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Cardiovascular disease and preventive care service utilization among midlife adults: The roles of diagnosis and depression

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ABSTRACT

Objectives: Secondary preventive care is important for monitoring the progression of cardiovascular disease (CVD). However, the factors that promote secondary prevention were not well understood. This study addressed this gap by investigating the impact of CVD diagnosis on preventive care utilization among midlife adults. Given the high prevalence of depression among this population, it further examined whether depression interacted with CVD diagnosis to affect preventive care utilization.

Methods: The study sample included 6,222 midlife adults from six waves of the National Longitudinal Survey of Youth 1979 (NLSY79) collected between 2006 and 2016. Multiple logistic regressions were conducted to examine the relationship between a CVD diagnosis and each of the five types of preventive care utilization: influenza vaccinations, electrocardiography (EKG) and screening for high blood pressure, cholesterol, and blood sugar. Depression was then added to examine its possible moderation effect.

Results: The results showed that midlife adults with a CVD diagnosis were more likely to utilize all five types of preventive care services. EKG, the most relevant preventive care type with CVD diagnosis, had the largest strength of likelihood. Depression strengthened the relationship between a CVD diagnosis and the utilization of blood pressure tests, but it showed no associations with other four types of preventive care utilization.

Conclusions: The study findings indicate that a CVD diagnosis could serve as an opportunity for promoting secondary preventive care utilization. Future research needs to explore how a CVD diagnosis affects different population groups, and further explore the roles of depression.

1. Introduction

Cardiovascular diseases (CVDs) are leading causes of disability and mortality among midlife and older adult populations in the United States [1–3]. As a major health threat, CVD also increases public health expenditure [4]. As such, the role of preventive medicine in preventing the onset or monitoring the progression of CVD has been studied to address this health concern [5,6]. Yet, despite the well-documented effectiveness of preventive care [5], utilization of such preventive care remains limited [7–9]. Therefore, it is important to further examine possible influencing factors and associated mechanisms affecting preventive care utilization associated with CVD.

Cardiovascular disease also impacts people's mental health. Depression is more prevalent among people with CVD, and people with depression are at risk of reduced motivation in health management actions [10]. This may be because individuals with depression are less agile in adjusting to and managing the changes they experience after CVD diagnosis. There are also reasons to examine how mental health affects associations between CVD diagnosis and preventive care utilization.

Given the growing incidences of midlife individuals living with CVDs [11], this study aims to investigate the impact of a CVD diagnosis on their preventive care utilization. Due to the high rate of depression among those diagnosed with CVD, it further examines the role of depression in moderating this relationship. Examining these associations will help contribute to developing more effective intervention strategies for disease management and improve health outcomes among this population. By investigating the impact of a CVD diagnosis on preventive care utilization and the moderating effects of depression on this impact, this study addresses several important gaps in the literature. First, while existing research has examined the impact of a CVD diagnosis on health behavior changes, most of these studies focus on smoking cessation [12,13] or physical activities [12,14]. Second, while evidence shows that adults with CVD and depression are at risk of reduced medical adherence (Hare et al., 2014), it is less clear if such a combination affects their preventive care use. As well, much of the empirical work on CVD has focused on older adults, and studies investigating midlife adults' preventive care utilization have been limited. Yet studying the role of CVD diagnosis and depression in utilization of preventive care services by midlife adults is critical for early detection and intervention in managing symptoms and reducing the risk of future complications.

2. Methods

2.1. Data source and study design

We used data from the National Longitudinal Survey of Youth (NLSY79), a nationally representative study. The NLSY79 data includes micro-information detailing respondents' education, employment,

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marriage, physical health, and mental health, which is relevant to the purposes of the current study. Respondents were interviewed annually from 1979 to 1994 and biennially thereafter, with the most recent wave (Wave 28) conducted in 2018. The total retention rate from 1979 to 2020 was 77%.

Table 1 illustrates the NLSY79 survey years and waves from which the study sample was selected. Temporal order was established between variables to help improve internal validity, as recommended in earlier studies [15]. The questions on a CVD diagnosis, diabetes, hypertension, and depression were asked when respondents turned 50, and demographic variables were gathered when respondents turned 48 years old. The five types of preventive care utilization were measured when these respondents turned 52 years old. The final study sample includes 6222 participants.

2.2. Study variables

Preventive care services were selected based on the U.S. Preventive Services Task Force's *2014 Guide to Clinical Preventive Services* [16] including blood pressure, cholesterol, and blood sugar screening, influenza vaccinations, and electrocardiography (EKG). Each of the five variables is a combined variable collected from four waves covering 2010 through 2016. The question is "During the past 24 months, have you had any of the following medical tests or procedures?" with binary coding no (0) and yes (1).

The diagnosis of CVD was a self-reported binary variable based on the question "Has a doctor ever told you that you had a heart attack, coronary heart disease, angina, congestive heart failure, or other heart probl0ems?" The variable was collected by combining four waves (2008 through 2014). The diagnosis status was binary coded into no (0) and yes (1).

The *depression* variable was collected by combining four waves of samples, covering 2008 through 2014. The seven-item short form of the Center for Epidemiological Studies-Depression Scale (CES-D) was used to measure depressive symptoms, such as no appetite, absent-mindedness, depressive feelings, extra effort in doing things, troubled sleep, sadness, and inability to get "going," with Cronbach's alpha scoring 0.80 or better for various samples [17]. The cutoff point was set at 6, which is the 3rd quartile of the total score. Thus, the reference group of the "less severe" (scored 1–6) was contrasted with the highest quartile of "severe" (scored 7–21). This cutoff point was chosen because it showed the most contrasting results of the two categories.

Other covariates included gender (male or female – the data do not have other options), education (high school or less, some college, and college graduate or higher), marital status (married, separated, and never married), health insurance (yes or no), family net income (median and below, third quartile, fourth quartile), race/ethnicity (White, Black, Hispanic, and other); with male, high school or less, married, no insurance, median family income and below, and White as the reference, respectively.

Comorbidity variables included *diabetes* (yes or no) and *hypertension* (yes or no). The diabetes and hypertension diagnoses were measured by similar questions, "Has a doctor ever told you that you had [the health condition name]?"

Table 1
NLSY79 sample with the time of data collection.

Variables	Survey years for samples collection (wave number)						
	2006 (22)	2008 (23)	2010 (24)	2012 (25)	2014 (26)	2016 (27)	Total N
Covariates	x	x	x	x			6222
CVD & other diseases		x	x	x	x		6222
Depression		x	x	x	x		6222
Preventive care			x	x	x	x	6222

Note: "x" stands for the selection of study samples.

2.3. Data analysis

After the descriptive analysis, multiple logistic regressions were conducted to examine the main effect, that is, whether a CVD diagnosis impacts utilization of each of the five preventive care services. Then, we added depression to examine whether the main effect association was moderated. The best model fit of the main effects was selected by comparing Akaike information criterion and Bayesian information criterion. Finally, we examined the sensitivity of the findings by using both full information maximum likelihood (FIML) to impute missing data and compared the results with those of the complete cases. Analyses were conducted using R, version 4.2.0 [18].

3. Results

3.1. Sample characteristics

Table 2 shows the characteristics of the sample, consisting of 6222 midlife adults free of chronic diseases (diabetes, heart disease, high blood pressure) before age 31.

Slightly over half of the participants were female (52.8%), married (54.5%), without any college education (53.9%). The largest racial/

Table 2
Characteristics of the study sample (unweighted).

Variables	Mean (Standard Deviation)	Number (Percentage)	Missing data (Percentage)
Gender			4 (0.06)
Female		3282 (52.8)	
Race/ethnicity			50 (0.8)
White, non-Hispanic		2656 (42.69)	
Black		1887 (30.33)	
Hispanic		983 (15.80)	
Other		646 (10.38)	
Marital Status			4 (0.06)
Married		3389 (54.5)	
Separated/divorced/ widowed		1877 (30.2)	
Never married		952 (15.3)	
Education	13.32 (3.35)		8 (0.13)
High school or less		3351 (53.9)	
Some college		1353 (21.8)	
College graduate or higher		1510 (24.3)	
Family income	$69,687 (93,425)		754 (12.12)
1st and 2nd quartile		2725 (49.8)	
3rd quartile		1357 (24.8)	
4th quartile		1386 (25.3)	
Poverty status		995 (18.2)	
Insurance			16 (0.25)
Yes		5540 (89.3)	
Poverty			754 (12.12)
Yes		995 (18.2)	
CVD diagnosis			12 (0.19)
Yes		371 (6.0)	
Hypertension diagnosis			13 (0.21)
Yes		1335 (21.5)	
Blood sugar diagnosis			8 (0.13)
Yes		582 (9.4)	
Depression	3.85 (4.46)		58 (0.93)
Less severe		4875 (79.1)	
Severe		1289 (20.9)	

ethnic group was non-Hispanic White (42.69%), followed by African American (33.33%), Hispanic (15.80%), and other racial and ethnic groups (10.38%). A poverty rate of 18.2% was reported among the respondents.

Regarding the mental health and health conditions, the prevalence of severe depressive symptoms was about 21% in the study sample, close to a 10th of the participants (9.37%) reported a high blood sugar diagnosis, more than one-fifth (21.50%) reported a diagnosis of hypertension, and 5.97% reported being diagnosed with heart problems. In terms of preventive care use, 49.67% of the participants had received influenza shots, and 37.94% had EKG testing. The tests for blood cholesterol, blood sugar, and blood pressure levels were 76.17%, 72.82%, and 91.83%, respectively.

3.2. Primary outcomes

The average response rate from 2006 to 2016 (6 waves) was 79.2. Given the proportion of missing data (12.12% for family income and poverty, $n = 754$), we examined the data nonresponse pattern. The results with complete cases were compared with results from imputation with the full information maximum likelihood (FIML). Similar patterns appear for the results with complete cases and those from FIML imputation. Results from FIML imputation are reported.

Table 3 shows the results from the logistic regression of the relationship between cardiovascular disease and the five types of preventive care utilization. CVD diagnosis on blood sugar test and blood pressure test was significant at $p < 0.01$, whereas significance was demonstrated at $p < 0.001$ on EKGs, cholesterol tests, and influenza vaccinations. A CVD diagnosis was associated with 3.8 times (OR = 3.80, 95% confidence interval [CI] = 2.96–4.88, $p < 0.001$) more likely to receive EKG tests compared to those who do not have CVD. In the order of magnitude of the associations, the association with EKG was the strongest, followed by blood pressure tests (OR = 2.56, 95% [CI] = 1.41–4.67, $p < 0.01$), cholesterol tests (OR = 1.83, 95% [CI] = 1.32–2.53, $p < 0.001$), influenza vaccinations (OR = 1.60, 95% [CI] = 1.26–2.03, $p < 0.001$), and blood sugar tests (OR = 1.49, 95% [CI] = 1.11–2.02, $p < 0.01$).

As covariate variables on medical conditions, both high blood sugar and hypertension diagnoses were significantly associated with all five types of preventive care utilization. Female respondents, those with college education, and those with health insurance were more likely to use most preventive care services than their counterparts.

3.3. Moderating effect

Table 4 illustrates the model estimation of the joint impact of a CVD diagnosis and depression on preventive care utilization.

The interaction impact of depression and CVD was statistically significant for blood pressure tests ($\beta = 4.98$, 95% CI= 1.03, 24.04, $p < 0.05$) (Table 5). As displayed in Fig. 1, at the lower level of depression, having CVD only slightly raised the utilization coefficients. Yet for severe cases of depression, having CVD correlated with a large increase in blood pressure tests. These results showed that depression strengthened the relationship between a CVD diagnosis and blood pressure testing.

Table 3
Percentage on receiving five types of preventive care screening stratified with CVD diagnosis and depression.

	Flu	Cholesterol	Blood Sugar	Blood Pressure	EKG
No Diagnosis	48.94	75.65	72.31	91.54	35.97
With Diagnosis	60.65	84.51	81.13	96.50	68.38
Less Severe	48.48	76.50	72.73	91.96	35.90
Severe	54.07	74.94	73.40	91.31	45.32

4. Discussion

It is a concerning public health issue that 10–30% of the individuals with CVD diagnosis did not get routine testing performed for blood pressure, glucose, and cholesterol tests. Table 3 showed that the CVD diagnosis is associated with pronounced increases in all five types of preventive care utilization. This study highlights the positive impact on the likelihood of preventive care utilization of a cardiovascular disease diagnosis, with depression providing moderating effects on the relationship. After adjusting for multiple demographic and socioeconomic variables, the analysis found that a CVD diagnosis significantly increased the likelihood of midlife adults' preventive care utilization, with the strongest impact on the use of EKG test. This result is congruent with the assumption that a health event can be a *teachable moment* in health behaviors [19]. Fig. 2 shows the sequences of the strengths of influences of CVD diagnosis and its two comorbidities, which repeated this interesting pattern: while a health event may enhance different types of preventive care utilizations, the most relevant preventive care services were enhanced with the highest strength. Thus, a diagnosis of hypertension demonstrates the greatest impact on blood pressure test and high blood sugar diagnoses entail largest impact on blood sugar test. In comparison with prior studies [20,21], the present research contributes to literature by expanding the scope to include blood sugar, blood pressure tests, and EKG, with all of which being crucial for secondary prevention of CVD. Therefore, these results show that positive impacts of a diagnosis can happen on a spectrum of preventive care utilization that is broader than prior research has indicated.

The logistic regression analysis also revealed a significant interaction impact of a CVD diagnosis with depression on the likelihood of blood pressure tests. Specifically, when depression was more severe, the odds of blood pressure test utilization associated with a CVD diagnosis were higher, controlling for other variables in the model. Contrary to the proposition of the cognitive model of depression [22,23] that depression reduces the impact of diagnosis on positive health behaviors, the finding from the present study corroborates with other studies that show depression might increase a patient's contact with the healthcare system [21,24,25]. Similar findings revealed that depression was related to more hospital admissions [25–27]. Such similar findings indicate that for people with severe depression, possibly due to the reduction of cognitive function associated with depression, doctors' visits may become more relying on other factors, such as the patients' social network or other supporting systems. Such evidence suggests the cognitive theory of depression may have limitations in overestimating the roles cognition plays in influencing the preventive care utilization behaviors of the people with a CVD diagnosis and depression. Further studies are needed to examine the roles of these patients' social network and other factors in their preventive care utilization.

This study is one of the few to study the ensuing, yet transformative, impacts of a CVD diagnosis on people's adoption of health behaviors in the form of preventive care utilization [21,24,25]. It holds a dialectic importance that shows the positive end, as in the increased preventive care utilization, of a negative start, as in the CVD diagnosis. Given the high prevalence of CVDs and other chronic diseases among midlife and older adults [11], the results of our study have important practice and policy implications. In addition, the findings on the role of depression that differ from the propositions from the cognitive theory of depression may not only be an empirical anomaly from the theory. Rather, these findings may be the manifestation of the theoretical limitation of the cognitive theory of depression in its overlook of social relations or other factors that enhance the preventive care behaviors of people with depression and with CVD. Therefore, the study helps inform the future theoretical development in this area.

Therefore, the key results of this study point to several other directions for future research. First, incorporating an inclusive list of health behaviors in the same study with preventive care utilization can help us understand the disparities of health behaviors more

Table 4
Results from logistic regression on the relationship between a CVD diagnosis and preventive care utilization.

Variables	Influenza vaccination	Cholesterol test	Blood sugar test	Blood pressure test	Electrocardiography
Gender					
Female	1.27	1.47	1.20	1.91	1.03
	(1.14, 1.42) ***	(1.28, 1.68) ***	(1.05, 1.36) **	(1.55, 2.37) ***	(0.92, 1.16)
Race/ethnicity					
(White, non-Hispanic)					
Hispanic	1.09	1.12	1.38	0.75	1.18
	(0.93, 1.28)	(0.92, 1.36)	(1.14, 1.67) ***	(0.56, 1.00) *	(0.99, 1.40) ^
Black	0.87	1.20	1.61	1.27	1.58
	(0.76, 1.00) ^	(1.01, 1.43) ^	(1.36, 1.90) ***	(0.97, 1.66) ^	(1.37, 1.82) ***
Other	1.01	0.84	0.93	0.76	1.11
	(0.83, 1.21)	(0.67, 1.04)	(0.76, 1.15)	(0.54, 1.06)	(0.92, 1.36)
Marital Status					
(Married)					
Never married	1.05	0.82	0.78	0.67	1.01
	(0.88, 1.26)	(0.66, 1.01)	(0.64, 0.96) *	(0.49, 0.91) *	(0.84, 1.22)
Separated/divorced/widowed	1.03	0.9	0.99	0.80	1.13
	(0.90, 1.19)	(0.80, 1.12)	(0.84, 1.17)	(0.61, 1.03) ^	(0.98, 1.31)
Education					
(High school or less)					
Some college	1.08	1.19	1.22	1.48	1.10
	(0.94, 1.24)	(1.00, 1.41)	(1.04, 1.44) *	(1.12, 1.96) **	(0.95, 1.28)
College graduate or more	1.51	1.38	1.27	1.65	1.13
	(1.30, 1.75) ***	(1.13, 1.67) ***	(1.07, 1.52) **	(1.18, 2.31) **	(0.97, 1.32)
Family income					
(1st and 2nd quartile)					
3rd quartile	1.09	1.32	1.25	1.47	1.05
	(0.93, 1.28)	(1.09, 1.59)	(1.04, 1.50) *	(1.08, 1.99) *	(0.90, 1.24)
4th quartile	1.17	1.85	1.60	2.22	1.28
	(0.98, 1.40) ^	(1.48, 2.32) ^	(1.30, 1.97) ***	(1.50, 3.28) ***	(1.06, 1.54) **
Living in poverty	1.03	0.98	0.94	0.86	1.23
	(0.87, 1.22)	(0.81, 1.19)	(0.78, 1.13)	(0.66, 1.12)	(1.03, 1.46) *
Having health insurance	2.61	3.56	2.95	3.40	2.00
	(2.13, 3.20) ***	(2.93, 4.33) ***	(2.42, 3.58) ***	(2.66, 4.36) ***	(1.62, 2.48) ***
CVD diagnosis	1.60	1.83	1.49	2.56	3.80
	(1.26, 2.03) ***	(1.32, 2.53) ***	(1.11, 2.01) **	(1.41, 4.67) **	(2.96, 4.88) ***
Blood sugar diagnosis	1.41	1.73	3.41	1.58	1.53
	(1.16, 1.70) ***	(1.33, 2.25) ***	(2.51, 4.62) ***	(1.04, 2.40) *	(1.26, 1.86) ***
Hypertension diagnosis	1.26	2.07	1.99	2.44	1.41
	(1.10, 1.45) ***	(1.72, 2.49) ***	(1.67, 2.37) ***	(1.77, 3.35) ***	(1.23, 1.62) ***

Notes: Adjusted Odds Ratio (Confidence Intervals) was presented in the table above;.
'***' $p < 0.001$; '**' $p < 0.01$; '*' $p < 0.05$; '^' $p < 0.10$.

Table 5
Moderation effects of depression.

	Flu vaccination	Cholesterol test	Blood sugar test	Blood pressure test	Electrocardiography
CVD	1.56 **	1.63 *	1.20	1.54	3.67
	(1.13, 2.14)	(1.06, 2.49)	(0.82, 1.75)	(0.79, 3.01)	(2.64, 5.09)
DEP	1.29 ***	0.95	1.01	1.02	1.36
	(1.11, 1.50)	(0.79, 1.13)	(0.84, 1.20)	(0.78, 1.33)	(1.17, 1.59)
CVD x DEP	0.98	1.48	1.70 ^	4.98 *	1.00
	(0.60, 1.61)	(0.75, 2.91)	(0.91, 3.17)	(1.03, 24.04)	(0.59, 1.68)
McFadden's Pseudo R^2	0.0348	0.0816	0.0715	0.1199	0.0435
Nagelkerke R^2	0.0628	0.1282	0.1162	0.1513	0.0762

Notes: Adjusted odds ratio (CIs) was presented in the table above; CVD: cardiovascular disease; DEP: depression; Control variables were included in all analyses.
'***' $p < 0.001$; '**' $p < 0.01$; '*' $p < 0.05$; '^' $p < 0.10$.

comprehensively. Second, individuals' social relation changes and their communication with medical professionals might be the unexamined mechanisms that mediate a CVD diagnosis and preventive care utilization. Such possible mechanisms of influence can all be formulated into more nuanced study designs to further explore the potential channels and mechanisms of influence.

The findings imply that following up after visits and sessions with midlife adults with recently diagnosed CVD may positively influence their preventive care utilization when they may be particularly receptive to health suggestions and behavioral changes. Primary healthcare providers can conduct brief training sessions to patients following the diagnosis. Doctors' recommendations and explanations on the relevance of preventive care services are needed in clinical settings. Given the possibility that severe depression can strengthen the relationship between a CVD diagnosis and preventive care utilization, health practitioners are recommended to note possible differing functions of the social support systems of patients with different levels of depression. Based on the same result, for people with CVD, screening for depression is recommended so that the positive turn of the doubling of diseases can be taken in its full.

5. Limitations

This study has several limitations. First, questions from CES-D measured the state of depressive symptoms occurring the week before each wave of interviews. Such a state of depressive symptoms could

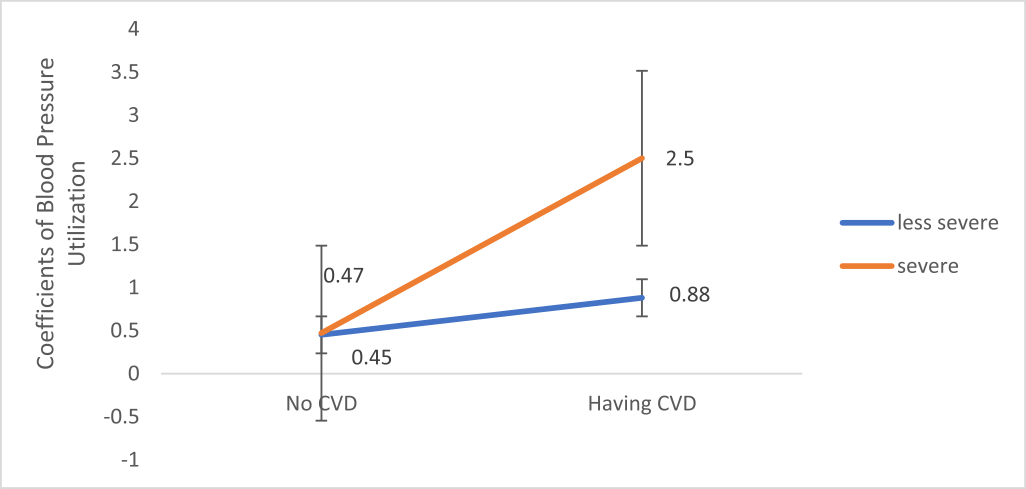

Fig. 1. Moderating effect of depression on the relationship between CVD and blood pressure test utilization.

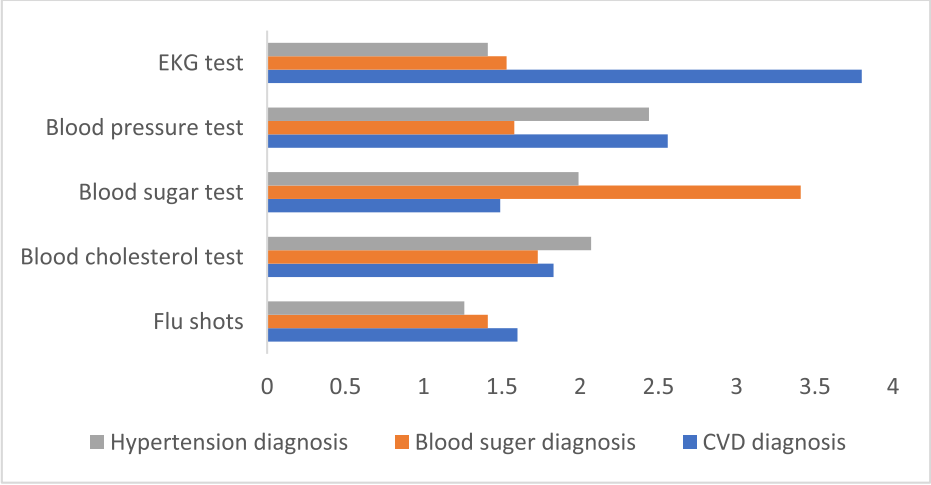

Fig. 2. Preventive care utilization of CVD, hypertension, and high blood sugar diagnosis in odds ratios (OR).

reflect more on most recent events rather than a trait. Or, if traumatic brain injury and/or stroke caused depression [28], depression may not have a cognitive influence due to reduction of brain functions. Second, CVD diagnoses in NLSY79 included multiple CVD symptomologies in one question: cardiac infarction, angina, coronary heart disease, and other heart problems. Therefore, we could not differentiate the impact of CVD symptomology. Therefore, different CVD types should be studied in the future. Third, it should be noted that self-reported variables were prone to memory errors and biases, although the chronic disease diagnoses and preventive care utilization in this study all had binary answers, which helped reduce memory errors. Future research that uses more objective measures needs to be conducted.

6. Conclusion

The study findings indicate that a CVD diagnosis significantly increases the likelihood of preventive care utilization. This indicates that the time period after a CVD diagnosis offers potential opportunities for promoting secondary preventive care utilization. The reasons for the associations uncovered here are likely complex, and additional studies are needed to further explore the role of depression and other factors that possibly moderate this relationship.

Funding

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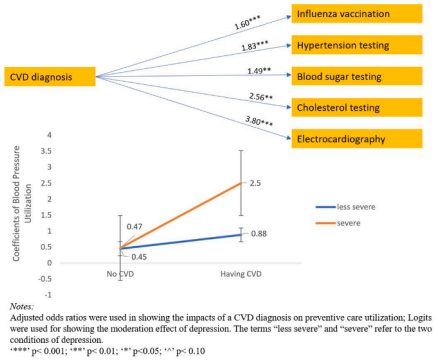
Central Illustration: Impacts of CVD diagnosis and depression on preventive care utilization



Notes:
Adjusted odds ratios were used in showing the impacts of a CVD diagnosis on preventive care utilization; Logits were used for showing the moderation effect of depression. The terms "less severe" and "severe" refer to the two conditions of depression.
'***' p< 0.001; '**' p< 0.01; '*' p<0.05; '^' p< 0.10

CRediT authorship contribution statement

Kang Sun: Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Min Zhan:** Writing – review & editing, Visualization, Validation, Supervision, Methodology, Funding acquisition,

Conceptualization.

Declaration of competing interest

The authors declare there is no conflict of interests.

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References

[1] American Heart Association. Heart disease and stroke statistics –2020 update: a report from the American Heart Association. Circulation 2020;141:e139–596.
[2] Benjamin EJ, Muntner P, Alonso A, Bittencourt MS, Callaway CW, Carson AP, Chamberlain AM, et al. Heart disease and stroke statistics –2019 update: a report from the American Heart Association. Circulation 2019;139(10):e56–528.
[3] Virani SS, Alonso A, Benjamin EJ, Bittencourt MS, Callaway CW, Carson AP, et al. Heart disease and stroke statistics –2020 update: a report from the American heart Association. Circulation 2020;141(9):e139–596.
[4] Aggarwal M, Ornish D, Josephson R, Brown TM, Ostfeld RJ, Gordon N, et al. Closing gaps in lifestyle adherence for secondary prevention of coronary heart disease. Am J Cardiol 2021;145:1–11.
[5] Pencina MJ, Navar AM, et al. Quantifying importance of major risk factors for coronary heart disease. Circulation 2018;139(13):1603–11.
[6] Vaidya V, Partha G, Karmakar M. Gender differences in utilization of preventive care services in the United States. J Womens Health 2012;21(2):140–5.
[7] Borsky A, Zhan C, Miller T, Ngo-Metzger Q, Bierman AS, Meyers D. Few Americans receive all high-priority, appropriate clinical preventive services. Health Aff 2018; 37(6):925–8.
[8] Jacob ME, Lo-Ciganic W-H, et al. The preventive services use self-efficacy (PRESS) scale in older women: development and psychometric properties. BMC Health Serv Res 2016;16:71.
[9] Levine S, Malone E, Lekiachvili A, Briss P. Health care industry insights: why the use of preventive services is still low. Cent Dis Control Prevent 2019.
[10] Thorpe JM, Thorpe CT, Kennelty KA, Chewning BA. Depressive symptoms and reduced preventive care use in older adults: the mediating role of perceived access. Med Care 2012;50(4):302–10. https://doi.org/10.1097/MLR.0b013e31821a933f.
[11] Jiang X, Lewis CE, Allen NB, Sidney S, Yaffe K. Premature cardiovascular disease and brain health in midlife. Neurology 2023;100(4):e1454–63.
[12] Jeon Y-J, Pyo J, Park Y-K, Ock M. Health behaviors in major chronic diseases patients: trends and regional variations analysis, 2008-2017, Korea. BMC Public Health 2020;20(1):1813.
[13] Lim YK, Shin DW, Kim HS, Yun JM, Shin J-H, Lee H, Koo HY, Kim MJ, Yoon JY, Cho MH. Persistent smoking after a cardiovascular event: a nationwide retrospective study in Korea. PLoS ONE 2017;12(10):e0186872.
[14] Dontje ML, Krijnen WP, de Greef MHG, Peeters GGMEE, Stolk RP, van der Schans CP, Brown WJ. Effect of diagnosis with a chronic disease on physical activity behavior in middle-aged women. Prev Med 2016;83:56–62.
[15] Cole DA, Maxwell SE. Testing mediational models with longitudinal data: questions and tips in the use of structural equation modeling. J Abnorm Psychol 2003; 112(4):558–77. https://doi.org/10.1037/0021-843X.112.4.558.
[16] US Preventive Services Task Force. The 2014 guide to clinical preventive services. Publisher; 2014.
[17] Kohout FJ, Berkman LF, Evans DA, Cornoni-Huntley J. Two shorter forms of the CES-D (Center for Epidemiological Studies Depression) depression symptoms index. J Aging Health 1993;5(2):179–93. https://doi.org/10.1177/089826439300500202.
[18] R Core Team. R: a language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing; 2022.
[19] McBride CM, Emmons KM, Lipkus IM. Understanding the potential of teachable moments: the case of smoking cessation. Health Educ Res 2003;18(2):156–70.
[20] Margolis KL, Dehmer SP, Sperl-Hillen J, O'Connor PJ, Asche SE, et al. Cardiovascular events and costs with home blood pressure telemonitoring and pharmacist management for uncontrolled hypertension. Hypertension 2020;76(4):1097–103.
[21] Xiang X. Chronic disease diagnosis as a teachable moment for health behavior changes among middle-aged and older adults. J Aging Health 2016;28(6): 995–1015.
[22] Beck AT. Depression: clinical, experimental, and theoretical aspects. New York, NY: Harper & Row; 1967.
[23] Beck AT, Freeman AM. Cognitive therapy of personality disorders. Guilford Press; 1990.
[24] Egede LE, Bishu KG, Walker RJ, Dismuke CE. Impact of diagnosed depression on healthcare costs in adults with and without diabetes: united States, 2004–2011. J Affect Disord 2016;195:119–26.
[25] Pearson SD, Katzelnick DJ, Simon GE, Manning WG, Helstad CP, Henk HJ. Depression among high utilizers of medical care. J Gen Intern Med 1999;14(8): 461–8.
[26] Hill T, Jiang Y, Friese CR, Darbes LA, Blazes CK, Zhang X. Analysis of emergency department visits for all reasons by adults with depression in the United States. BMC Emerg Med 2020;20(1):51.
[27] Prina AM, Cosco TD, Dening T, Beekman A, Brayne C, Huisman M. The association between depressive symptoms in the community, non-psychiatric hospital admission and hospital outcomes: a systematic review. J Psychosom Res 2015;78(1): 25–33.
[28] Bodnar CN, Morganti JM, Bachstetter AD. Depression following a traumatic brain injury: uncovering cytokine dysregulation as a pathogenic mechanism. Neural Regen Res 2018;13(10):1693–704.

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