Research Paper ■

The Effects of Creating Psychological Ownership on Physicians' Acceptance of Clinical Information Systems

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A b s t r a c t   **Objective:** Motivated by the need to push further our understanding of physicians' acceptance of clinical information systems, we propose a relatively new construct, namely, psychological ownership. We situated the construct within a nomological net using a prevailing and dominant information technology adoption behavior model as a logical starting point.

Design: A mail survey was sent to the population of users of a regional physician order entry (POE) system aimed at speeding up the transmission of clinical data, mainly laboratory tests and radiology examinations, within a community health network.

Measurements: All scales, but one, were measured using previously validated instruments. For its part, the psychological ownership scale was developed using a multistage iterative procedure.

Results: Ninety-one questionnaires were returned to the researchers, for a response rate of 72.8%. Our findings reveal that, in order to foster physicians' adoption of a clinical information system, it is important to encourage and cultivate a positive attitude toward using the new system. In this connection, positive perception of the technology's usefulness is crucial. Second, results demonstrate that psychological ownership of a POE system is positively associated with physicians' perceptions of system utility and system user friendliness. Last, through their active involvement and participation, physicians feel they have greater influence on the development process, thereby developing feelings of ownership toward the clinical system.

Conclusion: Psychological ownership's highly significant associations with user participation and crucial beliefs driving technology acceptance behaviors among physicians affirm the value of this construct in extending our understanding of POE adoption.

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Given the myriad of complicated elements in today's health care environment, the geographic dispersion of points of care, the interaction of many specialists, and the need to balance the complex set of care steps for every patient, health care organizations can no longer be competitive without substantial application of information technology (IT). Still, IT value is realized only when clinical information systems (CIS) are used by their intended users. Physician resistance is a common occurrence when new CIS are implemented within a health care organization, and there is a sizable amount of literature to explain and give insight into some of the reasons behind this resistance.[1–6] In response to this concern, several theoretical models have been proposed in the information systems field to better understand individual attitudes and behaviors toward new IT: innovation diffusion theory,[7] the technology acceptance model,[8,9] the theory of

reasoned action,[10] and the theory of planned behavior.[11,12] Despite differences among these models regarding the specific constructs and relationships posited, there is some convergence among them, whereby an individual's beliefs about or perceptions of IT have a significant influence on usage behavior. In general, beliefs are important not only because they influence subsequent behavior, but also because they are amenable to strategic managerial manipulation through appropriate interventions such as user involvement and user participation.[13–16]

Whereas prior research has focused considerable attention on the centrality of beliefs in several key outcomes such as attitudes and usage, less attention has been placed on how such beliefs are formed. A few notable exceptions examined the influence of perceived enjoyment, self-efficacy, and cognitive absorption, to name a few, on the formation of critical beliefs.[17–19] Given the recurrence of beliefs in theoretical models of user behavior toward IT, additional work that examines their determinants is still necessary. In the health care context, an understanding of what causes physicians to hold certain beliefs about the target CIS would be of value not only to individuals responsible for overseeing implementation of these systems, but also to researchers interested in explicating the paths through which technology use behavior is manifested.

Motivated by the need to push further our understanding of physicians' acceptance of IT, we propose a relatively new construct, namely, psychological ownership. Insights into the

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construct can be gleaned from related literature in human development, psychology, and sociology. For instance, Heider's[20] research on the development of attitudes of ownership toward objects within the self region, Etzioni's[21] work on the objective and subjective aspects of ownership, and various scholars'[22] work on the "psychology of mine" provide insights into the psychological phenomenon of ownership. In this research, we posit that psychological ownership is important to the study of technology acceptance behaviors among physicians because it serves as a key determinant to salient beliefs about a new CIS.

We begin by reviewing relevant work in the literature that frames the concept of psychological ownership. This is followed by arguments supporting the hypothesized relationships between psychological ownership and both its antecedents and consequences. An operational measure of the psychological ownership construct in the particular context of CIS implementation is then developed. Next, the research model is examined in a study of 91 physicians who use a regional physician order entry (POE) system implemented in early 2003. Results of the study, which support the theorized relationships, follow. Last, limitations and contributions of the study for both research and practice are briefly presented.

Background: The Domain of Psychological Ownership

The Concept of Psychological Ownership

As a state of the mind, psychological ownership is defined as that state in which individuals feel as though the target of ownership or a piece of it is "theirs" (i.e., "It is MINE!").[23] The core of psychological ownership is the feeling of possessiveness and of being psychologically tied to an object. One's possessions are felt as extensions of the self.[24]

The Objects of Ownership

As James[25] noted, we may have feelings of ownership about almost anything in our world, including a house, a piece of land, our personal reputation, our work, and other people. Feelings of ownership can also pertain to aspects of organizational life. Organizations are multifaceted, complex systems that include numerous objects available for feelings of ownership.[26] In the literature, there is empirical evidence that individuals express feelings of ownership toward their organization, the products they create, their jobs, and the practices employed by their organizations.[26–30]

In this paper, we argue that CIS can also become the object of feelings of ownership. These systems, like any other information system, are designed and constructed, directly or indirectly, by human actors, and hence only come into existence through creative human action.[31,32] As a consequence of such involvement in the design/development of technology, the latter might tend to reflect the assumptions and objectives of its "designers" and, in turn, lead to strong feelings of ownership.

Motivations to Own

Many scholars believe that people have an innate need to possess.[33,34] Others, mainly human development scholars, suggest that ownership and its psychological state are learned in the early development process.[35]

It has been proposed that psychological ownership emerges because it satisfies three basic human motives, some of

them genetic and others social in nature.[26,36] The first need, self-enhancement, refers to individuals' desires to achieve and maintain high levels of self-esteem. Individuals also have a need for self-continuity, which implies that people attempt to maintain stability of their self over time and across situations. Last, individuals have a desire to maintain and demonstrate a sense of control and a sense of efficacy. It is worth mentioning that each motive facilitates the development of psychological ownership rather than directly causing this state to occur.[36]

Effects of Psychological Ownership on Change Acceptance

Feelings of ownership can have important consequential effects on individuals. In their psychological theory of change, Dirks and colleagues[26] argue that psychological ownership provides insights into why and the conditions under which individuals react to change. They propose that psychological ownership leads to positive or negative orientations toward change, contingent on the type of change involved. Precisely, they argue that individuals are likely to promote change of a target toward which they feel ownership when the change is self-initiated (versus imposed), evolutionary (versus revolutionary), and additive (versus subtractive). As discussed in detail in the methodology section, the particular CIS implementation project examined in the study satisfies all three conditions, favoring a positive relationship between psychological ownership and technological change acceptance.

The Nomological Net of Psychological Ownership

In order to investigate the role played by psychological ownership in extending our understanding of physicians' reactions to IT, it is necessary to situate the construct within a nomological net. Figure 1 presents one plausible network of relationships for psychological ownership. While others might propose alternative causal pathways, we present theoretical arguments supporting the proposed paths and subsequently present data from a case study in support of these relationships. Thus, our goal is not theory testing per se to establish whether one model is more powerful than another; rather, we seek to enhance the Technology Acceptance Model (TAM),[8] a dominant model in the IT adoption literature, by including psychological ownership as a key determinant to salient beliefs about a new CIS. It is worth mentioning that TAM was recently found to be more appropriate than another prevailing IT adoption model, namely, the theory of planned behavior, for examining physicians' technology acceptance.[37]

The TAM posits that two particular beliefs, namely, perceived usefulness and perceived ease of use, are of primary relevance to IT acceptance behaviors. Perceived usefulness is defined as the prospective user's subjective probability that using a specific application system would increase his or her job
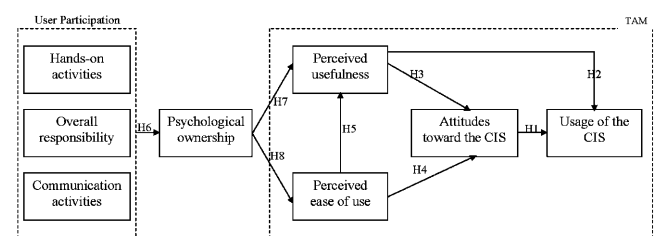

F i g u r e   1.   Theoretical model.

performance, and perceived ease of use refers to the degree to which the prospective user expects the target system to be free of effort.[8]

In the TAM, system use is predicted by both attitudes (H1) and perceived usefulness (H2); the latter also influences attitudes (H3). Perceived ease of use influences both attitudes (H4) and perceived usefulness (H5). In our context, the model hypothesizes that the degree to which the CIS is easy to use, as perceived by physicians, affects both their perception of the usefulness of the technology and their attitudes toward using the system. Attitude is also influenced by the level of the system's usefulness, as perceived by physicians. Finally, the intensity of physicians' use of the system can be explained or predicted jointly by their attitude toward using the new system and the technology's perceived usefulness.

Until now, the notion of psychological ownership has received very little attention in the information system and health informatics literature. Although we are not aware of any prior empirical study that has focused on the concept of ownership per se, several authors have referred to it when explaining the causes of IT project success. For instance, in his book titled *Successful IT Project Delivery*, Yardley[38] states: "Ownership must be demonstrated throughout the whole project if it is to stand any chance of success" (p. 119). Lorenzi and Riley,[3] two experts in change management issues in the field of health informatics, recently wrote: "People who have low psychological ownership in a system and who vigorously resist its implementation can bring a 'technically best' system to its knees" (p. 116). For their part, Barki and Hartwick[39] claimed that "because of their participation, users may perceive that they have had substantial influence on the development process and thereby develop feelings of ownership" (p. 72). A few studies on enterprise resource systems implementation corroborate such a hypothesis. For instance, in their analysis of the deployment of SAP/R3 at Nibco, Brown and Vessey[40] describe how potential users took ownership of the system through their involvement and participation in the project and the extent to which these feelings of ownership were key in ensuring user compliance. At Control Instruments Corporation, 75% of all employees were actively involved in the design and deployment efforts of a major enterprise system resulting in a shared sense of ownership among staff.[41]

In the present study, we posit that feelings of ownership toward a CIS may be developed through active physician involvement and participation in the system implementation process. User participation is defined as the extent to which users or their representatives carry out assignments and perform various activities during information systems development.[39] Support for a positive relationship between user participation and their feelings of possession toward a system can be found in the theory of psychological ownership.[36] Indeed, Pierce and colleagues[36] argue that psychological ownership may emerge through three interrelated routes. More specifically, individuals are thought to develop feelings of ownership of an object when they (1) exercise control over it, (2) associate with it, and (3) put a lot of time and effort into it. Each of these routes is briefly examined in turn.

First, control of an object appears to be a key characteristic of the ownership phenomenon. The greater the amount of control, the more the object is experienced as being a part of

the self.[42] As illustrated in Barki and Hartwick,[39] IT project leaders can provide the target users of a CIS with numerous opportunities to exercise varying degrees of control over the new system. From a managerial standpoint, for instance, physicians can share responsibility with health informatics specialists or other groups of actors for hardware and software selection, they can participate in the cost–benefits analysis, they can formally review IT professionals' work, they can formally approve an analysis of their information requirements, and they can go as far as assuming leadership of the CIS project. From a more hands-on perspective, physicians can gain control over the new system by participating in the design of screen layouts and report formats, by creating user procedures manuals, by designing the user training program, and/or by training other physicians.

Second, association with an object is also central to the development of feelings of ownership. Beaglehole[43] argues that through intimate knowledge of an object, a fusion of the self with the object takes place. The more information and the better knowledge an individual has about an object, the deeper the relationship between the self and the object and, hence, the stronger the feeling of ownership toward it. In our view, such an association is not possible without continuous communication activities involving formal or informal exchanges of facts, needs, opinions, visions, and concerns regarding the system among the users (physicians) and between users and other project stakeholders.[44] As physicians engage in communication activities with other participants, they expend time and energy. Such efforts can be directed toward making their own needs and desires known to others, toward listening to other actors and discussing their needs and desires, or toward discussing each party's reservations and concerns about the project. Thus, when physicians communicate or exchange information about the system or its development process, they are engaged in development-related activities. As such, they are likely to develop feelings of ownership toward the new system.

Third, an individual's investment of his or her energy, time, effort, and attention in objects causes the self to become one with the object and to develop feelings of ownership toward that object.[22] As illustrated above, there exists a wealth of opportunities for physicians to put time and effort into the development of a new CIS. In that particular context, the investment of the self comes primarily from one's time, skills, and knowledge and is realized through a variety of hands-on, communication, and/or overall responsibility activities.[39] As a result, physicians may begin to feel that the new system flows from the self. In short, we posit that the more physicians exercise control over a new CIS, associate with it, and put time and effort into it, the stronger their feeling of ownership of that system will be (H6).

Finally, we suggest that psychological ownership will, in turn, serve as a key determinant of salient beliefs about a new CIS. Indeed, since having psychological ownership means being psychologically tied to an object and having a feeling of possessiveness for that object, it seems reasonable to argue that the more a physician expresses feelings of ownership toward a new system, the more he or she will perceive it to be of high quality. Such an argument would also be consistent with cognitive dissonance theory[45] to the extent that individuals are more likely to find ownership of high-quality

objects more consonant than ownership of poor-quality objects. In the same vein, the psychology of possession literature demonstrates that people feel positively about targets of ownership. For instance, Beggan[46] showed that people evaluated ideas and objects more favorably when they felt a sense of ownership of the target. As discussed earlier, perceived usefulness and perceived ease of use figure among the system characteristics with the strongest influence in the formation of attitudes.[8] We therefore posit that the more physicians will develop feelings of ownership toward a new CIS, the greater their perception that the system is valuable (H7) and easy to use (H8).

Methods

Study Context and Sample

The CIS under study is a regional POE system primarily aimed at speeding up the transmission of clinical data, mainly laboratory tests and radiology examinations, within a community health network. More precisely, the network consists of 13 medical clinics (client side) as well as a regional community hospital and a private laboratory firm (production side). These organizations are located in a densely-populated suburb, north of Montreal, Quebec, Canada. The CIS also offers a series of electronic functionalities allowing physicians to share clinical information upon patient consent.

The POE system was made accessible to all 132 general practitioners (GPs) working in the 13 clinics. Adoption of the system was not mandatory, although GPs were strongly encouraged to use it. Only two physicians refused to adopt the new system and were not considered in our sample ($N = 130$). The implementation process was characterized by a strong participation of physicians. Indeed, in each participating clinic, a physician volunteered to act as project champion. The responsibilities assigned to these champions were numerous. First, they were all members of a steering committee that held monthly meetings and whose main objective was to conduct detailed clinical information requirements analyses. Second, champions acted as experimental users and repeatedly tested the system interface in laboratory settings. Third, they intervened as experts in the configuration of the POE system, adapting it to their respective clinics' needs. Last, they played the role of super users when the system was first introduced to their own colleagues. As a guarantee of their substantial and prolonged involvement, champions were remunerated for the time they allotted to the project.

Operationalization of Variables

Use of the TAM to investigate physician technology acceptance is advantageous because of its well-researched and validated measurement inventory. Scales for perceived usefulness and ease of use were adapted from those developed and rigorously validated by Venkatesh et al.,[47] while attitudes were adapted from a three-item scale (heightened enjoyment) developed and validated by Agarwal and Karahanna.[19] Actual use was measured using a three-item scale adapted from Thompson et al.[48] Three dimensions of user participation, overall responsibility, hands-on activity, and communication, were assessed in the study. These dimensions were operationalized with four-, four-, and six-item scales, respectively, developed by Barki and Hartwick.[39,44] All measures used a ten-point Likert scale with anchors ranging from "strongly disagree" to "strongly agree." Given the specific composition of the population, the items were operationalized to make sense in this context.

The psychological ownership scale was developed using a multistage iterative procedure. First, an initial set of items was constructed using the scale developed by Van Dyne and Pierce[27] as a starting point. A few adaptations to the scale were made since the target of ownership of that study was the organization. As did Van Dyne and Pierce, we emphasized possession as the basis of our scale and used possessiveness vocabulary such as reflected in everyday associations with property and association for our items. Next, in-depth interviews with ten experienced physicians in the use of various clinical systems were conducted in order to accomplish two main objectives: (1) probe their own conceptualization of the notion of ownership in the particular context of CIS development and implementation and (2) gather their reactions to the scale developed in stage 1. Results from this process led to further refinement of the original scale. As shown in the appendix, the final measure used in the study consisted of seven items.

Data Collection Procedures

As a first step, a pretest of the questionnaire was conducted with five physicians, all working in different clinics. Each of the respondents completed a first version of the questionnaire and provided feedback about the process (e.g., administration time, clarity of directions) and the measures. In general, physicians indicated that the questionnaire was relatively clear and easy to complete. Following the pretest, a small number of modifications to the instrument were made in order to improve the measures and the overall structure and clarity of the questionnaire. Those physicians who took part in the pretest were excluded from the subsequent mail survey.

In the spring of 2005, the final version of the questionnaire, with a cover letter indicating the purpose and the importance of the study, was then sent to the remaining 125 physicians in order to assess the reliability and construct validity of the various scales as well as the strength of the hypothesized relationships. Four weeks following the initial mailing, a follow-up letter was sent to the participants. This letter stressed the importance of their responses and provided a number to call if they had any questions or required a new copy of the survey.

Data Analysis Procedures

In order to establish the nomological validity of psychological ownership, we adopted a two-stage approach. First, the reliability and construct (convergent and discriminant) validity of all scales were assessed. One interpretation of the reliability criterion is the internal consistency of a test, that is, the extent to which the items are homogeneous.[49] In this sense, reliability refers to the accuracy or precision of a measuring instrument. This was tested by calculating Cronbach's α for each construct. Convergent validity refers to whether the items comprising a scale behave as if they are measuring a common underlying construct. Hence, in order to demonstrate convergent validity, items that measure the same construct (i.e., trait) should correlate highly with one another.[49] Further, in factor analysis, factor loadings represent correlations between original item scores and relevant factors and, thus, convergent validity is claimed when all scale items load highly on the same factor. Discriminant validity is concerned with the ability of a

measurement item to differentiate between concepts being measured. We thus compared the square root of the variance shared by the constructs and their measures to the correlations among constructs. Last, following the assessment of the measurement model, descriptive statistics were computed and the eight hypotheses presented in Figure 1 were tested using linear stepwise regression analyses.

Results

Profile of the Respondents

A total of 91 questionnaires (response rate of 72.8%) were returned to the researchers. Twenty-three questionnaires were received after the mailing of the follow-up letter. These were used in order to assess the possibility of a nonresponse bias. Precisely, a comparison of the responses returned early (first wave: $n = 68$) to those returned late (second wave: $n = 23$) was conducted.[50] Crosstabs analyses, Mann-Whitney tests, and t-tests were conducted to determine whether differences in response time were associated with different responses. Results (not shown here) indicated no significant differences in any of the variables of interest; hence, no significant bias was detected. In addition, independent t-tests did not show any statistically significant difference between respondents and nonrespondents in terms of gender, age, and job tenure.

Of the 91 questionnaires, 57% were received from men and 43% from women. A vast majority of respondents were established physicians, 66% of them having 11 years and more experience in the medical field. As expected, only one out of ten respondents acted as project champion. The respondents' average POE system use was 7.5 hours per week, and their average experience with personal computers was 6.1 on a ten-point Likert scale. Table 1 shows the profile of the respondents.

Psychometric Properties of Scales

The next step was to evaluate the measurement model in terms of its reliability and construct validity. Considering

Table 1 ■ Profile of the Respondent ($N = 91$)

Gender	
Male	57%
Female	43%
Age, y	
30–45	36%
46–55	38%
56+	26%
Tenure in medical clinic, y	
<1 year	3%
1–5	16%
6–10	15%
11+	66%
Champion	
Yes	11%
No	89%
System use per week, h	
Mean	7.5
Standard deviation	10.6
Minimum	<1
Maximum	48
Experience with computers in general	
Mean	6.1
Standard deviation	2.3
Minimum	1
Maximum	10

Nunally's guidelines,[51] it was decided that the target level of minimum reliability would be set in the 0.70 to 0.80 range. As shown in Table 2, the composite reliability coefficients of all the measurement scales ranged from 0.87 to 0.97.

A series of eight principal component factor analyses was then performed for items pertaining to each construct (not shown here). Results from these analyses reveal that all scale items associated with a given construct loaded highly on a single factor. One exception is item PO5, which was removed from the psychological ownership scale. As shown in Table 2, a fairly high level of discriminant validity was obtained given that diagonal elements (square root coefficients) are all larger than off-diagonal elements (interconstruct correlations). Results from a principal components factor analysis should also reflect that measures of constructs correlate higher with their own items than with measures of other constructs in the model. In the present study, the size of the sample precluded the use of factor analysis for this particular purpose. Nevertheless, overall results suggest adequate reliability as well as convergent and discriminant validity of the measurement instruments.

Descriptive Statistics and Hypothesis Testing

Table 2 presents the means and standard deviation of the constructs. As expected, physicians who acted as champions of the POE system participated more than nonchampion users and, hence, were found to have stronger feelings of ownership toward the system (Table 3). The difference between champions and nonchampions was smaller for the overall responsibility dimension than those observed for the other two dimensions of participation. To a certain extent, this result was expected, given that champions did not act as formal project leaders and, hence, did not spend a great deal of effort performing responsibility activities. Partly because of their higher level of ownership, champions perceived the CIS to be more valuable and easy to use than nonchampions and, hence, developed more favorable attitudes toward it. Last, champions' level of system use was only slightly higher than that of nonchampions.

The regression results are detailed in Table 4. First, findings reveal that perceived usefulness and attitudes toward using the system have significant positive effects on physicians' CIS usage, providing support for both H1 and H2. The study variables explained 55% of the variance in system use. Second, 78% of the variance in physicians' attitudes toward the CIS was explained by perceived usefulness (H3) and perceived ease of use (H4). As did others, we found that the two determinants were not equal in strength.[8,37,52] The link between perceived usefulness and attitude was significantly stronger than the link between perceived ease of use and attitudes. We concur with Davis[8] that the prominence of perceived usefulness makes sense conceptually since users are driven to adopt an application primarily because of the functions it performs for them, and secondarily for how easy or hard it is to get the system to perform those functions. In our view, another plausible explanation for the observed differential is that the importance of perceived ease of use as a determinant of user attitudes may become insignificant after users' prolonged exposure to the technology.

Third, a linear regression of predictors on physicians' perceived usefulness was conducted. The model explains 76% of the variance in the criterion variable, and both predictors

Table 2 ■ Descriptive Statistics, Reliability Coefficients, & Interconstruct Correlations

	α	Mean	SD	Use	A	PU	PEOU	PO	OR	HO	COM
Use	0.97	5.5	3.5	0.96							
A	0.92	6.5	2.7	0.71	0.93						
PU	0.96	5.0	3.0	0.75	0.87	0.94					
PEOU	0.96	6.6	2.3	0.67	0.79	0.79	0.95				
PO	0.92	4.0	2.7	0.67	0.75	0.81	0.69	0.83			
OR	0.87	1.5	2.4	0.17	0.27	0.31	0.14	0.56	0.85		
HO	0.89	2.0	2.8	0.22	0.31	0.34	0.26	0.48	0.65	0.89	
COM	0.95	4.2	3.4	0.39	0.40	0.50	0.34	0.65	0.34	0.24	0.90

The shaded numbers on the leading diagonal are the square root of the variance shared by the constructs and their measures. Off-diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.
SD = standard deviation; Use = system use; A = attitudes; PU = perceived usefulness; PEOU = perceived ease of use; PO = psychological ownership; OR = overall responsibility activities; HO = hands-on activities; COM = communications activities.

Table 3 ■ Comparison of Champions with Non-Champion Users

	Champions (n = 10)		Nonchampions (n = 81)		t-test	
Variable	Mean	SD	Mean	SD	t	p
Overall responsibility**	3.1	2.8	1.2	2.2	2.3	0.023
Hands-on activities***	4.6	3.1	1.6	2.5	3.4	0.001
Communication***	7.0	2.8	3.8	3.3	3.0	0.004
Psychological ownership***	6.5	2.5	3.6	2.5	3.4	0.001
Perceived usefulness**	7.0	2.5	4.6	3.0	2.4	0.021
Perceived ease of use**	8.3	1.7	6.4	2.3	2.5	0.04
Attitudes**	8.2	1.7	6.2	2.8	2.1	0.036
System use*	7.4	2.4	5.2	3.5	1.9	0.065

SD = standard deviation.
*p < 0.10; **p < 0.05; ***p < 0.005.

were statistically different from zero. The standardized regression coefficients show that feelings of ownership toward the new system (H7) and, to a lesser extent, perceived ease of use (H5) had significant and positive effects on the extent to which physicians perceived the CIS to be useful. Fourth, as anticipated, feelings of ownership toward the system were also found to explain 43% of the variance in perceived ease of use (H8). Altogether, these results provide preliminary, yet solid, empirical support for the inclusion of the construct of psychological ownership in future models of physicians' adoption of IT. Indeed, psychological ownership's highly significant relationships with crucial beliefs driving technology acceptance behaviors affirm the value of this construct in extending our understanding of physicians' reactions to IT.

Next, we tested the effects of three forms of user participation on physicians' feelings of ownership. As shown in Table 4, user participation was found to have a significant and positive influence on psychological ownership, accounting for 37% of the variance in the criterion variable. More specifically, the results indicate that communication and overall responsibility are the most important antecedents of psychological ownership. On the other hand, contrary to our expectations, the data show that hands-on activities did not have a significant effect on the development of feelings of ownership. One possible explanation for this finding might be that hands-on activities are not perceived by physicians as being meaningful enough to lead to the development of psychological ownership.

Discussion and Conclusion

Prior to discussing the practical implications of our findings, limitations that circumscribe their interpretation must be acknowledged. First, the ideal test for construct validity would require multimethod measurement of each construct[53] to distinguish one concept from another. This study, as does most of the research in the IT adoption behavior controversy, relied on single methods. Hence, future research should attempt to gather data from multiple methods such as structured interviews, questionnaires, and observation. Second, the psychological ownership construct requires further validation, particularly in terms of discriminant validity, as the size of the sample precluded the use of confirmatory factor analysis for this purpose. Further, in our study, we measured the state of psychological ownership retrospectively. We concur that an ideal examination of this state would take place during the development process and immediately following the system "going live." This suggests the need for longitudinal as opposed to cross-sectional studies.

Although the obtained response rate appears to be highly satisfactory in comparison with most mail surveys,[54] we acknowledge the usual limitations on generalizability associated with the use of the mail questionnaires for data collection purposes and the cross-sectional nature of the study. We also acknowledge that certain relationships might be circular in nature. For instance, the psychological ownership–perceived usefulness association seems to be a good case in hand that would benefit from more attention in future studies. Last, the theoretical findings would benefit not only from being tested in organizational contexts using other technologies such as telemedicine, imaging systems, and nursing information systems, but also to be tested against recent project failures where clinical systems were abandoned at some point or not used at all.

Several implications follow for both theory development and practice. With regard to theoretical advancement, for researchers interested in extending this line of work, the first critical issue relates to the psychometric properties of the psychological ownership construct. Although our initial assessment of these properties in this empirical study is encouraging, the loading for one of the items (PO5) was not at the desired level. Interestingly, this was the only item that was reverse-scaled. According to Herche and Engelland,[55] reverse-code items may have negative effects on the unidimensionality of the underlying scale. Therefore, we

Table 4 ■ Linear Regression Results

Dependent Variable	Independent Variable	PE	SE	Standardized Coefficients	t-Value	p
System use	Intercept	2.3	0.58		4.0	0.001
	Perceived usefulness*			0.40	2.5	0.015
	Attitudes*			0.38	2.3	0.023
	Overall model: $F = 43.4$; $p < 0.001$; $R^2 = 0.57$; adjusted $R^2 = 0.55$					
Attitudes toward the system	Intercept	1.2	0.48		2.6	0.012
	Perceived usefulness**			0.65	7.8	0.000
	Perceived ease of use*			0.29	3.5	0.001
	Overall model: $F = 127.4$; $p < 0.001$; $R^2 = 0.79$; adjusted $R^2 = 0.78$					
Perceived usefulness	Intercept	−0.7	0.55		−1.3	−0.211
	Psychological ownership**			0.62	7.8	0.000
	Perceived ease of use**			0.33	4.2	0.000
	Overall model: $F = 111.2$; $p < 0.001$; $R^2 = 0.77$; adjusted $R^2 = 0.76$					
Perceived ease of use	Intercept	4.4	0.36		12.1	0.000
	Psychological ownership			0.66	7.3	0.000
	Overall model: $F = 53.9$; $p < 0.001$; $R^2 = 0.44$; adjusted $R^2 = 0.43$					
Psychological ownership	Intercept	2.1	0.40		5.0	0.000
	Overall responsibility*			0.35	3.3	0.002
	Hands-on activities			0.20	1.5	0.151
	Communication**			0.39	3.7	0.000
	Overall model: $F = 20.9$; $p < 0.001$; $R^2 = 0.39$; adjusted $R^2 = 0.37$					

PE = parameter estimate; SE = standard error.
*$p < 0.05$; **$p < 0.001$.

encourage others using the psychological ownership scale to consider replacing the reverse scaled item in order to develop a measure that exhibits greater convergence.

Second, the nomological net for psychological ownership is worthy of continued development and refinement. Our focus was on three dimensions of user participation as antecedents. However, there are other constructs that may also be relevant. For instance, user involvement and subjective norms could be positively related to psychological ownership in the context of CIS implementation. Barki and Hartwick[13] define user involvement as "a subjective psychological state reflecting the importance and personal relevance of a system to the user" (p. 53). Based on this definition, it can be argued that the more a user perceives a system to be important and personally relevant, the more he or she will develop feelings of ownership toward it. Furthermore, empirical support has been found for the relationship between social norms and end-user behaviors. More specifically, immediate supervisors and peers can play an important part in influencing attitudes toward a system as well as actual system use.[56–58] Consistent with previous empirical findings, it therefore seems reasonable to argue that stronger social norms toward CIS usage will lead to higher levels of psychological ownership of the system.

The results obtained in this study can guide CIS project leaders whose objectives are to promote system adoption and use among clinicians in their organizations. First, our findings reveal that, in order to foster physicians' adoption of CIS, it is important to encourage and cultivate a positive attitude toward using the new system. In this connection, positive perception of the technology's usefulness is crucial, whereas the technology's ease of use may not be equally important for health professionals. We concur with Chau and Hu[37] that "the significant role of perceived usefulness and individual attitude formulation might have been partially rooted in physicians' tool-oriented view of technology, acceptable only when demonstrating proven or desired utility

in their practice" (p. 307). One logical implication is that CIS project leaders and managers should strongly emphasize devising effective means to communicate the clinical utility of the CIS to target physicians. Information sessions and sufficient training on the system need to focus primarily on *how* the technology *can help* improve the efficiency and effectiveness of physician's patient care and service delivery rather than on the steps or procedures of actual use of the system.

Second, one of the main objectives in this study was to increase our understanding of psychological ownership in the context of CIS implementation by testing predicted relationships between feelings of ownership and users' beliefs about the clinical system. Results demonstrate that psychological ownership of the CIS increased explained variance in perceived usefulness and perceived ease of use, two system characteristics having a strong influence in the formation of user attitudes. Overall, these findings are important because they show that psychological ownership of a clinical system increases project managers' ability to predict and understand physicians' acceptance of these systems.

Third, the findings reported herein reveal that through their participation, users feel they have greater influence on the development process, thereby developing feelings of ownership. More specifically, ownership of a system is not possible without continuous communication activities involving formal or informal exchanges of facts, needs, opinions, visions, and concerns regarding the system. The CIS project leaders and managers must therefore provide users with opportunities to make their own needs and desires known to other key actors (e.g., IT or medical informatics specialists), listen to others, and discuss each party's concerns about the system and its impact on work. Importantly, overall responsibility activities were also found to be positively related to psychological ownership. As noted by Barki and Hartwick,[39] such responsibilities are normally assigned to a very small number of user representatives. In order to create a sense of

responsibility in a larger number of users, these same authors proposed two strategies. First, additional development activities that lead to a sense of responsibility could be identified and assigned to different users. Alternatively, responsibility activities could be assigned to user groups.

In conclusion, the results presented in this paper have broadened and strengthened the foundations of previous physicians' IT adoption research. More specifically, this research was motivated by a broad interest in understanding physicians' behavior toward CIS. Acknowledging that the major challenges to CIS success often become more behavioral than technological,[3] we argued for the need to focus on the construct of psychological ownership. The proposed nomological net for psychological ownership included behavioral beliefs about CIS use as consequences and three dimensions of user participation as antecedents. Results provided strong support for the posited relationships. Psychological ownership's highly significant associations with crucial beliefs driving technology acceptance behaviors among physicians affirm the value of this construct in extending our understanding of CIS adoption.

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APPENDIX

Psychological Ownership Scale Items

PO1 I personally invested a lot in the development of the CIS in my medical clinic.

PO2 When I think about it, I see a part of myself in the CIS.

PO3 I feel the CIS belongs to all the doctors in my clinic.

PO4 I feel a high level of ownership toward the CIS.

PO5 I hardly think of the CIS as being my own system (reverse).

PO6 I see myself as a champion of the CIS in my medical clinic.

PO7 I configured the functionalities of the CIS to better align them with my medical practice.