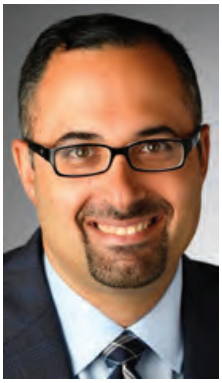
MARIJUANA USE – REAL MORTALITY IMPACT OR ALL JUST SMOKE AND MIRRORS?



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Executive Summary *With liberalization of legislation on a regional, national and global front, tetrahydrocannabinol (THC) use has increased substantially in the last decade in both medical and nonmedical circles. Studies have been largely inconclusive with respect to the direct morbidity and mortality impact attributed to THC use. It is clear, however, tobacco use and socioeconomic factors drive some of the mortality experiences seen in studies to date. This article explores health impacts and mortality implications of THC use as they pertain to physical and mental health. It also explores using insurance lab data, as well as national survey data, and how patterns of use and age of applicants can be used to guide underwriting decisions in an evidence-based and personalized fashion.*

Introduction

The cannabis genus contains over 500 different compounds, and of these about 100 are unique to the genus and are termed "cannabinoids." There are two main cannabinoids that are the subject of the greatest debate, both medically and politically, namely tetrahydrocannabinol (THC) and cannabidiol (CBD). This discussion will focus on THC.[1] THC is the psychoactive compound which causes intoxication and euphoria, but it also has medicinal effects of appetite stimulation, muscle relaxation, anti-inflammation and pain relief. These medicinal effects are targeted by a growing industry of pharmaceutical-grade THC products. Regulations on medical and social use vary by state, province and country, but the loosening of laws regarding cannabis use has become a global trend.

Prevalence

There are limited studies on the use of cannabis and its adverse effects, particularly on health and mortality. Over the last decade, due to its ubiquity and increasing potency, there has been a documented increase in cannabis-related health effects and associated deaths.[2] Cannabis is used by an estimated 192 million people or roughly 4% of the global population.[3] In the US, 14% of people over 12 years of age report use within the last year and 10% within the last month.[4]

Social Factors and Use Patterns

There are variances in data sets as to the impact of marijuana use on morbidity and mortality.[1] A myriad of social, occupational and financial factors portend a poorer prognosis with respect to morbidity and mortality from cannabis use. These include poor educational attainment, unemployment, lower income, lack of a formal social and family network, the use of other substances, and violent or illegal behavior.[5] Despite data variances, most studies point to mortality experiences being mediated by these other associated issues and having little or nothing to do with the physical effects of marijuana itself.

Health Implications – Mental and Physical

Like any psychogenic drug used recreationally or medicinally, THC may have immediate negative effects like anxiety, paranoia and memory impairment. There are also more negative chronic effects with respect to learning, attention, memory and concentra-

tion. In addition, like many euphorigenic compounds, repeated and prolonged use can lead to dependency. Studies show episodic use is common with about 20% of users using only 1-2 days per month. However, over 40% of users have use patterns that exceed 20 days per month.[6] Discussions about the short- and long-term negative health effects and mortality implications have gained significant traction as more and more countries legalize use. Risk factors like the aforementioned social issues and insight into patterns of use have and will continue to shape risk.

Amidst the paucity of quality data, studies have still shown no overall association between chronicity of use and illness or death.[6] There is, however, a reproducible relationship between heavy use and fatal motor vehicle crashes, perhaps owing to the diminished muscle coordination and reaction time associated with both acuity and chronicity of use. When used concomitantly with ethanol, the risk of a fatal accident is 24-fold that of a sober driver.[7]

From a mental health standpoint, adolescent users are 3.5 to 7 times more likely to attempt suicide than non-users.[8] Across all ages, there are higher incidences of major depressive disorder among those dependent on marijuana, and in adolescents those dependent exhibit higher incidences of schizophrenia. This pattern is also seen with anxiety and bipolar disorders.[9,10] While there is a commonly held belief marijuana does not lead to dependency, studies have shown that adolescents who use daily are 18 times more likely to become dependent than non-users and eight times more likely to use other drugs. This contests the idea that marijuana is not a "gateway drug." Diminished academic achievement and job performance are also widely reported across all ages. It is difficult to establish causality between cannabis use and psychological disease. Even with cannabis-induced psychosis, a diagnosis which has recently become more prevalent, affirming causation is a challenge. While those with psychotic disorder show a greater pattern of marijuana use, perhaps to mitigate negative symptoms, there has been recently increasing evidence of causality between marijuana and psychotic disorders like schizophrenia.[1]

Acute lung irritation has been observed in those who use marijuana, frequently presenting as cough, wheezing, and shortness of breath. Studies showing long-term sequelae, such as the development of bullae (lung cysts), have been mixed with some studies showing an improvement in lung function shortly after use, with chronic use leading to negative effects. No clear association between cannabis smoking and lung cancer has been established.[11]

Cardiac changes like increased heart rate and lower systemic vascular resistance have been observed. There are observed patterns of increased cardiac output and resultant supply/demand mismatches which are linked to a small risk of myocardial infarction. Stroke, peripheral vascular disease and supraventricular arrhythmias are also reported in greater prevalence in those who use.[12]

There have been reports of deaths linked to hyperemesis syndrome and ensuing dehydration. It is known that chronic and heavy use can lead to nausea, vomiting and abdominal pain.[1]

Mortality

In order to investigate the impact of marijuana use on mortality in the US population and/or the pool of US life insurance applicants, two data sources were consulted, Clinical Reference Laboratories (CRL) and the National Health and Nutrition Examination Survey (NHANES).[13]

CRL Data

CRL data containing information on over 450,000 applicants who had been tested for marijuana between 1995 and 2015 was used and evaluated in conjunction with the Social Security Death Master File for vital status. Risk was assessed for those testing positive for marijuana vs. those testing negative, controlling for age, sex and, in some models, tobacco use. For the purposes of this study, a smoker was defined as anyone either admitting to smoking on the lab slip or testing positive for cotinine at a threshold of 200 ng/ml.

While testing positive for THC was associated with increased mortality, in particular at younger ages, much of the excess mortality was mediated by tobacco use. The mortality ratio dropped from 1.8 to 1.2 when tobacco was added to the model. (See Table 1)

Table 1

	Mortality Ratio for THC +	Mortality Ratio for Tobacco +
Model 1 (THC Only)	1.8	N/A
Model 2 (THC and Tobacco)	1.2	3.3

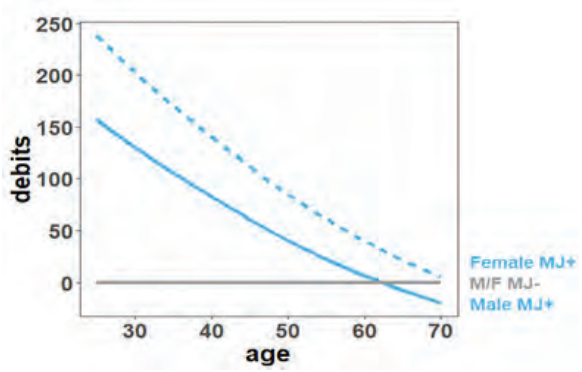
Tobacco smoking is much more prevalent among those who test positive for THC (51%) than among those who test negative (11%). In order to isolate the risk of marijuana, a model was constructed with a single variable encompassing the use of both substances (THC only, tobacco only, both or neither). (See Table 2)

Table 2

Substance Use	Mortality Ratio
THC Only	1.6
Tobacco Only	3.3
Both THC and Tobacco	3.4
Neither	1 (reference)

In another evaluation, we removed tobacco users, allowing marijuana use to interact with age alone, thereby demonstrating distinct mortality experiences at different ages. The following graph displays the result of this analysis. Debits are simply derived from the mortality ratio (debits = (MR-1) * 100). (See Graph 1)

Graph 1



This graph shows a sharp decline in the predicted mortality associated with marijuana detection at the older ages, and higher relative risks among women. This may be due to a limitation of the study in that there are few marijuana users over age 60 in the data (335) and very few deaths (5).

NHANES Data

In order to validate these findings on general population experiences, the NHANES data was evaluated. This dataset was derived from a sample reflective of the age and racial makeup of the US as a whole. Subjects in this sample were surveyed with in-person interviews, which included questions on marijuana use. For this study, a user was defined as anyone who self-reported marijuana use within 1 month prior to the interview. There was no urine THC testing performed to validate use. A comprehensive assessment of vital status was obtained through the National Death Index. Participants ranged in age from 20 to 80 years. In this sample, 9,776 participants were surveyed about marijuana use, and there were 127 deaths among them.

The findings in this study were similar to the findings in the CRL dataset but with smaller mortality ratios overall. This may be due to a difference in the definition of marijuana use, a lower baseline mortality in an insurance population, or a combination of both. (See Table 3)

The mortality effect of marijuana did not rise to statistical significance in either NHANES model.

Discussion

As stated above, studies to date have not been consistent, but in most it seems marijuana use does not, in aggregate, lead to early mortality. While the effects on motor vehicle accidents, physical health and mental health may contribute to higher mortality, when controlled for demographic, social and educational factors, that mortality effect appears to be negligible.[1,3,4,5]

With regard to fatal acute overdose, marijuana is unlike any other commonly used and abused substance, and it is estimated a user would have to consume thousands of "joints" in one sitting in order to die from marijuana use.

Our data, particularly in the insurance group, demonstrates a small but significant effect, most notably at younger ages. This may be observed for several reasons. The first lies in the fact that only those testing positive on screening are considered users. A positive screen would be likely in either a heavy chronic user or in one who used within a day or so of the screen, fully aware of their upcoming insurance evaluation and therefore select out heavier or careless users. NHANES data, on the other hand, used self-reported marijuana consumption to shape the definition of

Table 3

	Mortality Ratio for THC + (95% CI)	Mortality Ratio for Tobacco +
Model 1 (THC Only)	1.5 (0.9 – 2.6)	N/A
Model 2 (THC and Tobacco)	1.1 (0.6 – 1.8)	2.6

"user" and therefore was more likely to contain more casual or even one-time users, assuming accurate self-reporting. Secondly, the CRL data is retrospective to a time when marijuana use was not as widely accepted or legal, for that matter. Therefore, it can be deduced that some of the mortality experienced may be due to general risk-taking behavior and not due to the physical effect of the marijuana itself. This was alluded to in the introduction of this article. Thirdly, the insurance-buying population has a very low risk for mortality in the early durations because of the effect of underwriting. Mortality ratios may be higher not because of an effect of increased mortality in users (the numerator of the mortality ratio), but rather a lower risk in non-users (the denominator of the mortality ratio). Finally, there may be some residual unmeasured confounders not completely controlled for by virtue of the selection of an insurance population, such as socioeconomic status or education level, which cannot be ascertained as influencing the results of the CRL data experience.

Conclusion

This article presents data that highlights the relationships between mortality and marijuana use as a function of use patterns and age. Overall, the data points to a trend of higher mortality in younger ages and those with more frequent use patterns. These trends are amplified by concomitant risk factors like smoking, as well as psychiatric and medical illnesses. The study examined both a general population group representative of the US and an insured population in the US. The influence of age and frequency on mortality observed in these two studies can be impacted by study definitions, population makeup and the underwriting effect. While these studies can begin to shape guidelines on how we as industry professionals evaluate mortality risk of an ever-increasing population of medicinal and recreational users, no true mortality assessment can be done without considering the influence of social factors, such as job status, education, social involvement and family structure. Skilled underwriting should lean on a careful risk assessment of these social factors, concomitant health issues, prescription use, vices, and financial and motor vehicle records, while also looking at the aforementioned data trends to arrive at the most personalized and evidence-based decision for a given proposed insured.

Notes

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