service Attendance	←	Thresh *	–	–	–	–	–	–	–	–	0.529	<0.001
EXT Religiosity: Faith-based activities	←		–	–	–	–	–	–	–	–	0.068	0.021
Cannabis use	←		–	–	–	–	–	–	–	–	0.046	0.143
No Cannabis use	←		–	–	–	–	–	–	–	–	−0.022	0.580
Community-based activities	←		–	–	–	–	–	–	–	–	0.216	<0.001
INT Religiosity	←	Income >2× Fed Pov	–	–	–	–	–	–	–	–	−0.100	<0.001
EXT Religiosity: Service Attendance	←	Thresh*	–	–	–	–	–	–	–	–	1.007	<0.001
EXT Religiosity: Faith-based activities	←		–	–	–	–	–	–	–	–	0.179	<0.001
Cannabis use	←		–	–	–	–	–	–	–	–	−0.099	<0.001
No Cannabis use	←		–	–	–	–	–	–	–	–	−0.038	0.410
Community-based activities	←		–	–	–	–	–	–	–	–	0.774	<0.001

Model 1: Cannabis use & religiosity; *Model 2*: + community-based activities; *Model 3*: + lifetime MDE; *Model 4*: + sex; *Model 5*: + poverty. INT=Intrinsic; EXT = Extrinsic. Paths to No cannabis use describe the probability of being in the class "no past year use". *dummy variables for poverty categories based on U.S. Census Federal Poverty Threshold (reference category: Living in poverty).

important by less than 30% of the sample. Involvement in extrinsic-personal and extrinsic-social activities was reported variously by about half of participants.

In relation to the study hypotheses, young people with higher levels of religiosity, whether intrinsic or extrinsic-personal in terms of service attendance, were less likely to report past year cannabis use, even after controlling for putative confounders. There was no detectable effect of an extrinsic-social component of religiosity, defined in terms of church or faith-based activities. However, non-religious, social involvement in community-based volunteering activities appeared to protect against past year cannabis use.

Our findings are largely consistent with previous research showing that, in adolescents, extrinsic-personal religiosity defined in terms of church attendance is associated with abstinence from all kinds of substance use (Mak, 2019). Religious involvement entailing the sharing of rituals with church members of local religious organizations might help promote refraining from cannabis use. Indeed, ties with religious institutions expressed in personal behaviors like church attendance are associated with injunctive norm enforcement, which is likely to explain the protective role of this extrinsic-personal component in preventing

adolescent cannabis use (Salas-Wright et al., 2017). However, we found that also components of intrinsic religiosity have similar protective implications. It could be argued that religious faith might be helpful in preventing initiation to cannabis use more directly, through its ability to create beliefs and identities that are incompatible with substance use (Longest and Vaisey, 2008) as well as through the perceived risk that cannabis use may impact on the personal, spiritual well-being based on religious beliefs (Varma et al., 2017).

However, as for the extrinsic-social domain of religiosity, the picture seems more complex. Many young people volunteer within, and on behalf of, religious organizations than in any other organizational setting in Western Countries (Cnaan et al., 2016). Nonetheless, our findings show a protective role of secular volunteering activities but not from faith-based ones for cannabis use among adolescents. It might be argued that when religion is the protective factor involved, the intrinsic and the extrinsic-personal components are important. In non religious contexts, it is the social, altruistic component which seems protective. Nonetheless, little is known about what motivates young people who have a religious faith to volunteer. Whilst a faith-based organization may present relevant beliefs in its mission statement, individuals involved in that organization may differ in their own individual beliefs, and how these are then performed (Cloke et al., 2005). It is likely that alongside the initial motivations which leads to a young person starting to volunteer, ongoing volunteering journeys are rooted in effort and enthusiasm in order to turn an initial motivation into action, whilst faith motivation itself is inherently intrinsic, and relational as a personal relationship between young volunteers and God (Brace et al., 2011; Denning, 2021). Therefore, effort and enthusiasm may play a protective role as regards cannabis use for young people involved in secular volunteering, though for those belonging to faith-based organizations other, more personal and organizational-based domains, may be effectively in place. Thus, the protective effect of participating in religious volunteering activities may not be direct in nature, but rather it may be again accounted for by means of intrinsic religious moral beliefs relating to the use of illicit substances (Salas-Wright et al., 2017).

Alternative explanations are likely to involve also the role of parental tolerant injunctive norms, which can mediate the relationship between intrinsic and extrinsic-social religiosity and adolescent substance use, and reflecting at the same time some components of secular and faith-based volunteering activities (Hovey et al., 2014). In addition, as regards peers' attitudes, religious adolescents are more prone to hold conservative approaches toward cannabis use and tend to associate with likewise conservative peers, probably reinforcing self- and mutual-monitoring (Ford and Hill, 2012).

The differentiation between intrinsic, extrinsic-personal and extrinsic-social, individual-level religious components in adolescents is conceptually meaningful, and, as it transpires, empirically relevant in expanding our understanding of the mechanisms whereby these distinct components of religiosity reduce adolescent cannabis use. The findings may have preventive implications. Appealing preventive models are not easily adapted and implemented outside the original framework (e.g., Koning et al., 2021). Thus, alternative prevention programs to address the use of cannabis among adolescents on a local level are needed. In many cases local communities may lack the competence and capacity building required to implement complex technical initiatives like youth prevention education, campaigns and empowerment. Our study suggests that supporting secular youth volunteering programs may have cost-effective preventive value (Adamczyk, 2012). In addition, whilst it is certainly beyond the scope of any substance use preventive programs to promote intrinsic and extrinsic-personal religiosity, given our finding in relation to the protective value of religious involvement, it would seem reasonable to bolster this by providing some public health educational support to religious organizations.

4.1. Limitations

Our findings should be interpreted within the context of several limitations. Despite the location of NSDUH data within epidemiologically representative samples covering residents of households, they are not longitudinal but a series of cross-sectional observations. Causal inferences between different components of religiosity and cannabis use among young people are therefore merely suggestive, not robust. Nonetheless, longitudinal studies may suffer from their own problems, particularly attrition. Routinely collected electronic, health care data for public health surveillance of populations are an alternative, cost-effective design for monitoring national population trends (Choi, 2012). In addition, self-reports like those on which this study relies are influenced by various biases, including memory errors and under-reporting arising from social desirability biases. Ideally biological measures of cannabis use should be used, though the computer-based NSDUH interviews are held in a private setting, which demonstrably minimizes under-reporting (CBHSQ, 2020b).

More importantly, the proxy measures used in NSDUH to assess the different components of religiosity are of questionable validity, relying on the operationalization of single items, though consistent with previous evidence showing appropriate goodness of fit. Thus, it was impossible to be sure that intrinsic and extrinsic religiosity was equivalently assessed across different religions and, since information on religious and inter-denominational differences was unavailable, to test measurement invariance. This issue might be particularly important for the apparently contradictory findings showing protective effects from the involvement in non-religious community-based activities, but not in apparently similar church or faith-based activities (Salas-Wright et al., 2017).

Finally, NSDUH assessment of adolescent cannabis use does not provide information on important contextual determinants, such as deprivation, peer influence or parental supervision (Carrà et al., 2018).

5. Conclusions

Most preventive efforts spent to reduce cannabis use among adolescents have so far been oriented toward universal multi-modal programs (Norberg et al., 2013). Although such approaches are certainly needed, our results suggest the utility of considering both religious communities and secular volunteering activities as appropriate environments to be supported by specific preventive policies. However, future research is needed in order to better understand several elements which are likely to influence the protective role of religiosity for youth, including gender and ethnicity, religious inter-denominational differences, injunctive norms and youth involvement in non-religious communities that may serve to transmit beliefs about the use of cannabis.

Author statement

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Funding statement

The authors received no funding from an external source.

Data statement

Data from the National Survey on Drug Use and Health (NSDUH)

supporting the findings of the current study are publicly available, according to Substance Abuse and Mental Health Services Administration (SAMHSA) releases (https://www.samhsa.gov/data/data-we-collect/nsduh-national-survey-drug-use-and-health).

Declaration of competing interest

The authors declare no conflict of interest.

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