Willingness to use different types of information technology among patients with chronic non-communicable disease

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Abstract

Background: There is considerable interest in using information technologies such as email, text messages (SMS) and videoconferencing to facilitate management of non-communicable chronic diseases (NCDs) such as hypertension, diabetes, and vascular disease. Whether these technologies are available and appealing to the target population is unknown.

Methods: We analyzed data from a computer-assisted telephone survey conducted by Statistics Canada in February and March 2012 of 1,849 adults living in four western Canadian provinces and with at least one chronic disease. Survey respondents were asked about their capacity (e.g "Do you own a mobile phone?") and willingness to use each of the three information technologies to interact with health care providers. For all analyses, Statistics Canada's calibrated design weights and bootstrap weights were used to obtain population-level point estimates for proportions and odds ratios (ORs).

Results: 1849 of 2316 eligible persons participated (80%). Of the 1849 participants, 82% had hypertension, 26% had diabetes, 21% had heart disease and 8% had stroke; 32% had more than one chronic disease. A high proportion of respondents (76.4%; 73.3-79.3%) owned a computer with internet access or a mobile phone and a slightly lower proportion (66.3%; 63.0-69.5%) were interested in using email to interact with a specialist. Respondents were less enthusiastic about SMS than email since only 44.9% (41.2-48.7%) were interested in the former. Enthusiasm for information technology was more pronounced among those residing further from medical specialists than in those living closer. Among respondents who were potentially interested in videoconferencing, almost 50% of remote dwellers would use videoconferencing if it could save more than 60 minutes of travel time.

Conclusions: A substantial proportion of people with chronic disease were interested in using electronic technologies to help manage their chronic disease – especially videoconference- and email-based methods. The effectiveness and cost-implications of videoconferencing and email for management of NCDs deserves further consideration.

Background:

Management of non-communicable chronic diseases (NCDs) such as hypertension, diabetes, and vascular disease is a major challenge facing health services worldwide.[1] Although most patients with NCDs can be managed by primary care physicians, a substantial proportion require referral to specialist physicians, who generally practice in major urban centers. Given Canada's large size and low population density, an additional barrier for optimal NCD management for some patients is the so-called geographic barrier posed by the often-considerable distances to specialist physicians – which may be magnified in people with reduced capacity or willingness to travel.[2,3]

To facilitate self-management and ameliorate geographic barriers, there has been considerable interest in using electronic technologies such as email, text messages (short message service; SMS) and videoconferencing to facilitate NCD management.[4-6] Email could be used to send messages from provider to patient or vice versa; in theory it might improve patients' access to providers or reduce provider response time (especially for non-urgent issues). Text messages are ≤140 characters in length and are usually received by mobile phones. Because of their brevity, they are best suited to reminders directed to the patient (for example, to take medication) or motivational messages (for example, "Did you go for a walk today?"), although they could also be used to send brief queries from patient to provider. Videoconferencing can be used instead of face-to-face encounters between provider and patient and allows real-time, private interactions between the participants -- using specialized professional equipment or alternatively consumer grade components (such as Skype running on a personal computer).

These information technologies have been promoted as a potential solution to the geographic barriers faced by many Canadians with NCDs, as well as a method that could be used to promote ongoing NCD self-management regardless of residence location.[7] However, the utility of such technologies depends on their availability and appeal to the target population. Since many Canadian NCD patients are older and of lower socioeconomic status[8] (both factors that might reduce willingness and capacity to use information technologies),[9,10] the extent to which these criteria are met is uncertain. We used data from a large sample of Western Canadians with chronic disease to examine their capacity and willingness to use information technologies to facilitate health care service delivery, focusing on hypothetical

interactions with a relevant medical specialist. We hypothesized that the majority of survey participants would be interested in using one or more information technologies to help manage their NCDs, and would have access to the necessary equipment. We also hypothesized that interest in these technologies would be greater among those residing further from specialist medical services.

Methods

Data sources

We analyzed data from the 2012 *Barriers to Care for People with Chronic Health Conditions* survey (BCPCHC). The BCPCHC survey included data from adults aged 40 or older residing in the four western Canadian provinces who responded to the 2011 *Canadian Community Health Survey* (CCHS) and who reported that they had been diagnosed by a health professional as having diabetes, heart disease, hypertension or prior stroke. Members of the Canadian Forces, First Nations people living on reserves, and people in institutions were ineligible for inclusion in the CCHS. Computer-assisted telephone interviews were conducted by Statistics Canada in February and March 2012, and of the 2,316 individuals selected for inclusion for the BCPCHC, 1,849 (80%) completed the survey. With permission, the responses of these individuals were linked to their 2011 CCHS responses, which provided additional demographic and lifestyle information. The purpose of the survey was to elicit the perspectives of respondents about the current quality of their chronic disease care, including potential barriers and facilitators. The current manuscript presents results related to the use of information technologies.

Capacity and willingness to use information technologies

Survey respondents were asked about their capacity (e.g. “Do you own a mobile phone?”) and willingness to use each of the three information technologies (email, SMS, videoconferencing) to interact with health care providers. Those who had the capacity but were unwilling were asked open-ended questions to explore the reasons for their unwillingness. Using a hypothetical scenario, participants were also asked how many minutes a videoconference encounter would have to save them before they would be willing to use such an encounter to replace a face-to-face physician visit.

Proximity to specialist care

We classified residence location based on whether or not the respondent resided in the same city (census metropolitan area) as the closest relevant medical specialist's practice (e.g. cardiologist, endocrinologist, nephrologist, general internist), using residential postal codes to define the residence location of respondents. Respondents with a relevant medical specialist in the same metropolitan area were considered to reside "in close proximity" to such specialists; other participants were considered to reside "further" from specialists.

Other variables

We categorized respondents by their chronic disease(s) and by whether they reported being diagnosed with one vs. more than one of the four chronic diseases ("multimorbidity"). We obtained the sociodemographic and health characteristics presented in Table 1 from the CCHS. We calculated BMI category from self-reported weight and height, using an adjustment for self-reported data.[11]

Analysis

We did all analyses using STATA 11.0 (www.stata.com). The baseline characteristics of the survey respondents were tabulated and compared across residence location. The proportion of respondents reporting on key variables of interest was compared using design-based F tests. The reasons that respondents provided regarding why they were/were not interested in using the different technologies were also explored and illustrated.

We used logistic regression modeling to examine the association between sociodemographic factors and outcomes of interest (capacity and willingness to use the electronic technologies). The models were adjusted for characteristics as described in the behavioral model of health service utilizations[12] and the motivational model,[13] which are frameworks for factors that may be associated with interest in electronic technologies. These variables are categorized into baseline characteristics, current quality of health care and attitude toward new technologies. In addition, we also investigated respondents' attitudes towards how much time would have to be saved in order to use videoconferencing for a specialist visit (i.e., < 30 minutes, 31-60 minutes, > 60 minutes or don't know) compared to an in-person visit with a specialist.

For all analyses, Statistics Canada's calibrated design weights and bootstrap weights were used to obtain population-level point estimates for proportions or odds ratios (ORs) and bootstrapping was used to determine 95% confidence intervals (CIs) for the estimates. Following Statistics Canada guidelines, if the coefficient of variation (CV) was 16% to 33.3%, the results were interpreted with caution as they may be unreliable. If the CV was >33.3%, the results were considered unreliable and were not presented. Ethics approval was provided by the Conjoint Health Research Ethics Board of the University of Calgary and the Health Research Ethics Board of the University of Alberta.

Results

The majority of the 1849 respondents were white (87%) and married or in common-law relationships (67%). A substantial proportion of respondents were obese (30.8%) and 70% were current or former smokers. The greatest number of respondents were from British Columbia (45%), followed by Alberta (32%), Manitoba (13%) and Saskatchewan (11%). Most of the respondents were post-secondary and/or university graduates (60%) and half were between the ages of 40-64 years (49%).

Overall, 1514 (82%) of respondents had hypertension, 486 (26%) had diabetes, 396 (21%) had heart disease and 147 (8%) had stroke; 596 (32%) had more than one chronic disease. Despite having at least one chronic disease, 77% of respondents reported their health as 'good' or better. Other health related characteristics of the respondents are shown in Table 1. Less than 1% of respondents had used one of the information technologies to access health care in the last 12 months.

The majority of respondents (76.4%; 73.3-79.3%) owned a computer with internet access or a mobile phone and 66.3% (63.0-69.5%) were interested in using email to interact with a specialist (Table 2). However, respondents were less enthusiastic about text messaging than about email since only 44.9% (41.2-48.7%) were interested in using the former. There was considerable interest in using videoconferencing to interact with physicians, which was less pronounced for visits with primary care (50.4%; 46.4-54.4%) than specialized care (65.1%; 61.4-68.6%) – perhaps because respondents perceive fewer barriers to interacting with

primary care physicians. As expected, enthusiasm for information technology was more pronounced among those residing further from (vs closer to) medical specialists.

The most common reasons given by respondents for why they would be unwilling to correspond with a provider by email or text message are shown in Figure 1 and in Supplementary Table 1.

Based on hypothetical scenarios, those residing further from specialists stated that they would need to save more time before they were willing to visit a videoconferencing centre to replace a face-to-face visit with a specialist (as compared with those living in close proximity to a specialist, Table 2). Among the respondents who were potentially interested in videoconferencing, almost 50% of those residing further from a specialist would use videoconferencing if it could save more than 60 minutes of their time. However, approximately one third of respondents who were potentially interested in videoconferencing would use a videoconference visit in preference to a face-to-face visit in exchange for saving 30 minutes or less – indicating that even relatively small amounts of time saved may be potentially appealing to patients.

Multivariate logistic regression analyses identified the following characteristics as independently associated with willingness to visit a videoconferencing centre for specialist care: living further from a specialist, post-secondary education or greater, and lower burden of chronic disease. Interest in using email to interact with a specialist was independently associated with age 40-64 years (vs older), white ethnicity, having an internet connection at home, and having post-secondary education. Interest in using text messaging to interact with a specialist was significantly associated with younger age, owning a mobile phone, having an internet connection at home, having post-secondary education, and having higher income (Table 3).

Discussion

New information technologies such as videoconferencing, email support and SMS messaging have the potential to improve chronic disease care. Although there appears to be interest among providers in adopting these technologies,[6,14,15] the extent of interest among patients is less well described, and in particular among older adults with chronic disease. In this large

survey of community-dwelling western Canadians with chronic disease, we assessed patient self-reported interest in adopting these three types of information technology, focusing on their impact on interactions with specialist medical care.

There was substantial interest in using information technology for chronic disease care among respondents residing close to and further from specialists. Although younger and more educated respondents were more interested in information technology, a majority of respondents expressed interest in and capacity to use information technology regardless of age and educational status. The high level of patient interest in these technologies suggests the need for further research into the potential benefits of information technology to reduce geographic barriers to chronic disease care – especially since only 1% of respondents had used these technologies in the year before the survey. Although our survey focused on interactions with specialist care, it appears that videoconference visits with primary care physicians may also be of interest to patients.

There was consistently greater interest in use of videoconferencing and email than use of SMS. Because availability of all three technologies is relatively high, it is possible that fewer respondents were interested in SMS messaging because it is less familiar to them than the other two technologies -- or alternatively because they feel constrained by the short length of SMS messages (maximum 160 characters). However, of the three technologies considered in the current study, least is known about potential barriers to use of SMS messaging[16] and so this suggestion is speculative.

Several systematic reviews have suggested that different types of electronic interventions can improve process-based or clinical outcomes. These include remote monitoring for chronic heart failure;[17] home telemonitoring of respiratory conditions;[18] web and computer based smoking cessation programs;[19] telehealth approaches for secondary prevention of coronary heart disease;[20] telepsychiatry;[21] virtual reality exposure therapy for anxiety disorders;[22] home telehealth for diabetes, heart disease and chronic obstructive pulmonary disease.[23] On the basis of these studies, several countries including Scotland, Denmark, Spain and the United States have already initiated large scale telehealth programs.[24] There are less data on the clinical benefits of email and SMS-based information technology programs for management of

chronic disease, although physicians appear potentially interested in adopting such technologies into available management strategies.[6,14,15]

Despite this interest among providers and decision-makers, few studies have addressed the problem of patients' willingness to use electronic technologies for management of chronic disease. In a 1997 telephone survey of 461 non-institutionalized U.S adults, only one third of the respondents had heard of telehealth and nearly two thirds thought patients would find it less satisfactory than seeing a physician in person.[25] In our survey, the major reported barrier to uptake of the email or SMS was lack of knowledge, but respondents appeared more optimistic of the potential merits associated with an electronic encounter: <30% cited a preference for a face-to-face visit as a major barrier to using email to communicate with a physician. In our study, few participants cited concerns about cost as a major barrier to use of SMS. Previous studies suggest that many patients would be willing to pay a small annual fee for certain online services such as viewing parts of their medical record, messaging with their physician, medication refills, appointment requests, and billing inquiries.[26] Finally, although appropriate privacy measures would be mandatory before increasing the use of information technology in health care communication – concerns about privacy were rarely cited by participants in our study as a potential barrier.

Our study has some limitations that should be considered when interpreting results. First, although our response rates were relatively high, the sample was drawn from respondents to the CCHS survey and thus the generalizability of our findings to the general Canadian population is uncertain. Second, data were from self-report, and relationships with actual behavior were not examined. Third, we focused on certain important chronic diseases (hypertension, diabetes, heart disease) and the number of respondents with more than one of these conditions was small. This limited our ability to examine how disease burden affected interest in electronic technologies – and means that our findings cannot necessarily be generalized to patients with other chronic diseases such as cancer or lung disease. Fourth, our index of residence location was unsophisticated, largely because privacy considerations precluded us from assessing the precise residence location of each respondent. However, given the relatively high level of interest in electronic technologies among both urban and non-urban respondents, this is unlikely to have affected our conclusions. Fifth, although most patients with hypertension, diabetes or heart disease can be managed in primary care, we

considered electronic technologies largely as a means of facilitating specialist care. Future studies may wish to further address how electronic technologies can be used to enhance primary care management of chronic diseases. Finally, because of the study design, the questions included in the survey were quite general in nature. It would have been preferable to give specific examples of how the information technologies would work, ideally with reference to a working prototype. For example, specifying that videoconferencing could be done at home using Skype software and a webcam might be associated with increased enthusiasm among respondents, as compared to videoconferencing at a nearby health facility. This limitation should be addressed in future work.

In summary, we found that the majority of those with chronic diseases were interested in using electronic technologies to help manage their chronic disease – especially videoconference and email-based methods. Although younger patients and those with greater education were more likely to be interested and able to use such technologies, there was substantial interest even among those aged ≥75 years or earning $25,000 annually. These findings suggest that videoconferencing and email should be further explored as potential mechanisms for helping Canadians manage chronic diseases such as hypertension, diabetes and vascular disease.

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Table 1: Characteristics of study participants

	Total % (95% CI) †	Reside in close proximity to speciaist % (95% CI) †	Reside further from specialist % (95% CI) †	P-value
Male sex	49.9 (46.0 - 53.8)	50.6 (44.2 - 57.0)	49.2 (45.0 - 53.4)	0.710
Age category				0.042
40-64	48.8 (45.6 - 52.0)	50.8 (45.0 - 56.5)	46.8 (42.5 - 51.1)	
65-74	26.9 (24.1 - 30.0)	22.8 (18.4 - 27.9)	31.1 (27.3 - 35.1)	
75+	24.3 (21.7 - 27.1)	26.4 (21.7 - 31.8)	22.2 (19.3 - 25.3)	
Education				<0.0001
< High School	21.7 (19.0 - 24.5)	15.6 (11.9 - 20.2)	27.7 (24.3 - 31.4)	
High School	17.3 (14.6 - 20.4)	16.9 (12.7 - 22.1)	17.7 (14.5 - 21.5)	
Post-secondary	43.2 (39.4 - 47.0)	42.5 (36.5 - 48.8)	43.8 (39.6 - 48.2)	
University degree	17.9 (14.7 - 21.5)	25.0 (19.3 - 31.7)	10.7 (8.4 - 13.7)	
Household income:				0.001
<$25,000	15.2 (12.9 - 17.8)	13.0 (9.4 - 17.7)*	17.5 (14.6 - 20.7)	
$25-39,999	18.5 (15.9 - 21.3)	16.3 (12.6 - 20.9)	20.6 (17.6 - 23.9)	
$40-70,000	28.6 (25.5 - 31.9)	25.4 (20.6 - 31.0)	31.7 (27.7 - 36.0)	
>$70,000	37.8 (33.9 - 41.8)	45.3 (38.7 - 52.0)	30.2 (26.3 - 34.5)	
Have prescription drug insurance	85.9 (82.8 - 88.6)	85.8 (80.0 - 90.0)	86.1 (82.9 - 88.8)	0.907
Marital status				
Married/Common-law	67.0 (63.2 - 70.6)	68.1 (61.8 - 73.8)	65.8 (62.0 - 69.5)	0.510
Place of birth				
Born in Canada	76.2 (72.3 - 79.7)	69.1 (62.2 - 75.2)	83.4 (78.9 - 87.0)	0.0003
Province				0.0001
Alberta	31.7 (28.8 - 34.6)	35.4 (30.1 - 41.1)	27.9 (24.4 - 31.6)	
Manitoba	13.1 (11.2 - 15.2)	16.9 (13.4 - 21.0)	9.2 (7.2 - 11.8)	
Saskatchewan	10.8 (9.5 - 12.2)	8.1 (6.2 - 10.6)	13.5 (11.2 - 16.2)	
British Columbia	44.5 (41.4 - 47.7)	39.6 (34.0 - 45.6)	49.4 (45.3 - 53.5)	
Ethnicity				
White	87.0 (83.4 - 89.9)	82.8 (76.3 - 87.8)	91.2 (88.2 - 93.5)	0.004
Type of Chronic disease				
Hypertension	81.9 (78.9 - 84.5)	80.7 (75.4 - 85.1)	83.0 (79.4 - 86.1)	0.449
Diabetes	26.2 (23.7 - 28.9)	24.5 (20.1 - 29.5)	28.0 (24.4 - 31.9)	0.315
Heart disease	21.4 (18.7 - 24.3)	19.7 (15.5 - 24.7)	23.1 (19.5 - 27.1)	0.305
Stroke	7.9 (6.4 - 9.6)	7.0 (4.7 - 10.2)*	8.8 (6.6 – 11.6)	0.393
Additional chronic disease	63.0 (59.3 - 66.6)	62.1 (55.5 - 68.4)	63.9 (59.5 - 68.1)	0.663
Self-perceived Health Excellent/ Very Good / Good	77.1 (74.1 - 84.5)	80.3 (75.2 - 84.5)	73.9 (69.9 - 77.5)	0.054
Smoking Status				0.0005
Never	30.8 (27.0 - 34.9)	38.3 (31.8 - 45.2)	23.2 (19.9 - 26.9)	
Occasional/Former	53.0 (48.8 - 57.2)	46.8 (40.3 - 53.3)	59.4 (54.9 - 63.7)	
Daily	16.2 (13.2 - 19.7)	15.0 (10.4 - 21.1)*	17.4 (14.1 - 21.3)	
Alcohol use				0.303
None	26.0 (22.6 - 29.6)	26.9 (21.7 - 32.9)	25.0 (21.4 - 29.0)	
Occasional	19.8 (16.8 - 23.2)	17.4 (13.1 - 22.7)	22.2 (18.4 - 26.7)	
Regular	54.2 (50.2 - 58.2)	55.7 (49.2 - 62.0)	52.8 (48.4 - 57.1)	
Body mass index				
BMI< 30 kg/m^2	69.2 (65.3 - 72.9)	70.7 (64.1 - 76.6)	67.7 (63.6 - 71.6)	0.427

†All proportions and 95% CI are weighted and bootstrapped as per Statistics Canada guidelines; *CV=16-33.3%

Table 2: Capacity and willingness to use information technology

	Total % (95% CI†)	Reside in close proximity to specialist % (95% CI) †	Reside further from specialist % (95% CI) †	P-value
Own the requisite equipment for email/SMS communication				
Own computer with internet	76.4 (73.3 - 79.3)	80.2 (74.9 - 84.6)	72.6 (68.8 - 76.1)	0.020
Own a cell phone	73.9 (70.7 - 76.8)	75.6 (70.4 - 80.2)	72.1 (68.0 - 75.9)	0.292
Willingness to use information technologies				
Using videoconferencing to interact with primary care	50.4 (46.4 – 54.4)	47.1 (40.2 – 54.1)	53.8 (49.5 – 58.1)	0.121
Using videoconferencing to interact with specialist	65.1 (61.4 - 68.6)	60.1 (53.7 - 66.2)	70.2 (66.4 - 73.7)	0.006
Using email to interact with specialist	66.3 (63.0 - 69.5)	69.0 (62.9 - 74.5)	63.5 (59.7 - 67.2)	0.147
Using SMS to interact with specialist	44.9 (41.2 - 48.7)	46.2 (39.8 - 52.7)	43.6 (39.3 - 48.0)	0.520
Amount of travel time that videoconferencing would need to save respondents in order for them to select it in preference to an in-person visit with a specialist (among respondents who were willing to use videoconferencing)				
<=30 minutes	28.3 (23.9 - 33.0)	30.6 (23.1 - 39.4)	26.2 (21.5 - 31.5)	0.038
31-60 minutes	21.4 (17.2 - 26.4)	25.7 (18.2 - 35.0)*	17.7 (13.9 - 22.3)	
>60 minutes	41.7 (36.9 - 46.7)	34.1 (26.6 - 42.5)	48.3 (42.8 - 53.9)	
Don't know	8.6 (6.5 - 11.4)	9.6 (5.9 - 15.1)*	7.8 (5.5 - 10.9)*	

†All proportions and 95% CI are weighted and bootstrapped as per Statistics Canada guidelines; *CV=16-33.3%

Respondents with a relevant medical specialist in the same metropolitan area as their home were considered to reside "in close proximity" to such specialists; other participants were considered to reside "further" from specialists.

Table 3: Factors associated with willingness to use information technology, after adjustment for potential confounders

	Interest in video-conferencing % (95% CI) †	Adjusted OR (95% CI) †	Interest in email % (95% CI) †	Adjusted OR (95% CI) †	Interest in SMS % (95% CI) †	Adjusted OR (95% CI) †
Residence location						
Reside close to specialist	60.1 (53.7 - 66.2)	Ref	69.0 (62.9 - 74.5)	Ref	46.2 (39.8 - 52.7)	Ref
Reside further from specialist	70.2 (66.4 - 73.7)	2.00 (1.37 - 2.90)	63.5 (59.7 - 67.2)	1.08 (0.66 - 1.74)	43.6 (39.3 - 48.0)	1.21 (0.82 - 1.76)
Own internet						
No	52.0 (44.8 - 59.1)	Ref	16.4 (12.6 - 21.2)	Ref	23.0 (18.3 - 28.5)	Ref
Yes	69.2 (64.9 - 73.3)	1.40 (0.85 - 2.31)	81.7 (78.1 - 84.9)	12.76 (7.43 - 21.90)	52.7 (47.2 - 56.1)	2.05 (1.30 - 3.22)
Own cell phone						
No	57.5 (50.6 - 64.2)	Ref	48.7 (41.9 - 55.6)	Ref	27.3 (22.4 - 32.8)	Ref
Yes	68.4 (64.1 - 72.4)	1.10 (0.76 - 1.62)	72.3 (68.5 - 75.9)	0.92 (0.57 - 1.49)	52.6 (46.9 - 56.2)	1.60 (1.08 - 2.37)
Sex						
Male	66.1 (60.7 - 71.2)	Ref	69.6 (64.5 - 74.4)	Ref	49.1 (43.5 - 54.9)	Ref
Female	64.0 (58.8 - 68.9)	1.00 (0.68 - 1.47)	63.0 (58.1 - 67.6)	0.92 (0.56 - 1.50)	40.6 (35.5 - 46.0)	0.87 (0.60 - 1.25)
Age						
40-64	70.3 (64.6 - 75.4)	Ref	80.1 (75.2 - 84.2)	Ref	55.8 (49.6 - 61.8)	Ref
65-74	64.5 (57.7 - 70.8)	0.83 (0.54 - 1.28)	64.4 (57.8 - 70.4)	0.75 (0.44 - 1.28)	41.2 (34.6 - 48.1)	0.81 (0.53 - 1.23)
75+	55.3 (48.5 - 61.9)	0.81 (0.50 - 1.32)	40.7 (34.3 - 47.5)	0.46 (0.25 - 0.81)	26.9 (21.8 - 32.5)	0.61 (0.38 - 0.99)
Education						
< High School	49.8 (43.3 - 56.3)	Ref	38.0 (31.7 - 44.7)	Ref	28.6 (23.1 - 34.8)	Ref
High School	61.8 (52.3 - 70.4)	1.39 (0.83 - 2.30)	68.8 (59.6 - 76.7)	1.74 (0.96 - 3.16)	44.2 (34.8 - 54.1)	1.37 (0.81 - 2.31)
Post-secondary	68.2 (62.1 - 73.8)	2.05 (1.28 - 3.26)	70.5 (64.9 - 75.5)	1.60 (0.97 - 2.63)	46.6 (40.7 - 52.6)	1.33 (0.85 - 2.08)
University degree	79.0 (71.5 - 84,9)	3.89 (2.07 - 7.31)	89.1 (82.5 - 93.5)	4.41 (1.98 - 9.81)	62.4 (51.5 - 72.1)	2.31 (1.22 - 4.37)
Household income						
<$25,000	55.3 (45.9 - 64.4)	Ref	41.0 (32.4 - 50.1)	Ref	26.4 (20.0 - 34.1)	Ref
$25-39,999	60.6 (52.3 - 68.4)	1.05 (0.56 - 1.97)	50.1 (42.3 - 57.9)	0.92 (0.49 - 1.75)	29.7 (23.4 - 36.8)	1.09 (0.61 - 1.94)
$40-70,000	70.2 (64.1 - 75.6)	1.12 (0.59 - 2.15)	69.8 (63.7 - 75.3)	1.38 (0.75 - 2.55)	45.3 (38.8 - 52.0)	1.49 (0.84 - 2.67)
>$70,000	67.2 (59.8 - 73.9)	0.71 (0.34 - 1.47)	81.4 (74.9 - 86.6)	1.35 (0.64 - 2.87)	59.4 (52.0 - 66.4)	2.05 (1.11 - 3.77)
Drug insurance status						
No	67.1 (58.0 - 75.1)	Ref	68.2 (59.6 - 75.7)	Ref	40.4 (30.1 - 51.7)	Ref
Yes	64.8 (60.7 - 68.6)	0.79 (0.48 - 1.28)	66.0 (62.2 - 69.5)	0.72 (0.42 - 1.22)	45.7 (41.6 - 49.8)	1.15 (0.70 - 1.87)
Marital status						
Married/Common law	66.1 (61.1 - 70.7)	Ref	72.3 (68.2 - 76.1)	Ref	47.4 (42.5 - 52.2)	Ref
Widowed/Sep/Div/Single	62.9 (57.4 - 68.1)	0.96 (0.64 - 1.46)	54.0 (47.8 - 60.0)	0.85 (0.54 - 1.36)	40.1 (34.1 - 46.4)	1.33 (0.88 - 1.99)
Place of birth						
Born in Canada	66.5 (62.6 - 70.2)	Ref	67.1 (63.6 - 70.5)	Ref	47.9 (43.5 - 52.3)	Ref
Born outside Canada	60.4 (50.4 - 69.7)	0.84 (0.51 - 1.38)	63.4 (53.9 - 72.0)	1.32 (0.74 - 2.36)	35.3 (26.8 - 44.9)	0.80 (0.47 - 1.35)
Province						
Alberta	69.1 (62.0 - 75.4)	Ref	70.4 (64.6 - 75.5)	Ref	47.7 (40.8 - 54.7)	Ref
Manitoba	57.0 (45.6 - 67.7)	0.60 (0.31 - 1.16)	49.7 (39.1 - 60.3)	0.43 (0.19 - 0.97); P=0.042	48.6 (37.2 - 59.9)	1.23 (0.68 - 2.23)
Saskatchewan	59.4 (50.9 - 67.4)	0.62 (0.36 - 1.08)	62.7 (54.4 - 70.4)	0.87 (0.50 - 1.52)	44.0 (35.7 - 52.7)	0.87 (0.53 - 1.43)
British Columbia	66.0 (60.1 - 71.4)	0.84 (0.51 - 1.38)	69.2 (63.4 - 74.4)	0.77 (0.44 - 1.36)	42.1 (36.1 - 48.3)	0.79 (0.51 - 1.23)

	Interest in video-conferencing % (95% CI) †	Adjusted OR (95% CI) †	Interest in email % (95% CI) †	Adjusted OR (95% CI) †	Interest in SMS % (95% CI) †	Adjusted OR (95% CI) †
Ethnicity						
White	65.3 (61.5 - 68.9)	Ref	68.6 (65.3 - 71.8)	Ref	45.9 (41.9 - 50.0)	Ref
Aboriginal/Other	63.7 (50.6 - 75.0)	1.28 (0.68 - 2.43)	50.5 (36.3 - 64.6)	0.32 (0.13 - 0.76); P=0.010	38.1 (25.6 - 52.4)*	0.71 (0.36 - 1.40)
Type of chronic disease**						
Hypertension						
No	63.8 (54.6 - 72.1)	Ref	66.4 (57.2 - 74.6)	Ref	43.7 (34.3 - 53.6)	Ref
Yes	65.4 (61.5 - 69.1)	0.87 (0.52 - 1.45)	66.3 (62.6 - 69.8)	0.75 (0.42 - 1.31)	45.2 (41.0 - 49.4)	1.14 (0.69 - 1.89)
Diabetes						
No	66.2 (61.8 - 70.4)	Ref	68.0 (64.0 - 71.8)	Ref	45.1 (40.6 - 49.6)	Ref
Yes	61.9 (55.3 - 68.0)	0.83 (0.55 - 1.24)	61.4 (54.8 - 67.7)	0.84 (0.47 - 1.49)	44.5 (37.5 - 51.7)	1.20 (0.82 - 1.77)
Heart disease						
No	66.9 (62.8 - 70.7)	Ref	68.5 (64.7 - 72.0)	Ref	44.8 (40.5 - 49.1)	Ref
Yes	58.3 (49.9 - 66.2)	0.73 (0.46 - 1.17)	58.3 (50.8 - 65.5)	0.82 (0.47 - 1.43)	45.5 (38.0 - 53.1)	1.41 (0.94 - 2.10)
Stroke						
No	66.7 (62.9 - 70.3)	Ref	68.2 (64.8 - 71.4)	Ref	46.4 (42.4 - 50.4)	Ref
Yes	46.0 (33.2 - 59.3)	0.55 (0.28 - 1.07)	43.9 (31.7 - 57.0)	0.73 (0.37 - 1.45)	28.0 (18.6 - 39.8)*	0.73 (0.40 - 1.35)
Additional chronic disease						
No	75.4 (70.7 - 79.6)	Ref	75.3 (70.1 - 79.8)	Ref	50.2 (43.8 - 56.5)	Ref
Yes	59.0 (54.0 - 63.8)	0.56 (0.38 - 0.83)	61.0 (56.7 - 65.2)	0.74 (0.46 - 1.17)	41.8 (36.8 - 47.0)	0.92 (0.62 - 1.36)
Self-perceived health						
Excellent/ Very Good / Good	68.1 (64.0 - 72.0)	Ref	69.9 (66.1 - 73.5)	Ref	46.1 (41.9 - 50.5)	Ref
Fair/Poor	54.8 (47.4 - 61.9)	0.79 (0.52 - 1.19)	53.8 (46.4 - 61.0)	0.85 (0.49 - 1.46)	40.9 (33.2 - 49.1)	1.12 (0.70 - 1.77)

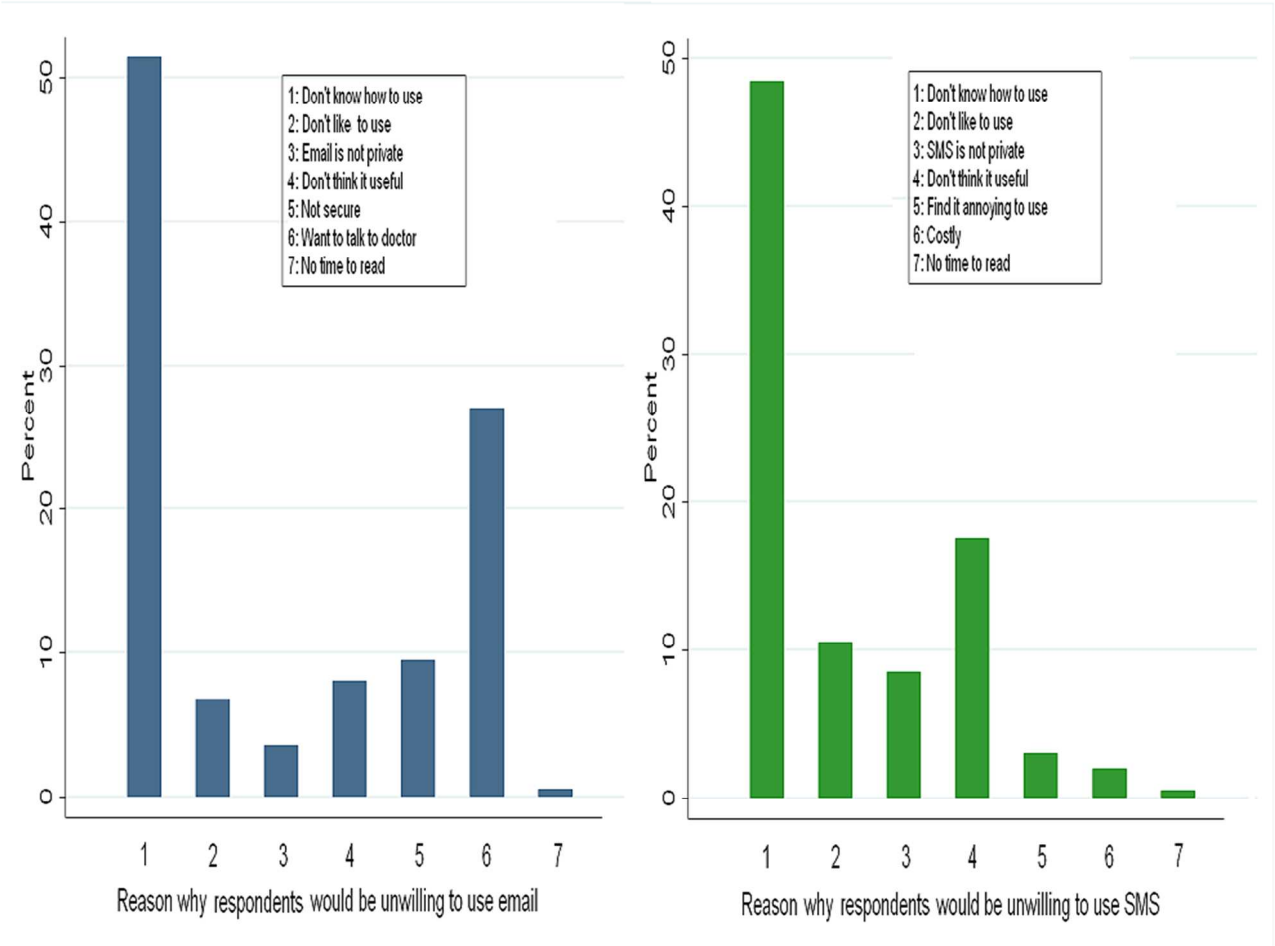
†All proportions and 95% CI are weighted and bootstrapped as per Statistics Canada guidelines; *CV=16-33.3%

Models were adjusted by resident location, barrier to specialist, own internet at home, own a cell phone, gender, age, education, household income, insurance status, marital status, place of birth, province, ethnicity, type of chronic disease, additional chronic disease, and self-perceived health.

** Conditional OR for patients who had at least one of the four chronic diseases

Sep = separated, div=divorced, OR=Odds Ratio; CI= confidence interval

Figure 1: Reasons provided for lack of willingness to use email and SMS



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Supplementary table 1: Reasons why respondents would be unwilling to use email/SMS

Unwilling to use email	Total % (95% CI)†	Unwilling to use SMS	Total % (95% CI)†
Don't know how to use email	51.5 (45.7 - 57.2)	Don't know how to use SMS	48.4 (43.4 - 53.5)
Don't like to use email	6.3 (3.6 - 10.8)*	Don't like to use SMS	10.5 (7.5 - 14.6)*
Email is not private	3.5 (1.9 - 6.2)*	SMS is not private	8.5 (5.9 - 11.9)*
Don't think email useful	8.0 (5.4 - 11.7)*	Don't think SMS useful	17.5 (13.5 - 22.3)
Not secure	9.5 (5.7 - 15.6)*	Find SMS annoying to use	3.0 (1.9 - 4.9)*
Want to talk to doctor	27.0 (22.1 - 32.6)	Costly	2.0 (0.7 - 5.8)**
No time to read email	0.5 (0.1 - 1.1)**	No time to read SMS	0.5 (0.2 - 1.2)**

†All proportions and 95% CI are weighted and bootstrapped as per Statistics Canada guidelines; *CV=16-33.3%; ** CV>33.3%

STROBE Statement—checklist of items that should be included in reports of observational studies

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

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
		(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
		(b) Indicate number of participants with missing data for each variable of interest
		(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
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
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
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
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
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

*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.