

Prevalence and characteristics of home Internet access in patients with cardiovascular disease from diverse geographical locations

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BACKGROUND: Patients living outside of urban centres do not have access to the same level of care as patients in cities. The use of the Internet has been suggested as a possible resolution to this geographic inequity.

OBJECTIVE: To identify the determinants of Internet use in patients with cardiovascular disease and the patterns of use.

METHODS: Cardiac inpatients of an urban tertiary and a northern regional hospital in British Columbia were invited to participate. Patients who could not speak English or who had mental impairment were excluded. Consenting patients were interviewed regarding demographics and home Internet use.

RESULTS: A total of 294 patients participated. The mean (\pm SD) age was 64.0 \pm 12.7 years. Most participants were men (68%) of European ancestry (77%) with some postsecondary education (57%). All geographical regions of British Columbia were represented. A total of 66% of patients had home Internet access. In rural areas, 47% of patients had access to the Internet ($P=0.020$ compared with nonrural areas). Eighty-four per cent of patients with Internet access had a high-speed connection, 55% reported using the Internet daily and 23% used it more than once per week. Accessing health information from the Internet was reported by 70% of patients.

CONCLUSION: These data indicate a high prevalence of Internet use among English-speaking cardiac patients and a strong desire to obtain health information using the Internet. Health care organizations can take advantage of the Internet to develop and evaluate the delivery of cardiac services to patients in their homes, particularly to patients in rural and remote communities.

Key Words: *Cardiovascular disease; Internet; Rural*

While cardiovascular disease (CVD) mortality has decreased over the past three decades, the number of people with CVD has been increasing (1). Because CVD requires ongoing management of symptoms, risk factors and lifestyle behaviours for optimal treatment and prognosis, the increase in patients with CVD will place an increased demand on health care services. This often requires regular contact between patients and health care providers who specialize in the management of CVD, as outlined in the chronic disease management model (2). However, these services are often located in large urban centres, many of which are operating at full capacity, yet CVD is no less prevalent in rural Canada (3). Therefore, a geographic inequity of care exists for those with CVD living outside of these urban centres, necessitating the investigation of other service models.

La prévalence et les caractéristiques de l'accès Internet à domicile sur les patients ayant une maladie cardiovasculaire provenant de diverses régions géographiques

HISTORIQUE : Les patients qui vivent à l'extérieur des centres urbains n'ont pas accès au même niveau de soins que les patients des villes. Il a été postulé que le recours à Internet pourrait résoudre cette inégalité géographique.

OBJECTIF : Repérer les déterminants et les profils d'utilisation d'Internet chez des patients ayant une maladie cardiovasculaire.

MÉTHODOLOGIE : On a invité les patients cardiaques hospitalisés d'un centre urbain de soins tertiaires et ceux d'un hôpital régional du Grand Nord britannocolumbien à participer à l'étude. Les patients qui ne parlaient pas anglais ou qui avaient un retard mental étaient exclus. Les patients consentants passaient une entrevue au sujet de leurs caractéristiques démographiques et de leur utilisation d'Internet à domicile.

RÉSULTATS : Au total, 294 patients, d'un âge moyen (\pm ÉT) de 64,0 \pm 12,7 ans, ont participé à l'étude. La plupart des participants étaient des hommes (68 %) d'ascendance européenne (77 %), pourvus d'une certaine éducation postsecondaire (57 %). Toutes les régions géographiques de la Colombie-Britannique étaient représentées. Au total, 66 % avaient accès à Internet à domicile. Dans les régions rurales, 47 % des patients y avaient accès ($P=0,020$ par rapport aux régions non rurales). Quatre-vingt-quatre pour cent des patients ayant accès à Internet avaient une connexion haute vitesse, 55 % déclaraient l'utiliser quotidiennement et 23 % l'utilisaient plus d'une fois par semaine. Enfin, 70 % des patients ont déclaré accéder à de l'information en matière de santé dans Internet.

CONCLUSION : Ces données font état d'une forte prévalence d'utilisation d'Internet chez les patients cardiaques de langue anglaise ainsi que d'un grand désir d'obtenir de l'information en matière de santé dans Internet. Les organisations de santé peuvent profiter d'Internet pour mettre au point et évaluer la prestation de services cardiaques à domicile aux patients, notamment à ceux des régions rurales et éloignées.

The Commission on the Future of Health Care in Canada highlighted the use of telehealth strategies to deliver services from a distance (4). To date, the majority of government- and health authority-sponsored telehealth service initiatives in Canada have focused on the transfer of images or consultation services that require sophisticated and costly video-conferencing networks situated in hospitals or clinics (5,6). This has helped facilitate communication between rural and large urban centres with respect to acute care but is not a feasible alternative for those with chronic conditions, such as CVD, that require more frequent, less intensive feedback between the patient and health care provider. The use of the Internet may provide an alternative that is less expensive and readily accessible in most Canadian communities. In addition, Internet-based services may provide solutions in urban environments that already experience maximal use of resources.

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TABLE 1
Demographic characteristics of study cohort stratified by home Internet access

	Home Internet access		P
	No (n=101)	Yes (n=193)	
Age, years, mean \pm SD	67.2 \pm 12.9	62.4 \pm 12.4	0.002
Men, n (%)	63 (62)	148 (77)	0.01
Annual household income, n (%)			
<\$20,000	25 (25)	17 (9)	<0.001
>\$60,000	16 (16)	73 (38)	
Education, n (%)			
Postsecondary (any)	42 (42)	127 (66)	<0.001
High school	25 (25)	47 (24)	
Less than high school	34 (34)	19 (10)	
Married, n (%)	63 (62)	146 (76)	0.017
Child younger than 19 years of age, n (%)	13 (3)	34 (18)	0.292
Primary admission, n (%)			
Myocardial infarction	34 (34)	51 (26)	0.194
Coronary artery bypass graft	1 (1)	11 (6)	0.053
Angioplasty	27 (27)	62 (32)	0.339
Heart failure	14 (13.9)	25 (13)	0.827
Arrhythmia	15 (15)	30 (15)	0.876
Other	17 (17)	42 (20)	0.316
Geographic location, n (%)			
Rural	18 (18)	16 (8)	0.02
Census agglomeration area	42 (42)	73 (38)	
Census metropolitan area	41 (41)	104 (54)	
Recruitment site (Vancouver, BC), n (%)	73 (72)	160 (83)	0.033
Current smoker, n (%)	14 (14)	25 (13)	0.74

BC British Columbia

Access to the Internet has dramatically increased over the past decade, as has the accessible information. In 2003, the Household Internet Use Survey (HIUS) (7) reported that more than 57% of Canadians had home Internet access. Similar values have been reported in the United States and Europe (8,9). For those with chronic disease, Internet access ranges from 34% to 65%, depending on the study (10-15). However, all of these studies were limited to patients living in large urban centres, and only one was conducted in Canada (15). In addition, none of these studies reported the frequency of Internet use. Given the potential for the Internet to be used as a medium for the delivery of chronic disease management of patients with CVD, it is important to identify the prevalence and characteristics of Internet use in this target group. Therefore, the purpose of the present investigation was to identify the determinants and patterns of Internet use in patients with CVD.

METHODS

Cardiac inpatients from an urban tertiary hospital and a northern regional hospital in British Columbia were approached to participate in the present study. The tertiary hospital, St Paul's Hospital in downtown Vancouver, is the site of The Heart Centre and is the only hospital in British Columbia that provides a full range of tertiary and quaternary cardiac services to patients throughout the province. Recruitment from this hospital occurred between July 2006 and November 2006. There were approximately 2700 cardiac admissions during this time, with 40% of these coming from outside the greater Vancouver area. The regional hospital, Prince George Regional Hospital, is the largest acute care centre in northern British Columbia, with 209 beds. It is located in Prince George, a city in the centre of British Columbia with a population of more than 70,000. Recruitment from this hospital occurred from July 2006 to February 2007, with approximately 413 cardiac admissions during this period. As per

requirements of the research ethics board, potentially eligible patients (those who spoke English and had no mental impairment) were identified and approached by a nurse on the inpatient ward and informed of the study. Patients who expressed interest were referred to the research assistant, who further explained the study and obtained informed consent. It was emphasized to potential participants that having Internet access was not a requirement to participate. The study was approved by the Simon Fraser University (Vancouver), Providence Health Care and Northern Health Authority research ethics boards.

Participants underwent a structured interview regarding socio-demographics, location of residence, admission indication, ownership of a home computer and home Internet access. Participants who indicated that they had home Internet access were asked about the type of access (ie, connection type), reasons for and frequency of use, and who the main household user was. All participants were asked if they accessed the Internet outside of their home. Those without home Internet access were asked to identify possible barriers to using the Internet. Using Statistics Canada definitions, participants were categorized based on their place of residence as either living in a census metropolitan area (CMA) with an urban core population greater than 100,000; a census agglomeration area (CA) with an urban core population of 10,000 to 99,999; or a rural area (ie, all other areas).

Statistical analysis

Categorical variables are reported as counts and percentages, and continuous variables are reported as means \pm SDs. The χ^2 test and independent *t* test were used to test for differences among groups for categorical and continuous variables, respectively. Forward logistic regression analysis was used to identify predictors of home Internet access. Statistical analyses were performed using SPSS version 15.0 (SPSS Inc, USA) and the level of significance was set at 0.05.

RESULTS

Of the 517 patients approached, 294 (57%) consented and completed the interview (228 and 66 patients from the tertiary and regional hospitals, respectively). Of those approached, the main reasons for refusal to participate were a lack of interest, no time (predominantly for those undergoing day transfers from another hospital) and not feeling well enough to participate. None of the patients who were approached refused due to not having home Internet access. The mean age of the patients was 64.0 \pm 12.7 years, and the majority of participants were men (68%) of European ancestry (77%) with some postsecondary education (57%). Seventeen (6%) participants identified themselves as having Aboriginal heritage. Participants came from all five of the provincial health authorities but predominantly from the southwestern and northern areas of the province. The majority (63%) of participants were from outside the Vancouver area. Using Statistics Canada census definitions, 34 (12%) patients lived in rural areas, while 115 (39%) and 145 (49%) lived in CAs and CMAs, respectively. Rural patients were less educated than patients from CMAs and CAs; 25% of rural patients reported less than high school education compared with 16% of patients living in CMAs and CAs ($P=0.004$).

A total of 193 (66%) patients reported using the Internet at home (52% for the 17 Aboriginal participants). Patients who used the Internet at home were mainly men, younger, had a higher household income and education level, and were more likely to be married and live in an urban centre than the group who reported not using the Internet at home ($P<0.05$ for all) (Table 1). Of those living in rural areas, 47% had Internet access compared with 63% and 72% for those in CAs and CMAs, respectively ($P=0.020$). Using logistic regression analysis, age, sex, education and marital status were independently associated with having home Internet access (Table 2).

Of patients accessing the Internet at home, 84% reported having a high-speed Internet connection (ie, nondial-up access). Fifty-five per cent reported using the Internet daily and 23% used it more than once per week (Figure 1). Accessing health and medical information was

TABLE 2
Determinants of household Internet access

	OR (95% CI)	P
Age (per one-year increase)	0.97 (0.95–0.99)	0.007
Female sex	0.55 (0.311–0.98)	0.043
Education		
Postsecondary (any)	1.00 (reference)	
High school	0.65 (0.35–1.24)	0.194
Less than high school	0.20 (0.10–0.42)	<0.001
Married	1.89 (1.07–3.35)	0.029

Data adjusted for geographic location and hospital recruitment site

reported by 70% of patients and ranked third behind e-mail (88%) and general browsing (90%) (Figure 2). Patients who accessed health information through the Internet were more likely to be married (75% versus 57%, $P=0.024$) and to use the Internet more often (82% versus 68% for Internet use more than once per week, $P=0.031$) than patients who did not access health information. There were no differences in age, sex, income, education or census regional designation.

Of patients who did not access the Internet at home ($n=101$), the primary reasons for not using the Internet were having no computer at home (36%) and having no interest (20%).

DISCUSSION

In the present geographically diverse population with CVD, the finding that 66% of the patients surveyed had home Internet access is higher than the national average of 57% in 2004 (7) and higher than that reported in previous studies of patients with various diseases (10-15). This may be due to the passage of time since the HIUS, because Internet access tends to increase steadily each year (16), with more recent studies reporting greater Internet access (14). Despite the differences in prevalence of Internet access, our results indicate that Internet access is lower in older adults, those with less education and a lower income, and unmarried individuals, which is consistent with previous studies (7,15). The results also highlight the persistent socioeconomic 'digital divide' (7).

Accessing health information was the third most common reason for using the Internet. While this is slightly higher than that reported in the HIUS (58%) (7), it was previously reported that people with disease use the Internet for health information more than those without disease (17). Our results are consistent with those of Wong et al (15), who reported that 64% of urban CVD patients access health information through the Internet. However, a wide range exists because other studies have reported between 46% and 86% of patients searching for health information through the Internet (10,13-15,18,19).

We specifically targeted patients from rural and small urban centres because these patients are likely to benefit the most from accessing health services through the Internet. We found that a much lower proportion of patients living in rural areas had home Internet access compared with those living in CAs and CMAs. This is consistent with data from the HIUS indicating that living in a rural area was inversely associated with Internet access, and that location was the second most important determinant of Internet access (20). In our study, location was no longer a determinant of Internet access after adjusting for education, because the level of education was lower in patients in rural locations. However, we also found that rural patients accessed the Internet at a similar frequency to those in urban centres. Nearly 80% of patients with home Internet access used the Internet at least once per week, with more than one-half using the Internet daily. This is slightly less than the figure reported in the HIUS, which observed that nearly 90% of Canadian adults who access the Internet from home do so at least once per week (7).

While government-led telehealth initiatives tend to focus on video conferencing, a number of small studies and pilot projects delivering health services via the Internet have been reported in patients with

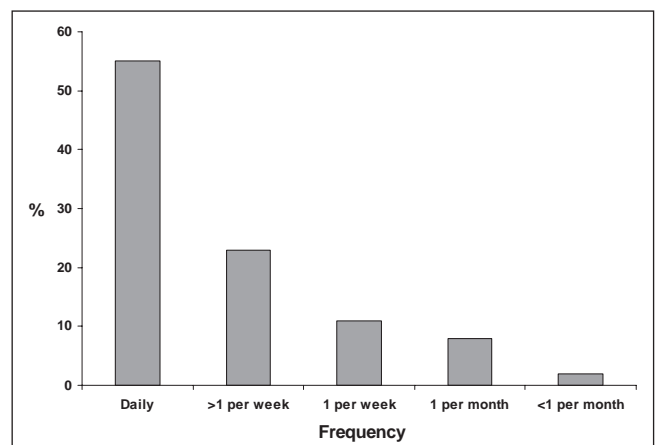


Figure 1) Frequency of Internet use at home in patients with home Internet access

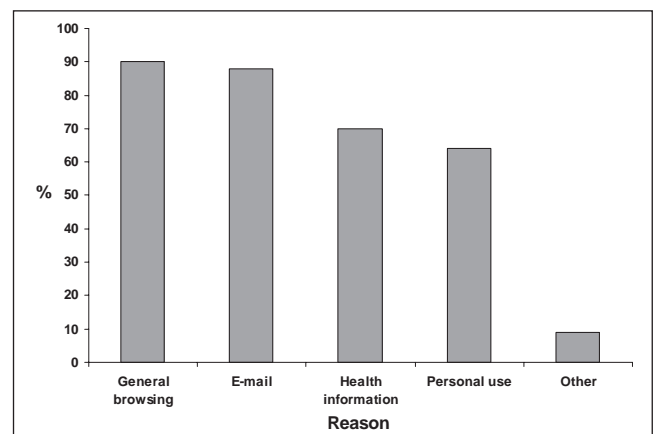


Figure 2) Reported reasons for Internet use at home in patients with home Internet access

breast cancer (21,22), asthma (23), chronic obstructive pulmonary disease (24,25), diabetes (26-32), lung transplantation (33), overweight (34-40), smokers (41), chronic heart failure (25,42-44) and CVD (45-48). These studies demonstrated that patients were willing to enter self-measured data online and communicate with health care providers via e-mail and/or chat/video conferencing. Furthermore, many patients have used information obtained from the Internet to discuss their condition with their health care professional (14,17), claiming that it improved their understanding of their disease (49) and helped them to make informed health care decisions (10). In addition, the majority of CVD patients would like to use the Internet to communicate directly with their health care providers (15,50). Indeed, patients prefer to obtain health care information from their physicians (9) and may only seek information on the Internet when they cannot contact their health care professional. Even though some patients question the validity of information provided on the Internet (14), the majority never check the validity of the source from which the information is provided (18).

Limitations

Our study was designed to investigate the prevalence and characteristics of home Internet access in patients with CVD. While every effort was made to encourage all patients to participate, it is possible that patients without home Internet access may have been more likely to refuse. Despite this limitation, the finding that as many as 33% of patients did not have home Internet access is within expectations. We also excluded patients who could not speak English, and this may limit the representativeness of our sample. We expect Internet access to be

lower in non-English speaking patients because the majority of content on the Internet is provided in English. Finally, while participants came from all areas of British Columbia, only 34 lived in rural areas (communities with fewer than 10,000 residents), which may limit our ability to make conclusions about this population. However, we are confident in our general finding that Internet access is likely to be less in rural populations than in urban areas.

CONCLUSIONS

Given the high proportion of CVD patients with Internet access and their regular use of it, our results support the use of the Internet as a viable medium to deliver health care services. Even though rural access to the Internet was lower, it nevertheless approached 50%. Recent government initiatives have targeted this geographic digital divide by increasing Internet access to rural communities (51). Health care organizations can take advantage of the Internet to develop and evaluate the delivery of cardiac services to patients in their homes. This would be advantageous to patients in rural communities and may also benefit patients in urban settings. Indeed, nearly three-quarters of patients who accessed the Internet used it to

obtain health information, indicating that many patients are already using the Internet to aid in their health care. We must acknowledge however, that patient Internet access is only one aspect of the requirements for the delivery of health services through the Internet. There is also a need for health authorities and professionals to be ready to adopt this technology and to implement appropriate policies. Research attention is therefore needed to develop and evaluate Internet-based cardiac service delivery programs so that the full potential of this medium can be realized.

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