BMJ Open

Multimorbidity, eHealth and implications for equity: A cross-sectional survey of patient perspectives on eHealth

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-023731
Article Type:	Research
Date Submitted by the Author:	25-Apr-2018
Complete List of Authors:	Mangin, Dee ; McMaster University, Family Medicine Parascandalo, Jenna; Mcmaster University, Family Medicine Khudoyarova, Olga; McMaster University, Family Medicine Orr, Sherrie; McMaster University, Family Medicine Agarwal, Gina; McMaster University, Family Medicine Bismah, Verdah; Queens University
Keywords:	eHealth, Multimorbidity, PRIMARY CARE

Multimorbidity, eHealth and implications for equity: A cross-sectional survey of patient perspectives on eHealth

Dee Mangin; MBChB (Otago), DPH (Otago), FRNZCGP (NZ); Department of Family Medicine, McMaster University, Hamilton, Ontario, Canada; mangind@mcmaster.ca

Jenna Parascandalo; BA, MPH (candidate); Department of Family Medicine, McMaster University, Hamilton, Ontario, Canada; parascaj@mcmaster.ca

Olga Khudoyarova, BHSc; Department of Family Medicine, McMaster University, Hamilton, Ontario, Canada; olgakhud@yahoo.ca

Gina Agarwal, MBBS, PhD (Epidemiology), MRCGP, CCFP, FCFP, DFFP; Department of Family Medicine, McMaster University, Hamilton, Ontario, Canada; agarg@mcmaster.ca

Verdah Bismah; BHSc, MD (candidate); Department of Medicine, Queens University, Kingston, Ontario, Canada; v.bismah@gmail.com

Corresponding author: Dee Mangin; MBChB (Otago), DPH (Otago), FRNZCGP (NZ)
Department of Family Medicine, McMaster University
DBHSC, 5th Floor, 1280 Main Street West
Hamilton, Ontario, L8S 4K1 Canada;
Phone: 905-525-9140 ext 21219, fax 905-527-4440
mangind@mcmaster.ca

Funding support: MacWork summer student bursary scheme, and the David Braley Nancy Gordon Chair in Family Medicine McMaster University

Prior Presentations:

Student Research Day, St. Joe's Hospital. Hamilton, Ontario, Canada. 2017

e-Health 2017 Conference, Toronto, Canada.

Trillium Primary Care Research Day 2016, Toronto, Canada.

Poster interim results. North American Primary Care Research Group 2015.

Word Count: 3227 Number of tables: two Number of Figures: two

Abstract

Objective: There is increasing awareness of the burden of medical care experienced by those with multimorbidity. There is also increasing interest and activity in engaging patients with chronic disease in technology-based health related activities ("eHealth") in family practice. Little is known about patients' access to, and interest in eHealth, in particular those with multimorbidity. We examined access and attitudes towards eHealth among patients attending family medicine clinics with a focus on those with multimorbidity.

Design: Cross sectional survey of consecutive adult patients attending consultations with family physicians in the McMaster University Sentinel and Information Collaboration practice based research network (MUSIC). We used univariate and multivariate analyses for quantitative data, and thematic analysis for free text responses.

Setting: Primary care clinics

Participants: 693 patients participated (response rate 70%). Inclusion criteria: Attending primary care clinic. Exclusions: Too ill to complete survey, cannot speak English.

Results: The majority of participants reported access to the internet at home, although this decreased with age. Participants 70 years and older were less comfortable using the internet compared to participants under 70. Univariate analyses showed age, multimorbidity, home internet access, comfort using the internet, privacy concerns, and self-rated health all predicted significantly less interest in eHealth. In the multivariate analysis home internet access and multimorbidity were significant predictors of disinterest in eHealth. Privacy and loss of relational connection were themes in the qualitative analysis.

Conclusion: There is a significant negative association between multimorbidity and interest in eHealth. This is independent of age, computer use and comfort with using the internet. These findings have important implications, particularly the potential for an inverse care effect to

further increase health inequity.

Strengths and limitation of this study

Strengths

- The strength of this study is the routine primary care setting. The study population reflects the population attending primary care appointments, and therefore most likely to be exposed to eHealth initiatives
- Provides patient perspectives in an area where data is lacking, despite great activity in health service delivery initiatives focussed on eHealth
- Focus on multimorbidity

Limitations

- Selection bias may have occurred: the research assistants noted that almost half of non-respondents indicated they did not have internet access and, despite encouragement, indicated that for that reason did not want to participate. We may therefore overestimate internet access.
- A larger sample size may reveal more nuanced predictions within the model; however, no other variables approached a level of significance suggesting influences as important as multimorbidity.

Abbreviations

Wi-Fi: Wireless internet network

MUSIC: McMaster University Sentinel and Information Collaboration, a practice based research network

SES: socio-economic status

RR: Risk Ratio

CI: Confidence Interval

INTRODUCTION

There is great interest from primary care clinicians, service providers and policymakers in the potential to use technology to improve care at the population and individual clinical level, especially in those with long-term health problems. The term eHealth came into use in around 2000 and is defined as:

"the cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research."[1]

Patients are being engaged more often in technology-based health activities ("eHealth") in day-to-day family medicine, such as booking appointments, gathering health information, communicating with their health team, and using an electronic personal health record to monitor health online, though there is little evidence to date for a significant impact on clinical outcomes, particularly patient-relevant outcomes.[2]

However, there are concerns that eHealth may increase health inequity if there is differential interest in and access to it, and chronic disease and multimorbidity are more prevalent in deprived populations.[3] In parallel there is increasing awareness of the burden of medical care experienced by those with multimorbidity, to the extent that it may overwhelm patients' ability to cope.[4] The 'inverse care law' describes the maldistribution of provision of, or access to, medical resources where the availability of good medical or social care tends to vary inversely with the health need of the population served. Increasing the health of those with the best health status increases the inequity gap.[5]

What is known about patients' perspectives on eHealth?

In 2011, Perera and colleagues showed most patients support the computerized sharing of their health records among their health care professionals providing clinical care.[6] Fewer agreed that the patient's de-identified information should be shared beyond this group (<70%).[6] Privacy concerns have been expressed about electronic versus paper records; however, most patients (58%) believe the benefits outweigh the risks.

Activities and technologies related to eHealth require access to and use of the internet (e.g. to access a personal health record), and sometimes a home wireless internet (Wi-Fi) network is also required (e.g. health monitoring devices that depend on Wi-Fi in the home). Computer and internet use have become more prevalent amongst seniors over the past 15 years.[7] There is research on how and why seniors use computers and the internet, but little information on access to Wi-Fi at home.[8]

There is even less information available in the literature about patient perceptions and concerns about eHealth activities relating to the structure and content of their clinical care, particularly among seniors and people with multimorbidity. This is an important gap as eHealth activities are often aimed at patients with chronic disease, and chronic disease is usually manifest in the context of multimorbidity. The risk of multimorbidity increases in seniors; however, the absolute number of patients with multimorbidity is now greater under age 65;[9] so these groups overlap, but are not identical. Data on patient perspectives on ability and desire to engage in eHealth are essential in order to understand any potential for increasing health inequity at the population level, while a patient-centered perspective mandates understanding patients' views prior to implementing any changes in clinical care.

We carried out a cross-sectional survey of patients attending primary care to estimate the occurrence of internet access, home Wi-Fi access, device use, and comfort using the internet. We also examined the attitudes of patients towards eHealth activities and the use of online health records. We planned subgroup analyses to assess these domains among older adults and those with multimorbidity.

METHODS

This study was approved by the Hamilton Integrated Research Ethics Board (Ref 14-501).

Study Design:

Cross-sectional survey.

Participants and Setting:

Consecutive patients attending primary care appointments with physicians who are part of the McMaster University Sentinel and Information Collaboration (MUSIC) primary care practice based research network were invited to participate in a survey. This network covers 36,887 enrolled patients, including 28,128 patients over 18, located in Hamilton, Ontario. These practices have good representation from low and middle socioeconomic status (SES) areas and the demographic characteristics are outlined in Table 1. Patients were excluded if they were under 18, too ill to complete the survey or did not speak English. Questionnaires were administered in the clinics' waiting areas from mid-December 2014 to mid-January 2015.

Sample size:

We estimated from clinic data that around 1 in 6 patients attending were age 70 and over, so we aimed to recruit at least 600 patients in order to include at least 100 seniors aged 70 and over in the sample, as we were interested in subgroup analyses for seniors as well as patients with multimorbidity.

Data Collection:

Patients completed a questionnaire designed to elicit their access to the internet, wireless devices, and their general views on eHealth. eHealth was defined for participants as, “Activity in booking appointments, gathering health information, communicating with your family health team and personalized monitoring and information around your health online.” Patients self-completed the questionnaire except where physical disability or literacy problems prevented this – in which case they could choose to have it administered by the research assistant interviewer.

The questionnaire was developed and piloted for face validity with academic staff, and then in a pilot sample of ten older adults. Questionnaire items were modified based on feedback from these pilots. The questionnaire gathered basic demographic information, and the number of long term medications was a proxy indicator for multiple chronic conditions. Questionnaire items covered the following domains: home internet access, home Wi-Fi access, degree of confidence using the internet, and types of devices used. We also asked participants about their level of interest in eHealth and any concerns that they had around eHealth or around privacy with respect to eHealth. The questionnaire items gathered quantitative data using 5-point Likert items (from strongly agree to strongly disagree with a neutral midpoint) and pre-coded categorical responses. Free text responses were also sought on concerns surrounding eHealth.

We assessed two key subgroups in analyses: age 70 and over, and multimorbidity, as estimated by use of 5 or more long-term medications.

Patient and Public Involvement

Patients and the public were not involved in the design or implementation of this study.

Potential for bias and confounding:

Multimorbidity is more common in lower socioeconomic groups.[10] It is also likely that lower SES limits an individual's access to computers and internet/Wi-Fi. Patients who do not access the internet and therefore have less appreciation of what eHealth might mean may not know how they might feel about eHealth and related domains of the survey. The patients served by the MUSIC network represent a wide range of SES, coming from a wide range of neighborhoods within Hamilton, Ontario, and the surrounding area with clinics located in both suburban Hamilton with a higher SES, and in downtown Hamilton with a much lower SES. All patients attending these clinics in the study period had the same chance of being approached for study recruitment.

Statistical Methods:

Data was entered from the questionnaires into a Microsoft Access database. A randomly selected sample of 10% was double entered and the error rate was less than 1%. All analyses were carried out in OpenEpi3.03a.com and SPSS 22.0.[11 12] Contingency tables were analyzed by chi-square tests plus confidence limits for proportions and risk differences. We were interested in the influence of different variables on patient interest in eHealth. We carried out a logistic regression, including in the model variables significant as univariate predictors of interest in eHealth. eHealth interest was recorded as a dichotomous outcome: No Interest versus Interest.

We included a neutral midpoint in the ‘interest’ group, as we specifically wished to understand those people who expressed definite disinterest.

Free text responses were analyzed using simple thematic coding, using constant comparison to develop a code list that was inclusive of all data.

RESULTS

The response rate to the questionnaire was estimated at 70%, using a two-day sample where eligible patients declining participation were recorded at all sites. A total of 693 surveys were completed and returned. There was very little missing data for any response category (<5%) except in the item as noted in the footnote to Fig 2. Demographic characteristics of the sample are shown in Table 1, along with the demographics of the MUSIC practice based research network adult patient population. The study sample included more females and participants from the older age bands than the MUSIC population demographic, consistent with the higher primary care attendance of these groups.[13] The aim of ensuring an adequate sample of older adults was met as 270 (40%) participants were aged $\geq$ 60 years, with 135 (20%) of these aged 70 and over.

Table 1 Patient sample characteristics

		Sample n (%)	**MUSIC PBRN*** n (%)
Gender	Male	249 (35.9)	11,659 (43.8)
	Female	424 (61.2)	14,910 (56.0)
	Other	1 (0.1)	9 (0.03)
	No Response	19 (2.7)	
Age	18-29	77 (11.1)	6,157 (26.1)
	30-39	75 (10.8)	5,074 (19.0)
	40-49	97 (14.0)	4,481 (16.8)
	50-59	159 (22.9)	4,475 (16.8)
	60-69	135 (19.5)	3,385 (12.7)
	70-79	92 (13.3)	1,745 (6.5)
	80+	43 (6.2)	1,261 (4.7)
	No Response	15 (2.1)	
Ethnicity**	European origins	572 (82.5)	Not available
	Latin, Central and South American origins	13 (1.9)	
	African origins	34 (4.9)	
	Asian origins	34 (4.9)	
	No response/other	55 (7.9)	

*McMaster University Sentinel and Information Collaboration PBRN rostered adult population (18+ years)
**multiple option recording allowed

The proportion of respondents reporting use of >5 medications increased substantially and significantly with age (see Figure 1): 33% (88/267) for those 60 years old and over compared to 10% (41/408) for those under 60 (RR 3.3; 95% CI 2.4 to 4.7; p<.001). Therefore, those aged 60 years and over are three times as likely to be on >5 medications compared to those under age 60. This is consistent with the known association between increasing multimorbidity with age, but illustrates the lack of complete overlap between groups.

The majority of respondents reported access to the internet at home (87%), although this declined significantly with age (p<.001). Patterns of access are illustrated in Figure 2. While in younger age groups, those who had internet access also had access to Wi-Fi, this was not the case in older age bands. 76% (70/92) of those aged 70-79 had access to a computer/phone with internet in their home; however, only 57% had access to Wi-Fi while 60% (26/43) of seniors aged 80 and over have access to a computer/phone with internet in their home, and 40% (17/43) of that age category had access to Wi-Fi. Participants who were on 5 or more medicines had less access to Wi-Fi than participants on less than 5 (Risk Ratio [RR] 0.85;95% confidence interval [CI] 0.77 to 0.95; p<.001.)

Figure 2 shows the range of responses to the statement, “I feel comfortable using the internet.” The graph shows overall proportions, together with the pre-specified subgroups: patients age 70 and over, and those reporting taking 5 or more medications. 82% (538/660) of the overall sample that responded to the question indicated they felt comfortable using the internet and comfort using the internet decreased with age. Those under 70 are more comfortable using the internet than those aged 70 and over, using the measure “strongly agree/agree” with the statement, “I feel comfortable using the internet” (RR=1.55; 87% vs 56%; 95% CI 1.33 to 1.83; p<.0001). The group of respondents currently taking less than 5 medications was also more comfortable using the internet than those taking 5 or more medications, RR 1.38 (86% vs 63%; 95% CI 1.20 to 1.60), though not to the same degree as those aged 70 and over. Figure 2 shows respondents' interest in eHealth. 58% (381/659) of the participants expressed an interest in eHealth ("Strongly Agree" or "Agree"), while 20% (129/656) expressed disinterest in eHealth ("Strongly Disagree" or "Disagree"); 23% (146/656) responded that they did not know or felt neutral, and 5% (66/693) did not answer the question. Participants on 5 or more medications were significantly less likely to express interest in eHealth than those on less than 5 medications (RR .78; 47.2% vs. 60.2%, 95% CI 0.64 to 0.96). Respondents aged 70 and older were also less likely to be interested in eHealth than those below age 70 (RR 0.58, 36% vs. 63%, 95% CI [0.45to 0.74]).

We were interested in the influence of different variables on patient interest in eHealth. We carried out a logistic regression, including variables significant as univariate predictors of interest in eHealth (age, use of 5+ long term-medications, home internet access, comfort using internet, privacy concerns, self-rated health). Table 2 shows the results of this analysis, which found internet access at home was significantly associated with interest in eHealth, while taking 5 or more long-term medications was a significant negative predictor of interest in eHealth (p=0.007; exp B 0.61 95% CI 0.43 to 0.87). There was no suggestion of a strong influence from any other particular variable (minimum p=0.11).

Table 2 Predictors of Interest in eHealth

		95% Confidence Interval for Exp(B)		
	Exp(B)	Lower Bound	Upper Bound	Sig.
Access to internet at home	2.992	1.684	5.314	<.001
Comfort using the internet	1.009	.989	1.029	.373

Privacy concerns	1.010	.991	1.028	.308
Self rated health	.834	.666	1.044	.114
More than 5 medications	.614	.430	.877	.007
Age	.896	.780	1.029	.119

Figure 2 shows the patient perspectives on privacy in the use of the internet specifically for the purpose of eHealth. Patients were asked whether they had privacy concerns around internet use related to eHealth. There were concerns about privacy raised by participants from all age groups. Nearly three quarters (73%, 480/660) of all participants that responded to the question on privacy concerns indicated they were concerned about privacy relating to eHealth. There was no significant difference in concerns between respondents aged 70+ and those under 70, (RR 1.01, 73% vs 72%, 95% CI [0.90 to 1.14]). Participants on 5 or more medications were less concerned about privacy on the internet than those on fewer medications (64% vs 75% Risk Ratio 0.86, 95% CI 0.75 to 0.99).

There was no difference between male and female respondents in reporting of computer use (RR 0.95, 95% CI 0.89 to 1.01) or Wi-Fi access (RR 1.05, 95% CI 0.99 to 1.12). There was no significant difference between men and women in the proportion taking 5 or more medications (RR 0.78, 95% CI .057 to 1.07), their concerns surrounding privacy on the internet (RR 0.98, 95% CI 0.89 to 1.08), their interest in eHealth (RR 1.02, 95% CI 0.89 to 1.17) and their comfort using the internet (RR 1.00, 95% CI 0.92 to 1.07).

Qualitative Analysis

As part of the questionnaire, participants were asked the open-ended question, “Do you have any concerns about eHealth?” The two main themes present in free text comments were:

- Concerns about privacy of medical records in general
  - *"Privacy is a big issue"*
  - *"Only concern is confidentiality"*
  - *"Use of spyware or 'hacking' to obtain personal health information"*

With concerns about third parties such as insurance companies having access to information

  - "*Only regarding privacy & ensuring that my health card # and health info (records) are not accessible to others."*
- The loss of human connection/interaction and communication with clinicians
  - *"Loss of personal dialogue"*
  - *"I prefer to discuss my problems in person"*
  - *"I might not be as comfortable discussing health problems online as in person."*

Other themes included concerns about:

- A lack of understanding of what eHealth is and how it is used
  - *"Not sure what it is exactly and what personal information it would entail using"*
- Inclusiveness and cost if patients need to purchase new technology to be included
  - *"Cost to me. I would be forced to purchase & maintain high speed internet and devices to facilitate eHealth."*
- Concerns about accuracy based on eHealth system errors already experienced (e.g. double bookings in online appointments)
  - *"Double bookings, bookings not being noticed on either end*."
- Cost to tax payer/previously inefficient system
  - *"How much will it cost the tax payers"*
  - *"Is this the same as the other [eHealth] mess the Ontario Government has tried to implement"*

Some patients were pleased about the introduction of eHealth writing, "*Why has it taken so long to implement such a system?"*

DISCUSSION

Main Findings: We found significant differences in responses in our groups of interest: older age groups and in those on 5 or more medications. These groups were less comfortable using the internet, and had less access to the tools required to engage with eHealth.

While in univariate analyses we found that age, use of 5+ long-term medications, home internet access, comfort using the internet, privacy concerns, and self-rated health were all associated with interest in eHealth, in the multivariate analysis only two associations remained significant: internet access (vs no internet access at home) had a significant positive association with interest in eHealth, as might be expected, while multimorbidity was a significant negative predictor.

Participants had privacy concerns around eHealth. In the literature, privacy has been found to be less of a concern around appointment scheduling only, where 63% of participants were not concerned with privacy around emailing appointment information, although a quarter of them still did hold serious concerns.[14] The willingness of patients to be contacted via email for appointment times did not vary significantly with patient age.[14]

A recent scoping review suggested that privacy concerns around personal health records are not high and can be reduced by positively framed explanations.[2] Our findings showed that privacy concern among patients with multimorbidity is lower than those without multimorbidity. Patients also expressed concerns surrounding impacts on relationship based care. This is an important domain to consider in evaluating interventions related to eHealth in primary care where patient centred care is a key function shown to support improved health outcomes, and in multimorbidity where a patient-centred approach to care is essential in integrating management of multiple chronic illnesses.[15]

Strengths: This study's strength is its routine primary care setting, reflecting the population that attends primary care appointments and is most likely to be exposed to eHealth initiatives. We found, as expected, that the proportion of patients taking 5 or more medications increased with age. The proportion of patients with multimorbidity appeared lower in the non-senior age groups than other studies have described[9] – this may be related to differences in the population, or our criteria of 5 or more medications as a proxy measure for multimorbidity.

Limitations: While the response rate was reasonable, it is possible that the respondents do not represent the population from which they were sampled: there may be selection bias as the research assistants noted that almost half of non-respondents indicated they did not have internet access and for that reason did not want to complete the survey despite encouragement. It is therefore likely that we overestimate internet access in this population. While the sample represented a wide socio-demographic range, the results may not be generalizable to other jurisdictions. It is also possible that a larger sample size would reveal more nuanced predictions within the model, however no other variables approached a level of significance suggesting influences as important as multimorbidity.

Implications: Our finding of a negative association between multimorbidity and interest in eHealth has important implications for program uptake and effectiveness in this group as well as health equity.

The majority of adult Canadians (60%) do not have the necessary skills to manage their health adequately.[16] Canadians with the lowest health-literacy skills are 2.5 times more likely to report being in fair or poor health compared to those with the highest skill levels, even after correcting for factors such as age, education and gender.[16] In a health care environment moving towards eHealth initiatives as an approach to chronic disease management, this will be compounded by our findings that show that multimorbidity was significantly associated with less interest in eHealth, less access to the internet, and less comfort using computers and the internet.

It is unclear whether the relationship we saw between multimorbidity and less interest in eHealth relates to the illnesses themselves, socioeconomic disadvantage, or to the increased general, physical, and cognitive complexity that comes with managing multimorbidity. The absence of any signal of a significant relationship with self-rated health suggests it is more likely to reflect the burden of socioeconomic disadvantage, and of the burden of treatment for patients with multimorbidity. Single disease approaches to multimorbidity mean care is complex and can be chaotic. [17] eHealth may add additional burden to the already complex lives of those with multimorbidity, and increased complexity can compromise healthcare and quality of life, as seen in the effects of polypharmacy on compliance.[17]

Those considering developing and implementing eHealth strategies for chronic illness need to take into account these issues, in order that eHealth strategies and projects support reduction in health inequity, and are effective in their aim of improving overall quality of life and health.

Contributions of Authors: DM conceived the research study and was responsible for overall design. OK, VB designed and piloted the survey with supervision from DM and JP, OK collected the data. JP inputted the data and carried out the data analysis with DM. DM, JP, GA, and VB reviewed the manuscript and made final edits.

Competing Interests: All authors have completed the ICMJE uniform disclosure form at **www.icmje.org/coi_disclosure.pdf** and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work

Transparency: The senior author, DM, affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted.

Ethical Approval: Ethics approval was obtained from the Hamilton Integrated Research Ethics Board. Project #14-501

Data sharing: No additional data available.

Acknowledgements: Thanks to Jill Berridge and Kathy De Caire for facilitating the survey administration at the clinics and to the doctors, nurses, allied health professionals, and patients of the McMaster University Sentinel and Information Collaboration for their willingness to contribute their time and thoughts. Thanks to Dawn Elston for assistance with survey implementation, Melissa Pirrie for helpful comments on the manuscript and Patricia Habran-Dietrich for formatting.

Funding: This work was supported by the Department of Family Medicine, McMaster University.

References

1. World Health Organization: eHealth Report by the Secretariat. Fifty-Eighth World Health Assembly. Geneva.
2. Archer N, Fevrier-Thomas U, Lokker C, et al. Personal health records: a scoping review. *Journal of the American Medical Informatics Association : JAMIA* 2011;18(4):515-22. doi: 10.1136/amiajnl-2011-000105
3. Starfield B, Gervas J, Mangin D. Clinical care and health disparities. *Annual review of public health* 2012;33:89-106. doi: 10.1146/annurev-publhealth-031811-124528 [published Online First: 2012/01/10]
4. May C, Montori VM, Mair FS. We need minimally disruptive medicine. *BMJ (Clinical research ed)* 2009;339(aug11 2):b2803-b03. doi: 10.1136/bmj.b2803
5. Tudor Hart J. The Inverse Care Law. *The Lancet* 1971;297(7696):405-12. doi: https://doi.org/10.1016/S0140-6736(71)92410-X
6. Perera G, Holbrook A, Thabane L, et al. Views on health information sharing and privacy from primary care practices using electronic medical records. *International journal of medical informatics* 2011;80(2):94-101. doi: 10.1016/j.ijmedinf.2010.11.005 [published Online First: 2010/12/21]
7. Canada S. Online activities of Canadian boomers and seniors 2014 [Available from: http://www.statcan.gc.ca/pub/11-008-x/2009002/article/10910-eng.htm accessed 15 January 2016.
8. Smith A. Older Adults and Technology Use: PewResearch Center, 2014:1-28.
9. Salisbury C, Johnson L, Purdy S, et al. Epidemiology and impact of multimorbidity in primary care: a retrospective cohort study. *British Journal of General Practice* 2011;61(582):e12-e21. doi: 10.3399/bjgp11X548929
10. Barnett K, Mercer SW, Norbury M, et al. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. *The Lancet*;380(9836):37-43. doi: 10.1016/S0140-6736(12)60240-2
11. Open Source Epidemiologic Statistics for Public Health, Version. [program]. 3.03a version, 2015.
12. IBM SPSS Statistics for Windows [program]. 22.0 version. Armonk, NY: IBM Corp., 2013.
13. Wang Y, Hunt K, Nazareth I, et al. Do men consult less than women? An analysis of routinely collected UK general practice data. *BMJ Open* 2013;3(8) doi: 10.1136/bmjopen-2013-003320
14. Seth P, Abu-Abed MI, Kapoor V, et al. Email Between Patient and Provider: Assessing the Attitudes and Perspectives of 624 Primary Health Care Patients. *JMIR Medical Informatics* 2016;4(4):e42. doi: 10.2196/medinform.5853
15. Mangin D. The contribution of primary care research to improving health services. In: Goodyear-Smith F, Mash B, eds. International perspectives on primary care research. Boca Raton, FL: CRC Press 2016:67-72.
16. Health Literacy in Canada: A Healthy Understanding. Ottawa: Canadian Council on Learning, 2008.
17. Mangin D, Heath I, Jamoulle M. Beyond diagnosis: rising to the multimorbidity challenge. *BMJ* 2012;344:e3526. doi: 10.1136/bmj.e3526 [published Online First: 2012/06/15]

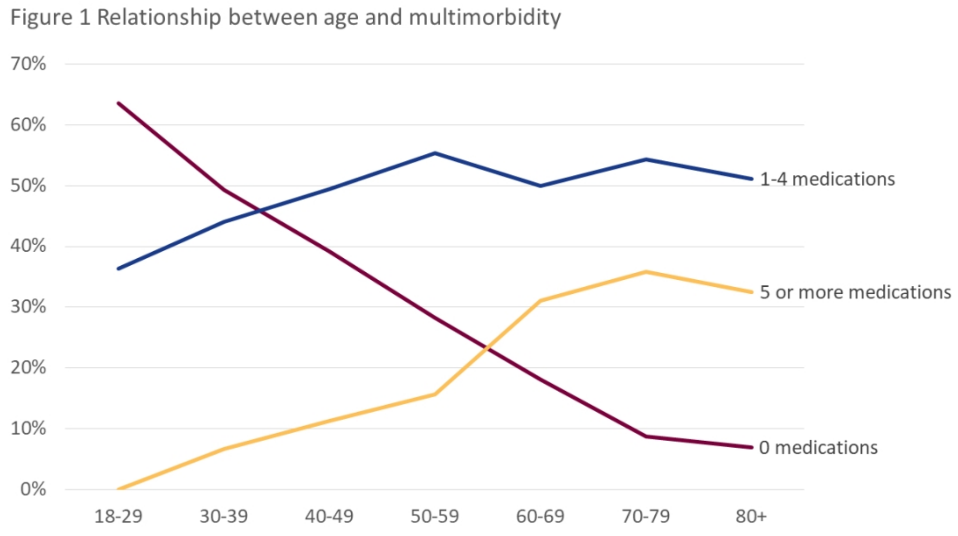
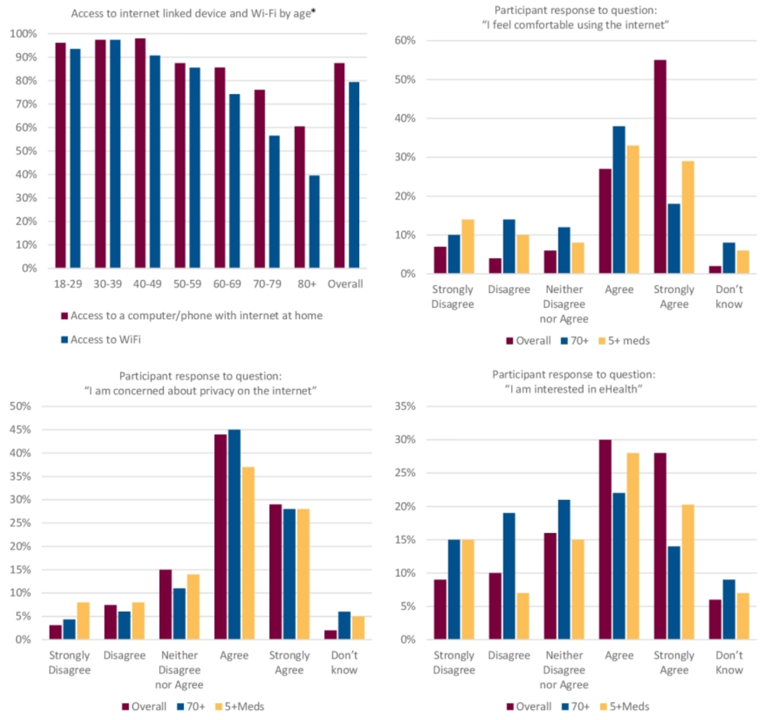


Figure 1

338x190mm (96 x 96 DPI)

Figure 2



*11% of participants did not respond to the question on WiFi access at home

215x279mm (200 x 200 DPI)

STROBE Statement

	Item No	Recommendation	Page Number
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	7
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7, 12
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	6-7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9-11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8
		(*b*) Describe any methods used to examine subgroups and interactions	8
		(*c*) Explain how missing data were addressed	9
		(*d*) *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	7
		(*e*) Describe any sensitivity analyses	N/A

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6, 7
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6, 10
		(b) Indicate number of participants with missing data for each variable of interest	9
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	11-12
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A- No adjustment made
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	13-14
Discussion			
Key results	18	Summarise key results with reference to study objectives	15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	16-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Multimorbidity, eHealth and implications for equity: A cross-sectional survey of patient perspectives on eHealth

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-023731.R1
Article Type:	Research
Date Submitted by the Author:	13-Sep-2018
Complete List of Authors:	Mangin, Dee; McMaster University, Family Medicine Parascandalo, Jenna; Mcmaster University, Family Medicine Khudoyarova, Olga; McMaster University, Family Medicine Agarwal, Gina; McMaster University, Family Medicine Bismah, Verdah; Queens University Orr, Sherrie; McMaster University, Pediatrics
Primary Subject Heading:	Patient-centred medicine
Secondary Subject Heading:	General practice / Family practice
Keywords:	eHealth, Multimorbidity, PRIMARY CARE

Multimorbidity, eHealth and implications for equity: A cross-sectional survey of patient perspectives on eHealth

Dee Mangin; MBChB (Otago), DPH (Otago), FRNZCGP (NZ); Department of Family Medicine, McMaster University, Hamilton, Ontario, Canada; mangind@mcmaster.ca

Jenna Parascandalo; BA, MPH (candidate); Department of Family Medicine, McMaster University, Hamilton, Ontario, Canada; parascaj@mcmaster.ca

Olga Khudoyarova, BHSc; Department of Family Medicine, McMaster University, Hamilton, Ontario, Canada; olgakhud@yahoo.ca

Gina Agarwal, MBBS, PhD (Epidemiology), MRCGP, CCFP, FCFP, DFFP; Department of Family Medicine, McMaster University, Hamilton, Ontario, Canada; agarg@mcmaster.ca

Verdah Bismah; BHSc, MD (candidate); Department of Medicine, Queens University, Kingston, Ontario, Canada; v.bismah@gmail.com

Sherrie Orr: BA; Department of Family Medicine, McMaster University, Hamilton, Ontario, Canada; orrs@mcmaster.ca

Corresponding author: Dee Mangin; MBChB (Otago), DPH (Otago), FRNZCGP (NZ)

Department of Family Medicine, McMaster University

DBHSC, 5th Floor, 1280 Main Street West

Hamilton, Ontario, L8S 4K1 Canada;

Phone: 905-525-9140 ext 21219, fax 905-527-4440

mangind@mcmaster.ca

Funding support: MacWork summer student bursary scheme, and the David Braley Nancy Gordon Chair in Family Medicine McMaster University

Prior Presentations:

Student Research Day, St. Joe's Hospital. Hamilton, Ontario, Canada. 2017

e-Health 2017 Conference, Toronto, Canada.

Trillium Primary Care Research Day 2016, Toronto, Canada.

Poster interim results. North American Primary Care Research Group 2015.

Word Count: 3227 Number of tables: three Number of figures: two

Abstract

Objective: There is increasing awareness of the burden of medical care experienced by those with multimorbidity. There is also increasing interest and activity in engaging patients with chronic disease in technology-based health related activities ("eHealth") in family practice. Little is known about patients' access to, and interest in eHealth, in particular those with a higher burden of care associated with multimorbidity. We examined access and attitudes towards eHealth among patients attending family medicine clinics with a focus on older adults and those with polypharmacy as a marker for multimorbidity.

Design: Cross sectional survey of consecutive adult patients attending consultations with family physicians in the McMaster University Sentinel and Information Collaboration practice based research network (MUSIC). We used univariate and multivariate analyses for quantitative data, and thematic analysis for free text responses.

Setting: Primary care clinics

Participants: 693 patients participated (response rate 70%). Inclusion criteria: Attending primary care clinic. Exclusions: Too ill to complete survey, cannot speak English.

Results: The majority of participants reported access to the internet at home, although this decreased with age. Participants 70 years and older were less comfortable using the internet compared to participants under 70. Univariate analyses showed age, multimorbidity, home internet access, comfort using the internet, privacy concerns, and self-rated health all predicted significantly less interest in eHealth. In the multivariate analysis home internet access and multimorbidity were significant predictors of disinterest in eHealth. Privacy and loss of relational connection were themes in the qualitative analysis.

Conclusion: There is a significant negative association between multimorbidity and interest in eHealth. This is independent of age, computer use and comfort with using the internet. These

findings have important implications, particularly the potential to further increase health inequity.

Strengths and limitation of this study

Strengths

- The strength of this study is the routine primary care setting. The study population reflects the population attending primary care appointments, and therefore most likely to be exposed to eHealth initiatives
- The high response rate provides quantitative estimation of patient perspectives in an area where data is lacking, despite great activity in health service delivery initiatives focussed on eHealth
- Focus on older adults, and those with polypharmacy as a marker for complex medical care in multimorbidity.

Limitations

- Selection bias may have occurred: the research assistants noted that almost half of non-respondents indicated they did not have internet access and, despite encouragement, indicated that for that reason did not want to participate. We may therefore overestimate internet access.
- A larger sample size may reveal more nuanced predictions within the model; however, no other variables approached a level of significance suggesting influences as important as polypharmacy. The use of a short questionnaire suitable for use in a routine clinical setting maximised response rate to accurately assess prevalence. This may not allow for, but complements, in depth insight in to patient perspectives of eHealth which requires a different methodological approach.

Abbreviations

Wi-Fi: Wireless internet network

MUSIC: McMaster University Sentinel and Information Collaboration, a practice based research network

SES: socio-economic status

RR: Risk Ratio

CI: Confidence Interval

INTRODUCTION

There is great interest from primary care clinicians, service providers and policymakers in the potential to use technology to improve care at the population and individual clinical level, especially in those with long-term health problems. The term eHealth came into use in around 2000 and is defined as:

“the cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research.”[1]

Patients are being engaged more often in technology-based health activities (“eHealth”) in day-to-day family medicine, such as booking appointments, gathering health information, communicating with their health team, and using an electronic personal health record to monitor health online, though there is little evidence to date for a significant impact on clinical outcomes, particularly patient-relevant outcomes.[2]

However, there are concerns that eHealth may increase health inequity if there is differential interest in and access to it, and chronic disease and multimorbidity are more prevalent in deprived populations.[3] In parallel there is increasing awareness of the burden of medical care experienced by those with multimorbidity, to the extent that it may overwhelm patients’ ability to cope.[4] The ‘inverse care law’ describes the maldistribution of provision of, or access to, medical resources where the availability of good medical or social care tends to vary inversely with the health need of the population served. Increasing the health of those with the best health status increases the inequity gap.[5]

What is known about patients' perspectives on eHealth?

In 2011, Perera and colleagues showed most patients support the computerized sharing of their health records among their health care professionals providing clinical care.[6] Fewer agreed that the patient's de-identified information should be shared beyond this group (<70%).[6] Privacy concerns have been expressed about electronic versus paper records; however, most patients (58%) believe the benefits outweigh the risks.

Activities and technologies related to eHealth require access to and use of the internet (e.g. to access a personal health record), and sometimes a home wireless internet (Wi-Fi) network is also required (e.g. health monitoring devices that depend on Wi-Fi in the home). Computer and internet use have become more prevalent amongst seniors over the past 15 years.[7] There is research on how and why seniors use computers and the internet, but little information on access to Wi-Fi at home.[8]

Some qualitative literature indicates the potential interest in and issues for eHealth among patients with multimorbidity. One qualitative study among 53 patients with multimorbidity who were already eHealth technology users assessed challenges and gaps in available technology and approaches, such as managing the high volume of information and tasks, and co-ordinating and synthesizing information for multiple conditions as well as meaningful engagement of their multiple providers.[9] Similar themes emerged in a qualitative study in Canada among 14 patients with multimorbidity who also reported both interest in the potential of eHealth but concerns related to privacy, accessibility, the loss of necessary visits, increased social isolation, and the downloading of responsibility onto patients for care management.[10] These latter themes were also echoed in a study using semi-structured interviews among 10 patients in Denmark. In this study patient-perceived value of eHealth and interest in using was variable and there were some signals this may be linked to treatment burden. There is even less information available in the literature about the range and extent of patient perceptions and concerns about eHealth activities relating to the structure and content of their clinical care, particularly among seniors and people with multimorbidity.[11] This is an important gap as eHealth activities are often aimed at patients with chronic disease, and chronic disease is usually manifest in the context of multimorbidity. The risk of multimorbidity increases in seniors; however, the absolute number of patients with multimorbidity is now greater under age 65;[12] so these groups overlap, but are not identical. Data on patient perspectives on ability and desire to engage in eHealth are essential in order to understand any potential for increasing health inequity at the population level, while a patient-centered perspective mandates understanding patients' views prior to implementing any changes in clinical care.

We carried out a cross-sectional survey of patients attending primary care to estimate the occurrence of internet access, home Wi-Fi access, device use, and comfort using the internet. We also examined the attitudes of patients towards eHealth activities and the use of online health records. We planned subgroup analyses to assess these domains among older adults and those with the more complex care needs of multimorbidity.

METHODS

This study was approved by the Hamilton Integrated Research Ethics Board (Ref 14-501).

Study Design:

Cross-sectional survey.

Participants and Setting:

Consecutive patients attending primary care appointments with physicians who are part of the McMaster University Sentinel and Information Collaboration (MUSIC) primary care practice based research network were invited to participate in a survey. This network covers 36,887 enrolled patients, including 28,128 patients over 18, located in Hamilton, Ontario. These practices have good representation from low and middle socioeconomic status (SES) areas and the demographic characteristics are outlined in Table 1. Patients were excluded if they were under 18, too ill to complete the survey or did not speak English. Questionnaires were administered in the clinics' waiting areas from mid-December 2014 to mid-January 2015.

Sample size:

We estimated from clinic data that around 1 in 6 patients attending were age 70 and over, so we aimed to recruit at least 600 patients in order to include at least 100 seniors aged 70 and over in the sample, as we were interested in subgroup analyses for seniors as well as patients with multimorbidity.

Data Collection:

Patients completed a questionnaire designed to elicit their access to the internet, wireless devices, and their general views on eHealth. eHealth was defined for participants as, "Activity in booking appointments, gathering health information, communicating with your family health team and personalized monitoring and information around your health online." After providing informed consent, patients self-completed the questionnaire except where physical disability or literacy problems prevented this – in which case they could choose to have it administered by the research assistant interviewer.

The questionnaire was developed and piloted for face validity with academic staff, and then in a pilot sample of ten older adults. Questionnaire items were modified based on feedback from these pilots. A focus was on pragmatic design to create a questionnaire that could be easily completed while waiting for an appointment to maximize response rate. The questionnaire gathered basic demographic information, and the number of long term medications was a proxy indicator for multiple chronic conditions. All data was collected by self-report as, to maximize response, the questionnaire was administered in a waiting room with no identifying information. Questionnaire items covered the following domains: home internet access, home Wi-Fi access, degree of confidence using the internet, and types of devices used. We also asked participants about their level of interest in eHealth and any concerns that they had around eHealth or around privacy with respect to eHealth. The questionnaire items gathered quantitative data using 5-point Likert items (from strongly agree to strongly disagree with a neutral midpoint) and pre-coded categorical responses. Free text responses were also sought on concerns surrounding eHealth.

We assessed two key subgroups in analyses: age 70 and over, and those using 5 or more long-term medications. We used this measure of use of 5 or more medications in this study as an estimate of multimorbidity with significant treatment burden. We used number of medications rather than self-reported condition number to define multimorbidity as we wished to define a population for subgroup analysis who experienced more complex care, including polypharmacy. The definition of multimorbidity varies depending on which conditions are defined as diseases (versus risk factors and syndromes) and which are included in the multimorbidity list. Getting patients to list all conditions would have added to the time burden, potentially compromising response rate. Further, our previous work in this same population demonstrated patient self-report was inaccurate for estimating the degree of multimorbidity.[13 14] We therefore chose number of medications as a pragmatic approach to defining our subgroup for analysis.

Patient and Public Involvement

Patients and the public were not involved in the design or implementation of this study.

Potential for bias and confounding:

Multimorbidity is more common in lower socioeconomic groups.[15] It is also likely that lower SES limits an individual's access to computers and internet/Wi-Fi. Patients who do not access the internet and therefore have less appreciation of what eHealth might mean may not know how they might feel about eHealth and related domains of the survey. The patients served by the MUSIC network represent a wide range of SES, coming from a wide range of neighborhoods within Hamilton, Ontario, and the surrounding area with clinics located in both suburban Hamilton with a higher SES, and in downtown Hamilton with a much lower SES. All patients attending these clinics in the study period had the same chance of being approached for study recruitment.

Analysis and Statistical Methods:

Data was entered from the questionnaires into a Microsoft Access database. A randomly selected sample of 10% was double entered and the error rate was less than 1%. All analyses were carried out in OpenEpi3.03a.com and SPSS 22.0.[16 17] Contingency tables were analyzed by chi-square tests plus confidence limits for proportions and risk differences. We were interested in the influence of different variables on patient interest in eHealth. We carried out a logistic regression, including in the model variables significant as univariate predictors of interest in eHealth. eHealth interest was recorded as a dichotomous outcome: No Interest versus Interest.

We included a neutral midpoint in the ‘interest’ group, as we specifically wished to understand those people who expressed definite disinterest.

As part of the questionnaire, participants were asked a single open-ended question, “Do you have any concerns about eHealth?” Open ended responses were transferred verbatim to an Excel worksheet where inductive coding, using constant comparison to develop a code list that was inclusive of all data, and thematic analysis was performed by JP. A second author, DM challenged the final thematic map and no discrepancies were noted. Trustworthiness was enhanced as DM is recognized as an expert in the field of polypharmacy in multimorbidity with a strong interest in the use of eHealth to improve patient care. Data units were identified then like codes were grouped together and themes were names. To demonstrate trustworthiness and authenticity, we include direct quotes in the results.

RESULTS

The response rate to the questionnaire was estimated at 70%, using a two-day sample where eligible patients declining participation were recorded at all sites. A total of 693 surveys were completed and returned. There was very little missing data for any response category (<5%) except in the item, “Access to internet linked devices and Wi-Fi by Age” (11%). Demographic characteristics of the sample are shown in Table 1, along with the demographics of the MUSIC practice based research network adult patient population. The study sample included more females and participants from the older age bands than the MUSIC population demographic, consistent with the higher primary care attendance of these groups.[18] The aim of ensuring an adequate sample of older adults was met as 270 (40%) participants were aged $\geq$ 60 years, with 135 (20%) of these aged 70 and over.

Table 1 Patient sample characteristics

		Sample n (%)	MUSIC PBRN* n (%)
Gender	Male	249 (35.9)	11,659 (43.8)
	Female	424 (61.2)	14,910 (56.0)
	Other	1 (0.1)	9 (0.03)
	No Response	19 (2.7)	
Age	18-29	77 (11.1)	6,157 (26.1)
	30-39	75 (10.8)	5,074 (19.0)
	40-49	97 (14.0)	4,481 (16.8)
	50-59	159 (22.9)	4,475 (16.8)
	60-69	135 (19.5)	3,385 (12.7)
	70-79	92 (13.3)	1,745 (6.5)
	80+	43 (6.2)	1,261 (4.7)
	No Response	15 (2.1)	
Ethnicity**	European origins	572 (82.5)	Not available
	Latin, Central and South American origins	13 (1.9)	
	African origins	34 (4.9)	
	Asian origins	34 (4.9)	
	No response/other	55 (7.9)	
Income	Mean (IQR)	$42 887 ($12 191)	Not available

*McMaster University Sentinel and Information Collaboration PBRN rostered adult population (18+ years)
**multiple option recording allowed

The proportion of respondents reporting use of >5 medications increased substantially and significantly with age (see Figure 1): 33% (88/267) for those 60 years old and over compared to 10% (41/408) for those under 60 (RR 3.3; 95% CI 2.4 to 4.7; p<.001). Therefore, those aged 60 years and over are three times as likely to be on >5 medications compared to those under age 60. This is consistent with the known association between increasing multimorbidity with age,[19 20] but illustrates the lack of complete overlap between groups.

The majority of respondents reported access to the internet at home (87%), although this declined significantly with age (p<.001). Patterns of access are illustrated in Figure 2. While in younger age groups, those who had internet access also had access to Wi-Fi, this was not the case in older age bands. 76% (70/92) of those aged 70-79 had access to a computer/phone with internet in their home; however, only 57% had access to Wi-Fi while 60% (26/43) of seniors aged 80 and over have access to a computer/phone with internet in their home, and 40% (17/43) of that age category had access to Wi-Fi. Participants who were on 5 or more medicines had less access to Wi-Fi than participants on less than 5 (Risk Ratio [RR] 0.85;95% confidence interval [CI] 0.77 to 0.95; p<.001.)

Figure 2 shows the range of responses to the statement, “I feel comfortable using the internet.” The graph shows overall proportions, together with the pre-specified subgroups: patients age 70 and over, and those reporting taking 5 or more medications. 82% (538/660) of the overall sample that responded to the question indicated they felt comfortable using the internet and comfort using the internet decreased with age. Those under 70 are more comfortable using the internet than those aged 70 and over, using the measure “strongly agree/agree” with the statement, “I feel comfortable using the internet” (RR=1.55; 87% vs 56%; 95% CI 1.33 to 1.83; p<.0001). The group of respondents currently taking less than 5 medications was also more comfortable using the internet than those taking 5 or more medications, RR 1.38 (86% vs 63%; 95% CI 1.20 to 1.60), though not to the same degree as those aged 70 and over. Figure 2 shows respondents' interest in eHealth. 58% (381/659) of the participants expressed an interest in eHealth ("Strongly Agree" or "Agree"), while 20% (129/656) expressed disinterest in eHealth ("Strongly Disagree" or "Disagree"); 23% (146/656) responded that they did not know or felt neutral, and 5% (66/693) did not answer the question. Participants on 5 or more medications were significantly less likely to express interest in eHealth than those on less than 5 medications (RR .78; 47.2% vs. 60.2%, 95% CI 0.64 to 0.96). Respondents aged 70 and older were also less likely to be interested in eHealth than those below age 70 (RR 0.58, 36% vs. 63%, 95% CI [0.45to 0.74]). Participant socio economic status (SES) was defined by linking participants postal code to median area income (Canadian census 2016 data is the most recent available). We found no association between participant's interest in eHealth and income level (p=0.38). There was no association between income and concern about privacy (p=0.45) or comfort using the internet (p=0.95).

We were interested in the influence of different variables on patient interest in eHealth. We carried out a logistic regression, including variables significant as univariate predictors of interest in eHealth (age, use of 5+ long term-medications, home internet access, comfort using internet, privacy concerns, self-rated health). Table 2 shows the results of this analysis, which found internet access at home was significantly associated with interest in eHealth, while taking 5 or more long-term medications was a significant negative predictor of interest in eHealth (p=0.007; exp B 0.61 95% CI 0.43 to 0.87). There was no suggestion of a strong influence from any other particular variable (minimum p=0.11).

Table 2 Predictors of Interest in eHealth

		95% Confidence Interval for Exp(B)		
	Exp(B)	Lower Bound	Upper Bound	Sig.
Access to internet at home	2.992	1.684	5.314	<.001
Comfort using the internet	1.009	.989	1.029	.373
Privacy concerns	1.010	.991	1.028	.308
Self rated health	.834	.666	1.044	.114
More than 5 medications	.614	.430	.877	.007
Age	.896	.780	1.029	.119

Figure 2 shows the patient perspectives on privacy in the use of the internet specifically for the purpose of eHealth. Patients were asked whether they had privacy concerns around internet use related to eHealth. There were concerns about privacy raised by participants from all age groups. Nearly three quarters (73%, 480/660) of all participants that responded to the question on privacy concerns indicated they were concerned about privacy relating to eHealth. There was no significant difference in concerns between respondents aged 70+ and those under 70, (RR 1.01, 73% vs 72%, 95% CI [0.90 to 1.14]). Participants on 5 or more medications were less concerned about privacy on the internet than those on fewer medications (64% vs 75% Risk Ratio 0.86, 95% CI 0.75 to 0.99).

Qualitative Analysis

The two main themes present in free text comments were concerns about privacy of medical records in general and the loss of human connection/interaction and communication with clinicians. Some patients were pleased about the introduction of eHealth writing, "*Why has it taken so long to implement such a system?"* Key themes and illustrative quotes are shown in Table 3.

Table 3: Quotes illustrating main themes in free text response question

Primary Themes	
Concerns about privacy of medical records in general	o"Privacy is a big issue" o"Only concern is confidentiality" o" Use of spyware or 'hacking' to obtain personal health information" o"Only regarding privacy & ensuring that my health card # and health info (records) are not accessible to others."
The loss of human connection/interaction and communication with clinicians	o"Loss of personal dialogue" o"I prefer to discuss my problems in person" o"I might not be as comfortable discussing health problems online as in person."
Secondary themes	
A lack of understanding of what eHealth is and how it is used	o *"Not sure what it is exactly and what personal information it would entail using"*

Inclusiveness and cost if patients need to purchase new technology to be included	○ *"Cost to me. I would be forced to purchase & maintain high speed internet and devices to facilitate eHealth."*
Concerns about accuracy based on eHealth system errors already experienced (e.g. double bookings in online appointments)	○ *"Double bookings, bookings not being noticed on either end*."
Cost to tax payer/previously inefficient system	○ *"How much will it cost the tax payers"* ○ *"Is this the same as the other [eHealth] mess the Ontario Government has tried to implement"*

DISCUSSION

Main Findings: We found significant differences in responses in our groups of interest: older age groups and in those on 5 or more medications. These groups were less comfortable using the internet, and had less access to the tools required to engage with eHealth.

While in univariate analyses we found that age, use of 5+ long-term medications, home internet access, comfort using the internet, privacy concerns, and self-rated health were all associated with interest in eHealth. In the multivariate analysis only two associations remained significant: internet access (vs no internet access at home) had a significant positive association with interest in eHealth, as might be expected, while multimorbidity was a significant negative predictor.

As indicated by the quantitative findings, and supported by the free text comments, participants had privacy concerns around eHealth. Our findings are consistent with recent literature indicating older adult's distrust of eHealth leads to refrained use.[9] Privacy has also been found to be less of a concern around appointment scheduling only, where 63% of participants were not concerned with privacy around emailing appointment information, although a quarter of them still did hold serious concerns.[21] The willingness of patients to be contacted via email for appointment times did not vary significantly with patient age.[21] A recent scoping review suggested that privacy concerns around personal health records are not high and can be reduced by positively framed explanations.[2] Our findings showed that privacy concern among patients with multimorbidity is lower than those without multimorbidity.

Patients also expressed concerns surrounding impacts on relationship based care. Our findings are consistent with other literature in this area: 2 studies using focus groups and semi-structured interviews with older adults found older adults associated the use of eHealth with increased social isolation, loss of necessary visits and a reduction in quality of care due to less face to face interactions.[10 22] This is an important domain to consider in evaluating interventions related to eHealth in primary care where patient centred care is a key function shown to support improved health outcomes, and in multimorbidity where a patient-centred approach to care is essential in integrating management of multiple chronic illnesses.[23]

Strengths: This study's strength is its routine primary care setting, reflecting the population that attends primary care appointments and is most likely to be exposed to eHealth initiatives. We found, as expected, that the proportion of patients taking 5 or more medications increased with age. The proportion of patients with multimorbidity appeared lower in the non-senior age groups than other studies have described[12] – this may be related to differences in the population, or our criteria of 5 or more medications as a proxy measure for multimorbidity.

Limitations: While the response rate was reasonable, it is possible that the respondents do not represent the population from which they were sampled: there may be selection bias as the research assistants noted that almost half of non-respondents indicated they did not have internet access and for that reason did not want to complete the survey despite encouragement. It is therefore likely that we overestimate internet access in this population. Postal code mapping is a blunt tool for estimating socioeconomic status. While the sample represented a wide socio-demographic range, the results may not be generalizable to other jurisdictions. It is also possible that a larger sample size would reveal more nuanced predictions within the model, however no other variables approached a level of significance suggesting influences as important as multimorbidity. The use of only 1 coder is a limitation in our qualitative analysis of the question that invited free text responses.

Implications: Our finding of a negative association between multimorbidity and interest in eHealth has important implications for program uptake and effectiveness in this group as well as health equity. This builds on previous qualitative studies identifying potential issues for patients with multimorbidity. Our findings add important quantitative data on the range and extent of patients' perceptions of, and interest in engaging in, eHealth.

The majority of adult Canadians (60%) do not have the necessary skills to manage their health adequately.[24] Canadians with the lowest health-literacy skills are 2.5 times more likely to report being in fair or poor health compared to those with the highest skill levels, even after correcting for factors such as age, education and gender.[24] In a health care environment moving towards eHealth initiatives as an approach to chronic disease management, this will be compounded by our findings that show that multimorbidity was significantly associated with less interest in eHealth, less access to the internet, and less comfort using computers and the internet.

It is unclear whether the relationship we saw between multimorbidity and less interest in eHealth relates to the illnesses themselves, disadvantage, or to the increased general, physical, and cognitive complexity that comes with managing multimorbidity. The absence of any signal of a significant relationship with self-rated health suggests it is more likely to reflect the burden of disadvantage, and of the burden of treatment for patients with multimorbidity. Single disease approaches to multimorbidity mean care is complex and can be chaotic. [25] eHealth may add additional burden to the already complex lives of those with multimorbidity, and increased complexity can compromise healthcare and quality of life, as seen in the effects of polypharmacy on compliance.[25]

Those considering developing and implementing eHealth strategies for chronic illness need to take into account these issues, in order that eHealth strategies and projects support reduction in health inequity, and are effective in their aim of improving overall quality of life and health.

Contributions of Authors: DM conceived the research study and was responsible for overall design. OK, VB and SO designed and piloted the survey with supervision from DM and JP, OK collected the data. JP inputted the data and carried out the data analysis with DM. DM, JP, GA, SO and VB reviewed the manuscript and made final edits.

Competing Interests: All authors have completed the ICMJE uniform disclosure form at **www.icmje.org/coi_disclosure.pdf** and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work

Transparency: The senior author, DM, affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted.

Ethical Approval: Ethics approval was obtained from the Hamilton Integrated Research Ethics Board. Project #14-501

Data sharing: No additional data available.

Acknowledgements: Thanks to Jill Berridge and Kathy De Caire for facilitating the survey administration at the clinics and to the doctors, nurses, allied health professionals, and patients of the McMaster University Sentinel and Information Collaboration and the McMaster Family Health Team for their willingness to contribute their time and thoughts. Thanks to Ric Angeles for assistance with analysis, Dawn Elston for assistance with survey implementation, Melissa Pirrie for helpful comments on the manuscript and Patricia Habran-Dietrich for formatting and proofreading.

Funding: This work was unfunded but was supported by the Department of Family Medicine, McMaster University. DMs position is supported by the David Braley Nancy Gordon Chair in Family Medicine and VB was supported by a MacWork summer student bursary.

References

1. World Health Organization: eHealth Report by the Secretariat. Fifty-Eighth World Health Assembly. Geneva.
2. Archer N, Fevrier-Thomas U, Lokker C, et al. Personal health records: a scoping review. *JAMIA* 2011;18(4):515-22. doi: 10.1136/amiajnl-2011-000105
3. Starfield B, Gervas J, Mangin D. Clinical care and health disparities. *Ann Rev of Pub Health* 2012;33:89-106. doi: 10.1146/annurev-publhealth-031811-124528
4. May C, Montori VM, Mair FS. We need minimally disruptive medicine. *BMJ (Clinical research ed)* 2009;339(aug11 2):b2803. doi: 10.1136/bmj.b2803 [published Online First: 2009/08/13]
5. Tudor Hart J. The Inverse Care Law. *The Lancet* 1971;297(7696):405-12. doi: https://doi.org/10.1016/S0140-6736(71)92410-X
6. Perera G, Holbrook A, Thabane L, et al. Views on health information sharing and privacy from primary care practices using electronic medical records. *Int J Med Inform* 2011;80(2):94-101. doi: 10.1016/j.ijmedinf.2010.11.005 [published Online First: 2010/12/21]
7. Canada S. Online activities of Canadian boomers and seniors 2014 [Available from: http://www.statcan.gc.ca/pub/11-008-x/2009002/article/10910-eng.htm accessed 15 January 2016.
8. Smith A. Older Adults and Technology Use: PewResearch Center, 2014:1-28.
9. Zulman DM, Jenchura EC, Cohen DM, et al. How Can eHealth Technology Address Challenges Related to Multimorbidity? Perspectives from Patients with Multiple Chronic Conditions. *J Gen Intern Med* 2015;30(8):1063-70. doi: 10.1007/s11606-015-3222-9
10. Steele Gray C, Miller D, Kuluski K, et al. Tying eHealth Tools to Patient Needs: Exploring the Use of eHealth for Community-Dwelling Patients With Complex Chronic Disease and Disability. *JMIR Research Protocols* 2014;3(4):e67. doi: 10.2196/resprot.3500
11. Runz-Jorgensen SM, Schiotz ML, Christensen U. Perceived value of eHealth among people living with multimorbidity: a qualitative study. *J Comorb* 2017;7(1):96-111. doi: 10.15256/joc.2017.7.98 [published Online First: 2018/01/24]
12. Salisbury C, Johnson L, Purdy S, et al. Epidemiology and impact of multimorbidity in primary care: a retrospective cohort study. *Br J Gen Pract* 2011;61(582):e12-e21. doi: 10.3399/bjgp11X548929
13. Fortin M, Stewart M, Poitras ME, et al. A systematic review of prevalence studies on multimorbidity: toward a more uniform methodology. *Ann Fam Med* 2012;10(2):142-51. doi: 10.1370/afm.1337 [published Online First: 2012/03/14]
14. Dolovich L OD, Lamarche L, Agarwal G, Carr T, Chan D, Cleghorn L, Griffith L, Javadi D, Kastner M, Longaphy J, Mangin D, Papaioannou A, Ploeg J, Raina P, Richardson J, Risdon C, Santaguida P, Straus S, Thabane L, Valaitis R, Price D. A protocol for a pragmatic randomized controlled trial using the Health Teams Advancing Patient Experience: Strengthening Quality (Health TAPESTRY) platform approach to promote person-focused primary healthcare for older adults. *Implementation Sci* 2016;11(49) doi: 10.1186/s13012-016-0407-5
15. Barnett K, Mercer SW, Norbury M, et al. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. *The Lancet*;380(9836):37-43. doi: 10.1016/S0140-6736(12)60240-2
16. Open Source Epidemiologic Statistics for Public Health, Version. [program]. 3.03a version, 2015.
17. IBM SPSS Statistics for Windows [program]. 22.0 version. Armonk, NY: IBM Corp., 2013.
18. Wang Y, Hunt K, Nazareth I, et al. Do men consult less than women? An analysis of routinely collected UK general practice data. *BMJ Open* 2013;3(8) doi: 10.1136/bmjopen-2013-003320
19. Boyd CM, Fortin M. Future of Multimorbidity Research: How Should Understanding of Multimorbidity Inform Health System Design? *Public Health Rev* 2010;32(2):451-74. doi: 10.1007/bf03391611

20. Barnett K, Mercer SW, Norbury M, et al. Epidemiology of multi-morbidity and implications for health care, research and medical education: a cross-sectional study. *The Lancet* 2012;380 doi: 10.1016/s0140-6736(12)60240-2
21. Seth P, Abu-Abed MI, Kapoor V, et al. Email Between Patient and Provider: Assessing the Attitudes and Perspectives of 624 Primary Health Care Patients. *JMIR Medical Informatics* 2016;4(4):e42. doi: 10.2196/medinform.5853
22. Runz-Jørgensen SM, Schiøtz ML, Christensen U. Perceived value of eHealth among people living with multimorbidity: a qualitative study. *J Comorb* 2017;7(1):96-111. doi: 10.15256/joc.2017.7.98
23. Mangin D. The contribution of primary care research to improving health services. In: Goodyear-Smith F, Mash B, eds. International Perspectives on Primary Care Research. Boca Raton, FL: CRC Press 2016:67-72.
24. Health Literacy in Canada: A Healthy Understanding. Ottawa: Canadian Council on Learning, 2008.
25. Mangin D, Heath I, Jamoulle M. Beyond diagnosis: rising to the multimorbidity challenge. *BMJ* 2012;344:e3526. doi: 10.1136/bmj.e3526 [published Online First: 2012/06/15]

FIGURES LEGEND

Figure 1: Relationship between age and medication number.

Data are shown from 2014/15. The graph indicates the relationship between a participants age and number of medications taken. The X axis indicates age and the Y axis indicates the proportion of the study population. The red line indicates participants taking 0 medications, the blue line indicates participants taking 1-4 medications and the yellow line indicates participants taking 5 or more medications.

Figure 2: Survey analysis results. Data are shown from 2014/2015.

- The graph on the top left represents the association between access to internet linked device at home, such as a phone or computer, and Wi-Fi according to age band. The X axis indicates age band and the Y axis indicates proportion of the defined age band expressed as a percentage. The red bar indicates access to a computer/phone with internet at home and the blue bar indicates access to Wi-Fi.
- The graph on the top right represents the association between comfort using the internet, and the two study subpopulations of interest: those aged 70 years and over, and those taking 5 or more medications. The X axis represents the response categories for the statement, “I feel comfortable using the internet”. The Y axis indicates proportion, expressed as a percentage of the relevant study (sub) group. The red bar represents the overall study population. The blue bar represents those aged 70 and over. The yellow bar represents those taking 5 or more medications.
- The graph on the bottom left represents the association between participants concern about privacy on the internet and the 2 subpopulations of interest: those aged 70 years and over, and those taking 5 or more medications. The X axis represents the response categories for the statement, “I am concerned about privacy on the internet.” The Y axis indicates proportion, expressed as a percentage of the relevant study (sub) group. The red bar represents the overall study population. The blue bar represents those aged 70 and over. The yellow bar represents those taking 5 or more medications.
- The graph on the bottom right represents the association between participant’s interest in eHealth overall, and in the 2 subpopulations of interest. The X axis represents the response categories for the statement, “I am interested in eHealth.” The Y axis indicates proportion, expressed as a percentage of the relevant study (sub) group. The red bar represents the overall study population. The bar represents those aged 70 and over. The yellow bar represents those taking 5 or more medications.

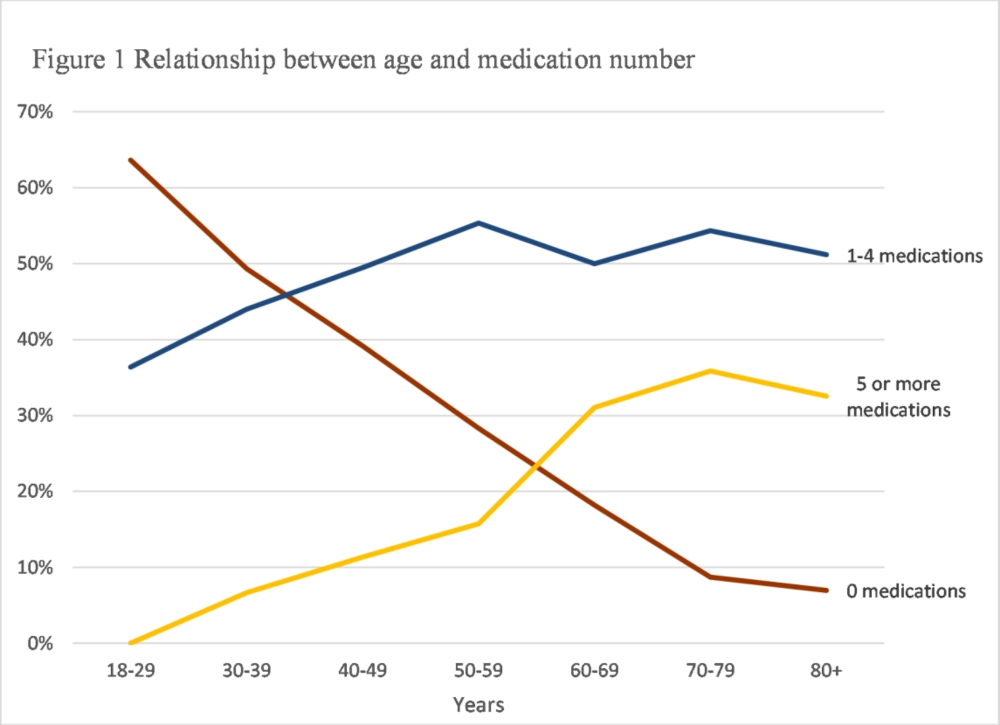
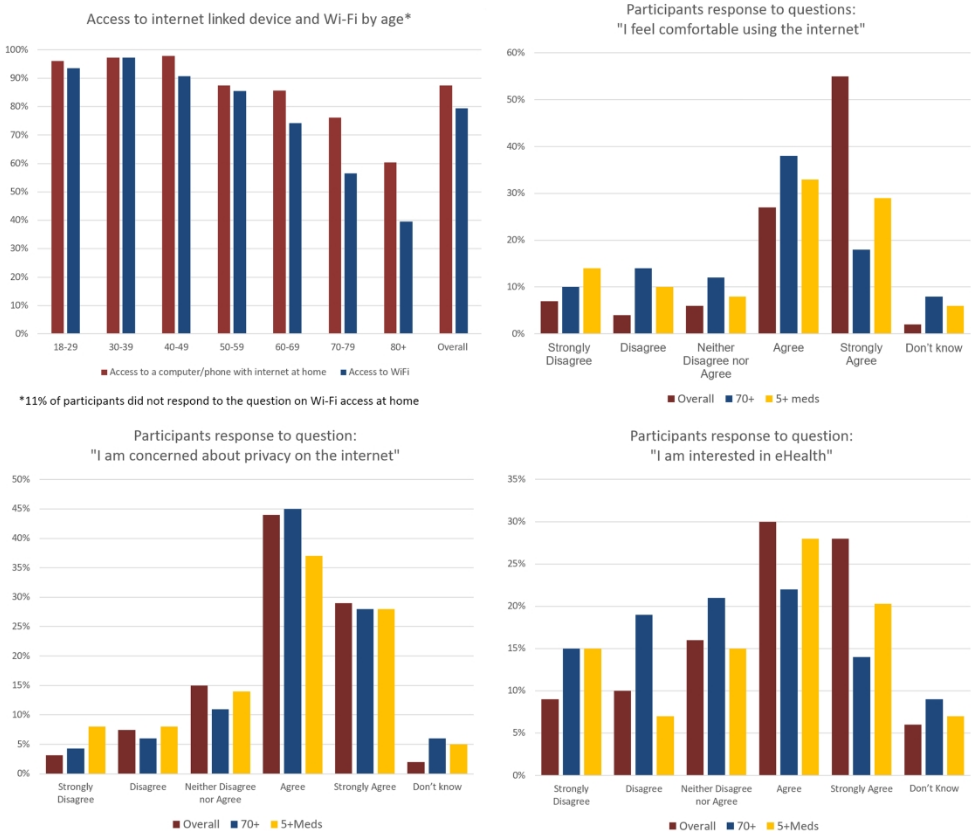


Figure 1: Relationship between age and medication number.
Data are shown from 2014/15. The graph indicates the relationship between a participant’s age and number of medications taken. The X axis indicates age and the Y axis indicates the proportion of the study population. The red line indicates participants taking 0 medications, the blue line indicates participants taking 1-4 medications and the yellow line indicates participants taking 5 or more medications.

149x108mm (300 x 300 DPI)

Figure 2



*11% of participants did not respond to the question on Wi-Fi access at home

Figure 2: Survey analysis results. Data are shown from 2014/2015.

- The graph on the top left represents the association between access to internet linked device at home, such as a phone or computer, and Wi-Fi according to age band. The X axis indicates age band and the Y axis indicates proportion of the defined age band expressed as a percentage. The red bar indicates access to a computer/phone with internet at home and the blue bar indicates access to Wi-Fi.
- The graph on the top right represents the association between comfort using the internet, and the two study subpopulations of interest: those aged 70 years and over, and those taking 5 or more medications. The X axis represents the response categories for the statement, “I feel comfortable using the internet”. The Y axis indicates proportion, expressed as a percentage of the relevant study (sub) group. The red bar represents the overall study population. The blue bar represents those aged 70 and over. The yellow bar represents those taking 5 or more medications.
- The graph on the bottom left represents the association between participants concern about privacy on the internet and the 2 subpopulations of interest: those aged 70 years and over, and those taking 5 or more medications. The X axis represents the response categories for the statement, “I am concerned about privacy on the internet.” The Y axis indicates proportion, expressed as a percentage of the relevant study (sub) group. The red bar represents the overall study population. The blue bar represents those aged 70 and over. The yellow bar represents those taking 5 or more medications.
- The graph on the bottom right represents the association between participant’s interest in eHealth overall, and in the 2 subpopulations of interest. The X axis represents the response categories for the statement, “I am interested in eHealth.” The Y axis indicates proportion, expressed as a percentage of the relevant study (sub) group. The red bar represents the overall study population. The bar represents those aged 70 and over. The yellow bar represents those taking 5 or more medications.

230x203mm (300 x 300 DPI)

STROBE Statement

	Item No	Recommendation	Page Number
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	7
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7, 12
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	6-7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9-11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8
		(*b*) Describe any methods used to examine subgroups and interactions	8
		(*c*) Explain how missing data were addressed	9
		(*d*) *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	7
		(*e*) Describe any sensitivity analyses	N/A

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6, 7
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6, 10
		(b) Indicate number of participants with missing data for each variable of interest	9
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	11-12
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A- No adjustment made
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	13-14
Discussion			
Key results	18	Summarise key results with reference to study objectives	15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	16-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Standards for Reporting Qualitative Research (SRQR)*

http://www.equator-network.org/reporting-guidelines/srqr/

Page/line no(s).

Title and abstract

Title - Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended	1
Abstract - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions	2

Introduction

Problem formulation - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement	3
Purpose or research question - Purpose of the study and specific objectives or questions	3

Methods

Qualitative approach and research paradigm - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**	10
Researcher characteristics and reflexivity - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability	10
Context - Setting/site and salient contextual factors; rationale**	6-7
Sampling strategy - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**	6-7
Ethical issues pertaining to human subjects - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	6
Data collection methods - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**	

Data collection instruments and technologies - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	6-8
Units of study - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	10
Data processing - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	9,10
Data analysis - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	9,10
Techniques to enhance trustworthiness - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	10

Results/findings

Synthesis and interpretation - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	15,16
Links to empirical data - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	15,16

Discussion

Integration with prior work, implications, transferability, and contribution(s) to the field - Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	17,18
Limitations - Trustworthiness and limitations of findings	18

Other

Conflicts of interest - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	NA
Funding - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	NA

*The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

**The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

Reference:

O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. **Standards for reporting qualitative research: a synthesis of recommendations.** *Academic Medicine*, Vol. 89, No. 9 / Sept 2014 DOI: 10.1097/ACM.0000000000000388