ISSN 0819-2642
ISBN 0 7340 2627 7

THE UNIVERSITY OF MELBOURNE

DEPARTMENT OF ECONOMICS

RESEARCH PAPER NUMBER 969

SEPTEMBER 2006

THE IMPACT OF CANNABIS & CIGARETTE USE ON HEALTH

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Australia.

The medical and epidemiological literature on the health effects of cannabis use has focussed on long term daily use, providing robust evidence that this mode of use is causally related to the development of several kinds of cancers and respiratory diseases. In contrast, the economics literature has examined the labour market impacts of less frequent or casual cannabis use. The health impacts of these more common models of use have not been widely studied in the medical literature and are not well understood.[1] However, because the economic studies have not directly accounted for the effect of drug use on health, the proper interpretation of their findings is not clear. It is in this context that this paper seeks to make a contribution by investigating the general health effect of the more common modes of cannabis use.

While medical research tends to focus on the impact of cannabis use on the incidence of specific diseases that may take years to develop, we measure the health effects of cannabis consumption using self-assessed health status. Self-assessed health status provides a more encompassing measure of health that is likely to be sensitive to subtle changes in health associated with less frequent or shorter-term use of cannabis. Our empirical investigation is based on information collected in the 2001 and 2004 waves of the Australian National Drug Strategy Household Survey (NDSHS). In addition to providing data on the extent of drug use by the non-institutionalized civilian population in Australia, the 2001 and 2004 waves of the survey also asked respondents to assess their overall health status using a five point scale. This combination of information on self-assessed health status and drug use provides an opportunity to examine the relationship between cannabis use and health. In examining this relationship we distinguish between frequent use (use in the last week) and any use in the last year. This allows us to establish whether there is a dose-response relationship in the health effects of cannabis use.

We address the potential correlation in unobserved characteristics that affect an individual's assessment of their overall health and their decision to consume cannabis using instrumental variable estimation. We examine the validity of these instruments using the standard methods. Importantly, as cigarette smoking is common amongst cannabis users, we will also account for the health impact of cigarette use. We find robust evidence that cannabis use has a detrimental effect on health. Moreover, the estimated impact of weekly cannabis consumption on the probability of being in excellent or very good health is found to be of a similar magnitude to the effect of daily smoking. We also find evidence of a dose-response relationship in the health impact of cannabis use, with weekly use having roughly twice the effect of annual use.

The rest of this paper is laid out as follows. Section 2 provides the background to this research by reviewing the literature on the labour market effects of drug use. Australian institutional factors, together with a description of the available data, are described in Section 3. Our conceptual framework and econometric model are then presented in Section 4, followed by our estimation results in Section 5. The paper then concludes with a discussion of our findings in Section 6.

[1] The medical literature tends to study the impact of cannabis use on specific diseases, such as cancers, chronic obstructive pulmonary disease, and emphysema, which take many years to develop. It is therefore not surprising that these studies focus on long term heavy cannabis use. An exception is Taylor et al. (2002), who found that cumulative cannabis use between the ages of 18 and 26 has a marginally significant negative effect on lung function in a birth cohort of almost 1000 young adult New Zealanders.

The impact of cannabis and cigarette use on health *

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Abstract. Chronic daily cannabis use has been shown to have long term harmful health effects, which in turn is expected to reduce labour market productivity. The evidence is less clear on the health impact of less frequent consumption, which is the more typical mode of use, and previous empirical studies fail to find robust evidence of an adverse impact of these modes of use on labour market productivity. This paper attempts to shed some light on this issue by directly estimating the impact of cannabis consumption in the past week and past year on health status using information on prime age individuals living in Australia. We find that cannabis use does reduce self-assessed health status, with the effect of weekly use being of a similar magnitude as smoking cigarettes daily. Moreover, we find evidence of a dose-response relationship in the health impact of cannabis use, with annual use having roughly half the impact of weekly use.

Keywords: self-assessed health, cannabis, cigarettes, productivity

JEL codes: I1

1. Introduction

The 1980's saw the use of illicit drugs rise to prominence as a significant public health concern in the U.S. The medical literature documented adverse physical and psychological effects of drug use and there was a general belief that these effects spilled over into the workplace, impairing the ability of workers to do their jobs. In an effort to control the use of illicit drugs, the U.S. federal government passed the Drug Free Workplace Act of 1988, requiring federal government contractors to maintain drug-free workplaces, and issued executive order 12564 requiring all federal agencies to establish drug-free workplace policies (Kaestner, 1994a). Hundreds of private companies followed suit, developing extensive drug abuse programs aimed at prevention, detection and treatment of employees who used illicit drugs. By the late 1980's over a million federal employees were eligible for drug testing, and some form of drug testing was being used by roughly 40% of Fortune 500 firms (Register and Williams, 1992).

The widespread adoption of drug testing has, amongst other things, real implications for the use of resources and the evidence base on which it was justified was viewed by economists with a good deal of scepticism. Their primary criticism of the evidence was that it treated drug use as exogenous to labour market outcomes. However, even the simplest economic model of drug using behaviour indicated that this assumption was ill-founded. This implied that correlations and associations between drug use, wages and employment had been misinterpreted as the causal effect of drug use. Despite accounting for the endogenous nature of drug use, the empirical literature in economics that arose in response to these criticisms failed to find robust evidence that cannabis use reduces productivity. This presents an interesting puzzle.

One potential explanation of this puzzle is that infrequent or casual use of cannabis does not have harmful health effects, and hence does not impair worker productivity.

* Helpful comments on an earlier draft were received from Jan van Ours, Rosalie Pacula, two anonymous referees and participants at the 81st Annual Conference of the Western Economic Association International.

2. Background and Review of Literature

2.1. First Wave Studies of the Labour Market Effects of Drug Use

In addition to their stock of human capital, a person's labour market productivity is determined by their health capital stock (Grossman and Benham, 1974, Lee, 1982, Haveman et al., 1994). Drug use is conjectured to reduce labour market productivity through its deleterious effects on an individual's stock of health. While intuitively appealing, empirically assessing the validity of this conjecture is complicated by the fact that individuals choose, or self-select into, drug use. One of the most significant contributions of the first wave of economic studies in this area (Kaestner, 1991, 1994a,b, Gill and Michaels, 1992, Register and Williams, 1992) is their formalization of the behavioural relationships between drug use and labour market outcomes, and the subsequent recognition of the potential endogeneity of the decision to use drugs. These early studies outlined two different avenues through which endogeneity of drug use may arise: reverse causality and omitted variables. Reverse causality occurs because a large component of a person's income is labour market earnings. Therefore, an increase in income (via an increase in wages or employment) will lead to a greater demand for drugs (if drug use is a normal good). Failing to account for this effect will lead to an understatement of the true impact of drug use on wages. A second reason to suspect that drug use may not be exogenous to labour market outcomes in a statistical sense is omitted variables. Specifically, there may be important unobserved determinants of wages or employment that also influence the decision to use drugs. An example of an omitted variable particularly relevant in the context of this paper is an individual's discount rate. Individuals who discount the future heavily are more likely to use drugs because they place little weight on the future negative health consequences of their drug use (Becker and Murphy, 1988). They are also more likely to choose jobs with little investment in on-the-job training, and that consequently pay relatively high current wages but relatively low future wages (Kaestner, 1998). This may give rise to a positive correlation between drug use and wages even if drug use is negatively causally related to wages.[2]

The empirical strategy pursued by Kaestner (1991), Register and Williams (1992) and Gill and Michaels (1992) for estimating the causal impact of drug use on wages and employment is instrumental variables. All three of these studies draw on data on 18-27 year olds from the 1984 cross-section of the National Longitudinal Survey of Youth (NLSY) and all three studies found evidence that, rather than reduce wages as theory predicts, drug use increases wages.[3] The estimated magnitudes of the wage effects are quite large. For example, Kaestner (1991) estimates that males who have tried cannabis earn 18% more than otherwise similar males who have not tried cannabis, Register and Williams (1992) estimate that using cannabis on one more occasion per

[2] Similarly, individuals with strong preferences for leisure may also be more likely to use drugs if drug use and leisure are complements in the production of euphoria. Such a relationship would produce a negative correlation between drug use and labour supply even in the absence of a causal effect of drug use on labour supply.

[3] Register and Williams (1992) used data on 18–26 year olds. Kaestner (1991) found that for males, drug use measured as past 30 day use of cannabis, lifetime use of cannabis, past 30 day use of cocaine, or lifetime use of cocaine, raises hourly wages. Similarly, male wages are found to be increasing in the frequency of cannabis use in the past 30 days by Register and Williams (1992). Gill and Michaels (1992) report that the use of any drugs in the past year or any hard drugs (cocaine, heroin, inhalants, psychedelics, other drugs, other narcotics) in the past year increases the hourly wage rate received in a combined sample of males and females.

month increases hourly wages by 5%, and Gill and Michaels (1992) find that drug users earn about 4% more per hour than non-users, and that hard drug users earn about 10% more per hour than non-hard drug users.[4]

The findings of these studies also present some interesting anomalies. For example, while past month cannabis use was found to increase male wages by Register and Williams (1992), past month cocaine use was found to have no significant impact by these authors. Kaestner (1991), however, did find a positive wage effect of past month cocaine (and cannabis) use for males, but not females. Similarly, the findings regarding the impact of drug use on employment present some inconsistencies. For example, while the use of cannabis in the past 30 days (Register and Williams, 1992) and the use of any drugs in the past 12 months (Gill and Michaels, 1992) is found to reduce the probability of current employment, the use of cocaine in the past 30 days (Register and Williams, 1992) and the use of hard drugs in the past 12 months (Gill and Michaels, 1992) is found to have no significant impact on current employment status.

Kaestner (1994a,b) uses the 1984 and 1988 waves of the NLSY to compare cross-sectional and longitudinal estimates of the impact of cocaine and cannabis use on labour supply and wages, respectively. He finds that the results based on the 1984 data, which show that cannabis and cocaine use increases wages and cannabis use decreases hours spent working in the sample of males, cannot be replicated using the 1988 data. Moreover, when unobserved differences that affect drug use and labour market outcomes are controlled for through a fixed effect estimator, drug use is found to have a negative but insignificant impact on wages for males (Kaestner, 1994b), and mixed, although generally insignificant, effects on hours worked (Kaestner, 1994a). The overall conclusion reached by Kaestner is that drug use does not have a systematic impact on labour supply or wages.

2.2. Second Wave Studies

The counter-intuitive and inconsistent findings of the above studies motivated a second wave of economic research into the impact of drug use on wages and labour supply. This wave of studies, defined as those studies published from 1998 onwards, generally seek to improve on the earlier work in one or more of the following three main ways. First, they may seek to determine whether there is a dose-response relationship between drug use and labour market outcomes (Buchmueller and Zuvekas, 1998, Zuvekas et al., 2005, French et al., 2001, Zarkin et al., 1998, French et al., 1998, Burgess and Propper, 1998). Many argue that unlike heavy or chronic drug use, low or moderate drug use is unlikely to cause harm, and it is therefore important to distinguish between different intensities of use when examining the impact of drug use on labour market outcomes. Second, these studies often raise the issue of timing (Buchmueller and Zuvekas, 1998, Zuvekas et al., 2005, Burgess and Propper, 1998). For example, Buchmueller and Zuvekas (1998) ask, if heavy drug use lowers productivity, is its effect immediate? Or is only persistent long term use harmful? Even if its effect is immediate, it may take time for an employer to notice and to take action. Consequently, any effects of heavy use may be more apparent in samples of older people. In order to assess the possibility that there are delayed or cumulative effects of drug use on labour market outcomes, data sources other than the NLSY that include older individuals are typically used. There have

[4] Moreover, both Kaestner (1991) and Gill and Michaels (1992) report that the premiums for drug use are attributable to unobserved differences between the users and non-users and not differences in returns to human capital and other characteristics.

also been efforts to separate out the effects of past from current drug use (MacDonald and Pudney, 2000a,b, 2001, Van Ours, 2005, 2006). The third issue addressed by some of the second wave of studies is the issue of the identification of the causal impact of drug use. Approaches to this issue include: using lifetime rather than current drug use as a way of minimizing the problem of reverse causality (Buchmueller and Zuvekas, 1998, Zuvekas et al., 2005, Burgess and Propper, 1998); using clinical definitions of drug abuse (Buchmueller and Zuvekas, 1998, Zuvekas et al., 2005);[5] looking more carefully at the economic and statistical merits of instruments (DeSimone, 2002, Van Ours, 2005); and using alternative econometric models that do not require exclusion restrictions for identification (Van Ours, 2006).

Taken at face value, most of the second wave studies tend to find evidence that non-problematic use of drugs (light to moderate use, or the use of soft drugs) has no impact on labour supply, measured by employment or hours worked, but that problematic use (heavy use, or the use of hard drugs) does, although Burgess and Propper (1998), DeSimone (2002), Zarkin et al. (1998) and Van Ours (2006) provide counter-examples. Similarly, most of the second wave studies find that infrequent or non-problematic drug use has no impact on wages, whereas problematic use does have negative wage effects. Once again, there are also exceptions to this generalization, such as Zuvekas et al. (2005) and MacDonald and Pudney (2000a,b, 2001). It is noteworthy that many of these studies (especially those based on US data) tend to treat drug use as exogenous to labour market outcomes. Some suggest that the use of clinical definitions mitigate biases, others report that a Hausman type test failed to detect endogeneity without providing information on the statistical adequacy of their instruments. This treatment of drug use as exogenous is somewhat perplexing given that the formalized theoretical models proposed by the first wave studies make it clear that, at a minimum, simultaneity is a source of bias in models which seek to assess the causal impact of drug use on labour market outcomes.

Focusing on the studies that are more rigorous in their efforts to address the endogeneity of drug use, the results are mixed. For example, while Van Ours (2005) finds that using cannabis at least 25 times in one's lifetime reduces the wage of prime age males, the use of cocaine is found to have no effect, and MacDonald and Pudney (2000a,b, 2001) are unable to detect any impact of either hard or soft drug use on their proxy for wages, occupational attainment. Similarly, with respect to the employment of males, DeSimone (2002) finds that both past year cannabis and cocaine use reduces the probability of employment, whereas, MacDonald and Pudney (2000a,b, 2001) find no employment impact of soft drug use (which includes cannabis) and Van Ours (2006) finds no impact of cannabis or cocaine use on employment.

Given the conflicted nature of the empirical findings, it is simply uncertain as to whether there are negative labour market consequences of drug use in general, and cannabis use in particular. Furthermore, it is unclear as to whether this literature should be interpreted as reflecting a lack of robust evidence of a negative health effect of drug use, or as reflecting the presence of a productivity improving effect of drug use that is confounding the negative health effects. In order to gain some insights into this issue, this paper seeks to directly determine the impact of cannabis use on health.

[5] While not eliminating biases associated with the reverse causality of drug use, the authors argue that the issue is mitigated because a person's psychological response should be less influenced by income than measures such as frequency of use.

3. Cannabis and Health in Australia

3.1. Cannabis Policy in Australia

The legal environment surrounding cannabis use varies across Australia's eight states and territories. South Australia, Western Australia, the Australian Capital Territory and the Northern Territory have decriminalized cannabis use, adopting a system of cannabis expiation or infringement notices. South Australia was the first to adopt this system, introducing it in 1987. The Australian Capital Territory followed suit in 1992, the Northern Territory in 1997, and Western Australia in 2004. Under this system, it is still an offence to use, possess, or grow cannabis for personal use, but (for small quantities) the offence is punishable by payment of a fine, with no conviction recorded if the fine is paid.

Where decriminalization has not been legislated, most states have reduced penalties for minor cannabis offences. Cannabis cautioning programs have been introduced in Victoria, Tasmania, and New South Wales. These programs do not require legislative changes. Rather, they are based on a change to policy that allows police officers to exercise discretion in the use of a caution (rather than an arrest) for possession of small amounts of cannabis for personal use.[6]

3.2. Data Sources

This research draws on individual level data on health and substance use collected in the 2001 and 2004 waves of the Australian National Drug Strategy's Household Survey (NDSHS).[7] The NDSHS provides information on the extent of drug use by the non-institutionalized civilian population. The 2001 survey covers the Australian population aged 14 years and over while the 2004 survey covers the population aged 12 years and over. Both surveys employ a stratified multi-stage sampling frame, where stratification is based on region of residence. While there are differences in questions asked across the two waves of the survey, the outcomes studied in this research are consistently collected across time. This individual level data is augmented with information on state level legislation governing cigarette and cannabis use, and information on health services provided by the government (Medicare Statistics, various issues).[8]

The outcomes of interest for our analyses are the potentially health damaging activities of cigarette and cannabis use, and measures that reflect the health impact of these activities: the respondent's self-assessed health status and whether the respondent visited a doctor in the past year. Although the NDSHS is the only survey of drug use that is representative of the Australian population, it is subject to limitations. For example, those who are contacted may be reluctant to take part in the survey, or may not respond truthfully about using cannabis for fear of legal consequences of admitting an illegal act. It is difficult to get a sense of the extent to which this is an issue in these data, given the absence of an alternative Australian survey for comparison. However, a study from the US that compared responses on self-reported drug use in the NLSY

[6] Queensland has adopted the Police Diversion Program. Under this program, eligible offenders charged with possession of 50 grams or less of cannabis will be required to admit guilt and agree to undertake a drug assessment or brief intervention that includes an education program.

[7] The survey was also conducted in 1985, 1988, 1991, 1993, and 1995. However, only the two most recent waves collected information on self-assessed health status and for this reason our analysis is based on these surveys only.

[8] The state level data on smoking restrictions are from Buddelmeyer and Wilkins (2005) and information on the legal status of cannabis is updated from Williams (2004).

with a survey that was taken anonymously without interviewers finds no evidence of under-reporting of current cannabis use (Mensch and Kandel, 1988).[9]

Self-assessed health status is an increasingly used measure in empirical studies of health (see, for example, Deaton and Paxson (1998), Case et al. (2002) and Currie and Stabile (2003)). Its use is supported by a literature that shows that it is a good predictor of subsequent morbidity and mortality (see, for example, Idler and Angel (1990), Idler and Kasl (1995), Idler and Benyamini (1997) and van Doorslaer and Gerdtham (2003)). Nonetheless, there is some evidence that: (1) responses to self-assessed health questions are sensitive to the mode of administration of the questionnaire and question order, and (2) there may be measurement error or uncertainty in individual's assessment of their health (Crossley and Kennedy, 2002). We note, however, that the first issue is largely a problem for comparing the distributions of self-assessed health across different surveys, while the second issue presents a problem for estimation in models that treat health as a right-hand-side variable.

The sample used in estimation is limited to respondents between the ages of 20 and 50 years of age. We do not consider those aged less than twenty because of concerns about differences in the way children and youth report on their health status compared to adults. Those over the age of 50 are dropped from the sample because cannabis use is quite rare amongst older age groups.

3.3. Self-Assessed Health Status and Use of Doctors Services

Our primary measure of health is self-assessed health status. In the 2001 and 2004 waves of the NDSHS, respondents are asked to rank their general health on a five point scale where a one corresponds to excellent health and a five corresponds to poor health. In the combined sample of respondents aged 20–50 years old used in the analysis, 17% report being in excellent health, 40% report having very good health, 33% report being in good health, 8% in fair health and 1% report being in poor health. They were also asked when they last consulted a doctor about any injury of illness. Possible responses are: less than 3 months ago (44%), between 3 and 6 months ago (18%), between 6 and 12 month ago (16%), more than 12 months ago (20%) and never been to the doctors ($< 1\%$). From these measures of health, we construct binary indicators for being in excellent or very good health, and for not having consulted a doctor for injury or illness in the past year.

Table I provides a joint frequency distribution of self-assessed health status against the respondent's visits to the doctor in the past year. It shows that the probability of visiting a doctor is a decreasing function of self-assessed health status. For example, 96% (243/253) of those who assessed their health as poor visited the doctor in the past year compared to 67% (2324/3453) of those who assessed their health as excellent.

One can also infer from Table I conditional distributions for self-assessed health status amongst those who did and did not visit a doctor in the past 12 months, respectively. The two distributions have similar profiles. For example, the probability of being in excellent health is smaller than the probability of being in very good health for each group. However, the self-assessed health of those who did not visit a doctor appears to be better than that of those who did, with 27% (1129/4179) of those who did not visit a doctor reporting excellent health compared to 15% (2324/15773)

[9] They did, however, find under-reporting in the use of drugs other than cannabis. This under-reporting was concentrated among individuals who claimed to have only been experimental drug users. We note that since we are looking at individuals aged 20-50, and initiation into cannabis use (or cigarette use) is uncommon in this age group, we are unlikely to encounter this type of under-reporting.

Table I. Joint Frequency Distribution of Visits to Doctor and Self-Assessed Health Status

Self-Assessed Heath Status	Visited Doctor in Past Year Yes	No	Total
Excellent	2324	1129	3453
Very Good	6271	1691	7962
Good	5480	1149	6629
Fair	1455	200	1655
Poor	243	10	253
Total	15773	4179	19952

of those who did. Overall, the information in Table I indicates that good health is associated with fewer visits to the doctor. This suggests that self-assessed health is indeed informative about a person's overall health.

3.4. Use of Cannabis and Cigarettes

For those who report having used cannabis in their lifetime, the NDSHS asks respondents whether they have used cannabis in the last 12 months, and if they have, whether they used it (in the last month and) in the last week. For cigarettes the questionnaire enquires as to whether respondents have ever tried smoking, and if so whether they have ever smoked a full cigarette, whether they have smoked 100 cigarettes in their lifetime, and if so whether they have ever smoked on a daily basis, with currently smoking on a daily basis as one of the categories for response (more than 85% of current smokers are daily smokers). Table II provides information on the distribution of respondent's use of cigarettes and cannabis. We see that 58% ((7619 + 2198 + 1729)/19970) of 20–50 year old respondents in the combined 2001 and 2004 surveys have used cannabis at some stage in their lifetime, nearly 20% ((2198 + 1729)/19970) of respondents have used cannabis in the past year, and almost 9% (1729/19970) have used cannabis in the past week. By comparison, approximately 55% ((970 + 5198 + 4869)/19970) of respondents report having smoked at least 100 cigarettes in their life-time, with 50% having smoked daily at some point in their life and 24% currently smoking daily. This higher retention rate for cigarette smokers suggests that cigarettes are more addictive than cannabis.

Table II is also informative about respondents' joint use of cannabis and cigarettes. For example, conditional on having used cannabis at some point, 32% (4869/11546) currently smoke cigarettes daily, whereas only 14% (1166/8424) of those who have never used cannabis smoke cigarettes daily. This effect becomes stronger when the comparison is based on higher intensities of cannabis use. Conditional on using cannabis at any time in the past year or just in the past week, the probability of currently smoking cigarettes daily is 0.46 (1793/3927) and 0.59 (1019/1729), respectively. The information in Table II makes clear the importance of accounting for cigarette use when examining the health impacts of cannabis use.

Table II. Joint Distributions of Cannabis and Cigarette Use

Cigarette Use	Cannabis Use				Total
	Never	Lifetime[a]	Past Year[b]	Past Week[c]	
Never	4025	1000	233	95	5353
> 0 but < 100[d]	1620	1472	368	120	3580
> 100[d]	254	481	156	79	970
Ever Daily[e]	1359	2756	667	416	5198
Currently Daily[f]	1166	1910	774	1019	4869
Total	8424	7619	2198	1729	19970

[a]Has used cannabis but not in the past year.
[b]Has used cannabis in the past year but not in the past week.
[c]Has used cannabis in the past week.
[d]Lifetime cigarette use, never a daily smoker.
[e]Lifetime use exceeds 100 cigarettes. Previously a daily smoker but not one currently.
[f]Currently a daily smoker, lifetime use exceeds 100 cigarettes.

3.5. Characteristics of the Full Sample, of Cannabis Users, and of Cigarette Smokers

Tables III and IV contain mean responses for the full sample and for the sub-samples of weekly cannabis users and current daily cigarette smokers. In terms of the measures of health, Table III shows that while 57% of the full sample report being in excellent or very good health, only 41% of weekly cannabis users and 38% of daily cigarettes smokers report excellent or very good health status. The proportion of those who report not visiting a doctor in the past year does not vary across the three samples.

Tables III and IV also show that weekly cannabis users are younger, more likely to be male, and are less likely to have children of any age compared to the full sample, and the sub-sample of daily smokers. Both daily cigarette smokers and weekly cannabis users are less likely to be married, more likely to be divorced, live in smaller households, are less educated, and have a lower household income than a typical person from the full sample.

3.6. The Full Price of Substance Use

An important determinant of the decision to consume cannabis or cigarettes is the full price of use. The full price of a good includes all money and non-money components of price. In the case of cannabis, we attempt to account for the full price using (i) a measure of the risk associated with engaging in an illegal activity, being an indicator for cannabis consumption being decriminalised in the respondent's state of residence, (ii) the time cost of obtaining an illicit substance being an indicator for the respondent believing that cannabis is easy to obtain, and (iii) factors that may affect opportunities or attitudes to cannabis use, as measured by the life-cycle variables 'married with children' and 'living in a single parent household', where in each case the parents are living with their child(ren). As information on the state level money price of cannabis is extremely sparse for 2004, we do not account for this aspect of price in the analysis.

We measure the full price of cigarette use by (i) the ease with which cigarettes may be consumed, which is proxied by an index of the number and severity of state level smoking restrictions in the respondents state of residence, (ii) the external cost of smoking, measured by an indicator equal to one if the respondent considers that

Table III. Sample Averages for Indicator Variables

Description (Symbol)[a]	Means		
	Full sample	Weekly cannabis users	Daily smokers
Used cannabis in past week (canw)	0.09	1.00	0.21
Used cannabis in past year (cany)[b]	0.20	1.00	0.37
Use cigarettes daily now (cig)	0.24	0.59	1.00
Self-assessed health excellent or very good (health)	0.57	0.41	0.38
No visit to doctor in past year (nvdy)	0.21	0.21	0.21
Respondent is male (male)	0.44	0.60	0.46
Respondent is Aboriginal (aboriginal)	0.01	0.03	0.03
Respondent is Australian born (oz-born)	0.80	0.83	0.82
Respondent is married (married)	0.63	0.43	0.52
Respondent is divorced (divorced)	0.11	0.14	0.17
Has kids aged 0–2 years (kids 0–2)	0.18	0.14	0.16
Has kids aged 3–5 years (kids 3–5)	0.18	0.15	0.17
Has kids aged 6–8 years (kids 6–8)	0.17	0.13	0.17
Has kids aged 9–11 years (kids 9-11)	0.16	0.13	0.16
Has kids aged 12–14 years (kids 12–14)	0.12	0.09	0.12
Has kids aged 15 years or older (kids $\geq$ 15)	0.10	0.05	0.09
Postgraduate degree (postgrad)	0.09	0.04	0.04
Undergraduate degree (undergrad)	0.17	0.10	0.08
Diploma (diploma)	0.10	0.09	0.09
Certificate (certificate)	0.25	0.31	0.31
High school graduate (year 12)	0.13	0.14	0.14
Secondary school student (school)	0.06	0.07	0.05
No post-primary school qualifications (npq)	0.19	0.25	0.30
Bottom quintile of SEDI (sedi1)[c]	0.14	0.17	0.19
Second quintile of SEDI (sedi2)[c]	0.20	0.20	0.24
Third quintile of SEDI (sedi3)[c]	0.18	0.20	0.20
Fourth quintile of SEDI (sedi4)[c]	0.20	0.18	0.17
Lives in a capital city (capital)	0.67	0.65	0.62
Cannabis use decriminalized in state (decrim)	0.25	0.29	0.24
Think cannabis easy to get (easytoget)	0.67	0.96	0.80
Think mixing with smokers bad for health (swsdhp)	0.86	0.76	0.69
Couple with kids (couplekids)	0.50	0.35	0.42
Single with kids (singlekids)	0.12	0.16	0.17
No kids (nokids)	0.37	0.50	0.40
Sample size (N)	19970	1729	4869

[a]Indicator variables equal 1 if definition met and zero otherwise.
[b]This variable includes individuals who have used cannabis in the past week.
[c]SEDI denotes an index of socio-economic disadvantage.

Table IV. Sample Averages for Non-indicator Variables

Description (Symbol)	Means		
	Full sample	Weekly cannabis users	Daily smokers
Age (age)	35.39	32.73	35.03
Log of household size (log(size))	1.02	0.90	0.96
Log of household income (log(income))	7.04	6.79	6.79
Index of number and severity of state restrictions on cigarette smoking (smokelaw3)	13.07	12.83	12.94
Number of health services per capita (nhspc)	8.99	8.51	8.87
Percent bulk-billed (bulkbill)	71.02	70.50	70.92
Sample size (N)	19970	1729	4869

socialising with smokers will lead to the development of health problems, and (iii) the impact of social norms and attitudes to smoking, which is proxied by belonging to a single parent household or being married with children. The use of single parent status, for example, is designed to capture differences over and above the effect of household income in attitudes to smoking across socio-economic groups and hence the cost of social sanctions. As cigarettes taxes are uniform across Australian states from October 1996, there is no inter-state variation in cigarette prices over the time period under consideration and for this reason we are unable to account for the money price of cigarettes in the analysis that follows.

In terms of the full price of cannabis and cigarettes use, Tables III and IV indicate that on average, weekly cannabis users are more likely to live in a state that has decriminalized use compared to a person from the full sample. Both cannabis users and cigarettes smokers are more likely to believe that cannabis is easy to obtain compared to a typical person from the full sample. They are also more likely to live in a state with fewer smoking restrictions and are less likely to believe that socializing with smokers (second-hand smoking) will lead to the development of health problems. On average, cannabis users and cigarette smokers are less likely to belong to a household which is a couple with children, and more likely to belong to a single parent household (with children present), or a household in which there are no children present.

4. Conceptual and Econometric Framework

Presumably most people use cannabis and cigarettes because of utility they derive from the euphoria their consumption induces. While infrequent, low level substance use may be unlikely to cause significant harm, it is well established that long-term, high-intensity use of either cigarettes or cannabis is harmful to one's health. Smoking has been identified as a major cause of heart disease, stroke, several different forms of cancer and a wide variety of other health problems including emphysema and chronic bronchitis (US Department of Health and Human Services, 1989).[10] The health effects

[10] It is worth pointing out that the ill effects of cigarette smoking are not suffered exclusively in old age. Cancers may begin to occur in people aged in their 30's if initiation occurred 15–20 years

of daily cannabis use over many years include respiratory diseases such as chronic bronchitis and an increased risk of cancers of the aero-digestive system (Hall and Pacula, 2003). There is also speculation of a causal relationship between psychological diseases such as schizophrenia and youthful cannabis use. The medical literature on this issue appears somewhat divided. For example, in their systematic review of general population longitudinal studies, Macleod et al. (2004) concluded that cannabis use is inconsistently associated with psychological problems, and hence there is insufficient evidence to conclude a causal relationship exists. In contrast, a review of the literature by Kalant (2004) concludes that there is stronger evidence suggestive of cannabis use producing psychiatric disorders, including schizophrenia, than of these disorders contributing to cannabis use. This is clearly an area in which further research is needed. While the focus of this paper is on the physical, rather than psychological, health effects of cannabis use, we acknowledge that any psychological effects are likely to impact on the way individuals assess their overall health status. To the extent that this occurs one might expect our estimates of the health effects of cannabis use to be affected.

4.1. Conceptual Framework

The conceptual framework that we use is an adaptation of the Rosenzweig and Schultz (1983) model for the production of health. We assume the health cost of substance use (both cigarettes and cannabis), along with the cost of acquiring the substance, is traded off against the utility associated with their consumption. More specifically, we assume that individuals maximize a concave, twice differentiable utility function that depends on a vector of health 'bads', b, a composite commodity, z, and their stock of health capital, h, representing the utility benefits of feeling well:[11]

$$U = U(b, z, h).$$

The utility function is assumed to be separable in the composite commodity, z. The health production function has the form

$$h = \Gamma(b, g, \mu; X), \tag{1}$$

where g represents a vector of 'good' health inputs, such as medical services, μ represents individual specific health endowments such as genetic traits or environmental factors that are observed by the individual but unobserved by the econometrician, and X represents observed characteristics that impact on an individual's production of health, such as education, age and gender. We assume that, although no utility is directly derived from their consumption, the 'good' health inputs provide indirect utility through augmenting health capital. Conversely, in addition to their direct effects, the 'bad' health inputs effect utility indirectly through the reduction of health capital.

The budget constraint is given by

$$F = p_z z + p_b' b + p_g' g,$$

where F is exogenous money income and p_z, p_b and p_g represent the exogenous prices of z, b, and g, respectively.

prior. The influence of smoking on heart disease is much greater at younger ages, with 73% of deaths from coronary disease for the 35–44 year old age group attributable to smoking compared to 14% in the 75–84 year old age group. The toxic chemicals in cigarettes smoke damages the lung capacity and clearance function, resulting in increased coughs and respiratory infections amongst smokers. Smokers are generally less fit than non-smokers in terms of performing both endurance and short term exercises (Winstanley et al., 1995).

[11] For notational convenience we suppress the i subscripts distinguishing individuals.

Individuals are assumed to maximize their utility subject to their resource constraint and the technology for producing health. This yields reduced form demand functions for g, b, z and h of the generic form

$$d = d(p_z, p_b, p_g, F, \mu; X),$$

where (importantly) the levels of demand are seen to be functions of the individual specific health endowments μ. As we are interested in determining the relationship between health inputs and health, rather than estimating the reduced form demand for health, we focus hereafter on estimating the structural relationship described by the health production function (1).

4.2. Econometric Model

Assuming a linear technology for transforming inputs into health, the empirical specification for the structural health production function for the ith individual can be written as

$$h_i^* = \alpha_0 + \alpha_1 can_i^* + \alpha_2 cig_i^* + \alpha_3' g_i + \alpha_4' X_i + \eta_i,$$

where h_i^* represents latent health, and can_i^* and cig_i^* denote the actual levels of consumption of cannabis and cigarettes, respectively, with $\eta_i = \mu_i + \varepsilon_i$ being comprised of an individual specific unobservable health endowment, μ_i, and a random error, ε_i. As shown by Rosenzweig and Schultz (1983), estimation of the parameters of this production function is complicated by the presence of μ_i. Specifically, since the health inputs also depend upon μ_i, and are thus correlated with the unobserved component in the health production function, OLS is inconsistent for this model. Therefore, an estimator robust to endogenous regressors is required in order to consistently estimate the parameters of interest.

Turning attention to the reduced form equations for 'bad' health inputs, we note that the vast majority of people do not currently use cannabis nor do they smoke cigarettes. Therefore, linear demand models are not appropriate. In order to simplify the estimation strategy, we model demand using an indicator for weekly use of cannabis and an indicator for current daily use of cigarettes. Health status is modelled using an indicator taking the value unity when health is self-assessed as excellent or very good. Thus the model to be estimated is

$$\begin{aligned} h_i &= \alpha_0 + \alpha_1 can_i + \alpha_2 cig_i + \alpha_3' g_i + \alpha_4' X_i + \epsilon_i \\ can_i &= \gamma_0 + \gamma_1 pcan_i + \gamma_2 pcig_i + \gamma_3' pg_i + \gamma_4' X_i + \tau_i \qquad (2) \\ cig_i &= \beta_0 + \beta_1 pcan_i + \beta_2 pcig_i + \beta_3' pg_i + \beta_4' X_i + \phi_i \qquad (3) \end{aligned}$$

where

$$h_i = \begin{cases} 1, & \text{if } h_i^* > 0 \text{ (indicating very good or excellent health)} \\ 0, & \text{otherwise} \end{cases}$$

$$can_i = \begin{cases} 1, & \text{if } can_i^* > 0 \text{ (indicating smokes cannabis at least weekly)} \\ 0, & \text{otherwise} \end{cases}$$

$$cig_i = \begin{cases} 1, & \text{if } cig_i^* > 0 \text{ (indicating smokes cigarettes daily)} \\ 0, & \text{otherwise.} \end{cases}$$

Here $\epsilon_i = \mu_i + \upsilon_i$, $\tau_i = \mu_i + u_i$ and $\phi_i = \mu_i + \nu_i$, where the υ_i, u_i and ν_i are independent random errors but $\text{corr}(\epsilon_i, \tau_i) \neq 0$, $\text{corr}(\epsilon_i, \phi_i) \neq 0$ because of the presence of the μ_i.

The observed characteristics that we control for include gender, age, aboriginality, Australian born, marital status, presence of children (by child age-group), educational attainment, household size, household income, index of socio-economic disadvantage, an indicator for residing in a capital city, and an indicator for year of survey. While we have no individual level information on the inputs of health 'goods', we attempt to account for them using state level information on access to health services. Specifically, we use the number of government provided health services per capita and the proportion of doctors who bulk-bill in the respondent's state of residence. Bulk-billing refers to the act of directly billing the government for services provided by general practitioners (GP) to patients. Individuals who receive services from a GP who bulk-bills incur no out of pocket cost for those services.

In addition to the observed characteristics X_i, the reduced form demand equations for cannabis (2) and cigarettes (3) depend upon the full price of cannabis ($pcan_i$), the full price of cigarettes ($pcig_i$) and the full prices of the health 'goods' (pg_i). The full price of cannabis is measured by the legal status of cannabis use in the state in which the individual resides, whether cannabis is readily available (measured buy an indicator equal to one if the individual responds that he or she believes that cannabis is easy to get), and differences in attitudes to smoking across socio-economic groups (married with children, living in a single parent household). The full price of cigarette use is measured by an index of the number and severity of state level restrictions on smoking, views about second-hand smoke (indicator equal to one if the respondent believes that socializing with smokers will lead to the development of health problems), and measures of life-cycle factors that may affect opportunities or attitudes to substance use (married with children, living in a single parent household). Finally, the price of inputs of health 'goods' are proxied using information on access to health services.

4.3. Estimation Issues

The model is estimated using the two-step efficient generalized method of moments (GMM). This method has the advantage of relaxing the assumption of identically and independently distributed error terms required of instrumental variables (IV) or two stage least squares. This is important as we are using the linear probability model (LPM) as the basic econometric structure, and this model is inherently heteroskedastic.

Cannabis use and smoking cigarettes are treated as potentially endogenous in the health production function. Their endogeneity arises through unobserved heterogeneity that affects the production of health as well as the health inputs. The ability to estimate the causal impact of substance use on health therefore relies on the availability of variables that determine the demand for the health inputs that can be validly excluded from the health production function.

As variables measuring the full price of cannabis and cigarettes use determine demand for these substances, but do not directly impact on the production of health, these price measures identify the effects of these substances on health. Thus, the ability to estimate the causal impact of substance use on health relies on the validly of the restrictions excluding them from the health production function. Indicators for the legal status of cannabis use and cigarette smoking restrictions have a long history of being used to identify the effects of consuming these substances on various outcomes. This is justified because they contribute to the cost of use, and hence determine demand, but are not related to unobserved heterogeneity (in this case, health endowments). We also employ beliefs about the ease with which cannabis can be obtained, the dangers of second hand smoke and variables measuring household structure as identifying variables. The ease of obtaining cannabis reflects the expected time cost involved in obtaining the drug and hence the full cost of use. Similarly, believing that second-hand smoke endangers others health increases the expected full cost of smoking. Finally, attitudes to cigarettes and cannabis use may differ according to social circumstance and other life-cycle factors. We attempt to capture these differences in attitudes (and hence the cost of social sanctions) over and above the effect of household income by using indicators for single parent status and married with children present.[12] A natural concern associated with the use of attitudinal variables as instruments for health is the potential for reverse causality. In other words, in addition to attitudes affecting the choice of health inputs, the choice of health inputs may also affect attitudes. This would invalidate the attitudinal variables as instruments. In order to affirm the validity of the identification strategy, we conduct thorough specification tests of the full set of instruments as well as the subset of attitudinal variables.

If an IV procedure is to improve upon methodologies that treat drug use as exogenous it is vital that there exists a (sufficiently) strong correlation between the excluded instruments and the variables they are instrumenting. This is one aspect of IV-based inference that is frequently overlooked in empirical work, often because the paucity of available instruments provides a powerful disincentive to exploring the issue further. Unfortunately weak instruments have extremely deleterious effects on the sampling properties of IV estimators, inducing substantial bias in small samples and potentially rendering invalid standard forms of inference such as t tests and the construction of confidence intervals. Consequently, in our analysis we paid considerable attention to the strength of our instruments to ensure that our results are not subject to this problem, primarily through examination of the first-stage regression.

We also investigate whether health impacts of cannabis use increase with the frequency of use by estimating models in which cannabis use is defined as use in the last year. This measure includes infrequent as well as weekly users of cannabis. Finding smaller impacts from the broader class of users compared to weekly users will provide evidence of a dose-response relationship between cannabis use and harm. Finally, as a robustness check on the results based on using self-assessed health status, we investigate the relationship between substance use and doctors visits. In a country such as Australia, which has a universal health system in which visits to a general practitioner involve either no out of pocket or a small out of pocket expense, doctors visits may be a somewhat more objective measure of health.

5. Results

Our discussion will focus on the coefficient estimates of the impact of cannabis and cigarette use on health, and information about these estimates is summarized in Tables V and VI.[13] In Table V the dependent variable, health, is measured by an indicator for the respondent reporting their self-assessed health status as excellent or very good. The results presented in Table VI use an indicator of whether or not the individual has visited the doctor in the past year as a measure of health. For each of these measures of health we consider 5 specifications of the health production functions described in Section 4. In specifications 1 and 2 cannabis use means use in the week prior to survey, whereas in specifications 4 and 5 cannabis use denotes use in the twelve months prior

[12] Note also that, irrespective of marital status, having children reduces the amount of time available for recreational drugs use and hence raises the cost of use.

[13] A full set of results can be found in the Appendix in Tables IX–XVIII.

Table V. Coefficient Estimates for Substance Use as Determinants of Self-Assessed Health

Specification	Estimator	Cannabis Use[a]		Cigarette Use[b]	
		Estimate	Std Error	Estimate	Std Error
1	OLS	-0.0581	0.0127	-0.2010	0.0086
	GMM	-0.1815	0.1088	-0.2303	0.0438
2	OLS	-0.1230	0.0126	—	—
	GMM	-0.4649	0.0799	—	—
3	OLS	—	—	-0.2093	0.0084
	GMM	—	—	-0.2612	0.0032
4	OLS	-0.0306	0.0091	-0.2028	0.0086
	GMM	-0.0827	0.0464	-0.2395	0.0385
5	OLS	-0.0789	0.0091	—	—
	GMM	-0.2170	0.0366	—	—

[a]For specifications 1 and 2 cannabis use is defined to be use in the past week. For specifications 4 and 5 cannabis use is defined to be use any time in the past year, including use in the past week.
[b]A cigarette user here is defined to be currently a daily smoker.

Table VI. Coefficient Estimates for Substance Use as Determinants of Number of Doctor Visits

Specification	Estimator	Cannabis Use[a]		Cigarette Use[b]	
		Estimate	Std error	Estimate	Std error
1	OLS	-0.0080	0.0107	0.0014	0.0072
	GMM	-0.2224	0.0944	0.1078	0.0381
2	OLS	-0.0075	0.0105	—	—
	GMM	-0.1041	0.0675	—	—
3	OLS	—	—	0.0003	0.0070
	GMM	—	—	0.0649	0.0271
4	OLS	0.0073	0.0078	-0.0010	0.0072
	GMM	-0.0946	0.0400	0.0923	0.0332
5	OLS	0.0070	0.0076	—	—
	GMM	-0.0454	0.0311	—	—

[a]For specifications 1 and 2 cannabis use is defined to be use in the past week. For specifications 4 and 5 cannabis use is defined to be use any time in the past year, including use in the past week.
[b]A cigarette user here is defined to be currently a daily smoker.

to survey. In each case the measure of cannabis use is an indicator taking the value unity if the condition is met and zero otherwise. Specifications 1 and 4 account for the impact on health of both cigarette and cannabis use, specifications 2 and 5 ignore the impact of being a daily cigarette smoker when estimating the impact of past week and past year cannabis consumption on health, respectively, and specification 3 ignores the impact of cannabis use when measuring the impact of cigarette smoking on health.

For each of our specifications we report both OLS and GMM estimates. The former treat smoking and cannabis use as exogenous to health whereas the latter allow both cigarette smoking and cannabis use to be endogenous. The OLS results serve as a benchmark for judging the biases arising from failing to account for the endogeneity of cigarette smoking and cannabis use. Since the overall results for each of the specifications contained in Table V lead to the same qualitative conclusions, we will present a detailed discussion of the results for specification 1 only. This will be followed by an assessment of the evidence in support of a dose-response relationship in the health impact of cannabis use. This is done by comparing results based on weekly cannabis use with results based on cannabis use in the last year. We also examine the biases arising from taking a single substance approach to measuring health impacts of cannabis and cigarette use. First, however, we explore the validity and strength of the instruments used by the GMM estimators.

In Tables VII and VIII we present various diagnostic statistics, including the first-stage partial R^2's, denoted R_p^2, the F-statistic for testing the joint significance of the instruments, and a variety of statistics exploring the validity of the instruments. In this latter set are Hansen's J statistic, denoted J_1, for testing the validity of excluding the full set of instruments from the health production function and the C statistic which allows us to more carefully investigate whether the household structure variables (married couple with children present, single parent with children present) are improperly excluded from the health production functions.[14] We also report the Hansen J test, denoted J_2, of the remaining over-identifying restrictions. Finally, we conduct a Hausman test, H, for the endogeneity of the substance use variables in the health production function.

Focusing on specification 1, the first stage partial R^2's indicate that the instrumental variables included in the reduced form models for cannabis and cigarettes use explain around 3% and 8% of the variation in these outcomes, respectively. The (heteroskedasticity robust) F-statistic for the joint significance of the instruments in the weekly cannabis use and daily cigarette use equations are 158.87 and 248.43, respectively. Each of these leads to the conclusion that the instruments are jointly significant in their respective models and that weak instruments are unlikely to be a problem in this sample. The P-value associated with J_1 is 0.842, indicating that the exclusion restrictions cannot be rejected on the basis of these data at conventional levels of significance. Additionally, the C test has a P-value of 0.73 and so we are unable to reject the hypothesis that the full set of orthogonality conditions (including those associated with the household structure variables) are valid at the 5% level of significance. These results provide no evidence of weak instruments, nor any suggestion that the instruments are invalid. Consequently, GMM yields consistent estimates of the impact of endogenous substance use on self-assessed health status. Moreover, the Hausman test suggests that these estimates are preferred over the OLS estimates of the LPM.

5.1. Estimates of the Impact of Substance Use on Self-Assessed Health

A comparison of the point estimates from OLS and GMM in Table V reveals that the former tend to under-state the impact of substance use on health, particularly in the case of cannabis use. For example, the OLS estimates suggest that using cannabis weekly is associated with a 6 percentage point reduction in the probability of being in excellent or very good health compared to someone who uses it less often, whereas

[14] The test statistic, defined as the difference in the Hansen J test statistic from the model that uses the set of instruments not being investigated (valid under both the null and alternative hypotheses) and the model that uses the full set of instruments (including the instruments whose validity is suspect), is distributed as a chi-squared random variable with degrees of freedom equal to the number of instruments being investigated.

Table VII. Diagnostic Tests Accompanying Specifications in Table V

Speci-fication	Endogenous[a] Regressor	R_p^2	F	P[b]	H	P[c]	AR	P[d]	J_1	P[e]	J_2	P[f]	C	P[g]
1	canw	0.0292	158.87	0.000	3.62	0.027	101.08	0.000	1.413	0.842	0.776	0.679	0.637	0.727
	cig	0.0836	248.43	0.000										
2	canw	0.0242	228.06	0.000	19.07	0.000	36.53	0.000	2.029	0.566	1.056	0.304	0.973	0.615
3	cig	0.0707	271.65	0.000	2.95	0.086	68.42	0.000	0.467	0.926	0.288	0.591	0.179	0.915
4	cany	0.0640	345.48	0.000	3.57	0.028	100.99	0.000	1.133	0.889	0.543	0.762	0.590	0.744
	cig	0.0835	248.50	0.000										
5	cany	0.0591	500.48	0.000	15.23	0.000	36.67	0.000	1.319	0.725	0.557	0.456	0.762	0.683

[a]Variable descriptions in Tables III and IV.
[b]P-values based on the following distributions 1: F(6,19935), 2: F(4,19937), 3: F(4,19937), 4: F(6,19946), 5: F(4,19948)
[c]P-values based on the following distributions 1: F(2,19937), 2: F(1,19939), 3: F(1,19939), 4: F(2,19948), 5: F(1,19950)
[d]P-values for Anderson-Rubin test (AR) based on the χ_4^2 distribution for specifications 2, 3 and 5, and the χ_6^2 distribution for specifications 1 and 4.
[e]P-values for J_1 based on the χ_3^2 distribution for specifications 2, 3 and 5, and the χ_4^2 distribution for specifications 1 and 4.
[f]P-values for J_2 based on the χ_1^2 distribution for specifications 2, 3 and 5, and the χ_2^2 distribution for specifications 1 and 4.
[g]P-values for C based on the χ_2^2 distribution.

Table VIII. Diagnostic Tests Accompanying Specifications in Table VI

Specification	Endogenous[a] Regressor	R_p^2	F	P[b]	H	P[c]	AR	P[d]	J_1	P[e]	J_2	P[f]	C	P[g]
1	canw	0.0292	158.85	0.000	4.25	0.014	10.74	0.097	2.188	0.701	0.735	0.692	1.453	0.484
	cig	0.0837	248.43	0.000										
2	canw	0.0242	227.89	0.000	2.13	0.145	3.53	0.473	1.132	0.769	0.000	0.999	1.132	0.569
3	cig	0.0708	272.23	0.000	6.18	0.013	8.66	0.070	2.850	0.415	0.176	0.675	2.675	0.263
4	cany	0.0640	345.28	0.000	4.63	0.010	10.46	0.107	2.039	0.729	0.351	0.839	1.688	0.430
	cig	0.0836	248.69	0.000										
5	cany	0.0591	499.95	0.000	3.08	0.079	3.43	0.489	1.284	0.733	0.008	0.929	1.276	0.528

[a] Variable descriptions in Tables III and IV.
[b] P-values based on the following distributions 1: F(6,19921), 2: F(4,19923), 3: F(4,19923), 4: F(6,19932), 5: F(4,19934)
[c] P-values based on the following distributions 1: F(2,19923), 2: F(1,19925), 3: F(1,19925), 4: F(2,19934), 5: F(1,19936).
[d] P-values for Anderson-Rubin test (AR) based on the χ_4^2 distribution for specifications 2, 3 and 5, and the χ_6^2 distribution for specifications 1 and 4.
[e] P-values for J_1 based on the χ_3^2 distribution for specifications 2, 3 and 5, and the χ_4^2 distribution for specifications 1 and 4.
[f] P-values for J_2 based on the χ_1^2 distribution for specifications 2, 3 and 5, and the χ_2^2 distribution for specifications 1 and 4.
[g] P-values for C based on the χ_2^2 distribution.

the GMM results imply an 18 percentage point reduction (although this effect is only significant at the 10% level of significance). There is surprisingly little difference between the OLS and GMM point estimates of the impact of cigarette smoking on health status. The OLS results suggest smoking cigarettes daily reduces the probability of being in excellent or very good health by 20 percentage points, whereas the GMM estimates suggest that the magnitude of the effect is 23 percentage points. In Table VII we report the Anderson-Rubin (AR) test which is used to test the null hypothesis that the endogenous variables are jointly insignificant in the health production function. This test is robust to heteroskedasticity and the presence of weak instruments. The Anderson-Rubin test leads to the conclusion that the endogenous variables are jointly significant in the structural model of health.

The overall conclusion with regard to the statistical merits of the GMM estimates is not sensitive to measuring cannabis use by the broader measure of past year use, as shown by the results for specification 4. When we compare the estimated health impact of past year and past week cannabis use, we find that the adverse consequences of using cannabis are greater for weekly use (specification 1) than for use in the past year (specification 4). Specifically, while weekly use is estimated to reduce the probability of being in excellent or very good health by 18 percentage points, the impact of past year use is about half that, at 8 percentage points.[15] The relative magnitude of the coefficients for weekly and yearly use suggests that there is a dose-response relationship between cannabis use and health, such that the more frequently cannabis is used, the greater the harm incurred.

Specifications 2 and 5 estimate the impact of using cannabis in the past week and past year, respectively, ignoring the effect of cigarette smoking on health. Specification 3 estimates the impact of cigarette smoking ignoring the effects of cannabis use. As can be seen from the results in Table V, omitting either cigarette smoking or cannabis use from the health production function causes an upward bias in the estimated impact of the included substance on health. As shown by the GMM results for specification 3, the impact of omitting cannabis use is, however, quite small. For example, if the health effects of cannabis use are ignored, the GMM estimate indicates that daily smoking is associated with a 26 percentage point reduction in the probability of a person reporting excellent or good health. This effect falls to 23 percentage points when cannabis use is taken into account. In contrast, failing to account for the harmful effects of cigarette smoking leads to a large upward bias in the estimated heath impact of cannabis use. For example, if the health effects of cigarette smoking are ignored, the GMM estimate indicates that weekly cannabis use is associated with a 46 percentage point reduction in the probability of a person reporting excellent or good health. This effect falls to 18 percentage points when cigarette smoking is taken into account. This reflects the fact that the effect of cigarette smoking is being attributed to cannabis use.

5.2. Visits to the Doctor

We also examine the impact of cannabis and cigarettes use on the probability that a person has not visited a doctor in the past 12 months. The results are reported in Tables VI and VIII. The specifications are the same as those discussed earlier except

[15] When interpreting these numbers, it is important to remember that weekly and past year users are heterogeneous groups with respect to the frequency and intensity with which they use cannabis. The weekly use group is comprised of people ranging from those who smoke a single joint or bong once a week to those who smoke many joints or bongs daily. The variation in patterns of use is even greater amongst the annual user group, whose use ranges from one joint or bong per year to high intensity daily use.

for the definition of the dependent variable. Thus, the first stage reduced form models of substance use are the same as those reported above. However, since the sample size is slightly different when the dependent variable is an indicator for having not visited a doctor in the past 12 months (compared to reporting self-assessed health as excellent or very good), the first stage statistics are reported for the slightly smaller sample used in estimating this structural equation. The slight difference in sample size has no meaningful impact on the first stage statistics and so, as above, we conclude that that the issue of weak instruments is unlikely to be a problem in this sample. As with the specifications in Table V, the validity of the full set of exclusion restrictions is supported by the data for all specifications reported in Table VI.

Focusing for the moment on specification 1, the Hausman test finds sufficient evidence to conclude that substance use variables are jointly endogenous in the model of having no doctors visits in the past 12 months (at the 5% level of significance). This implies that the OLS estimator of the LPM is biased and inconsistent. A comparison of the OLS and GMM estimates reveals that the OLS estimates of the impact on going to the doctors of smoking cigarettes daily and using cannabis weekly are downward biased in absolute magnitude. In fact, they are close to zero and statistically insignificant for both cigarette and cannabis use. The GMM estimates, on the other hand, suggest that using cannabis weekly reduces by approximately 22 percentage points the probability of not having visited a doctor during the past year. Surprisingly however, daily smokers are estimated to be 11 percentage points more likely to have no doctor visits in the past year compared to a non-smoker (or someone who smokes less frequently than daily). We can only speculate as to what underlies this counter-intuitive result. It is possible that smokers may not go to a doctor when they are ill in order to avoid a lecture on the dangerous health consequences of smoking. Equally, minor ailments such as coughs and bronchitis may be so common amongst daily smokers that ill health may be a much more normal state. Consequently, they may be less likely than non-smokers to visit a doctor for any given illness. However, given that the Anderson-Rubin test leads to the conclusion that the endogenous variables are not jointly significant in the structural model for not visiting the doctor at the 5% level, we do not attach much weight to these results.

We investigated whether these findings are robust to the time interval considered. Specifically, we looked at the impact of substance use on visits to the doctor in the 3 months prior to survey. The findings did not differ qualitatively from those discussed above. We therefore conclude that these data provide no clear evidence of a relationship between either cannabis use or cigarettes use and whether a person visited a doctor.

As in the case of self-assessed health, the qualitative results for models in which the outcome of interest is no visits to a doctor in the past 12 months are not sensitive to whether cannabis use is measured by past week (specification 1) or past year use (specification 4), and the estimated impact of past year use is roughly half the magnitude of the estimated impact of weekly use. This is supportive of a dose-response relationship in the impact of cannabis use on the probability of visiting a doctor due to illness. However, as the Anderson-Rubin test fails to reject the null hypothesis that cannabis use in the past year and daily smoking is jointly insignificant in the model for not visiting a doctor, these results should be viewed with caution.

Finally, we turn to the single substance specifications of the impact of cannabis and cigarette use on the likelihood of not visiting a doctor (specifications 2, 3 and 5 in Table VI). Given that specifications 1 and 4 find that cigarettes and cannabis have opposite effects on the probability of no doctor visits, it is not surprising to see that the single substance specifications lead to downward biased estimates on the impact of substance use. What is perhaps most interesting in the terms of these specifications is the failure of the Hausman test to reject the exogeneity of cannabis use (measured as weekly or past year use) in the decision of whether or not to visit the doctor. If cannabis use is exogenous, then the OLS estimates of the LPM are preferred to the GMM estimates on efficiency grounds, and these estimates indicate that cannabis use has no significant impact on the decision to not visit a doctor. While the Hausman test for specification 3 leads to the conclusion that cigarette use is endogenous, and hence the GMM results are preferred to the OLS results, the Anderson-Rubin test fails to find a significant impact of smoking on whether a person visits a doctor in the preceding year.

6. Discussion

This paper investigates the health impact of cannabis use on self-assessed health status using information representative of prime age Australians. Given the high rate of cigarette smoking amongst cannabis users in our sample, we are careful to account for this behaviour so as to not improperly attribute the health effects of cigarette smoking to cannabis use. The potential correlation in unobserved characteristics that affect an individual's assessment of their overall health and their decision to consume cannabis and cigarettes is addressed using instrumental variable estimation. We examine the validity of the instruments using a battery of specification tests. Our results provide robust evidence that cannabis use has a detrimental effect on health. We also demonstrate the importance of accounting for cigarette use when estimating the impact of cannabis use on health by demonstrating the significant biases that arise from failing to do so. In specifications that do account for cigarette use, the estimated impact of weekly cannabis consumption on the probability of being in excellent or very good health is found to be of a similar magnitude to the effect of daily smoking. Our results also provide evidence consistent with a dose-response relationship in the health impact of cannabis use, with weekly use having roughly twice the effect of annual use.

Our findings have important implications for the way that we interpret the literature on the productivity effects of cannabis use. First, they provide evidence that cannabis use, measured as either as weekly or annual use, does have adverse health effects. Therefore, the failure in the literature to find robust evidence of negative productivity effects of cannabis use should not be taken as evidence that casual use of cannabis is not harmful to one's health. Second, they raise the issue of what the proper interpretation of the earlier findings might be. Apparently, the health effects of cannabis use are being confounded with some other effect (or effects) that mitigate the negative productivity effects associated with worse health. Understanding what these productivity enhancing effects might be remains an area for future research.

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Appendix

A. Regression Results

This appendix reports full-model regression results for the models summarized in Tables V and VI. In addition to OLS and GMM results we also report the results for the first stage regressions used in construction of the instruments for the GMM estimators. For each set of regression results we report here the coefficient estimates, their robust standard errors and the accompanying P-value. In addition, we also report the sample size, the (uncentred) R^2, and the F statistic used to test the null hypothesis that all slope coefficients are zero. Numerous other descriptive statistics for these equations are reported in Tables VII and VIII.

Table IX. Model For Self-Assessed Health: Specification 1

	OLS			GMM		
Variable[a]	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value
canw	-0.0581	0.0127	0.000	-0.1815	0.1088	0.095
cig	-0.2009	0.0086	0.000	-0.2303	0.0438	0.000
log(income)	0.0475	0.0053	0.000	0.0430	0.0056	0.000
log(size)	-0.0126	0.0110	0.252	-0.0115	0.0111	0.298
age	-0.0042	0.0005	0.000	-0.0046	0.0006	0.000
male	-0.0681	0.0070	0.000	-0.0599	0.0091	0.000
married	0.0350	0.0100	0.000	0.0262	0.0108	0.015
divorced	0.0361	0.0135	0.007	0.0367	0.0140	0.009
aboriginal	-0.0929	0.0290	0.001	-0.0799	0.0299	0.008
oz-born	0.0127	0.0086	0.139	0.0129	0.0086	0.135
postgrad	0.1302	0.0144	0.000	0.1178	0.0156	0.000
undergrad	0.1101	0.0121	0.000	0.0966	0.0137	0.000
diploma	0.0808	0.0134	0.000	0.0736	0.0139	0.000
certificate	0.0462	0.0106	0.000	0.0429	0.0108	0.000
year 12	0.0528	0.0126	0.000	0.0458	0.0130	0.000
school	0.0817	0.0167	0.000	0.0664	0.0179	0.000
kids 0–2	0.0240	0.0103	0.019	0.0208	0.0104	0.046
kids 3–5	0.0213	0.0100	0.034	0.0207	0.0101	0.039
kids 6–8	0.0163	0.0104	0.115	0.0147	0.0105	0.159
kids 9–11	0.0158	0.0108	0.141	0.0160	0.0108	0.138
kids 12–14	0.0220	0.0122	0.070	0.0229	0.0122	0.061
kids $\geq$ 15	0.0236	0.0129	0.067	0.0188	0.0132	0.153
capital	-0.0031	0.0080	0.698	-0.0032	0.0080	0.687
sedi1	-0.0464	0.0123	0.000	-0.0461	0.0129	0.000
sedi2	-0.0222	0.0110	0.043	-0.0236	0.0116	0.042
sedi3	-0.0286	0.0108	0.008	-0.0285	0.0112	0.011
sedi4	-0.0016	0.0102	0.873	-0.0028	0.0103	0.787
year	-0.0192	0.0024	0.000	-0.0188	0.0024	0.000
nhspc	-0.0004	0.0012	0.743	-0.0005	0.0012	0.673
bulkbill	0.0004	0.0004	0.370	0.0003	0.0004	0.470
intercept	38.8517	4.8709	0.000	38.0408	4.8967	0.000
N	19970			19970		
R^2	0.0837			0.0777		
F(30, 19939)	66.90		0.000	44.88		0.000

[a]Variable descriptions in Tables III and IV.

Table IX. Model For Self-Assessed Health: Specification 1 (continued)

	1st stage: canw			1st stage: cig		
Variable[a]	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value
log(income)	-0.0273	0.0032	0.000	-0.0402	0.0045	0.000
log(size)	0.0203	0.0076	0.008	0.0248	0.0103	0.016
age	-0.0019	0.0003	0.000	-0.0010	0.0004	0.024
male	0.0513	0.0041	0.000	0.0078	0.0058	0.179
married	-0.0476	0.0066	0.000	-0.0534	0.0088	0.000
divorced	-0.0168	0.0092	0.068	0.0488	0.0128	0.000
aboriginal	0.0643	0.0223	0.004	0.0894	0.0282	0.002
oz-born	-0.0040	0.0047	0.395	-0.0130	0.0070	0.065
postgrad	-0.0399	0.0074	0.000	-0.1832	0.0109	0.000
undergrad	-0.0460	0.0067	0.000	-0.1892	0.0098	0.000
diploma	-0.0242	0.0076	0.001	-0.1013	0.0116	0.000
certificate	-0.0116	0.0066	0.078	-0.0526	0.0097	0.000
year 12	-0.0250	0.0075	0.001	-0.0918	0.0110	0.000
school	-0.0665	0.0101	0.000	-0.1980	0.0139	0.000
kids 0–2	-0.0132	0.0058	0.023	-0.0155	0.0087	0.074
kids 3–5	-0.0005	0.0055	0.931	0.0006	0.0083	0.939
kids 6–8	-0.0074	0.0056	0.188	-0.0044	0.0086	0.610
kids 9–11	0.0038	0.0059	0.517	0.0049	0.0090	0.587
kids 12–14	0.0096	0.0064	0.132	0.0054	0.0101	0.593
kids $\geq$ 15	-0.0264	0.0062	0.000	-0.0184	0.0105	0.080
capital	0.0019	0.0047	0.681	0.0088	0.0070	0.205
sedi1	-0.0142	0.0073	0.050	0.0538	0.0105	0.000
sedi2	-0.0209	0.0063	0.001	0.0381	0.0091	0.000
sedi3	-0.0105	0.0063	0.097	0.0366	0.0089	0.000
sedi4	-0.0134	0.0057	0.018	0.0095	0.0080	0.234
year	0.0026	0.0015	0.091	0.0017	0.0022	0.456
nhspc	-0.0006	0.0007	0.449	-0.0021	0.0010	0.043
bulkbill	0.0003	0.0003	0.318	-0.0011	0.0004	0.015
smokelaw3	-0.0015	0.0007	0.022	-0.0011	0.0009	0.225
swsdhp	-0.0558	0.0070	0.000	-0.3148	0.0098	0.000
couplekids	-0.0227	0.0061	0.000	-0.0268	0.0089	0.002
singlekids	-0.0167	0.0084	0.045	0.0067	0.0118	0.572
decrim	0.0135	0.0060	0.026	-0.0120	0.0086	0.163
easytoget	0.0902	0.0031	0.000	0.1046	0.0058	0.000
intercept	-4.8027	3.0665	0.117	-2.3871	4.5023	0.596
N	19970			19970		
R^2	0.0768			0.1602		
F(34, 19935)	46.60		0.000	117.12		0.000

[a]Variable descriptions in Tables III and IV.

Table X. Model For Self-Assessed Health: Specification 2

Variable[a]	OLS Estimates $\hat{\beta}$	OLS SE($\hat{\beta}$)	OLS P-value	GMM Estimates $\hat{\beta}$	GMM SE($\hat{\beta}$)	GMM P-value	1st-Stage: canw $\hat{\beta}$	1st-Stage SE($\hat{\beta}$)	1st-Stage P-value
canw	-0.1230	0.0126	0.000	-0.4649	0.0799	0.000	—	—	—
cig	—	—	—	—	—	—	—	—	—
log(income)	0.0548	0.0054	0.000	0.0460	0.0058	0.000	-0.0285	0.0032	0.000
log(size)	-0.0140	0.0112	0.211	-0.0116	0.0114	0.311	0.0197	0.0077	0.010
age	-0.0040	0.0005	0.000	-0.0050	0.0006	0.000	-0.0018	0.0003	0.000
male	-0.0690	0.0071	0.000	-0.0482	0.0087	0.000	0.0525	0.0041	0.000
married	0.0462	0.0101	0.000	0.0277	0.0112	0.014	-0.0488	0.0066	0.000
divorced	0.0233	0.0137	0.090	0.0198	0.0142	0.164	-0.0173	0.0092	0.061
aboriginal	-0.1104	0.0286	0.000	-0.0831	0.0306	0.007	0.0664	0.0223	0.003
oz-born	0.0141	0.0087	0.106	0.0150	0.0089	0.091	-0.0045	0.0047	0.332
postgrad	0.1703	0.0145	0.000	0.1531	0.0152	0.000	-0.0450	0.0074	0.000
undergrad	0.1512	0.0122	0.000	0.1318	0.0132	0.000	-0.0510	0.0067	0.000
diploma	0.1039	0.0135	0.000	0.0936	0.0140	0.000	-0.0280	0.0076	0.000
certificate	0.0581	0.0107	0.000	0.0538	0.0110	0.000	-0.0141	0.0066	0.033
year 12	0.0731	0.0127	0.000	0.0629	0.0131	0.000	-0.0277	0.0075	0.000
school	0.1210	0.0168	0.000	0.0963	0.0182	0.000	-0.0702	0.0102	0.000
kids 0–2	0.0274	0.0104	0.008	0.0204	0.0107	0.056	-0.0131	0.0058	0.024
kids 3–5	0.0222	0.0102	0.029	0.0209	0.0104	0.044	-0.0011	0.0056	0.850
kids 6–8	0.0170	0.0105	0.105	0.0130	0.0107	0.223	-0.0069	0.0056	0.218
kids 9–11	0.0159	0.0109	0.148	0.0164	0.0111	0.140	0.0030	0.0059	0.608
kids 12–14	0.0216	0.0124	0.082	0.0234	0.0136	0.064	0.0104	0.0064	0.103
kids $\geq$ 15	0.0271	0.0131	0.038	0.0161	0.0135	0.233	-0.0272	0.0062	0.000
capital	-0.0046	0.0081	0.568	-0.0056	0.0082	0.499	0.0015	0.0047	0.757
sedi1	-0.0592	0.0124	0.000	-0.0630	0.0127	0.000	-0.0128	0.0073	0.078
sedi2	-0.0317	0.0112	0.005	-0.0386	0.0115	0.001	-0.0206	0.0063	0.001
sedi3	-0.0371	0.0110	0.001	-0.0398	0.0112	0.000	-0.0102	0.0064	0.110
sedi4	-0.0048	0.0103	0.638	-0.0087	0.0105	0.405	-0.0119	0.0057	0.036
year	-0.0198	0.0025	0.000	-0.0190	0.0025	0.000	0.0010	0.0014	0.493
nhspc	0.0002	0.0012	0.900	0.0001	0.0012	0.951	-0.0007	0.0007	0.328
bulkbill	0.0006	0.0004	0.195	0.0005	0.0005	0.319	0.0003	0.0003	0.298
decrim	—	—	—	—	—	—	0.0165	0.0060	0.006
easytoget	—	—	—	—	—	—	0.0917	0.0031	0.000
couplekids	—	—	—	—	—	—	-0.0233	0.0061	0.000
singlekids	—	—	—	—	—	—	-0.0169	0.0084	0.043
intercept	39.9598	4.9379	0.000	38.3655	5.0497	0.000	-1.6534	2.8800	0.566
N	19970			19970			19970		
R^2	0.0571			0.0212			0.0720		
F(29, 19940)	45.71		0.000	40.79		0.000	F(32,19937)	48.580	0.000

[a]Variable descriptions in Tables III and IV.

Table XI. Model For Self-Assessed Health: Specification 3

	OLS Estimates			GMM Estimates			1[st]-Stage: cig		
Variable[a]	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value
canw	—	—	—	—	—	—	—	—	—
cig	-0.2093	0.0084	0.000	-0.2612	0.0315	0.000	—	—	—
log(income)	0.0486	0.0053	0.000	0.0463	0.0055	0.000	-0.0372	0.0045	0.000
log(size)	-0.0130	0.0110	0.240	-0.0125	0.0110	0.256	0.0236	0.0104	0.023
age	-0.0040	0.0005	0.000	-0.0041	0.0005	0.000	-0.0021	0.0004	0.000
male	-0.0714	0.0070	0.000	-0.0702	0.0070	0.000	0.0170	0.0058	0.004
married	0.0375	0.0100	0.000	0.0338	0.0102	0.001	-0.0582	0.0088	0.000
divorced	0.0372	0.0134	0.006	0.0404	0.0136	0.003	0.0539	0.0129	0.000
aboriginal	-0.0966	0.0290	0.001	-0.0908	0.0294	0.002	0.0997	0.0283	0.000
oz-born	0.0125	0.0086	0.145	0.0122	0.0086	0.156	-0.0037	0.0071	0.597
postgrad	0.1313	0.0144	0.000	0.1202	0.0158	0.000	-0.1893	0.0110	0.000
undergrad	0.1115	0.0121	0.000	0.1000	0.0139	0.000	-0.1960	0.0098	0.000
diploma	0.0815	0.0134	0.000	0.0751	0.0139	0.000	-0.1043	0.0117	0.000
certificate	0.0464	0.0106	0.000	0.0432	0.0108	0.000	-0.0512	0.0097	0.000
year 12	0.0536	0.0126	0.000	0.0478	0.0130	0.000	-0.0944	0.0111	0.000
school	0.0840	0.0167	0.000	0.0727	0.0180	0.000	-0.1986	0.0140	0.000
kids 0–2	0.0250	0.0103	0.015	0.0237	0.0103	0.021	-0.0156	0.0087	0.074
kids 3–5	0.0215	0.0100	0.032	0.0213	0.0100	0.034	-0.0001	0.0084	0.990
kids 6–8	0.0169	0.0104	0.103	0.0166	0.0103	0.110	-0.0069	0.0086	0.422
kids 9–11	0.0157	0.0108	0.144	0.0157	0.0108	0.143	0.0059	0.0091	0.514
kids 12–14	0.0220	0.0122	0.074	0.0220	0.0122	0.071	0.0016	0.0102	0.872
kids $\geq$ 15	0.0253	0.0129	0.050	0.0238	0.0129	0.065	-0.0185	0.0106	0.080
capital	-0.0029	0.0080	0.718	-0.0025	0.0080	0.753	0.0027	0.0070	0.701
sedi1	-0.0453	0.0123	0.000	-0.0422	0.0125	0.001	0.0583	0.0105	0.000
sedi2	-0.0207	0.0101	0.059	-0.0187	0.0110	0.091	0.0404	0.0092	0.000
sedi3	-0.0279	0.0109	0.010	-0.0259	0.0109	0.018	0.0397	0.0090	0.000
sedi4	-0.0009	0.0102	0.932	-0.0003	0.0102	0.974	0.0098	0.0080	0.222
year	-0.0193	0.0024	0.000	-0.0191	0.0025	0.000	0.0037	0.0023	0.101
nhspc	-0.0004	0.0012	0.737	-0.0006	0.0012	0.645	-0.0020	0.0010	0.050
bulkbill	0.0004	0.0004	0.355	0.0004	0.0004	0.424	-0.0009	0.0004	0.013
smokelaw3	—	—	—	—	—	—	-0.0008	0.0009	0.398
swsdhp	—	—	—	—	—	—	-0.3205	0.0098	0.000
couplekids	—	—	—	—	—	—	-0.0305	0.0089	0.001
singlekids	—	—	—	—	—	—	0.0081	0.0119	0.495
intercept	39.0572	4.8720	0.000	38.6715	4.8786	0.000	-6.3816	4.5267	0.159
N	19970			19970			19970		
R^2	0.0827			0.0809			0.1484		
F(29, 19940)	68.39		0.000	45.77		0.000	F(32,19937)	109.530	0.000

[a]Variable descriptions in Tables III and IV.

Table XII. Model For Self-Assessed Health: Specification 4

	OLS Estimates			GMM Estimates		
Variable[a]	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value
cany	-0.0306	0.0091	0.001	-0.0827	0.0464	0.075
cig	-0.2028	0.0086	0.000	-0.2395	0.0385	0.000
log(income)	0.0481	0.0053	0.000	0.0452	0.0055	0.000
log(size)	-0.0131	0.0110	0.236	-0.0128	0.0110	0.245
age	-0.0042	0.0005	0.000	-0.0047	0.0006	0.000
male	-0.0689	0.0070	0.000	-0.0633	0.0079	0.000
married	0.0349	0.0100	0.000	0.0268	0.0106	0.012
divorced	0.0371	0.0134	0.006	0.0392	0.0137	0.004
aboriginal	-0.0949	0.0290	0.001	-0.0870	0.0295	0.003
oz-born	0.0125	0.0086	0.146	0.0124	0.0086	0.149
postgrad	0.1314	0.0144	0.000	0.1213	0.0159	0.000
undergrad	0.1121	0.0121	0.000	0.1018	0.0141	0.000
diploma	0.0815	0.0134	0.000	0.0754	0.0139	0.000
certificate	0.0470	0.0106	0.000	0.0447	0.0109	0.000
year 12	0.0532	0.0126	0.000	0.0477	0.0130	0.000
school	0.0849	0.0166	0.000	0.0745	0.0181	0.000
kids 0–2	0.0236	0.0103	0.022	0.0201	0.0104	0.054
kids 3–5	0.0215	0.0100	0.032	0.0209	0.0100	0.037
kids 6–8	0.0158	0.0104	0.128	0.0142	0.0104	0.175
kids 9–11	0.0159	0.0108	0.139	0.0158	0.0108	0.143
kids 12–14	0.0219	0.0122	0.072	0.0223	0.0122	0.067
kids $\geq$ 15	0.0237	0.0129	0.066	0.0200	0.0130	0.124
capital	-0.0026	0.0080	0.746	-0.0025	0.0080	0.758
sedi1	-0.0465	0.0123	0.000	-0.0457	0.0128	0.000
sedi2	-0.0219	0.0110	0.046	-0.0222	0.0113	0.050
sedi3	-0.0285	0.0109	0.009	-0.0276	0.0110	0.012
sedi4	-0.0016	0.0102	0.875	-0.0024	0.0103	0.816
year	-0.0191	0.0024	0.000	-0.0186	0.0024	0.000
nhspc	-0.0004	0.0012	0.723	-0.0005	0.0012	0.657
bulkbill	0.0004	0.0004	0.380	0.0003	0.0004	0.491
decrim	—	—	—	—	—	—
easytoget	—	—	—	—	—	—
couplekids	—	—	—	—	—	—
singlekids	—	—	—	—	—	—
intercept	38.6477	4.8704	0.000	37.7483	4.8916	0.000
N	19981			19981		
R^2	0.0832			0.0801		
F(30, 19950)	66.60		0.000	45.33		0.000

[a]Variable descriptions in Tables III and IV.

Table XII. Model For Self-Assessed Health: Specification 4 (continued)

	1st stage: cany			1st stage: cig		
Variable[a]	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value
log(income)	-0.0290	0.0042	0.000	-0.0399	0.0045	0.000
log(size)	0.0234	0.0098	0.017	0.0247	0.0103	0.017
age	-0.0058	0.0004	0.000	-0.0010	0.0004	0.022
male	0.0695	0.0055	0.000	0.0076	0.0058	0.194
married	-0.0916	0.0089	0.000	-0.0532	0.0088	0.000
divorced	-0.0182	0.0119	0.126	0.0495	0.0128	0.000
aboriginal	0.0455	0.0259	0.079	0.0894	0.0282	0.002
oz-born	-0.0128	0.0065	0.049	-0.0132	0.0070	0.061
postgrad	-0.0258	0.0106	0.015	-0.1834	0.0109	0.000
undergrad	-0.0217	0.0092	0.017	-0.1892	0.0098	0.000
diploma	-0.0205	0.0099	0.038	-0.1013	0.0116	0.000
certificate	-0.0018	0.0082	0.824	-0.0524	0.0097	0.000
year 12	-0.0179	0.0096	0.063	-0.0915	0.0110	0.000
school	-0.0375	0.0140	0.007	-0.1983	0.0139	0.000
kids 0–2	-0.0375	0.0080	0.000	-0.0152	0.0087	0.079
kids 3–5	-0.0022	0.0075	0.775	0.0005	0.0083	0.949
kids 6–8	-0.0187	0.0074	0.012	-0.0044	0.0086	0.605
kids 9–11	0.0005	0.0077	0.948	0.0053	0.0090	0.560
kids 12–14	0.0141	0.0084	0.096	0.0053	0.0101	0.601
kids $\geq$ 15	-0.0415	0.0088	0.000	-0.0181	0.0105	0.086
capital	0.0074	0.0063	0.240	0.0088	0.0070	0.208
sedi1	-0.0329	0.0096	0.001	0.0535	0.0105	0.000
sedi2	-0.0335	0.0086	0.000	0.0380	0.0091	0.000
sedi3	-0.0150	0.0086	0.083	0.0367	0.0089	0.000
sedi4	-0.0243	0.0079	0.002	0.0093	0.0080	0.244
year	0.0043	0.0021	0.043	0.0016	0.0022	0.470
nhspc	-0.0006	0.0010	0.556	-0.0021	0.0010	0.041
bulkbill	0.0002	0.0004	0.653	-0.0011	0.0004	0.016
smokelaw3	-0.0017	0.0009	0.048	-0.0011	0.0009	0.234
swsdhp	-0.0775	0.0086	0.000	-0.3146	0.0098	0.000
couplekids	-0.0391	0.0082	0.000	-0.0270	0.0089	0.002
singlekids	-0.0314	0.0111	0.005	0.0069	0.0118	0.557
decrim	0.0187	0.0082	0.022	-0.0117	0.0086	0.173
easytoget	0.1999	0.0046	0.000	0.1048	0.0058	0.000
intercept	-8.0094	4.2601	0.060	-2.2914	4.5028	0.611
N	19981			19981		
R^2	0.1440			0.1601		
F(34, 19946)	118.93		0.000	117.14		0.000

[a]Variable descriptions in Tables III and IV.

Table XIII. Model For Self-Assessed Health: Specification 5

	OLS Estimates			GMM Estimates			1^{st}-Stage: cany		
Variable[a]	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value
cany	-0.0789	0.0091	0.000	-0.2170	0.0366	0.000	—	—	—
cig	—	—	—	—	—	—	—	—	—
log(income)	0.0559	0.0054	0.000	0.0526	0.0055	0.000	-0.0307	0.0043	0.000
log(size)	-0.0149	0.0112	0.184	-0.0149	0.0112	0.184	0.0226	0.0098	0.022
age	-0.0043	0.0005	0.000	-0.0054	0.0006	0.000	-0.0056	0.0004	0.000
male	-0.0693	0.0071	0.000	-0.0569	0.0078	0.000	0.0713	0.0056	0.000
married	0.0447	0.0101	0.000	0.0303	0.0109	0.005	-0.0932	0.0089	0.000
divorced	0.0245	0.0137	0.074	0.0238	0.0138	0.085	-0.0189	0.0120	0.114
aboriginal	-0.1141	0.0287	0.000	-0.1038	0.0294	0.000	0.0483	0.0258	0.061
oz-born	0.0139	0.0087	0.111	0.0143	0.0088	0.102	-0.0136	0.0065	0.037
postgrad	0.1731	0.0145	0.000	0.1669	0.0147	0.000	-0.0328	0.0106	0.002
undergrad	0.1553	0.0121	0.000	0.1496	0.0123	0.000	-0.0286	0.0092	0.002
diploma	0.1053	0.0135	0.000	0.1011	0.0136	0.000	-0.0257	0.0099	0.010
certificate	0.0598	0.0107	0.000	0.0595	0.0108	0.000	-0.0052	0.0082	0.530
year 12	0.0743	0.0127	0.000	0.0707	0.0128	0.000	-0.0217	0.0096	0.024
school	0.1272	0.0167	0.000	0.1209	0.0169	0.000	-0.0425	0.0140	0.002
kids 0–2	0.0258	0.0104	0.013	0.0189	0.0106	0.073	-0.0374	0.0080	0.000
kids 3–5	0.0223	0.0102	0.029	0.0211	0.0102	0.039	-0.0029	0.0075	0.697
kids 6–8	0.0159	0.0105	0.129	0.0122	0.0106	0.251	-0.0181	0.0074	0.015
kids 9–11	0.0156	0.0110	0.154	0.0153	0.0110	0.164	-0.0006	0.0078	0.941
kids 12–14	0.0213	0.0124	0.086	0.0219	0.0124	0.078	0.0152	0.0085	0.073
kids $\geq$ 15	0.0267	0.0131	0.041	0.0196	0.0132	0.138	-0.0427	0.0088	0.000
capital	-0.0041	0.0081	0.615	-0.0045	0.0082	0.584	0.0071	0.0063	0.259
sedi1	-0.0599	0.0124	0.000	-0.0636	0.0126	0.000	-0.0312	0.0096	0.001
sedi2	-0.0317	0.0112	0.005	-0.0360	0.0113	0.001	-0.0332	0.0086	0.000
sedi3	-0.0371	0.0110	0.001	-0.0383	0.0111	0.001	-0.0145	0.0087	0.094
sedi4	-0.0051	0.0103	0.621	-0.0081	0.0104	0.436	-0.0225	0.0079	0.004
year	-0.0196	0.0025	0.000	-0.0187	0.0025	0.000	0.0025	0.0020	0.199
nhspc	0.0001	0.0012	0.904	0.0001	0.0012	0.904	-0.0008	0.0010	0.420
bulkbill	0.0006	0.0004	0.213	0.0004	0.0004	0.330	0.0002	0.0004	0.646
decrim	—	—	—	—	—	—	0.0220	0.0080	0.006
easytoget	—	—	—	—	—	—	0.2021	0.0046	0.000
couplekids	—	—	—	—	—	—	-0.0398	0.0083	0.000
singlekids	—	—	—	—	—	—	-0.0316	0.0111	0.005
intercept	39.5019	4.9379	0.000	37.8583	4.9844	0.000	-4.4753	3.9213	0.254
N	19981			19981			19981		
R^2	0.0562			0.0449			0.0140		
F(29, 19951)	45.13		0.000	42.68		0.000	F(32,19948)	123.93	0.000

[a]Variable descriptions in Tables III and IV.

Table XIV. Model For Number of Doctors Visits: Specification 1

	OLS			GMM		
Variable[a]	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value
canw	-0.0080	0.0107	0.457	-0.2224	0.0944	0.018
cig	0.0014	0.0072	0.842	0.1078	0.0381	0.005
log(income)	0.0045	0.0046	0.330	0.0037	0.0049	0.443
log(size)	-0.0041	0.0093	0.657	-0.0037	0.0094	0.698
age	0.0004	0.0004	0.392	-0.0001	0.0005	0.815
male	0.0631	0.0061	0.000	0.0737	0.0080	0.000
married	0.0023	0.0084	0.785	-0.0016	0.0092	0.865
divorced	-0.0065	0.0113	0.568	-0.0151	0.0119	0.205
aboriginal	-0.0122	0.0235	0.602	-0.0070	0.0241	0.773
oz-born	-0.0352	0.0076	0.000	-0.0341	0.0076	0.000
postgrad	0.0100	0.0125	0.422	0.0222	0.0137	0.105
undergrad	0.0211	0.0103	0.041	0.0327	0.0117	0.005
diploma	0.0149	0.0112	0.185	0.0218	0.0118	0.064
certificate	0.0098	0.0088	0.268	0.0138	0.0091	0.130
year 12	0.0135	0.0105	0.197	0.0190	0.0109	0.082
school	0.0237	0.0139	0.089	0.0316	0.0150	0.036
kids 0–2	-0.0032	0.0087	0.714	-0.0050	0.0089	0.572
kids 3–5	0.0069	0.0085	0.420	0.0069	0.0086	0.422
kids 6–8	0.0111	0.0089	0.212	0.0094	0.0090	0.296
kids 9–11	0.0226	0.0094	0.016	0.0227	0.0095	0.017
kids 12–14	0.0180	0.0106	0.090	0.0187	0.0108	0.083
kids $\geq$ 15	0.0095	0.0110	0.387	0.0060	0.0114	0.600
capital	-0.0384	0.0069	0.000	-0.0398	0.0070	0.000
sedi1	-0.0196	0.0103	0.057	-0.0285	0.0108	0.009
sedi2	-0.0046	0.0094	0.625	-0.0132	0.0100	0.185
sedi3	0.0003	0.0093	0.972	-0.0055	0.0096	0.566
sedi4	0.0005	0.0088	0.958	-0.0033	0.0090	0.717
year	-0.0017	0.0021	0.419	-0.0016	0.0021	0.459
nhspc	-0.0007	0.0010	0.480	-0.0005	0.0010	0.652
bulkbill	-0.0008	0.0004	0.036	-0.0008	0.0004	0.047
intercept	3.6018	4.1667	0.387	3.3799	4.2299	0.424
N	19956			19956		
R^2	0.0103			-0.0154		
F(30,19925)	6.88		0.000	6.96		0.000

[a]Variable descriptions in Tables III and IV.

Table XIV. Model For Number of Doctors Visits: Specification 1 (continued)

	1st stage: canw			1st stage: cig		
Variable[a]	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value
log(income)	-0.0273	0.0032	0.000	-0.0404	0.0045	0.000
log(size)	0.0203	0.0076	0.008	0.0247	0.0103	0.017
age	-0.0020	0.0003	0.000	-0.0010	0.0004	0.023
male	0.0514	0.0041	0.000	0.0079	0.0058	0.178
married	-0.0478	0.0066	0.000	-0.0537	0.0088	0.000
divorced	-0.0170	0.0092	0.065	0.0486	0.0128	0.000
aboriginal	0.0641	0.0223	0.004	0.0892	0.0282	0.002
oz-born	-0.0040	0.0047	0.390	-0.0130	0.0070	0.063
postgrad	-0.0401	0.0074	0.000	-0.1840	0.0109	0.000
undergrad	-0.0462	0.0067	0.000	-0.1895	0.0098	0.000
diploma	-0.0244	0.0076	0.001	-0.1014	0.0116	0.000
certificate	-0.0118	0.0066	0.075	-0.0526	0.0097	0.000
year 12	-0.0249	0.0075	0.001	-0.0918	0.0110	0.000
school	-0.0668	0.0101	0.000	-0.1982	0.0139	0.000
kids 0–2	-0.0131	0.0058	0.023	-0.0155	0.0087	0.074
kids 3–5	-0.0003	0.0056	0.951	0.0008	0.0083	0.920
kids 6–8	-0.0073	0.0056	0.192	-0.0043	0.0086	0.613
kids 9–11	0.0039	0.0059	0.510	0.0049	0.0090	0.589
kids 12–14	0.0097	0.0064	0.131	0.0058	0.0101	0.563
kids $\geq$ 15	-0.0263	0.0062	0.000	-0.0191	0.0105	0.069
capital	0.0019	0.0047	0.693	0.0088	0.0070	0.204
sedi1	-0.0145	0.0073	0.046	0.0537	0.0105	0.000
sedi2	-0.0210	0.0063	0.001	0.0381	0.0091	0.000
sedi3	-0.0108	0.0063	0.090	0.0365	0.0089	0.000
sedi4	-0.0135	0.0057	0.017	0.0097	0.0080	0.224
year	0.0026	0.0015	0.090	0.0016	0.0022	0.470
nhspc	-0.0005	0.0007	0.468	-0.0020	0.0010	0.048
bulkbill	0.0003	0.0003	0.312	-0.0011	0.0004	0.014
smokelaw3	-0.0015	0.0007	0.023	-0.0011	0.0009	0.255
swsdhp	-0.0562	0.0070	0.000	-0.3152	0.0098	0.000
couplekids	-0.0230	0.0061	0.000	-0.0271	0.0089	0.002
singlekids	-0.0170	0.0084	0.042	0.0062	0.0118	0.602
decrim	0.0137	0.0061	0.024	-0.0116	0.0086	0.177
easytoget	0.0902	0.0031	0.000	0.1045	0.0058	0.000
intercept	-4.8167	3.0678	0.116	-2.2828	4.5026	0.612
N	19956			19956		
R^2	0.0770			0.1605		
F(34, 19921)	46.66		0.000	117.56		0.000

[a]Variable descriptions in Tables III and IV.

Table XV. Model For Number of Doctors Visits: Specification 2

	OLS Estimates			GMM Estimates			1^{st}-Stage: canw		
Variable[a]	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value
canw	-0.0075	0.0105	0.471	-0.1041	0.0675	0.123	—	—	—
cig	—	—	—	—	—	—	—	—	—
log(income)	0.0044	0.0046	0.334	0.0020	0.0049	0.686	-0.0286	0.0032	0.000
log(size)	-0.0041	0.0093	0.658	-0.0035	0.0093	0.706	0.0197	0.0077	0.010
age	0.0004	0.0004	0.393	0.0001	0.0005	0.892	-0.0018	0.0003	0.000
male	0.0631	0.0061	0.000	0.0691	0.0074	0.000	0.0526	0.0041	0.000
married	0.0022	0.0084	0.792	-0.0031	0.0092	0.732	-0.0490	0.0066	0.000
divorced	-0.0064	0.0113	0.573	-0.0075	0.0113	0.509	-0.0174	0.0092	0.059
aboriginal	-0.0121	0.0235	0.606	-0.0047	0.0241	0.845	0.0662	0.0223	0.003
oz-born	-0.0352	0.0076	0.000	-0.0351	0.0076	0.000	-0.0046	0.0047	0.328
postgrad	0.0097	0.0124	0.433	0.0047	0.0129	0.713	-0.0452	0.0074	0.000
undergrad	0.0208	0.0102	0.041	0.0153	0.0109	0.160	-0.0513	0.0067	0.000
diploma	0.0147	0.0112	0.189	0.0118	0.0114	0.300	-0.0282	0.0076	0.000
certificate	0.0097	0.0088	0.271	0.0084	0.0089	0.342	-0.0142	0.0066	0.031
year 12	0.0133	0.0104	0.201	0.0106	0.0107	0.322	-0.0277	0.0075	0.000
school	0.0234	0.0138	0.091	0.0163	0.0146	0.264	-0.0704	0.0102	0.000
kids 0–2	-0.0032	0.0087	0.712	-0.0051	0.0088	0.561	-0.0131	0.0058	0.024
kids 3–5	0.0069	0.0085	0.420	0.0066	0.0085	0.438	-0.0009	0.0056	0.865
kids 6–8	0.0111	0.0089	0.212	0.0100	0.0089	0.261	-0.0069	0.0056	0.220
kids 9–11	0.0226	0.0094	0.016	0.0225	0.0094	0.016	0.0031	0.0059	0.603
kids 12–14	0.0180	0.0106	0.090	0.0186	0.0107	0.081	0.0105	0.0064	0.102
kids $\geq$ 15	0.0095	0.0110	0.389	0.0065	0.0113	0.564	-0.0272	0.0062	0.000
capital	-0.0384	0.0069	0.000	-0.0387	0.0069	0.000	0.0014	0.0047	0.767
sedi1	-0.0195	0.0103	0.058	-0.0205	0.0103	0.047	-0.0131	0.0073	0.072
sedi2	-0.0045	0.0094	0.630	-0.0066	0.0095	0.488	-0.0207	0.0063	0.001
sedi3	0.0004	0.0093	0.967	-0.0004	0.0093	0.967	-0.0104	0.0064	0.101
sedi4	0.0005	0.0088	0.956	-0.0006	0.0088	0.950	-0.0121	0.0057	0.034
year	-0.0017	0.0021	0.420	-0.0014	0.0021	0.489	0.0010	0.0014	0.488
nhspc	-0.0007	0.0010	0.477	-0.0008	0.0010	0.464	-0.0007	0.0007	0.344
bulkbill	-0.0008	0.0004	0.036	-0.0008	0.0004	0.029	0.0003	0.0003	0.292
decrim	—	—	—	—	—	—	0.0167	0.0060	0.005
easytoget	—	—	—	—	—	—	0.0917	0.0031	0.000
couplekids	—	—	—	—	—	—	-0.0235	0.0061	0.000
singlekids	—	—	—	—	—	—	-0.0172	0.0084	0.040
intercept	3.5939	4.1652	0.388	3.1750	4.1775	0.447	-1.6795	2.8820	0.560
N	19956			19956			19956		
R^2	0.0103			0.0061			0.0722		
F(29, 19926)	7.11		0.000	7.12		0.000	F(32,19923)	48.62	0.000

[a]Variable descriptions in Tables III and IV.

Table XVI. Model For Number of Doctors Visits: Specification 3

	OLS Estimates			GMM Estimates			1^{st}-Stage: cig		
Variable[a]	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value
canw	—	—	—	—	—	—	—	—	—
cig	0.0003	0.0070	0.969	0.0649	0.0271	0.016	—	—	—
log(income)	0.0046	0.0046	0.314	0.0075	0.0047	0.114	-0.0374	0.0045	0.000
log(size)	-0.0042	0.0093	0.654	-0.0049	0.0093	0.601	0.0235	0.0104	0.024
age	0.0004	0.0004	0.363	0.0005	0.0004	0.265	-0.0021	0.0004	0.000
male	0.0627	0.0060	0.000	0.0612	0.0061	0.000	0.0170	0.0058	0.004
married	0.0026	0.0084	0.753	0.0074	0.0086	0.391	-0.0585	0.0089	0.000
divorced	-0.0063	0.0113	0.577	-0.0102	0.0115	0.372	0.0537	0.0129	0.000
aboriginal	-0.0128	0.0235	0.587	-0.0202	0.0235	0.391	0.0995	0.0283	0.000
oz-born	-0.0353	0.0076	0.000	-0.0350	0.0076	0.000	-0.0039	0.0071	0.583
postgrad	0.0101	0.0125	0.415	0.0240	0.0137	0.079	-0.1901	0.0110	0.000
undergrad	0.0213	0.0103	0.039	0.0359	0.0118	0.002	-0.1963	0.0098	0.000
diploma	0.0150	0.0112	0.182	0.0233	0.0117	0.046	-0.1043	0.0117	0.000
certificate	0.0098	0.0088	0.266	0.0139	0.0090	0.120	-0.0513	0.0097	0.000
year 12	0.0136	0.0105	0.193	0.0210	0.0108	0.053	-0.0944	0.0111	0.000
school	0.0240	0.0139	0.084	0.0380	0.0150	0.011	-0.1990	0.0140	0.000
kids 0–2	-0.0031	0.0087	0.726	-0.0015	0.0087	0.861	-0.0156	0.0088	0.075
kids 3–5	0.0069	0.0085	0.418	0.0076	0.0085	0.372	0.0001	0.0084	0.991
kids 6–8	0.0112	0.0089	0.208	0.0117	0.0089	0.188	-0.0069	0.0086	0.424
kids 9–11	0.0226	0.0094	0.016	0.0223	0.0094	0.018	0.0060	0.0091	0.511
kids 12–14	0.0180	0.0106	0.091	0.0178	0.0107	0.096	0.0021	0.0102	0.834
kids $\geq$ 15	0.0098	0.0110	0.376	0.0119	0.0111	0.282	-0.0193	0.0106	0.069
capital	-0.0384	0.0069	0.000	-0.0388	0.0069	0.000	0.0028	0.0070	0.691
sedi1	-0.0194	0.0103	0.059	-0.0233	0.0104	0.025	0.0582	0.0105	0.000
sedi2	-0.0044	0.0094	0.641	-0.0071	0.0094	0.449	0.0404	0.0092	0.000
sedi3	0.0004	0.0093	0.963	-0.0022	0.0094	0.816	0.0396	0.0090	0.000
sedi4	0.0006	0.0088	0.949	-0.0002	0.0088	0.982	0.0101	0.0080	0.211
year	-0.0017	0.0021	0.415	-0.0019	0.0021	0.354	0.0037	0.0023	0.106
nhspc	-0.0007	0.0010	0.479	-0.0006	0.0010	0.588	-0.0020	0.0010	0.056
bulkbill	-0.0008	0.0004	0.037	-0.0007	0.0004	0.057	-0.0009	0.0004	0.011
smokelaw3	—	—	—	—	—	—	-0.0007	0.0009	0.435
swsdhp	—	—	—	—	—	—	-0.3209	0.0098	0.000
couplekids	—	—	—	—	—	—	-0.0307	0.0089	0.001
singlekids	—	—	—	—	—	—	0.0076	0.0119	0.524
intercept	3.6301	4.1663	0.384	4.0567	4.1779	0.332	-6.2737	4.5270	0.166
N	19956			19956			19956		
R^2	0.0103			0.0060			0.1487		
F(29, 19926)	7.10		0.000	7.30		0.000	F(32, 19923) 109.98		0.000

[a]Variable descriptions in Tables III and IV.

Table XVII. Model For Number of Doctors Visits: Specification 4

	OLS Estimates			GMM Estimates		
Variable[a]	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value
cany	0.0073	0.0078	0.352	-0.0946	0.0400	0.018
cig	-0.0010	0.0072	0.885	0.0923	0.0332	0.005
log(income)	0.0046	0.0046	0.317	0.0063	0.0047	0.184
log(size)	-0.0041	0.0093	0.657	-0.0051	0.0094	0.588
age	0.0005	0.0004	0.287	-0.0002	0.0005	0.660
male	0.0620	0.0061	0.000	0.0690	0.0069	0.000
married	0.0032	0.0084	0.706	-0.0007	0.0090	0.940
divorced	-0.0061	0.0113	0.589	-0.0124	0.0116	0.287
aboriginal	-0.0133	0.0235	0.570	-0.0162	0.0235	0.492
oz-born	-0.0355	0.0076	0.000	-0.0347	0.0076	0.000
postgrad	0.0104	0.0125	0.402	0.0260	0.0139	0.060
undergrad	0.0213	0.0103	0.038	0.0380	0.0121	0.002
diploma	0.0152	0.0112	0.176	0.0239	0.0117	0.042
certificate	0.0098	0.0088	0.265	0.0155	0.0091	0.087
year 12	0.0146	0.0105	0.162	0.0223	0.0109	0.041
school	0.0247	0.0139	0.076	0.0405	0.0152	0.008
kids 0–2	-0.0026	0.0087	0.769	-0.0055	0.0089	0.537
kids 3–5	0.0072	0.0085	0.400	0.0071	0.0086	0.405
kids 6–8	0.0117	0.0089	0.185	0.0097	0.0090	0.278
kids 9–11	0.0223	0.0094	0.017	0.0217	0.0094	0.021
kids 12–14	0.0180	0.0106	0.090	0.0182	0.0107	0.090
kids $\geq$ 15	0.0099	0.0110	0.370	0.0075	0.0112	0.503
capital	-0.0385	0.0069	0.000	-0.0394	0.0069	0.000
sedi1	-0.0190	0.0103	0.065	-0.0274	0.0107	0.010
sedi2	-0.0041	0.0094	0.664	-0.0111	0.0097	0.253
sedi3	0.0007	0.0093	0.941	-0.0039	0.0095	0.677
sedi4	0.0007	0.0088	0.941	-0.0026	0.0089	0.768
year	-0.0018	0.0021	0.392	-0.0015	0.0021	0.467
nhspc	-0.0008	0.0010	0.431	-0.0005	0.0010	0.601
bulkbill	-0.0008	0.0004	0.039	-0.0008	0.0004	0.044
intercept	3.7982	4.1646	0.362	3.2929	4.2029	0.433
N	19967			19967		
R^2	0.0103			-0.0037		
F(30, 19936)	6.92		0.000	7.06		0.000

[a]Variable descriptions in Tables III and IV.

Table XVII. Model For Number of Doctors Visits: Specification 4 (continued)

	1st stage: cany			1st stage: cig		
Variable[a]	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value
log(income)	-0.0291	0.0043	0.000	-0.040	0.0045	0.000
log(size)	0.0233	0.0098	0.017	0.025	0.0103	0.017
age	-0.0058	0.0004	0.000	-0.001	0.0004	0.022
male	0.0696	0.0055	0.000	0.008	0.0058	0.194
married	-0.0917	0.0089	0.000	-0.054	0.0088	0.000
divorced	-0.0183	0.0119	0.125	0.049	0.0128	0.000
aboriginal	0.0453	0.0259	0.081	0.089	0.0282	0.002
oz-born	-0.0126	0.0065	0.053	-0.013	0.0070	0.059
postgrad	-0.0260	0.0106	0.014	-0.184	0.0109	0.000
undergrad	-0.0222	0.0092	0.015	-0.190	0.0098	0.000
diploma	-0.0205	0.0099	0.039	-0.101	0.0116	0.000
certificate	-0.0020	0.0082	0.804	-0.052	0.0097	0.000
year 12	-0.0184	0.0096	0.055	-0.092	0.0110	0.000
school	-0.0378	0.0140	0.007	-0.199	0.0139	0.000
kids 0–2	-0.0375	0.0080	0.000	-0.015	0.0087	0.080
kids 3–5	-0.0018	0.0075	0.808	0.001	0.0083	0.930
kids 6–8	-0.0186	0.0074	0.012	-0.004	0.0086	0.608
kids 9–11	0.0006	0.0078	0.933	0.005	0.0090	0.562
kids 12–14	0.0141	0.0084	0.095	0.006	0.0101	0.571
kids $\geq$ 15	-0.0413	0.0088	0.000	-0.019	0.0105	0.075
capital	0.0075	0.0063	0.232	0.009	0.0070	0.206
sedi1	-0.0334	0.0096	0.001	0.053	0.0105	0.000
sedi2	-0.0332	0.0086	0.000	0.038	0.0091	0.000
sedi3	-0.0151	0.0086	0.080	0.037	0.0089	0.000
sedi4	-0.0242	0.0079	0.002	0.010	0.0080	0.234
year	0.0042	0.0021	0.047	0.002	0.0022	0.484
nhspc	-0.0006	0.0010	0.575	-0.002	0.0010	0.045
bulkbill	0.0002	0.0004	0.654	-0.001	0.0004	0.015
smokelaw3	-0.0017	0.0009	0.050	-0.001	0.0009	0.265
swsdhp	-0.0781	0.0086	0.000	-0.315	0.0098	0.000
couplekids	-0.0394	0.0083	0.000	-0.027	0.0089	0.002
singlekids	-0.0318	0.0112	0.004	0.006	0.0118	0.586
decrim	0.0189	0.0082	0.021	-0.011	0.0086	0.188
easytoget	0.1999	0.0046	0.000	0.105	0.0058	0.000
intercept	-7.8252	4.2611	0.066	-2.188	4.5030	0.627
N	19967			19967		
R^2	0.1442			0.1604		
F(34, 19932)	119.03		0.000	117.57		0.000

[a]Variable descriptions in Tables III and IV.

Table XVIII. Number of Doctors Visits: Specification 5

	OLS Estimates			GMM Estimates			1^{st}-Stage: cany		
Variable[a]	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value	$\hat{\beta}$	SE($\hat{\beta}$)	P-value
cany	0.0070	0.0076	0.355	-0.0454	0.0311	0.144	—	—	—
cig	—	—	—	—	—	—	—	—	—
log(income)	0.0046	0.0046	0.311	0.0034	0.0046	0.465	-0.0307	0.0043	0.000
log(size)	-0.0041	0.0093	0.656	-0.0042	0.0093	0.649	0.0225	0.0098	0.022
age	0.0005	0.0004	0.287	0.0000	0.0005	0.968	-0.0057	0.0004	0.000
male	0.0620	0.0061	0.000	0.0668	0.0067	0.000	0.0714	0.0056	0.000
married	0.0032	0.0084	0.701	-0.0024	0.0090	0.792	-0.0933	0.0089	0.000
divorced	-0.0062	0.0113	0.585	-0.0065	0.0113	0.562	-0.0190	0.0120	0.113
aboriginal	-0.0134	0.0235	0.567	-0.0098	0.0236	0.677	0.0481	0.0258	0.063
oz-born	-0.0355	0.0076	0.000	-0.0355	0.0075	0.000	-0.0134	0.0065	0.040
postgrad	0.0106	0.0124	0.390	0.0082	0.0125	0.511	-0.0330	0.0106	0.002
undergrad	0.0216	0.0102	0.034	0.0194	0.0102	0.059	-0.0291	0.0092	0.001
diploma	0.0153	0.0112	0.171	0.0138	0.0112	0.220	-0.0257	0.0099	0.010
certificate	0.0099	0.0088	0.261	0.0098	0.0088	0.267	-0.0054	0.0083	0.514
year 12	0.0147	0.0104	0.159	0.0134	0.0105	0.201	-0.0223	0.0096	0.021
school	0.0249	0.0138	0.072	0.0224	0.0139	0.107	-0.0429	0.0140	0.002
kids 0–2	-0.0025	0.0087	0.770	-0.0051	0.0088	0.561	-0.0374	0.0080	0.000
kids 3–5	0.0072	0.0085	0.400	0.0069	0.0085	0.419	-0.0027	0.0075	0.725
kids 6–8	0.0117	0.0089	0.185	0.0104	0.0089	0.244	-0.0181	0.0074	0.015
kids 9–11	0.0223	0.0094	0.017	0.0219	0.0094	0.019	-0.0005	0.0078	0.953
kids 12–14	0.0180	0.0106	0.090	0.0183	0.0106	0.085	0.0152	0.0085	0.072
kids $\geq$ 15	0.0099	0.0110	0.369	0.0073	0.0112	0.514	-0.0425	0.0088	0.000
capital	-0.0385	0.0069	0.000	-0.0387	0.0069	0.000	0.0072	0.0063	0.249
sedi1	-0.0191	0.0103	0.063	-0.0205	0.0103	0.047	-0.0318	0.0096	0.001
sedi2	-0.0041	0.0094	0.660	-0.0059	0.0094	0.532	-0.0329	0.0086	0.000
sedi3	0.0007	0.0093	0.944	0.0001	0.0093	0.988	-0.0147	0.0087	0.089
sedi4	0.0006	0.0088	0.942	-0.0004	0.0088	0.962	-0.0225	0.0079	0.004
year	-0.0018	0.0021	0.391	-0.0015	0.0021	0.480	0.0024	0.0020	0.214
nhspc	-0.0008	0.0010	0.433	-0.0008	0.0010	0.432	-0.0008	0.0010	0.436
bulkbill	-0.0008	0.0004	0.040	-0.0008	0.0004	0.030	0.0002	0.0004	0.645
decrim	—	—	—	—	—	—	0.0222	0.0080	0.006
easytoget	—	—	—	—	—	—	0.2021	0.0046	0.000
couplekids	—	—	—	—	—	—	-0.0401	0.0083	0.000
singlekids	—	—	—	—	—	—	-0.0320	0.0112	0.004
intercept	3.8026	4.1636	0.361	3.2183	4.1731	0.441	-4.3176	3.9229	0.271
N	19967			19967			19967		
R^2	0.0103			0.0079			0.0140		
F(29,19937)	7.16		0.000	7.14		0.000	F(32,19934)	124.00	0.000

[a]Variable descriptions in Tables III and IV.