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Determinants of COVID-19 testing among late middle-aged and older adults: Applying the health belief model

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ABSTRACT

Objectives: The purpose of this study was to examine correlates of taking a COVID-19 test among late middle-aged and older adults using nationally representative data.

Methods: Data were obtained from the 2020 Health and Retirement Study midway release COVID-19 module. Our sample was representative of community residing adults aged 51 and over in the United States ($n = 2,870$).

Measurements: We regressed taking a COVID-19 test on demographic characteristics, medical comorbidities, and measures related to the health belief model (i.e., perceived severity, perceived susceptibility, cues to action, and perceived barriers) using logistic regression, stratifying the model by 10-year age categories.

Results: Concern about the pandemic was associated with an increase in the likelihood of taking a test among late middle-aged adults. Knowing someone who was diagnosed with COVID-19 was associated with taking a test in most age categories. Financial barriers and knowing someone who died of COVID-19 were not associated with taking a test.

Conclusions: How late middle-aged and older adults perceive the COVID-19 pandemic may significantly influence their likelihood of taking a COVID-19 test.

Introduction

As of March 10th, 2022, there have been 79,248,406 reported cases of COVID-19 and 961,620 deaths in the United States [1]. Late middle-aged and older adults have the highest hospitalization rates among all age groups and are more likely to have risk factors such as hypertension and cardiovascular disease [2]. Higher rates of testing are associated with reduced transmission and lower COVID-19 mortality [3,4,5]. However, the success of testing largely depends on public acceptability and accessibility [6].

Limited research has examined determinants of late middle-aged and older adults' decisions to obtain a COVID-19 test. Previous research on determinants of COVID-19 testing has not exclusively focused on these age groups. Among the general population of adults in the United States, Black and Hispanic individuals are more likely to be tested [7,8], which likely relates to their disproportionate risk of exposure [7]. High comorbidity burden is also associated with increased likelihood of getting tested [7,9]. One state-specific study found that individuals who were worried about COVID-19 were more likely to seek a COVID-19 test. Conversely, financial strain was a barrier in the decision to obtain a test [10].

The health belief model (HBM) is a psychosocial framework used to explain why people take action to prevent, screen for, or control an illness [11,12]. The HBM postulates that decisions to partake in a health behavior are influenced by perceived susceptibility of getting an illness, perceived severity of its consequences, perceived benefits of the behavior, perceived barriers to participating in the behavior, self-efficacy (i.e., the conviction that a person can successfully execute a behavior), and cues to action such as environmental events [11]. The major components of the HBM have been found to be significant predictors of HIV testing uptake [13,14], cancer screening [15] and some preventative behaviors against COVID-19 such as wearing a face mask [16,17,18,19]. The HBM has also been applied to older adult populations [20,21]. In this study, we examined correlates of decisions to use a COVID-19 test among late middle-aged and older adults in the United States using the HBM as the overarching theoretical framework.

Methods

Data

This analysis used midway release data from the Health and Retirement Study, (2020 HRS COVID-19 Project), sponsored by the

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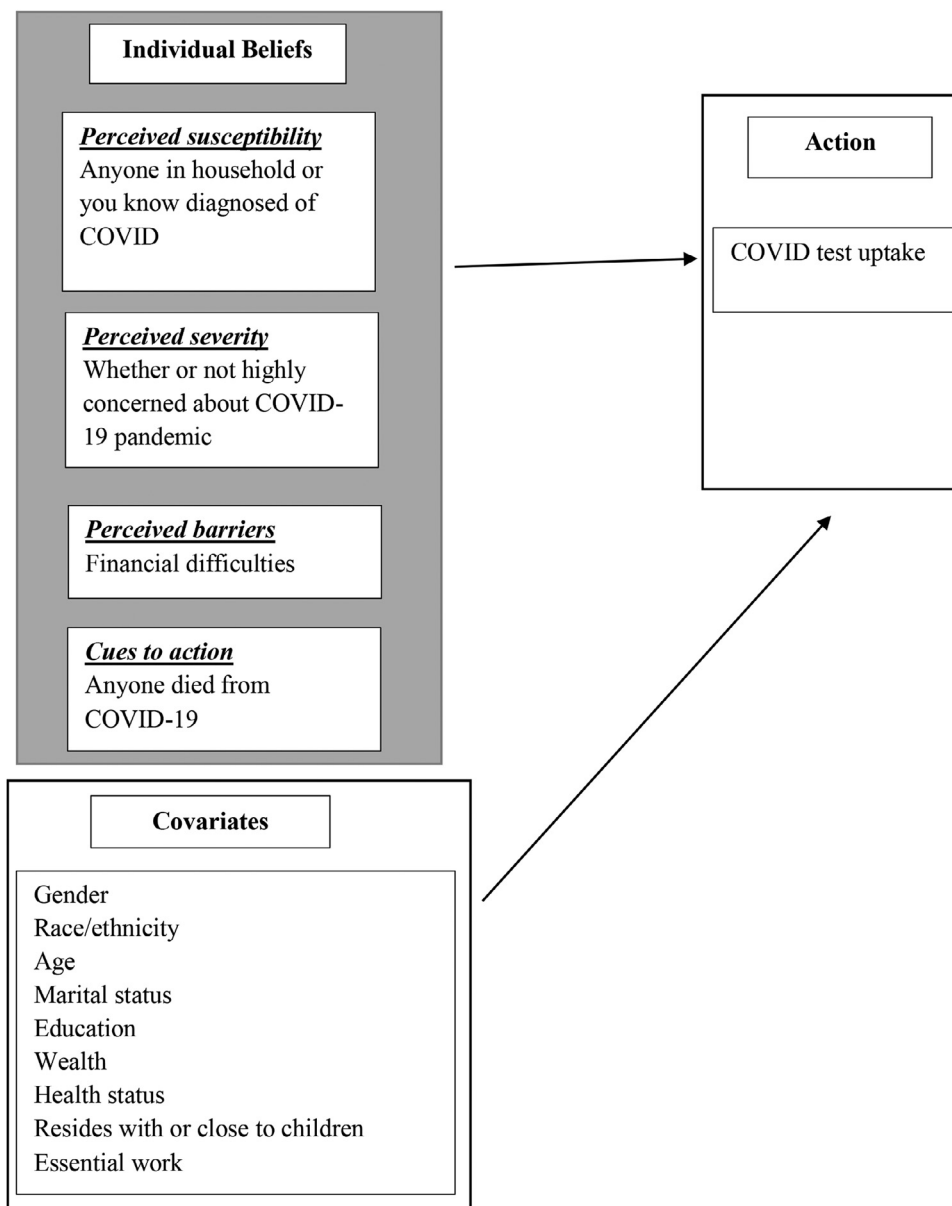


Fig. 1. The health belief model and COVID-19 testing uptake.

National Institute on Aging (grant number NIA U01AG009740) and conducted by the University of Michigan [22]. The midway release data was collected beginning in June 2020 and released in November 2020. The HRS is a nationally representative longitudinal survey of adults over age 50 and their spouses. Every two years, a random subsample is administered a psychosocial questionnaire with the other half receiving it in alternating waves. Of this subsample, 50% of participants were selected randomly to participate in the midway release version of the COVID-19 module in 2020. This project asked respondents' experiences with COVID-19 such as family and friends' diagnoses, getting COVID-19 tests, health care use, and financial issues. The 2018 RAND HRS dataset was used to provide cleaned and imputed demographic and health characteristics for the participants in the COVID-19 module, as these measures were not yet available in the 2020 midway release COVID-19 data. The midway release sample of the HRS COVID-19 module had 3266 participants. We excluded age-ineligible individuals and individuals of other races than non-Hispanic White, non-Hispanic Black, and Hispanic due to small sample size, creating an analytic sample of 2870 participants.

The outcome measure came from the following survey question: "Have you been tested for the coronavirus?" We created a binary vari-

able indicating whether the respondent took a test for COVID-19. We chose survey items using an abbreviated HBM model, which we display in Fig. 1. We created a binary variable designating whether someone the respondent knew had been diagnosed with COVID-19, which we believed to be related to perceived susceptibility. A possibility of exposure to COVID-19 was the most common reason cited for higher perceived susceptibility in one study [23].

Additionally, we created a binary variable indicating whether a participant was highly concerned about COVID-19 as a measure of perceived severity. Participants were asked to rank on a scale of 1 to 10 how concerned they were by COVID-19, with 1 being the least concerned and 10 being the most concerned. We classified scores at or above the median (8) as highly concerned.

We also used a measure of financial hardship, which was related to the perceived barrier component of the HBM. We created an indicator that denoted whether the respondent experienced at least one of 7 hardships such as trouble buying food and missed payments. Previous work that incorporated financial difficulties as a perceived barrier found that it was related to obtaining a colorectal cancer screening test [24,25]. We also created an indicator for whether a participant knew someone

Table 1
Descriptive statistics of analysis measures (n = 2870).

Measures	N	Mean (SE) or% (SE)
Took a COVID-19 test,%	2861	20.76 (1.05)
Gender,%	2870	
Female		53.63 (1.27)
Male		46.37 (1.27)
Race/ethnicity,%	2866	
Black		11.34 (0.62)
Hispanic		10.81 (0.68)
White		77.85 (0.90)
Age, mean	2870	67.98 (0.23)
Marital status,%	2868	
Married or partnered		66.30 (1.18)
Other status		33.70 (1.18)
Education,%	2869	
Less than high school		11.49 (0.72)
High school or above		88.51 (0.72)
Number of chronic conditions, mean	2870	2.25 (0.37)
Wealth (log-transformed), mean	2866	14,785 (3691.33)
Reside with or close to children/child	2870	48.20 (1.26)
Self or household member has essential work	1888	37.25 (1.52)
Health belief model components		
Perceived susceptibility, %		
Knows someone who has been diagnosed with COVID	2870	39.11 (1.26)
Perceived severity, %		
Highly concerned about the coronavirus pandemic	2838	62.73 (1.24)
Perceived barriers,%		
At least one financial barrier such as a missed regular payment	2849	26.55 (1.11)
Cues to action,%		
Knows someone who died of COVID	2859	16.32 (0.91)

Note. SE = standard error; N represents the number of valid observations.

who died of COVID-19. Cues to action represent internal or external factors that can trigger decision-making. Previous work used a measure of knowing someone who died of COVID-19 as a variable representing a cue to action to receive a COVID-19 vaccine [26]. We did not include a measure of perceived benefit or self-efficacy due to a lack of comparable HRS questions. Please see Supplemental Table 1 for more information regarding how the HBM measures were coded.

To control for greater risk of exposure to COVID-19, we included an indicator of whether the participant or someone in the house participated in essential work. Essential work, broadly defined, is a range of services critical to infrastructure operations (e.g., energy, childcare, critical retail) [27]. Additionally, we included an indicator of whether the participant lived with a child or within ten miles of a child. We also included sociodemographic factors as covariates. We incorporated self-reported gender (female, with male as the reference group), age in years, indicators for race (non-Hispanic Black and Hispanic, with non-Hispanic White as the reference group), marital status (married/partnered, with not married/partnered as the reference group), education level (less than a high school education, with at least a high school education as the reference group), and a count of chronic conditions (0–8). These conditions included hypertension, diabetes, coronary heart disease, stroke, lung disease (COPD, emphysema, or chronic bronchitis), psychometric diseases, cancer (a malignancy of any kind), and arthritis (rheumatoid arthritis, gout, lupus, or fibromyalgia).

Statistical analyses

We first examined the population weighted descriptive statistics of the sample, using preliminary weights from the HRS COVID-19 module that accounted for attrition and selection. To account for the complex sample design, we used the stratification weight and the cluster weight variables from the HRS. Weighted logistic regression was performed to examine the relationship between components of the HBM model and whether the participant took a COVID-19 test after adjusting for demographic characteristics and health conditions. For covariates with missing values, we used multiple imputation by chained equations.

The percentage of observations with missing values ranged from 0% to 34.3%. A total of 25 datasets were used to conduct statistical analysis. All data preparation and analyses were conducted via SAS version 9.4 [28]. We stratified the models by 10-year age brackets because the risk and severity of COVID-19 varies by age and may differentially impact testing decisions.

Results

Descriptive characteristics of the sample are shown in Table 1. Approximately 21% of the sample took a COVID-19 test. Additionally, 39% of the participants knew someone, including anyone in their household, diagnosed with COVID-19. Approximately 63% of the sample rated their concern about the pandemic at or above 8 out of a scale of 10. About 27% of the sample had been through some kind of financial hardship. Approximately 16% of the sample knew someone who died of COVID-19. The majority of the variables had less than 5% values missing, except for the one that asks if the respondent or someone in the household participated in essential work (35% missing). We addressed this issue with multiple imputation. Please see Supplemental Table 2 for the characteristics of participants who had missing values on the essential work measure.

The results from the logistic regression models stratified by age are shown in Table 2. Individuals in the late middle-aged group who were highly concerned about the pandemic were 64% more likely to take a test holding demographic and health characteristics constant (adjusted odds ratio [OR]= 1.64, 95% CI =1.05–2.55). Being concerned about the pandemic was not associated with test uptake among older age groups. Perceived susceptibility was a significant predictor of test uptake among most age groups. Specifically, individuals aged 51–64, 75–84, and 85 and over who knew someone diagnosed with COVID-19 were 105% (OR=2.05, 95% CI= 1.36–3.09), 119% (OR=2.19, 95% CI= 1.33–3.06) and 187% (OR= 2.87, 95% CI= 1.25–6.61) more likely to take a COVID-19 test, respectively. Experiencing financial difficulties and knowing someone who died of COVID-19 were not associated with taking a test for all age groups when holding other measures constant.

Table 2
Odds Ratios from Age-Stratified Logistic Regression Models.

Measures	Aged 51–64				Aged 65–74				Aged 75–84				Aged 85+			
	OR	OR 95% CI		p	OR	OR 95% CI		p	OR	OR 95% CI		p	OR	OR 95% CI		p
		Low	Upp			Low	Upp			Low	Upp			Low	Upp	
Gender (ref=male)																
Female	0.90	0.58	1.40	0.65	0.84	0.56	1.25	0.39	0.86	0.51	1.45	0.58	1.27	0.62	2.61	0.52
Race/ethnicity (ref=White)																
Black	1.03	0.60	1.77	0.92	2.06	1.16	3.66	0.01	1.49	0.63	3.53	0.37	0.60	0.21	1.65	0.32
Hispanic	0.99	0.60	1.63	0.97	1.13	0.44	2.90	0.79	0.58	0.28	1.20	0.14	0.25	0.04	1.55	0.14
Marital status (ref=other status)																
Married or partnered	0.61	0.40	0.92	0.02	0.71	0.43	1.17	0.18	0.95	0.52	1.71	0.86	1.17	0.54	2.54	0.70
Education (ref= high school or above)																
Less than high school education	1.07	0.54	2.14	0.84	0.96	0.44	2.11	0.92	0.63	0.32	1.23	0.18	1.82	0.75	4.41	0.18
Number of chronic conditions	1.07	0.95	1.20	0.27	0.34	1.10	0.90	1.34	1.19	1.03	1.36	0.02	1.19	0.96	1.49	0.11
Wealth (log transformed)	1.00	0.99	1.00	0.07	1.00	0.99	1.00	0.87	1.00	1.00	1.00	0.94	1.00	0.99	1.00	0.13
Reside with or close to children/child (ref=no)	1.25	0.80	1.94	0.33	0.81	0.50	1.32	0.40	1.33	0.77	2.31	0.31	2.90	0.98	8.60	0.05
Self or household member has essential work (ref=no)	1.36	0.81	2.29	0.24	1.44	0.85	2.43	0.18	1.59	0.80	3.16	0.18	0.33	0.05	2.00	0.22
Perceived susceptibility (ref=no)																
Knows someone who has been diagnosed with COVID	2.05	1.36	3.09	0.00	1.11	0.67	1.84	0.69	2.19	1.33	3.60	0.00	2.87	1.25	6.61	0.01
Perceived severity (ref=no)																
Highly concerned about the coronavirus pandemic	1.64	1.05	2.55	0.03	1.47	0.85	2.55	0.17	1.06	0.63	1.78	0.84	0.60	0.32	1.13	0.11
Perceived barriers (ref=no)																
At least one financial barrier such as a missed regular payment	1.37	0.88	2.14	0.17	0.60	0.35	1.02	0.06	1.16	0.68	1.97	0.59	0.53	0.17	1.65	0.27
Cues to action (ref=no)																
Knows someone who died of COVID	0.85	0.50	1.44	0.55	0.99	0.49	2.00	0.97	1.02	0.40	2.64	0.96	1.20	0.38	3.77	0.76

Note. OR = adjusted odds ratio; CI = confidence interval; ref = reference group; All numbers are rounded to two decimal places; Low=lower limit; Upp=upper limit.

For the oldest old age group, living with or within close proximity to a child was associated with taking a test (OR = 2.90, 95% CI = 0.98–8.60). Individuals aged 75–84 with a greater number of chronic conditions were more likely to take a COVID-19 test (OR= 1.19, 95% CI = 1.03–1.36). Demographic characteristics were related to COVID-19 testing for the comparatively younger age groups. Individuals in the late middle-aged category who were married were less likely to obtain a test holding other measures constant (OR= 0.61, 95% CI = 0.40–0.92). Among individuals aged 65–74, Black individuals were 106% more likely to test (OR= 2.06, 95% CI = 1.16–3.66). Participating or living with someone who participated in essential work was not associated with taking a test.

Discussion

Very little is known about what influences individuals' decisions to take a COVID-19 test, especially older adults who are at greatest risk of complications from the virus. Understanding what influences decisions to obtain a test may help inform public health strategies to increase testing rates. Using a nationally representative sample of older adults, we examined correlates of older adults' decisions to obtain a COVID-19 test. We used the HBM to guide our analysis.

Our study found that concern about the pandemic, our measure of perceived severity, was associated with an increased likelihood of taking a test among late middle-aged adults. This conforms with other's finding that middle-aged people show greater concern for COVID-19 than other age groups [29]. Perceived severity has also been associated with health behaviors during COVID-19 such as social distancing and wearing a face mask in some previous studies [17], but not in others [18]. Effective public health messaging may help improve testing rates. Information about COVID-19 has proliferated on social media since the beginning of the pandemic, yet not all messages are based on accurate information [30]. Compared to people who rely on traditional news sources for information about COVID-19, people who use social media for information are less likely to perceive that COVID-19 is severe [31]. Because perceptions of severity are associated with taking a COVID-19 test among individuals aged 51–64, credible and accurate information about COVID-19's severity for this age group should be created that can be easily disseminated through social media.

Knowing someone who was diagnosed with COVID-19, our measure of perceived susceptibility, was also associated with an increased likelihood of obtaining a test for most age groups except those aged 65–74. A study in the early stages of the pandemic found that older adults' perceived susceptibility to COVID was low and they preferred to stay at home [32]. Potentially, adults in this age bracket are retired from work and do not have occupational exposures. Additionally, they may not yet necessitate a caregiver to assist with activities of daily living. Interestingly, the association between cues to action (knowing someone who died of COVID-19) and obtaining a COVID-19 test was not statistically significant. Death due to COVID-19 in the early pandemic may not be high enough to make an impact on testing decisions. Financial difficulty was also not associated with taking a COVID-19 test. A potential reason for this finding is that COVID-19 is covered by Medicare Part B; thus, the cost may be less of a concern for the older adult population [33]. Other types of barriers, such as a lack of correct information and timely healthcare use, may play a more important role.

This study is not without limitations. First, we did not have a direct measure of exposure to COVID-19 such as whether the participant lived in a state with a high COVID-19 case rate. We were also not able to control for the specific date of the survey, which may be related to how participants perceived the severity of the pandemic given changes in death rates and public health guidance.

We used indirect measures of the HBM theoretical model. For example, the HRS did not directly ask participants if they perceived that they were susceptible to COVID-19. Instead, we used a measure of whether the participant knew someone who had COVID-19. The reason that in-

dividuals take a COVID-19 test after knowing someone with the virus could be because a healthcare provider required them to take a test. Moreover, these survey questions do not capture every construct of the HBM. There were also likely other factors that acted as a perceived barrier such as a lack of time to obtain a test. However, we were limited by the measures available in the HRS survey.

Additionally, when the HRS COVID-19 survey was conducted, the pandemic had not reached its peak mortality rates. Thus, perceived levels of concern and rates of testing were likely lower than they would be at other times during the pandemic. Testing supplies were also very limited during this time period in the United States. Many people may have wanted a test but were unable to obtain one because they did not meet a local eligibility criterion such as displaying symptoms. Future research can examine whether perceived levels of concern change over time due to COVID-19 peaks and "pandemic fatigue", as well as how fluctuating levels of concern influence rates of testing. Finally, we used the midway release version of the HRS COVID-19 data, which may not be completely free from errors.

How older people perceive their pandemic-related experiences may significantly influence their likelihood of taking a COVID-19 test, and this is salient to policymakers in terms of disease control and prevention. First, for the ongoing pandemic, public surveillance is critical to disease control and treatment. Since testing is voluntary, it's important to understand what the determinants of the public's taking the test are so as to promote willingness to participate in testing, especially among the older population who face a higher risk of the disease. Second, for future new pandemics or epidemics, timely and mass testing could assist health systems and governments in the early detection of diseases in order to respond quickly in constructing preventive and treating strategies. Understanding what is associated with taking a test among older adults can assist with early detection. To that point, decision-makers should consider enhancing informational resources for older adults to encourage them to participate in necessary testing.

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Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ahr.2022.100066.

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