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Mental Health Problems and Cancer Risk Factors Among Young Adults

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Abstract

Introduction—Chronic mental health problems often emerge in young adulthood, when adults begin to develop lifelong health behaviors and access preventive health services. The associations between mental health problems and modifiable cancer risk factors in young adulthood are not well understood.

Methods—In 2016, the authors analyzed 2014 Behavioral Risk Factor Surveillance System data on demographic characteristics, health service access and use, health status, and cancer risk factors (tobacco use, alcohol use, overweight or obesity, physical activity, and sleep) for 90,821 young adults aged 18–39 years with mental health problems (depressive disorder or frequent mental distress) compared to other young adults.

Results—Mental health problems were associated with white race; less than a high school education; lower income; being out of work or unable to work; being uninsured (for men only); poor health; previous diagnosis of asthma, skin cancer, or diabetes; and not having a recent checkup. After controlling for demographic characteristics, health service use, and health status, mental health problems among young adults were associated with smoking, binge drinking, inadequate sleep, having no leisure time physical activity, and being overweight or obese (among women only). Cervical cancer screening was not associated with mental health problems after controlling for demographic characteristics, health service use, and health status.

Conclusions—Mental health problems in young adulthood were associated with potentially modifiable factors and behaviors that increase risk for cancer. Efforts to prevent cancer and promote health must attend to mental health disparities to meet the needs of young adults.

INTRODUCTION

Young adulthood is a period in life with opportunities for cancer prevention and also unique developmental characteristics relevant to cancer and health. Assuming responsibility for one's health, healthcare needs, and making choices that impact health—like tobacco use, physical activity, and alcohol use—may be challenging for young adults. Many young adults

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are able to meet these challenges and thrive, but some find themselves without the intrapersonal or interpersonal resources to successfully navigate these life transitions. Chronic and sometimes debilitating mental health problems, including depression and anxiety, often emerge in young adulthood. For example, 75% of major depressive episodes have a first occurrence by age 24 years.¹ The prevalence of mental illnesses in the U.S. has increased among all age groups, but the highest proportions are among young adults aged 18–25 years, affecting about 6.4 million people.^{1–3}

Mental health problems and poor physical health often co-occur: Poor mental health is associated with having been diagnosed with cancer, asthma, arthritis, heart disease, diabetes, and other conditions.^{2, 4, 5} About 68% of adults with mental health problems also have at least one medical or chronic health condition.⁶ Adults with mental health problems have a greater propensity for co-existing substance abuse disorders,^{1, 7} cigarette smoking,⁸ and poor adherence to recommended physical activity and nutritional guidelines⁷ compared with adults without mental health problems. Some behaviors with adverse short- and long-term effects on health, such as alcohol use, are most prevalent among young adults, although others, like tobacco use and physical inactivity, can emerge in young adulthood and worsen over time.³ Poor health behaviors can lead to greater risk for cancers and other chronic health conditions. Opportunities during young adulthood to prevent cancer later in life include focusing on efforts to identify groups at increased risk for tobacco use, physical inactivity, alcohol use, and other health behaviors and conditions that increase risk for cancer.

Emerging adulthood is a developmental period that demands more autonomy in decisions related to health, health care, and health behaviors. According to National Health Interview Survey data, 63% of men and 78% of women aged 18–26 years had a usual place for health care, and 59% of men and 81% of women visited the doctor in the past 12 months.³ The majority of young adults thus access and utilize healthcare services, but there is a substantial portion of young adults who do not. It is unclear whether this is due to lack of access to care among young adults or if they use less health care because they are typically in good health. It is possible that engagement with the health system early in adulthood can establish patterns of improved access and use of preventive services, although research in this area is lacking. Understanding the potentially modifiable factors that are associated with use of health care, preventive services, and health behaviors can provide valuable insights into opportunities to prevent cancer and promote health among young adults. To date, little research has examined the association between mental health problems and health in the unique developmental period of young adulthood.

Although mental health problems have been associated with health behaviors and utilization of health care in adults, less is understood about these associations among young adults. Understanding the interaction among these factors and behaviors can inform opportunities to identify populations that are at increased risk for cancer and other health problems, and develop interventions to address these health outcomes.² In the current study, the authors examined the association between mental health problems and cancer risk factors, health service use, and health status among young adults. The authors hypothesized that mental

health problems in young adults would be associated with more cancer risk factors and fewer health protective behaviors, such as receipt of cancer screening.

METHODS

Behavioral Risk Factor Surveillance System (BRFSS) data from 2014 were analyzed. Data analysis was performed in 2016. BRFSS is a cross-sectional, random-digit-dial telephone survey that collects health-related information from non-institutionalized adults aged 18 years from the U.S., including those in the U.S. territories (Guam, Puerto Rico, and the U.S. Virgin Islands). The mean response rate from 2014 was 45.8%. The analysis included 90,821 participants aged 18–39 years (19.5% of total survey respondents) from all U.S. states and territories. “Young adulthood” was defined as individuals aged 18–39 years because this age range captures a broad developmental period that reflects the risk factors and health behaviors of interest. In particular, the developmental factors in the epidemiology of mental health problems are consistent with this age range. For example, the majority of individuals with depressive disorders experience their first depressive episodes at age <40 years.^{9, 10} Also, individuals aged >40 years are more likely to receive treatment for mental health problems, suggesting that the measure of mental distress and impairment in functioning used in this study may be confounded with treatment effects.¹¹

The sample was stratified by sex to account for sex-specific differences in the prevalence and clinical presentation of mental health problems, and then the following demographic characteristics were examined among young adults: age, race/ethnicity, marital status, education, employment, and household income. The following health service access and use factors were examined: receiving an influenza vaccine or mist within the past 12 months, having a checkup in the last 2 years, and having healthcare coverage. To examine health status, questions about whether the respondent had ever been told by a doctor or other health professional that they had asthma, skin cancer, or diabetes were used. These were chosen as measures of chronic disease that often emerge in young adulthood. Questions about the respondent’s self-reported health status and the number of days in the past 30 days that their physical health was not good were also used.

Measures

Two BRFSS questions about self-reported mental health problems over the past 30 days were used. The first referred to mental distress: *Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?* Respondents who reported 14 days of problems with mental health over the past month were included in the “mental health problems” group. This approach has been used previously, and mental distress as defined in this manner is associated with poor functional health and unemployment.^{2, 12, 13} The following question was used to assess a history of a depression diagnosis: *Has a doctor, nurse, or other health professional EVER told you that you have a depressive disorder (including depression, major depression, dysthymia, or minor depression)?* Respondents who answered *yes* to the question were also included in the “mental health problems” group. Respondents who both did not report 14 days with mental distress and did not report a

depression diagnosis were categorized into the “no mental health problems” group. The majority of men and women were in the no mental health problems group (81.6% of men and 72.6% of women). The mental health problems group included 12.3% of men and 20.5% of women who had a history of depression and 10.1% of men and 14.2% of women who had frequent mental distress (note that the percentages do not add up to 100 because having a history of depression and frequent mental distress are not mutually exclusive).

The analysis examined the association between mental health problems and the following cancer risk factors: being overweight or obese (based on BMI kg/m²), being a current or former smoker, binge drinking in the past 30 days (five or more drinks for men and four for women on one occasion), having no leisure time physical activity in the past 30 days, and having inadequate sleep (<7 hours on an average night in the past 30 days). These factors were chosen because they are associated with risk of developing cancer and other poor health outcomes later in life.^{14, 15} For women aged 24–39 years who did not have a hysterectomy, the association between mental health problems and being up to date on cervical cancer screening (having a Pap test in the past 3 years) was also assessed. This age range captured women who were within the range of being up to date based on U.S. Preventive Services Task Force recommendations.¹⁶

Statistical Analysis

The authors used SAS, version 9.3 with SAS-callable SUDAAN, version 9.3 was used to account for the BRFSS complex sampling design. All continuous variables were categorized, and chi-square tests were used to assess significant differences by mental health problems stratified by sex; *p*-values were calculated using the Wald *F*-test (*p*<0.05).¹⁷ Demographic characteristics, health service access and use, health status, and cancer risk factors were compared for mental health problems groups. Following these analyses, predicted marginals assessed associations between mental health problems and cancer risk factors. First, individuals with mental health problems were compared to those with no reported mental health problems on cancer risk factors, stratified by sex. A logistic regression analysis was used to produce adjusted percentages (predicted marginals) to achieve a standardized weighted average for each level of the cancer risk behavior variable of interest.¹⁸ This method allows comparison of the mental health problems groups on cancer risk factors as if they had the same demographic, health service access, and health status characteristics. Sex-specific models were created that used each cancer risk behavior variable as the dependent variable and controlled for age, race/ethnicity, marital status, education, employment, and household income.¹⁶ All dependent variables were dichotomous.

RESULTS

The prevalence of mental health problems is presented in Table 1, with demographic characteristics and descriptive statistics for the full sample and by sex. There were more women with mental health problems (27.4% compared with 18.4% for men). Slightly more than half the sample were aged 18–29 years (56.0%) and non-Hispanic white (55.2%); about one third were married (34.9%), and >10% did not graduate high school; similar patterns

were observed for men and women. Nearly two thirds were employed for wages or self-employed, with more men (74.3%) than women (56.6%) in the workforce.

Table 2 includes the distribution of demographic characteristics, health service access, and health status by sex and mental health group. There were significant differences between individuals with versus without a history of mental health problems for all variables for both men and women, except for age, having an influenza vaccine in the last year, overweight status among men, and health coverage for women. Both men and women with mental health problems were more likely to be non-Hispanic white, not have graduated from high school, be out of work or unable to work, and have a lower household income. With respect to health service access and use, young adults with mental health problems had lower proportions of visiting a doctor for a regular checkup and healthcare coverage (for men). Young adult men and women with mental health problems also had worse health: They were more likely to report a history of asthma, skin cancer, diabetes, having 5 days in poor physical health in the past month, and having fair or poor health.

Table 2 also includes results of analyses of cancer risk behaviors and cancer screening by sex and mental health problems. Young adult men and women with mental health problems had higher prevalence of being a current or former smoker, binge drinking, having no leisure time physical activity in the past month, and not getting adequate sleep. Women with mental health problems were more likely to be overweight or obese, but did not differ on the proportion receiving a Pap test in the past 3 years. Table 3 includes adjusted results of cancer risk factors and cancer screening by sex and mental health groups. After adjusting for demographic characteristics, health service access, and health status, men and women with mental health problems were more likely to be current or former smokers, have had an episode of binge drinking in the past month, have no leisure time physical activity in the past month, and have inadequate sleep. Women in these groups were also more likely to be overweight or obese. After adjusting for confounding variables, young adult women with mental health problems did not differ from those without mental health problems in receipt of recommended Pap tests.

DISCUSSION

This is the first population-based analysis of the association between mental health problems and cancer risk factors among young adults. Mental health problems, as defined by self-reported mental distress and depression, seems to be a meaningful characteristic for both men and women associated with modifiable cancer risk factors and less access to health care and greater barriers to use of health services. The hypothesis was supported by the findings. Mental health problems were associated with smoking, binge drinking, no leisure time physical activity, and inadequate sleep, as well as overweight and obesity for women.

Bivariate results indicate that young adults with mental health problems are clearly in distress and are experiencing functional impairments across several areas. Young adults are less likely to be gainfully employed or have a high school diploma, and they have lower household income. Also, men with mental health problems are less likely to have health insurance. Additionally, they have been diagnosed with health problems like asthma, skin

cancer, and diabetes and are in poor physical health. Both men and women with mental health problems are less likely to have had a checkup in the last 2 years. In light of the fact that these are young adults, it is revealing that they are experiencing so many health problems, barriers to health care, and problems with functioning. More than one quarter of young adult men and three in ten young adult women with mental health problems had 5 days when physical health was not good, and more than two in ten were in fair or poor health. These findings indicate that young adults with mental health problems are struggling in a variety of domains in their lives. Although serious health problems like cancer often do not emerge until later adulthood, young adults with mental health problems seem to be on a path that could lead to higher risk given their patterns of health behavior and poor access to and use of health services. In terms of attenuating future risk for cancer, some mental health problems can be modifiable risk factors; appropriate mental health screening, referral, and treatment services can provide support and care to address both mental health problems and related health behaviors. For example, counseling and treatment for tobacco cessation and weight management can often be delivered in the context of mental health treatment.

Although this analysis did not examine cancer outcomes, these results indicate that mental health problems in young adulthood are associated with greater risk of engaging in a host of behaviors that increase individuals' risk for cancer over the course of the lifespan. Given the long latency of cancer, it is impossible to assess these associations with cancer outcomes using cross-sectional data, but these findings highlight a group—those with mental health problems—who are at heightened cancer risk and could benefit from targeted interventions to address health needs and reduce risk for cancer later in life. Longitudinal data are needed to assess whether these associations between mental health problems in young adulthood and risk factors persist over time. Similarly, this analysis used limited indicators of chronic disease and other measures of health status, partly due to low prevalence of chronic disease and other health problems among young adults. Additional research on the association between mental health and chronic disease and health status among young adults is needed.

The importance of addressing mental health problems at the population level have been highlighted by *Healthy People 2020* objectives (www.healthypeople.gov), which acknowledge the critical role that mental health plays in people's ability to maintain good physical health and engage in health-promoting behaviors.¹⁹ *Healthy People 2020* objectives emphasize the need for expansion of screening and treatment services for mental health, but surveillance data indicate that there is still a long way to go to ensure access and reach. For example, fewer than 3% of primary care office visits for patients aged 19 years included screening for depression.²⁰ Only 68.6% of adults with depression receive treatment, below the *Healthy People 2020* target of 75.9%.¹⁹ The U.S. Preventive Services Task Force recommends screening for depression among adults.²¹ Screening instruments in common use are often self-report and brief. If appropriate follow-up referral for treatment is available, screening can lead to reductions in clinical morbidity.^{22, 23}

Limitations

These analyses are subject to several limitations. Owing to the use of cross-sectional data, it is not possible to examine the developmental timing of associations between mental health

problems. The present approach was to examine the associations between mental health problems and risk factors in order to identify populations at risk. Causal or temporal conclusions about associations among health status, cancer risk, and mental health cannot be drawn. Furthermore, these analyses are limited by self-reported data from a single questionnaire item on each of the mental health variables. Because of this, it is not possible to confirm psychiatric diagnosis or use a broader definition of mental health beyond proxy measurements of mental distress and depression. The emphasis in this analysis is on mental distress and history of depression rather than on categorical diagnosis. This analysis does not reflect mental health diagnosis, and lacks information on duration, frequency, or chronicity. Examination of the association of risk factors and healthcare use among young adults with diagnosed mental health disorders would yield additional information on populations at risk. The mental health problems measure relied on questions about frequent mental distress and self-reported history of depression; these measures have not been compared to diagnosed mental health disorders to determine how they reflect such diagnoses. Analyses with the education variable were not restricted to adults aged ≥ 25 years because 25.8% of the sample was aged 18–24 years; the distribution of the education variable for adults aged ≥ 25 years did not vary from results presented here.

CONCLUSIONS

Mental health problems emerged as a substantial marker of disparities in risk factors for cancer in young adulthood. These findings can inform the development of interventions to reduce risk among individuals with emerging mental health problems at a vulnerable developmental stage in order to promote health and well-being both in young adulthood and throughout the lifespan.

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Mental Health Problems, Demographic Characteristics, Health Service Use, and Cancer Risk Factors Among Young Adults

Table 1

Factors	Total (n=90,821) (n=7,740,767 weighted)	Men (n=41,906) (n=1,828,382 weighted)	Women (n=48,915) (n=5,912,385 weighted)
	% (95% CI)	% (95% CI)	% (95% CI)
Mental health			
Mental health problems	22.4 (21.9, 22.9)	18.0 (17.4, 18.6)	26.9 (26.3, 27.6)
Demographic characteristics			
Age, years			
18–29	56.0 (55.5, 56.6)	57.0 (56.2, 57.8)	55.0 (54.2, 55.8)
30–39	44.0 (43.4, 44.5)	43.0 (42.2, 43.8)	45.0 (44.2, 45.8)
Race/ethnicity			
White, non-Hispanic	55.2 (55.5, 56.6)	57.0 (56.2, 57.8)	55.0 (54.2, 55.8)
Black, non-Hispanic	12.7 (12.3, 13.1)	11.4 (10.9, 11.9)	14.0 (13.5, 14.6)
American Indian/Alaska Native	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	1.1 (1.0, 1.2)
Asian/Pacific Islander	7.2 (6.8, 7.6)	7.2 (6.7, 7.7)	7.2 (6.6, 7.8)
Hispanic	21.6 (21.1, 22.1)	21.8 (21.1, 22.6)	21.4 (20.7, 22.1)
Other/no preference (multi-racial)	2.3 (2.2, 2.4)	2.3 (2.1, 2.4)	2.3 (2.1, 2.5)
Marital status			
Married	34.9 (34.4, 35.5)	32.4 (31.7, 33.2)	37.5 (36.8, 38.3)
Divorced/separated/widowed	7.6 (7.3, 7.9)	6.5 (6.1, 6.9)	8.8 (8.4, 9.2)
Single, never married	49.8 (49.3, 50.4)	53.5 (52.7, 54.0)	46.0 (45.2, 46.8)
Member of unmarried couple	7.6 (7.3, 7.9)	7.6 (7.1, 8.0)	7.7 (7.3, 8.1)
Education			
Did not graduate high school	14.4 (14.0, 14.9)	15.0 (14.3, 15.7)	13.9 (13.3, 14.6)
High school graduate	28.2 (27.7, 28.7)	31.4 (30.6, 32.2)	24.9 (24.2, 25.6)
Some college	33.3 (32.8, 33.9)	31.6 (30.8, 32.3)	35.2 (34.4, 36.0)
College graduate	24.0 (23.6, 24.4)	22.1 (21.5, 22.6)	26.0 (25.4, 26.6)
Employment			
Employed for wages	65.6 (65.0, 66.1)	74.3 (73.5, 75.0)	56.6 (55.8, 57.4)
Out of work/unable to work	12.3 (11.9, 12.7)	12.0 (11.5, 12.6)	12.6 (12.0, 13.1)

Factors	Total (n=90,821) (n=7,740,767 weighted)	Men (n=41,906) (n=1,828,382 weighted)	Women (n=48,915) (n=5,912,385 weighted)
	% (95% CI)	% (95% CI)	% (95% CI)
Other (homemaker/student/retired)	22.2 (21.7, 22.7)	13.7 (13.1, 14.3)	30.8 (30.1, 31.6)
Household income			
<\$15,000	11.8 (11.5, 12.2)	9.5 (9.0, 10.0)	14.3 (13.7, 14.9)
\$15,000-\$34,999	26.5 (26.0, 27.0)	26.0 (25.3, 26.8)	27.0 (26.4, 27.8)
\$35,000-\$49,999	11.7 (11.4, 12.1)	12.3 (11.8, 12.9)	11.1 (10.6, 11.6)
\$50,000	34.5 (33.9, 35.0)	37.3 (36.5, 38.1)	31.5 (30.8, 32.3)
Unknown/refused	15.5 (15.0, 15.9)	14.9 (14.3, 15.5)	16.0 (15.4, 16.7)
Health status and service access and use			
Received a flu shot in past 12 months	28.7 (28.1, 29.2)	24.3 (23.6, 25.0)	33.1 (32.4, 33.9)
Had a checkup in past 2 years	71.3 (70.8, 71.9)	70.5 (69.7, 71.2)	81.4 (80.7, 82.0)
Had a Pap test in the past 3 years ^a	NA	NA	85.2 (84.4, 85.9)
Has healthcare coverage	78.3 (77.8, 78.8)	76.4 (75.7, 77.1)	80.3 (79.6, 80.9)
Health status			
Ever asthma	15.2 (14.8, 15.6)	13.5 (12.9, 14.0)	16.9 (16.4, 17.5)
Current asthma (among those with ever asthma)	60.6 (59.2, 62.0)	49.4 (47.2, 51.6)	69.7 (67.9, 71.4)
Skin cancer	0.6 (0.6, 0.7)	0.5 (0.4, 0.6)	0.7 (0.6, 0.8)
Diagnosed diabetes	2.1 (1.9, 2.2)	1.9 (1.6, 2.1)	2.3 (2.1, 2.5)
Number of days in past 30 days physical health was not good			
0	67.6 (67.1, 68.2)	70.7 (69.9, 71.4)	64.5 (63.7, 65.3)
1-4	18.3 (17.8, 18.7)	17.1 (16.5, 17.7)	19.4 (18.8, 20.0)
5 or more	14.1 (13.7, 14.5)	12.2 (11.7, 12.8)	16.1 (15.5, 16.7)
Health status			
Excellent/very good	58.6 (58.1, 59.2)	60.4 (59.6, 61.2)	56.8 (56.0, 57.6)
Good	30.6 (30.0, 31.1)	29.8 (29.0, 30.5)	31.4 (30.6, 32.1)
Fair/poor	10.8 (10.5, 11.2)	9.8 (9.3, 10.4)	11.8 (11.3, 12.4)
Cancer risk factors			
Overweight or obesity (≥ 25 BMI)	54.8 (54.2, 55.4)	59.7 (58.8, 60.5)	49.3 (48.5, 50.2)
Smoker			
Current	20.2 (19.8, 20.7)	23.4 (22.7, 24.1)	17.0 (16.5, 17.6)

Factors	Total (n=90,821 (n=7,740,767 weighted)	Men (n=41,906 (n=1,828,382 weighted)	Women (n=48,915 (n=5,912,385 weighted)
	% (95% CI)	% (95% CI)	% (95% CI)
Former	13.7 (13.3, 14.1)	15.8 (15.2, 16.4)	11.5 (11.0, 11.9)
Never	66.1 (65.5, 66.6)	60.8 (60.0, 61.6)	71.5 (70.8, 72.2)
Binge drinking	24.3 (23.8, 24.8)	30.8 (30.1, 31.6)	17.7 (17.1, 18.4)
No leisure time physical activity in past month	18.7 (18.2, 19.1)	16.9 (16.3, 17.6)	20.5 (19.8, 21.1)
Inadequate sleep (<7 hours)	36.0 (35.4, 36.5)	36.8 (36.0, 37.6)	35.1 (34.4, 35.9)

Note: Respondents with missing data or who answered “don’t know” or refused are excluded from the denominators.

^dPap test among women aged 24–39 years.

NA, not applicable

Table 2
Differences in Demographics, Health Service Use, and Cancer Risk Factors for Young Adults With and Without Mental Health Problems

Factors	Men		Women		p-value
	Mental health problems	No MH problems	Mental health problems	No MH problems	
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	
Demographic characteristics					
Age					
18–29 years	55.5 (53.7, 57.4)	57.3 (56.4, 58.1)	53.7 (52.3, 55.2)	55.3 (54.3, 56.2)	0.09
30–39 years	44.5 (42.6, 46.3)	42.7 (41.9, 43.6)	46.3 (44.8, 47.7)	44.7 (43.8, 45.7)	
Race/ethnicity					
White, non-Hispanic	64.9 (63.0, 66.8)	54.6 (53.7, 55.6)	64.1 (62.6, 65.6)	50.5 (49.5, 51.4)	<0.001
Black, non-Hispanic	9.6 (8.5, 10.9)	11.7 (11.1, 12.3)	12.4 (11.4, 13.6)	14.5 (13.9, 15.2)	
American Indian/ Alaska Native	1.4 (1.1, 1.7)	0.9 (0.8, 1.0)	1.4 (1.1, 1.7)	1.0 (0.8, 1.1)	
Asian/Pacific Islander	3.7 (3.0, 4.6)	7.9 (7.3, 8.5)	3.4 (2.7, 4.4)	8.6 (7.9, 9.4)	
Hispanic	17.5 (15.9, 19.3)	22.8 (21.9, 23.7)	15.8 (14.6, 17.1)	23.3 (22.4, 24.2)	
Other/no preference (multi-racial)	2.9 (2.4, 3.4)	2.1 (1.9, 2.3)	2.9 (2.4, 3.3)	2.1 (1.9, 2.3)	
Marital status					
Married	24.6 (23.1, 26.2)	34.4 (33.5, 35.2)	31.3 (30.0, 32.6)	40.1 (39.2, 41.0)	<0.001
Divorced/separated/ widowed	10.7 (9.6, 11.9)	5.5 (5.1, 5.9)	13.7 (12.7, 14.7)	6.9 (6.4, 7.3)	
Single, never married	56.2 (54.3, 58.0)	52.8 (51.9, 53.7)	46.5 (45.0, 48.0)	45.6 (44.7, 46.6)	
Member of unmarried couple	8.5 (7.5, 9.6)	7.3 (6.8, 7.9)	8.5 (7.7, 9.4)	7.4 (6.9, 8.0)	
Education					
Did not graduate high school	18.7 (16.9, 20.5)	13.9 (13.2, 14.6)	16.4 (15.1, 17.7)	12.8 (12.1, 13.6)	<0.001
High school graduate	30.7 (29.1, 32.4)	31.6 (30.7, 32.4)	26.4 (25.1, 27.8)	24.1 (23.3, 24.9)	
Some college	33.6 (31.8, 35.4)	31.2 (30.4, 32.1)	38.8 (37.4, 40.3)	33.9 (33.0, 34.9)	
College graduate	17.0 (15.9, 18.3)	23.3 (22.7, 24.0)	18.4 (17.5, 19.4)	29.1 (28.4, 29.9)	
Employment					
Employed for wages	65.1 (63.2, 66.9)	76.6 (75.8, 77.4)	52.0 (50.5, 53.5)	58.5 (57.5, 59.4)	<0.001
Out of work/unable to work	22.6 (21.0, 24.3)	9.5 (9.0, 10.1)	20.6 (19.4, 21.8)	9.3 (8.8, 9.9)	
Other (homemaker/student/ retired)	12.3 (11.1, 13.7)	13.9 (13.2, 14.5)	27.4 (26.0, 28.9)	32.2 (31.2, 33.1)	

Factors	Men			Women		
	Mental health problems	No MH problems	p-value	Mental health problems	No MH problems	p-value
	% (95% CI)	% (95% CI)		% (95% CI)	% (95% CI)	
Household income						
<\$15,000	14.9 (13.6, 16.3)	8.1 (7.5, 8.6)	<0.001	19.0 (17.9, 20.2)	12.4 (11.8, 13.1)	<0.001
\$15,000-\$34,999	30.8 (29.0, 32.5)	25.0 (24.2, 25.8)		30.6 (29.2, 31.9)	25.8 (25.0, 26.6)	
\$35,000-\$49,999	11.5 (10.4, 12.7)	12.6 (12.0, 13.2)		11.3 (10.4, 12.3)	11.1 (10.6, 11.7)	
\$50,000	29.2 (27.5, 30.9)	39.6 (38.7, 40.5)		24.8 (23.6, 26.0)	34.3 (33.5, 35.2)	
Unknown/refused	13.7 (12.5, 15.1)	14.7 (14.0, 15.4)		14.3 (13.2, 15.5)	16.3 (15.5, 17.0)	
Health status and service access and use						
Received a flu shot in past 12 months	24.8 (23.2, 26.5)	24.4 (23.6, 25.2)	0.689	31.9 (30.6, 33.3)	33.6 (32.7, 34.5)	0.053
Had a checkup in past 2 years	68.3 (66.6, 70.0)	71.0 (70.2, 71.9)	0.005	79.5 (78.3, 80.6)	82.2 (81.5, 83.0)	<0.001
Has healthcare coverage	72.8 (71.0, 74.6)	77.4 (76.6, 78.3)	<0.001	79.9 (78.7, 81.1)	80.5 (79.7, 81.3)	0.455
Health status						
Ever asthma	21.9 (20.4, 23.4)	11.6 (11.0, 12.2)	<0.001	27.0 (25.7, 28.4)	13.1 (12.5, 13.8)	<0.001
Current asthma	11.6 (10.4, 12.8)	5.2 (4.9, 5.6)	<0.001	19.9 (18.6, 21.1)	8.4 (7.9, 8.9)	<0.001
Skin cancer	0.9 (0.6, 1.3)	0.4 (0.4, 0.6)	0.007	1.1 (0.9, 1.4)	0.6 (0.5, 0.7)	0.002
Diagnosed diabetes	3.6 (3.0, 4.4)	1.4 (1.3, 1.7)	<0.001	4.1 (3.5, 4.7)	1.7 (1.4, 1.9)	<0.001
Number of days in past 30 days physical health was not good						
0	51.4 (49.5, 53.3)	75.0 (74.2, 75.8)	<0.001	47.2 (46.5, 47.9)	71.0 (70.4, 71.6)	<0.001
1-4	20.9 (19.5, 22.4)	16.3 (15.7, 17.0)		22.6 (21.4, 23.9)	18.2 (17.5, 19.0)	
5 or more	27.7 (25.9, 29.5)	8.7 (8.2, 9.2)		30.2 (28.8, 31.6)	10.8 (10.2, 11.4)	
Health status						
Excellent/very good	41.8 (39.9, 43.7)	64.9 (64.0, 65.8)	<0.001	41.2 (39.8, 42.7)	63.0 (62.1, 63.9)	<0.001
Good	35.8 (34.0, 37.6)	28.2 (27.4, 29.1)		35.5 (34.1, 36.9)	29.6 (28.7, 30.5)	
Fair/poor	22.4 (20.8, 24.1)	6.9 (6.4, 7.4)		23.3 (22.1, 24.6)	7.4 (6.9, 8.0)	
Cancer risk factors						
Overweight or obesity (≥ 25 BMI)	61.0 (59.0, 62.9)	59.5 (58.6, 60.4)	0.171	57.3 (55.7, 58.9)	46.2 (45.2, 47.2)	<0.001
Smoker						
Current	38.7 (36.8, 40.6)	19.7 (19.7, 20.5)	<0.001	31.6 (30.3, 33.0)	11.4 (10.9, 12.0)	<0.001
Former	17.4 (16.1, 18.8)	15.5 (14.9, 16.2)		15.3 (14.3, 16.3)	10.0 (9.5, 10.5)	

Factors	Men				Women			
	Mental health problems		No MH problems		Mental health problems		No MH problems	
	% (95% CI)	p-value	% (95% CI)	p-value	% (95% CI)	p-value	% (95% CI)	p-value
Never	43.9 (42.0, 45.8)		64.8 (63.9, 65.7)		53.1 (51.6, 54.6)		78.6 (77.9, 79.3)	
Binge drinking	36.1 (34.2, 38.0)	<0.001	29.7 (28.8, 30.5)	<0.001	22.2 (21.0, 23.5)	<0.001	16.2 (15.5, 16.9)	<0.001
No leisure time physical activity in past month	21.0 (19.5, 22.6)	<0.001	15.8 (15.1, 16.5)	<0.001	23.1 (21.9, 24.4)	<0.001	19.2 (18.5, 20.0)	<0.001
Inadequate sleep (<7 hours)	52.2 (50.2, 54.1)	<0.001	33.3 (32.5, 34.2)	<0.001	48.0 (46.5, 49.5)	<0.001	30.3 (29.4, 31.1)	<0.001
Had a Pap test in the past 3 years ^a	NA	-	NA	-	84.7 (83.3, 86.0)	-	85.6 (84.7, 86.4)	0.273

Notes: Respondents with missing data or who answered “don’t know” or refused are excluded from the denominators. Boldface indicates statistical significance ($p < 0.05$).

^aPap test among women aged 24–39 years.

MH, mental health; NA, not applicable

Table 3
 Predicted Marginals for Cancer Risk Factors for Young Adults by Mental Health Problems

Cancer risk factors	Men			Women			p-value
	Mental health problems	No MH problems	% (95% CI)	Mental health problems	No MH problems	% (95% CI)	
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	
BMI			0.408				<0.001
Underweight or normal weight	18.7 (17.6, 19.8)	81.3 (80.2, 82.4)	24.9 (23.6, 26.2)	75.1 (73.8, 76.4)			
Overweight or obese	18.1 (17.3, 19.0)	81.9 (81.0, 82.7)	31.6 (30.4, 32.8)	68.4 (67.2, 69.6)			
Smoking			<0.001				<0.001
Never smoker	25.2 (24.1, 26.5)	74.8 (73.5, 75.9)	41.7 (40.1, 43.3)	58.3 (56.7, 59.9)			
Current or former smoker	13.7 (12.9, 14.5)	86.3 (85.5, 87.1)	21.7 (20.7, 22.8)	78.3 (77.2, 79.3)			
Binge drinking in past month			0.010				0.002
None	19.6 (18.4, 20.8)	80.4 (79.2, 81.6)	31.5 (29.4, 33.5)	98.5 (66.5, 70.6)			
One or more times	17.7 (17.0, 18.6)	82.3 (81.4, 83.0)	28.0 (27.1, 29.0)	72.0 (71.0, 72.9)			
Leisure time physical activity in past month			<0.001				<0.001
Yes	17.6 (16.9, 18.3)	82.4 (81.7, 83.1)	27.7 (26.8, 28.7)	72.3 (71.3, 73.2)			
None	22.3 (20.6, 24.2)	77.7 (75.8, 79.4)	32.5 (30.4, 34.7)	67.5 (65.3, 69.6)			
Adequate sleep (7+ hours)			<0.001				<0.001
Adequate sleep	14.5 (13.7, 15.3)	85.5 (84.7, 86.3)	24.6 (23.5, 25.7)	75.4 (74.3, 76.5)			
Inadequate sleep	24.5 (23.4, 25.7)	75.5 (74.3, 76.6)	30.3 (29.2, 31.4)	64.7 (63.1, 66.2)			
Pap test in the past 3 years ^a			-				0.688
Had a Pap test	NA	NA	28.8 (27.8, 29.7)	71.2 (70.3, 72.2)			
Did not have a Pap test	NA	NA	28.3 (26.0, 30.6)	71.7 (69.4, 74.0)			

Notes: Respondents with missing data or who answered “don’t know” or refused are excluded from the denominators. Boldface indicates statistical significance ($p < 0.05$).

^aPap test among women aged 24–39 years.

MH, mental health; NA, not applicable