

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/49967719>

# Clinical Information System Post-Adoption Evaluation at the Georges Pompidou University Hospital

Article in AMIA ... Annual Symposium proceedings / AMIA Symposium. AMIA Symposium · November 2010

Source: PubMed

---

CITATIONS

20

READS

120

5 authors, including:



**Patrice Degoulet**

Paris Descartes, CPSC

325 PUBLICATIONS 4,070 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



Determinants of Hospital Efficiency [View project](#)

# Clinical Information System Post-Adoption Evaluation at the Georges Pompidou University Hospital

Jean-Marc Palm, MS, PhD<sup>1,2</sup>, Thierry Dart, MD<sup>2</sup>, Isabelle Dupuis, RN<sup>2</sup>,  
Laurence Leneveut, MD<sup>2</sup>, Patrice Degoulet, MD PhD<sup>2</sup>

<sup>1</sup> Collaborative Research for Effective Diagnostics, Sherbrooke University, Québec, Canada

<sup>2</sup> Pompidou University Hospital, Paris Descartes University, and INSERM UMR-S872 Eq.20, Paris, France

## Abstract

*The evaluation of a clinical information system (CIS) at different stages of deployment and routine use is a key factor to improve acceptability and use by health professionals. This paper examines on an expectation-confirmation model (ITPAM) the relationships between the determinants of success of a CIS in a cross-sectional survey performed at the Georges Pompidou University Hospital (HEGP). Results for the groups of physicians and nurses that replied to the survey (n=312) suggest that health professional satisfaction (overall  $R^2=0.60$ ) is determined by the quality of user support ( $r=.21$ ,  $p<.0001$ ), ease of use ( $r=.19$ ,  $p<.0001$ ), confirmation of expectations ( $r=.15$ ,  $p=.0037$ ), usefulness ( $r=.12$ ,  $p=.0068$ ), and compatibility ( $r=.10$ ,  $p=.0206$ ). The best predictor of physician satisfaction ( $R^2=0.71$ ) was compatibility ( $r=.21$ ,  $p=.0072$ ) whereas for nurses ( $R^2=0.52$ ) it was user support ( $r=.22$ ,  $p<.0001$ ) and ease of use ( $r=.22$ ,  $p=.0001$ ). Confirmation of expectations had an impact on post-adoption expectation and user's satisfaction, and confirms its importance for CIS evaluation studies.*

## Introduction

The integration of information technology (IT) into clinical processes must be analyzed and evaluated during the different phases of deployment of a clinical information system (i.e., pre-adoption, installation, and post-adoption), in order to improve their quality and effectiveness.<sup>1,2</sup>

For health care providers that have adopted IT to support their clinical processes, it is essential in post-adoption settings, to analyze the relationships between acceptability factors under successful IT implementation. For the continuous use of a CIS it is important that managers identify and manage the critical barriers to CIS implementation and foster the capabilities of physicians and nurses to perform their routine tasks.<sup>3</sup>

The CIS of the Georges Pompidou Hospital (HEGP), a 827-acute-bed university hospital located in southwest Paris, was operational at its opening in July 2000. It includes a unique, permanent and multimedia patient record, and a hospital wide resource and appointment scheduling system. An incremental implementation strategy was adopted for the deployment of the computerized provider order entry (CPOE), and namely the medication order entry.<sup>4</sup>

The purpose of this study is to investigate the expectation-confirmation theory perspectives, which is an integrated model (Health Information Technology Post-Adoption Model - ITPAM) that analyzes the relationships between post-adoption beliefs such as, compatibility, perceived usefulness, ease of use, and user support, with confirmation of expectations and user satisfaction. Several studies have shown the driving role of the compatibility<sup>5</sup>, perceived usefulness and ease of use<sup>1,6</sup>, and user support<sup>7</sup>, in the evolution of the adoption process and IT diffusion in organizations. This integrative approach is supported by the combining of relevant constructs of these IS research models<sup>8,9</sup>.

## Materials and Methods

### *Clinical Information System and Setting*

The HEGP component-based CIS<sup>4</sup> includes (1) admissions, discharge and transfer (ADT), (2) electronic health records (EHR) integrating laboratory, radiology and imaging, diagnostic test results with clinical and nursing notes, and discharge and consultation reports, a (3) computerized provider-order entry (CPOE) including medications, laboratory and radiology tests, (4) appointment and patient scheduling (APS). In practice, physician/nurses notes, problem lists, medication lists, discharge summaries, nursing assessments, medical and nurse orders, are entered directly on computer. At the time of the survey (spring 2008), 99.6 % of laboratory and 71.0% of radiology orders were entered directly by physicians into the CPOE system without nurse or secretary mediation.

### Survey Instrument

The survey was designed to measure user characteristics, CIS compatibility, CIS support, confirmation of expectations, perceived CIS usefulness, perceived CIS ease of use, and user satisfaction. Seven-point Likert scales (1=Strongly disagree, 2=Disagree, 3=Somewhat disagree, 4=Neither disagree nor agree, 5=Somewhat agree, 6=Agree, 7=Strongly agree) were used within each dimension. All measurements were adapted from previously validated instruments. Items under *Compatibility* were adapted from Rogers and Moore.<sup>5,8,10</sup> *User Support* assessed the availability of CIS, helped to access and understand CIS data, availability of assistance and training.<sup>7,8,11</sup> Items for measuring *Confirmation of Expectations* were adapted from Bhattacharjee.<sup>1</sup> Four items were used to measure CIS expectations: compatibility, ease of use, usefulness and overall quality of the CIS.<sup>1,7</sup> *User Satisfaction* asked respondents to indicate their general satisfaction with the experience of using CIS, clinical information quality, reliability and user support quality.<sup>7</sup> Scales for perceived CIS *Usefulness* and *Ease of Use* were adapted from previous studies on technology acceptance model – TAM<sup>1,6,8</sup>.

### Research Model

According to the proposed *Health IT Post-Adoption Model (ITPAM)* created from multiple sources (figure 1), the post-adoption user satisfaction is determined by the users' confirmation of expectations (H3a), perceived usefulness (H2a) and ease of use (H4a), compatibility (H1a), support (H5a) and user characteristics (H0). The perception of the usefulness is influenced by confirmation of expectations (H3b), perceived ease of use (H4b), compatibility (H1b) and support (H5b). The confirmation of expectations (H3c), compatibility (H1c) and support (H5c) directly influence perceived ease of use. In this model, the degree to which health professional expectations are confirmed is affected by both compatibility (H3d) and user support (H3e).

### Survey administration

The survey targeted all physicians (n=600) and nurses (n = 1100) working part-time or full-time, and used electronic CIS to support their daily clinical process at the HEGP. A total of 1700 anonymous survey questionnaires, with a cover letter that explained the study, were sent to physicians and nurses in clinical units, between March and April 2008. Each target group received three reminders asking them to complete the survey. The response rate was 16.83% (n=101) and 19.18% (n=211) for physicians and nurses, respectively.

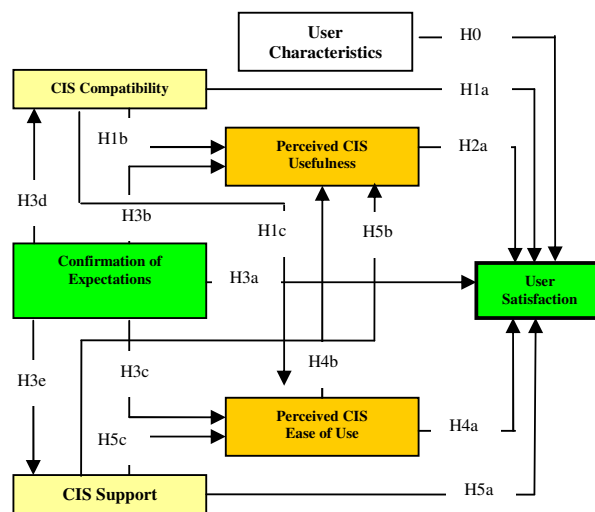


Figure 1: Health IT Post-Adoption Model (ITPAM)

### Data analysis methods

For each dimension, descriptive statistics were used to summarize information. An aggregated variable was computed by dimension and presented with means and standard deviations. Mean scores for physicians and nurses were compared by F tests. To address the research hypotheses, separate multivariate regression analysis, as recommended by Gefen when the sample size was too small to use advanced statistical approaches such as structural equation modeling.<sup>12</sup> The reliability and validity of the items measuring the various elements were evaluated using Cronbach's alpha.<sup>13</sup> As shown in Table 1, the values were either close to or above 0.70, in the range acceptable.<sup>14</sup> In a pre-test phase, we evaluated the content and clarity of the questions with a small target group, two physicians and five nurses. Analyses were performed using the statistical packages Statview<sup>®</sup> and Stata<sup>®</sup>.

Table 1 :Validity of the instrument (Cronbach's Alpha)

Dimensions (Items Number)	Physicians n=101	Nurses n=211	Total n=312
Compatibility (3)	0.94	0.90	0.92
Confirmation of Expectations (4)	0.95	0.95	0.95
User support (4)	0.78	0.70	0.74
Perceived CIS Ease of Use (4)	0.95	0.93	0.93
Perceived CIS Usefulness (4)	0.93	0.91	0.91
User Satisfaction (4)	0.75	0.84	0.80

CIS= Clinical Information System

### Results

#### Users' characteristics

A total of 101 and 211 questionnaires were analyzed from the physicians and nurses respectively (table 2). Only 24.0% (p<.0001) of the respondents were male, working full-time 86.3% (p=.0236) and having

received prior CIS training 62.7%. The respondents averaged 37.7±10.8 (p=.0003) years of age and 5.5±4.7 (p=.0202) years of work seniority at HEGP. The perception of CIS experience did not differ significantly between physicians and nurses.

Table 2: Respondents demographic characteristics

	Physicians	Nurses	Total	p-value
Profile N	101	211	312	
Physicians (n)	87		87	
Residents (n)	14		14	
Nurses (n)		168	168	
Auxiliary nurses (n)		43	43	
Male sex (%)	45.54	13.74	24.04	<0.0001
Working full time (%)	79.31	89.34	86.27	0.0236
Prior CIS Training (%)	55.1	66.35	62.75	NS
<i>Mean (SD)</i>				
Age (years)	40.9 (11.25)	36.14 (10.2)	37.73 (10.78)	0.0003
Seniority at work (years)	4.49 (3.6)	5.88 (5.04)	5.45 (4.68)	0.0202
CIS Experience§	4.58 (1.17)	4.33 (1.13)	4.41 (1.15)	NS

§ Proficiency scale 1= No experience to 7 Very experienced; NS= p>.05

### Compatibility

For physicians, the perception on the item “Using CIS is compatible with organization of my work”, scored (3.92±1.65) below average level on the scale of 1 to 7 points. The average perception of the CIS compatibility was 4.18 without any difference between health professionals (Table 3).

Table 3: Factors describing Compatibility Dimension - Means (SD)

Using CIS is compatible with or (fits into)...	Physicians n=101	Nurses n=211	Total n=312	p-value
All aspects of my work	4.32 (1.67)	4.27 (1.43)	4.29 (1.51)	NS
My Work habits	4.01 (1.66)	4.28 (1.40)	4.19 (1.49)	NS
Organization of my work	3.92 (1.65)	4.12 (1.50)	4.06 (1.55)	NS
<b>CIS Compatibility§</b>	<b>4.08 (1.58)</b>	<b>4.22 (1.33)</b>	<b>4.18 (1.41)</b>	NS

CIS= Clinical Information System; §= Aggregated variable; NS = p>.05; Scale: 1=Strongly disagree to 7=Strongly agree

### Confirmation of Expectations

The nurses’ (4.04±1.12) aggregated variable of confirmation expectations was higher than that of the physicians (3.70±1.44, p=.0161) (Table 4). All post-adoption expectations differed significantly.

Table 4: Factors describing Expectations Dimension - Means (SD)

The CIS....was better than what I expected	Physicians n=101	Nurses n=211	Total n=312	p-value
Compatibility	3.69 (1.50)	4.02 (1.17)	3.91 (1.29)	0.0400
Perceived ease of use	3.66 (1.58)	4.08 (1.24)	3.94 (1.37)	0.0117
Perceived usefulness	3.80 (1.49)	4.12 (1.20)	4.01 (1.31)	0.0488
Overall quality of the CIS	3.63 (1.56)	4.09 (1.20)	3.94 (1.34)	0.0048
<b>Expectations§</b>	<b>3.70 (1.44)</b>	<b>4.07 (1.12)</b>	<b>3.95 (1.25)</b>	<b>0.0161</b>

CIS= Clinical Information System; SD=Standard Deviation; NS = p>.05; §= Aggregated variable; Scale: 1=Strongly disagree to 7=Strongly agree

### User support

The average ratings on the CIS support were below the midpoint, i.e. (3.70±1.21) and (3.69±1.12) for physicians and nurses respectively (table 5). The appreciation of the user assistance (3.71±1.58) and training (3.29±1.50) ranked lower than the IT department objectives.

Table 5: Factors describing User Support Dimension - Means (SD)

	Physicians n=101	Nurses n=211	Total n=312	p-value
Availability of CIS when I need it.	4.12 (1.53)	4.00 (1.55)	4.04 (1.54)	NS
Help to access and understand CIS data	3.61 (1.56)	3.77 (1.43)	3.72 (1.47)	NS
Availability for assistance	3.63 (1.54)	3.75 (1.59)	3.71 (1.58)	NS
Training	3.46 (1.58)	3.21 (1.45)	3.29 (1.50)	NS
<b>CIS Support§</b>	<b>3.70 (1.21)</b>	<b>3.69 (1.12)</b>	<b>3.69 (1.15)</b>	NS

CIS= Clinical Information System; SD=Standard Deviation; NS = p>.05; §= Aggregated variable; Scale: 1=Strongly disagree to 7=Strongly agree

### Perceived CIS Ease of Use

Overall, the appreciation of the perceived CIS ease of use (p=.0438) differed significantly between physicians and nurses (Table 6). However, the aggregated variables, simplicity and learning items were relatively low and not significantly different among health professionals.

Table 6: Factors describing CIS Ease of Use Dimension - Means (SD)

	Physicians n=101	Nurses n=211	Total n=312	p-value
Simplicity	4.24 (1.68)	4.51 (1.41)	4.42 (1.51)	NS
CIS comfort of use	4.21 (1.61)	4.57 (1.38)	4.46 (1.46)	0.0406
Learning	4.33 (1.61)	4.5 (1.36)	4.44 (1.45)	NS
Overall perceived ease to use	4.11 (1.66)	4.47 (1.35)	4.35 (1.46)	0.0438
<b>CIS Ease of Use§</b>	<b>4.22 (1.55)</b>	<b>4.51 (1.29)</b>	<b>4.41 (1.38)</b>	NS

CIS= Clinical Information System; SD=Standard Deviation; NS = p>.05; §= Aggregated variable; Scale: 1=Strongly disagree to 7=Strongly agree

### Perceived CIS Usefulness

Except for the nurses, the perception of the physicians of the CIS impact on performance (4.22±1.66) and effectiveness (4.06±1.70) were slightly above the midpoint on the Likert scale (NS). For all groups, the score of the item on “Using CIS improves ability to make good decisions” was under expectations (3.73±1.52) (table7).

Table 7: Factors describing CIS Usefulness Dimension - Means (SD)

Using CIS...	Physicians n=101	Nurses n=211	Total n=312	p-value
Improves performance	4.22 (1.66)	3.95 (1.32)	4.04 (1.45)	NS
Improves effectiveness	4.06 (1.70)	3.88 (1.39)	3.94 (1.49)	NS
Improves ability to make good decisions	3.89 (1.67)	3.65 (1.45)	3.73 (1.52)	NS
Overall CIS usefulness	4.64(1.62)	4.48 (1.37)	4.53 (1.45)	NS
<b>CIS Usefulness§</b>	<b>4.21 (1.55)</b>	<b>3.99 (1.23)</b>	<b>4.06 (1.35)</b>	NS

CIS= Clinical Information System; SD=Standard Deviation ; NS= p>.05; §= Aggregated variable; Scale: 1=Strongly disagree to 7=Strongly agree

### User Satisfaction

In general, physicians (4.21±1.55) and nurses (4.38±1.01) considered to be satisfied with the CIS except for the quality of user support (Table 8). The items such as clinical information quality and reliability scored similar for physicians and nurses. However the overall satisfaction of health professionals’ with their CIS experience differed between the two profiles (p=.0223).

Table 8: Factors describing User Satisfaction Dimension - Means (SD)

I am satisfied with.....	Physicians n=161	Nurses n=352	Total n=513	p- value
Clinical information quality	4.22 (1.59)	4.36 (1.19)	4.31 (1.33)	NS
Reliability	4.57 (1.44)	4.53 (1.13)	4.54 (1.24)	NS
User support quality	3.86 (1.50)	4.14 (1.24)	4.05 (1.34)	NS
Overall experience of using CIS	4.24 (1.39)	4.58 (1.11)	4.47 (1.22)	0.0223
<b>User satisfaction§</b>	<b>4.21 (1.18)</b>	<b>4.39 (1.01)</b>	<b>4.33 (1.07)</b>	NS

CIS= Clinical Information System ; SD=Standard Deviation; NS = p>.05

§= Aggregated variable; Scale: 1=Strongly disagree to 7=Strongly agree

### Model Testing Results

Table 9 presents regression results by user profile. The model in figure 2, based on the whole group of users (n=312), showed the relationships of the predictors of user satisfaction (overall R<sup>2</sup> =0.60), perceived CIS usefulness (R<sup>2</sup> =0.47), and ease of use (R<sup>2</sup>=0.39), support (R<sup>2</sup> =0.19), and compatibility (R<sup>2</sup> =0.36).

Table 9: Linear Regression analysis of Health ITPAM

Dimensions	H	Physicians n=101	Nurses n=211	Total n=312
		r (p)	r (p)	r (p)

Regression 1: Stepwise multiple regressions analysis on User's Satisfaction

User characteristics				
Physicians	H0			-.01 (NS)
Male Sex	H0	.05(NS)	.00 (NS)	-.00 (NS)
Age	H0	-.01(NS)	-.01(NS)	-.01(.0113)
Working Full	H0	-.13(NS)	.20(NS)	.08(NS)
Prior CIS Training	H0	.30(NS)	.04(NS)	.13 (NS)
CIS experience	H0	.01(NS)	-.11(.0473)	-.07(NS)
CIS Compatibility§	H1a	.21(0.0072)	.07(NS)	.10(.0206)
CIS Usefulness§	H2a	.04(NS)	.14(.0158)	.12(.0068)
Expectations§	H3a	.19(.0306)	.16(.0219)	.15(.0037)
CIS Easy of Use§	H4a	.10(NS)	.22(.0001)	.19 (<.0001)
CIS Support§	H5a	.20(.0096)	.22(<.0001)	.21 (<.0001)
<b>Adjusted R<sup>2</sup> (p)</b>		<b>.71(&lt;.0001)</b>	<b>.52(&lt;.0001)</b>	<b>.60(&lt;.0001)</b>

Regression 2: Stepwise multiple regressions analysis on CIS Usefulness

CIS Compatibility§	H1b	.58(<.0001)	.28(<.0001)	.39(<.0001)
Expectations§	H3b	.41(.0006)	.43(<.0001)	.38(<.0001)
CIS Easy of Use§	H4b	-.21(NS)	-.01(NS)	-.07(NS)
CIS Support§	H5b	.12(NS)	.15(.0282)	.13(.0239)
<b>Adjusted R<sup>2</sup> (p)</b>		<b>.57(&lt;.0001)</b>	<b>.45(&lt;.0001)</b>	<b>.477(&lt;.0001)</b>

Regression 3: Stepwise multiple regressions analysis on CIS Ease of Use

CIS Compatibility§	H1c	.32(.0002)	.20 (.0058)	.25 (<.0001)
Expectations§	H3c	.44(<.0001)	.23 (.008)	.35 (<.0001)
CIS Support§	H5c	.31(.0008)	.24 (.0028)	.24 (<.0001)
<b>Adjusted R<sup>2</sup> (p)</b>		<b>.63(&lt;.0001)</b>	<b>.25(&lt;.0001)</b>	<b>.395(&lt;.0001)</b>

Regression 4: Stepwise simple regression analysis on CIS Compatibility

Expectations§	H3d	.73(<.0001)	.66(<.0001)	.68(<.0001)
<b>Adjusted R<sup>2</sup> (p)</b>		<b>.45(&lt;.0001)</b>	<b>.31(&lt;.0001)</b>	<b>.368(&lt;.0001)</b>

Regression 5: Stepwise simple regression analysis on CIS Support

Expectations§	H3e	.39(<.0001)	.45(<.0001)	.41(<.0001)
<b>Adjusted R<sup>2</sup> (p)</b>		<b>.21(&lt;.0001)</b>	<b>.19(&lt;.0001)</b>	<b>.193(&lt;.0001)</b>

CIS= Clinical Information System; NS p>0.05 §= Aggregated variable; H=Hypothesis

Support (r=.21, p<.0001) and perceived ease of use (r=.19, p<.0001) were most strongly correlated with user satisfaction.

Physicians' satisfaction (R<sup>2</sup> =0.71) was strongly associated with compatibility (r=.21, p=.0072), support (r=.20, p=.0096) and expectations (r=.19, p=.0306). Nurses' satisfaction (R<sup>2</sup> =0.52) was significantly determined by support (r=.22, p<.0001), perceived ease of use (r=.22, p=.0001) and expectations (r=.16, p=.0219), while the CIS experience (r=-.11, p=.0473) had a negative

influence. For each group, confirmed expectations were strongly associated with usefulness, ease of use, compatibility and support.

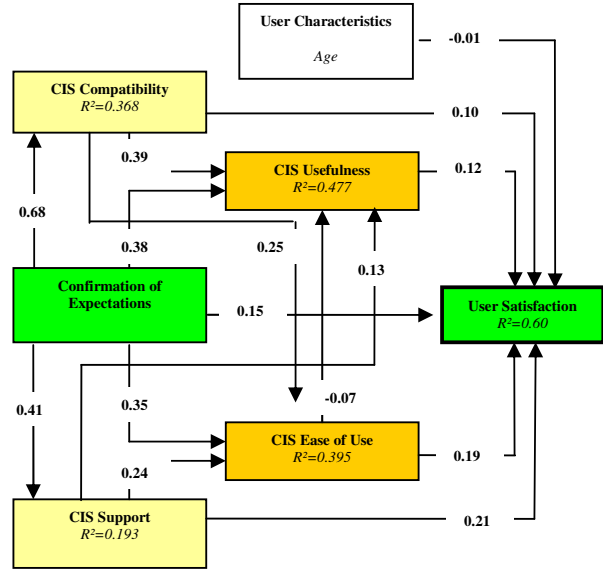


Figure 2: Results of tested ITPAM (Total n=312)

### Discussion

This study proposes an integrated model for CIS post-adoption evaluation (ITPAM) and then investigates the expectation-confirmation theory and the relationships between success factors and user satisfaction. Results suggest that the best predictor of healthcare professional satisfaction is the quality of CIS support and training. For physicians, the compatibility of IT with their clinical processes is more crucial for their satisfaction, whereas, for nurses perceived CIS ease of use seems more relevant. Chau *et al* found that compatibility was a significant determinant of perceived usefulness but not of perceived ease of use<sup>15</sup>. The perceived usefulness and ease of use were important determinants of a healthcare professional's satisfaction. These results supported previous research such as Lee *et al* that showed relationship between satisfaction, perceived ease of use and response time<sup>16</sup>. The expectation confirmation was stronger and more relevant predictor for each CIS post-adoption success factors. The relevance of the confirmation of the expectations positioned the initiatives of analyses of the expectations at the heart of the process of design and evolution of CIS in post-adoption setting. Paré *et al* analyzed PACS adoption, and their results showed that the confirmation expectations and perceived usefulness were correlated with clinician

satisfaction.<sup>17</sup> Thus physicians seem satisfied when the installed CIS provides desirable utility to their practice. Results also demonstrate the importance of perceived ease of use in mediating the relationship between user support, compatibility and confirmation of expectations and satisfaction.

For all groups, perceived ease of use had no significant or positive effects on perceived usefulness. Chismar *et al*, showed this relationship also had no significant effects among the physicians, especially in post-adoption.<sup>18</sup> This finding consolidated the HEGP position in post-adoption setting and showed that its health professionals were weaned off the pre-adoption phase.

The data showed that the quality of support had a direct effect on satisfaction, perceived usefulness and perceived ease of use. In a previous study findings showed that perceived CIS usefulness, perceived CIS quality and service quality had a significant effect on physician and nurse satisfaction.<sup>11</sup> According to Delone and McLean, satisfaction influenced IT net benefits<sup>9</sup>. However, when the research findings were compared to a previous study in 2004, it was found that the appreciation of IT support and training quality had decreased, (3.77±1.38), (3.79±1.37) for physicians and nurses respectively. This means that health IT management must improve technical support, assistance and training, and better understand what clinicians need to improve their capabilities and technical skills in CIS use.

Several limitations of our study have to be emphasized. The response rate was low, 16.8% and 19.2% for physicians and nurses respectively. The relatively low explained variance of CIS technical support and training dimension, compared with prior studies, suggested the potential limitations and possible omission of factors important to the healthcare post-adoption context. Future perspectives of this work could mean the consolidation of the ITPAM model with integrating others dimensions such as continuance intention and use. The refinement of the model and analysis of confirmed health professional expectations would help to better inform the design and implementation of HIT in pre and post-adoption setting.

## Conclusion

Evaluation of CIS post-adoption suggested that the confirmation of expectations was a relevant determinant of perceived usefulness, ease of use, compatibility and user support. This positions the analysis of requirements and expectations in the centre CIS post-adoption success factors.

## Acknowledgements

This work was carried off within a PhD thesis achieved jointly at Paris Descartes University under the direction of Patrice Degoulet and Sherbrooke University under the direction of Andrew Grant and Jean-Marie Moutquin whom we deeply acknowledge.

## References

1. Bhattacharjee A. Understanding information systems continuance: an expectation-confirmation model, *MIS Quarterly*. 2001; 25(3): 351-70.
2. Ammenwerth E, Mansmann U, Iller C, Eichstadter R. Factors affecting and affected by user acceptance of computer-based nursing documentation: results of a two-year study. *J Am Med Inform Assoc*. 2003;10:69-84.
3. Ash JS and D. W. Bates. Factors and forces affecting EHR system adoption: report of a 2004 ACMI discussion. *J Am Med Inform Assoc*. 2005; 12(1): 8-12.
4. Degoulet P, Marin L, Lavril M et al. The HEGP component-based clinical information system. *Int J Med Inform*. 2003; 69: 115-26
5. Rogers EM. *The Diffusion of innovation*. Fifth ed. New York: The Free Press, 2003.
6. Davis F. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*. 1989; 13: 319-340.
7. Van Der Meijden TH, Troust J, Hasman A. Determinants of success of inpatient clinical information system: A literature review. *J. Am Med Inform Assoc*. 2003; 10: 235-243.
8. Wu JH, Wang SC, Lin LM. Mobile computing acceptance factors in the healthcare industry: A structural equation model. *Int J Med Inform*. 2007; 76(1): 66-77.
9. Jeyaraj A, Rottman JW, Lacity MC. A review of the predictors, linkages, and biases in IT innovation adoption research. *Journal of Information Technology*. 2006; 21(1):1-23.
10. Moore GC, Benbasat I. Development of an instrument to measure the perception of adopting an information technology innovation. *Information Systems Research*. 1991; 2(3): 192-222.
11. Palm JM, Colombet I, Sicotte C, Degoulet P. Determinants of user satisfaction with a clinical information system. *AMIA Annu Symp Proc*. 2006; 614-8.
12. Gefen, D, Straub DW, Boudreau MC. Structural equation modeling techniques and regression: Guidelines for research practice. *Comm AIS*. 2000; 4: 1-78.
13. Straub DW. Validating instruments in MIS research. *MIS Quarterly*. 1989; 13: 147-69.
14. Nunnally JC. *Psychometric theory*, 2d ed. New York: McGraw-Hill 1978.
15. Chau PYK, Hu PJ. Examining a model of information technology acceptance by individual professionals: An exploratory study. *Journal of Management Information Systems*. 2002; 18(4): 191-229.
16. Lee F, Spurr CD, Bates DW. Implementation of physician order entry: User satisfaction and self-reported usage patterns. *J Am Med Inform Assoc*. 1996; 3: 42-55.
17. Pare GC, Bauman AL, McHenry M, Michel JJ, Dodge-Kafka KL, Kapiloff MS. Toward a multidimensional assessment of picture archiving and communication system success. *Int J Technol Assess Health Care*. 2005; 21(4): 471-9.
18. Chismar WG, Wiley-Patton S. Does the extended technology acceptance model apply to physicians? *Proc 36<sup>th</sup> Hawaii Int Conf on System Sciences*. 2002; 6: 160-67.