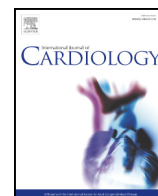




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Short communication

Insurance, self-reported medication adherence and LDL cholesterol: The REasons for Geographic And Racial Differences in Stroke study

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ABSTRACT

Background: Lack of health insurance may adversely impact medication adherence and the control of cardiovascular risk factors. We examined if the association between insurance and LDL-C is due to self-reported low medication adherence.

Methods: This cross-sectional study included 8685 black and white men and women aged 45 and older who participated in the REasons for Geographic And Racial Differences in Stroke (REGARDS) cohort and used statins. Medication adherence was assessed using the 4-item Morisky Medication Adherence Scale (MMAS-4). Mean differences in LDL-C between participants with and without insurance were calculated using generalized linear models before and after adjustment for MMAS-4. Subgroups stratified by age, annual household income, diabetes, and CHD were compared. Separately, individual MMAS-4 questions were examined for mediation effects.

Results: After multivariable adjustment but without MMAS-4, LDL-C was 2.5 mg/dL (95% CI – 0.6, 5.6) higher among uninsured versus insured participants. After further adjustment for MMAS-4, LDL-C was 2.6 mg/dL (95% CI – 0.5, 5.6) higher. Stratified analyses produced similar results. No mediating effect was observed when each MMAS-4 question was examined separately.

Conclusion: High medication adherence does not mediate the association between having health insurance and lower LDL-C.

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Background

Despite efforts to increase health insurance coverage in the US, in 2015 29 million American adults were uninsured [1]. A majority of these individuals are under 64 years old, racial minorities or have lower socioeconomic status [1]. Lack of health insurance is associated with greater barriers to preventive services [2] and treatment of both acute and chronic illnesses [3] resulting in worse reported health status [4]. Being uninsured also adversely impacts medication adherence [5] and the control of cardiovascular risk factors [6]. For example, elevated low density lipoprotein cholesterol (LDL-C) is an important risk factor for future cardiovascular (CV) events [7], and having no insurance is associated with higher LDL-C in primary and secondary prevention populations [6,8].

The Morisky Medication Adherence Scale (MMAS-4) is a validated self-reported scale [9]. Worse adherence, defined using the MMAS-4, has been associated with higher prevalence of uncontrolled LDL-C [10]. However, there is limited research assessing the mediating effect of MMAS-4 on the association between insurance and LDL-C. A mediation effect by MMAS-4 would suggest that taking medications as prescribed is a mechanism by which having health insurance is associated with having low LDL-C. We examined this association in a cross-sectional analysis of the REasons for Geographic And Racial Differences in Stroke (REGARDS) study.

Methods

The REGARDS study is a population-based observational cohort study of 30,183 black and white adults aged ≥45 from the continental United States enrolled between January 2003 and October 2007 [11]. Institutional review boards (IRB) at participating centers approved this study, and participants provided written informed consent. The University of Alabama at Birmingham IRB approved this project which conforms to the ethical guidelines of the 1975 Declaration of Helsinki. We excluded participants who were not taking statins ($n = 20,716$), or had missing LDL-C values, insurance status, or did not complete the MMAS-4 ($n = 802$). Characteristics of included and excluded participants are presented in Supplemental Table 1. After these exclusions were applied, all analyses included 8685 participants.

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¹ This author takes responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.

Table 1
REGARDS participant characteristics, overall and by insurance status.

	Overall (n = 8685)	Insured (n = 8352)	Uninsured (n = 333)	p-Value*
Age, mean (SD)	66.7 (8.7)	66.9 (8.6)	60.7 (7.5)	<0.001
Female, n (%)	4253 (49.0)	4034 (48.3)	219 (65.8)	<0.001
Race, n (%)				
White	5382 (62.0)	5257 (62.9)	125 (37.5)	Ref
Black	3303 (38.0)	3095 (37.1)	208 (62.5)	<0.001
BMI**, kg/m ² , mean (SD)	29.9 (5.9)	29.8 (5.6)	32.3 (7.2)	<0.001
High school education**, n (%)	7525 (86.6)	7274 (87.1)	251 (75.4)	<0.001
Income, n (%)				
≥\$35,000	3946 (45.4)	3889 (46.6)	57 (17.1)	Ref
<\$35,000	3679 (42.4)	3452 (41.3)	227 (68.2)	<0.001
Declined to report	1060 (12.2)	1011 (12.1)	49 (14.7)	–
Geographic region, n (%)				
Stroke belt/Buckle	4816 (55.4)	4597 (55.0)	219 (65.8)	0.001
Non-stroke belt	3869 (44.6)	3755 (45.0)	114 (34.2)	Ref
HPSA**, n (%)				
Non	4957 (57.1)	4773 (57.1)	184 (55.3)	ref
Partial	3064 (35.3)	2955 (35.4)	109 (32.7)	–
Full	660 (7.6)	620 (7.4)	40 (12.0)	0.008
Current smoking**, n (%)	1082 (12.5)	1008 (12.1)	74 (22.2)	<0.001
Depressive symptoms (CESD-4), n (%)	672 (7.7)	615 (7.4)	57 (17.1)	<0.001
Cognitive impairment**, n (%)	598 (6.9)	576 (6.9)	22 (6.6)	0.67
Chronic conditions, n (%)				
CHD**	2792 (32.2)	2700 (32.3)	92 (27.6)	0.08
Stroke**	833 (9.6)	802 (9.6)	31 (9.3)	0.87
Diabetes**	2909 (33.5)	2761 (33.1)	148 (44.4)	<0.001
Hypertension**	6203 (71.4)	5928 (71.0)	275 (82.6)	<0.001
Total number of medications, mean (SD)	7.8 (3.9)	7.8 (3.9)	7.1 (3.5)	0.001
LDL-C, mg/dL, mean (SD)	96.1 (28.8)	95.8 (28.7)	103.5 (32.2)	<0.001
High medication adherence				
Yes	5912 (68.1)	5687 (68.1)	225 (67.6)	Ref
No	2773 (31.9)	2665 (31.9)	108 (32.4)	0.84

Abbreviations: BMI, body mass index; CESD, Center for Epidemiologic Studies Depression Scale; CHD, coronary heart disease; HPSA, health professional shortage area; LDL-C, low density lipoprotein cholesterol; SD, standard deviation.

* Alpha = 0.05 used for statistical significance.

** Contains missing values for some participants.

Table 2
Difference in low density lipoprotein cholesterol between participants without insurance compared to participants with insurance and mediating effect of self-reported medication adherence.

	Difference in LDL-C without self-reported adherence, β (SE)	Difference in LDL-C with self-reported adherence, β (SE)	Absolute mediation effect of self-reported adherence, $\Delta\beta$ (95% CI ^b)	Percent change mediation effect of self-reported adherence, $\Delta\%$ (95% CI ^b)
Unadjusted	7.7 (1.6)	7.6 (1.6)	–	–
Multivariable adjusted*	2.5 (1.6)	2.6 (1.6)	0.1 (–0.14, 0.29)	2.6 (–33.3, 50.3)
Subgroup analysis, multivariable adjusted ^a				
Age				
<65 years	2.0 (1.9)	2.2 (1.9)	0.2 (–0.17, 0.56)	5.3 (–80.8, 139.2)
≥65 years	4.5 (3.6)	4.5 (3.6)	0.0 (–0.30, 0.35)	0.6 (–31.7, 27.3)
Income				
<\$35,000	1.2 (2.0)	1.2 (2.0)	0.0 (–0.38, 0.32)	–0.4 (–85.0, 76.3)
≥\$35,000	9.1 (3.5)	9.1 (3.5)	0.0 (–0.49, 0.37)	–0.2 (–9.3, 10.5)
Diabetes				
Yes	0.6 (2.5)	0.6 (2.5)	0.0 (–0.29, 0.21)	–0.3 (–51.2, 57.9)
No	4.0 (2.1)	4.2 (2.1)	0.2 (–0.12, 0.52)	4.4 (–21.7, 50.1)
CHD				
Yes	1.3 (1.9)	1.4 (1.9)	0.1 (–0.14, 0.35)	1.0 (–7.2, 22.0)
No	5.7 (2.9)	5.8 (2.9)	0.1 (–0.26, 0.39)	1.2 (–63.4, 64.0)
Exploratory analysis, multivariable adjusted ^a				
Mediation by MMAS-4 Question 1 ^c	2.5 (1.6)	2.5 (1.6)	0.0 (–0.17, 0.22)	1.4 (–23.3, 38.7)
Mediation by MMAS-4 Question 2	2.5 (1.6)	2.4 (1.6)	–0.1 (–0.26, 0.12)	–1.7 (–27.1, 26.9)
Mediation by MMAS-4 Question 3	2.5 (1.6)	2.6 (1.6)	0.1 (–0.05, 0.25)	2.6 (–24.8, 33.5)
Mediation by MMAS-4 Question 4	2.5 (1.6)	2.4 (1.6)	–0.1 (–0.52, 0.25)	–3.7 (–64.3, 58.5)

Abbreviations: CI, confidence interval; CHD, coronary heart disease; LDL-C, low density lipoprotein cholesterol; MMAS-4, Morisky medication adherence scale; SE, standard error.

^a Multivariable adjusted for predisposing (age, sex, race, body mass index), need (geographic region, income, education, health professional shortage area), and enabling (history of coronary heart disease, diabetes, stroke, hypertension, smoking, depressive symptoms, cognitive impairment, # medications taken) factors.

^b 95% CI generated with bootstrap analysis of 1000 simulations.

^c MMAS-4 Question 1: “Do you ever forget to take your medication?”

MMAS-4 Question 2: “Are you careless at times about taking your medicine?”

MMAS-4 Question 3: “Sometimes if you feel worse when you take the medicine, do you stop taking it?”

MMAS-4 Question 4: “When you feel better do you sometimes stop taking your medication?”

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