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The Role of Cancer in Marijuana and Prescription Opioid Use in the United States: A Population-Based Analysis from 2005-2014

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Abstract

Background: For cancer patients, marijuana may be an alternative to prescription opioid analgesics. We analyzed self-reported marijuana and prescription opioid use among people with cancer over a 10-year time-period.

Methods: Population-based datasets from the US National Health and Nutrition Examination Survey between 2005-2014 were compiled for respondents aged 20-60. Cancer and non-cancer respondents were propensity score matched (1:2) by demographics to compare substance use. Outcomes included current (past 30 days) marijuana and prescription opioid use. Pearson chi-square tests and logistic regressions were performed; two-tailed $P<.05$ was significant.

Results: Of 19,604 respondents, 826 people with cancer were matched to 1,652 controls. Among cancer respondents, 40.3% used marijuana within the past year and 8.7% used it currently. Cancer respondents were significantly more likely to use prescription opioids (OR 2.43, 95% CI 1.68-3.57; $P<0.001$). Cancer was not associated with current marijuana use on multivariable conditional logistic regression, but was associated with current opioid use (OR 1.82, 95% CI 1.17-2.82; $P<0.001$). Among all survey respondents, the odds of marijuana use significantly

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AUTHOR CONTRIBUTIONS

Kathryn Ries Tringale: Conceptualization, data curation, formal analysis, funding acquisition, software, and writing – original draft, review and editing; revision

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increased over time (OR 1.05, 95% CI 1.01-1.10; *P*=0.012), while the odds of opioid use did not significantly change. There were no significant differences in the longitudinal odds of marijuana or opioid use over time between respondents with a cancer diagnosis and those without.

Conclusion(s): This population-based analysis revealed a considerable (40%) proportion of cancer respondents self-reporting marijuana use and a significantly higher prevalence of opioid use among cancer respondents. In the midst of an opioid epidemic, an evolving political landscape, and new developments in oncology, quantifying the prevalence of opioid and marijuana use in the US population, especially among cancer patients, is particularly relevant. While opioid use did not significantly change from 2005-2014 among all respondents, marijuana use did increase, likely reflecting increased availability and legislative changes. Cancer diagnosis did not significantly impact longitudinal opioid or marijuana use.

Precis:

On analysis of self-reported marijuana and prescription opioid use from the population-based US National Health and Nutrition Examination Survey datasets between 2005-2014, a considerable proportion (40.3%) of respondents with cancer used marijuana within the last year and, compared to propensity score matched controls, were significantly more likely to use prescription opioids. Among all respondents, while opioid use did not significantly change over time, there was an increased odds of marijuana use over the 10-year study period.

Keywords

marijuana use; self report; prevalence; analgesics, opioid; health policy; cancer

INTRODUCTION

Pain is one of the most distressing symptoms of cancer and can considerably impact quality of life[1,2]. While 40% of patients with early-intermediate stage cancer and 90% of patients with advanced cancer experience moderate to severe pain[3,4], up to 70% of patients with cancer-related pain do not receive adequate pain relief and thus experience a lower quality of life[4,5].

More than 289 million opioid prescriptions are written in the US each year[6], and these analgesics are a mainstay in the effective treatment of cancer-related pain[7,8]. However, opioids are also associated with risk of misuse and dependence; there has been a doubling of the rate of opioid-overdose related inpatient hospitalizations between 2000 and 2012[9]. Per the 2016 Surgeon General's report, the US is facing an opioid epidemic, as opioid overdose accounted for 61% of 47,055 drug overdose deaths in 2014 – more than any previous year on record[10,11]. The financial burden of opioid abuse, misuse, and overdose is also substantial, around $78.5 million in aggregate costs[12]. Cancer patients, in particular, may be at higher risk for opioid use disorders than non-cancer patients[13], and previous studies have reported increased risk of long-term prescription opioid use after cancer-related surgeries[14,15]. Among cancer patients taking prescription opioids, opioid prescribing patterns (i.e., higher doses prescribed) are associated with the risk of opioid overdose death[16].

Medicinal marijuana has been shown to have analgesic properties[17], and specifically for cancer patients, has demonstrated relief from adverse effects of therapy like nausea and anorexia[18], with few reports even suggesting antineoplastic activity[19,20]. Recent research among Medicaid beneficiaries suggests that medical and adult-use marijuana has the potential to lower opioid prescriptions[21]. As of 2016, approximately 60% of the US population now resides in states with legalized use of medicinal marijuana, which highlights increasing public support given its promising medical benefits[22]. A cross-sectional survey of adult cancer patients in Washington State showed that nearly a quarter of patients reported active cannabis use[23]. Classification of marijuana as a Schedule I controlled substance[24], however, makes large-scale clinical studies challenging[25]. While marijuana use appears to be quite promising in the management of chronic and neuropathic pain[17,26,27], there are associated adverse effects including the potential for addiction, impairment of memory and judgement, and the potential to exacerbate psychiatric illness including depression and anxiety[25,26].

There is limited population-based or epidemiologic data on marijuana and other substance use specifically in patients with cancer. The primary objectives of this study were to examine the associations between cancer and marijuana use as well as between cancer and prescription opioid use in a population-based setting. We also sought to examine trends in marijuana and opioid use over a 10-year period given the evolving legislation for marijuana legalization and dynamic temporal changes in prescription opioid use.

METHODS

Study Population

We compiled population-based datasets from the US National Health and Nutrition Examination Survey (NHANES), a survey designed to assess the health and nutritional status of non-institutionalized adults and children in the US[28]. This nationally representative, biennially administered survey interviews 10,000 individuals per two-year cycle about demographic characteristics (i.e. age, gender), substance use, and medical conditions. We compiled five biennial datasets from 2005-2014 and included all respondents aged 20-60 years (n=19,620, **see** eFigure 1), which includes all respondents that were asked to report on a cancer diagnosis (age ≥20) and marijuana use (age 18-59 years). Respondents missing a definitive ‘yes’ or ‘no’ response to cancer diagnosis (n=16, 0.08%) were excluded.

Descriptions of Variables

eTable 1 summarizes the NHANES variables considered in the analyses. Respondents were grouped by reported diagnosis of cancer. For respondents with multiple cancer diagnoses, primary cancer site was defined as the first site reported[29,30].

Demographic variables of interest included age, gender, race, education, self-reported health status, low income, and insurance coverage. Age was analyzed as a continuous variable. Race was categorized as non-Hispanic white, non-Hispanic black (reference), Hispanic, and other. Education was dichotomized as less than college-level education versus college-level education or beyond. Self-reported health status was dichotomized as “good” (e.g. excellent,

very good, or good) versus “poor” (e.g. fair or poor). Low income was categorized as annual household income of less than $20,000[31] versus $20,000 and above given the average federal poverty line for a family of four from 2005-2014. Insurance coverage status was categorized as covered or not covered.

Current marijuana use was defined as use within the past 30 days and recent marijuana use as use within the past year. Prescription opioid use was defined per the Prescription Medication subsection of the survey on use of prescription medications during a one-month period prior to the survey date and included the following generic drug names: morphine, hydrocodone, codeine, oxycodone, fentanyl, dihydrocodeine, hydromorphone, meperidine, and methadone.

Additional substance use variables included cigarette smoking, binge alcohol use, and illicit drug use. Cigarette smoking was defined as having smoked at least 100 cigarettes in a lifetime. Binge alcohol use was defined as drinking an average of more than 5 drinks/drinking day in the last year for men and more than 3 drinks/drinking day for women. Illicit drugs included cocaine, heroin, and methamphetamines (not including marijuana). Current illicit drug use was defined as use within 30 days.

Primary Variables of Interest

The primary explanatory variable of interest was diagnosis of cancer, while the primary outcome variables were marijuana use and prescription opioid use. Other associated variables explored included previously-described demographic variables and other substance use including alcohol, smoking, and current illicit drug use. Given the potential for polysubstance use in this cohort,[32–35] we also investigated the relationship between our primary outcomes of marijuana and opioid use.

Propensity Score Matching

Propensity score matching was performed to compare respondents with cancer to controls (respondents without cancer). A 1:2 matching was performed based on a nearest-neighbor matching algorithm with a caliper width of 0.1 of the propensity score with age, gender, race, education, and self-reported health status as co-variables. These demographics were chosen to better estimate the association between cancer diagnosis and marijuana and prescription opioid use, especially given the tendency of NHANES to oversample certain groups (i.e., minorities).

Cancer respondents and propensity score matched controls were compared for primary outcome measures of current marijuana use and prescription opioid use using Pearson chi-square tests for categorical data and independent sample t-tests for continuous data (i.e., age).

Statistical Analyses

Univariable and multivariable logistic regressions were used to evaluate significantly associated variables (particularly cancer diagnosis) of marijuana and prescription opioid use among both cancer and non-cancer matched controls (i.e., propensity score matched

respondents). Demographic and substance use co-variables that were not significant at level $P<0.10$ on multivariable analyses were removed via backward stepwise elimination from the final multivariable logistic regression models[36]. Conditional logistic regression models were used when analyzing the propensity score matched cohort to account for the matched pairs.

Logistic regressions were used to investigate trends in marijuana and opioid use over the 10-year time-period for all NHANES respondents as well as cancer respondents, and to investigate differences in these trends between respondents with cancer and matched controls by using an interaction term of year and cancer diagnosis. Survey sampling weight, strata, and clusters were accounted for in any analysis of non-propensity score matched cohorts (i.e., longitudinal analyses of all survey respondents). Two tailed $P<.05$ was considered significant for all analyses. All statistical analyses were done using SAS v9.4 (SAS Institute Inc).

RESULTS

Study Population

Of 19,620 total NHANES respondents aged 20-60 from 2005-2014, 19,604 people responded to the question of whether they had been diagnosed with cancer (826 [4.2%] with cancer, 18,778 [95.8%] without cancer). Primary sites of cancer diagnosis are summarized in eTable 2; the most common primary sites were cervix (19.3%) non-melanomatous skin cancer (15.1%), and breast cancer (13.1%). Demographics of all respondents are summarized in Table 1.

After propensity score matching the 826 cancer respondents to 1,652 controls (N=2,478), there were no significant differences in demographic variables between cases and controls (Table 2, eFigure 2).

Substance Use by Cancer Diagnosis

There were no missing values for either outcome variable (marijuana or opioid use). Prevalence of substance use in matched cancer and non-cancer respondents is summarized in Table 3. Among respondents with cancer, 40.3% had used marijuana within the past year compared with 38.0% in respondents without cancer. A greater proportion of respondents with cancer currently used marijuana compared to those without cancer (8.7% vs. 6.6%), though this did not reach statistical significance. Respondents with cancer were significantly more likely to use prescribed opioids (13.9% vs 6.4%; OR 2.43, 95% CI, 1.68-3.57; $P<0.001$) compared to those without cancer. In terms of other substance use, cancer respondents were significantly more likely to smoke cigarettes (52.9% vs 47.2%; OR 1.34, 95% CI, 1.09-1.65; $P=0.005$. There were no significant differences between the groups in illicit drug and alcohol use.

Marijuana Use—Univariable associations with marijuana use are summarized in eTable 3. Respondents who smoked (OR 3.82, 95% CI, 1.93-8.22; $P<0.001$) or used illicit drugs (OR 9.00, 95% CI, 1.25-394.48; $P=0.022$) were significantly more likely to currently use marijuana, while respondents who binge drank alcohol were significantly more likely to have used marijuana within the last year (OR 2.06, 95% CI, 1.33-3.25; $P<0.001$).

On multivariable conditional logistic regression, cancer was not significantly associated with current marijuana use (Table 4). Smoking and illicit drug use remained associated with increased odds of current marijuana use, but these associations did not reach statistical significance. Insurance status and income were not associated with marijuana use.

Prescription Opioid Use—Univariable associations with of opioid use are summarized in eTable 4. Respondents with cancer were significantly more likely to use prescription opioids compared to non-cancer respondents (OR 2.43, 95% CI, 1.68-3.57; $P<0.001$). Smoking (OR 2.79, 95% CI, 1.62-4.99; $P<0.001$) was also significantly associated with prescription opioid use.

On multivariable conditional analysis, respondents with cancer were significantly more likely to use prescription opioids (OR 1.82, 95% CI, 1.17-2.82; $P=0.008$). Respondents with insurance coverage were more likely to use prescription opioids, although this association did not reach statistical significance (OR 1.97, 95% CI, 0.91-4.26; $P=0.085$).

Relationship between Marijuana and Opioid use

On univariable analysis, respondents using marijuana were not statistically more likely to use prescribed opioids. Among cancer respondents, only respondents *recently* using marijuana were significantly more likely to use prescribed opioids (OR 1.90, 95% CI, 1.25-2.88; $P=0.002$), although this relationship was no longer significant upon multivariable analysis.

Longitudinal Trend Analyses of Marijuana and Opioid Use: 2005-2014

Of all 19,604 NHANES respondents from 2005-2014, 2,107 (10.8%) currently used marijuana. The proportion of current marijuana users in 2005-2006 increased from 9.3% (325 of 3,493 respondents) to 12.3% (496 of 4,040 respondents) in 2013-2014 (Figure 1). On univariable logistic regression, there was a 5.0% increase in odds of marijuana use per two-year study period (OR 1.05, 95% CI, 1.01-1.10; $P=0.012$). This finding remained significant even on multivariable analysis when accounting for patient characteristics ($P<0.001$).

Of all respondents, 981 (5.3%) used prescription opioids. The proportion of respondents using prescription opioids remained approximately the same over the study period (4.7% in 2005-2006 to 4.8% in 2013-2014), with no significant change in the odds of opioid use per two-year study period on logistic regression ($P=0.981$). This finding was also not significant on multivariable analysis upon accounting for patient characteristics.

The Association of Cancer with Marijuana and Prescription Opioid Use Over Time—Among the propensity score matched cohort, the proportion of respondents with cancer had a 118% increase in marijuana use (5.6% to 12.2%) from 2005-2006 to 2013-2014, while the proportion of respondents without cancer had a smaller increase of 12.5% in marijuana use (6.4% to 7.2%) (Figures 2A, B). There was no statistically significant difference in longitudinal odds of marijuana use over time between respondents

with a cancer diagnosis and those without (i.e. an insignificant interaction between cancer and time).

Opioid prescription use increased among both cancer (9.6% to 14.4%) and non-cancer respondents (5.0% to 7.8%) from 2005-2006 to 2013-2014. Similar to marijuana use, on conditional logistic regression, cancer diagnosis was not significantly associated with the odds of opioid use over time (P=0.546). Unlike marijuana, neither subgroup of cancer respondents nor controls had significantly increased odds of opioid use over time on stratified subanalysis.

DISCUSSION

In an era of rapidly evolving marijuana legislation and a growing opioid epidemic, it has become critically important to understand and quantify current substance use patterns. To our knowledge, this is the first population-based analysis of the prevalence of marijuana and prescription opioid use in people with a cancer diagnosis.

Among cancer respondents, 8.7% and 40.3% reported using marijuana in the last 30 days and one year, respectively. This contrasts with a recent survey of cancer patients in Washington State which found that 24% used cannabis in the last year and 21% in the last 30 days[23]. While cancer respondents in this study self-reported more current and recent use of marijuana than non-cancer matched controls, cancer was not significantly associated with current marijuana use. This may be in part because our data do not specify medicinal versus recreational marijuana use, the former being more associated with managing cancer-related symptoms, including pain[18,23]. Among cancer patients surveyed in Washington State, active users reported using cannabis most frequently for pain[23]. Also, we analyzed years 2004-2015, so perhaps with future datasets reflecting the evolving role of marijuana in oncology[18] and broadening legalization, the association of cancer and marijuana use may change.

Nearly 14% of cancer respondents reported prescription opioid use in the last month, and cancer diagnosis was the only variable significantly associated with opioid use. Indeed, opioid analgesics are critical to the management of moderate to severe cancer-related pain,[37] and we cannot draw conclusions regarding the association between cancer status and opioid misuse from this analysis presented here. However, it is becoming increasingly important to identify risk factors for opioid misuse, such as younger age and higher pain levels, which have previously been identified among cancer patients being treated for pain[38]. We did find that insurance status trended towards a significant association with opioid use, likely reflecting access to a prescribing provider. A previous study found that uninsured and low-income adults had a higher prevalence of prescription opioid misuse and substance use disorders[31].

While there are no randomized trials of marijuana compared with prescription opioids for cancer-related pain, patients are increasingly reporting the use of cannabis as a substitute for prescription opioids[39–41]. Oncology patients may have apprehensions about opioids including fear of dependence and potential side effects[42]. Indeed, the most commonly

reported motivation for opioid misuse is pain relief[31], yet these fears introduce potential barriers to effective cancer pain management[42]. Medical marijuana legalization has been associated with a 23% reduction in hospitalizations related to opioid dependence or abuse, suggesting that if patients are in fact substituting opioids with marijuana, this substitution may reduce the risks of opioid-related health problems[22]. However, most large-scale randomized trials of marijuana use for pain are limited to non-cancer pain[17], and there may be potential adverse effects of marijuana use that should be considered[25,26].

We found an increase in the proportion of marijuana users between 2005-2006 and 2013-2014 with a significantly increased likelihood of 5% each two-year study period among all survey respondents. This finding reflects increased US support of marijuana legalization and changes to local and state legislation over this decade. In 2005, 36% of the population supported marijuana legalization; in 2014, 51% of Americans were supportive[43,44]. Between 2005-2014, seven states legalized medical marijuana, while four states and Washington, DC legalized marijuana for recreational use[45,46]. By November 2014, nearly 175 million people lived in areas where recreational or medical marijuana were fully legal or decriminalized[47]. This phenomenon is particularly relevant for oncology, as prior studies have shown that legalization is an important factor in cancer patients' decision to use cannabis[23].

Given the current opioid epidemic with sales of opioid pain relievers quadrupling between 1999 and 2010[48], it is interesting that there was no significant increase in the proportion of respondents using prescription opioids between 2005-2006 and 2013-2014. This outcome echoes a recent Centers for Disease Control report, which found that recent annual opioid prescribing rates actually decreased by 13.1% between 2012 and 2015, yet still remained three times as high compared to 1999[49]. A recent observational study over a 6 year period found that doses of opioids prescribed to cancer patients had decreased[50]. These recent decreases suggest heightened awareness among physicians and all patients about the risks associated with opioid pain relievers. The increase in marijuana use measured in this study in the context of stable opioid use highlights the significance of increasing marijuana usage between 2005-2006 and 2013-2014.

This study has several limitations. Given the cross-sectional study design, our findings are associations and not indicative of a causal relationship between cancer and marijuana or opioid use. Future studies that further investigate these relationships should consider investigating additional clinical characteristics not accounted for here but previously shown to predict opioid abuse, such as number of opioid prescriptions, number of opioid prescribers, early opioid refills, and psychiatric diagnoses[51]. Second, data currently available from NHANES does not include results beyond 2015. Thus we are unable to capture time and prevalence trends after some of the most recent legislative changes in marijuana legalization and responses to opioid epidemic. With NHANES data we cannot discern between medicinal and recreational marijuana use. The cancer variable for our analysis is not confirmed with medical records but instead is self-reported and subject to recall bias. Thus, we do not have additional information about respondent cancer status that may impact substance use (i.e, currently undergoing treatment vs in remission) and it is possible that these data may not be generalizable to all cancer patients with a verified diagnosis. However,

NHANES data (and this specific cancer variable) has been used to investigate cancer in other studies[29,30]. Finally, we defined opioid use based on filling a prescription within the last 30 days, which may be an underrepresentation of total opioid use. While the complex, multistage probability sampling method of NHANES data collection introduces statistical challenges, our analysis effectively accounts for confounding variables via propensity score matching and multivariable analyses. Ultimately, while the NHANES data is self-reported and subjective to sampling bias (which was accounted for in our analyses of non-propensity score matched respondents), we are able to investigate the outcome of substance use in this representative population otherwise not previously documented.

CONCLUSION

This population-based analysis shows a significant association between cancer status and opioid (but not marijuana) use. While the odds of opioid use did not significantly change among all respondents, marijuana use increased from 2005-2014, likely reflecting increased public availability and governmental legislative changes. This data is the first insight into marijuana and opioid use over time in people with cancer. Prospective clinical trials are needed to quantify the efficacy of marijuana in cancer-specific pain as well as the risk of opioid misuse among this patient population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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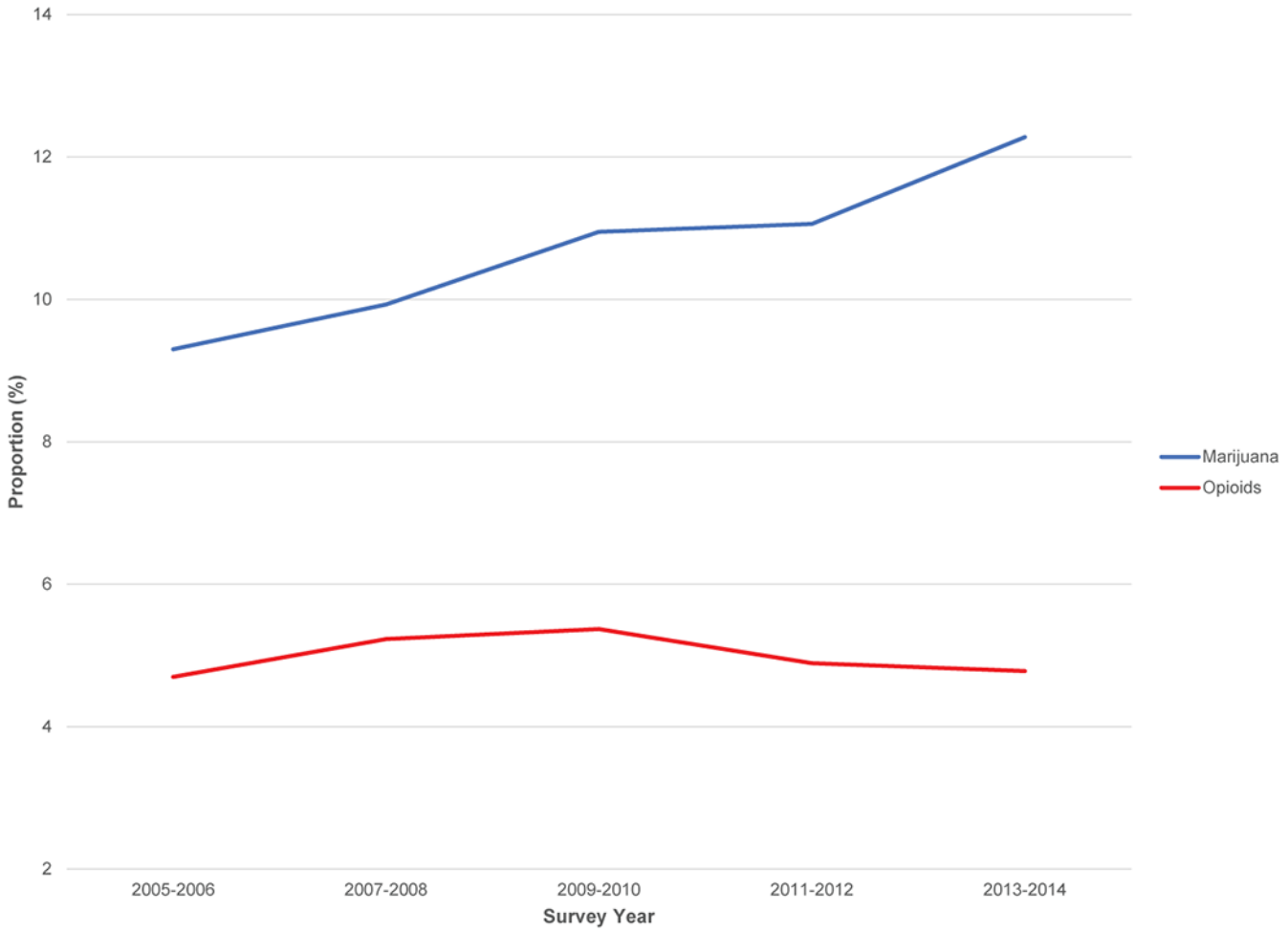
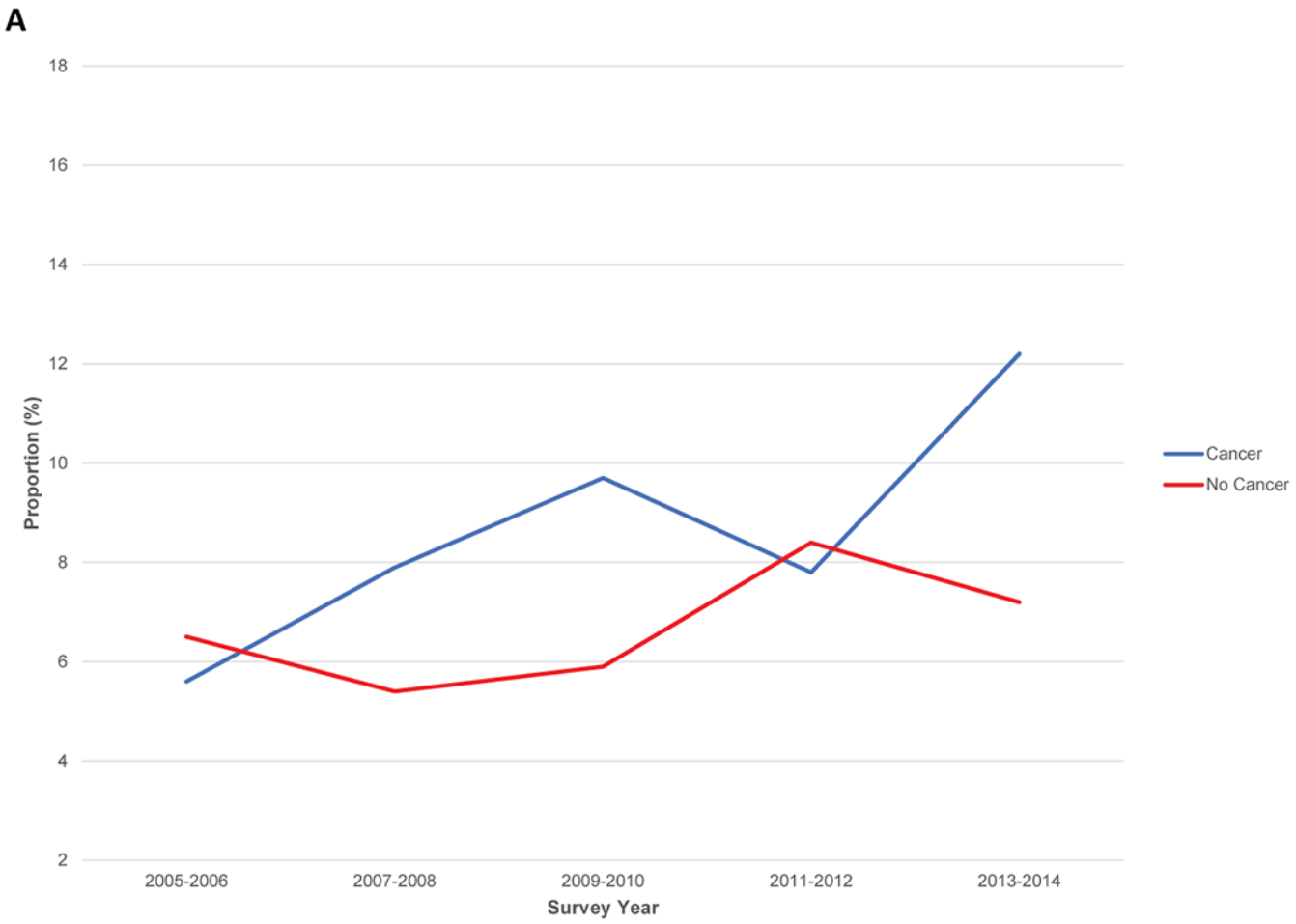


Figure 1.

Proportion of all National Health and Examination Survey (NHANES) respondents using marijuana or prescription opioids. Survey years are displayed by biennial survey responses over ten years from 2005-2014. Proportion of respondents using marijuana (blue) and opioids (red) per survey results are out of 19,604 total NHANES respondents.



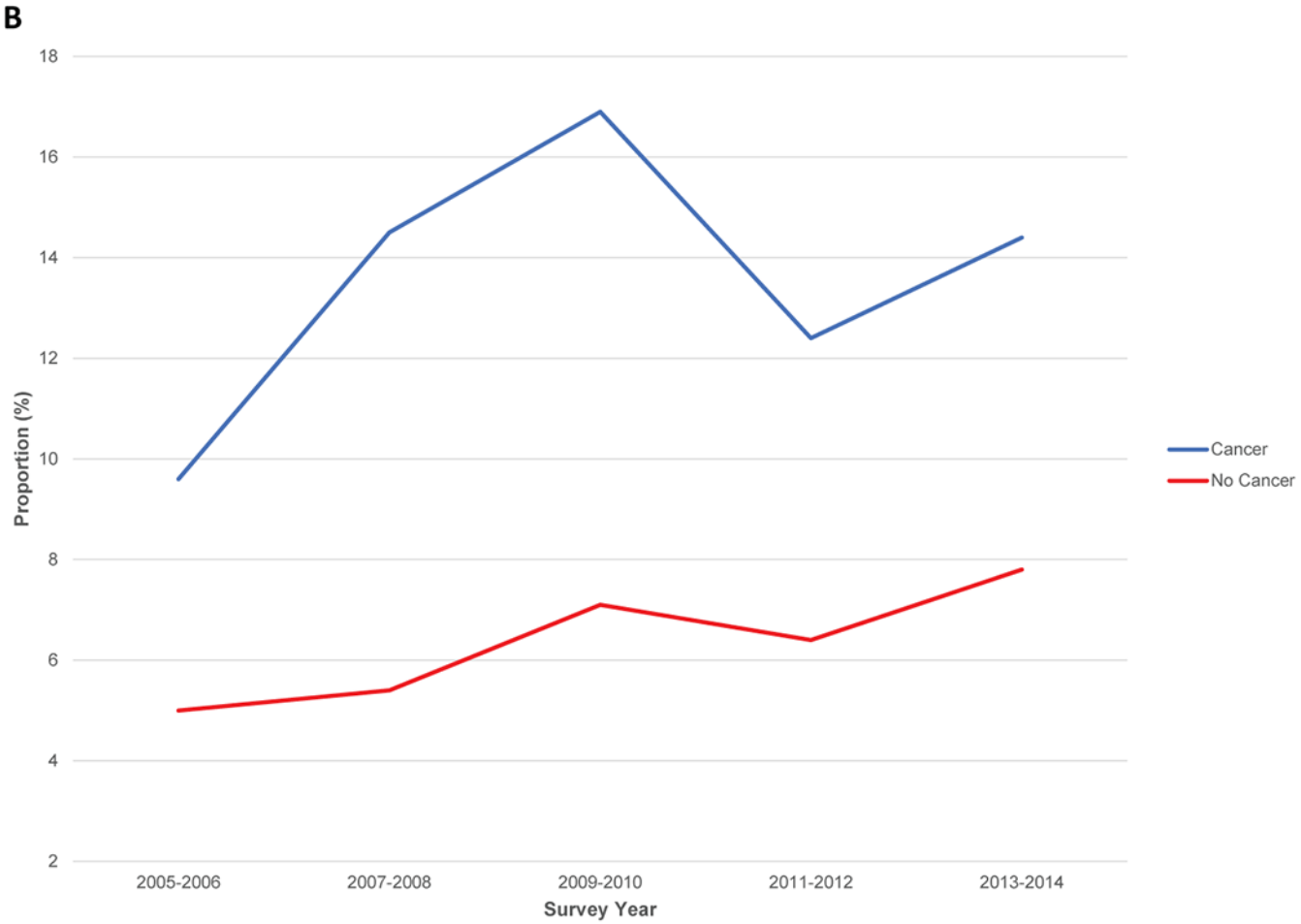


Figure 2.

Proportion of all National Health and Examination Survey (NHANES) respondents using (A) marijuana or (B) prescription opioids stratified by cancer versus non-cancer matched controls. Survey years are displayed by biennial survey responses over ten years from 2005-2014. Proportion of respondents using marijuana and opioids per survey results are out of all respondents with cancer (red, N=826) and their non-cancer matched controls (blue, N=1,652). The interaction between cancer and time was not significantly associated with either odds of marijuana or opioid use, indicating that the rate of substance use over time was not statistically significantly different between cancer and non-cancer matched controls.

Table 1.

Demographics of survey respondents

	All Respondents			
	Cancer N=826	**No Cancer N=18,778**	***P*-value**[a]	**Standard Difference**[b]
Age (mean, SD)	47.42 (10.58)	39.17 (11.69)	<0.001	0.06
Gender (N, %)				
Men	275 (33.29)	9,196 (48.97)	<0.001	0.32
Women	551 (66.71)	9,582 (51.03)		
Race (N, %)				
Non-Hispanic White	536 (64.89)	7,490 (39.89)		
Non-Hispanic Black	115 (13.92)	4,174 (22.23)	<0.001	0.52
Hispanic	130 (15.74)	5,134 (27.34)		
Other	45 (5.45)	1,980 (10.54)		
Education (N, %)				
Less than College	330 (39.95)	8,734 (46.51)		
College and Above	496 (60.05)	10,027 (53.40)	<0.001	0.19
Missing	0	17		
Self-Reported Health Status (N, %)				
Good	526 (71.18)	12,895 (79.46)		
Poor	213 (28.82)	3,333 (20.54)	<0.001	0.13
Missing	87	2,550		

Abbreviations: SD, standard deviation

[a] Chi squared test for proportions, independent samples t-test for continuous variables

All variables described here were included as propensity score matching criteria.

[b] Standard difference is the difference in means or proportions divided by standard error; imbalance defined as absolute value greater than 0.20 (small effect size)

Table 2:

Demographics of cancer and non-cancer matched controls (i.e., propensity score matched respondents)

	Propensity Score Matched Sample			
	Cancer N=826	**No Cancer N=1,652**	***P*-value[a]**	**Standard Difference[b]**
Age (mean, SD)	47.42 (10.58)	46.67 (11.01)	0.195	0.01
Gender (N, %)				
Men	275 (33.29)	561 (33.96)	0.741	0.01
Women	551 (66.71)	1091 (66.04)		
Race (N, %)				
Non-Hispanic White	536 (64.89)	1016 (61.50)	0.281	0.07
Non-Hispanic Black	115 (13.92)	260 (15.74)		
Hispanic	130 (15.74)	294 (17.80)		
Other	45 (5.45)	82 (4.96)		
Education (N, %)				
Less than College	330 (39.95)	676 (40.92)	0.644	0.05
College and Above	496 (60.05)	967 (59.08)		
Missing	0	9		
Self Reported Health Status (N, %)				
Good	526 (71.18)	1,083 (73.27)	0.297	0.02
Poor	213 (28.82)	395 (23.73)		
Missing	87	174		

Abbreviations: SD, standard deviation

[a] Chi squared test for proportions, independent samples t-test for continuous variables

All variables described here were included as propensity score matching criteria.

[b] Standardized difference is the difference in means or proportions divided by standard error; imbalance defined as absolute value greater than 0.20 (small effect size)

Table 3:

Prevalence of marijuana, illicit drug, opioid prescriptions, alcohol, and smoking among cancer and non-cancer respondents

	Cancer N=826 N (%)	No Cancer N=1,652 N (%)	Odds Ratio[a] OR (95% CI)	*P*-value[b]
Marijuana				
Current (30 days)	72 (8.72)	109 (6.60)	1.11 (0.76-1.61)	0.648
Recent (1 year)	333 (40.31)	628 (38.01)	1.20 (0.96-1.50)	0.119
Illicit Drugs[c]				
Current (30 days)	11 (1.33)	16 (0.97)	1.38 (0.50-3.94)	0.648
Recent (1 year)	24 (2.91)	42 (2.24)	1.00 (0.53-1.89)	1.000
Prescribed Opioids[d]	115 (13.92)	106 (6.42)	2.43 (1.68-3.57)	<0.001
Alcohol[e]	133 (16.10)	232 (14.04)	1.08 (0.80-1.44)	0.666
Smoking[f]	437 (52.91)	779 (47.16)	1.34 (1.09-1.65)	0.005

[a]Odds ratio calculated by univariable, conditional logistic regression to account for matched pairs and represents the odds of cancer respondents compared to non-cancer respondents to use substance of interest

[b]Chi squared test for proportions, independent samples t-test for continuous variables

[c]Illicit drugs included cocaine, heroin, and methamphetamines (not including marijuana).

[d]Prescription opioid use was defined per the Prescription Medication subsection of the survey on use of prescription medications during a one-month period prior to the survey date and included the following generic drug names: morphine, hydrocodone, codeine, oxycodone, fentanyl, dihydrocodeine, hydromorphone, meperidine, and methadone.

[e]Binge alcohol use was defined as drinking an average of more than 5 drinks/drinking day in the last year for men and more than 3 drinks/drinking day for women.

[f]Smoking was defined as having smoked at least 100 cigarettes in a lifetime.

Abbreviations: OR, odds ratio; CI, confidence interval

Table 4:

Multivariable, conditional stepwise logistic regressions using backward elimination for odds of current marijuana and prescribed opioid use among propensity score matched respondents (N=2,478)

	Current Marijuana Use[a] **OR (95% CI)**[b]	***P*-value**	**Prescribed Opioid Use**[c] **OR (95% CI)**[b]	***P*-value**
Cancer	-	-	1.82 (1.17-2.82)	0.008
Smoking[d]	5.21 (1.94-14.01)	0.053	-	-
Alcohol[e]	-	-	-	-
Current Illicit Drug Use[f]	7.06 (0.73-68.01)	0.091	-	-
Insurance Coverage[g]	-	-	1.97 (0.91-4.26)	0.085
Income >$20,000[h]	-	-	-	-

[a] Current marijuana use was defined by use within the past 30 days.

[b] Odds ratio calculated by multivariable, conditional logistic regression to account for matched pairs and represents the odds of current marijuana or prescription opioid use as indicated. All variables shown were initially included in the multivariable model and were eliminated stepwise if $P>0.1$.

[c] Prescription opioid use was defined per the Prescription Medication subsection of the survey on use of prescription medications during a one-month period prior to the survey date and included the following generic drug names: morphine, hydrocodone, codeine, oxycodone, fentanyl, dihydrocodeine, hydromorphone, meperidine, and methadone.

[d] Smoking was defined as having smoked at least 100 cigarettes in a lifetime.

[e] Binge alcohol use was defined as drinking an average of more than 5 drinks/drinking day in the last year for men and more than 3 drinks/drinking day for women.

[f] Illicit drugs included cocaine, heroin, and methamphetamines (not including marijuana).

[g] Insurance coverage was dichotomized as “covered” versus “not covered.”

[h] Low income was categorized as annual household income of less than $20,000 versus $20,000 and above given the average federal poverty line for a family of four from 2005-2014.

Abbreviations: OR, odds ratio; CI, confidence interval