ACCESS IN THE DIGITAL FIELD, E-HEALTH BEHAVIORS AND HEALTH*

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ABSTRACT

Although digital information and communication technologies (ICTs) are becoming more and more essential for accessing important resources, many experience barriers to digital access. Patterns of digital access may influence health differentials as many digital resources are closely related to health. Despite the growing pervasiveness of digital access, and its potential importance for individual's health, empirical research examining the association between and health is scarce. In this study, we fill in this gap in the literature by investigating how digital access is associated with health outcome, using data from (Cycles 1 and 3) of the Health Information National Trends Survey 4 (*N*=4,816). Our findings indicate that among the respondents who have internet connections, those with various modes for internet connection have better health compared to those who have limited access, and this association was not mediated by eHealth behaviors. We discussed implications of our findings and next steps for the analysis.

INTRODUCTION

Digital information and communication technologies (ICTs) are becoming more and more essential for accessing important resources such as employment, housing, social support, and health information and services. However, many experience barriers to accessing digital ICTs which can lead to total or partial digital exclusion. This may pose a significant problem as many of these resources which are increasingly accessed (in some cases exclusively) through the digital field are closely related to health outcomes. As such, digital equity may be closely tied to health equity.

Over the past decade some demographic gaps in digital access have nearly closed altogether. Disparities in access between whites and minorities, and between men and women, have been significantly reduced and in many cases disappear altogether when other factors, such as language proficiency in the case of racial disparities in access, are controlled for (Zickuhr and Smith 2012). However, despite recent gains in digital access among the US population in general, there remains a persistent gap along demographic lines such as income, education, and age (Zickuhr and Smith 2012). These forms of digital inequality will likely exacerbate existing health inequalities because the patterns are closely related to other forms of social exclusion, which have significant effects on health outcomes. In other words, the populations being most negatively affected by digital inequality are in many cases the same marginalized populations who are already more likely to experience poor health.

THEORETICAL BACKGROUND

Digital Access

Van Dijk's (2005) multiple access model of digital inequality involves four types of successive stages and kinds of access: (1) motivational access, (2) material or physical access,

(3) skills access, and (4) usage access. Here, problems of accessing digital technologies gradually shift from the first two stages and kinds, if and when motivational and material access have been achieved, to the second two stages and kinds of access, skills and usage. According to Van Dijk, the unequal distribution of temporal, material, mental, social, and cultural resources are of particular importance for digital ICT access.

Drawing on the works of Pierre Bourdieu (1986) this study examines the relationship between digital access and health outcomes by situating Van Dijk's (2005) multiple access model within what can be understood as the "digital field" to construct a framework for understanding digital inequality as rooted in the disproportionate distribution of capital. Competition over different types of capital between individuals and institutions occurs in different social arenas termed *fields*. This is to say that existing forms of capital may be utilized in an effort to gain the capital at stake in the competition constantly occurring within a particular field.

Following the work of Baum, Newman, and Biedrzycki (2014), we conceptualize the digital world as a field in which competition over capital occurs, and is subsequently unevenly distributed to competitors, based on the capital they bring to the field. In other words, within this framework, one's ability to access digital ICTs is determined by the amount and types of capital they possess. For example, digital access may be determined by economic capital in terms of whether or not a person can afford a computer or reliable network connection. Further, having entered the field of digital ICTs, their digital abilities, understood as a form of cultural capital, will structure their subsequent access to other forms of capital, many of which have significant impact on health outcomes. For example, an individual's ability to compete in the digital field, for resources such as the utilization of health-related applications or other eHealth behaviors,

may depend on the level of cultural capital they bring to the field in terms of their level of education.

Social Determinants of Health

In terms of the possible health consequence of digital inequality, a social determinants of health perspective is useful for understanding the role that socially patterned access to resources plays in shaping health outcomes (Marmot and Wilkinson 2006). The focal premise of this perspective is that social conditions which shape social inequalities also shape health inequalities (Marmot 2002). The relationship between digital access and health outcomes may be shaped in terms of the material conditions that affect health outcomes and which are increasingly gained or managed at least partially through the use of digital ICTs.

eHealth Behaviors

Access to digital ICT's may affect health in terms of health behaviors and lifestyle. Individuals with higher levels of digital access may be more capable and more likely to use digital ICTs to better their lives as opposed to simply for enjoyment. One way in which digital ICTs can be used to better one's life is through eHealth behaviors. Using the internet to browse for health information online, health communication and all other eHealth behaviors, including looking up healthy recipes, streaming exercise videos, using health promoting applications, belonging to health-related online communities, and accessing ones medical charts. These behaviors may potentially increase positive health outcomes.

RESEARCH QUESTIONS AND HYPOTHESES

This study investigates the association between digital access and health outcomes by addressing an overarching question of whether or not access to digital ICTs is associated with better overall self-rated health. According to a social determinants of health perspective, we expect to find a positive association between higher levels of digital access with better overall health as many valuable resources can be accessed through the digital field. Additionally, we examine whether this potential relationship may be mediated by eHealth activities or when put together may be called, eHealth Lifestyle. According to the framework we've constructed, where digital inequality occurs along multiple lines of access and is both shaped and reproduced in terms of is the uneven distribution of capital, we expect to find that eHealth lifestyle will mediate the relationship between digital access and overall health. This is to say that the amount and composition of capital one possesses will shape both their level of digital access as well as the returns on health gained in the digital field. In this sense, we believe much of the association between digital access and health will be explained by eHealth behaviors in the digital field.

METHODS

Data

For this study, we used data from the Health Information National Trends Survey (hereafter HINTS). Conducted by the National Cancer Institute, the HINTS was designed to track health communication and information technology trends using a nationally representative sample of adult population in the US. Beginning in 2003, there have been six cross sectional waves of HINTS data collection. We used a pooled data set from HINTS 4 Cycle 1, collected in 2011 (N=3,959), and Cycle 3, collected in 2013 (N=3,185), because in both cycles the survey included

questions regarding eHealth activities. However, Cycle 1 had both a long-form and a short-form questionnaire. The short-form questionnaire did not include these eHealth measures and were excluded from our analyses leaving a total of 3,516 cases for Cycle 1 and a total of 6,701 cases for the integrated data set. Also excluded from the analyses were non-internet users who responded "no" to the question, "Do you ever go online to access the Internet or World Wide Web, or to send and receive e-mail?" leaving 4,890 cases. Cases with missing values for the dependent variable measure of general health were also excluded leaving a total of 4,816 cases included in the analyses.

Measures

Dependent variable. Our outcome variable measures general overall condition of health. This measure asks respondents to indicate their health status in terms of a five-point scale ranging from excellent to poor (1 Excellent, 2 Very Good, 3 Good, 4 Fair, 5 Poor). This variable was reverse coded, with higher values indicating better health conditions (1 Poor, 2 Fair, 3 Good, 4 Very Good, 5 Excellent).

Independent variable. One important indicator of digital access has to do with the material and physical issue of whether or not an individual is able to access the Internet. Internet connection is a crucial component of the physical and material as well as usage forms and stages of digital access. HINTS4 cycles 1 and 3 include 5 separate questions regarding the mode of access respondents' use when connecting to the Internet. The questions ask whether respondents access the Internet through, "a dial-up telephone line", "broadband such as DSL, cable, of FiOS," "a cellular network," "a wireless network (Wi-Fi)," and "any other way" with yes responses coded

1 and no responses coded 2. While many respondents report using more than one mode to access the internet, the vast majority report not using dial-up (n=4412), and among all those who report that they do use a dial-up connection (n=302) it is the only mode they report using. As such, three mutually exclusive dichotomous variables were created to measure level of physical/material digital access (1) 'dial-up only' includes respondents who rely solely on a dial-up connection (n=302), (2) 'all but dial-up' which includes respondents who connect using any combination of Wi-Fi, broadband, and or cellular (n= 4360), and (3) 'internet connect missing' for the cases with missing values for the internet access mode questions (n=154).

Mediating variables. eHealth lifestyle was measured using 11 questions about different online activities respondents participated in. These questions ask respondents whether or not they have engaged in the following eHealth behaviors during the previous 12 months: (a) looked for information about health or medical topics from any source, (b) looked for health or medical information for yourself, (c) looked for health or medical information for someone else, (d) looked for a health care provider, (e) kept track of personal health information, (f) downloaded health-related info to a mobile device, (g) bought medicine or vitamins on-line, (h) participated in an on-line support group for people with a similar health or medical issue, (i) shared health information on social networking sites, such as Facebook or Twitter?, (j) Wrote in an on-line diary or blog about any type of health topic, and (k) looked for information about quitting smoking. These measures are all coded as dichotomous variables (1 yes, 2 no).

Sociodemographic control variables. Sociodemographic control variables were included in the analyses in order to measure the main effects of eHealth behaviors on the relationship between

digital access and health. These included variables for age, gender, race and ethnicity, education, income, and marital status which were all categorically coded.

Analyses

Data analysis began with univariate analysis of the dependent variable to check for normal distribution, missing cases, and level of measurement. Next, descriptive analyses were used to determine frequencies and distribution within independent and control variables.

Ordered logistic regression analyses were used to estimate the association between digital access and self-rated health. More specifically, Model 1 examines the bivariate association between digital access and health without any control variables. In Model 2 we included sociodemographic controls for age, gender, and race and ethnicity. In Model 3 the eHealth behaviors were added to model 2 and in Model 4 the measures for education, income, and marital status were added to Model 3.

PRELIMINARY FINDINGS

To begin, the frequencies and percentages for the dependent variable as well as all demographic variables by level of access are reported in Table 1.

[insert Table 1 here]

According to the results presented in table 1, the majority of respondents included in the sample access the Internet via modes included in the 'all but dial up' measure. Those who connect using 'dial up only' tend to report worse overall health, have lower levels of education and income, and are more likely to be older and less likely to be non-Hispanic white than the total sample. Additionally, respondents who access the internet via 'dial up only' are more likely to be widowed while those who access via 'all but dial up' are more likely to be single. While the

gender distribution among those who access using ‘all but dial up’ is very similar to that of the overall sample, the distribution among those who access using ‘dial up only’ is made up of more male respondents than the overall sample.

Next, a close examination of the demographic trends in who participated in the reported eHealth behaviors suggest that the most widely engaged activities include seeking health related information online for oneself or for someone else followed by searching for a provider online, tracking one’s personal health record, and purchasing medicine or vitamins online, respectively. Trends in who participated in eHealth behaviors varied by activity. For example, those with higher levels of education were more likely to participate in the eHealth activity of searching online for a healthcare provider than those who had lower levels of education. While participation in blogging about a health-related topic was very low overall, younger respondents were more likely to have engaged in the behavior. Respondents with higher levels of income were more likely to purchase vitamins or medicine online than those who reported lower levels of household income. Female respondents were more likely to participate in an on-line support group than male respondents. Figures 1-4 provide a visual representation of these trends in eHealth engagement.

[insert figures 1-4 here]

Table 2 provides the unstandardized odds ratios and p values for ordered logistic regression Models 1-4.

[insert Table 2 here]

According to the results in Table 2, Model 1 suggests that there is a positive association between higher levels of digital access and better overall health. This relationship remains significant in

Model 2 when the controls for age, gender, and race and ethnicity are included. In Model 3, the addition of eHealth behaviors to the model works to increase the level of significance for the association between level of digital access and health which suggests that these behaviors are actually confounding in their affect rather than mediating. Results of Model 4 indicate that with the inclusion of measures for education, income, and marital status, the association between digital access and health is no longer significant which implies that these factors remain more influential and important for predicting health outcomes than level of digital access. This result is not unexpected as the level and composition of capital one possesses (education, income, social relationships) shapes one's level of digital access.

DISCUSSION AND NEXT STEPS

While the importance of digital access cannot be overstated in current society, empirical studies examining if and how digital access influences individual's health are limited. This study contributes to the literature by looking at eHealth behaviors in an attempt to estimate how they are associated with self-rated health. More specifically, we addressed two research questions using data of a nationally representative sample of adult population in the US. For the first research question of whether access to digital ICTs is associated with better health, our results show that those who have 'all but dial up' are more likely to have better health relative to those who connect using 'dial up only', and this association is still statistically significant after accounting for demographic characteristics. In regard to the second research question about whether eHealth Lifestyle mediates the association between digital access and health condition, eHealth behaviors seem to be confounding rather than mediating the association.

While these results do not support the research hypothesis, it may be partially explained in terms of selection, as those who choose to engage in various eHealth activities do so because they are experiencing poor health. Furthermore, as previously discussed usage access is not a simple matter of time spent on the internet, rather type and diversity of digital activity is a key component to usage access. Some of the digital ICT activities which may not provide many capital enhancing opportunities such as gaming, video and audio streaming, and social interaction, are rather time-consuming activities. Here, cultural capital may play a key role in determining usage access, as some research has demonstrated that individuals with lower levels of education use the internet more frequently and for more hours of the day, and that they are more likely to participate in online activities such as gaming and socializing (Van Deursen and Van Dijk 2014). On the other hand, research has also demonstrated that those with higher levels of education and more privileged social positions, or in Bourdieu's terms, people who have more economic and cultural capital, tend to use digital ICTs for more beneficial purposes (Van Deursen and Van Dijk 2014; Zillien and Hargittai 2009).

As next steps, we plan to closely look at those who did not have internet connections in comparison to those who have them. In the current study, we focused on the respondents who have access to internet in order to tease out roles of eHealth behaviors in the association between digital access and health. However, eHealth behaviors appear to be confounding for the digital access and health link, at least in our cross-sectional data, so a better understanding of who is likely to be completely excluded versus have these levels of digital access, is critical. Additionally, we also plan to explore ways to better capture eHealth activity – in terms of kinds and levels of activities to ensure that our findings here are held consistent. We believe that this study is important and timely because as digital ICTs are becoming increasingly necessary for

accessing important resources, digital access will likely have an increasing effect on the social health gradient. We hope that future research should also look at this important link in a longitudinal setting when data is available.

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Table 1. Sample frequencies and proportions by level of digital access

	Total Sample	**Dial Up Only**	**All But Dial Up**	**Internet Connect Missing**
	N = 4,816	N = 302	N =4360	N=154
	freq. (%)	freq. (%)	freq. (%)	freq. (%)
Health				
Excellent	690 (14.33)	20 (6.62)	654 (15.00)	16 (10.39)
Very Good	1886 (39.16)	99 (32.78)	1737 (39.84)	50 (32.47)
Good	1680 (34.88)	129 (42.72)	1492 (34.22)	59 (38.31)
Fair	477 (9.90)	46 (15.23)	408 (9.36)	23 (14.94)
Poor	83 (1.72)	8 (2.65)	69 (1.58)	6 (3.90)
Education				
Less than High School	186 (3.86)	23 (7.62)	144 (3.30)	19 (12.34)
High School Graduate	716 (14.87)	72 (23.84)	612 (14.04)	32 (20.78)
Some College	1539 (32.00)	111 (36.75)	1369 (31.40)	59 (38.31)
Bachelor's Degree	1382 (28.70)	62 (20.53)	1290 (29.59)	30 (19.48)
Post Baccalaureate's	927 (19.25)	29 (9.60)	888 (20.37)	10 (6.49)
Unknown	66 (1.37)	5 (1.66)	57 (1.31)	4 (2.6)
Race & Ethnicity				
Hispanic	550 (11.42)	47 (15.56)	484 (11.10)	19 (12.34)
Non-Hispanic White	3005 (62.40)	163 (53.97)	2778 (63.72)	64 (41.56)
Non-Hispanic Black	623 (12.94)	52 (17.22)	534 (12.25)	37 (24.03)
Non-Hispanic Other	329 (6.83)	13 (4.30)	306 (7.02)	10 (6.49)
Unknown	309 (6.42)	27 (8.94)	258 (5.92)	24 (15.58)
Gender				
Male	1830 (38.00)	124 (41.06)	1655 (37.96)	51 (33.12)
Female	2907 (60.36)	171 (56.62)	2643 (60.62)	93 (60.39)
Unknown	79 (1.64)	7 (2.32)	62 (1.42)	10 (6.49)
Income				
Income <$20K	693 (14.39)	83 (27.48)	562 (12.89)	48 (31.17)
Income $20-$35K	610 (12.67)	54 (17.88)	534 (12.25)	22 (14.29)
Income $35-$50K	653 (13.56)	46 (15.23)	588 (13.49)	19 (12.34)
Income $50-$75K	851 (17.67)	44 (14.57)	790 (18.12)	17 (11.04)
Income $75K +	1599 (33.20)	49 (16.23)	1530 (35.09)	20 (12.99)
Income Unknow	410 (8.51)	26 (8.61)	356 (8.17)	28 (18.18)
Marital Status				
Married	2768 (57.48)	149 (49.34)	2547 (58.42)	72 (46.75)
Divorced Separated	820 (17.03)	42 (13.91)	749 (17.18)	27 (17.53)
Widowed	856 (17.77)	74 (24.50)	235 (5.39)	33 (21.43)
Single / Other	280 (5.81)	29 (9.60)	751 (17.22)	16 (10.39)
Unknown	92 (1.91)	8 (2.65)	78 (1.79)	6 (3.90)
Age				
18-34	849 (17.63)	24 (7.95)	808 (18.53)	17 (11.04)
35-49	1315 (27.30)	71 (23.51)	1220 (27.98)	24 (15.58)
50-64	1695 (35.20)	116 (38.41)	1520 (34.86)	59 (38.31)
65-74	619 (12.85)	46 (15.23)	542 (12.43)	31 (20.13)
75+	261 (5.42)	41 (13.58)	205 (4.70)	15 (9.74)
Unknown	77 (1.60)	4 (1.32)	65 (1.49)	8 (5.19)

Table 2. Ordered Logistic regression on self-rated health

N=4816	**Model 1**		**Model 2**		**Model 3**		**Model 4**	
	Odds Ratio	p (value)	Odds Ratio	p (value)	Odds Ratio	p (value)	Odds Ratio	p (value)
Access - Dial up only is Reference								
All but dial up	0.582	0.002	0.500	0.008	0.535	0.006	0.303	0.151
Internet connect missing	-0.085	0.802	-0.058	0.859	-0.051	0.876	-0.032	0.922

Model 1 includes the independent variable measuring digital access
Model 2 adds the demographic control variables for age, gender, and race and ethnicity to Model 1
Model 3 adds the measures for eHealth Lifestyle to Model 2
Model 4 adds controls for education, income, and marital status to model 3

Figure 1.

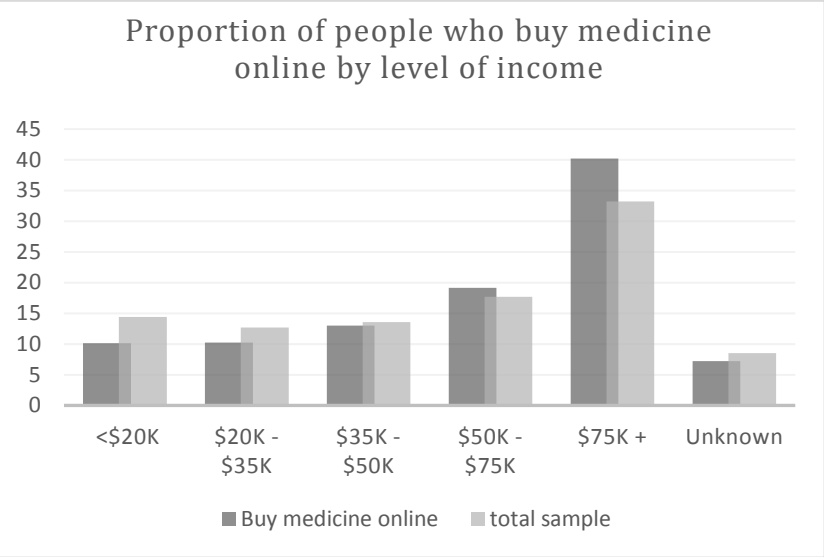

Figure 2.

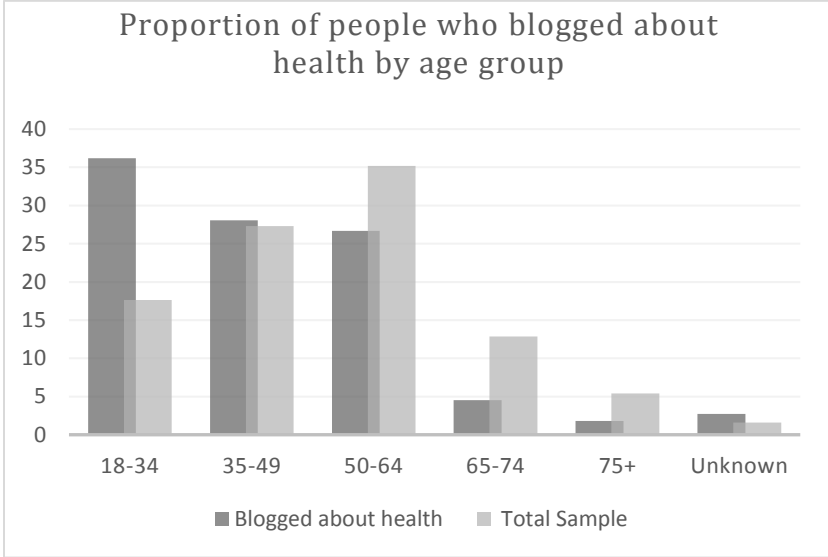

Figure 3.

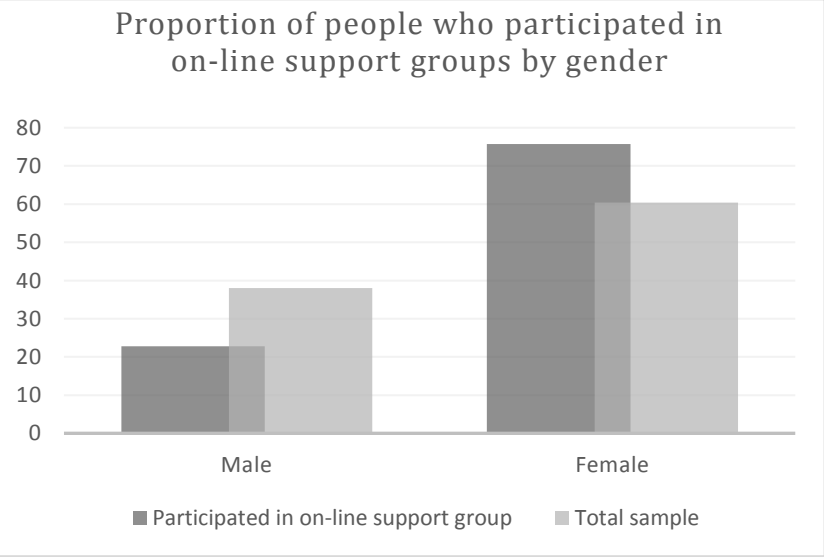

Figure 4.