Management of techno-psychological factors influencing the patient-physician electronic relationship

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Abstract: Focusing on the patient-physician electronic relationship, this empirical study was conducted to explore certain personal traits and psychological factors that can influence behavioural attitude toward adopting a patient portal. Statistical tests were used to compare the answers of physicians and patients and to test patients' dispositions toward technology. The results revealed significant differences among physicians and patients with respect to the purpose of website referrals. With the exception of the education level, the findings indicated that age, sex and ethnicity did not significantly influence participants' attitudes. The three psychological factors used in the regression model turned out to be significant predictors of participants' behavioural attitude toward adopting the patient portal. Based on these results, e-health applications require a long-term investment in technology generation to develop a new education system that supports these online platforms; this strategy, along with adequate support from healthcare providers, will produce the most effective results.

Keywords: website referrals; computer self-efficacy; computer anxiety; e-health literacy; patient portal.

Reference to this paper should be made as follows: Razmak, J. and Bélanger, C.H. (2018) 'Management of techno-psychological factors influencing the patient-physician electronic relationship', *Int. J. Healthcare Technology and Management*, Vol. 17, No. 1, pp.29–48.

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1 Introduction

In the healthcare sector, there have been a number of e-health resources including ready-made systems on the market, such as My HealtheVet, MyChart, Google Health, Microsoft HealthVault and TELUS health space. E-health resources are "tools that enable consumers, patients and informal caregivers to gather information, make health care decisions, communicate with health care providers, manage chronic disease and engage in other health-related activities" [Lefebvre et al., (2010), p.667]. In many countries, such as the USA, the UK, Canada and Germany, health organisations are using Microsoft HealthVault for patients (Kostadinovska et al., 2015). In Canada, TELUS launched their own personal health record (PHR) system: 'TELUS health space' is powered by Microsoft HealthVault and hosted on Canadian servers. TELUS health space "is a comprehensive solution for consumers, physicians, government and the private sector, seamlessly connecting to PHRs, electronic medical records (EMRs), portable health devices, healthcare applications and existing information systems" (TELUS Health Space, 2016).

Although Canada has paid billions of dollars for innovative technology in general and e-health applications (such as EMRs) in particular, it is still facing barriers in the adoption process of these applications (Dickson, 2016; Razmak and Bélanger, 2016). Nevertheless, several provincial governments in Canada, such as the governments of Ontario, British Columbia and Saskatchewan, are asking for transformational change with a focus on patient-centred change (Dickson, 2016). Some Canadian healthcare organisations, such as Sunnybrook Hospital, have moved toward patient-centred technological change, establishing patient-physician electronic communication through MyChart as a PHR portal. Sunnybrook has also identified some concerns related to patient access to information and its impact on the patient-physician electronic relationship (Chung et al., 2012). Understanding Canadian e-health applications paradoxes requires more investigation into human technology behaviour, specifically in a country that is multicultural, which adds layers to the range of personal idiosyncrasies. Therefore, the main objective of this study is to explore the role of personality traits and psychological factors in predicting behavioural attitudes toward adopting the patient-physician electronic relationship (through a PHR system) for a group of Canadians living in a selected region of the province of Ontario. Section 2 presents the study's conceptual framework along with an overview of the Canadian patients' competencies and characteristics, as well as certain psychological factors related to their usage of PHRs.

Section 3 describes the study's methods and materials, including the study approach, participants and measurements scale. Section 4 presents the data analysis and results of the study's quantitative assessment. Section 5 discusses and recommends some actions that could help Canadian healthcare policy makers in their future decisions. The final section concludes with a few key points, some limitations and a discussion of avenues for future research.

2 Conceptual framework

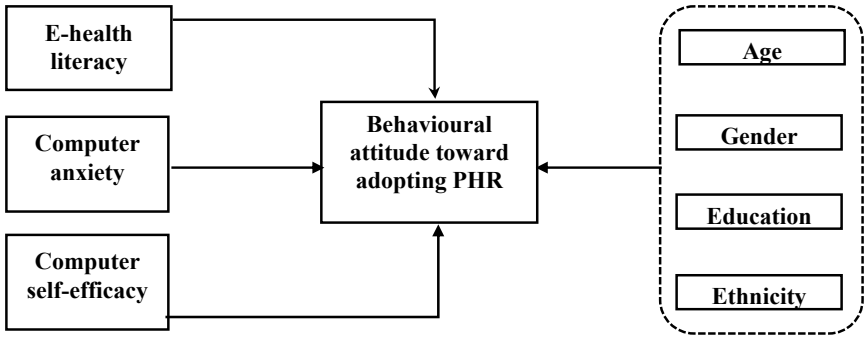
This study presents a two-stage model for the adoption of a patient portal (see Figure 1), driven by information provided by physicians on their referrals to patients to seek health information from health-related websites. Analysing this information led to a two-path model: the first involves characteristics of patients and their behavioural attitude toward adopting a PHR portal; the second involves the influence of three psychological factors (e-health literacy, computer self-efficacy and computer anxiety) on patients' behavioural attitudes toward adopting a PHR portal. The selected psychological factors have been adapted from several previous studies (Compeau and Higgins, 1995; Heinssen et al., 1987; Norman and Skinner, 2006). We asked three research questions to conduct an initial assessment of website referrals for health purposes and tested the two paths of the study research model.

1 Are there any significant differences between physicians' and patients' answers in terms of website referrals for healthcare purposes?

2 Do the individual characteristics of sex, age, education and ethnicity have an effect on determining behavioural attitudes toward a PHR portal?

3 Can psychological factors (computer self-efficacy, computer anxiety and e-health literacy) predict behavioural attitudes toward adopting a PHR portal?

Figure 1 Research model and hypotheses



In order to answer these questions, we conducted a review of the support physicians provide patients when referring them to websites for healthcare purposes. These referrals were themselves reviewed to determine the effects of patients' characteristics on future usage of the PHR system. In addition, we explored certain psychological factors that could help predict patients' future attitudes.

2.1 Website referrals by physicians

Traditionally, one must speak with a student's teacher to find out whether that student has acquired competency in a given skill; similarly, we believe that physicians can assess their patients' competencies. The national physician survey (NPS) in Canada has provided us with customised data from the 2014 survey on physicians' responses regarding patient referrals to any websites, whether for healthcare or other purposes (NPS, 2014). The customised data relates to the physicians' population in the region under study (N = 2114). When responding to this question, 67.3% of 310 physicians' responses were positive and 32.7% were negative. For those who answered yes (n = 212), the second question asked about the purpose of referring their patients to any websites. As shown in Table 1, physicians indicated that the main purpose of their referral was to encourage the patient to seek information about diseases (90.6%), treatments (73.3%) and lifestyle/disease prevention (63.9%).

Table 1 Physicians' purpose for website referrals

Purpose of website referrals	*Physicians*
Disease information	90.6%
Treatment information	73.3%
Lifestyle/disease prevention information	63.9%
Patient support	61.7%
Other	3.1%

Browsing websites for electronic health information can act as a gateway that provides a useful self-management tool for active and informed healthcare patients (Jin, 2012). When physicians encourage their patients to seek out e-health information, they are contributing to creating an environment conducive to allowing these patients to manage their personal medical concerns and develop partnerships with physicians electronically (Ferguson, 2007; Winston et al., 2012). However, some physicians have concerns about developing a collaborative relationship with their patients, reasoning that patients' lack of trust in their physicians and inconsistency in information quality reduce the quality of healthcare (Norris, 2007; Whetten et al., 2006; Winston et al., 2012). Indeed, the slow adoption of EMRs by Canadian physicians is indicative of some of these concerns, in addition to their concern about an increased workload generated from online communication with their patients. Nevertheless, Table 1 demonstrates the advantages of an active PHR portal website that allows patients to communicate with their physicians. Before exploring patients' attitudes toward this website, let us ask this question: do patients' responses corroborate the percentages of website referrals from their physicians? The first and second hypotheses attempted to verify any differences between the responses on website referrals by physicians and patients using e-health services.

H1 There is no difference between the two population proportions regarding website referrals in physicians' responses about their patients and in patients' responses about their physicians.

H2 There is no difference between the two population proportions regarding the purpose of website referrals in physicians' responses about their patients and in patients' responses about their physicians.

2.2 Users' characteristics and competencies

A major issue facing the adoption of e-health applications today is the growing challenge created by the baby boomers' healthcare needs and their level of computer literacy. The most recent population estimates indicate that the number of Canadians aged 65 and over is projected to reach 20.1% in July 2024 (The Annual Demographic Estimates, 2015). The 2013 sex structure of the Canadian population counted 98 males for every 100 females and 'males outnumbered females in the 0–14 and 15–39 age ranges, owing to the sex ratio at birth, which averages 105 males per 100 females'. The working age population is 48.9% for the younger segment (aged 15 to 39) and 51.1% for the older segment (aged 40 to 64) (The Annual Demographic Estimates, 2013).

Linking these percentages to technical skills, Statistics Canada conducted a survey of 5,048 Canadians actively using information technology through the internet. They found that those with higher levels of education and income are more likely to use IT and access the Internet from places other than their home. The percentage is higher in Ontario compared with other provinces and for those under 55 and men compared with other segments (EKOS, 2011). Younger Canadians are more active than older Canadians with IT and the Internet and more knowledgeable about online threats and security. However, "older Canadians are less active, but more concerned about security," and they are always looking for methods to protect themselves online [EKOS, (2011), p.7]. We cannot overlook the fact that most Canadian patients are from an aging segment, which increases their resistance to adopting e-health.

According to Dewing and Leman (2006), the concept of multiculturalism refers to demographic information defining people from different ethno-cultural backgrounds in a single society or organisation. Using data from the 2011 Census, the Ethnocultural Mosaic determined that, at that time, Canada had more than 200 different ethnic origins, including Aboriginal peoples, European groups and immigrants from visible minority groups who came to Canada over the past century (Bélanger and Wardley, 2014; Statistics Canada, 2013). In Ontario alone, for example, visible minorities in 2011 represented 52.3% (= 3,279,600) of the population of Ontario, which is more than half of Canada's total visible minority population (Statistics Canada, 2013). Multiculturalism is an important factor in the adoption of e-health technology, because it creates a veritable smorgasbord of ethno-cultural perspectives on and experiences in, technology acceptance.

Some Canadian physicians have expressed their support for the public to adopt PHR systems. For example, Dr. Jay Mercer from the Central Ottawa Family Medicine Associates is one of the earliest adopters of EMRs and he believes that a PHR portal, as an e-health application, is very important for patients because it allows them to access health information without ever leaving home (Canada Health Infoway, 2014). Another early EMR adopter, Dr. William Haver, is one of 26 physicians in Saskatoon's Lakeside Medical Clinic and he believes that a PHR portal based on EMRs is a much-needed tool in patient care. The electronic relationship created through a PHR system would improve communication between physicians and patients by sharing healthcare information and it would enhance the quality of records by highlighting inaccuracies and lessen the burden of care by encouraging patients to manage their own health and illness (Pagliari et al., 2007). Unfortunately, because PHRs and patient portals are often novel concepts to patients, they have not yet overcome their anxiety and resistance, two major barriers regardless of patient age. In conclusion, examining users' characteristics led us to the

following question: where is the middle ground between users' characteristics and PHR adoption? Our third hypothesis, therefore, attempted to verify the effect of individual characteristics on attitudes toward adopting a patient portal or PHR system.

H3 Individual characteristics will have no significant effect on attitudes toward adopting a PHR portal.

2.3 Psychological factors affect users' characteristics and competencies

Several studies have focused on factors facilitating the adoption of a PHR system from a patient's perspective (Househ et al., 2014). For example, Day and Gu (2012) studied the motivating factors that influenced patients' use of PHRs, such as computer literacy, the effectiveness and efficiency of the system and an improved patient-physician relationship. Other scholars have investigated the characteristics of patients who choose to share health information and assessed their behavioural and emotional feedback (Gibbons et al., 2009). As a result, these scholars have proposed that in order to take e-health to the next level, research must now focus on psychological aspects and shift away from the emphasis placed on the technical side of e-health in past research (Kaplan, 2001; Berg et al., 2003; Spitzer, 2009). Psychological factors have rarely been considered in the relationship between patients and e-health technologies. An additional consideration is that implementing e-health is a complex process that may not necessarily result in the planned outcomes, specifically in regional communities. For example, more than 250 regions across the USA have created "collaborative regional health information organisations" to support the implementation of electronic health records to exchange health data (Goroll et al., 2009). Nevertheless, implementation has been hampered by barriers ranging from lack of capital and technical standards – particularly in converting paper records to electronic form – to concerns about privacy and confidentiality (Goroll et al., 2009; Miller et al., 2005; Walker et al., 2005).

As another example, the introduction of EMRs in the UK's National Health Service is four years behind schedule and each major hospital deployment has encountered significant problems including strong resistance, lack of use and staff members' perceived negative computer attitudes (Whittaker et al., 2013). Based on the UK situation, we can expect that the psychological impacts of limited access to Canadian e-health systems may generally translate into insufficient access to healthcare systems. Deteriorating health may also cause psychological stress for various reasons, including disease-associated stress, anxiety and the psychological consequences of limited medical attention, such as feelings of frustration and helplessness. However, the main challenge is to gain insight into the everyday lives of healthcare providers and patients to integrate these observations into e-health when relevant (Veen et al., 2011). Therefore, the NPS question was intended to obtain the patients' own perspectives on their physicians' answers on the one hand and to examine these patients' behavioural attitude toward the patient portal (PHR) on the other hand. The question was also intended to determine whether their behavioural attitude could be predicted by the three following factors: e-health literacy, computer self-efficacy and computer anxiety. Table 2 provides a summary of these factors including their definitions, factor items and literature sources in an attempt to verify the last hypothesis in predicting patients' attitudes toward a PHR portal.

H4 There is no significant prediction or positive relationship between the psychological variables (e-health literacy, computer self-efficacy and computer anxiety) and behavioural attitudes of patients toward adopting a PHR portal.

Table 2 Components of behavioural factors

	Definitions and factor items	*Source*
1	*E-health literacy (EHL):* 'the ability to seek, find, understand and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem'.	Norman and Skinner (2006)
	• *EHL1* – I know how to find helpful health resources on the internet.	
	• *EHL2* – I know how to interpret the health information I find on the internet.	
	• *EHL3* – I feel confident in using information from the Internet to make health decisions.	
2	*Computer self-efficacy (CSE):* 'a judgment of human's capability to use a computer'.	Compeau and Higgins (1995)
	• *CSE1* – I could complete a job using a secure online hospital website even if I had never used similar website like it before.	
	• *CSE2* – I could complete a job using a secure online hospital website if someone else had helped me get started.	
3	*Computer anxiety (CA):* 'the fear of computers when using the computer, or when considering the possibility of computer use'.	Heinssen et al. (1987)
	• *CA1* – I do not think I would be able to learn how to use a computer to exchange health information with my doctor.	
	• *CA2* – I feel insecure about my ability to interpret a computer health information printout.	
	• *CA3* – It scares me to think that I could cause the computer to destroy a large amount of health information by hitting the wrong key.	
4	*Behavioural attitude (ATT):* 'the degree to which performance of the behaviour is positively or negatively valued'.	Ajzen (1991)
	• *ATT1* – Using a secure online hospital website to manage my health information is a wise idea.	
	• *ATT2* – I think it would be very good to use electronic records rather than paper records.	

3 Materials and method

3.1 Study approach

The research questions and the above hypotheses were tested with four statistical approaches: Descriptive statistics, a Z-test for two proportions, ANOVA and multiple regressions. The first two approaches were used to make a comparative analysis between physicians' and patients' responses to the same questions. The third statistical approach was used to explore whether patients' characteristics have an effect on their behavioural

attitudes toward adopting the patient-physician electronic relationship. The fourth approach sought to explore whether behavioural attitude toward adopting a patient-physician electronic relationship could be predicted by e-health literacy, computer self-efficacy and computer anxiety.

3.2 Participants and procedure

The study uses a survey design, a popular and common strategy in empirical research that is usually associated with a deductive approach (Saunders et al., 2011). The target population for this study was a representative region of Ontario, Canada. Two samples of data were used. Customised secondary data from the 2014 NPS in the same region for approximately 2,196 physicians shows that only 323 physicians participated in this survey in the selected region. This first sample was from all socio-economic and demographic levels, male and female and within several age groups from < 35 to 65+. The second sample was collected as primary data that represented 325 participants in the same region to collect their opinions on their physicians' responses and to predict their attitudes toward the use of e-health services. This sample included subgroups of various ages, genders and ethnicities/cultures, readily accessible in public places (e.g., mall-intercept personal interviews) to help ensure that the sample represented the entire population base. The survey was approved by the Research Ethics Board at the Laurentian University in Ontario, Canada.

3.3 Measures

In the primary survey, we used the same measurement as the NPS (Yes/No) questions to make the comparison between physicians and patients. As noted in Table 2, all survey items were measured on a five-point Likert scale, ranging from 1 for 'very strong' to 5 for 'not strong at all'.

4 Results

The results show the key topics of the study's conceptual framework, which includes descriptive statistics and a Z-test for the comparative analysis of physicians' and patients' answers, univariate ANOVA for users' characteristics and multiple regressions for the human behavioural factors.

4.1 Descriptive statistics

Table 3 presents the demographic information collected from the primary sample of participants to explore their attitudes toward patient-physician electronic relationships. As shown in Table 3, 60.6% of respondents (out of 325) were female and 39.4% were male. Since many studies have focused on e-health for seniors, this study focuses on the technology generation. We divided the age groups into three generations: < 35 technology generation, 35–54 semi-technology generation and 55+ early-technology generation.

Table 3 Descriptive statistics and demographic data for a sample of patients

Demographics		*Respondents*			
		N	*N (%)*	*M*	*SD*
Sex	Male	128	39.4	3.6367	.97350
	Female	197	60.6	3.5431	1.03973
	Total	325	100.0	3.5800	1.01367
Age	< 35 technology generation	194	59.7	3.6443	.94529
	35–54 semi-technology generation	87	26.8	3.6034	1.10269
	55+ early-technology generation	44	13.5	3.2500	1.08102
	Total	325	100.0	3.5800	1.01367
Ethnicity	Caucasian/white	202	62.2	3.5891	.98470
	Aboriginal	18	5.5	3.2222	1.10110
	Black	21	6.5	3.5476	1.08288
	Asian	60	18.5	3.7083	1.00124
	Other	24	7.4	3.4792	1.16544
	Total	325	100.0	3.5800	1.01367
Degree	No degree	16	4.9	3.0625	1.20934
	Grade 12	90	27.7	3.3278	.98346
	Diploma	90	27.7	3.5722	1.05085
	Bachelor's	77	23.7	3.8636	.80556
	Master's	47	14.5	3.8936	1.00508
	PhD	5	1.5	2.6000	1.14018
	Total	325	100.0	3.5800	1.01367

Figure 2 Physicians' referrals to websites by sex category

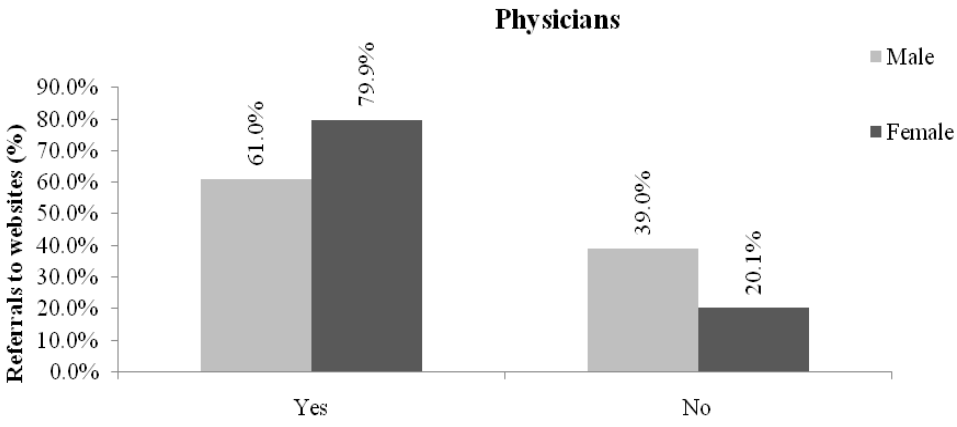
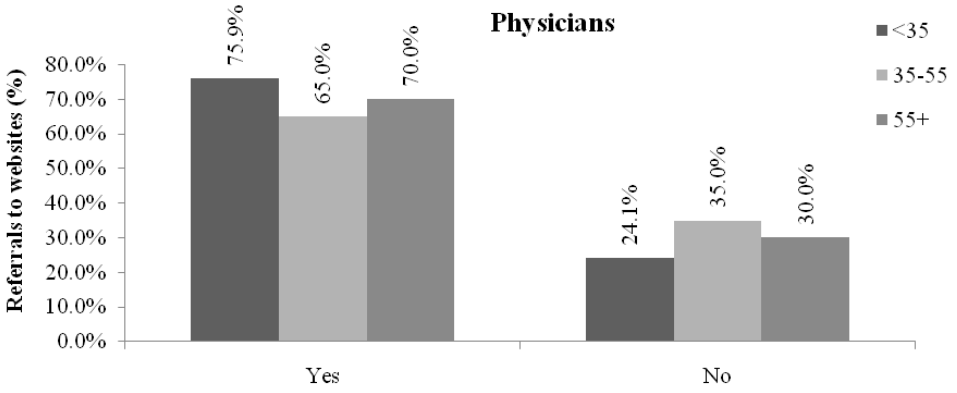


Figure 2 indicates the percentage of physicians who refer their patients to any websites, broken down by the sex of the physician (61.0% of males and 79.9% of females). Figure 3 shows the physicians' referrals broken down by physician age (75.9% under age 35 and 70% above age 55).

Figure 3 Physicians' referrals to websites by age category



Figures 4 and 5 reveal a similar pattern but for patients' responses, with vastly different outcomes. Only 18.7% of male patients and 16.2% of female patients indicated being referred to any websites by their physicians. Among those referred, 18.6% were under age 35 and 6.8% were above age 55.

Figure 4 Patients' responses about their physicians' referrals to any websites by sex category

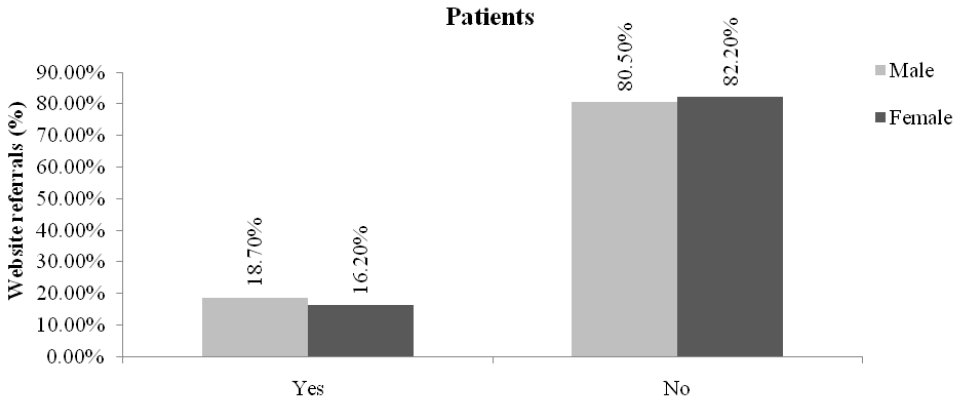


Figure 6 shows a comparison between physicians and patients on referrals to any websites. The discrepancy is large: 67.3% of physicians stated that they refer their patients to websites to get information about their healthcare, while just 17.2% of patients confirmed that their physicians referred them to any websites for the same purpose.

Figure 5 Patients' responses about their physicians' referrals to any websites by age category

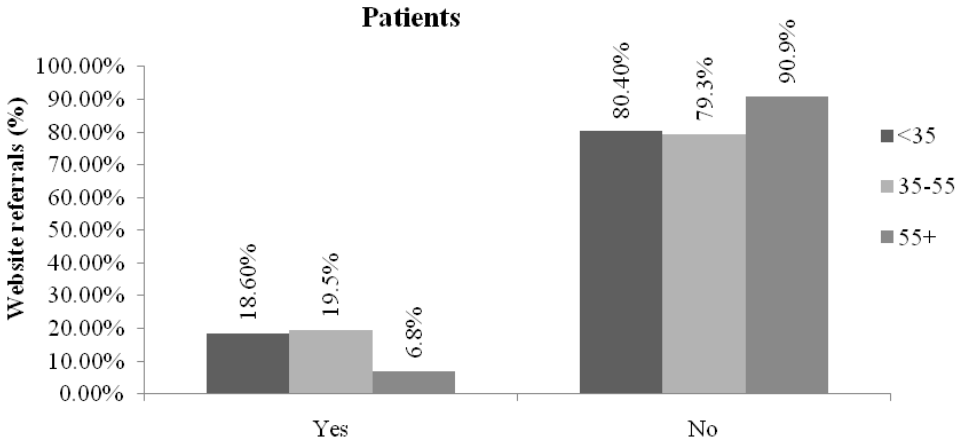


Figure 6 Physicians' responses vs. patients' responses about physicians' referrals to any websites

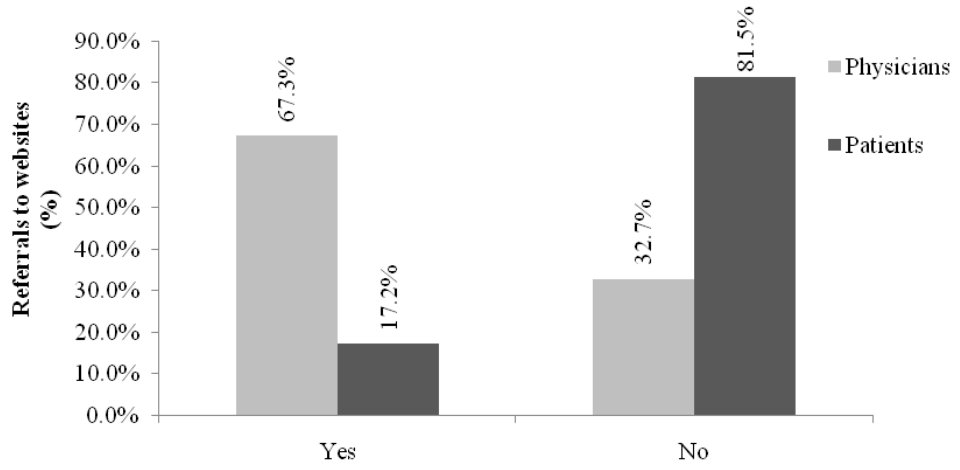
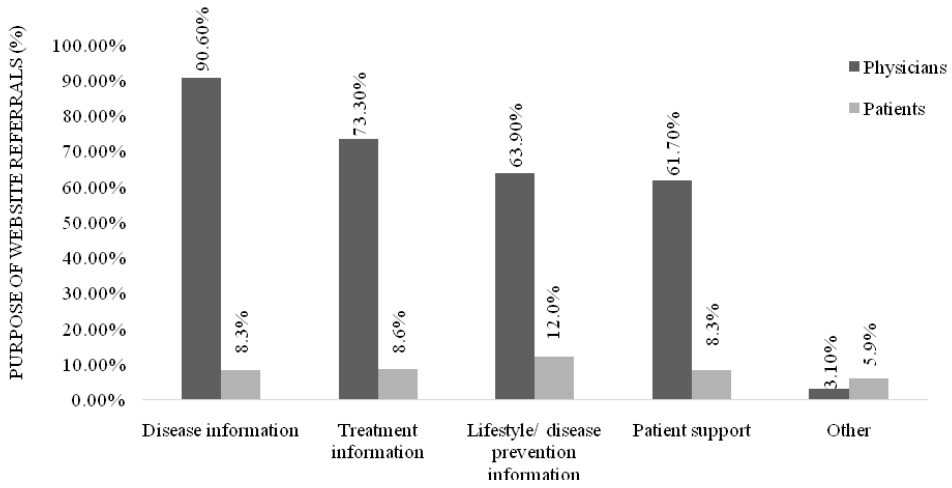


Figure 7 shows percentages for physicians' responses about the purpose of referring their patients to any websites and the responses of patients regarding the purpose of website referrals from their physicians. Physicians stated that the main purpose of their referral was to encourage patients to seek information about diseases (around 90.6%), their treatments (73.3%) and their lifestyle/disease in addition to protecting them by encouraging them to obtain reliable information about prevention (63.9%). However, only 8.3% of patients stated that the main referral purpose was to get information about their diseases, 8.6% stated it was to get information about their treatment and 12% stated it was to get information about their lifestyle/disease and to protect them through access to more elaborate prevention information.

Figure 7 Physicians' responses vs. patients' responses on the purpose of website referrals



4.2 Z-test for two population proportions (physicians vs. patients)

To answer the first research question, a Z-test for two population proportions between physicians' and patients' answers examined whether there was a significant difference between them for website referrals. Table 4 indicates that the no difference hypothesis (H1) between both answers was rejected.

Table 4 Z-test calculation of website referrals by physicians and patients

	Users	*p ^ 'yes'*	*N*	*Z-score*	*p-value*	*Decision at p < 0.05*
Website referrals for healthcare	Physicians	0.671	310	12.7446	0.001	Significant, reject H1
	Patients	0.172	321			

Table 5 Z-test calculation of the purpose of website referrals by physicians and patients

Purpose of website referrals	*Users*	*p ^ 'yes'*	*N*	*Z-score*	*p-value*	*Decision at p < 0.05*
Disease information	Physicians	0.906	212	18.9601	0.001	Significant, reject H2a
	Patients	0.083	325			
Treatment information	Physicians	0.731	212	15.414	0.001	Significant, reject H2b
	Patients	0.086	325			
Patient support	Physicians	0.618	212	13.2947	0.001	Significant, reject H2c
	Patients	0.083	325			
Lifestyle/disease prevention information	Physicians	0.637	212	12.5079	0.001	Significant, reject H2d
	Patients	0.12	325			
Other	Physicians	0.028	212	–1.6215	0.105	Not significant, accept H2e
	Patients	0.058	325			

Table 5 also indicates a difference between the two population proportions for specific website referral purposes, based on physicians' and patients' responses. The null hypotheses H2a, b, c and d were not supported.

4.3 One-way analysis of variance (one-way ANOVA)

To answer the second research question, a one-way ANOVA with Likert scale data as parametric statistics was used to compare demographic information on patient categories and behavioural attitude toward adopting a PHR portal (Norman, 2010). The Likert scale design was sufficiently clear to generate interval measurement. The independent variable represented the four different categorical groups:

1 age

2 sex

3 degree

4 ethnicity.

The dependent variable was the sample's behavioural attitude toward adopting a PHR portal.

H3a Age will have no significant effect on attitude toward adopting an EMR-based PHR portal. The null hypothesis was supported ($F (2, 322) = 2.776$, $p = .064 > .05$).

H3b Sex will have no significant effect on attitude toward adopting an EMR-based PHR portal.

The null hypothesis was supported ($F (1, 323) = .660$, $p = .417 > .05$).

H3c Educational degree will have no significant effect on attitude toward adopting an EMR-based PHR portal. The null hypothesis was not supported ($F (5, 319) = 5.322$, $p = .000 < .05$).

Given that the education level hypothesis was significant at the .05 level, multiple comparisons by degree category of behavioural attitude toward adopting an EMR-based PHR portal were conducted to evaluate the statistical significance of differences between means and to show which groups differed from one another. Table 6 shows that there is a significant difference in behavioural attitude toward adopting e-health between the groups that have bachelor's degrees and the no-degree ($p = .037$) and grade 12 ($p = .007$) groups. In addition, there is a significant difference between the group that has master's degrees and the no-degree ($p = .042$) and grade 12 ($p = .019$) groups.

H3d Ethnicity will have no significant effect on attitude toward adopting an EMR-based PHR portal. The null hypothesis was supported ($F (4, 320) = .868$, $p = .483 > .05$).

Table 6 Multiple comparisons of behavioural attitude toward adopting e-health by degree category

(I) DEGREE	*(J) DEGREE*	*MD (I-J)*	*SE*	*Sig.*	*95% confidence interval*	
					Lower bound	*Upper bound*
Bachelor's	No degree	.80114*	.26966	.037	.0280	1.5743
	Grade 12	.53586*	.15236	.007	.0990	.9727
	Diploma	.29141	.15236	.396	–.1454	.7282
	Master's	–.02998	.18167	1.000	–.5509	.4909
	PhD	1.26364	.45295	.062	–.0350	2.5623
Master's	No degree	.83112*	.28408	.042	.0166	1.6456
	Grade 12	.56584*	.17663	.019	.0594	1.0723
	Diploma	.32139	.17663	.455	–.1850	.8278
	Bachelor's	.02998	.18167	1.000	–.4909	.5509
	PhD	1.29362	.46168	.060	–.0301	2.6173

Note: *The mean difference is significant at the 0.05 level.

4.4 Multiple regression analysis

To answer the final research question, multiple regression was conducted to examine the significant prediction and positive relationship between the psychological variables (e-health literacy, computer self-efficacy and computer anxiety) and the behavioural attitude of the patients toward adopting a PHR portal. Table 7 shows that the model is statistically significant ($F(3, 321) = 62.706$, $p < .001$), explaining 36.9% of the variance in the patients' behavioural attitude toward adopting a patient portal. The results of H4 are as follows:

H4a The e-health literacy variable does not significantly predict attitude toward adopting a PHR portal. The null hypothesis was not supported ($\beta = .266$, $p = .000 < .001$).

H4b The computer self-efficacy variable does not significantly predict attitude toward adopting a PHR portal. The null hypothesis was not supported ($\beta = .356$, $p = .000 < .01$).

H4c The computer anxiety variable does not significantly predict attitude toward adopting a PHR portal. The null hypothesis was not supported ($\beta = –.126$, $p = .007 < .05$).

Table 7 Multiple regression analysis of the influence of psychological variables on the behavioural attitude of patients toward adopting a PHR portal

Variables		*R*	*R2*	*B*	*SE*	*β*	*t*	*Sig.*
Model 1	(Constant)	.608a	.369	1.568	.247		6.345	.000
	E-health literacy			.273	.059	.266	4.673	.000
	Computer self-efficacy			.372	.059	.356	6.282	.000
	Computer anxiety			–.127	.046	–.126	–2.735	.007

5 Discussion

5.1 Website referrals

The first research question includes a comparative analysis of physicians and patients on website referrals and the purpose of these referrals. There are significant differences between physicians' and patients' responses, which could generate more debate in establishing future electronic relationships. The main goal in this study is not to present the contradictions between the answers, but to bring both parties to an effective online communication that could reduce waiting time for patients and improve quality of life for Canadians. The results of this comparative analysis reveal two indicators that healthcare policy could build on. The first is that the answers given by physicians indicate their intended support of their patients in allegedly referring them to websites for several healthcare purposes. The second is that, for patients, simply responding to these questions will at least have increased their awareness of e-health services. Healthcare policy makers must build on these indicators by establishing a plan that enhances physicians' support and increases patients' awareness; this will require investing in a long-term strategy that focuses on technology generation.

5.2 Characteristics of users and their attitude toward adopting a PHR portal

The second research question involves the individual characteristics that have an effect on people's attitudes toward PHR technology. The findings indicate that age, gender and ethnicity do not significantly affect people's attitudes; only educational degree level was found to have a significant effect. Additional analysis (a multiple comparisons test) conducted among six educational categories indicates that statistically significant differences exist between the groups that have bachelor's degrees and grade 12 education, the groups that have master's degrees and no degree and the groups that have master's degrees and grade 12 education.

The pattern of results among age, gender, ethnicity and attitude toward PHR portals agrees with the study hypothesis and our expectations. Generally speaking, no demographic differences, except for education, were found to significantly affect behavioural attitude. This result is consistent with some studies and contradicts others in showing that there is no significant effect of patient user characteristics on their acceptance of health technologies. For example, Or and Karsh (2009) conducted a systematic review of patient characteristics and their effect on acceptance of health technologies. After examining 39 studies, age was found to have a significant effect for 26 participants, while for 11 the opposite was found to be true. The gender factor also showed no effect in 84% of these studies, but education as a factor did influence acceptance: 68% of 28 studies showed that acceptance increased with higher education, which is consistent with our results. It seems that patients with a bachelor's degree or higher have a greater ability to adopt a PHR system; this result is also consistent with other studies, such as Ammenwerth et al. (2012), Mossaed et al. (2015) and Wen et al. (2010).

This implies that people with higher education are more positively disposed toward PHR systems than are those with grade 12 and college education, which also implies that more highly educated individuals have better technology skills and greater health literacy.

We believe that education is the most important factor in improving the ability to understand health information and new technology (Agarwal and Prased, 1999; Jian et al., 2012). Therefore, the group of people with bachelor's or master's degrees are expected to be the first adopters, which could be helpful if they demonstrate their engagement with this technology in their communities in the future. More than half of our participants were in the technology generation category, which implies that e-health technology could become another common application in addition to the many that they are already using in their daily lives. Indeed, as we mentioned above, this result implies that, as a long-term investment, working on e-health applications is more worthwhile than spending money to encourage the early-technology generation to adopt these systems. For example, investing in a new education system with an application such as an e-learning system will provide the most effective results.

5.3 Psychological predictors of users' attitudes toward adopting a PHR portal

The regression model in the third research question investigates the psychological influences (e-health literacy, computer self-efficacy and computer anxiety) associated with behavioural attitude. The model explains 36.9% of the variance in the behavioural attitude toward adopting a PHR system for the individuals surveyed (as shown in Table 7). The results indicate a significant positive prediction of the e-health literacy factor on behavioural attitude, a significant positive prediction of the computer self-efficacy factor on behavioural attitude and a significant negative prediction of computer anxiety on behavioural attitude.

Although people indicate their acceptance of e-health technologies, some physicians worry about patients' ability, anxiety, distress and confusion, which results in a greater workload for healthcare providers (Earnest et al., 2004; Walker et al., 2011; Woods et al., 2013). Investigating computer anxiety, computer self-efficacy and e-health literacy as predictors of PHR acceptance will provide useful data that could reduce physicians' concerns in the future. Our results indicate that computer self-efficacy and e-health literacy play a significant role in shaping people's attitudes, with no significant effect for computer anxiety. These results are consistent with other studies that have used these variables as predictors of acceptance of new technologies (Compeau and Higgins, 1995; Compeau et al., 1999; Hsu and Chiu, 2004; Kim and Abner, 2015; Mossaed et al., 2015; Tripathi et al., 2009; Venkatesh, 2000; Wen et al., 2010). Our results confirm their suggestions by encouraging a positive behavioural attitude toward PHR systems in several ways. Encouragement could come in the form of support from healthcare institutions, including medical staff. This could be achieved through training programs and workshops aimed at increasing users' levels of computer self-efficacy and decreasing their anxiety, which by extension would increase their levels of e-health literacy as well.

Low computer self-efficacy affects usage of new technology due to concerns regarding privacy and security; this effect extends to the adoption of a PHR portal (Jian et al., 2012). This study has found that computer self-efficacy can predict people's attitudes toward the adoption of PHRs. In addition, computer anxiety has a direct negative relationship with attitudes toward using new technology such as a PHR system, which is consistent with other studies (Archer and Cocosila, 2014; Venkatesh et al., 2003). For e-health literacy, the result implies that patients do not indicate a lack of e-health literacy as a factor affecting PHR adoption. In e-health tasks, mixed results were found in people's PHR self-management skills. In addition, it was found that a low

percentage of patients believed in their ability to perform several tasks online. Because the present study explores only perception of ability for future use, this result is to be expected and can be improved with future support from healthcare stakeholders. Generally speaking, the skills needed to increase health literacy as part of the PHR adoption process must be acquired through hands-on practice, that is, by actually using the system. To fully engage people with the PHR system, we suggest using health literacy principles that have been developed through educational materials, focusing on privacy and security issues (Tripathi et al., 2009; Wen et al., 2010). Additionally, further research should broaden our understanding of e-health literacy in relation to users' characteristics, particularly for age and education differences. Lower computer or health literacy is usually present in older patients, who bring with them a negative attitude toward technology such as PHR systems (Or and Karsh, 2009; Patterson et al., 1997). In addition, some studies show that patients with a higher level of education have improved health literacy compared with patients who are less educated (Levinson et al., 2005; Mossaed et al., 2015; Peters et al., 2009).

6 Conclusions

To obtain thorough evidence, this study focused simultaneously on several variables pertaining to the initial steps in the adoption of a PHR system. Generations of users, both physicians and patients, who have been educated on how to use technology are at the forefront of the movement toward the successful adoption of e-health services. Further research should investigate these specific variables to show the evolution of users' characteristics, self-efficacy, anxiety and level of health e-literacy regarding PHRs. We can conclude that low computer efficacy and high computer anxiety lead to low usage of PHRs, which results in a waste of taxpayers' hard-earned money. The model of these three variables explains the relatively low percentage we obtained in terms of our ability to predict the behavioural attitude of people toward PHRs. This implies that our model could explain more of the variance if other relevant psychological factors were added as predictive independent variables.

References

Agarwal, R. and Prasad, J. (1999) 'Are individual differences germane to the acceptance of new information technologies?', *Decision Sciences*, Vol. 30, No. 2, pp.361–391.

Ajzen, I. (1991) 'The theory of planned behavior', *Organizational Behavior and Human Decision Processes*, Vol. 50, No. 2, pp.179–211.

Ammenwerth, E., Schnell-Inderst, P. and Hoerbst, A. (2012) 'The impact of electronic patient portals on patient care: a systematic review of controlled trials', *Journal of Medical Internet Research*, Vol. 14, No. 6, pp.1–27 [online] http://doi.org/10.2196/jmir.2238.

Archer, N. and Cocosila, M. (2014) 'Canadian patient perceptions of electronic personal health records: an empirical investigation', *Communications of the Association for Information Systems*, Vol. 34, No. 1, p.20.

Bélanger, C.H. and Wardley, L.J. (2014) 'Can too much diversity be a threat to identity?', in Krempkow, R., Pohlenz, P. and Huber, N. (Eds.): *Diversity Management und Diversität in der Wissenschaft*, pp.205–224, UniversitätsVerlag, Germany.

Berg, M., Aarts, J. and Van Der Lei, J. (2003) 'ICT in healthcare: sociotechnical approaches', *Methods of Information in Medicine*, Vol. 42, No. 4, pp.297–301.

Canada Health Infoway (2014) *Patient Portals Open the Door to Patient-Driven Care* [online] https://www.infoway-inforoute.ca/en/home/209-what-we-do/digital-health-and-you/stories/376-patient-portals-open-the-door-to-patient-driven-care (accessed 5 February 2016).

Chung, K., Cheng, S., Rose, K., Marafioti, S. and Leonard, K.J. (2012) 'The development and change management strategy of Sunnybrook health sciences centre's MyChart™', *Electronic Healthcare*, Vol. 10, No. 3, pp.e10–14.

Compeau, D., Higgins, C.A. and Huff, S. (1999) 'Social cognitive theory and individual reactions to computing technology: a longitudinal study', *MIS Quarterly*, pp.145–158.

Compeau, D.R. and Higgins, C.A. (1995) 'Computer self-efficacy: development of a measure and initial test', *MIS Quarterly*, pp.189–211.

Day, K. and Gu, Y. (2012) 'Influencing factors for adopting personal health record (PHR)', *Stud. Health Technol. Inform.*, Vol. 178, pp.39–44.

Dewing, M. and Leman, M. (2006) *Canadian Multiculturalism*, Library of Parliament, Parliamentary Research Branch.

Dickson, G. (2016) 'Health reform in Canada enabling perspectives for health leadership', in *Healthcare Management Forum*, Vol. 29, No. 2, pp.53–58, SAGE Publications.

Earnest, M.A., Ross, S.E., Wittevrongel, L., Moore, L.A. and Lin, C.T. (2004) 'Use of a patient-accessible electronic medical record in a practice for congestive heart failure: patient and physician experiences', *Journal of the American Medical Informatics Association*, Vol. 11, No. 5, pp.410–417.

EKOS Research Associates (2011) *Baseline, Online Probability Survey of Internet Users Regarding Cyber Security* [online] http://www.ekospolitics.com/articles/032-11.pdf (accessed 15 January 2016).

Ferguson, T. (2007) 'E-patients: how they can help us heal healthcare', *Patient Advocacy for Health Care Quality: Strategies for Achieving Patient-Centered Care*, pp.93–150.

Gibbons, M.C., Wilson, R.F., Samal, L., Lehmann, C.U., Dickersin, K., Lehmann, H.P. and Bass, E.B. (2009) 'Impact of consumer health informatics applications', *Agency for Healthcare Research and Quality*, Report No.09(10)-E019, Rockville, MD.

Goroll, A.H., Simon, S.R., Tripathi, M., Ascenzo, C. and Bates, D.W. (2009) 'Community-wide implementation of health information technology: the Massachusetts ehealth collaborative experience', *Journal of the American Medical Informatics Association*, Vol. 16, No. 1, pp.132–139.

Heinssen, Jr., R.K., Glass, C.R. and Knight, L.A. (1987) 'Assessing computer anxiety: development and validation of the computer anxiety rating scale', *Computers in Human Behavior*, Vol. 3, No. 1, pp.49–59.

Househ, M.S., Borycki, E.M., Rohrer, W.M. and Kushniruk, A.W. (2014) 'Developing a framework for meaningful use of personal health records (PHRs)', *Health Policy and Technology*, Vol. 3, No. 4, pp.272–280.

Hsu, M.H. and Chiu, C.M. (2004) 'Internet self-efficacy and electronic service acceptance', *Decision Support Systems*, Vol. 38, No. 3, pp.369–381.

Jian, W.S., Syed-Abdul, S., Sood, S.P., Lee, P., Hsu, M.H., Ho, C.H. and Wen, H.C. (2012) 'Factors influencing consumer adoption of USB-based Personal Health Records in Taiwan', *BMC Health Services Research*, Vol. 12, No. 1, p.277.

Jin, S.A.A. (2012) 'To disclose or not to disclose, that is the question: a structural equation modeling approach to communication privacy management in e-health', *Computers in Human Behavior*, Vol. 28, No. 1, pp.69–77.

Kaplan, B. (2001) 'Evaluating informatics applications – some alternative approaches: theory, social interactionism and call for methodological pluralism', *Int. J. Med. Inf.*, Vol. 64, No. 1, pp.39–56.

Kim, S. and Abner, E. (2015) 'Predictors affecting personal health information management skills', *Informatics for Health and Social Care*, Vol. 41, No. 3, pp.1–19.

Kostadinovska, A., De Vries, G.J., Geleijnse, G. and Zdravkova, K. (2015) 'Employing personal health records for population health management', in *ICT Innovations 2014,* pp.65–74, Springer International Publishing.

Lefebvre, R.C., Tada, T., Hilfiker, S.W. and Baur, C. (2010) 'The assessment of user engagement with eHealth content: the eHealth engagement scale', *Journal of Computer-Mediated Communication*, Vol. 15, No. 4, pp.666–681.

Levinson, W., Kao, A., Kuby, A. and Thisted, R.A. (2005) 'Not all patients want to participate in decision-making', *Journal of General Internal Medicine*, Vol. 20, No. 6, pp.531–535.

Miller, R.H., West, C., Brown, T.M., Sim, I. and Ganchoff, C. (2005) 'The value of electronic health records in solo or small group practices', *Health Affairs*, Vol. 24, No. 5, pp.1127–1137.

Mossaed, S., Leonard, K. and Eysenbach, G. (2015) 'Patient preferences and perspectives on accessing their medical records', *Journal of Medical Imaging and Radiation Sciences*, Vol. 46, No. 2, pp.205–214.

National Physician Survey (NPS) (2014) *College of Family Physicians of Canada, Canadian Medical Association, Royal College of Physicians and Surgeons of Canada (Q#12)* [online] http://nationalphysiciansurvey.ca/wp-content/uploads/2014/10/NPS-2014-Questionnaire-EN.pdf. (accessed 20 January 2016).

Norman, C.D. and Skinner, H.A. (2006) 'eHEALS: the eHealth literacy scale', *Journal of Medical Internet Research*, Vol. 8, No. 4, pp.1–18 [online] http://doi.org/10.2196/jmir.8.4.e27.

Norman, G. (2010) 'Likert scales, levels of measurement and the 'laws' of statistics', *Advances in Health Sciences Education*, Vol. 15, No. 5, pp.625–632.

Norris, P. (2007) *Skeptical Patients: Performance, Social Capital and Culture. The Trust Crisis in Healthcare*, pp.32–46, Oxford University Press, New York.

Ontario Ministry of Health and Long Term Care (2015) *Putting Patients First: Action Plan for Health Care*, February [online] http://www.health.gov.on.ca/en/ms/ecfa/healthy_change/docs/rep_patientsfirst.pdf (accessed 30 November 2015).

Or, C.K. and Karsh, B.T. (2009) 'A systematic review of patient acceptance of consumer health information technology', *Journal of the American Medical Informatics Association*, Vol. 16, No. 4, pp.550–560.

Pagliari, C., Detmer, D. and Singleton, P. (2007) *Electronic Personal Health Records. Emergence and Implications for the UK*, the Nuffield Trust, London.

Patterson, T.L., Shaw, W.S. and Masys, D.R. (1997) 'Improving health through computer self-help programs: theory and practice', *Information networks for community health*, pp.219–246, Springer, New York.

Peters, K., Niebling, M., Green, T., Slimmer, C. and Schumacher, R. (2009) *Google Health vs. Microsoft HealthVault*, Vol. 11, No. 21.

Razmak, J. and Belanger, C.H. (2016) 'Interdisciplinary approach: a lever to business innovation', *International Journal of Higher Education*, Vol. 5, No. 2, p.173.

Saunders, M.N., Saunders, M., Lewis, P. and Thornhill, A. (2011) *Research Methods for Business Students, 5/e*. Pearson Education, India.

Spitzer, R. (2009) 'Clinical information and sociotechnology', *Nurse Leader*, Vol. 7, No. 3, pp.6–7.

Statistics Canada (2013) *Immigration and Ethnocultural Diversity in Canada, National Household Survey, 2011*, Catalogue no. 99-010-X201100 [online] https://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-010-x/99-010-x2011001-eng.cfm (accessed 10 February 2016).

TELUS Health Space (2016) *Patient and Consumer Health Platforms?* [online] https://www.telushealth.co/health-solutions/patient-and-consumer-health-platforms/products/personal-health-records/ (accessed 1 February 2016).

The Annual Demographic Estimates (2015) *Canada's Population: Age and Sex*, November, Catalogue no. 91-215-X, No. 2, Canada, Provinces and Territories [online] http://www.statcan.gc.ca/pub/91-215-x/91-215-x2013002-eng.pdf (accessed 10 February 2016).

The Annual Demographic Estimates Canada (2013) *Canada's Population Estimates: Age and Sex*, Catalogue no. 91-215-X, 1 July 1, Canada, Provinces and Territories [online] http://www.statcan.gc.ca/daily-quotidien/150929/dq150929b-eng.pdf (accessed 20 February 2016).

Tripathi, M., Delano, D., Lund, B. and Rudolph, L. (2009) 'Engaging patients for health information exchange', *Health Affairs*, Vol. 28, No. 2, pp.435–443.

Veen, M., Gremmen, B., te Molder, H. and Van Woerkum, C. (2011) 'Emergent technologies against the background of everyday life: discursive psychology as a technology assessment tool', *Public Understanding of Science*, Vol. 20, No. 6, pp.810–825.

Venkatesh, V. (2000) 'Determinants of perceived ease of use: integrating control, intrinsic motivation and emotion into the technology acceptance model', *Information Systems Research*, Vol. 11, No. 4, pp.342–365.

Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003) 'User acceptance of information technology: toward a unified view', *MIS Quarterly*, pp.425–478.

Walker, J., Leveille, S.G., Ngo, L., Vodicka, E., Darer, J.D., Dhanireddy, S. and Ralston, J.D. (2011) 'Inviting patients to read their doctors' notes: patients and doctors look ahead: patient and physician surveys', *Annals of Internal Medicine*, Vol. 155, No. 12, pp.811–819.

Walker, J., Pan, E., Johnston, D. and Adler-Milstein, J. (2005) 'The value of health care information exchange and interoperability', *Health Affairs Web Exclusive*, 19 January, Vol. 24, pp.W5-10–W5-18.

Wen, K.Y., Kreps, G., Zhu, F. and Miller, S. (2010) 'Consumers' perceptions about and use of the internet for personal health records and health information exchange: analysis of the 2007 health information national trends survey', *Journal of medical Internet research*, Vol. 12, No. 4, pp.1–31 [online] http://doi.org/10.2196/jmir.1668.

Whetten, K., Leserman, J., Whetten, R., Ostermann, J., Thielman, N., Swartz, M. and Stangl, D. (2006) 'Exploring lack of trust in care providers and the government as a barrier to health service use', *American Journal of Public Health*, Vol. 96, No. 4, pp.716–721.

Whittaker, L., Van Zyl, J. and Soicher, A.S. (2011) 'What is the point of the point-of-care? A case study of user resistance to an e-health system', *Telemedicine and e-Health*, Vol. 17, No. 1, pp.55–61.

Winston, E.R., Medlin, B.D. and Romaniello, B.A. (2012) 'An e-patient's end-user community (EUCY): the value added of social network applications', *Computers in Human Behavior*, Vol. 28, No. 3, pp.951–957.

Woods, S.S., Schwartz, E., Tuepker, A., Press, N.A., Nazi, K.M., Turvey, C.L. and Nichol, W.P. (2013) 'Patient experiences with full electronic access to health records and clinical notes through the My HealtheVet Personal Health Record Pilot: qualitative study', *Journal of Medical Internet Research*, Vol. 15, No. 3, pp.1–31 [online] http://doi.org/10.2196/jmir.2356.