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Patient Centered Communication and E-Health Information Exchange Patterns: Findings From a National Cross-Sectional Survey

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ABSTRACT This paper aimed to determine whether there was a connection between patient's perception of communication with their doctors in the visit and their use of online health information exchange using a nationally representative survey. We used the data from the Health Information National Trends survey pooled HINTS4 Cycle 4 data and assessed outcomes using logistic regression modeling composite communication scores as a continuous variable. We weighted participants to create population-level estimates. We adjusted for age, gender, race, and census region. The 3677 patients were included in the analysis who had an outpatient visit within the previous 12 months. In unadjusted analysis and analysis adjusted for demographic factors, patients who experienced higher communication scores were more likely to use online health information exchange with their providers. In unadjusted analysis, patients had 0.04 higher odds of interest in receiving appointment reminders from health care providers electronically (OR = 1.04 and $p = 0.01$) and 0.03 higher odds of interest in receiving general health tips (OR = 1.03 and $p = 0.04$) for every score increase in the communication summary score. In adjusted model, for each score increment in the communication score, patients were 7% more inclined to receive appointment reminders ($p < 0.05$), 4% more inclined to receive general health tips ($p = 0.02$), and 4% more likely to exchange information about lifestyle behaviors ($p = 0.02$). Findings suggest that the quality of the communication in the visit might increase use of informatics tool to exchange health information.

INDEX TERMS Health information exchange, informatics, patient centered communication, patient portals.

I. INTRODUCTION

Effective communication is integral to achieving quality healthcare [1], [2]. Rapid technological advances and increased access to the internet have created new channels for patients to communicate and exchange health information with clinicians and their offices [2], [3]. These channels are increasingly utilized in health care systems, especially with the implementation of patient portals and intention to access personal health records. Clinicians are also increasingly monitoring patients using third party services, such as the use of glucometer or blood pressure monitoring using mobile applications. There has been a recent attention on how online provider-patient communication can contribute to patient centered care. This is particularly of interest given that past research has linked in-person patient-centered

communication to various outcomes including trust, satisfaction, adherence and well-being. Patient centered communication is defined as mutual understanding patients' health needs, values, and perspectives, and helping to share power and responsibility [4], [5], with increased engagement, follow-through with care plans, better health outcomes, and higher patient satisfaction [6]–[12].

Online communication between patients and clinicians has indeed been linked to a number of benefits including shared decision making, better health outcomes, improved patient-provider communication, patient experience, and patient engagement as well as higher quality of care [13]. Some recent studies also showed financial benefits of online communication such as decreasing low value administrative time for patients as well as lowering out-of-pocket costs for

some patients [2]. Furthermore, several studies have reported factors influencing patients' internet based health communication frequency, preferences or usage, including access to internet and technology, disparities, socio-economic factors, and education level.

Despite benefits, not all patients wish to engage electronically with their clinicians. Gaps in our current understanding of engagement include knowing how best to engage patients in online communication. Particularly as organizations seek to increase participation in patient portals, research that identifies actionable factors that influence adoption is needed. One qualitative study identified that patients may be more interested in access to health records if their perception of communication of visits was suboptimal, such that online tools may be a way to compensate for poor in-person communication [13]. How communication impacts decisions to engage online directly with clinicians and their staff is not fully understood.

In this study, we sought to determine whether there was a connection between patient's perception of communication with their doctors in the visit and their use of online health information exchange (communication) using a nationally representative survey. We hypothesized that patients who experienced relatively better patient-centered communication with their clinicians in the visit will be more interested in exchanging medical information online with their providers.

II. METHODS

A. DATA

Information for this analysis was drawn from HINTS4 Cycle 4 data file of year 2014 from Health Information National Trends Survey (HINTS). HINTS accumulate data from the US public to explore gradients in the use of health communication systems between healthcare providers and patients, particularly relating to access and usage, as well as demographic characteristics including age, gender, race/ethnicity and region.

The HINTS4 Cycle4 survey was administered using the single mode mailing service and the Next Birthday Method for respondent selection. The data samples are derived from consolidated databases used by the Marketing Systems Group (MSG) to obtain a random sample of addresses. A total of 13,996 households received the 4-part mailed questionnaires and there was a response rate of 34.44% for HINTS4 Cycle 4. We documented 3,677 respondents from the final HINTS4 Cycle4 survey. We explicitly utilized weights for the population estimates in our analysis. Information regarding the sampling design and survey procedures are available at <http://hints.cancer.gov>. Demographic characteristics (Age, Gender, Race/Ethnicity and Region) of the survey participants have been taken into account to understand the relationship between socioeconomic status and their inclination to exchange medical information online with their provider.

1) PATIENT-CENTERED COMMUNICATION

To understand the quality of communication with the health care provider declared by the survey respondent, six interaction questions were considered to calculate an overall communication score. Respondents have answered the following questions to express their interaction with their specific health care provider: 1. "How often did they give you the chance to ask all the health-related questions you had?" 2. "How often did they give the attention you needed to your feelings and emotions?" 3. "How often did they involve you in decisions about your health care as much as you wanted?" 4. "How often did they make sure you understood the things you needed to do to take care of your health?" 5. "How often did they help you deal with feelings of uncertainty about your health or health care?" 6. "In the past 12 months, how often did you feel you could rely on your doctors, nurses, or other health care professionals to take care of your health care needs?" Patients replied using a Likert scale, with options for the above questions being 'Always', 'Usually', 'Sometimes' and 'Never'. We created a composite score for patient-centered communication by reverse coding individual interaction item and reforming to a cumulative score range of 0-18.

2) MEDICAL INFORMATION EXCHANGE

The following questions correspond to the key outcome variables in order to measure the tendency of survey candidates to exchange medical information with their health care providers 1. "In the past 12 months, have you used app(s) on a smart phone or mobile device to exchange medical information with a health care professional?" - Medical Information 2. "How interested are you in exchanging information about appointment reminders with a health care provider electronically?" - Appointment Reminders 3. "How interested are you in exchanging information about general health tips with a health care provider electronically?" - General Health Tips 4. "How interested are you in exchanging information about medication reminders with a health care provider electronically?" - Medication Reminders 5. "How interested are you in exchanging information about lab/test results with a health care provider electronically?" - Lab/Test Results 6. "How interested are you in exchanging information about diagnostic information (e.g., medical illnesses or diseases) with a health care provider electronically?" - Diagnostic Information 7. "How interested are you in exchanging information about vital signs (e.g., heart rate, blood pressure, glucose levels, etc.) with a health care provider electronically?" - Vital Signs 8. "How interested are you in exchanging information about lifestyle behaviors (e.g., physical activity, food intake, sleep patterns, etc.) with a health care provider electronically?" - Lifestyle 9. "How interested are you in exchanging information about symptoms (e.g., nausea, pain, dizziness, etc.) with a health care provider electronically?" - Symptoms 10. "How interested are you in exchanging information like digital images/video

TABLE 1. Demographic characteristics.

HINTS4 Cycle4		
Sample size	n=3,677	
	Weighted Sample Size(N)	%
Gender		
Male	112,801,184	48.00%
Female	120,917,291	52.00%
Age		
18-34	70,435,028	31.00%
35-44	39,310,466	17.00%
45-64	79,287,542	35.00%
>=65	39,953,302	17.00%
Race		
Hispanic	32,816,984	15.00%
Non-Hispanic White	144,404,440	67.00%
Non-Hispanic Black or African American	24,517,634	11.00%
Non-Hispanic Asian	10,346,625	5.00%
Non-Hispanic other	4,633,129	2.00%
Census Region		
Northeast	43,357,462	18.00%
Midwest	51,178,513	22.00%
South	88,188,015	37.00%
West	54,935,126	23.00%

(e.g., photos of skin lesions) with a health care provider electronically?” – Digital Images/Video. Possible response options for question (1) was documented with a two-level category response type with *Selected/ Not Selected* as 2 options to choose. While all other questions were documented using 4 categories with *Very/Somewhat/A little/Not at all* as options to choose. Which we further dichotomized *Very/Somewhat* to “Interested” and *A little/Not at all* to “Not Interested”.

3) COVARIATES

We considered covariates of age, race, gender, and also the region of the country where the respondent was to explore any significant association between the respondent’s demographic traits and their interest to engage in medical information exchange.

B. STATISTICAL ANALYSES

We used unadjusted logistic regression model followed by multivariate logistic regression model to analyze each of the question. We considered age, gender, race/ethnicity and census region as sociodemographic covariates to perform adjusted regression models. We looked at the correlation between the respondent’s interest in exchanging medical

information and quality of communication with healthcare provider using generalized linear regression model including the logit quasibinomial type. We utilized continuous communication scores for analysis. To perform weighted analysis, replicated weight survey package with ‘JKn’ type technique was implemented along with all the regression models [14], [15]. Complete analysis has been performed using R-studio statistical software.

III. RESULTS

In HINTS4 Cycle 4, 3,677 participants responded. Of the total survey sample size, females constituted 52%, age group of 45 to 64 years constituted 35%, Non-Hispanic White race/ethnicity constituted 67% and 37% were from the southern region. To gauge the internal consistency between the chosen six communication questions, a Cronbach alpha test was executed, and we recognized α coefficient to be 0.77. Furthermore, the mean cumulative communication score is 13.9 and standard deviation of 4.2 with minimum score equal to 0 and maximum score of 18. Table1 displays demographic data from HINTS4 Cycle4.

Table 2 illustrates results from univariate logistic regression analysis. Respondents from HINTS4 Cycle4 were

TABLE 2. Models predicting interest in exchanging medical information.

	Composite Patient-Centered Communication Score	
	(0-18)	
	OR-CI	P-value
<i>Answered 'Selected'/'Interested' Exchanging Information With Clinicians</i>		
Medical Information	1.02(0.97-1.07)	0.47
Appointment Reminders	1.04(1.01-1.08)	0.01
General Health Tips	1.03(1.00-1.06)	0.04
Medication Reminders	1.00(0.97-1.03)	0.99
Lab/Test Results	1.00(0.97-1.03)	0.88
Diagnostic Information	1.00(0.97-1.03)	0.88
Vital Signs	1.01(0.98-1.04)	0.39
Lifestyle	1.02(0.99-1.05)	0.23
Symptoms	1.00(0.97-1.03)	0.89
Digital Images / Video	1.00(0.97-1.03)	0.87

4% more likely to show interest in receiving appointment reminders from health care providers electronically (OR = 1.04 p=0.01) and 3% more likely to be interested in receiving general health tips (OR = 1.03 p=0.04) for every score increase in the communication summary score.

From the multivariate logistic regression model outcomes demonstrated in (Table 3), for each score increment in the communication score, participants were 7% more inclined to receive appointment reminders (p<0.05), 4% more inclined to receive general health tips (p=0.02) and 4% more likely to exchange information about lifestyle behaviors (p=0.02). Respondents between 45 and 64 years of age were less likely to exchange information about appointment reminders (OR=0.38, 95% CI=0.21-0.67), exchange information about diagnostic information (OR=0.63, 95% CI=0.43-0.92) and exchange information about lifestyle behaviors (OR=0.65, 95% CI=0.44-0.94). Participants of age group 65 and above are less likely to use apps on smart phones to exchange health information (OR=0.12, 95% CI=0.05-0.26), exchange appointment reminders with health care provider (OR=0.22, 95% CI=0.12-0.40), exchange about medication reminders with a health care provider (OR=0.43, 95% CI=0.28-0.67), exchange information about lab/test results with a health care provider electronically (OR=0.49, 95% CI=0.32-0.76), exchange information about diagnostic information with a health care provider electronically (OR=0.44, 95% CI=0.29-0.64), exchange information about vital signs (OR=0.52, 95% CI=0.34-0.79), exchange information about

lifestyle with a health care provider electronically (OR=0.42, 95% CI=0.28-0.62), exchange information about symptoms (OR=0.46, 95% CI=0.31-0.70) and exchange information like digital images/video (OR=0.47, 95% CI=0.32-0.70). On the other hand, females are less likely to exchange information about lab/test results with a health care provider electronically (OR=0.73, 95% CI=0.55-0.97) and exchange information about diagnostic information (OR=0.70, 95% CI=0.54-0.90).

With respect to race/ethnicity, Hispanics are more likely to use apps on smart phones to exchange health information (OR=2.10, 95% CI=1.00-4.41), exchange appointment reminders with health care provider (OR=1.60, 95% CI=1.70-2.41), receive general health tips (OR=2.49, 95% CI=1.67-3.70), receive medication reminders (OR=1.93, 95% CI=1.30-2.88), exchange information about lifestyle behaviors (OR=2.24, 95% CI=1.49-3.36) and exchange information about symptoms (OR=1.54, 95% CI=1.03-2.32). Non-Hispanic Black patients are more likely to express interest in receiving general health tips (OR=2.15 95% CI=1.41-3.28), receive general health tips (OR=1.70, 95% CI=1.14-2.55) and exchange information about lifestyle behaviors (OR=1.63, 95% CI=1.11-2.41). Non-Hispanic Asian patients are more likely to receive general health tips (OR=2.96 95% CI=1.46-6.02), receive medication reminders (OR=2.46, 95% CI=1.21-5.00), exchange information about lab/test results with a health care provider electronically (OR=2.21, 95% CI=1.02-4.82),

TABLE 3. Detailed odds ratios for demographics values in adjusted models predicting interest in exchanging medical information.

	Answered 'Selected'/'Interested'									
	Medical Information ¹ n=3,577	Appointment Reminders ² n=3,534	General Health Tips ³ n=3,448	Medication Reminders ⁴ n=3,451	Lab/Test Results ⁵ n=3,471	Diagnostic Information ⁶ n=3,465	Vital Signs ⁷ n=3,471	Lifestyle ⁸ n=3,456	Symptoms ⁹ n=3,461	Digital Images/Video ¹⁰ n=3,447
	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR
Summary Score										
(0-18)	1.03(0.97-1.09) (p=0.31)	1.07(1.03-1.10) (p<0.05)	1.04(1.01-1.07) (p=0.02)	1.02(0.98-1.05) (p=0.38)	1.01(0.97-1.04) (p=0.62)	1.01(0.97-1.04) (p=0.74)	1.03(0.99-1.06) (p=0.12)	1.04(1.01-1.07) (p=0.02)	1.01(0.98-1.04) (p=0.53)	1.02(0.99-1.05) (p=0.26)
Age										
18-34										
35-44	0.86(0.37-1.99)	0.69(0.36-1.32)	0.93(0.59-1.45)	1.01(0.62-1.66)	0.72(0.44-1.19)	0.75(0.47-1.18)	0.87(0.54-1.41)	0.89(0.57-1.41)	0.87(0.54-1.40)	0.98(0.63-1.55)
45-64	1.21(0.68-2.16)	0.38(0.21-0.67)	1.03(0.71-1.51)	0.71(0.47-1.07)	0.78(0.52-1.19)	0.63(0.43-0.92)	0.83(0.55-1.23)	0.65(0.44-0.94)	0.71(0.48-1.05)	0.89(0.61-1.29)
>=65	0.12(0.05-0.26)	0.22(0.12-0.40)	0.76(0.51-1.13)	0.43(0.28-0.67)	0.49(0.32-0.76)	0.44(0.29-0.64)	0.52(0.34-0.79)	0.42(0.28-0.62)	0.46(0.31-0.70)	0.47(0.32-0.70)
Gender										
Male										
Female	1.13(0.65-1.98)	0.76(0.57-1.02)	0.96(0.74-1.25)	1.01(0.77-1.33)	0.73(0.55-0.97)	0.70(0.54-0.90)	0.86(0.66-1.14)	1.02(0.78-1.33)	0.95(0.72-1.24)	0.84(0.65-1.10)
Race										
Non-Hispanic White										
Hispanic	2.10(1.00-4.41)	1.60(1.07-2.41)	2.49(1.67-3.70)	1.93(1.30-2.88)	1.09(0.73-1.64)	0.96(0.66-1.41)	1.21(0.80-1.84)	2.24(1.49-3.36)	1.54(1.03-2.32)	1.25(0.84-1.84)
Non-Hispanic Black	1.48(0.72-3.03)	1.10(0.67-1.80)	2.15(1.41-3.28)	1.70(1.14-2.55)	0.82(0.53-1.25)	1.05(0.70-1.57)	1.08(0.71-1.64)	1.63(1.11-2.41)	1.53(1.04-2.26)	0.91(0.61-1.36)
Non-Hispanic Asian	2.77(0.83-9.22)	1.24(0.64-2.41)	2.96(1.46-6.02)	2.46(1.21-5.00)	2.21(1.02-4.82)	2.54(1.31-4.94)	2.98(1.42-6.25)	1.66(0.78-3.55)	1.86(0.82-4.20)	2.05(0.95-4.41)
Non-Hispanic Other	7.66(2.64-22.24)	0.88(0.35-2.20)	1.11(0.52-2.38)	0.94(0.42-2.09)	0.70(0.32-1.54)	0.87(0.41-1.85)	1.07(0.50-2.31)	0.79(0.36-1.73)	0.92(0.43-1.97)	0.92(0.41-2.06)
Region										
Northeast										
Midwest	1.22(0.53-2.80)	1.04(0.66-1.63)	1.27(0.85-1.90)	1.08(0.71-1.66)	1.25(0.84-1.88)	1.11(0.76-1.63)	1.04(0.69-1.56)	1.12(0.74-1.70)	1.11(0.74-1.67)	1.05(0.70-1.58)
South	0.59(0.28-1.25)	0.91(0.57-1.43)	1.37(0.95-1.97)	1.13(0.78-1.66)	0.98(0.67-1.42)	0.91(0.64-1.29)	0.94(0.65-1.35)	1.42(0.98-2.06)	0.85(0.58-1.24)	1.06(0.73-1.52)
West	0.80(0.35-1.85)	1.25(0.82-1.92)	1.58(1.04-2.42)	1.21(0.78-1.87)	1.48(0.92-2.37)	1.18(0.78-1.78)	1.40(0.89-2.20)	1.78(1.15-2.74)	1.35(0.87-2.09)	1.34(0.87-2.05)
¹ In the past 12 months, have you used app(s) on a smart phone or mobile device to exchange medical information with a health care professional? ² How interested are you in exchanging information about appointment reminders with a health care provider electronically? ³ How interested are you in exchanging information about general health tips with a health care provider electronically? ⁴ How interested are you in exchanging information about medication reminders with a health care provider electronically? ⁵ How interested are you in exchanging information about lab/test results with a health care provider electronically? ⁶ How interested are you in exchanging information about diagnostic information (e.g., medical illnesses or diseases) with a health care provider electronically? ⁷ How interested are you in exchanging information about vital signs (e.g., heart rate, blood pressure, glucose levels, etc.) with a health care provider electronically? ⁸ How interested are you in exchanging information about lifestyle behaviors (e.g., physical activity, food intake, sleep patterns, etc.) with a health care provider electronically? ⁹ How interested are you in exchanging information about symptoms (e.g., nausea, pain, dizziness, etc.) with a health care provider electronically? ¹⁰ How interested are you in exchanging information like digital images/video (e.g., photos of skin lesions) with a health care provider electronically?										
<i>Note: Co-variate categories in bold denote reference groups.</i>										

and exchange information about diagnostic information (OR=2.54, 95% CI=1.31-4.94) and exchange information about vital signs (OR=2.98, 95% CI=1.42-6.25).

IV. DISCUSSION

Findings from this nationally representative study highlight the potential association between perceived patient

centered communication in the visit and exchanging medical information online with their providers. Our findings support our hypothesis partially that patient who experience higher quality communication in the visit will be more interested in exchanging medical information online with their providers regarding apt reminders, general health tips and lifestyle behaviors. In addition, the analysis identified demographic

characteristics that influenced interest in exchanging clinical information, adjusted for communication scores. The analysis also showed significant differences based on demographics factors regarding the influence of communication score on patients' interested in medical information exchange.

The continuum of communication beyond visit as well as the quality of that communication can contribute to the overall patient centeredness. Our study showed that patients who perceive high quality of communication in the visit will be more likely to continue to communicate with their providers using online mediums to exchange specific information especially regarding general health tips and life style behaviors. This continuum of communication can help patients to manage their overall health. In addition, given the importance of continuity of care for urgent health needs and questions, it is so critical to provide open communication channels between providers and patients so when needed they can easily contact their doctor for questions. In fact, one of the main driver of entire online health information exchange idea is to facilitate this proves and make it more efficient. However, our study shows that if patient has poor communication experience with their doctors in the visits, he or she may not necessarily use this channel to exchange information with their providers and may seek other sources to address their own needs. Notably, our prior work using data from a single academic health system identified that per-patient messaging volumes have not markedly risen over time, and also that individual clinicians within a large academic practice have marked variability in message volume, likely explained by overall receptiveness to communication and perhaps to in-person communication style [16].

Our analysis also reveals that minorities have greater response and tendency for online medical information exchange compared to white patients after adjustment for communication quality in the visit. Previous studies showed mixed results on minorities' willingness to communicate with their providers via text, apps etc. A recent Pew study also showed a positive trend among minorities to access health information via using their mobile phones [17]. Our findings showed that the race/ethnicity groups Hispanic and Non-Hispanic Blacks across the analysis have greater odds of exchanging information with increase in communication score. This finding might have implications on increasing the prevalence of online medical exchange or patient portal use among minority populations, as well as might address and solve disparity problems among this population. Although there is a growing number of tethered portals and consumer informatics tools which are meant to create better communication channels and increase the patient voice in health care systems, studies shows poor intake percentages especially among minorities [18]–[22]. Our analysis highlights that there may be opportunities to increase portal usage among minority patients. Finally, comparable with previous research, our findings also showed that older patients are less likely to exchange medical information online.

“Bedside manner” is one of the critical factors contributing to patient centered communication. With increased number of informatics tools, patients' expectation of “bedside manner” might transform to a “screen side manner” to have positive outcome out of this communication. Some of the screen side manner might include shared content, clarity of language, timeliness of response, formality, building on best practices promulgated in the past for electronic patient-clinician communication [23]. This “screen side manner” of providers would be another factor influencing patients' preference in using online information exchange tools for continuum of their care. Future studies might develop “online patient centered communication” tools to measure this concept and see how it influence patients consecutive behaviors of using portals or other health communication tools including consumer informatics. Many successfully implemented consumer informatics tools, including portals, had problems of nonusers, users with minimal interest, users with decreasing use rate over time etc that impede clinicians and organizations abilities to maintain digital connectivity with their patients. Indeed, there are many factors behind these outcomes including technical and design features, orientation, and training [24] but our analysis also yield that providers quality of communication in the visit and beyond visit (screen side manner) might be another factor feeding to the results of patients use of consumer informatics tools for medical information exchange.

Although the study reports valuable insights, it is not without limitations. First, the data is cross-sectional and relies on self-reported data, therefore cannot offer information on causality. Second, low response rate might introduce some potential biases specifically related to non-respondents and sampling strategy. However, the sampling and weighting strategy used by HINTS administrators help minimize biases and improve national representativeness and generalizability of findings [3]. Finally, although this data shows association and snapshots regarding perceived patient centered communication as well as online medical information exchange, it does not show insights for justification. Therefore, more qualitative studies are needed to explore and understand some of these findings in detail.

V. CONCLUSION

In conclusion, the perceived quality of patient-provider communication in the visit was found to be correlated with patients' use of online health information exchange behaviors. It is even more interesting to see minorities have greater odds of health information exchange when adjusted for communication scores. Findings suggest that one way of increasing use of patient portals and other health information exchange tools might rely on how those patients perceive their communication quality with their doctors in the visit. This might be especially important for the patients who live in rural areas and potentially might get maximum benefit from online information exchange. Patient centered

communication skills of provider might support efforts at increasing eHealth uptake, and enhance overall health care experience and outcomes especially for minority patients.

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