

Quality of Life and Cannabis Use: Results from Canadian Sample Survey Data¹

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How to cite this paper: Hassunah, R. and McIntosh, J. (2016) Quality of Life and Cannabis Use: Results from Canadian Sample Survey Data. *Health*, 8, 1576-1588.
<http://dx.doi.org/10.4236/health.2016.814155>

Received: September 29, 2016
Accepted: November 20, 2016
Published: November 23, 2016

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Abstract

Data from the 2013 Canadian Tobacco, Alcohol and Drugs Survey, and two other surveys are used to determine the effects of cannabis use on self-reported physical and mental health. Daily or almost daily marijuana use is shown to be detrimental to both measures of health for some age groups but not all. The age group specific effects depend on gender. Males and females respond differently to cannabis use. The health costs of regularly using cannabis are significant but they are much smaller than those associated with tobacco use. These costs are attributed to both the presence of delta9-tetrahydrocannabinol and the fact that smoking cannabis is itself a health hazard because of the toxic properties of the smoke ingested. Cannabis use is costlier to regular smokers and age of first use below the age of 15 or 20 and being a former user leads to reduced physical and mental capacities which are permanent. These results strongly suggest that the legalization of marijuana be accompanied by educational programs, counseling services, and a delivery system, which minimizes juvenile and young adult usage.

Keywords

Marijuana, Sample Survey Data, Canada

1. Introduction

Marijuana is about to become legal in Canada. Consequently, an analysis of its effects on users is a high priority. Canadian researchers have explored this issue to some extent but there are gaps in what is known about the effects of using marijuana. Most of the Canadian studies, whose results are summarized in Section 3, focus on youth or adolescent use. This is clearly important as is adult use. The link between early usage and

¹These results were presented at the 2016 annual meetings of the Canadian Economic Association in Ottawa on June 3-5, 2016.

its effect over an individual's lifetime also needs to be examined. One of the most surprising results that we found is that almost all users start when they are teenagers². This means that the age group under 21 is the one that should be the center of our attention. It also means that we will not be able to examine the effects of marijuana use on late starters, an issue of considerable interest since it is likely that some Canadian adults will start smoking marijuana because it is no longer illegal and is likely to be more socially acceptable.

That using marijuana is a health hazard is not an issue in dispute. The health literature on marijuana use surveyed below finds that using marijuana as an adolescent has a negative impact on both physical and mental health. Longitudinal studies show that individuals who start around the age of 15 and continue to be regular and significant users into early adulthood suffer memory loss, cognitive function impairment, diminished IQ, and lower educational success rates. Early users also suffer physically in terms of higher rates of respiratory diseases and higher rates of certain cancers. What these studies do not show is the duration of these effects. Do they become less debilitating as individuals age or are they of a more permanent nature? Our results show that the damage is permanent. The costs of starting to use marijuana at the age of 15 are borne by the individual for his or her whole lifetime. What is more disturbing is that this result was obtained without any information on actual usage at age of first use. What teenagers use on average when they start to use marijuana imposes health costs on them for the rest of their lives.

The paper has the following format. The next section reviews the literature on the health implications of using marijuana. Section 3 discusses the variables, which can be used to measure the effects of marijuana use as well the data employed in our analysis. Section 4 outlines the statistical procedures employed. Section 5 contains our results and they are discussed in Section 5.

2. A Brief Review of the Literature

The long-term effect of cannabis use is an important medical policy issue, yet there is much uncertainty about it. This is partly due to the limited number of longitudinal studies which have examined marijuana use over extended periods of time and the limitations of sample surveys, which so far have not been able to accurately determine the adverse health effects of regular or early use of marijuana. This is worrying since Rotterman *et al.* [1] estimated that 43% of Canadians, who are 15 years of age or older used marijuana at least once in their lifetime. As attitudes towards marijuana use become more tolerant and use increases, a better understanding of its effects becomes even more important.

Most studies available are longitudinal and are based on self-reported variables. Most of the literature considers psychological health, physical health and cognitive impairment. They are somewhat limited in their analysis of the age when individuals start us-

²To be precise, the number of current users who started at the age of 21 or over was 45 out of 3475 for men and 40 out of 4060 for women.

ing marijuana and how this determines health outcomes at much higher ages. Most of the research on early marijuana use concludes that it leads to continued use as the individual gets older. However, the impact of usage by late starters has, not to our knowledge, been examined in much detail.

Characteristics of underage use is summarized in [2] who showed that few respondents reported trying cannabis without first trying tobacco or alcohol, or both. Their data comes from the 2002 and 2004 Canadian Youth Smoking Survey. They also found that the rate of cannabis use was highest among tobacco smokers. An Australian study, the same thing was found and it was also noted that chronic cannabis users are more likely to participate in risky behavior. This implies that effective regulations on the sale of marijuana products need to be in place when marijuana becomes legal.

Many Canadian studies noted a significant difference in attitude towards tobacco and cannabis use between males and females, and that more males than females have either smoked or intend to smoke cannabis [2], [3], and [1] reported that among daily users, males reported using twice as much cannabis as females, and [4] reported similar findings, and added that in Ontario in 2013, nearly 25% of high school students had used cannabis. Overall, these findings coincide with ours, where the proportions of users who reported using cannabis before the age of 21 were around 30% higher for males. What is lacking in these studies is a comprehensive analysis of the long-term effects of cannabis use on mental and physical health, and the role age of first use plays in it. In terms of mental health, numerous studies linked depression, anxiety, as well as other mental illnesses to regular cannabis use. This is discussed in [5], [6] and [7]. See [8] for a review of the literature that shows a weak link between cannabis use and depression. This literature showed a difference in self-reported mental health between the two genders. Females reported a lower mental health score in association with cannabis use than men. See [9], [10], and [11]. Cannabis use is shown to exacerbate mental problems in users who are prone to such illnesses and worsen it in users who already have a mental illness. Along with other Canadian studies, including [4] and [12], we recommend a “public health approach” to cannabis use, similar to that which governs production and sale of alcohol and tobacco, rather than one dependent on the criminal justice system. Policy should be directed towards helping high-risk users (daily or weekly users), as not only do frequent users of cannabis have a 50% - 200% higher risk of psychosis than non-users, but mental and physical illnesses due to cannabis use tend to be concentrated in daily and weekly smokers, [4].

As already noted, early use is reported to increase the likelihood of long-term habitual use and dependence. Prevention of early use will have positive health and social benefits, as indicated in a report by [13], which is based on data from Australia and New Zealand. Strong correlations between early use and negative effects on present and future social life, health and education are a common theme in the literature. Educational attainment is negatively correlated with age of first daily cannabis use, as shown in [13], and with dosage [7] [12], and [13]. Both are significant variables in explaining physical and mental health. Silins [13] reports that daily users with age of first use lower

than 17 years had an average of 62.5% lower chance of achieving a high school degree. In this literature, cannabis use was described as a key factor to low educational attainment and increased symptoms of problematic mental health. See [7] and [8] who also show that there is a higher risk of failing to complete high school or post-secondary school among cannabis users who start using early.

Furthermore, [14] like many other researchers, claim that early and frequent use of marijuana has a significant negative effect on psychological health. Shubart *et al.* [14] showed that individuals who start using marijuana after the age of 18 do not see as great a negative effect on mental health in terms of psychotic experiences, but rather it's the individuals who start using earlier than that, especially as early as 12 years old who suffer much more. Another study by [12] showed similar findings; a 15 year follow up of over 50,000 Swedish military personnel revealed that those who tried cannabis before the age of 18 were 2.4 times more likely to develop schizophrenia than those who did not. After an adjustment for a history of mental illness and personal adverse conditions like parental divorce, they found that those who used at least 10 times before the age of 18 were 2.3 more times likely to develop schizophrenia.

Physical health is also a concern with early age of first cannabis use. The literature shows that risk of physical illnesses is significantly lower among cannabis users than among tobacco users but frequent cannabis use can cause chronic respiratory problems, mainly bronchitis, [8]. Lev-Ran *et al.* [10] analyzed American cross-sectional data and used a quality of life variable based on the self-reported SF-12 summary scale.³ Scores are based on an item response model. This contains a physical component summary score (PCS) and a mental component summary score (MCS) that are derived from the survey. Like other researchers, they found that cannabis users had lower scores for MCS than those of non-users, but surprisingly a higher score of PCS. Physical symptoms as they are related to cannabis use are the least discussed in the literature. McLeod *et al* [15], for example, dismissed the physical harms of cannabis as they were not as significant as the psychological ones; see this paper for more examples of similar findings.

2.1. Measuring the Effects of Marijuana Use

Many of the studies referred to earlier show higher probabilities of both physical and mental illness as a consequence of early and repeated use of marijuana. These results are often based on longitudinal databases and refer to samples of older respondents. To assess the impact of marijuana use especially on younger respondents a measure, which can be applied to respondents regardless of their age, is needed. Questions, which ask respondents to reveal how they feel or whether they are experiencing certain physical or psychological difficulties can be put to respondents even when they are teenagers. As will be seen below, marijuana use by this age group is crucial in understanding what happens to respondents in older age groups. The Canadian survey simply asks respondents to indicate the current state of their physical and mental health using a five point

³The SF-12 schedule is a set of 12 items, the first of which is a general health indicator.

scale which goes from poor to excellent. This appears to produce reliable results even when the respondents are adolescents.⁴ Responses by age and gender are shown in **Table 1**.

Generalizations of this approach are sometimes used. The World Health Organization disability assessment schedule, the Kessler psychological distress score, [16] and the 12 item health survey (SF-12), [17] [18], which is contained in the National Epidemiological Survey of Alcohol and Related Conditions all use supplementary questions to bring more precision to the notion of how individuals regard their mental health. Their questions are also on a five point scale going from 0 to 4, which is the worst state possible. The first two scores are just the sum of the answers making the scores run from 0 to 24. This procedure is somewhat crude since differences in states are constrained to be equal and all items have the same weight. A more reliable procedure is used for analyzing the SF-12 data is used by [10]; it used an item response model to summarize the information contained in the items.

The use of self-reported health indicators has a long history of being a reliable indicator of current health status. For a summary of the literature, which evaluates its performance see [19].

2.2. Sample Survey Data

The data come from the 2013 Canadian Tobacco, Alcohol and Drugs Survey (CTADS) [20], the 2102 Canadian Alcohol and Tobacco Monitoring Use Survey, [21] and the

Table 1. Distributions of health scores by age group and gender.

	Male			Female		
	15 - 24	25 - 44	45 - 64	15 - 24	25 - 44	45 - 64
	Physical			Health		
Excellent	0.328	0.251	0.188	0.274	0.306	0.234
Very Good	0.383	0.424	0.353	0.434	0.397	0.392
Good	0.274	0.272	0.328	0.250	0.258	0.259
Fair	0.038	0.041	0.094	0.036	0.044	0.085
Poor	0.002	0.012	0.037	0.005	0.125	0.029
	Mental			Health		
Excellent	0.464	0.424	0.336	0.419	0.402	0.370
Very Good	0.343	0.379	0.353	0.348	0.354	0.356
Good	0.183	0.153	0.263	0.178	0.205	0.222
Fair	0.026	0.028	0.040	0.048	0.028	0.041
Poor	0.003	0.009	0.009	0.007	0.011	0.011

⁴Self-reported health distributions for the age group 15 - 25 are similar to the distributions for other age groups except that there are more respondents with excellent health and fewer with poor health as would be expected. See **Table 1**.

2014 American National Survey on Drug Use and Health, (NSDUH) [22]. There are 14,555 respondents in the first survey, and adolescents are over-sampled. The proportion of the sample 21 or younger is 32.6%. There are two endogenous variable of interest. These are “self-reported physical health” and “self-reported mental health”. Both of these variables are categorical with five outcomes running from poor to excellent. Explanatory variables include current smoking behavior whose three categories are smoking cigarettes every day, occasionally, or not at all. Age of first daily use of alcohol and marijuana are included. Alcohol use is described by an eight category variable describing drinking behavior over the last twelve months. This runs from daily or almost daily to less than once a month. The residual category is never. Marijuana use is described by a frequency variable over the last three months. The categories run from daily or almost daily to once or twice. The residual category is never. The other available variables are age, gender and province of residence.

Unfortunately, there is no information on quantities of marijuana consumed. Nor is there any socio-demographic information like education, earnings, or occupation. As a check on our results our models were estimated using the 2014 NSDUH. No major differences were found but because of the much larger sample size of the American survey estimated coefficients had much smaller standard errors than those based on the Canadian sample and consequently gave a clearer picture of the effects of marijuana use on mental health.

3. Statistical Models

The two self-reported health variables are analyzed in an ordered probability framework. The categorical outcomes are determined by a latent variable

$$y_{ih}^* = M_i\beta + A_i\alpha + X_i\gamma + u_i \quad (1)$$

$$= Z_i\delta + u_i \quad (2)$$

where the M_i are the four categorical marijuana use variables, A_i is the vector of two age at first use variables: age of first use less than 16 and age of first use between 16 and 20. X_i is a vector of all the other covariates. Categorical probabilities are generated by y_{ih}^* crossing a set of thresholds: $\kappa_j = 1, 2, 3, 4$. These generate a set of dummy variables $\{y_{ih}\}$. When u_i is normally distributed with mean of zero and a variance of unity the following set of health category probabilities are obtained.

$$\begin{aligned} \Pr\{y_{ih} = 1\} &= \Phi(\kappa_1 - Z_i\delta) \\ \Pr\{y_{ih} = j\} &= \Phi(\kappa_j - Z_i\delta) - \Phi(\kappa_{j-1} - Z_i\delta), \quad j = 2, 3, 4 \\ \Pr\{y_{ih} = 5\} &= 1 - \Phi(\kappa_4 - Z_i\delta) \end{aligned} \quad (3)$$

where h is either physical or mental health. Maximizing the sample likelihood function, which arises from these categorical probabilities, leads to parameter estimates shown in **Table 2** and **Table 3**.

4. Results

It is clear from **Table 4** that most weekly or daily or almost daily users are concentrated

Table 2. Effect on self-rated physical health of using marijuana by age group. Parameter estimates.

Age Group	Males					
	β_1	β_2	β_3	β_4	α_1	α_2
15 - 24	-0.182†	0.289**	-0.102	-0.329**	-0.247**	-0.087
25 - 44	0.127	0.026	0.702**	-0.135	0.229†	-0.179*
45 - 64	0.271	0.285	-0.354†	-0.535**	-0.403**	-0.121†
Females						
15 - 24	-0.011	0.423**	-0.052	-0.677**	-0.468**	-0.304**
25 - 44	0.299	-0.327	-0.172	0.286	-0.021	0.138†
45 - 64	-0.179	-0.279	1.047**	-0.608**	-0.143	0.116†

Note for **Table 3** and **Table 4**. † indicates significant at the 10% level, * at the 5% level and ** at the 1% level.

Table 3. Effect on self-rated mental health of using marijuana by age group. Parameter estimates.

Age Group	Males					
	β_1	β_2	β_3	β_4	α_1	α_2
15 - 24	-0.250**	0.059	-0.053	-0.088	-0.532**	-0.259**
25 - 44	0.280	-0.125	1.070**	-0.135	-0.226†	-0.003
45 - 64	0.590*	-0.073	0.312	-0.404*	-0.241*	-0.165**
Females						
15 - 24	-0.197	0.231†	-0.337*	-0.540**	-0.423**	-0.145**
25 - 44	-0.576**	-0.490	0.087	0.427	-0.312*	-0.052
45 - 64	-0.664**	0.181	-0.287	-0.215	-0.125	0.044

Table 4. Marijuana use in the last month by age group and gender. Age group proportions.

Age Group	Males			Females		
	Sample Size	Daily	Weekly	Sample Size	Daily	Weekly
15 - 24	3032	0.073	0.051	2997	0.027	0.025
25 - 44	936	0.055	0.029	1285	0.016	0.014
45 - 64	1611	0.025	0.017	2078	0.007	0.005
65+	965	0.002	0.003	1411	0.001	0.000
Average	-	0.048	0.032	-	0.015	0.013

Table note: daily means daily or almost daily.

more in the age group 15 - 24 rather than in older age groups. No one uses marijuana more often than weekly in the age group 65+. For this reason there will be no analysis of respondents in this group. It is also the case that female respondents are much less likely to be users than males.

Table 5 displays weekly or more use by age of first use. Here the results are quite surprising. Early use is accompanied by some continued use at older ages, a result that many studies have found. However, what is unusual and has not been highlighted in the literature in this area is that abstinence prior to the age of 21 means that these respondents are unlikely ever to start using marijuana in a significant way. Only 0.03% of males are daily or almost daily users if they started using marijuana at the age of 21 or older. Males and females who start using marijuana do so at about the age of 15 or 16.

For males under 21 the proportion of respondents who report an age of first use less than 21 is 28.6%. The figure for females is 23.9%. These proportions are much higher than those associated with smoking cigarettes, 10.7% and 8.7%, respectively, although the distributions of starting ages are similar.

The parameter estimates for the ordered probability models mentioned above appear in **Table 2** and **Table 3**. They are weighted maximum likelihood estimates using the sample weights provided by Statistics Canada to make the results representative for the country as a whole.

Two dimensions of use are important. First the parameters β_1 to β_4 measure the effect of the frequency of actual usage. β_3 and β_4 are the most interesting since they are associated with more frequent usage. For both genders and measures of health there is considerable variation in the effects of marijuana use. For physical health β_4 is significantly negative for the age groups 15 - 24 and 45 - 64, and β_3 is sometimes significantly positive indicating beneficial effects of weekly usage. For mental health only two of the six β_4 coefficients are significantly negative.

The estimates of α_1 and α_2 are a little more informative. Respondents in the age group 15 - 24 who start using marijuana on or before the age of 15 experience lower self-reported scores for both health measures. For some of the older age groups starting early has a significant negative impact on how they feel.

5. Discussion

The results of the previous section present a picture which is not as definitive as one would like. There are two reasons for this. First, there are variables, which are important in explaining these self-reported health outcomes, which, as was shown in [19], need to be included but are not available in the survey. Marijuana use is, in part, deter-

Table 5. Marijuana use in the last three months by age at first use and gender. Age group proportions.

Age Group	Males			Females		
	Sample Size	Daily	Weekly	Sample Size	Daily	Weekly
15-	668	0.271	0.128	614	0.111	0.080
16 - 20	1379	0.086	0.081	1159	0.035	0.039
21+	3532	0.003	0.017	4587	0.002	0.002
Average	-	0.056	0.037	-	0.018	0.016

Table note: the sample is all respondents aged 15 to 65.

mined by the respondent’s socio-economic status as measured by income, level of education, and occupation. When they are not included as regressors in model, which explain self-reported health, the estimates of the included variables can be biased and in the case of marijuana this could lead to unreliable results on the effects of its use. Secondly the sample size of the survey is quite small.

As a remedy for this we examined a similar American survey for 2014, the NSDUH. It has the same information on marijuana use and timing of first use as well as the more detailed demographic information on all respondents which is absent from the Canadian survey. The sample is much larger than the Canadian survey used here; there are over 55,000 respondents.

With respect to self-reported physical health the results of the two surveys are similar. However, the NSDUH survey has no self-reported mental health scores. It does have the Kessler 6 score and WHO disability schedule. We use the six items upon, which the Kessler6 score is based in an item response model⁵ rather than using the k6 score itself since it makes better use of the item information.⁶ As is shown in **Table 6** at least one of the age at first use coefficients, α_1 or α_2 , is negative and highly significant for all age groups. This says that juvenile or adolescent marijuana use has a negative impact on mental health which lasts a lifetime. Regular daily or almost daily use is also harmful to mental health for all age and gender groups. The larger sample sizes play a role here but the inclusion of other demographic variables may also explain the increase in their significance. The consequences of this are extremely serious and underline the importance of developing a marijuana policy which limits usage for adolescents. This result was not found for tobacco use. Age of first use below 21 was not significant

Table 6. Effect on self-rated mental health of using marijuana by age group. parameter estimates using NSDUH data.

Age Group	Males					
	β_1	β_2	β_3	β_4	α_1	α_2
15 - 24	-0.193**	0.007	-0.224†	-0.129**	-0.036	-0.193**
25 - 34	-0.266**	-0.171†	-0.256†	-0.157**	-0.188**	-0.059
35 - 49	0.078	-0.288†	-0.238	-0.298**	-0.063*	-0.162**
50 - 64	-0.504**	-0.674**	0.631**	0.210	-0.086†	-0.208**
	Females					
15 - 24	-0.286**	-0.244**	-0.059	-0.073	-0.269**	-0.381**
25 - 34	-0.057	-0.037	-0.863**	-0.155†	-0.213**	-0.265**
35 - 49	-0.778**	-0.966**	-0.682**	-0.698**	-0.135**	-0.352**
50 - 64	-0.745**	-0.921**	-0.438**	-0.485**	-0.052	-0.252**

Table note: The data comes from the six items that make up the Kessler 6 score. Parameter estimates are based on an item response model.

⁵See [23] and [24] for a modern description of IRT models.

⁶In k_6 different item outcomes can generate the same score.

for older age groups. Clearly, the health dynamics of marijuana and tobacco use are different.

One of the interesting questions that arise as a consequence of the intention of Canada to make marijuana legal is what the effect will be on individuals who start using marijuana as an adult. The fact that there are hardly any serious marijuana users who started after the age of 21 means that it is impossible to determine what effect marijuana use will have on adults if they abstain until they are 21 or older. Age of first use has not been examined extensively in the literature on marijuana but there are some results. Grotenhermen [25] notes the serious health hazards that arise with early marijuana use but suggests that they are much less severe for adult starters. Schubart *et al.* [15] using Dutch survey data found no increase in adverse psychotic responses in respondents who started over the age of 18 but an increase in depressive symptoms in those who started over the age of 20.

Some insight on this issue can be gained by looking at the effects of regular smoking on health in the sample of respondents who did not smoke when they were teenagers. The two smoking coefficients are somewhat smaller and not significant in the age group 26 - 44 but larger and more significant for the age group 46 - 64. This is not surprising since the smoking durations for adult starters are less. Cigarette smoking is harmful, eventually. Since marijuana is often ingested as smoke through combustion, results similar to tobacco are possible.

Daily smoking leads to more adverse consequences of marijuana use than just using marijuana alone. This is also not surprising since the total amount of smoke ingested by users of both products is likely to be much greater than that ingested by respondents who smoke only marijuana.

Tobacco and marijuana are similar in many respects so that the damage that these two products cause can be compared. **Table 7** shows the proportion of explained variation that is due to tobacco and marijuana use for the age group 15 - 24. The first row in this table gives the values of the ln-likelihood function at baseline; that is when no regressors are used. The next rows display the ln-likelihood function as groups of regressors are added as explanatory variables. First demographic variables are included, then smoking variables, and finally the variables representing marijuana use. The proportion of the explained variation due to smoking is 62.2% and 66.1% for males and females, respectively. However, the proportions explained by marijuana use are much smaller at 7.1% and 21.3% so marijuana use as a factor in self-reported physical health is much less important than tobacco use. It should also be noted that in addition to the larger proportion of explained variation, which due to marijuana use it is also the case that both self-reported health measures are higher among regular marijuana users than for daily smokers. This result also holds for self-reported mental health though the difference between the effects of two substances is not nearly as great. This is not so surprising as it may appear; there is a literature, which deals with smoking and mental problems. Depression, anxiety, schizophrenia have been linked to cigarette smoking. See, for example, [26] and [27].

Table 7. Relative contributions of smoking and marijuana use as determinants of self-rated physical health, ages 15 - 24.

	Ln(L)	Males Δ Ln(L)	% Δ Ln(L)	Ln(L)	Females Δ Ln(L)	% Δ Ln(L)
Baseline Ln(L0)	-3705	0.0	0.0	-3632	0.0	0.0
Respondent						
Characteristics Ln(L1)	-3675	30	30.6	3615	17	12.5
Smoking Ln(L2)	-3614	61	62.2	-3525	90	66.1
Smoking and						
Marijuana Use Ln(L3)	-3607	7	7.1	-3496	29	21.3
Ln(L0) - Ln(L3)		98	100		136	100

Summarizing what we have found, the major health issue involving marijuana concerns teenagers and adolescents. It starts with this age group and often ends with it. Individuals who do not use marijuana before the age of 21 almost never use it. Its use is also more likely to be associated with males. Like most other researchers who have examined the health consequences of marijuana use, we find harmful effects on both physical and mental health that are persistent even if respondents are no longer users. The impression portrayed by the literature is that early and continued significant use is what matters. Our results are consistent with these findings but are much less favorable towards marijuana use. It seems that given existing use habits of Canadian teenagers if they start using earlier than the age of 15 they will suffer for the rest of their lives even if they never use marijuana after the age of 21. On a more positive note we found that marijuana use explained less of the variation in self-reported health than that attributable to smoking tobacco for the age group 15 - 24, in spite of the fact that there more marijuana users than tobacco users in this age group. Male marijuana users under the age of 21 were almost 3 times as numerous as tobacco users. Marijuana is damaging health-wise but not as damaging as teenage tobacco smoking, the consequences of which as a society we have been able to manage.

It would also seem that the likelihood of an epidemic of health problems emerging out of new marijuana regulations could be dramatically reduced if extensive educational programs in schools accompany legalization. Data from the 2012 Canadian Alcohol and Drug Use Monitoring Survey show that only five percent of respondents below the age of 21 think that regular use of marijuana is a health hazard. If this age group were better informed about the risks of cognitive impairment and psychological damage that arise with adolescent marijuana use its members might be less inclined to be users. Anti-smoking campaigns have been very successful in reducing tobacco use among elementary and high school students. This shows up in our data as a lower rate of tobacco use. It is possible that marijuana usage could be also reduced in this age group if more information is made available.

The implication for drug policy that comes from these results is that marijuana legalization should be facilitated through a set of institutional arrangements which limit

access to marijuana for all individuals under the age of 18. Adolescents need to be encouraged not to use marijuana and strict government control over its production and distribution is needed to protect them. Price, THC content, and advertising also have to be regulated. At a more general level public policy should promote caution and awareness of the harmful consequences of marijuana use.

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