

INFORMATION FROM THE INTERNET AND HEALTH

Hager Khechine, Daniel Pascot and Pierre Prémont

Management Information Systems department
Laval University, Quebec, Canada

Hager.Khechine@fsa.ulaval.ca, Daniel.Pascot@sio.ulaval.ca, Pierre.Premont@sio.ulaval.ca

ABSTRACT

Since the Internet is known as an excellent source of information, it can certainly offer immense information on various health topics. Consequently, the Internet could contribute to making patients become more active participants in their provisions for healthcare. The aim of this paper is to study the impact on consuming healthcare resources when a patient uses the Internet as a source of information on health. We present a quantitative model that we test empirically. Our method involves an online questionnaire addressed to Canadian residents. The targeted population was composed of patients that suffer from chronicle or long-term diseases and who have Internet access. Structural equation modeling was used for data analysis because of the latent nature of the variables. The 128 responses obtained were analyzed using SPSS and PLS tools. Field data show good reliability and validity coefficients. Also, the research hypothesis that assumes a possible relationship between the use of Internet information by patients and the consumption of healthcare resources is confirmed. Indeed, the estimated path coefficient of about 0.267 between the two studied variables is statistically significant. The results of this study are shown to have implications for researchers and practitioners.

Keywords: Internet, Health information, Health care resources, Chronicle and long-term disease, Structural equation modeling.

1. INTRODUCTION

People often use the Internet to find answers to their medical questions because it has certain advantages over traditional information mediums like newspapers, television and books. So, the use of the Internet for gathering health information is growing rapidly. Two factors are driving this upward trend. The first is the "pull" factor that reflects demand from patients who want more access to medical information. The second is the "push" factor that relates to the information providers who strive to meet patients' demands and to create new needs (Sieving, 1999).

The use of information obtained by patients on the Internet is a topic of growing interest in the fields of information management and health sciences. Many institutions such as the federal government of Canada (Comité consultatif sur l'infrastructure de la santé, 2001) and the British National Health Service (Coulter, 1999) have recognized the importance of using health information retrieved by patients on the Internet for medical reasons. Furthermore, many researchers are manifesting a special interest to this area. For instance, they look to the quality of the information in the Internet (Eysenbach et al., 2002) and the effects of the Internet on patients' outcomes (Eysenbach, 2003). This study on Internet use for health purposes is in the same vein and uses an empirical approach. The purpose of this research is to understand the relationship between patients' use of information obtained from the Internet and their consumption of medical resources.

In this paper, we first present the research objective and the research question addressed. We then make a synthesis of the theoretical foundations that underlie our objective. A research model and its hypothesis are presented in the following section. We then describe the strategies

used for collecting and analyzing data. We also explain the results obtained and the possible contributions of the research. In conclusion, we discuss about some research limits.

2. RESEARCH QUESTION AND OBJECTIVE

Our research question is: "What is the impact on patients' consumption of healthcare resources when they employ medical information obtained from the Internet?". In order to get an answer to this question, we designed a conceptual framework that we present subsequently.

Some evidence exists to reflect the inverse relationship between the variables related to the use of Internet information by patients and to the consumption of medical resources. Indeed, people that access the Internet for health concerns often find answers to their questions. This could translate to fewer calls for medical assistance, fewer meetings with a clinician for reassurance and comfort, and less requests for unnecessary medical exams (Coile, 2000).

However, the use of Internet information can also contribute to increase healthcare resources consumption. Patients can feel depressed or confused because of unpleasant or unreliable information found on the Web (Pew Internet & American Life, 2003). They will react to these situations by calling their clinicians for example. Also, patients could spend more time with their clinician because they misunderstood some medical information from the Internet.

So, the research objective is to study the relationship between the use of the Internet information by patients and their consumption of medical resources. We suppose the existence of such a relationship without specifying its sign.

3. THEORETICAL FOUNDATIONS

There are roughly between 10,000 and 20,000 Web sites specializing in health care (Eysenbach et al., 1999). It is also estimated that 52 million people across the world visit these sites (Pew Internet & American Life, 2000) and the figure is estimated to grow to 88.5 million adults in 2005. People searching the Internet for health related topics seek health information, places to shop for health products and areas to communicate with providers (Cyberdialogue, 2000). Patients tend to look for information on diseases, and especially chronic illnesses such as cancer, diabetes, allergies or heart diseases (Miller and Reents, 1998). They also use the Internet to get information about medical providers and drugs (Webb, 1997). People often participate in online discussion groups and list servers (Elsberry, 2000). These activities tend to increase the patient's comfort, which leads to a better control of their affective and emotional needs (Tetzlaff, 1997). Finally, patients also use the Internet for other functions such as communicating by electronic mail with their clinicians (Bush et al., 2000) but this practice may have significant drawbacks. First, clinicians could easily be overloaded with emails and not have enough time to answer patients' questions online (Gawande and Bates, 2000). Secondly, advice sent by email could be misunderstood by patients and thus causes patients more harm than good (Elsberry, 2000). Thirdly, many people think that using electronic communication can threaten the personal "Patient-Clinician" relationship that is quite important. Another problem with patients relying on information from the Internet is that they could use it to contest or critic a clinician and hence, cause serious tensions in their relationship (Eysenbach et al., 1999).

Despite these concerns, the Internet is still becoming a major source of health information (Pennbridge et al., 1999) and this topic raises many researchers' interest. For example, Suggs (1999) and Hjortdahl et al. (1999) focused on the effect of the use of Internet information on "Patient-Clinician" relationship. Eysenbach et al. (1999) tried to understand the impact of the use of this information on the quality of healthcare services. Eysenbach's current projects¹ deal with many topics related to Internet information used by patients. For instance, he is working on understanding the needs and preferences of consumers.

Although there is a lot of literature on the patient's use of Internet information, we did not find any empirical studies revealing how it influences the patient's consumption of healthcare resources. The lack of empirical research in this area and the relevance of this topic motivated us

¹ <http://yi.com/home/EysenbachGunther/projects.htm>. Last visited: February, 18th 2004.

to investigate the issue more carefully. In this context, the literature argues that the Internet allows patients to draw from the same knowledge base than physicians. Patients become then more educated and are considered as "informed consumers" (Ipsos-Reid, 2002; Anderson et al., 2003). They are more involved in disease prevention and healthcare decision-making (Eysenbach et al., 1999; Coile, 2000; Anderson et al., 2003). These decisions mainly concentrate on direct contacts with health resources such as making appointments with clinicians, making phone calls to medical staff, shopping for a new clinician, or preparing questions for consultations. This resource consumption will be studied by testing the research model and hypothesis that we present in the following section.

4. RESEARCH MODEL AND HYPOTHESIS

To explore our research question, we designed a research model and its hypothesis (Pascot et al., 2003). As shown in Figure 1, the model has one exogenous variable "Use of Internet information by patients" and one endogenous variable "Consumption of medical resources", both being latent.

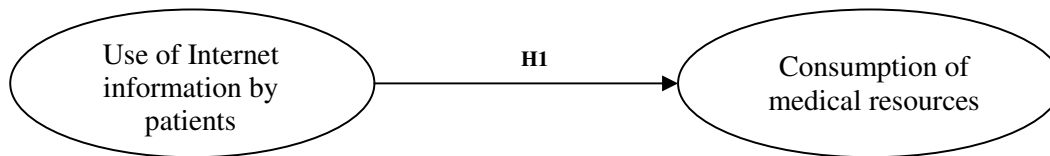


Figure 1: Research model

According to this research model, it is assumed that a relationship exists between the two variables. Indeed, patients find in the Internet some answers to their health-related questions, which will decrease their frequency of consulting clinicians. Patients should also feel comforted about their health state and hence demand fewer complementary medical exams, do fewer "shopping" for other clinicians, or call medical staff for explanations less frequently (Coile, 2000). Consequently, the use of these medical resources can be reduced when patients use Internet information.

However, many people think that the use of Internet information can increase healthcare resources consumption. In fact, people can find in the Web information that can make them confused and depressed (Pew Internet & American Life, 2003). This situation will lead them to call their clinicians or to take further appointments. In this context, Pew Internet & American Life (2003) stipulates the existence of a positive correlation between the Internet information use and the number of appointments taken to meet a health professional. Added to that, advice found in online discussion groups could be misunderstood by patients and thus contributes to worsen their health state (Elsberry, 2000). The length of the medical consultation can be extended because patients may be worried about contradictory information or technical jargon in medicine retrieved from the Internet (Pew Internet & American Life, 2003). Finally, the abundance and lack of relevance and reliability of some Internet information can lead patients to make bad choices and wrongly manage their health (Baker et al., 2003).

So, for the purpose of this research, we suppose the existence of a relationship between the use of the Internet information by patients and their consumption of medical resources. This leads to the following hypothesis:

H1: The use of Internet information by patients has an effect on their consumption of medical resources.

The measurement instruments of the research variables were essentially designed from instruments that have been used and validated by prior researches. These instruments, that show a good internal consistency, were modified in wording in order to fit the particular context of this research. For instance, the variable "Use of Internet information by patients" was measured by

assessing the intensity of navigating on the Web to look for health-related information. Its measurement instrument, made of five items, was developed from the works of Limayem and Chabchoub (1996) and Dhrif (1998). The variable "Consumption of medical resources" evaluates the use of material, human, and time-related medical resources by patients. Since we did not find any measurement instrument in the literature for this variable, we developed our own set of six items.

5. METHODOLOGY

Patients that suffer from a long-term disease and that are accustomed to using the Internet for health-related concerns represent a group well suited for our sample. We have chosen this population for two reasons. First, the aim of our research is to evaluate patients' actions and attitudes once they use the Internet. Hence, we need to get information from Internet users. Secondly, people that suffer from long-term diseases are the most inclined to use the Internet frequently for health purposes (ex. Diabetes and cancer).

The sampling is not probabilistic and we obtained 128 responses from only Canadian people in order to insure homogeneity. The health system in Canada is public and does not discern between social classes. These respondents were invited to fill an online French version of our questionnaire. An introduction letter presenting the research objective and ensuring respondents about confidentiality precedes the survey questions. The link to the questionnaire WebPages was sent to them directly or embedded in discussion forums and Web sites specialized in healthcare. For instance, the Quebec ministry on health and social services introduced our link in their Web site.

For statistical analysis, we first used SPSS 11.5 software to assess the reliability of the measurement instruments. Structural equation modeling (SEM) was the analysis method that we used to test the research hypothesis. This method includes a set of statistical analysis tools such as confirmatory factorial analysis for validity, multiple regression analysis as a multivariate statistic and the classical path analysis to evaluate the effects between variables (Mueller, 1996). Partial least squares (PLS) is the chosen procedure for SEM analysis (Wold, 1989). PLS has as advantage to model latent constructs under conditions of non-normality and small to medium sample sizes (Chin, 1998). It allows for simultaneous analysis of the relationships between measures and their corresponding constructs and between latent variables. We used PLS-Graph version 3.00 (Chin 1994).

6. RESULTS AND INTERPRETATION

As it is suggested by Hair et al. (1998), we first examined the measurement models, then the structural model. The aim of this approach was to ensure satisfying psychometric properties of the measurement instruments that allow for good conclusions on structural relationships.

6.1 The measurement models

Internal consistency was first tested by Cronbach's alpha using SPSS software. The values of alphas for the measurement instruments of the constructs "Use of Internet information by patients" and "Consumption of medical resources" are respectively 0.89 and 0.52. The first value is satisfactory because it corresponds to what is recommended by Nunally (1978). The second value can also be considered as relevant because the measurement instrument to which it is associated is tested for the first time. Indeed, Cronbach's alpha between 0.5 and 0.6 can be seen as satisfactory for preliminary researches (Nunally, 1978).

As a second step, we performed a confirmatory analysis using PLS-Graph software. Three items belonging to the measurement instrument of the endogenous variable show low loading values. They were eliminated before subsequent analysis.

Table 1 presents the loadings of the items for the two constructs. Because items were reflective, their weights are not considered. All items have significant path loadings at the 0.05 level. These loadings are higher than 0.50, as recommended by Fornell and Larcker (1987). Also, the measures fulfilled the recommended levels of composite reliability and average variance

extracted. As shown in Table 1, all the values of composite reliability (CR) and average variance extracted (AVE) were considered very satisfactory, with composite reliability at 0.83 or above and average variance extracted at 0.63 or above. These two last results ensure respectively the reliability and the convergent validity of the measurement instruments. Standard errors and t-values for items' significance are also presented in table 1.

Table 1: Psychometric Properties of Measures

	Loadings	St. Error	t-value
Use of Internet information by patients AVE = 0.70 ; CR = 0.92			
Item 1: Frequency of using the Internet during the last month	0.70	0.08	8.49
Item 2: Hours spent on the Internet to look for information on the current disease during the last month	0.79	0.07	10.73
Item 3: Hours usually spent on the Internet to look for information on the current disease per month	0.84	0.06	12.86
Item 4: Number of times the Internet is accessed to look for information on the current disease during the last month	0.90	0.04	21.61
Item 5: Number of times per month the Internet is accessed to look for information on the current disease	0.91	0.02	35.58
Consumption of medical resources AVE = 0.63 ; CR = 0.83			
Item 6: Appointments made with doctors concerned with the current disease	0.80	0.08	9.12
Item 7: Complementary medical tests made for the current disease	0.81	0.08	9.48
Item 8: Phone calls made to health professionals to ask questions about the current disease	0.75	0.1	6.62

CR=Composite Reliability, AVE= Average Variance Extracted

Discriminant validity was verified with the average variance extracted for each construct higher than the squared correlations between it and all other constructs (Fornell and Larcker, 1987). As shown in Table 2, each construct shares greater variance with its own block of measures (Underlined values in the diagonal) than with the other constructs representing a different block of measures. We can thus conclude in satisfactory discriminant validity.

Table 2: Correlations between Constructs (Diagonal Elements are the Average Variance Extracted)

	Use of Internet information by patients	Consumption of medical resources
Use of Internet information by patients	<u>0.704</u>	
Consumption of medical resources	0.071	<u>0.631</u>

6.2 The structural model

Results support the research hypothesis of this study. As we can see in table 3, the estimated path coefficient between the two constructs is statistically significant at 95 percent significance level. In fact, the associated t-value exceeds 1,64 (t-value = 2.95). Test of significance was performed using the bootstrap resampling procedure. The path coefficient is about 0.267 and the exogenous construct explains 7 percent of the variance in consumption of medical resources. These results mean that patients that use the Internet for their health take further appointments with doctors, make more complementary medical tests and more phone calls to medical staff.

Table 3: Path coefficient and test of significance

	Consumption of medical resources R-squared = 0.0713	
Use of Internet information by patients	Path-Coefficient	0.267
	t-value	2.95

p<0,05

These findings agree with many results of recent studies and confirm some literature. Indeed, researches conducted on cancer patients (Fleisher, 2002) concluded that getting information from the Web is overwhelming for some patients and make most of them aware of conflicting medical information about their disease. Few patients think that information from the Internet make them confused about their treatment. Also, Chen and Siu (2001) results show that patients' understanding of information is most of the time incorrect. In the same vein, Helft et al. (2003) warn that Internet information also increases the patients' level of confusion and anxiety. So, patients' misunderstanding of Internet information can be harmful for their health, especially when it is a matter of advices from online discussion groups (Elsberry, 2000). Furthermore, unreliable and abundant information from the Internet can lead patients to make bad choices (Baker et al., 2003), to meet clinicians more frequently (Pew Internet & American Life, 2003) and to extend the consultation length (Pew Internet & American Life, 2003). These results support our findings and justify the obtained positive relationship between the use of Internet information by patients and their use of healthcare resources.

7. IMPLICATIONS FOR THEORY AND PRACTICE

To the best of our knowledge, this study is the only that have attempted to investigate empirically the direct relationship between Internet use by patients and their consumption of medical resources. Another key contribution of this study is that it provides important insights into the Internet use and its effects on patients' behavior. Indeed, researchers from the fields of management information systems and medical sciences will be concerned with the role that Internet information can play in the management of medical systems. It should be underlined that informed patients from the Internet do make a different use of medical resources. This research showed that patients' consumption of medical resources does not decrease when they get information from the Internet. This should make managers think about how to better inform patients in order to improve medical resources allocation.

Researchers are encouraged to use obtained results to develop further studies that will explain the reasons of a positive relationship between Internet use and healthcare resources consumption. For instance, observational studies can explore details about how patients use the Internet to find illness related information.

Practitioners can also use these findings to improve Internet offer in order to make patients better informed. It is interesting to investigate the matters with the actual health

information in the Internet and to make it more reliable. More health-related portals and Websites can be developed by experts in healthcare. Patients that access to these sites can then benefit from the information and make a more appropriate use of medical resources.

CONCLUSION

As a conclusion, we would like to address some limitations in this study. First, the kinds of illnesses and their severity may have an impact on responses. This is a variable that we are unable to control because of the variety of chronic diseases. Second, the explained variance of resources consumption in this study was only 7 percent. This suggests that the inclusion of other important variables can be warranted. Finally, the development of a more reliable instrument to measure the consumption of medical resources can be planned. Indeed, this instrument is tested for the first time and has to be refined. Findings can be improved if such matters are considered.

REFERENCES

- Anderson, J.G., Rainey, M.R. and Eysenbach, G. (2003), "The Impact of CyberHealthcare on the Physician-Patient Relationship", *Journal of Medical Systems*, 27(1), 67-84.
- Baker, L., Vagner, T.H., Singer, S. and Bundorf, M.K. (2003), "Use of the Internet and E-mail for health care information: Results from a national survey", *Journal of the American Medical Association*, 289(18), 2400-2406.
- Bush, J., McAuley, A. and Pecaitis, F. (2000), "Navigating the options", *Health Management Technology*, 21 (11).
- Chen, X., Siu, L.L. (2001), "Impact of the media and the Internet on oncology: survey of cancer patients and oncologists in Canada", *Journal of Clinical Oncology*, 19, 4291-4297.
- Chin, W.W. (1994), *PLS-Graph Manual*, Unpublished manuscript, University of Calgary, 1994.
- Chin, W.W. (1998), The Partial Least Squares Approach for Structural Equation Modeling, *In Modern Methods for Business Research* (G. A. Marcoulides ed.), Lawrence Erlbaum Associates, pp. 295-336.
- Coile, R.C.Jr. (2000), "E-health: Reinventing healthcare in the information age", *Journal of Healthcare Management*, 45 (3), 206-210.
- Comité consultatif sur l'infrastructure de la santé (2001), *Plan tactique pour une infrastructure pancanadienne de la santé*, Bureau de la santé et de l'inforoute santé Canada.
- Coulter, A., "Paternalism or partnership?", *British Medical Journal*, Vol. 319, No. 7212, Sep. 18, 1999, pp. 719-720.
- Cyberdialogue (2000), *Online Health Information Seekers Growing Twice as Fast as Online Population*, <http://www.cyberdialogue.com/news/releases/2000/05-23-cch-future.html>, (accessed July. 4th, 2003).
- Dhrif, H. (1998), *Impacts de l'utilisation du réseau Internet sur la performance organisationnelle*, Master thesis, Laval University.
- Elsberry, R.B. (2000), *Internet offers medical advice and 'virtual' house calls*, Electrical Apparatus, Chicago.
- Eysenbach, G. (2003), "The impact of the Internet on cancer outcomes", *Canadian Cancer Journal for Clinicians*, 53 (6), 356-371.
- Eysenbach, G., Powell, J. , Kuss, O. and Sa, E.R. (2002), "Empirical studies assessing the quality of health information for consumers on the World Wide Web: A systematic review", *Journal of American Medical Association*, 287, 2691-2700
- Eysenbach, G., Sa, E.R. and Diepgen, T.L. (1999), "Shopping Around the Internet Today and Tomorrow: Towards the Millennium of Cybermedicine", *British Medical Journal*, 319 (1294).

- Falvo, D.R. (1994), *Effective Patient Education: A guide to Increased compliance*, Second Edition, An Aspen publication, USA.
- Fleisher, J. (2002), "Relationships among Internet health information use, patient behavior and self efficacy in newly diagnosed cancer patients who contact the National Cancer Institute's Atlantic Region Cancer Information Service", *Proceedings of the AMIA Annual Fall Symposium*, pp 260–264.
- Fornell, C., and Larcker, D. (1987), *A Second Generation of Multivariate Analysis: Classification of Methods and Implications for Marketing Research*, in *Review of Marketing*, M. J. Houston (ed.), American Marketing Association, Chicago, pp. 407-450.
- Gawande, A.A. and Bates, D.W. (2000), "The use of information technology improving medical performance: Part III. Patient-support tools", *MedGenMed*, 6 (E12).
- Graber, M.A. (1999), "Rejoice and Help Patients Get the Best From the World Wide Web", *Western Journal of Medicine*, 171.
- Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, W.C. (1998), *Multivariate Data Analysis* (5th ed.), Prentice-Hall, Englewood Cliffs, NJ.
- Helft, P.R., Hlubocky, F. and Daugherty, C.K. (2003), "American oncologists' views of Internet use by cancer patients: a mail survey of American Society of Clinical Oncology members", *Journal of Clinical Oncology*, 21, 942–947.
- Hjortdahl, P., Nylenna, M. and Aasland, O.G. (1999), "Internet and the physician-patient relationship: From "thank you" to "why"?", *Tidsskr Nor Laegeforen*, 119 (29), 4339-4341.
- Ipsos-Reid (2002), *Searching for online health information the number one online activity in Canada: Two-thirds of all online Canadians have visited a health website, up from 55% in 2000*, 1-5.
- Limayem, M. and Chabchoub, N. (1996), *Les facteurs motivateurs de l'utilisation du réseau Internet*, Faculté des sciences de l'administration, Laval University.
- Miller, T.E. and Reents, S. (1998), *The Health Care Industry in Transition: The Online Mandate to Change*, *American Internet User Survey*, Based on new data from the July 1998, Cyber Dialogue.
- Mueller, R.O. (1996), *Basic Principles of Structural Equation Modeling: An Introduction to LISREL and EQS*, Springer-Verlag, New York.
- Nunnally, J.C. (1978), *Psychometric theory*, 2nd ed., New York: McGraw-Hill.
- Pascot, D., Khechine, H. and Prémont, P. (2003), "Effets de l'utilisation de l'information d'Internet par les patients sur leur consommation des ressources médicales", *10èmes Journées Francophones d'Informatique Médicale*, Tunis, Collection Informatique et Santé, Springer-Verlag, Paris.
- Pennbridge, J., Moya, R. and Rodrigues, L. (1999), "Questionnaire survey of California consumers' use and rating of sources of health care information including the Internet", *Western Journal of Medicine*, 171, 302-305.
- Pew Internet & American Life (2000), *The online health care revolution: How the Web helps Americans take better care of themselves*, Principal authors: Susannah Fox and Lee Rainie.
- Pew Internet & American Life (2003), *Internet Health Resources: Health searches and email have become more commonplace, but there is room for improvement in searches and overall Internet access*, 1-42.
- Sieving, P.C. (1999), "Factors Driving the Increase in Medical Information on the Web-One American Perspective", *Journal of Medical Internet Research*, 1 (1).

- Suggs, S.L. (1999), *Women's Health Education and the Internet: Consumerism or Mutuality?*, Master of Science Thesis, Texas Woman's University, Denton, Texas, 83.
- Tetzlaff, L. (1997), "Consumer Informatics in Chronic Illness", *Journal of the American Medical Informatics Association*, 4, 285-300.
- Webb, T. (1997), The Role of the Internet in Healthcare: Opportunities, *In The Internet and Healthcare*, Edited by L. Nicholson., Chicago: Health Administration Press.
- Wold, H. (1989), Introduction to the Second Generation of Multivariate Analysis, *In Theoretical Empiricism*, H. Wold (ed.), Paragon House, New York, vii-xi.

Received: March 18th 2004

Accepted in final format: May 20th 2004 after one revision

About the authors:

Hager Khechine is completing her PhD in Information Systems at the University of Laval, Canada. She holds a MBA from Laval. Her areas of research are in information technology, cybemedicine, information systems security and outsourcing. She can be reached by email at Hager.Khechine@fsa.ulaval.ca.

Daniel Pascot is a Professor and Chairman of the Department of Management Information Systems at the University of Laval, Quebec City, Canada. He holds a PhD in Management sciences at Aix-en-Provence. His main research interests are in IS methodologies, methods for evaluation of IS, complex systems and DSS. He can be reached by email at Daniel.Pascot@sio.ulaval.ca.

Pierre Prémont is a Professor in the Department of Management Information Systems, University of Laval, Quebec City, Canada. He holds a PhD from University of Laval. His main research interests are in information technology, electronic commerce and IT outsourcing. He can be reached by email at Pierre.Premont@sio.ulaval.ca