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Association of multimorbidity with the use of health information technology

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Abstract

Objective: To examine the association of multimorbidity with health information technology use among adults in the USA.

Methods: We used cross-sectional study design and data from the Health Information National Trends Survey 5 Cycle 4. Health information technology use was measured with ten variables comprising access, recent use, and healthcare management. Unadjusted and adjusted logistic and multinomial logistic regressions were used to model the associations of multimorbidity with health information technology use.

Results: Among adults with multimorbidity, health information technology use for specific purposes ranged from 37.8% for helping make medical decisions to 51.7% for communicating with healthcare providers. In multivariable regressions, individuals with multimorbidity were more likely to report general use of health information technology (adjusted odds ratios = 1.48, 95% confidence intervals = 1.01–2.15) and more likely to use health information technology to check test results (adjusted odds ratios = 1.85, 95% confidence intervals = 1.33–2.58) compared to adults with only one chronic condition, however, there were no significant differences in other forms of health information technology use. We also observed interactive associations of multimorbidity and age on various components of health information technology use. Compared to younger adults with multimorbidity, older adults (≥ 65 years of age) with multimorbidity were less likely to use almost all aspects of health information technology.

Conclusion: Health information technology use disparities by age and multimorbidity were observed. Education and interventions are needed to promote health information technology use among older adults in general and specifically among older adults with multimorbidity.

Keywords

Multimorbidity, health information technology, health information national trends survey, chronic conditions

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Introduction

Health information technology and multimorbidity

In 2018, over half of noninstitutionalized adults in the US had at least one chronic health condition, with nearly 25% having multiple chronic conditions or multimorbidity.[1] Obtaining appropriate healthcare to manage these conditions can prove challenging for many individuals[2, 3]; however, there is evidence that technology-supported interventions may improve chronic disease self-care.[4]

Health information technology (HIT) is defined as the exchange of health information in an electronic environment including "storage, retrieval, sharing, and use of health care information, data, and knowledge for communication and decision making."[5] The diverse components of patient-facing HIT include electronic portals that allow patients to access their personal health records (PHRs), communicate with their providers, schedule appointments, refill medications. They can also help patients utilize mobile health Apps, wearables, telehealth, and access internet-based health information, and education.[6] These tools can foster remote patient management, patient education, and patient-provider interactions, which may be especially useful for patients with chronic conditions.[7] However, current literature findings are quite diverse, many factors can affect HIT use among individuals with multimorbidity including demographics, environment, lifestyle practices, and socio-economic status.[8,9] For example, one US national representative survey study showed that respondents with multimorbidity were more likely to share their medical records with others. However, such trends diminished with the increase in respondents' age.[10] Whereas another US national survey study found that even with geriatric patients with multimorbidity, their HIT use varied depending on certain sociodemographic factors including race, education level, region, and marital status.[8] In addition to the different HIT use with different demographic characteristics among individuals with multimorbidity, their HIT-seeking behavior could also be different when compared with their counterparts, indicating unique features of HIT uses among such a cohort. For example, one study showed that individuals with multimorbidity tended to seek more health information toward disease treatment, whereas those without multimorbidity were more interested in disease diagnosis and prevention.[11] Whereas another study, using the same database, found that health information-seeking behavior can be varied due to different personal and environmental factors in individuals with multimorbidity.[12] Therefore, a holistic review of HIT use status among individuals with multimorbidity seems to be important.

Given the high prevalence of multimorbidity (and its adverse consequences on all aspects of an individual's health),[13] multi-faceted self-management support to improve outcomes in individuals with multimorbidity has become a global priority. Of the numerous interventions, policies, and programs that have been implemented to manage multimorbidity,[14] interventions that supported patient self-management and integrated HIT were considered effective elements of multimorbidity care.[15–18]

Challenges with HIT

As HIT becomes more widely used, there is a greater possibility of disenfranchisement, disadvantage, and greater social and economic costs for those on the negative side of the "digital divide."[19] At least one study reports older adults may be less likely to use HIT in general.[20] However, there is some evidence that when HIT is perceived as useful and has a low effort commitment, older adults are more likely to adopt it, whereas cost value may be a barrier to uptake.[21] Some research has suggested that older adults with multiple chronic conditions were more likely to access their personal medical records or use the internet for health-related tasks than those without, but they also report significant differences by age.[22,23] This is a concern as the likelihood of having multimorbidity has also been shown to increase with age.[24]

In addition to age-related barriers, individuals of all ages with multimorbidity face a lack of eHealth tools available to help manage their healthcare. For example, there is a scarcity of eHealth tools to help manage high volumes of information often from different healthcare systems; nor do they provide resources or algorithmic methods to aid in clinical decision-making.[7,25] Further, what tools are available or have been tried in clinical studies, can also be disruptive to clinical workflows and challenging for these patients and their caregivers to manage. This creates more hurdles and decreases patients' motivation to utilize the tools.[21,25] Furthermore, individuals with multimorbidity disproportionately lack internet access, a basic cell phone, smartphone, or tablet compared to those without chronic conditions.[26]

Justification

Thus, a holistic understanding of multimorbidity care management requires a clearer understanding of the type of HIT currently being used by adults with multimorbidity.[27] Previous literature has utilized data from both the National Health Interview Survey (NHIS, 2012 and 2014) and the Health Information National Trends Survey (HINTS, 2014 and 2018); however, trends in usage may have changed in the following years.[23,26,28,29] Some studies involved individuals with chronic conditions but did not compare between those with multimorbidity, those with one chronic condition, and those with none.[26,28] Another focused on one outcome measure of ePHR use, defined only as whether an individual had low or high frequency of accessing their own protected health

information.[23] Similarly, Zhang et al. utilized five measures of HIT use from NHIS[29]; using HINTS we included a wider range of variables to obtain a broader understanding of how HIT is utilized in this population. Given the significant potential benefits of HIT use among individuals with multimorbidity, it is important to assess the current HIT use among these individuals to guide future interventions and research. It is also important to compare their use specifically to others without multimorbidity—instead of comparing them only to those with no chronic conditions—as effective management strategies and healthcare priorities may differ between groups.[25] Additionally, given how quickly technology advances, using more recently available data and covering a growing range of possible HIT uses will provide more relevant, usable results for clinicians, policymakers, and patients alike.

Objective

Therefore, the purpose of this study is to determine the prevalence of various components of HIT use among individual adults with multimorbidity and to investigate the association of multimorbidity to various components of HIT use within a multivariable framework using data from a nationally representative survey in the United States. In addition to this, we also performed a sub-cohort analysis specifically focusing on determining the HIT use statuses interacting with age and multimorbidity.

Methods

Data source

We used a cross-sectional study design. Data were obtained from the publicly available HINTS.[30] HINTS is a nationally representative, cross-sectional survey that focuses on health communication in American adults. HINTS survey administered by the National Cancer Institution with publicly available data. The survey was randomly assigned to a US address included in the Marketing Systems Group (MSG) database. A full-sample weight used to calculate population estimates and a replicate weight used to calculate standard error estimates are provided to each completed respondent. A detailed explanation can be found in the literature.[31] This study used one wave, HINTS 5 Cycle 4, with data collected by single-mode mail survey throughout 2020 with complete data collected from 3865 respondents (https://hints.cancer.gov/data/survey-instruments.aspx#H5C4). For this study, observations were excluded if they had missing values for one or more of the variables: age, race/ethnicity, sex, multimorbidity status, and HIT use. The final sample included 3260 individuals. Due to the nature of de-identified data, this study was exempted from review by the North Texas Regional Institutional Review Board (IRB, No.1705528-1).

Dependent variables

As stated in the introduction, HIT use can include a wide range of activities all of which are important to individuals with multimorbidity. In this study researchers selected and agreed on 10 activities (Table 1) to include in the analysis from survey questions relating to HIT access, use, and if HIT has helped in their healthcare management. Most dependent variables were dichotomized into yes/no responses, however, questions that relied on whether the respondent owned a smartphone were divided into three categories to account for this potential disparity.

Key explanatory variables: multimorbidity and its interaction with age

The primary independent variable of interest was the presence of multimorbidity. Multimorbidity was assigned one of three categories based on the number of chronic conditions an individual reported based on the question stem, "Has a doctor or other health professional ever told you that you had …" We included all the chronic conditions mentioned in this survey. Chronic conditions included in this variable were asthma or chronic obstructive pulmonary disease, cancer, diabetes mellitus, hypertension, heart disease, and depression. If an individual reported having none of these conditions, then they were coded as having no chronic conditions. If they reported only having one, then they were coded as having no multimorbidity, and if they reported having more than one they were coded as having multimorbidity.

An interactive analysis of multimorbidity and age interaction

Because increasing age has been associated with increasing multimorbidity in previous literature, a new variable was constructed to assess any interactions between multimorbidity and age in our sample by grouping individuals based on both age and multimorbidity status. Age was divided into two groups, with younger adults ages 18 to <65 years and older adults ≥ 65 years of age. Within each age category individuals were further divided based on whether they had multimorbidity, no multimorbidity, or no chronic conditions at all. This resulted in six total groups for analysis.

Other explanatory variables

Other factors used as explanatory variables included demographics, the physical environment, lifestyle practices, and socioeconomic status. For demographic measures, we included a categorical age variable (not included in the age/multimorbidity interaction models), sex, and race/ethnicity. Physical environment variables included metro/non-

Table 1. Selected survey questions and their associated variable names and levels of measurement.

HINTS 5, Cycle 4, 2020		
Variable name	Question	Levels of measurement
Smart device	Derived variable to categorize responses to device ownership question	1. Smartphone or tablet, 2. basic cell only or none
Internet use	Do you ever go on-line to access the Internet or World Wide Web, or to send and receive e-mail?	Yes, no
HIT use	In the past 12 months have you used a computer, smart phone, or other electronic means to look for health or medical information for yourself?	Yes, no
Mobile health app	On your tablet or smartphone, do you have any apps related to health and wellness?	Yes, no, no smart device
HIT talkdoc	In the past 12 months have you used a computer, smart phone, or other electronic means to use e-mail or the internet to communicate with a doctor or a doctor's office?	Yes, no
HIT test results	In the past 12 months have you used a computer, smart phone, or other electronic means to look up medical test results?	Yes, no
HIT make apt	In the past 12 months have you used a computer, smart phone, or other electronic means to make appointments with a health care provider?	Yes, no
HIT self-management	Has your tablet or smartphone helped you track progress on a health-related goal, such as quitting smoking, losing weight, or increasing physical activity?	Yes, no, no smart device
HIT decision	Has your tablet or smartphone helped you make a decision about how to treat an illness or condition?	Yes, no, no smart device
HIT discussion	Has your tablet or smartphone helped you in discussions with your health care provider?	Yes, no, no smart device

Note: Questions quoted from the HINTS 5 Cycle 4 2020 survey. HIT: Health information technology; HINTS: Health Information National Trends Survey.

metro living status and region (Northeast, Midwest, South, West). Lifestyle practice variables included body mass index (BMI) (underweight, normal, overweight, obese), physical activity (5 times per week for at least 30 min,[32] other exercise, no exercise), smoking status (current, former, non-smoker), and healthcare visits in the past year (none, 1-2, 3 +). Socioeconomic measures included education (less than high school, high school, some college, college), annual income (less than 20k, 20–35k, 35–50k, 50–75k, 75k +), and health insurance status (insured/uninsured). For variables with missing values (education, income, health insurance status, physical activity, smoking status, and BMI), we created a missing indicator. This category was included in the models.

Statistical analysis

Descriptive statistics were performed with weighted percentages reported. A Rao-Scott chi-square test, using the jackknife variance estimation method and replicate weights, was used to assess any significant differences among groups. The associations of multimorbidity with the HIT use variables (yes, no) were modeled using unadjusted and adjusted logistic regression techniques, while unadjusted and adjusted multinomial logistic regressions were used for the remaining HIT use variables that factored in whether or not the respondent had a smartphone. We present the adjusted odds ratios (AOR) and 95% confidence intervals (CIs) of multimorbidity from four models of increasing complexity to determine if significant associations were maintained at each level. The first model controlled for the common demographic factors of age, sex, and race/ethnicity. In the second model, we additionally controlled for socioeconomic (SES) predisposing factors, namely, education and annual income level. The third model included the preceding variables and the enabling factors of health insurance status and metro/non-metro status. Finally, the full model included all previous factors and also added BMI, physical activity, smoking status, residential region, and number of healthcare provider visits in

Table 2. Description of selected characteristics by multimorbidity status (row percentages)

Adults (age ≥ 18 years)							
HINTS 5, Cycle 4, 2020							
	Multimorbidity		No multimorbidity		No chronic conditions		
Variable	N	Wt. %	N	Wt. %	N	Wt. %	*P*-value
All	1195	29.7	1039	31.1	1026	39.2	
Sex							0.040
Female	684	28.8	617	34.5	577	36.7	
Male	511	30.6	422	27.6	449	41.8	
Race/ethnicity							<0.001
Non-Hispanic whites	751	32.8	648	31.4	607	35.8	
African Americans	190	37.2	141	31.8	105	31.0	
Hispanics	169	16.8	157	26.9	225	56.3	
Other race/ethnicities	85	21.5	93	35.6	89	42.9	
Age in years							<0.001
18–34 years	60	11.6	157	28.9	253	59.5	
35–44 years	76	25.6	126	24.5	220	49.8	
45–54 years	155	29.6	171	37.8	182	32.6	
55–64 years	304	40.3	233	32.8	183	26.9	
65–74 years	359	44.1	248	33.2	140	22.8	
75 + years	241	61.5	104	26.3	48	12.2	
Education							<0.001
Less than high school	112	38.2	48	22.0	50	39.7	
High school	339	33.3	236	26.8	228	39.9	
Some college	302	34.5	215	30.4	203	35.1	
College	437	19.6	537	38.0	543	42.4	
Income							<0.001
Less than 20k	267	40.7	136	33.0	112	26.3	
20k-35k	180	38.3	117	28.1	119	33.7	

(continued)

Table 2. Continued.

Adults (age ≥ 18 years)							
HINTS 5, Cycle 4, 2020							
	Multimorbidity		No multimorbidity		No chronic conditions		
Variable	N	Wt. %	N	Wt. %	N	Wt. %	*P*-value
35k-50k	166	32.8	166	38.5	101	28.7	
50–75k	218	28.7	179	31.7	173	39.7	
75k +	363	23.5	438	28.8	520	47.7	
Health insurance status							0.009
Insured	1148	30.4	967	31.7	940	37.8	
Uninsured	31	20.8	57	22.9	79	56.3	
Physical activity							0.014
5× per week for ≥30 min	226	26.4	254	29.4	282	44.1	
Other exercise	522	26.5	503	32.5	540	41.1	
No exercise	419	39.2	259	29.7	190	31.1	
Smoking status							<0.001
Current smoker	180	40.4	93	24.2	93	35.4	
Former smoker	352	41.3	258	31.8	177	26.8	
Non-smoker	650	23.1	678	32.3	745	44.6	
Region							0.206
Northeast	171	27.0	144	31.7	165	41.3	
Midwest	197	31.4	188	32.8	160	35.9	
South	566	33.4	445	29.0	425	37.6	
West	261	24.3	262	32.5	276	43.2	
Metro status							0.051
Metro	1039	28.7	929	30.9	932	40.4	
Non-metro	156	36.9	110	32.1	94	31.0	
BMI							<0.001
Underweight	14	14.7	20	39.4	17	45.9	

(continued)

Table 2. Continued.

Adults (age ≥ 18 years) HINTS 5, Cycle 4, 2020							
	Multimorbidity		No multimorbidity		No chronic conditions		
Variable	N	Wt. %	N	Wt. %	N	Wt. %	*P*-value
Normal	238	17.9	324	29.5	417	52.7	
Overweight	389	29.4	344	31.3	342	39.2	
Obese	539	41.8	336	32.4	225	25.8	

Note: Based on 3260 adults (age 18 years or older) who completed the mailed survey in HINTS 5 Cycle 4 during the year 2020 with no missing data on age, race/ethnicity, sex, multimorbidity status, and health information technology use. Significant group differences were assessed with Rao-Scott chi-square test statistics. Percentages may not sum to 100% due to missing values in education, income, health insurance status, physical activity, smoking status, and BMI. *N*: unweighted number of individuals in a category; row %: weighted; Wt.: weighted; 5x: five times; BMI: Body mass index; HINTS: Health Information National Trends Survey.

the past year. When assessing age-multimorbidity interactions, the individual age variable was excluded from the models as it was accounted for in the interaction variable. All analyses were performed in SAS 9.4 using survey procedures. All statistical procedures were performed for each dependent variable separately and their associations with multimorbidity were also investigated.

Results

In our study, 30% of respondents reported having multimorbidity, 31% reported having only one chronic condition, and 39% reported having no chronic conditions based on the list of chronic conditions available in HINTS (Table 2). The mean age of the full sample was 47.5 years, while the mean age was 56 years, 48.4 years, and 40.4 years for individuals with multimorbidity, no multimorbidity, and no chronic conditions, respectively.

Although an overwhelming majority of individuals with multimorbidity (86%) reported using the internet, the use was still lower when compared to 89% of individuals with one chronic condition and 94% of individuals with no chronic conditions ($p = 0.003$, Table 3). A higher percentage of adults with multimorbidity (51%) reported using HIT to check medical test results compared to 46% of those with only one chronic condition and 36% of those with no chronic conditions ($p < 0.001$, Table 3). Meanwhile, using HIT to communicate with healthcare providers was reported by 52% of those with multimorbidity and 55% of those with one chronic condition, compared to less than half (49%) of individuals with no chronic conditions ($p = 0.001$, Table 3). A significantly lower percentage of those with multimorbidity (40%) reported that their tablet or smart device had helped them make progress in a health-related goal, compared to 50% of those with only one chronic condition and 48% of those with no chronic conditions ($p = 0.005$, Table 3).

In the unadjusted logistic regressions, multimorbidity was not found to have statistically significant associations with any of the binary HIT use variables (Figure 1). These included general internet use, smart device use, having a mobile health app downloaded on a smart device, and using HIT to look up health information, talk to healthcare providers, check test results, and schedule medical appointments.

After adjusting for age, sex, and race/ethnicity, individuals with multimorbidity had greater odds (AOR 1.43, 95% CI 1.06–1.92) of using HIT to check test results (Table 4). Additionally, after also adjusting for income, those with multimorbidity also had greater odds of using general HIT (AOR 1.51, 95% CI 1.03–2.20) and checking test results (AOR 1.85, 95% CI 1.33–2.57, Table 4).

In the unadjusted multivariable logistic regression (MLR), individuals with multimorbidity had lower odds (UOR 0.66, 95% CI 0.47–0.93) of reporting that their smart device helped them track progress on a health-related goal compared to individuals with only one chronic condition (Figure 1(a)). Similarly, they also had lower odds (UOR 0.76, 95% CI 0.59–0.98) of reporting that their smart device helped them decide how to treat an illness or condition compared to individuals with only one chronic condition (Figure 1(a)). Both of these associations, however, became statistically insignificant after adjusting for age, sex, and race/ethnicity (Table 4).

Table 3. Description of dependent variables by multimorbidity status (column percentages).

Adults (age ≥ 18 years)							
HINTS 5, Cycle 4, 2020							
	Multimorbidity		No multimorbidity		No chronic conditions		
Variable	*N*	Wt. %	*N*	Wt. %	*N*	Wt. %	*P*-value
All	1195	30	1039	31	1026	39	
Smart device							0.003
Yes	997	88.5	905	91.2	951	93.9	
No	187	11.5	124	8.8	69	6.1	
Internet use							0.040
Yes	964	85.5	899	89.3	922	89.7	
No	231	14.5	140	10.7	104	10.3	
HIT use							0.582
Yes	835	73.5	771	76.2	773	73.4	
No	360	26.5	268	23.8	253	26.6	
Mobile health app							0.016
Yes	520	51.2	508	56.2	530	52.2	
No	441	37.1	376	34.9	404	41.6	
No smart device	187	11.8	124	8.9	69	6.2	
HIT talk doc							0.001
Yes	595	51.7	537	54.8	502	41.7	
No	595	48.3	492	45.2	523	58.3	
HIT test results							<0.001
Yes	557	51.4	489	45.9	426	36.0	
No	628	48.6	539	54.1	598	64.0	
HIT make apt							0.462
Yes	592	50.4	543	53.4	537	48.6	
No	597	49.6	486	46.6	488	51.4	
HIT self-management							0.005

(continued)

Table 3. Continued.

Adults (age ≥ 18 years)							
HINTS 5, Cycle 4, 2020							
	Multimorbidity		No multimorbidity		No chronic conditions		
Variable	*N*	Wt. %	*N*	Wt. %	*N*	Wt. %	*P*-value
Yes	396	39.6	448	50.0	458	47.5	
No	586	48.8	453	41.1	486	46.4	
No smart device	187	11.6	124	8.8	69	6.1	
HIT decision							<0.001
Yes	399	37.8	396	45.4	370	34.7	
No	582	50.6	502	45.8	573	59.2	
No smart device	187	11.6	124	8.8	69	6.1	
HIT discussion							<0.001
Yes	435	41.0	393	41.4	369	29.8	
No	546	47.4	507	49.8	575	64.1	
No smart device	187	11.6	124	8.8	69	6.1	

Note: Based on 3260 adults (age 18 years or older) who completed the mailed survey in HINTS 5 Cycle 4 during the year 2020 with no missing data on age, race/ethnicity, sex, multimorbidity status, and health information technology use. Significant group differences were assessed with Rao-Scott chi-square test statistics. See Table 1 for variable descriptions and associated survey questions. *N*: unweighted number of individuals in a category; column %: weighted; Wt.: weighted; HIT: health information technology; HINTS: Health Information National Trends Survey.

While these associations were measured with no multimorbidity as the reference group, similar results were observed in the full model using adults with no chronic conditions as the reference group. Compared to this group in the full model, individuals with multimorbidity had significantly higher odds of reporting the use of HIT (AOR 1.48, 95% CI 1.01–2.15) and checking test results (AOR 1.85, 95% CI 1.33–2.58).

We observed interactive associations of multimorbidity and age on various components of HIT use. Compared to younger adults with multimorbidity, older adults (≥ 65 years of age) with multimorbidity were significantly less likely to use almost all components of HIT in both the unadjusted and adjusted models. For example, compared to young adults with multimorbidity, older adults with multimorbidity were less likely to use the internet in general, to use HIT to look up health information for themselves, to own any sort of smart device, to communicate with their doctor, to check test results, and to make medical appointments (AOR = 0.11, 0.29, 0.13, 0.41, 0.41, 0.56) respectively. In the adjusted MLR, older adults with multimorbidity were also less likely than younger adults with multimorbidity to report that HIT helped them manage a health-related goal (AOR = 0.36), that it helped them make a medical decision (AOR = 0.54), that it helped in discussions with their doctors (AOR = 0.50), or that they had a mobile health or wellness app downloaded on their phone (AOR = 0.34).

Discussion

Findings

When analyzing the most recent health information trend survey (HINTS5 Cycle 4), we found the overall rates of HIT use varied by type of use, indicating the existence of digital disparities among individuals with multimorbidity. The highest use among adults with multimorbidity was

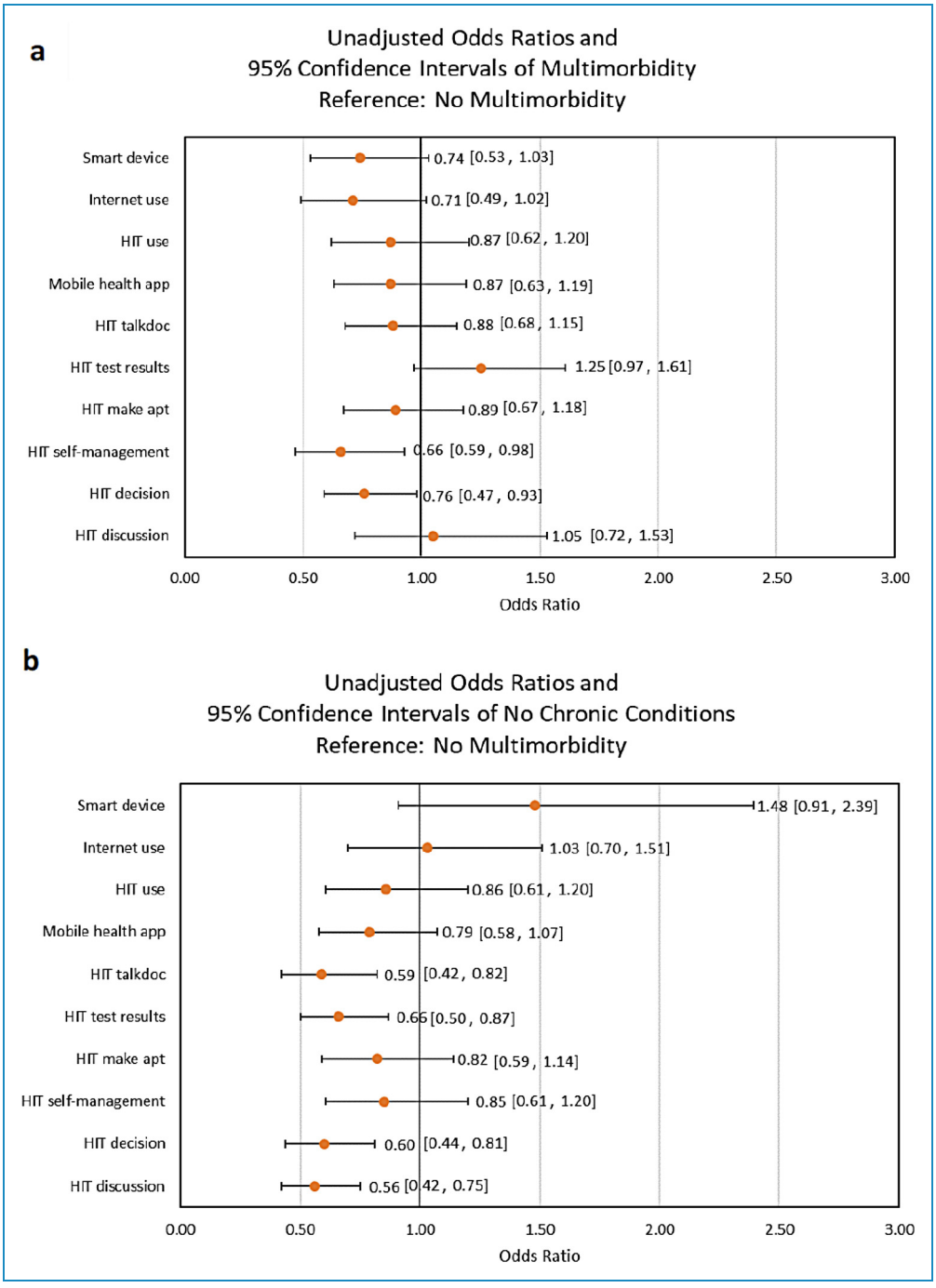

Figure 1. See Table 1 for variable descriptions and associated survey questions. Based on 3260 adults (age 18 years or older) who completed the mailed survey in HINTS 5 Cycle 4 during the year 2020 with no missing data on age, race/ethnicity, sex, multimorbidity status, and health information technology use. Forest plot of the unadjusted logistic and multinomial logistic regression models. For multinomial regressions, only "yes" vs "no" is reported here. HIT: Health information technology; HINTS: Health Information National Trends Survey.

found in general use of the internet to look up health information (73.5%) and the lowest was in using HIT to guide discussions with a physician (37.8%). In the unadjusted analyses, we found that HIT use in several categories was generally lower in those with multimorbidity compared to those with only one chronic condition. In adjusted analyses, we found that those with multimorbidity were significantly more likely to report general use of HIT and using HIT to check test results compared to those with no multimorbidity, however, other forms of HIT use were similar.

Table 4. Adjusted odds ratios and associated logistic regression models.

One chronic condition (no multimorbidity) as the reference group						
HINTS 5, Cycle 4, 2020						
	Multimorbidity			No chronic conditions		
	AOR	95% CI	*P*-value	AOR	95% CI	*P*-value
Model 1 age, sex, race/ethnicity						
Smart device	1.19	[0.84, 1.68]	0.3166	0.93	[0.59, 1.49]	0.7722
Internet use	1.09	[0.70, 1.70]	0.7004	0.69	[0.44, 1.08]	0.1051
HIT use	1.15	[0.82, 1.63]	0.4041	0.73	[0.49, 1.08]	0.1132
Mobile health app	1.04	[0.77, 1.41]	0.7898	0.70	[0.50, 0.98]	0.0317
HIT talkdoc	1.03	[0.78, 1.36]	0.8474	0.55	[0.39, 0.76]	<0.001
HIT test results	1.43	[1.06, 1.92]	0.0208	0.67	[0.51, 0.87]	0.0038
HIT make apt	1.07	[0.80, 1.42]	0.6508	0.74	[0.52, 1.04]	0.0839
HIT self-management	0.82	[0.57, 1.17]	0.2605	0.70	[0.50, 0.98]	0.0308
HIT decision	0.85	[0.66, 1.09]	0.1822	0.56	[0.41, 0.77]	<0.001
HIT discussion	1.09	[0.73, 1.62]	0.6725	0.57	[0.41, 0.77]	<0.001
Model 2 age, sex, race/ethnicity, education, income level						
Smart device	1.46	[0.99, 2.17]	0.0527	0.89	[0.53, 1.48]	0.6354
Internet use	1.35	[0.84, 2.17]	0.2035	0.62	[0.38, 1.02]	0.0578
HIT use	1.51	[1.03, 2.20]	0.0294	0.73	[0.48, 1.12]	0.1421
Mobile health app	1.25	[0.90, 1.74]	0.1728	0.66	[0.47, 0.93]	0.0148
HIT talkdoc	1.25	[0.93, 1.69]	0.1275	0.52	[0.37, 0.73]	<0.001
HIT test results	1.85	[1.33, 2.57]	<0.001	0.62	[0.47, 0.81]	<0.001
HIT make apt	1.27	[0.93, 1.72]	0.1218	0.74	[0.52, 1.05]	0.0857
HIT self-management	0.96	[0.66, 1.40]	0.8385	0.67	[0.49, 0.93]	0.0129
HIT decision	0.89	[0.68, 1.16]	0.3576	0.57	[0.41, 0.79]	<0.001
HIT discussion	1.23	[0.82, 1.86]	0.3124	0.58	[0.43, 0.78]	<0.001
Model 3 age, sex, race/ethnicity, education, income level, health insurance, metro						
Smart device	1.48	[0.97, 2.26]	0.0604	0.84	[0.50, 1.42]	0.5037

(continued)

Table 4. Continued.

One chronic condition (no multimorbidity) as the reference group						
HINTS 5, Cycle 4, 2020						
	Multimorbidity			No chronic conditions		
	AOR	95% CI	*P*-value	AOR	95% CI	*P*-value
Internet use	1.32	[0.82, 2.14]	0.2413	0.61	[0.37, 1.02]	0.0531
HIT use	1.51	[1.02, 2.21]	0.0332	0.73	[0.47, 1.14]	0.1544
Mobile health app	1.25	[0.90, 1.75]	0.1708	0.68	[0.48, 0.97]	0.0306
HIT talkdoc	1.26	[0.93, 1.70]	0.1190	0.52	[0.37, 0.734]	<0.001
HIT test results	1.87	[1.36, 2.58]	<0.001	0.64	[0.48, 0.84]	0.0010
HIT make apt	1.27	[0.93, 1.72]	0.1171	0.75	[0.52, 1.08]	0.1150
HIT self-management	0.96	[0.66, 1.40]	0.8333	0.69	[0.50, 0.95]	0.0200
HIT decision	0.89	[0.68, 1.16]	0.3739	0.58	[0.41, 0.80]	0.0009
HIT discussion	1.24	[0.82, 1.87]	0.2959	0.61	[0.45, 0.82]	0.0010
Full model - Model 3 + BMI, physical activity, smoking status, region, HCP visits						
Smart device	1.45	[0.94, 2.26]	0.0868	1.02	[0.54, 1.92]	0.9443
Internet use	1.26	[0.77, 2.06]	0.3502	0.70	[0.42, 1.16]	0.1506
HIT use	1.48	[1.01, 2.15]	0.0376	0.90	[0.58, 1.39]	0.6190
Mobile health app	1.34	[0.96, 1.86]	0.0769	0.67	[0.47, 0.95]	0.0225
HIT talkdoc	1.19	[0.89, 1.60]	0.2265	0.63	[0.44, 0.89]	0.0073
HIT test results	1.85	[1.33, 2.58]	<0.001	0.77	[0.59, 1.01]	0.0536
HIT make apt	1.28	[0.94, 1.73]	0.1045	0.87	[0.59, 1.28]	0.4663
HIT self-management	0.98	[0.66, 1.47]	0.9280	0.68	[0.49, 0.95]	0.0221
HIT decision	0.85	[0.64 1.15]	0.2864	0.58	[0.41, 0.81]	0.0012
HIT discussion	1.22	[0.82, 1.83]	0.3142	0.59	[0.44, 0.79]	<0.0001

Note: Based on 3260 adults (age 18 years or older) who completed the mailed survey in HINTS 5 Cycle 4 during the year 2020 with no missing data on age, race/ethnicity, sex, multimorbidity status, and health information technology use. See Table 1 for variable descriptions and associated survey questions. HIT: Health information technology; HCP: Health Care Providers; HINTS: Health Information National Trends Survey; AOR: adjusted odds ratios; BMI: body mass index.

Due to differences in definitions of HIT use and specific outcomes measured, our study and other published studies are not easily compared. One similar study reported that HIT was relatively common among individuals with multimorbidity and one chronic condition,[29] although our percentages were much higher, indicating greater HIT use in 2020 than in 2012. Zhang et al.[29] also found that HIT use was most common among individuals with one

chronic condition while individuals with multimorbidity used HIT the least. Our results indicated that except in general HIT use and HIT use to check test results, individuals with multimorbidity did not have significantly different HIT use compared to those with one chronic condition. Our general HIT use disparities among individuals with multimorbidity could be considered similar to the outcome question used by Greenberg et al.[23] ("How many times did you access your PHI online through a secure website or app in the last 12 months?", dichotomized into high and low use), who found that individuals with multimorbidity were more than twice as likely to be high users of ePHRs than those with one or no chronic conditions. Our findings differ somewhat from those of Griffin and Chung[26]; however, true comparisons are challenging as we specifically focused on comparing individuals with multimorbidity to individuals with one or no chronic conditions, whereas Griffin considered individuals with 3+, 1–2, and no chronic conditions.

Although the prevalence rates of internet and computer use are growing quickly among older adults,[33] we observed age as another important factor associated with HIT use among individuals with multimorbidity. Compared to younger adults with multimorbidity, older adults (≥65 years of age) with multimorbidity were significantly less likely to use almost all components of HIT. Although we did not explore factors associated with low rates of use among older adults, we speculate that older adults may be less confident about using electronic devices and need more education and training in using certain features.[34,35] Also, we speculate that they may have more difficulty with keyboards and screens (typing and swiping) and hearing audio on health-related videos due to chronic conditions, as well as having internet/cell phone plans that drop connections or have less coverage.

Although not specific to older adults with multimorbidity, three factors that have previously been associated with low rates of older adults using HIT include: lack of trust in the technology; the concern for personal privacy when using HIT[36]; and ageist stereotype threat.[37] Our study did not explicitly explore these factors, however, researchers have also found that once older adults receive education and practice regarding HIT use, they will use it more actively,[38,39] indicating a possible area for targeted intervention. There is a need for future studies to examine barriers to HIT use among older adults with multimorbidity so that this growing population can take advantage of the available e-health tools to improve health outcomes. Additionally, while individuals with multimorbidity had greater overall HIT use and were more likely to use HIT to check test results, there are still opportunities for greater integration such as using HIT to guide discussions with physicians, for personal health goal tracking, and for communicating with physicians.

Limitations

Our study has its limitations. First, this is a national cross-sectional survey study, missing and incorrect information cannot be avoided. Second, due to the nature of the survey study, we are only able to analyze the existing variables included in the survey (i.e., number of chronic diseases) which could potentially cause patient selection bias. For example, we can only analyze individuals with certain chronic diseases/conditions; individuals with other chronic disease/conditions cannot be determined. In addition, individuals' health belief about HIT use could be a potential confounding factor, since HINTS did not include a specifically focused question, such analyses were not performed. Third, in terms of HIT use in the adjusted logistic regressions, our study analyzed some potential confounders (such as age, sex, race/ethnicity, insurance, levels of income, and levels of education); not adjusting for other factors could potentially introduce biases. Therefore, with such limitations, our study results should be interpreted with caution, and a large-scale prospective well-controlled study is warranted for external validation.

Conclusions

This study found that there were no differences in many components of HIT use among adults with multimorbidity compared to those with no chronic conditions. We also found an interaction between multimorbidity and age, which is important to investigate in future research to ensure those with the most need of HIT use do not fall further behind. Future studies should focus on determining barriers to HIT use among those with multimorbidity and older adults, such as access, training, and knowledge. Targeted policies and programmatic interventions could be useful in both investigating and improving the relationships among multimorbidity, age, and HIT use.

Summary table

What was already known:
- HIT use is vital to chronic disease management.
- Older adults, especially those with multimorbidity, may be less likely to use HIT in general.
- Available research on HIT use among those with multimorbidity has produced mixed findings.

What this study adds:
- Our study was comprehensive in the types of HIT use and covered a wide spectrum from access, to engagement, to shared decision-making.
- Group differences may be dependent on the type of HIT examined.
- There is an interaction between multimorbidity and age with regards to HIT use.

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