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MOBILE & WIRELESS HEALTH

Access to Broadband Internet and its Utilization for Health Information Seeking and Health Communication among Informal Caregivers in the United States

Hyunmin Kim[1] · **Asos Mahmood**[1] · **Joy V. Goldsmith**[2] · **HyukJae Chang**[3] · **Satish Kedia**[4] · **Cyril F. Chang**[5,6]

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Abstract

Informal caregivers provide unpaid care to their physically or mentally ill loved ones and play a critical role in the healthcare delivery. eHealth tools, including the broadband internet, can facilitate care processes and impact the caregiving burden through seeking health information and health communication. This study examines the predictors of access to broadband internet and the factors associated with health information seeking and health communication among informal caregivers with broadband internet. We used data from cycles 1 and 2 of the Health Information National Trends Survey (HINTS 5) and employed generalized linear regression models with the maximum likelihood estimation. Specifically, we performed a two-part model: (1) a logistic regression model of broadband internet access among all caregivers ($n = 929$) and (2) a logistic regression model of health information seeking and health communication among caregivers with broadband internet access ($n = 404$). We found that caregivers who were younger (18–34 years versus 45+ years), female (versus male), and those who were divorced/widowed/separated (versus singles) were less likely to have broadband internet access. While those who were married/living as married (versus singles), with higher incomes (≥\$100,000 versus <\$35,000), and those living in metropolitan areas were more likely to have broadband internet access. Among caregivers with broadband internet access, younger, female, non-Hispanic white caregivers, and those with higher levels of education and income, as well as those who cared for cancer patients, were more likely to seek health information for someone else. Additionally, caregivers aged 35–39 years and those with more education were more likely to look for health information for themselves than their counterparts. Furthermore, caregivers who were aged 40–44 years, females, divorced/widowed/separated, those with higher incomes, and those who cared for patients with Alzheimer's, confusion, and dementia were more likely to communicate electronically with a provider. The results suggest disparities in broadband internet access and indicate variations in factors associated with health information seeking and health communication. The findings underscore the need to address barriers attributed to the digital divide among informal caregiving groups.

Keywords Broadband internet · Health information seeking · Health communication · Informal caregivers · Digital divide

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✉ Hyunmin Kim
hkellykim19@gmail.com

[1] Division of Health Systems Management and Policy, School of Public Health, University of Memphis, 3825 DeSoto Ave, Memphis, TN 38152, USA

[2] Department of Communication & Film, College of Communication and Fine Arts, University of Memphis, Memphis, TN 38152, USA

[3] CONNECT-AI R&D center, Department of Internal Medicine, Yonsei University College of Medicine, Seoul 03722, Republic of Korea

[4] Division of Social and Behavioral Sciences, School of Public Health, University of Memphis, Memphis, TN 38152, USA

[5] The Methodist and Le Bonheur Center for Healthcare Economics, Memphis, TN 38152, USA

[6] Department of Economics, the Fogelman College of Business and Economics, University of Memphis, Memphis, TN 38152, USA

Background and introduction

The caregivers' ability to find information and ask for help is key to obtaining supportive resources for caregiving tasks [1, 2]. The internet is widely recognized as an essential tool for seeking health information, health education, and health communication [3, 4]. In 2018, a survey conducted by Pew Research Center indicated that most Americans count on their own research concerning making an important decision., and almost half of them would utilize digital tools to do [5]. Evidence also showed that more than half of the U.S adults used the internet for health information seeking (HIS) and over 30% used it to help solve health or medical issues, such as identifying a diagnosis for themselves or someone else [6]. Specifically, females, the young, those with more education and those with higher income levels were more likely to figure out a probable diagnosis via the internet compared to males, the older, and those with less education and income [6]. The internet has also enabled medical and public health professionals to communicate more efficiently with patients to address health problems and concerns [7]. Notably, recent developments in broadband internet have enabled a much faster transmission of information and facilitated video calling compared to the dial-up connection [8, 9]. Broadband can better integrate the internet's beneficial health information and communication features with less geographic, physical, and time-related barriers [8].

Even though internet availability has substantially increased over the past decade, a gap remains in broadband internet access, further perpetuating the digital divide [8, 9]. The digital divide refers to the difference between those with and without internet access and information technologies [10]. Disparities in internet access exacerbate the already existing inequities in health and healthcare [6]. Evidence shows that individuals living in remote rural communities are less likely to have access and use internet, and more likely to depend on family and friends to obtain health information [11, 12].

Although the digital divide issue has been explored in previous studies identifying barriers and contributing factors, less is known about the digital divide among the caregiving subgroups, including informal caregivers [7, 13–18]. Informal caregivers provide unpaid care to family members or close friends who have physical or mental health issues; these stakeholders play a vital role in the healthcare system [19]. To provide appropriate care to a patient or a person in need, caregivers often look for medical and health information on the internet because of its efficiency and convenience [6]. For instance, caregivers of cancer patients use the internet to seek information about cancer treatment or related procedures or use it to participate in clinical decision-making or support groups [20]. Despite the importance of accessing health information critical in providing care, not all caregivers can utilize the internet to seek health information, primarily due to the lack of reliable internet access. This is particularly true for those living in remote rural areas lacking telecommunication infrastructure, the urban poor, and the elderly as well [6].

With increasing aging populations and more people with chronic conditions, the caregiver burden expands as many in this segment of the population receive care at home or outside the inpatient settings [21, 22]. Evidence shows that caregivers compared to their general population counterparts are more likely to have depressive symptoms, caregiving distress, and unhealthy lifestyle such as poor diet and sleep due to the added burden of caregiving [6, 23]. Therefore, health information and communication, including eHealth tools, accessible through the broadband internet can reduce the caregiving burden and efficiently facilitate caregiving tasks. However, to the best of our knowledge, no study has thus far investigated the predictors of access to broadband internet among caregivers; and the extent of HIS and health communication among caregivers with access to broadband internet remains understudied.

In the present study, we explore the digital divide for HIS and health communication among informal caregivers with access to the broadband internet. Our aims in this study are twofold: (1) to explore predictors of access to broadband internet among informal caregivers; and (2) to examine the factors associated with health information seeking and health communication among informal caregivers with broadband internet.

Methods

Data and study sample

We used data collected through the Health Information National Trends Survey (HINTS), which is a national cross-sectional survey of the civilian, noninstitutionalized U.S adults aged 18 and older, conducted annually by the National Cancer Institute (NCI) [24]. The HINTS surveys how the U.S. adults access and use health information for themselves and their loved ones via different communication means, including the internet [25]. Our study utilized two of the most recent HINTS data cycles (HINTS 5 Cycle 1 and Cycle 2), which consisted of mail-administered surveys conducted between January 25 to May 5, 2017, and January 26 to May 2, 2018, respectively. Notably, HINTS 5 Cycle 2 includes the questions related to informal caregiving (i.e., caregivers' experience in providing care to the patient and the time spent for caregiving). We obtained the sampling frame for both cycles from a database of all the non-vacant U.S residential addresses provided by Marketing Systems Group. An equal-probability sampling method was used to achieve a random sample of the addresses reflecting the regional proportion of high- or low-minority populations with an oversampling strategy [26]. The overall response rates for HINTS 5 Cycle 1 and Cycle 2 were 32.4% and 32.9%, respectively.

The study sample included all respondents who classified themselves as caregivers based on the survey question, "*Are you currently caring for or making health care decisions for someone with a medical, behavioral, disability, or other condition?*" Participants were asked to answer this question with "yes" or "no," and if they answered as "yes," then they were asked to provide further information about whom they cared for, including child/children, spouse/partner, parent/parents, a close family member, a friend or another non-relative. We specifically focused on those caring for a family member, which resulted in an analytical sample of 929 informal caregivers.

Variables

This study included three dependent variables: (1) electronic health information seeking for someone else; (2) electronic health information seeking for yourself; and (3) communicating with a provider electronically. These dependent variables were constructed based on the survey questions: (1) "*Past 12 months…used electronic means to look for health/medical information for someone else?*" (2) "*Past 12 months…used electronic means to look for health/medical information for yourself?*" and (3) "*Past 12 months…used electronic means to communicate with a doctor using e-mail/internet?*" Survey respondents answered these questions with either a "yes" or a "no," which allowed us to code each dependent variable as binary. The primary independent variable was "access to the broadband internet," based on the survey question, "*When you use the internet, do you access it through broadband such as DSL, cable or FiOS?*"

Guided by Andersen's behavioral model [27–30], we included several covariates in the models, which were organized into three familiar groups of predisposing, enabling, and need-for-care factors that were reflective in the extent to which these factors were associated with individual health behaviors and health services use. Specifically, the predisposing factors included demographic variables of age, sex, race/ethnicity, marital status, and education. Age was categorized as: "18–34 years," "35–39 years," "40–44 years," and "45 years or older." Sex was dichotomized as "male vs. female." Race/ethnicity was categorized into "non-Hispanic White," "non-Hispanic Black," "Hispanic," and "non-Hispanic other." Marital status was categorized as: "married/living as married," "divorced/widowed/separated," and "single (never been married)." Education level was categorized as "less than high school," "high school graduate," "some college," and "college graduate or more." Enabling factors included the respondents' income and residential location. Income was used as a categorical variable: "<\$35,000," "\$35,000–\$100,000," and "≥\$100,000." Residential location was assessed by the survey question of whether an individual lived in a "metropolitan vs. non-metropolitan," location, based on the 2013 U.S. Department of Agriculture Rural/Urban Designation. Finally, the need-for-care factors were represented by general health status assessed by the survey question "*Overall, how would you rate the quality of health care you received in the past 12 months?,*" of which responses were categorized into "excellent/very good," "good," "fair or poor."

Besides the variables used in the Anderson framework, the study included some caregiving conditions and the number of caregiving hours as additional related factors for control. These were included based on the belief that the extent of caregiving time and other circumstances could affect health-related internet use among caregivers. Caregiving circumstances were ascertained from the caregivers' responses to conditions for which they provided care for their family, which included Alzheimer's, confusion, dementia, and cancer. These caregiving conditions were included in the analyses as a new combined variable with the four categories ('Alzheimer's, confusion, dementia,' 'cancer,' 'Alzheimer's, confusion, dementia + cancer,' 'neither cancer nor Alzheimer's, confusion, dementia'). Caregiving hours were assessed based on the survey question "*About how many hours do you spend in an average week providing care?*", and was included as a categorical variable: "< 5 hours," "5–20 h," and "> 20 hours" in our analyses.

Statistical analysis

All statistical analyses were performed by applying HINTS weights reflective of the U.S. caregiver population. Descriptive statistics were used to assess the characteristics of caregivers as well as the differences between those with and without broadband internet. An unweighted number of caregivers and the weighted percentages of them were calculated for each variable of interest. Since the HINTS was conducted with a complex sampling structure, the study incorporated the full-sample weights to make national-level estimates. To compare caregivers by whether they have broadband internet or not, we performed a statistical test (i.e., Rao-Scott Chi-square test for dichotomous variables). Further, the Jackknife variance estimation was used to assess correct standard errors. Because the dependent variables were dichotomous, we employed generalized linear regression models with the maximum likelihood estimation to examine the independent effects of the variables of interest on each of the three outcomes: (1) electronic health information seeking for someone else; (2) electronic health information seeking for yourself; and (3) communicating with a provider electronically. Specifically, we analyzed a two-part model: (1) a logistic regression model of broadband internet access among all caregivers ($n = 929$) and (2) a logistic regression model of health information seeking and health communication among caregivers with broadband internet access ($n = 404$). That is, we first identified factors predictive of broadband internet access among caregivers. We then examined the extent to which factors were associated with engaging in HIS and health communication among caregivers with broadband internet access. Therefore, the second part of the model addresses the question of which predictors are related for caregivers to seek health information for someone else and themselves and to communicate with a provider electronically, given the broadband internet availability. Choice of the model factors was guided by the Andersen-Newman Behavioral Model of Health Services Use. All statistical analyses were performed using SAS version 9.4 statistical software (SAS Institute Inc. Cary, NC, USA ©2014) program. The statistical significance threshold level was set at a p value of 0.05.

Results

Table 1 presents caregivers' overall characteristics and characteristics by access to broadband internet. Among the 929 caregivers, 397 (42.73%) did not have access to broadband internet. Most caregivers were aged 45+ years (63.48%), females (66.15%), divorced/widowed/separated (67.69%), and reported as being non-Hispanic White (65.33%). About 39.57% of caregivers had a college degree or more, while 4.77% had less than a high school education. Overall, the majority (41.85%) belonged to \$35,000–\$100,000 income category, and slightly less than a third (31.14%) were in ≥\$100,000 income group. Most (85.75%) caregivers lived in metropolitan areas. Close to 46% of caregivers reported their health to be excellent or very good, while less than 18% described their health as fair or poor. Over 18.36% and 8.72% of caregivers reported providing care for a patient with "Alzheimer's, confusion, dementia" and "cancer," respectively. Close to 40% of caregivers spent less than five hours per week in caregiving, while about 35% spent more than 20 h per week in caregiving. The Rao-Scott Chi-square tests for crude associations indicate that caregivers with and without broadband internet were significantly different on all reported characteristics but not in age, race/ethnicity, and health information seeking for themselves.

Table 2 shows the results of the two-part model. The first part depicts the significant predictors of access to broadband internet among the caregivers. These predictors were caregivers' age, sex, marital status, race/ethnicity, income, and residential location. Specifically, caregivers of ages 18 to 34 ($\beta = -0.3953$; p value = .0458, vs. 45+ years), females ($\beta = -0.2697$; p value = .0019, vs. males), and those who were divorced/widowed/separated ($\beta = -0.3119$; p value = .0298, vs. single) were significantly less likely to have access to broadband internet. While caregivers who were married/living as married ($\beta = 0.2746$; p value = .0211, vs. single), non-Hispanic other race/ethnicities ($\beta = 0.4343$; p value = .0348, vs. non-Hispanic Blacks), caregivers with an annual income of ≥\$100,000 ($\beta = 0.263$; p value = .0320, vs. < \$35,000), and residents of metropolitan areas ($\beta = 0.2782$; p value = .0337, vs. non-metropolitan) were significantly more likely to have access to broadband internet.

Given the opportunity of access to the broadband internet, caregivers of ages 35–39 ($\beta = 0.1240$; p value = .0187) and 40–44 ($\beta = .1178$; p value = .0178) were more likely to seek health information for someone else electronically as compared to those of ages 45+. Further, females ($\beta = 0.0948$; p value = .0078, vs. males), non-Hispanic Whites ($\beta = 0.1201$; p value = .0207, vs. non-Hispanic Blacks), caregivers with some college or more education ($\beta = 0.1593$; p value = .0024, vs. high-school graduate or less), and those with an annual income of ≥\$100,000 ($\beta = 0.1078$; p value = .0252, vs. < \$35,000) were again significantly more likely to seek health information for someone else electronically compared to their counterparts.

Regarding seeking health information for themselves, caregivers of ages 35–39 ($\beta = 0.1126$; p value = .0188, vs. 45+ years) and those of some college or more education ($\beta = 0.1187$; p value = .0110, high-school graduate or less) were significantly more likely to use electronic means to seek health information for themselves. Lastly, caregivers of ages 40–44 ($\beta = 0.2089$; p value = .0358, vs. 45+ years), females ($\beta = 0.1704$; p value = .0241, vs. males), divorced/widowed/separated ($\beta = 0.3256$; p value = .0309, vs. single), non-Hispanic other race/ethnicities ($\beta = 0.3507$; p value = .0126, vs. non-Hispanic Blacks), caregivers with annual incomes of $\$35,000 \leq X < \$100,000$ ($\beta = 0.2736$; p value = .0213, vs. < \$35,000), and ≥ \$100,000 ($\beta = 0.6295$; p value<.001, vs. < \$35,000), and those who providing care for health conditions such as Alzheimer's, confusion, and dementia ($\beta = 0.1661$; p value = .0433, vs. neither cancer, nor Alzheimer's, confusion, and dementia conditions) were significantly more likely to communicate with a provider electronically compared to their counterparts.

Discussion

The purpose of this study was to investigate the predictors of access to broadband internet among informal caregivers and to examine the factors associated with HIS and health communication among informal caregivers with broadband internet. Although informal caregivers play a critical role in the healthcare system by providing essential care and support to family members and close friends, there is limited knowledge on the impact of broadband internet access on their ability to provide quality care to their loved ones and to take care of themselves. Our results confirm that a digital divide exists in access to broadband internet. Specifically, the first part of a

Table 1 Characteristics of informal caregivers by the access to the Broadband Internet in the HINTS 5 dataset [a]

	Caregivers (*n* =929)		Do you have the Broadband Internet?				Chi-Square test	p value
			Yes (n=404)		No (*n*=397)			
Characteristic	% [b]	SE [c]	% [b]	SE [c]	% [b]	SE [c]		
Age (in years)								
18–34	14.59	1.94	9.93	2.30	20.51	3.22	6.92	.074
35–39	9.22	1.43	9.09	2.09	9.24	1.98		
40–44	12.69	2.02	14.35	2.99	11.35	3.18		
45+	63.48	2.80	66.61	4.10	58.88	3.65		
Sex								
Male	33.84	2.27	44.00	3.59	22.36	3.69	13.06	.0003
Female	66.15	2.27	55.99	3.59	77.63	3.69		
Marital status								
Married/living as married	21.05	2.58	18.22	3.77	24.38	3.94	7.01	.03
Divorced/widowed/separated	67.69	2.65	74.01	3.63	60.28	3.81		
Single (never been married)	11.24	1.73	7.75	1.76	15.33	2.79		
Race/Ethnicity								
Non-Hispanic White	65.33	2.25	65.20	3.48	66.21	3.30	0.14	.985
Non-Hispanic Black	12.37	1.84	12.26	2.69	12.21	2.18		
Hispanic	13.75	1.82	13.29	2.50	13.46	2.75		
Non-Hispanic other	8.53	1.07	9.23	1.67	8.09	2.06		
Education								
Less than high school	4.77	1.43	1.17	0.55	9.05	2.93	12.54	.005
High school graduate	17.77	1.75	17.49	2.49	17.74	3.18		
Some college	37.86	2.70	37.53	4.28	38.02	3.96		
College graduate or more	39.57	2.15	43.79	4.05	35.17	3.23		
Income (X)								
X<$35,000	27.00	2.53	16.87	2.57	39.05	3.74	33.38	<.001
$35,000≤X<$100,000	41.85	2.29	44.16	3.42	38.95	3.44		
X≥$100,000	31.14	2.43	38.95	3.72	21.99	2.46		
Residential location								
Metropolitan	90.35	1.33	93.34	1.41	85.76	2.73	6.69	.0096
Non-metropolitan	9.64	1.33	6.65	1.41	14.23	2.73		
General health								
Excellent/very good	45.90	2.01	46.36	2.98	44.87	3.53	6.50	.038
Good	36.34	2.31	40.20	3.49	32.27	3.32		
Fair or poor	17.74	1.92	13.42	2.24	22.85	3.31		
Caregiving conditions								
Cancer	8.72	1.61	1.87	1.87	9.28	2.60	413.79	<.001
Alzheimer's, confusion, dementia	18.36	2.08	19.24	3.42	18.66	2.88		
Cancer + Alzheimer's, confusion, dementia	2.79	0.74	0.66	0.66	2.57	1.12		
Neither cancer nor Alzheimer's, confusion, dementia	70.11	2.47	69.79	3.63	69.47	3.92		
Caregiving hours per week								
< 5 h	39.80	3.13	45.56	4.35	33.58	4.01	24.14	<.001
5–20 h	25.28	3.16	31.08	5.22	18.99	2.72		
> 20 h	34.91	3.49	23.35	3.59	47.41	4.52		
Health information seeking for someone else	86.72	1.89	89.67	1.92	83.08	2.90	5.68	.017
Health information seeking for yourself	86.70	1.66	90.43	2.23	82.98	2.89	3.72	.0537
Communicate with a provider	47.81	3.10	58.10	3.87	36.50	3.53	25.79	<.001

[a] HINTS; Health Information National Trends Survey, HINTS 5 Cycle 1 and Cycle 2 (2017–2018), the United States

[b] Weighted percentages

[c] Standard error of percentages

two-part model indicated that younger (18–34 years versus 45+ years), female (versus males), and the divorced/widowed/separated (versus singles) caregivers were less likely to have access to broadband internet, but those married/living as married (versus singles), with higher incomes (≥$100,000 versus <$35,000), and those living in metropolitan areas were more likely to have access to broadband internet. The second portion of our analysis showed that among caregivers with broadband internet access, the younger (35–44 years versus 45+ years), females (versus males), and whites (versus blacks), those with higher levels of education (some college or more versus high school graduate or less) and with incomes

Table 2 A two-part model of access to broadband internet among informal caregivers, and health information seeking and health communication among informal caregivers with access to broadband internet

All caregivers (n=929)			Caregivers with BB access (n=404)					
	Broadband internet		HIS for someone else		HIS for yourself		Communicating with a provider	
Characteristics	*β*	p value	*β*	p value	*β*	p value	*β*	p value
Age (in years) (Ref.: 45+)								
18–34	−0.3953	.0458	0.0850	.0933	0.0876	.0594	0.1591	.1445
35–39	0.1351	.5146	0.1240	.0187	0.1126	.0188	0.2074	.0632
40–44	0.2210	.2850	0.1178	.0178	0.0743	.1164	0.2089	.0358
Female (Ref.: male)	−0.2697	.0019	0.0948	.0078	0.0051	.8724	0.1704	.0241
Marital status (Ref.: single)								
Married/living as married	0.2746	.0211	−0.0160	.7515	0.0324	.4895	0.1970	.1542
Divorced/widowed/separated	−0.3119	.0298	−0.0193	.7393	0.0350	.5160	0.3256	.0309
Race/Ethnicity (Ref.: non-Hispanic Black)								
Non-Hispanic White	−0.1652	.1887	0.1201	.0207	0.0807	.0856	0.1132	.3430
Hispanic	−0.0989	.5937	0.1086	.0916	0.0307	.6072	−0.0258	.8655
Non-Hispanic other	0.4343	.0348	0.0951	.1663	0.0970	.1151	0.3507	.0126
Education								
Some college or more (Ref.: high school graduate or less) [a]	−0.1261	.2803	0.1593	.0024	0.1187	.0110	0.1886	.1663
Income (X) (Ref.: X<$35,000)								
$35,000≤X<$100,000	0.00314	.9760	0.0358	.4073	0.0140	.7210	0.2736	.0213
X≥$100,000	0.2637	.0320	0.1078	.0252	0.0730	.0974	0.6295	<.001
Residential location (Ref.: non-metropolitan)								
Metropolitan	0.2782	.0337	−0.0192	.7058	0.0962	.0589	0.0225	.8520
General health (Ref.: fair or poor)								
Excellent/very good	–	–	–	–	−0.0774	.0630	−0.0183	.8629
Good	–	–	–	–	−0.0662	.1307	0.0067	.9521
Caregiving conditions (Ref.: neither cancer nor Alzheimer's, confusion, dementia)								
Cancer	–	–	0.1300	.0132	0.0576	.2612	0.0837	.4840
Alzheimer's, confusion, dementia			0.0124	.7572	0.0337	.3551	0.1661	.0433
Cancer + Alzheimer's, confusion, dementia			−0.0703	.5152	−0.0495	.6037	0.0288	.8969
Caregiving hours per week (Ref.: > 20 h)								
< 5 h	–	–	0.0168	.7579	−0.0049	.9187	0.0120	.9143
5–20 h	–	–	0.0857	.1452	0.0305	.5626	−0.0819	.5247

β, Beta Coefficient; BB, broadband; HIS; Health Information Seeking; Ref, reference

[a] The categories were combined due to quasi-complete separation with which convergence fails

(≥$100,000 versus <$35,000) were more likely to seek health information for someone else. Further, those aged 35–39 years and those with more education were more likely to look for health information for themselves. Furthermore, individuals aged 40–44 years, females, the divorced/widowed/separated, those with higher incomes, and caregivers providing care for health conditions such as Alzheimer's, confusion, and dementia were more likely to communicate with a provider electronically. In general, the findings imply a gap in broadband internet access and indicate existing variations in HIS and health communication among informal caregivers with access to broadband internet.

This digital divide could be detrimental to both caregivers and patients as they navigate their ongoing healthcare needs. Consistent with the general conclusions of the existing health inequality literature, our findings indicate that a metropolitan residence was a significant predictor for caregivers' having broadband internet access, enabling health information seeking and health communication. Indeed, there is greater availability of broadband internet in metropolitan areas than non-metropolitan areas, which presents a public health concern as this difference in access likely exacerbates health disparities in the caregiving realm [9]. Earlier studies report that compared to non-rural adults, rural adults were more likely to find online health-related information helpful or useful but were less likely to utilize the internet for HIS [31]. In fact, many individuals rely on their providers first and their family and close friends to obtain health information, which may be particularly true for people residing in rural settings [12]. Given growing evidence for the potential of health-related internet use to address health and healthcare disparities [9, 11], policymakers should support expanding internet access to medically underserved regions. For example, national and local governments should increase funding for improving access to broadband technology and telecommunication infrastructure in remote rural communities and make it more affordable for those with limited resources.

Among caregivers with broadband internet access, those caring for cancer patients were found to be more likely to seek health information for someone, and those who provide care to persons with Alzheimer's disease, confusion, or dementia were more likely to communicate with a provider electronically compared to their counterpart caregivers with neither of those conditions. Probably, caregivers of patients with cognitive problems may need to directly communicate with clinicians more to ask a question related to the patients' specific behavior, while cancer caregivers may merely need cancer-related information required for patient treatment symptoms and side effects, including pain [32, 33]. Evidence indicates that caregivers of cancer patients often look for information about cancer treatment options or procedures and are involved in clinical decision-making [20, 34]. Studies have also reported that family caregivers of people with Alzheimer's disease or dementia have information needs concerning diagnosis, symptoms, treatments, and daily care [33, 35].

Considering the difficult circumstances for caregivers, such as time constraints, financial challenges, and a multitude of obstacles associated with the caregiving role, broadband internet can improve efficiency in seeking relevant information and communicating with providers, thus, reducing the caregiving burden. Furthermore, broadband internet can enhance caregivers' physical and mental health by providing essential health information they may need for themselves or their patients' conditions; thus, enabling them to browse the internet with more ease and increased efficiency [9]. There is a greater recognition that eHealth tools will transform healthcare by empowering patients and their caregivers by helping them to meaningfully interact with healthcare without restrictions of time and location [19]. Notably, reliable and relevant health information on the internet will not only address health disparities but also improve health outcomes [19]. Delivery of health-related information and interventions via the internet could be further promoted by policymakers, public health practitioners, and researchers; at the same time more public and private sectors should continually improve the quality of health-related information on the internet.

It is crucial to integrate the tenets of health literacy and technology literacy essential for utilizing the internet and other information technologies for HIS and health communication [36]. Although individuals have access to information and communication technologies, it does not equate to developing proper understanding or comprehending the context of health or utilizing those technologies to improve health. Previous studies indicate that individuals with health literacy barriers have a lower likelihood of using information technology in healthcare settings [36, 37]. Functional health literacy is critical for caregivers since they are pivotal in providing or supporting patient care by receiving information about patients' health conditions/symptoms and making healthcare decisions [6, 20]. Low health literacy among caregivers can lead to worse patient outcomes by affecting the care process negatively [38]. In this regard, providing educational resources or materials to better understand health and technology use to caregivers should be supported with more public and private endeavors [39].

Despite the implications for policy and practice, this study is not without limitations. First, although the study explored the digital divide specific to broadband internet among informal caregivers, we cannot establish causality for the relationship between independent and dependent variables because of the cross-sectional nature of the HINTS survey. Second, although we included caregiving conditions and hours among caregivers with broadband internet access, we could not adjust for the severity of those conditions due to lack of information in the data. Further, this study was conducted based on self-reported information where there is a possibility of recall bias. Finally, despite controlling for related factors, there may be other confounders that were not available in the surveys and we were unable to account for them. For instance, we could not include many other contextual factors that could have been related to the outcome variables. All these weaknesses in the study provide other researchers and us with a potential opportunity to expand the study in the future.

Conclusion

The internet is widely recognized as an essential tool for obtaining health-related information and offers great potential to address some issues in health and healthcare disparities. Given the role of informal caregivers in supporting and providing care to the physically or mentally ill or disabled, the benefits of health-related internet use can help improve outcomes and address inequities in healthcare delivery both for caregivers and their care recipients. Despite the advantageous features of the internet, we found a gap in the access to broadband internet and variations in HIS and health communication among informal caregivers with broadband internet access, related to demographic characteristics, metropolitan residence, and socioeconomic conditions such as income and education. These findings underscore the need for addressing the issue of the digital divide among caregiving populations. As we already discussed, policies should support expanding broadband internet access to medically underserved areas by providing a subsidy to internet services providers while reducing or eliminating barriers to broadband internet. Essentially, more efforts should be put into delivering reliable and relevant health-related information and interventions through the internet to patients and their caregivers.

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