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Lifestyle and Psychosocial Risk Factors Predict Non-adherence to Medication

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Abstract

Blood pressure and cholesterol reduction have proven effective to reduce cardiovascular disease (CVD) risk, yet adherence to medical therapy is suboptimal and contributing factors to non-adherence are not well-established. The purpose of this study was to determine the prevalence and predictors of non-adherence to blood pressure and cholesterol-lowering medications in individuals who participated in an NHLBI-sponsored evaluation of a hospital-based screening and outreach program for high-risk employees and the community. This was a cross-sectional study of 371 adults (mean age 60 years, 57% female, 60% non-white) who were eligible to participate if they were men >40 years, women >50 years, or had established CVD or CVD-risk equivalent. Each participant received a comprehensive standardized CVD screening evaluation; medication non-adherence was defined as missing any pills for high blood pressure or abnormal cholesterol in the past week. Associations between participant demographics, lifestyle and psychosocial risk factors, and non-adherence were assessed using logistic regression to adjust for confounders. The prevalence of taking medication for high blood pressure or abnormal cholesterol in the study population was 48% and 38%, respectively. Among those participants, 14% reported missing high blood pressure pills and 23% reported missing cholesterol pills in the past week. Significant ($p < 0.05$) univariate predictors of non-adherence to blood pressure medication were smoking, depression, feeling sad or blue for 2 weeks or more, and eating fast food ≥ 2 times per week. In a multivariable regression model adjusted for confounders, participants who reported missing any blood pressure pills in the past week were 6.6 times more likely to have uncontrolled hypertension ($\geq 140/90$ mmHg) compared to those who were adherent (95% CI=2.1–20.2). Age <65 years and eating outside the home ≥ 2 times per week were significantly associated with non-adherence to cholesterol medication even after adjusting for measured confounders. Non-adherence to preventive medications was associated with poor blood pressure control and several lifestyle and psychosocial risk factors for CVD. This information may be clinically useful to help identify individuals who may be non-adherent to medical therapy and at increased CVD risk.

Keywords

Cardiovascular disease; Depression; Prevention; Risk factors; Adherence

Introduction

Non-adherence to prescription therapy has been identified as a leading contributor to failure to control blood pressure and cholesterol levels [1]. Hypertension and hyperlipidemia, which are major risk factors for cardiovascular disease (CVD), affect 33% and 45% of the US adult population, respectively [2]. Studies have shown that these conditions are often poorly controlled among affected patients; and of the major causes of failure to control hypertension and high cholesterol, one of the most critical factors is compliance with prescribed medications [3, 4]. Adherence to prescribed antihypertensive and lipid-lowering medications is suboptimal, with rates estimated to be at 50% or lower, and these medications are often discontinued by patients shortly after initial prescription [5–7].

Although the reduction of blood pressure and cholesterol has consistently proven effective in reducing CVD risk [8, 9], the contributing factors to medication non-adherence are poorly understood [10]. Previous research has pointed to the possible role of demographic [11], socioeconomic [12], and psychological factors [13, 14], in predicting non-adherence to drug therapy in patients, yet these have not been well-established, especially in diverse populations of free-living, high-risk individuals. Understanding the factors that influence medication adherence could be a major advancement in optimizing the management of hypertension and hyperlipidemia. The purpose of this study was to determine the prevalence of non-adherence to preventive medications and to identify the factors associated with non-adherence among adults in a free-living ethnically diverse population, who are at increased risk for CVD.

Methods

Design and Participants

This was a cross-sectional study of 371 adult family members of patients with CVD, employees, community members, ambulatory outpatients, or visitors of New York-Presbyterian Hospital/Columbia University Medical Center. Participants were invited to receive a free onsite CVD risk factor screening and education on CVD prevention during a 1-year period from February 2008-February 2009. Participants were eligible if they were men over age 40, women over age 50, or they had established CVD or an equivalent as classified by the National Cholesterol Education Program Adult Treatment Panel III Guidelines: diabetes, stroke, peripheral arterial disease, abdominal aortic aneurysm, symptomatic carotid artery disease, or multiple risk factors that confer a 10-year Framingham Risk Score >20% [9]. Bilingual staff members were available to assist participants and all forms were available in English and Spanish. The study was approved by the Institutional Review Board of Columbia University Medical Center and therefore was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. All participants gave informed consent prior to their inclusion in the study.

Measurements

Participants received a standardized screening evaluation including medical history, lifestyle habits, traditional and psychosocial risk factors, and standard measurements of blood pressure and lipids. They also received a brief education session with a trained health educator, nurse, or physician at the conclusion of the screening event. Blood pressure was

measured using *Omron HEM-711 AC* automated blood pressure machines according to standard protocol [15]. Blood cholesterol measurements were obtained by finger-stick technology using desktop analyzers that have been validated in a similar population [16], and are commonly used in health screening and outreach programs [17, 18]. Uncontrolled risk factors were defined as blood pressure $\geq 140/90$ and total cholesterol ≥ 240 mg/dL [9, 19]. Participants with abnormal values were referred to their primary physician for medical follow-up, or to a provider within the hospital network, if appropriate.

Medication Non-adherence

Participants were asked if a physician had ever told them that they had high blood pressure or abnormal cholesterol and if they were taking any medications for these conditions, using standardized questionnaires. Among those who reported taking medications for high blood pressure or cholesterol, non-adherence was assessed by asking, "Have you missed any pills in the past week?" If participants answered yes, they were asked to indicate how many pills they had missed in the past week. Non-adherence to blood pressure medication was defined as missing any pills for high blood pressure in the past week, and non-adherence to lipid-lowering medication was defined as missing any pill for abnormal cholesterol in the past week.

Depression

The INTERHEART study documented that there was a 1.55 increased odds of having a myocardial infarction among individuals classified as clinically depressed based upon standardized questionnaires [20]. A screening tool from the INTERHEART study was used to assess depression [20]. Participants were asked whether during the past 12 months they had felt sad, blue, or depressed for 2 weeks or more in a row. If yes, they were graded by a set of yes-no questions related to loss of interest in things, feeling tired or low on energy, gain or loss of weight, trouble falling asleep, trouble concentrating, thoughts of death, and feelings of worthlessness. Five or more positive responses were defined as clinical depression.

Data Management and Statistical Analyses

All data were collected on standardized forms and double entered into a Microsoft Access database then exported to SAS version 9.1 (SAS Institute, Inc., Cary, NC, USA) for purposes of statistical analysis. Participant characteristics are described using numbers and percentages for categorical variables. For continuous variables, values are reported as means \pm standard deviation (SD).

Non-adherence to prescription blood pressure and/or lipid-lowering medications were assessed as categorical variables (yes vs. no). Potential predictors of medication non-adherence were assessed using logistic regression, with missing blood pressure pills in the past week (yes vs. no) and missing cholesterol pills in the past week (yes vs. no) as the dependent variables. Associations between participant demographics, lifestyle and psychosocial risk factors, and non-adherence were assessed using logistic regression to adjust for age, sex, race/ethnicity, and education. Statistical significance was set at $p < 0.05$.

Results

Characteristics

The characteristics of the 371 participants are listed in Table 1. The mean age was 59 ± 9 years, over half of participants were female, and 60% were racial/ethnic minorities. Nearly one in five participants was classified as depressed, and 43% reported eating outside their homes two or more times per week. Mean blood pressure was $136 \pm 21 / 82 \pm 11$ mmHg and

mean fasting total cholesterol was 194±44 mg/dL. More than 40% of participants had either hypertension or hyperlipidemia.

The prevalence of taking medication for high blood pressure or abnormal cholesterol in the study population was 48% and 38%, respectively. Among those participants, 14% reported missing high blood pressure pills and 23% reported missing cholesterol pills in the past week.

Predictors of Medication Non-adherence

Significant ($p<.05$) univariate predictors of non-adherence to blood pressure medication are shown in Table 2. Current/past smoking (OR=3.4, 95% CI=1.3–9.3), depression (OR=2.5, 95% CI=1.1–6.1), feeling sad or blue for 2 weeks or more in a row during the past 12 months (OR=2.5, 95% CI=1.1–5.8), eating fast food two or more times per week (OR=2.8, 95% CI=1.1–7.2), and blood pressure \geq 140/90 mmHg (OR=6.6, 95% CI=2.2–19.6) were significantly associated with missing blood pressure pills in the past week. Significant univariate predictors of non-adherence to cholesterol medication were age less than 65 years (OR=0.2, 95% CI=0.04–0.7) and eating outside the home two or more times per week (OR=2.3, 95% CI=1.1–4.8).

In a multivariable regression model adjusted for confounders of age, gender, race/ethnicity, smoking, depression, feeling sad or blue, and eating fast food (Table 3), participants who reported missing any blood pressure pills in the past week had 6.6 times higher odds of having uncontrolled hypertension (140/90 mmHg) compared to those who were adherent (95% CI=2.1–20.2). Age <65 years and eating outside the home \geq 2 times per week remained associated with non-adherence to cholesterol medication after adjusting for confounders of gender, race/ethnicity, total cholesterol, smoking, depression, and feeling sad or blue.

Discussion

We documented that several important lifestyle and psychosocial risk factors were significant determinants of non-adherence to anti-hypertensive and lipid-lowering medications in an ethnically diverse population of high-risk screening participants: (1) smoking, (2) clinical depression, (3) feeling sad or blue for at least 2 weeks, (4) eating outside the home, and (5) eating fast food. In addition, compared with adherent participants, non-adherent participants were significantly more likely to have uncontrolled hypertension.

Depressed patients were more likely to be non-adherent to blood pressure medication. This finding is consistent with that of a recent study of hypertensive patients enrolled in a randomized controlled trial at a primary care center at an urban, county health system [21], in which depressed patients had low self-reported adherence. One possible explanation for this is the documented relationship between psychosocial risk factors for CVD, such as depression, stress, and low social support, and decreased compliance with preventive self-care behaviors [22].

Demographic and socioeconomic factors such as age, marital status, and race/ethnicity have also been associated with non-adherence to medication in previous research [11, 23, 24]. Mochari et al. [25] found that younger age and lack of health insurance predicted lower adherence to medical therapy in a racial/ethnic minority population. In our study, we found that younger age also predicted non-adherence to cholesterol medication, and there was a similar trend for anti-hypertensive medication. Younger patients may be more likely to be non-adherent to cholesterol medications or discontinue their use prematurely possibly due to

lower perceived risk of myocardial infarction, misconceptions about the duration of treatment, or concerns about potential harm from statins [23, 26, 27].

In order to improve adherence rates, healthcare providers must first identify patients who are non-adherent to medical therapy, and this study highlights the importance of systematically interviewing about lifestyle. The identification of easily measured, novel factors such as the frequency of fast food consumption as strong determinants of non-adherence suggests that collecting this information may represent an opportunity to identify non-adherent patients. However, the findings on fast food consumption require further investigation into the specific types of foods that are chosen while eating out, and other possible mediating variables.

Limitations of our study that should be taken into consideration are that this was a population of English/ Spanish-speaking, high-risk participants in a hospital-based setting, and results may not extrapolate to other populations. In addition, data on adherence to medications was by self-report, and therefore may underestimate or overestimate rates of adherence. However, non-adherence to blood pressure medication was significantly associated with poor blood pressure control in this population. In addition, when self-report was compared to other methods of adherence measurement, including electronic lids and prescription refill records, in two randomized controlled trials of patients with heart failure and hypertension, all measures provided similar estimates of overall adherence (median adherence 84% for self-report) [28].

In conclusion, non-adherence to preventive medications was not uncommon and was associated with poor blood pressure control and several other risk factors for CVD. This information may be clinically useful to help identify individuals who may be non-adherent to medical therapy and at increased CVD risk.

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Table 1Baseline characteristics of participants (*N*=371)

Characteristic	<i>N</i> (%)
Age (≥60 years)	183 (49)
Female sex	213 (57)
White race	147 (40)
Married/living with partner	217 (59)
Education ≤ high school	96 (26)
No health insurance	57 (15)
Current/Past Smoker	160 (44)
Depression (as classified by INTERHEART study)	66 (18)
Eat outside the home ≥2 times/week	159 (43)
Eat fast food ≥2 times/week	51 (14)
Blood pressure ≥120/80 mmHg	293 (81)
Blood pressure ≥140/90 mmHg	167 (46)
Total cholesterol ≥200 mg/dL	149 (41)
Total cholesterol ≥240 mg/dL	50 (14)
Have history of high blood pressure and/or currently taking medication for high blood pressure	224 (61)
Have history of abnormal cholesterol and/or currently taking medication for abnormal cholesterol	241 (65)

Table 2

Univariate associations between CVD risk factors and medication non-adherence

CVD risk factors	Comparisons	OR (95%CI)	p value
Missed blood pressure pills (yes vs. no)			
Age	≥65 years vs. <65 years	0.69 (0.25, 1.89)	0.47
Sex	Male vs. female	1.65 (0.72, 3.78)	0.24
Race/ethnicity	Minority vs. white	2.05 (0.79, 5.30)	0.14
Current/past smoker	Yes vs. no	3.42 (1.26, 9.27)	0.02
Depression	Score≥5 vs. <5 on INTERHEART questionnaire	2.47 (1.01, 6.05)	0.04
Felt sad or blue 2 weeks or more in a row	Yes vs. no	2.53 (1.10, 5.82)	0.02
Eat outside the home	≥2 vs. <2 times per week	1.63 (0.710, 3.73)	0.25
Eat fast food	≥2 vs. <2 times per week	2.84 (1.11, 7.23)	0.03
Blood pressure	≥140/90 vs. <140/90 mm Hg	6.56 (2.19, 19.6)	<0.01
Total cholesterol	≥240 vs. <240 mg/dL	0.56 (0.13, 2.45)	0.44
Missed cholesterol pills (yes vs. no)			
Age	≥65 years vs. <65 years	0.17 (0.04, 0.72)	0.02
Sex	Male vs. female	0.72 (0.34, 1.55)	0.41
Race/ethnicity	Minority vs. white	1.21 (0.53, 2.61)	0.62
Current/past smoker	Yes vs. no	1.86 (0.67, 5.19)	0.24
Depression	Score≥5 vs. <5 on INTERHEART questionnaire	2.02 (0.88, 4.61)	0.09
Felt sad or blue 2 weeks or more in a row	Yes vs. no	0.95 (0.43, 2.08)	0.89
Eat outside the home	≥2 vs. <2 times per week	2.26 (1.06, 4.81)	0.03
Eat fast food	≥2 vs. <2 times per week	1.96 (0.80, 4.82)	0.14
Total cholesterol	≥240 vs. <240 mg/dL	1.59 (0.62, 4.10)	0.33
Blood pressure	≥140/90 vs. <140/90 mm Hg	0.84 (0.39, 1.77)	0.65

Table 3

Multivariable model: associations between CVD risk factors and non-adherence to blood pressure and cholesterol pills

CVD risk factors	Comparisons	OR (95%CI)	p value
Missed blood pressure pills (yes vs. no)			
Age	≥65 years vs. <65 years	0.73 (0.24, 2.18)	0.57
Sex	Male vs. female	1.82 (0.74, 4.50)	0.19
Race/ethnicity	Minority vs. white	2.02 (0.73, 5.58)	0.18
Blood pressure	≥140/90 vs. <140/90 mm Hg	6.56 (2.13, 20.2)	<0.001
Current/past smoker	Yes vs. no	1.22 (0.49, 3.04)	0.67
Depression	Score≥5 vs. <5 on INTERHEART questionnaire	1.21 (0.34, 4.34)	0.77
Felt sad or blue 2 weeks or more in a row	yes vs. no	2.32 (0.72, 7.46)	0.16
Eat fast food	≥2 vs. <2 times per week	2.10 (0.74, 5.75)	0.17
Missed cholesterol pills (yes vs. no)			
Age	≥65 years vs. <65 years	0.18 (0.04, 0.76)	0.02
Sex	Male vs. female	0.59 (0.27, 1.31)	0.20
Race/ethnicity	Minority vs. white	1.13 (0.51, 22.5)	0.77
Eat outside the home	≥2 vs. <2 times per week	2.31 (1.10, 5.03)	0.03
Total cholesterol	≥240 vs. <240 mg/dL	1.31 (0.48, 3.56)	0.60
Current/past smoker	Yes vs. no	2.10 (0.91, 4.43)	0.08
Depression	Score≥5 vs. <5 on INTERHEART questionnaire	6.81 (0.81, 15.69)	0.08
Felt sad or blue 2 weeks or more in a row	Yes vs. no	0.17 (0.02, 1.29)	0.08