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Original article

Psychological distress associated with self-reported high blood pressure and high blood cholesterol in U.S. adults, 2007

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Abstract

Objectives: The relationship between psychological distress and high blood pressure (HBP) and high blood cholesterol (HBC) is controversial. Psychological distress may interfere with lifestyle modification and health care service use among persons with these conditions. we examined the association between persons with HBP or HBC and psychological distress using a population-based study.

Methods: Data from the 2007 Behavioral Risk Factor Surveillance System (BRFSS) were used to assess if U.S. adults aged 35 years or older with self-reported HBP or HBC also had experienced psychological distress or mental health problems that interfered with their work or usual activities during the preceding 30 days.

Results: Respondents with self-reported HBP or HBC reported more psychological distress and more severe mental health problems that interfered with their work or usual activities than persons without those conditions. Psychological distress was associated with less use of selected health care services and lifestyle modification.

Conclusions: This population-based study confirmed the close association between two major cardiovascular risk factors (HBP and HBC) and psychological distress. Persons with these conditions may improve these conditions and their mental health if they receive mental health interventions.

Keywords: Hypertension – Hypercholesterolemia – Mental health – Psychological distress.

Introduction

Cardiovascular disease (CVD) including coronary heart disease and stroke is the leading cause of death and a major cause of disability and lost productivity in U.S. adults[1]. High blood pressure (HBP) and high blood cholesterol (HBC) are two of the major CVD risk factors[2]. Although the prevalence of HBC has declined in the United States in recent decades, the prevalence of HBP is still rising[3,4].

Research suggests that psychological distress may be associated with the development and prognosis of cardiovascular events[5–9]. However, the association between psychological distress and HBP or HBC is controversial. Although some studies have found that mental health is impaired among those with either HBP or HBC[9–14], some case-control studies suggest that persons with either HBP or HBC have equal or better mental health than those without these conditions[15–17].

This study examined the association between psychological distress and two common CVD risk factors, HBP and HBC. Furthermore, we examined whether psychological distress is associated with compliance with lifestyle modification advice and use of selected health care services among persons with HBP. We also examined whether mental health treatment or use of medication among persons who are psychologically distressed and have HBP is associated with lifestyle modifications and use of selected health care services.

Methods

We used data from the Behavioral Risk Factor Surveillance System (BRFSS), an annual health survey conducted by

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random-digit-dialing methods among noninstitutionalized U.S. adults aged 35 years or older (http://www.cdc.gov/brfss/). The BRFSS was established in 1984 by the Centers for Disease Control and Prevention (CDC). It collects state based information on health risk behaviors, preventive health practices, and health care access primarily related to chronic disease and injury. In 2007, state health departments, in collaboration with CDC and the Substance Abuse and Mental Health Services Administration (SAMHSA), used a Mental Illness and Stigma Module (which contains the Kessler 6 scale) in 37 states and U.S. territories to collect data from an independent probability sample of adults aged 18 years or older. The median cooperation rate for the BRFSS – that is, the percentage of eligible respondents who completed the survey – in the participating states was 72.1 %. This analysis included respondents aged 35 years or older who had effective answers to all Kessler 6 questions. Respondents with a history of coronary heart disease, stroke, or diabetes were excluded (n = 37,860), resulting in a sample of 139,803 adults.

Ascertainment of HBP and HBC status

HBP status was ascertained by the question, "Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?" Respondents who answered "yes" to the question were classified as diagnosed with HBP. Respondents who answered "no" to the question were classified as not diagnosed with HBP. Respondents who refused or answered "don't know" (n = 239) to the HBP status questions were excluded from analysis. HBC status was ascertained by two questions, "Have you EVER had your blood cholesterol checked?" and "Have you ever been told by a doctor, nurse, or other health professional that your blood cholesterol is high?" Respondents answering "yes" to both questions were classified as diagnosed with HBC. Respondents answering "yes" to the first question and "no" to the second question were classified as not diagnosed with HBC. Respondents who never had their cholesterol checked, refused, or answered "don't know" (n = 17,854) to any of the HBC questions were excluded from analysis.

Psychological distress indicators

Psychological distress during the past 30 days was assessed by use of the Kessler 6 scale [17,18], which asks respondents how frequently they experienced symptoms of psychological distress: "During the past 30 days, how often did you feel 1) so sad that nothing could cheer you up? 2) nervous? 3) restless or fidgety? 4) hopeless? 5) that everything was an effort? and 6) worthless?" Possible responses were organized on a likert scale with the following responses: "all of the time," "most of the time," "some of the time," "a little of the time," and "none of the time." Each response was given a score from 0 ("none of the time") to 4 ("all of the time") for each item (individual item scores). The Kessler 6 total score was the sum of the scores derived from these six items. Thus, the total score ranged from 0 to 24. A score of 13 or higher was defined as serious psychological distress[10,12].

Interference of a mental health condition with work or other usual activities was ascertained by the question "During the past 30 days, for about how many days did a mental health condition or emotional problem keep you from doing your work or other usual activities?"

Receipt of mental health services was ascertained by the question "Are you now taking medicine or receiving treatment from a doctor or other health professional for any type of mental health condition or emotional problem?"

Lifestyle modification and use of health care services among persons with HBP

"Actions to control high blood pressure" is an optional module of the 2007 BRFSS, and it was implemented in 16 states. Respondents who had EVER been told by a doctor, nurse, or other health professional that they had HBP were further asked, "Are you now doing any of the following to help lower or control your high blood pressure?" The possible answers were "Changing your eating habits," "Cutting down on salt," "Reducing alcohol use," and "Exercising."

In the 2007 core questionnaire, respondents with self-reported HBP were asked whether they were currently taking medicine for this condition. All respondents were asked whether they had had their cholesterol levels checked within the past 5 years.

Covariates

Sociodemographic variables included sex (male versus female); race or ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and other); age group (18–25, 26–35, 36–45, 46–55, 56–65, 65 and over); education attainment (lower than high school, high school graduate, some college, college graduate); marital status (currently married, previously married, never married); employment status (currently employed, currently unemployed, retired, unable to work, homemaker/student); and healthcare coverage (yes/no). Health care coverage was assessed by asking if the respondent had health care coverage, including health insurance, prepaid plans such as health maintenance organizations (HMOs), or government plans such as Medicare. Body mass index (BMI = mass [kg] divided by height squared [m^2]) was determined from self-reported height and weight. Three categories were created. Adults were considered overweight if their BMI was $\geq 25\,kg/m^2$ and obese if their BMI was $\geq 30\,kg/m^2$.

Table 1. Kessler 6 total score, individual item scores, and number of days in the past 30 days that mental health problems interfered with usual activities (mean, SEM)* by high blood pressure (HBP) and high blood cholesterol (HBC) status among U.S. adults aged ≥35 years excluding those having a history of coronary heart disease, stroke, or diabetes. Behavioral Risk Factor Surveillance System, United States, 2007.

Psychological distress indicators	HBP		HBC	
	Yes (n = 44,677)	No (n = 94,916)	Yes (n = 48,285)	No (n = 74,981)
Kessler 6 total score	3.37 (0.05)	2.84 (0.02)	3.33 (0.04)	2.70 (0.02)
Feel so sad that nothing could cheer you up?	0.28 (0.01)	0.21 (0.00)	0.28 (0.01)	0.19 (0.00)
Feel nervous?	0.93 (0.01)	0.60 (0.01)	0.90 (0.01)	0.76 (0.01)
Feel restless or fidgety?	0.89 (0.01)	0.77 (0.01)	0.88 (0.01)	0.75 (0.01)
Feel hopeless?	0.34 (0.01)	0.28 (0.00)	0.33 (0.01)	0.25 (0.01)
Feel that everything was an effort?	0.70 (0.01)	0.61 (0.01)	0.69 (0.01)	0.59 (0.01)
Feel worthless?	0.26 (0.01)	0.20 (0.00)	0.25 (0.01)	0.18 (0.00)
Number of days in the past 30 days mental health problems interfered with usual activities, mean	0.93 (0.07)	0.60 (0.02)	0.88 (0.04)	0.54 (0.02)

* Estimates were obtained after adjusting for age, race/ethnicity, sex, marital status, education attainment, employment status and BMI category. SEM = standard error of mean. All comparisons between HBP "yes/no" and between HBC "yes/no" were significant at P<0.01.

	Serious psychological distress (K6 score ≥13)		
	Yes	No	P for difference
% Changing eating habits	67.0 (1.8)	70.5 (0.4)	0.06
% Cutting down on salt	78.0 (1.7)	78.9 (0.4)	0.59
% Reducing or no alcohol use	81.5 (1.6)	73.9 (0.4)	0.0000
% Exercising	47.7 (1.8)	69.0 (0.4)	0.0000
% Taking antihypertensive medication	83.3 (1.3)	82.8 (0.4)	0.74
% Cholesterol checkup within past 5 years	87.6 (1.6)	92.1 (0.2)	0.005

Table 2. Prevalence (%)* and 95 % confidence intervals (CIs) of actions to control high blood pressure, use of antihypertensive medication, and cholesterol checkup among persons with high blood pressure (HBP) aged ≥35 years by serious psychological distress status. Behavioral Risk Factor Surveillance System, United States, 2007.

* Estimates were obtained after adjustment for age, race/ethnicity, sex, marital status, education attainment, and employment status

Statistical Analysis

Analysis was conducted using SUDAAN V9 (Release 9.0.1, Research Triangle Institute, Research Triangle Park, NC, 2007) to account for the complex sampling design of the BRFSS. We used the DESCRIPT procedure to estimate the Kessler total score and standard errors (SE) by demographic characteristics. REGRESS procedure was used to obtain the adjusted estimates for continuous variables by serious psychological distress status after adjusting for age, race/ethnicity, sex, marital status, educational attainment, employment status and BMI category. We used the RLOGIST procedure to obtain the adjusted prevalence estimates for binary variables (predicted marginal probability) by psychological distress status. We used LOGLINK procedure to obtain the adjusted prevalence ratios for mental health treatment or use of medicine associated with lifestyle modification and use of other health care services after adjusting for sociodemographic variables among persons with HBP and serious psychological distress.

Results

Respondents with a history of HBP or HBC had higher Kessler 6 total scores and individual item scores compared with those without such a history (Table 1). These respondents reported more days that a mental health condition or emotional problem interfered with work or other usual activities in the past 30 days.

Respondents who did not provide valid information on HBC status (either by refusing to answer the questions or not knowing their status) were more likely to have higher psychological distress scores (mean = 3.47; SE = 0.07) than those not having HBC (mean = 2.96; SE = 0.02). A brief analysis was conducted to examine the characteristics of respondents who refused or answered "don't know" to the HBC status questions. Compared with respondents who were aware of their conditions, those who refused or were unaware of their status were more likely to be males, younger, and members of racial/ethnic minorities and to

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	Prevalence (%) of mental health treatment or use of medicine (95% CI)	APR (95% CI)
Lifestyle modification to control high blood pressure		
No	44.4 (5.9)	1.00
Yes	60.7 (1.8)	1.37 (1.05, 1.71)
Taking antihypertensive medication		
No	40.1 (3.5)	1.00
Yes	57.7 (2.5)	1.52 (1.27, 1.81)
Cholesterol checkup within past 5 years		
No	35.7 (5.9)	1.00
Yes	57.8 (1.8)	1.49 (1.17, 1.90)

Table 3. Prevalence (%), adjusted prevalence ratios (APRs),* and 95% confidence intervals (CIs) for mental health treatment or use of medicine among U.S. adults aged 35 years with high blood pressure (HBP) who experienced serious psychological distress, by lifestyle modification, use of antihypertensive medication, and cholesterol checkup status. Behavioral Risk Factor Surveillance System, United States, 2007.

* The adjusted prevalence ratio estimates were obtained after adjusting for age, race/ethnicity, sex, marital status, education attainment, and employment status

have attained less education; they also were less likely to be married.

Among persons with HBP aged 35 years or older, those who had serious psychological distress were less likely to exercise to control blood pressure (47.7 % vs. 69.0 %, P = 0.0000) (Table 2); they also were less likely to have had their cholesterol level checked within the past 5 years (87.6 % vs. 92.1 %, P = 0.005). The difference in changing eating habits was marginally significant (67.0 % vs. 70.5 %, P = 0.06). Interestingly, persons with HBP who had serious psychological distress were more likely to reduce or never have used alcohol (81.5 % vs. 73.9 %, P = 0.0000). There were no significant differences for cutting down on salt and taking antihypertensive medication according to serious psychological distress status.

Persons with HBP who had serious psychological distress were more likely to be taking medicine or receiving treatment for any type of mental health condition if they were taking the following actions than those who were not: 1) were taking lifestyle modification actions to control their HBP, 2) were taking antihypertensive medication, and 3) had had their cholesterol checked during the preceding 5 years (Table 3).

Discussion

Data from a major population-based health survey in the United States showed that self-reported HBP or HBC were independently and significantly associated with psychological distress measured by Kessler 6. These findings are consistent with research that indicates a link between psychological distress and cardiovascular risk factors such as HBP and HBC[5–8,19,20].

The relationship between cholesterol levels and psychological distress is intriguing. There are complex interactions between psychological distress, hypothalamus-pituitary-adrenal axis, noradrenergic activity, homeostatic process, and lipid metabolism[21,22]. On one hand, researchers found that persons with lower levels of serum cholesterol are more likely to experience depressive symptoms and that cholesterol lowering medication is associated with relapse of depression[23–25]. One case-control study showed that higher cholesterol levels were particularly associated with panic disorder when compared with major depression[22]. On the other hand, evidence indicates that the prevalence of major depression and negative mood was higher among persons with HBC than among those without HBC[23,24]. In our particular study, we found significant associations between HBC and psychological distress. However, we were unable to verify whether low cholesterol is also associated with high psychological distress due to lack of such information from this telephone survey.

Studies have shown an increased prevalence of HBP among depressed persons and an increased prevalence of depression in persons with HBP.[1,19] However, some studies found that anxiety – not depression – was associated with HBP[13]. In our study, we found that both depressive symptoms (e. g., feeling depressed, worthless, or hopeless) and anxiety symptoms (e. g., feeling nervous, restless, or fidgety) were associated with HBP. Hyperactivity of the sympathetic nervous system and genetic influences may be the underlying mechanisms in the relationship between psychological distress and HBP.[9,19] Furthermore, there may be other pathways linking psychological distress with HBP or HBC. Obesity might be a potential confounder. However, our results showed that the associations were still significant when obesity was controlled. Depression and anxiety may increase the risk of engaging in unhealthy behaviors, such as smoking, poor eating habits, and

physical inactivity, that increase the risk of HBP or HBC.[19] Echoing these findings, our study showed that psychological distress seems to hinder actions on lifestyle modifications (e. g., exercising) and use of preventive clinical services (e. g., cholesterol checkup) among persons with HBP. Contrary to studies that indicated poorer antihypertensive medication adherence among persons with psychiatric disorders,[23] we did not find significantly poorer antihypertensive medication adherence among psychologically distressed persons with HBP. Therefore, when persons with HBP are treated, mental health issues should be addressed simultaneously to improve compliance with lifestyle changes or preventive care use. On the other hand, our results implicate that taking these actions may also facilitate distressed hypertensives seek mental health treatment or services more actively.

A major limitation of this study is that BRFSS respondents self-reported their HBP or HBC status. HBP is usually defined as having elevated blood pressure (systolic pressure of ≥140 mm Hg or diastolic pressure of ≥90 mm Hg) and/or taking antihypertensive medication. About 68.7 % of U.S. adults with HBP were aware of their condition in 1999–2000; about 75.7 % were aware of their condition in 2003–2004.[26] HBC can be defined as the presence of total cholesterol concentrations ≥240 mg/dL (some studies used the cutpoint ≥200 mg/dL), self-reported, physician diagnosed HBC, or self-reported exposure to lipid lowering medications. National Health and Nutrition Examination Survey (NHANES) data for 1988–1994 showed that only 51 % of persons who had HBC (total cholesterol ≥200 mg/dL) and/or were taking cholesterol lowering medication self-reported that they had HBC.[27] NHANES data for 1999–2002 showed only about 63 % of those who had HBC (total blood cholesterol level ≥240 mg/dL) and/or were taking cholesterol-lowering medication were aware of their HBC status.[28] According to national surveys, only about 63 %–73 % of U.S. adults were screened for blood cholesterol during the preceding 5 years.[28–30] Some persons who had never been screened for a condition would not have a chance to learn their status and might assume that they did not have the condition. Other persons who had HBC might not have accepted the label despite being told that they had the condition.[16] Consequently, the association between self-reported HBC and psychological distress might have been confounded.

The second limitation of this study is that we were unable to evaluate lifestyle modification among respondents with HBC because there were no relevant modules in the 2007 BRFSS.

Although we are not able to infer any causal direction because of the cross-sectional nature of the BRFSS surveys, the significant association between psychological distress and two major cardiovascular risk factors (HBP and HBC) suggests the complex interaction between mental and physical health. A more comprehensive cohort study with data from both self-reported status and direct measurement could help to clarify the association of psychological distress with HBP and HBC. If our findings were confirmed in such studies, integrating mental health interventions with clinical management for persons with these conditions could be justified.

The findings and conclusions in this article are those of the authors and do not necessarily represent the official position of the Centers of Disease Control and Prevention.

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