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Direct and Indirect Information System Use: A Multimethod Exploration of Social Power Antecedents in Healthcare

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Abstract. When an organization introduces an information system (IS), management often expects employees to utilize the system. However, rather than use the system directly, designated users may delegate some parts of their IS use to other users while assuming primary responsibility and accountability for the system use tasks. This behavior is called indirect IS use, a behavior that is acknowledged in some studies but not adequately scrutinized. This research distinguishes between direct and indirect IS use and proposes a model of their respective antecedents. The research was carried out in three stages. First, we conceptually distinguished direct and indirect IS use and drew on a social power lens to develop a theoretically driven research framework. Second, we contextually refined the research framework with a case study in a Confucian society. Third, we validated the research model through a survey of 213 Chinese physicians. Results revealed that direct and indirect IS use are partially substitutive, as demonstrated by the varying effects of social power and physiological power on these types of IS use. Further insights were gained by splitting the two forms of IS use based on the extent of clinical accountability risks and combining the two types of IS use based on their sum or relative amount. With the distinct relationships between social power and different forms of IS use, management could employ the appropriate strategies to influence the desired system usage behavior from its employees.

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Keywords: indirect IS use • direct IS use • healthcare information system • social power • Confucian context

1. Introduction

Designated system users can deviate from management expectations by asking other people to interact with the system on their behalf. This behavior is known as indirect information system (IS) use (Kane and Alavi 2008). As early as four decades ago, indirect IS use was observed in a case study on five school superintendents and was termed “chauffeur-driven” use (Carlson et al. 1977, p. 58). Since then, other researchers have discussed the nature of indirect IS use beyond the notion of such use as a mere substitute for direct IS use (Kraemer et al. 1993) and have noted its prevalent use in contexts such as healthcare (Davidson and Chiasson 2005, Kane and Alavi 2008). The majority of the IS literature still considers direct IS use as the de facto representation of IS use (DeLone and McLean 2003) and disregards the coexistence of indirect IS use, a practice that leaves us with an incomplete understanding of IS use in work settings.

Based on the system use definition by He and King (2008), direct and indirect IS use are defined as follows: (a) *direct IS use* is the extent to which a designated

user personally operates an IS in work settings, and (b) *indirect IS use* is the extent to which a designated user interacts with an IS via one or more intermediary users while assuming primary responsibility and accountability for the system use tasks. Engaging in indirect IS use can be helpful or harmful, depending on the context. Ultimately, researchers should be able to advise organizations on how to maximize benefits and minimize costs. A complete program of research on indirect IS use can include assessing the total amount of use (i.e., direct IS use plus indirect IS use), the relative amount of direct over indirect IS use, and the separation of direct and indirect IS use. As a first step, this research focuses on the last approach to understand why and how both types of IS use arise in work settings. In this way, direct and indirect IS use can be assessed separately in a partial substitution setting.

Past research suggests that the system-related factors (such as system quality and perceived usefulness) are instrumental to IS use (Hsieh et al. 2011, Venkatesh and Davis 2000). This research adopts a different perspective on examining the relevance of social power to

predict direct and indirect IS use. Departing from the system perspective accords to the viewpoint that when a system has been assimilated within an organization, the system issue could be less of a profound concern. Rather, it is the users, such as the physicians, who can exert and be subjected to social power/influence, to decide how to use the IS (Kohli and Kettinger 2004, Lapointe and Rivard 2005, Wang et al. 2013).

The social power lens was selected for two reasons. First, social power is the ability of a group or a person (i.e., agent) to affect the belief or ability of another person (i.e., target) according to the agent's desires (French and Raven 1959). Indirectly using a system inevitably involves delegation, which cannot occur without power over those to whom the agent delegates. Second, although IS researchers have long examined how power can influence direct IS use through the lens of social influence such as subjective norms (Ajzen 1991), they did not differentiate the effect of this influence on direct IS use vis-à-vis indirect IS use. We extend this line of work by adopting the social power typology of Raven et al. (1998) to capture multiple forms of social power and examine how such forms affect both direct and indirect IS use.

We situate our study in the context of physicians' use of an electronic medical record (EMR) system in a Confucian society. An EMR system is a computer-based patient record management system in which health-related information on a patient is electronically created, captured, and managed by healthcare professionals in a hospital (Wager et al. 2013). We select this context because physicians are known to engage in indirect IS use (Davidson and Chiasson 2005), and the potential benefits (in terms of efficiencies) and costs (in terms of risks) of indirect IS use are particularly salient in this context (Ash et al. 2007). Hence, social power could be essential in predicting physicians' direct and indirect IS use in hospitals. The Confucian context also exhibits several interesting characteristics related to social power, such as acceptance of an unequal distribution of power and adherence to social rules (Liang et al. 2013, Xie et al. 2008, Xue et al. 2011).

The research was conducted using a three-stage, multimethod approach (Mingers 2001) as outlined in Table 1. Each stage (conceptualization, refinement, and validation) is discussed in the subsequent sections. We then summarize theoretical and practical implications of this study and conclude the paper.

2. Stage 1: Conceptualization of the Initial Research Framework

2.1. Direct and Indirect IS Use

The notion of indirect IS use needs to be formalized because only direct IS use is well established in the literature. The conceptualization of indirect IS use in this research is rooted in prior conceptualizations of

indirect IS use and delegated use (see Table 2). Previous studies on indirect IS use (e.g., Culnan 1983, Keen 1976, Kraemer et al. 1993) and delegated IS use (e.g., Larsen 1993) considered designated users as managers who specify a single type of task (e.g., acquiring system information for decision making) to intermediary users, such as secretaries. Intermediary users typically obtain printed outputs from the system, which are then read and used by designated users in making decisions or taking action. Thus, in the early studies, indirect or delegated IS use involved extensive interaction between managers and the IS via secretaries. Later studies on indirect IS use (e.g., Bisaso et al. 2008, Kane and Alavi 2008) and delegated IS use (e.g., Farhoomand and Drury 2002, Saunders and Chiasson 2009) expanded the scopes of designated users to include regular employees, intermediary users to include colleagues, and type of tasks to include transactional activities. By contrast to earlier studies, the interaction of designated users with the system is not as clear cut. For instance, designated users may or may not need to verify, add to, or act on what was input into or retrieved from the system.

Despite the similarities between indirect and delegated IS use in the literature, we select indirect IS use as the notion of our focal behavior for two reasons. First, delegation is rooted in the organizational behavior literature and is often indicative of a shift in responsibility and subordinate empowerment (Chen and Aryee 2007). However, in this study, responsibility and accountability still reside with the designated user and not the intermediary users. Second, the notion of indirect IS use is more extensively adopted than delegated IS use by researchers. The conceptualization of indirect IS use in the current research is closely aligned with the conceptualization adopted by Bisaso et al. (2008) and Kane and Alavi (2008).

With a clear conceptualization of indirect IS use, we next explain the relationship between indirect and direct IS use. Even if system use is mandatory, its exact usage is not mandatory (Hartwick and Barki 1994, Jaspersen et al. 2005) and may vary for three reasons. First, an organizational IS is comprised of multiple features to support work tasks (Jaspersen et al. 2005). The use of these features depends on how users interpret the IS, which, in turn, leads to different use behaviors (Griffith 1999). Second, actual IS use can also be related to how motivated users are to perform specific nonmandatory system tasks (Hsieh et al. 2011). For example, motivated physicians may perform certain noncompulsory system tasks, such as recording intermediary discussions into the system for future reference, thereby inducing a high total use of the EMR system. Third, the extent of indirect IS use depends on how much users decide to delegate the tasks to others to do on their behalf. Following the previous example,

Table 1. Summary of the Sequential Multistage Approach

	Stage 1: Conceptualization	Stage 2: Refinement	Stage 3: Validation
Purpose	Conceptualize direct and indirect IS use Identify a theoretically driven research framework	Refine the derived research framework in Stage 1 by considering the focal context (i.e., institutional (hospital) and cultural (China) domains)	Empirically test the refined research model in Stage 2 through a survey
Data source	Extant literature (e.g., social power, IS use, IS assimilation, and healthcare IS)	On-site observations; interviews with 2 supervisory physicians and 14 regular physicians; dialogues with IS professionals; documents on EMR system deployment	On-site survey (213 physicians)
Key findings	Direct and indirect IS use are partially substitutive Research framework • Harsh and soft powers have different bases and are expected to exert different effects on both direct and indirect IS use	Refined research model • Contextual assumptions are understood • Appropriate forms of social power are selected • Specific hypotheses are formulated	Hypothesis testing results • Social power from others —Harsh power and soft power affect direct and indirect IS use in different manners —Harsh power is more effective than soft power • Power from physicians can affect direct and/or indirect IS use

physicians may ask interns to input the intermediary results, but then personally review and synthesize the information to complete the diagnosis, thereby demonstrating high direct and indirect IS use.

Given such considerable discretion, we posit that direct IS use and indirect IS use are partially substitutive; that is, we should expect some substitutive (i.e., users may delegate things they would otherwise do

themselves) and some nonsubstitutive relationships (i.e., users may delegate things they would not have had time to do themselves). The extent to which direct and indirect IS use actually substitute for each other depends on the given empirical context. In cases where substitution is very strong, researchers can probably focus on one usage behavior (e.g., direct or indirect IS use) or one combined measure of usage behavior

Table 2. Conceptualization of Indirect IS Use and Its Related Terms

Key references	Term	Conceptualization	Typical task	Extent of interaction between the designated user and the system via the intermediary user
Conventional conceptualization				
Keen (1976), Culnan (1983), Kraemer et al. (1993)	Indirect use; “chauffeured” use	Designated users (e.g., managers) do not interact directly with the system but receive and use the information produced by the system via intermediary users (e.g., secretaries)	Acquiring information from the system for decision making	Extensive (designated users usually specify the system tasks and read the system information)
Larsen (1993)	Delegated use	Designated users (e.g., managers) obtain information from computers by delegating the execution of these tasks to secretaries, staff members, or other available sources		
Recent conceptualization				
Bisaso et al. (2008), Kane and Alavi (2008)	Indirect use	Designated users (e.g., healthcare providers or school staff members) ask intermediary users (e.g., subordinates or colleagues) to enter or retrieve information from the system	Performing multiple system-related transactions (e.g., enter or retrieve system-related information)	Mixed (designated users may or may not need to verify, add to, or act on what was input into or retrieved from the system)
This study	Indirect IS use	Designated users (i.e., physicians) interact with the system via one or more intermediary users (i.e., interns or colleagues) while assuming primary responsibility and accountability for system use tasks		

(e.g., sum of direct IS use and indirect IS use, or relative amount of direct over indirect IS use). However, when the substitution is weak, we then need to model direct and indirect IS use separately. This partially substitutive relationship can also be inferred from the fact that the effects of both usage types are not diametrically opposed, because both types can achieve the same end, namely, to complete system tasks. Therefore, the two-by-two permutations of IS use can be derived as follows: (1) high direct IS use and low indirect IS use, (2) high direct IS use and high indirect IS use, (3) low direct IS use and high indirect IS use, and (4) low direct IS use and low indirect IS use. We posit that direct and indirect IS use are partially substitutive in the studied context and hence consider them separately as two dependent variables.

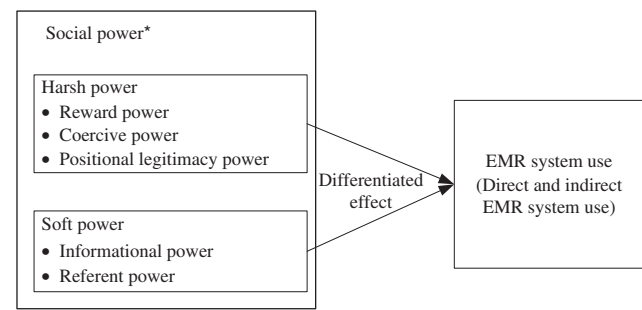
2.2. Forms of Social Power

Social power theory suggests that an individual or a group of people with a specific social power (i.e., agent) can induce the psychological or behavioral compliance of another person (i.e., target), which the latter would not do otherwise (Raven et al. 1998). In various dyadic relationships (e.g., supervisor–subordinate and professor–student), the social power of an agent can affect the outcomes of a target, such as work performance, organizational commitment, and compliance (Carson et al. 1993, Koslowsky et al. 2001). The typology of Raven et al. (1998) provides a comprehensive view of social power. According to this typology, a person can comply with another person when the latter (1) offers positive compensation for the compliance (i.e., reward power), (2) imposes unpleasant penalties for noncompliance (i.e., coercive power), (3) occupies a legitimate position in an organizational hierarchy or norm (i.e., legitimacy power), (4) is a valuable referent to the target (i.e., referent power), or (5) possesses the expertise or information that the target lacks (i.e., informational power). These forms of social power can be dichotomized into harsh power and soft power (Schwarzwalld et al. 2005).

Harsh power chiefly stems from organizational resources, such as the position of the authority (Raven et al. 1998). An agent (e.g., supervisor) who possesses harsh power has inherent advantages over a target (e.g., subordinate). Harsh power is demonstrated in two ways. First, the compliance of a target can be based on his or her desire to receive additional outcomes, such as obtaining a bonus or avoiding disapproval from a supervisor (i.e., reward and coercive power; Mulder et al. 1986). Second, harsh power can be induced by a sense of obligation that is based on an organizational hierarchy without any returns (i.e., positional legitimacy power; Raven et al. 1998).

Differing from harsh power, soft power is often formed through the personal characteristics of an agent,

Figure 1. Research Framework



*Adapted from Raven et al. (1998).

such as perceived attractiveness (i.e., referent power) or knowledge (i.e., informational power; Schwarzwalld et al. 2005). The effectiveness of soft power depends on how a target recognizes the personal characteristics of an agent (e.g., if a physician wants to identify with departmental peers).

2.3. Initial Research Framework

After considering the extant development of social power and relating such development to IS use, we propose an initial research framework that suggests the two broad forms of social power, namely, harsh power and soft power, have different effects on the direct and indirect EMR system use of a physician (Figure 1). This research framework warrants further refinement for several reasons. First, although previous studies have recognized the impacts of social influence or social power (Kohli and Kettinger 2004, Jaspersion et al. 2002), the mechanism by which social power affects the two types of compliance (in this case, direct and indirect IS use) remains unclear. Second, instead of being affected by one power agent, as examined in the previous literature, an individual can be subjected to social power from multiple agents, such as supervisors and peers (Lewis et al. 2003). Third, subjects in previous studies constitute only one part of the dyad, either as an agent exerting power or as a target receiving the power but not both. Physicians are not only affected by power from others (e.g., supervisors) but also naturally possess power in hospitals (e.g., positional legitimacy power). Fourth, existing studies were mainly conducted in Western countries. However, the influence of traditional Confucian values may challenge or moderate the previously established relationships in Western countries (Farh et al. 1998, Xie et al. 2008).

3. Stage 2: Refinement of the Research Framework

In light of the aforementioned gaps, this research follows the sequential multimethod research approach (Mingers 2001) to refine the research framework through a case study. Qualitative data help explain the context, determine the appropriate forms of social

power, and identify the different effects of social power on direct and indirect IS use. A contextualized research model is proposed from the case study, in which a large public general hospital in China with approximately 3,000 beds is examined. Selecting a single hospital helps identify individual-level effects by controlling for the effects at the organizational level, such as hospital differences (Karahanna et al. 1999). This hospital was selected for three reasons. First, given that the EMR system was introduced approximately three years prior to data collection, the physicians in the hospital had entered a stable system use phase. Second, the EMR system was implemented throughout the hospital to provide physicians with a centralized view of the electronic health records of their patients. This system allowed physicians to document patient medical information, order medications and tests, and search test results and billing information. Third, the studied hospital is located in a Confucian society, which is a criterion of the current study.

3.1. Data Collection

The qualitative data collection lasted for more than three months. The data-gathering techniques included on-site observations, dialogues with IS professionals, acquisition of EMR system-related documents, and interviews with 14 physicians¹ with different ranks and two supervisory physicians (i.e., department heads).² In the interviews, the physicians were asked about their IS use (e.g., How do you use the EMR system in your daily work? How do you view the value of the EMR system? What are the possible reasons behind your usage behaviors?). They were also asked about pertinent contextual issues, such as their perceptions of their supervisors' views on EMR system use and on the regulations related to EMR system use. Supervisory physicians were also interviewed to ascertain their role in EMR system use. The interview questions included the following: How is the EMR system being used by the physicians in your department? What is your attitude toward the EMR system? Are you confident that the EMR system has been deployed as originally envisioned?

The interviews were open ended and interactive. The interviewees were encouraged to answer by using examples, specifically for points relevant to the focus of the research. Each interview lasted 30 minutes to an hour. We adopted the interpretive approach in the data collection and analysis. In accordance with Klein and Myers (1999), we followed the principal of multiple interpretations by documenting multiple viewpoints from supervisors and physicians. The theoretical lens served as a "sensitizing device" to help identify an initial set of themes pertinent to this study (e.g., direct or indirect IS use behavior, attitude toward system use, social power, and Confucian philosophies).

We organized and coded the transcribed interview data according to this set of themes. We updated the preconceptions formed by the theoretical lens with the qualitative data in several rounds (Klein and Myers 1999), and also triangulated the findings derived from different sources (Dooley 2001).

3.2. Case Findings

Hospital Setting Toward EMR System Use. Based on the dialogue with IS professionals and the related documents, the EMR system was regarded as a key information technology (IT) delivery vehicle for efficient and quality healthcare. This system was the most expensive IS investment of the hospital to date. The hospital management highly endorsed EMR system use and assumed the system would be directly used by the physicians. Administrative strategies were set to promote such use. First, system access control was implemented in such a way that (1) each physician was given a system access account; (2) interns, who were not official physicians, were not given access accounts because all system-related tasks were designed to be accomplished by physicians directly; and (3) only the accounts of the physicians-in-charge could prescribe medications and issue test orders for a patient. Second, policies were established to guide the conduct of physicians in relation to (direct) IS use (e.g., procedures on how a physician can personally perform system-related tasks were specified in the user guide). Third, supervisory physicians (i.e., medical department heads) were tasked with promoting use (especially the direct use) of the EMR system to their fellow physicians and were encouraged to consider EMR system use when appraising the fellow physicians. Despite these efforts, a physician who used the system indirectly in the focal hospital was not likely to be liable for legal issues. The hospital did not implement the digital signature in the EMR system. Hence, the applicable regulations of EMR systems in China at that time focused on the accurate, timely, and comprehensive documentation of medical information, and not on explicitly dictating how the system features should be used (Ministry of Health 2010). The designated physicians were required to sign on the printed reports (e.g., discharge summary), which were stored physically as legal proof.

Use and Attitudes of Physicians Toward EMR System Use. The interviewed physicians revealed that they engaged in indirect IS use to a certain extent via intermediary users, such as interns and peers. Similar to physicians in other large public hospitals in China, they had a high workload (typically in charge of 10 inpatients and 30 outpatients a day). Therefore, indirect EMR system use was perceived by many physicians as a quick and practical solution to system-related hassles and busy work schedules. They felt that the

Table 3. Incidences and Effects of Direct IS Use, Indirect IS Use, and Nonuse

EMR system feature (description)	Typical incidence	Effect on care delivery
Input diagnosis or summary for patients (Physicians can input medical diagnoses and summarize additional medical details, such as the symptoms and medical history of the patient, the treatment plan, and the discharge summary.)	<i>Direct IS use:</i> A designated physician inputs the diagnosis or summary into the EMR system. <i>Indirect IS use:</i> A designated physician asks the interns to input the diagnosis or summary and then verifies the input information during his or her free time. <i>Nonuse:</i> When the diagnosis must be input after office hours, a physician usually leaves notes for other physicians to input the information the next day.	Quality care can be provided, but a physician may sacrifice the time used for patient interaction. Quality care can be provided. Quality care may not be ensured.
Input computerized prescriptions (medication or test) (Physicians can input prescription orders, including medications and laboratory or radiology tests.)	<i>Direct IS use:</i> A designated physician inputs the prescriptions into the EMR system after finishing his or her rounds in the morning. <i>Indirect IS use:</i> A designated physician who must perform day surgery tells an intern about the prescription, which is inputted into the EMR system. The designated physician may check the record after the surgery. <i>Nonuse:</i> When a patient has a deep stupor and no family member is present, the timely electronic prescriptions for the patient cannot be issued as creating a complete and authorized patient account at this time is impossible. Hence, a designated physician issues a written prescription or writes notes in the paper-based patient record.	Quality care is provided. Efficiency of care is ensured. The quality of care may be undermined when an intern transcribes the prescription incorrectly (e.g., indicating the wrong dosage or no end date of the medication). Quality care can still be provided because the patient can be treated, though less efficiently (i.e., in contrast to electronic prescriptions, paper-based prescriptions cannot be transmitted instantly to the pharmacy).
Search test order results (Physicians can search and view the prescribed laboratory or radiology test orders.)	<i>Direct IS use:</i> A designated physician may directly search the test report in the EMR system. <i>Indirect IS use:</i> A designated physician asks an intern to check the results in the EMR system and report to him or her if an abnormal situation is observed. <i>Nonuse:</i> Instead of using the EMR system, physicians can refer to the paper case notes for the patients, which contain the printed copies of all test results.	Quality care can be provided. Quality care may be undermined when the intern may be unable to interpret complex test results. Quality care can be provided.
Search patient bills (Physicians can search and view the medical bills and insurance coverage information.)	<i>Direct IS use:</i> A designated physician searches the previous bills of a patient in the EMR system and the patient's insurance coverage. The physician selects the medications covered by the insurance. <i>Indirect IS use:</i> A designated physician asks an intern to check the previous bills of a patient in the EMR system. When the intern reports to the physician, the physician adjusts the medications. <i>Nonuse:</i> Instead of searching the bills from the EMR system, physicians can walk in or call the financial counter to check the bills.	Affordable care can be provided. Affordable care can be provided although slightly less efficiently. Affordable care can be provided.

enforced process of EMR system use would not always be beneficial to patient care. The system might be helpful, but is not entirely necessary in providing adequate care. Table 3 illustrates such non-black-and-white situations with the key features of the EMR system, typical incidences, and effects. Many physicians perceived the EMR system more as a form of administrative work and that most of the system benefits, if realized, would directly benefit the hospital. Such benefit asymmetry was explained by an assistant chief physician as follows:

The hospital management definitely benefits from the system. The management can conduct reports and

analyses and obtain a better view of the hospital administration. However, for us, it is difficult to say. Many system functions are routine data entry work. They do not improve our expertise in treating our patients.

Attitudes of Supervisory Physicians Toward EMR System Use. By closely working with physicians, handling medical teams, and working in offices adjacent to those of their subordinates, the interviewed supervisory physicians were aware that many physicians in their departments engaged in indirect EMR system use. In other words, although supervisors could not monitor the actual EMR system use of

their subordinates automatically via system logs, as physicians could share their log-in credentials, they could still detect the extent of their subordinates' EMR system use through daily observations and contacts. According to a supervisory physician

All of the physicians and interns in my department sit in one big shared office called the physicians' office. I have a separate office within the large physicians' office, so I can clearly observe their behaviors, including how they use the system.

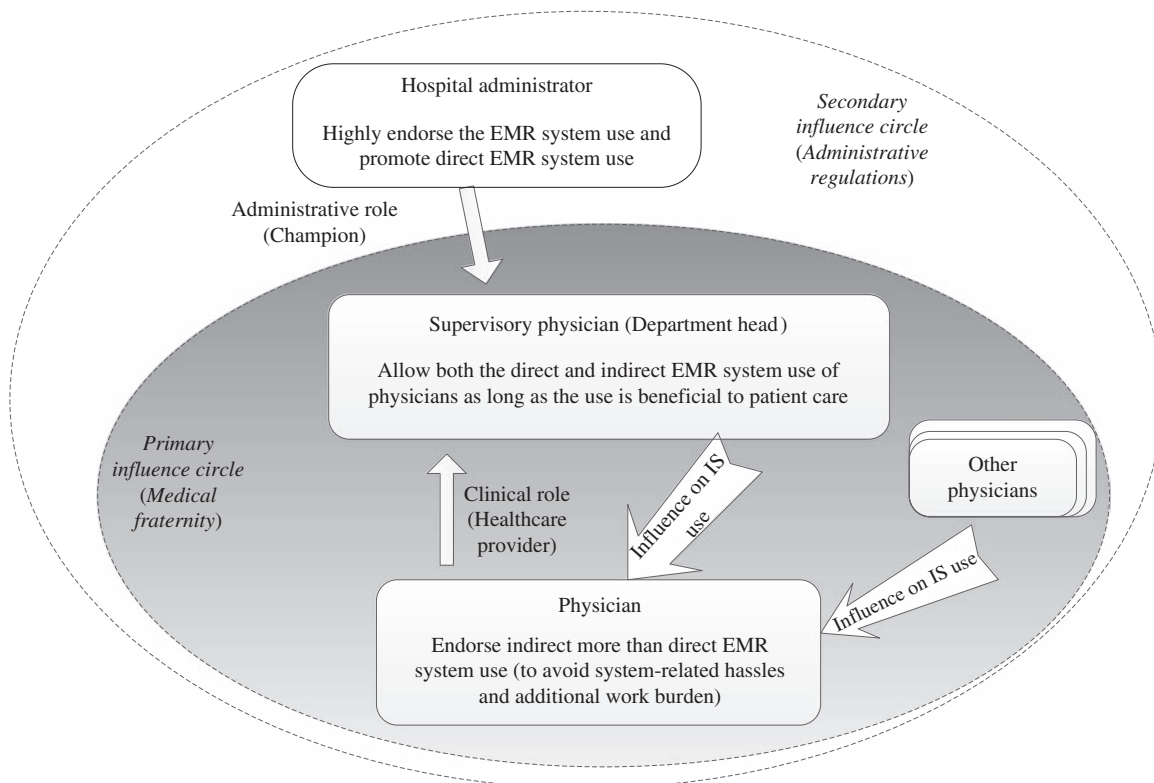
The attitude of supervisory physicians toward EMR system use was influenced by their administrative and clinical roles. On one hand, supervisory physicians acknowledged that hospital administrators tasked them with promoting direct IS use. On the other hand, as members of the medical fraternity, supervisory physicians also empathized with their fellow physicians and valued their core clinical responsibility of achieving improved patient care. According to a supervisory physician, indirect IS use was "not always unacceptable" and did not violate the existing regulations in China (i.e., medical data should be properly inputted into the system). However, given his administrative role of promoting direct IS use, he was hesitant to leave overt proof of his promotion of indirect IS use (e.g., openly praising his subordinate for his or her indirect IS use). Hence, both supervisory physicians acknowledged that they promoted EMR system

use by condoning both direct and indirect IS use when viewing the EMR system as a whole. However, regardless of the type of use (direct or indirect), their main priorities were that the type of use (1) would be beneficial to patient care and (2) would not cause trouble for the supervisory physicians (e.g., by leaving overt proof that these supervisors were violating their roles as promoters of direct IS use). Such management reflects the Confucian philosophy of the Doctrine of the Mean (中庸之道) (Ames and Hall 2001), which aims for a state of balance or a middle approach to harmonize conflicting demands (e.g., the expectation of administrators and the preference of physicians). Figure 2 summarizes the viewpoints of the key stakeholders.

3.3. Relating the Case Findings to Social Power

The interview data showed that the EMR system use of physicians was subjected to social power from two groups of people, namely, supervisory physicians and their colleagues. Regarding the reasons for EMR system use, the evidence of harsh power (e.g., "my supervisor's stand," "favorable appraisal from my supervisor") was overwhelmingly more visible than that of soft power (e.g., "my peers feel that the system is valuable"). Compared with Western hospitals, where supervisory physicians might not hold strong positional legitimacy power over other physicians, harsh power was particularly salient in the studied hospital, which is located in a Confucian

Figure 2. Context Illustration



society. Physicians, regardless of ranks, felt obligated to adjust their behaviors according to the inclinations of their supervisors. A chief physician mentioned, “Given that he occupies the department head position, I would care about his attitude even though both of us are chief physicians.” The salience of this power is attributed to the hierarchical order perception that is rooted in the Confucian philosophy of the Five Cardinal Relationships of Confucianism (五伦), which posits that the stability of a society depends on the differentiated relationships with inherent power distance between the ruler and the ruled (Farh et al. 1998).

Among the five forms of social power from others, referent power is deemed less relevant in determining the IS use behavior of a physician in the focal context. The effectiveness of referent power as a form of soft power lies in the recognition of the target when the system is used (Mulder et al. 1986). However, our interviews and conversations with physicians indicated that they cared more about building intimate interpersonal relationships than achieving a sense of group identification. This intimate interpersonal relationship is called *guanxi* (关系), a relationship built between two parties through sentiment (情) and obligation (义), and can benefit employees in Chinese organizations (Chen et al. 2004). Identifying with the referent, as a relatively weak interpersonal tie, does not induce a favorable *guanxi*. Hence, we did not consider the referent power of others as a predictor of direct or indirect EMR system use behavior.

Aside from the social power from others, the physicians also demonstrated two salient types of legitimacy power, as indicated in the qualitative data. First, physicians were cognizant of their positional legitimacy power inside the hospital, particularly vis-à-vis

nurses, interns, and junior physicians. Second, some older physicians mentioned that when facing difficulties in using the system, they had valid reasons to delegate the system-related task. This influence stems from the physicians’ physiological factors (i.e., age and gender) through which their social legitimacy power is manifested. Table 4 summarizes the social power selected in this study. For each form of social power, we differentiate between (1) the power of others that influences one’s use and (2) one’s own power that influences one’s use.

3.4. Hypothesis Development

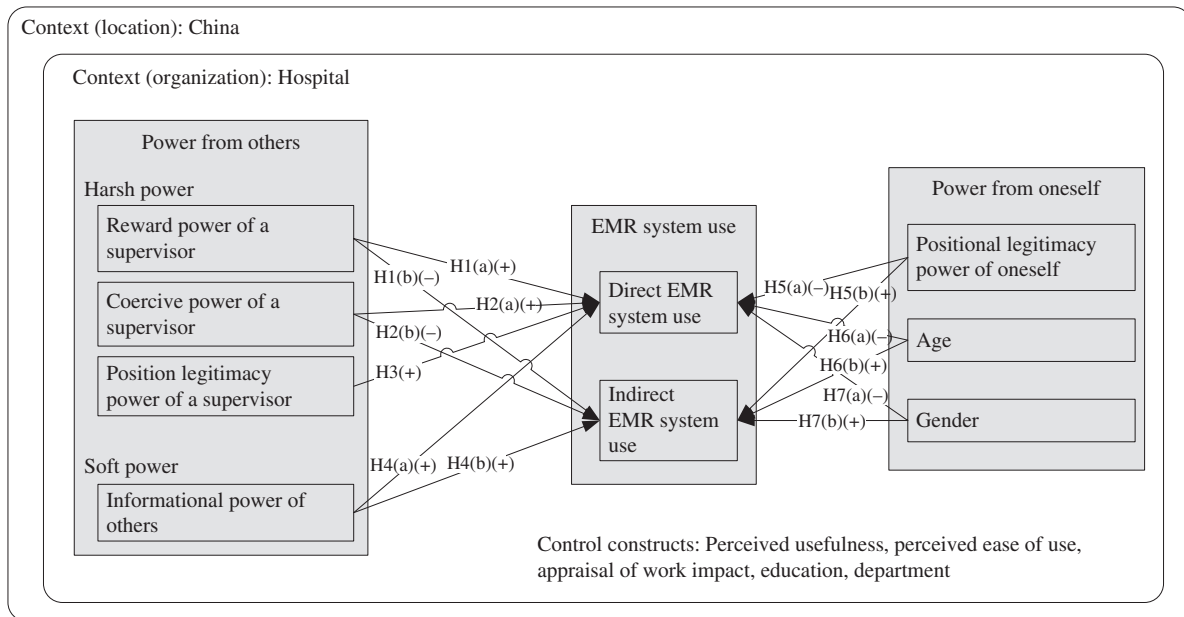
Based on the case study findings, we refine the research framework into the model shown in Figure 3. We posit that harsh power and soft power from others differentially affect the direct and indirect IS use of physicians. Physicians also utilize the social power arising from positional legitimacy and demographic characteristics (age, gender) to influence direct and indirect IS use. All of the hypotheses are framed from the perspective of physicians who are designated users of the EMR system.

Reward Power of the Supervisor. Reward power denotes the ability of an agent to provide a target positive valence for compliance, such as approval (Raven et al. 1998). When an individual (target) perceives that an authoritative person (agent) may administer positive outcomes for adopting a certain behavior, then the target has a higher propensity to follow the expected behavior (Kelman 1958). Within an organization, the positive outcomes resulting from the reward power of a supervisor (e.g., appraisal and promotion) are based on accountable organizational resources (Raven et al. 1998). The provision of these outcomes may serve as “evidence” of the disposition of a supervisor and,

Table 4. Selecting Appropriate Forms of Social Power

Social power	Application of the principle to understand how the power of others influences one’s use	Application of the principle to understand how one’s own power influences one’s use
<i>Reward power</i>	Reward power of supervisor (evident in the qualitative data)	N.A. (First, respect for authority is highly valued in Confucian society. The interviewed physicians deemed positional legitimacy power as sufficient and effective for delegation. Hence, exercising reward or coercive power was unnecessary. Second, exercising these two forms of power would leave accountable evidence of overtly engaging in behavior deviating from the hospital management’s expectation, which violated the Doctrine of the Mean principle.)
<i>Coercive power</i>	Coercive power of supervisor (evident in the qualitative data)	
<i>Positional legitimacy power</i>	Positional legitimacy power of supervisor (Evident in the qualitative data)	Positional legitimacy power of oneself (Evident in the qualitative data)
<i>Informational power</i>	Informational power of others (evident in the qualitative data)	Demographic characteristics (age, gender) manifesting physiological legitimacy power of oneself (evident in the qualitative data)
<i>Referent power</i>	N.A. (According to the qualitative data, physicians cared more about building intimate <i>guanxi</i> than identifying with the referent.)	N.A. (Such potential influences could change the IS use of others but were not associated with a physician’s own use behavior.)

Figure 3. Research Model



therefore, is often aligned with the related policies set by organizational management (e.g., a promotion is more likely to be given if the performance of an employee meets the explicit promotion criteria).

Compared with no use or indirect IS use, direct IS use is consistent with the expectation of the hospital management (as stated in the qualitative data). A supervisory physician is directed to promote direct IS use given his or her administrative role. Hence, the supervisory physician is more likely to provide rewards when fellow physicians engage in direct IS use and is less likely to do so in the case of indirect IS use, because providing rewards for the latter could leave overt evidence of violating the hospital management's expectation. Under such circumstances, direct and indirect IS use become more substitutive in nature. When a physician strongly perceives that the supervisor associates reward power with EMR system use, he or she tends to engage in direct IS use to get the rewards. By contrast, the physician will be reluctant to engage in indirect IS use because he or she is less likely to be rewarded. This view concurs with the reward discounting perspective, which suggests that one will discount the attraction of a reward when he or she is uncertain that a reward will be given (Green and Myerson 2004).

Hypothesis 1 (H1). *The reward power of a supervisor is (a) positively related to the frequency of physicians in engaging in direct EMR system use and (b) negatively related to the frequency of physicians in engaging in indirect EMR system use.*

Coercive Power of the Supervisor. Coercive power refers to the ability of an agent to threaten a target by disapproving or disliking for his or her noncompliance

(Raven et al. 1998). Similar to reward power, direct and indirect IS use tend to be substitutive in nature in the case of coercive power of supervisors. A physician who perceives a strong EMR system use-related coercive power from the supervisory physician may engage in a high extent of direct IS use to avoid potential negative consequences (Raven 1999). The indirect IS use, which deviates from the hospital management's expectation, is at risk of receiving coercion from a supervisor. A physician noted, "Indirect IS use is not 100% safe to avoid punishment. It is not what the hospital management wants." Based on this perception, we posit that a physician tends to have a low extent of indirect IS use when the perceived coercive power of the supervisor in relation to EMR system use is high.

Hypothesis 2 (H2). *The coercive power of a supervisor is (a) positively related to the frequency of a physician in engaging in direct EMR system use and (b) negatively related to the frequency of a physician in engaging in indirect EMR system use.*

Positional Legitimacy Power of the Supervisor. Derived from the organizational hierarchy, positional legitimacy power emphasizes that an agent (e.g., supervisor) has the authority to prescribe a particular behavior (Raven et al. 1998). This form of social power takes effect when a target (e.g., subordinate) generates a sense of oughtness toward the agent and decides to comply without expecting additional outcomes (French and Raven 1959). Different from reward or coercive power, no overt outcome (e.g., reward) is provided in this form of power. The case study revealed that despite having clinical autonomy, the physicians in the studied context were still considerably influenced by the positional

legitimacy power of their supervisors because of their strong proclivity to respect authority in a Confucian society (Farh et al. 1998). Therefore, the behavior of these physicians is primarily driven by the disposition of their supervisors.

Supervisory physicians hold dual roles in the focal setting: administrative and clinical. Given that a supervisory physician serves in his or her administrative role as a champion of direct EMR system use, we expect that the strong positional legitimacy power of a supervisor can increase the extent of direct EMR system use. Aside from their administrative role, supervisory physicians also hold a clinical role and therefore value patient care and empathize with the heavy workload of fellow physicians. The case findings indicate that the supervisory physicians tend to adopt a middle-way approach to harmonize their conflicting roles, which was also evident in a recent study on Chinese managers (Zhang et al. 2015). Such a management style is best realized in positional legitimacy power. Different from reward or coercive power, exercising this type of power is not associated with specific outcomes and does not overtly violate the administrative role of promoting direct IS use. Moreover, indirect IS use may not undermine patient care (e.g., allowing assistants to record the patient discharge summary may relieve physicians from additional administrative work and allow them to focus on treating the patients). Hence, supervisory physicians hold ambivalent attitudes toward indirect IS use; that is, they do not hold negative attitudes against indirect IS use by fellow physicians, but do not hold positive views either. A physician who is subjected to a supervisor's positional legitimacy power will not significantly reduce his or her indirect EMR system use behavior. So we hypothesize an effect only for direct IS use and not for indirect IS use. Direct and indirect IS uses are not substitutive in this case.

Hypothesis 3 (H3). *The positional legitimacy power of a supervisor is positively related to the frequency of a physician engaging in direct EMR system use.*

Informational Power of Others. Informational power is a soft power that originates from the ability of an agent to provide convincing and valuable information to affect the behavior or attitude of the target (Kelman 1958, Raven et al. 1998, Schwarzwald et al. 2005). This influence takes place when the induced behavior is congruent with the target's value system (i.e., a behavior is intrinsically rewarding; Cialdini and Goldstein 2004). A physician may recognize the value of the system (e.g., digitizing patient records is beneficial to the patients) by interacting with others (e.g., peers or supervisors). Hence, the physician could be motivated to use the EMR system more frequently, which results in high total IS use. As suggested in our case findings, physicians acknowledged that the EMR system could be helpful, but the realization of the benefits did not

always link with a specific type of use behavior. If the system is implemented and configured well, direct and indirect use of the EMR system can both be beneficial in care delivery (see Table 3). Hence, direct and indirect IS use are not substitutive in this situation. We expect that when subjected to high informational power of others, physicians will increase direct and indirect IS use to maximize the value brought by the EMR system.

Hypothesis 4 (H4). *The informational power of others is positively related to the frequency of a physician engaging in (a) direct and (b) indirect EMR system use.*

Positional Legitimacy Power of Oneself. When an individual possesses legitimacy power, he or she can influence other people by inducing a sense of oughtness for them to comply (Raven et al. 1998). Physicians are generally well respected in the hospitals, and therefore enjoy positional legitimacy power over other healthcare professionals such as nurses and interns. When physicians possess a high extent of positional legitimacy power, they can easily make others (e.g., interns) comply with certain tasks, such as delegating system-related work they would otherwise do themselves. Hence, with the strong support of intermediary users, we expect direct IS use and indirect IS use to be strongly substitutive; that is, physicians are less likely to engage in direct IS use and will tend to engage in indirect IS use.

Hypothesis 5 (H5). *The positional legitimacy power of oneself is (a) negatively related to the frequency of a physician engaging in direct EMR system use and (b) positively related to the frequency of a physician engaging in indirect EMR system use.*

Physiological Aspects of Power (Age and Gender). Previous studies have shown that individual physiological characteristics, such as age and gender, may be associated with the power of an individual and affect his or her IS use behavior. In particular, aging may be accompanied by a decline in intellectual ability and change in work preference (Morris and Venkatesh 2000). Older users who face difficulties in operating the system possess a social legitimacy power (Raven 1999). Furthermore, respecting the elderly is considered a strong social norm in Asian societies (Seeman et al. 2004). Consequently, the older physicians in our context possess a higher extent of social legitimacy power and can easily make younger physicians operate the EMR system on their behalf. Older people tend to stick to their habits and suppress new learning (Venkatesh et al. 2012). As in the case of positional legitimacy power of oneself, direct and indirect IS use tend to be substitutive in such a context. Therefore, we posit that older physicians embrace indirect EMR system use, which requires less learning effort, whereas younger physicians, who "grew up" using technology, are more inclined toward direct IS use.

Hypothesis 6 (H6). Age is (a) negatively related to the frequency of a physician engaging in direct EMR system use and (b) positively related to the frequency of a physician engaging in indirect EMR system use.

In the workplace, men are given more opportunities to speak and are more often accepted as influencing agents than women because they are presumed to be more competent and knowledgeable (Halford and Leonard 2001, Keshet et al. 2006). Therefore, male physicians are more likely able to employ intermediary users for indirect IS use than female physicians. Men are also more outcome driven and tend to devote more effort to things that help achieve their work goals than women (Venkatesh and Morris 2000, Venkatesh et al. 2012). Given that the core responsibility of physicians is to treat their patients rather than to operate the system, male physicians are expected to be less willing to engage personally in their system-related work than female physicians. Assuming the substitutive relationship of direct and indirect IS use, male physicians tend to engage in more indirect use than female physicians.

Hypothesis 7 (H7). Male physicians are (a) less likely to engage in direct EMR system use and (b) more likely to engage in indirect EMR system use than female physicians.

Other Control Constructs. We control for technology-related constructs, such as *perceived usefulness* and *perceived ease of use*, which are posited in the technology acceptance model, and *appraisal of work impact* to reflect the effect of the system. We also control for the education level and department of the physicians.

4. Stage 3: Validate the Refined Model Through a Survey Approach

In validating the proposed refined model, a survey was conducted among physicians in the studied hospital. Table 5 summarizes the operationalization of the constructs.

Direct and Indirect Use of the EMR System. We adopted the approach of Burton-Jones and Straub (2006) in selecting the appropriate measurement. Following our definitions, a rich measure of IS use was selected by capturing the “IS-task” relationship. Specifically, we measured the two constructs of IS use in terms of the frequency of performing several key EMR system tasks. By using the documents and our observations, we listed the EMR system tasks of the physicians. Six regular and supervisory physicians in the hospital verified the list and identified the tasks on the basis of two principles, namely, (1) the importance of having these tasks and (2) the tendency for the physicians to perform these tasks in the inpatient setting. Four important tasks were eventually produced: inputting diagnoses/summaries for

patients, inputting computerized prescriptions (medications/tests), searching for test order results, and searching for patient bills.³ Although we preferred to use system logs to measure IS use, these two use behaviors were not differentiated using the logs because the intermediary users often accessed the EMR system through the account of a designated physician who was logged on for most of the shift.

Social Power. We adapted the measurement of Raven et al. (1998) by incorporating the context (i.e., using the EMR system) into the original social power scale. By contrast to the original scale, which examined social power in the general context, our interview results indicated that EMR system use was not directly relevant to the core work responsibility of physicians (i.e., attending to patients). Although a supervisory physician demonstrated harsh power, the extent to which the supervisor would associate each form of power with EMR system use could vary. A general measure of social power without the EMR system context would elicit confusing, diverse, and inaccurate responses from the physicians, that is, they could respond to the social power of the supervisor in other work contexts aside from EMR system use.

Multiple approaches were considered to incorporate the EMR system context into the measure of social power: social power related to direct IS use, to indirect IS use, and to general use. Given physicians’ busy schedules, we chose only one type of use (i.e., “using the EMR system”) instead of all three to keep the questionnaire short (this point was raised by the physicians when we checked for face validity). With the supervisory physicians as the major influencing agent of social power, we primarily considered their viewpoint (condoning direct and indirect uses when viewing the EMR system as a whole; i.e., general EMR system use) when developing the scale for social power. Including the term “direct use” or “indirect use” in the items also could have skewed the survey responses of the physicians (i.e., the physician might prefer a favorable evaluation in lieu of social desirability bias; Nederhof 1985). Based on our context, three or four items were obtained for the reward, coercion, and positional legitimacy powers of the supervisor. Items that were irrelevant to the context were removed. For instance, no monetary reward or punishment was associated with system use. Hence, the items on the reward and coercive power of the supervisor focused on personal aspects, such as receiving a favorable appraisal, gaining approval, and avoiding disapproval.

The case study indicated that three types of agents can have informational power, namely, supervisors, departmental peers, and hospital peers outside the department. These types were in accordance with the scale scheme of Lewis et al. (2003), who also considered the social influence from sources such as departmental

Table 5. Operationalization of Constructs

Constructs and sources	Items	Scale
Dependent variables		
<i>Direct use of EMR system</i> (Self-developed)	In doing your own job in the inpatient department, how often do you use the EMR system directly by yourself to _____ (a) input diagnosis/summary for patients (b) input computerized prescriptions (medication/test) (c) search test order results (d) search patient bills	Seven-point Likert scale (1, never/rarely; 4, sometimes; 7, every time)
<i>Indirect use of EMR system</i> (Self-developed)	In doing your own job in the inpatient department, how often do you ask others to use the EMR system for you to _____ (a) input diagnosis/summary for patients (b) input computerized prescriptions (medication/test) (c) search test order results (d) search patient bills	
Social and physiological power constructs as independent variables		
<i>Reward power of the supervisor</i> (Raven et al. 1998)	(a) Using the EMR system can help me get a good appraisal from my supervisor. (b) Using the EMR system can help me gain approval from my supervisor. (c) Using the EMR system can help me feel more valued by my supervisor. (d) Using the EMR system can make me feel personally accepted by my supervisor.	Seven-point Likert scale (1, strongly disagree; 4, neutral; 7, strongly agree)
<i>Coercive power of the supervisor</i> (Raven et al. 1998)	(a) My supervisor will make things unpleasant for me if I do not use the EMR system. (b) My supervisor will disapprove of me if I do not use the EMR system. (c) My supervisor will be cold to and keep a distance from me if I do not use the EMR system. (d) I will be on the bad side of my supervisor if I do not use the EMR system.	
<i>Positional legitimacy power of the supervisor</i> (Raven et al. 1998)	(a) My supervisor has the right to order me to use the EMR system. (b) As a subordinate, I have an obligation to use the EMR system as my supervisor has instructed. (c) I have to use the EMR system as my supervisor said. After all, he/she is my supervisor.	
<i>Informational power of others</i> (Lewis et al. 2003, Raven et al. 1998)	(a) My interaction with my supervisor allows me to understand why using the EMR system is valuable. (b) My interaction with my departmental peers allows me to understand why using the EMR system is valuable. (c) My interaction with my hospital peers outside my department allows me to understand why using the EMR system is valuable.	
<i>Positional legitimacy power of oneself</i> (Raven et al. 1998)	(a) Given my position, I can ask others to use the EMR system on my behalf. (b) I have the right to request others (e.g., subordinate, younger colleagues, etc.) to use the EMR system on my behalf. (c) As a subordinate/nurse, he/she has an obligation to use the EMR system on my behalf if I request.	
Age	What is your age? Below 20 years [___] 20 years to 24 years [___] 25 years to 29 years [___] 30 years to 34 years [___] 35 years to 39 years [___] 40 years to 44 years [___] 45 years to 49 years [___] 50 years and over [___]	Not applicable
Gender	Gender: _____	

Table 5. (Continued)

Constructs and sources	Items	Scale
Control variables		
<i>Perceived usefulness</i> (Venkatesh and Davis 2000)	(a) I find the EMR system to be useful in my job. (b) Using the EMR system enhances my effectiveness in my job.	Seven-point Likert scale (1, strongly disagree; 4, neutral; 7, strongly agree)
<i>Perceived ease of use</i> (Venkatesh and Davis 2000)	(a) I can easily make the EMR system do everything I wish. (b) Overall, I believe that the EMR system is easy to use.	
<i>Appraisal of work impact</i> (Ahmad 2005)	(a) I have to give up many things at work because of the EMR system. (b) My job has been harmed in some way by using the EMR system.	
<i>Education</i>	What is your education level? Bachelor <input type="checkbox"/> Master <input type="checkbox"/> Ph.D. <input type="checkbox"/> Others: _____	Not applicable
<i>Department</i>	Department: _____	
<i>Rank</i>	What is your rank? Resident physician <input type="checkbox"/> Attending physician <input type="checkbox"/> Assistant chief physician <input type="checkbox"/> Chief physician <input type="checkbox"/> Others: _____	

Note. The actual survey was administered in Chinese.

colleagues, peers outside the department, and supervisors. A question was then developed for each type of agent.

Demographic and Control Variables. Physicians were asked to indicate an age range instead of their actual age to prevent them from feeling any discomfort with such sensitive questions. The respondents were directly asked about their gender and department. Rank and education were obtained by asking the respondents to select the appropriate category from a list. The items on perceived usefulness and perceived ease of use were adopted from Venkatesh and Davis (2000). Appraisal of work impact was adopted from Ahmad (2005). To keep the questionnaire short, two items from the control variables were selected.

To validate the survey instrument, we first consulted three senior researchers with more than 10 years of research experience on the survey methodology. They helped identify framing-related problems in the questions. Second, to enhance conceptual validity, postgraduate IS students were recruited to conduct one unlabeled and one labeled sorting session (six participants per session). We made some minor modifications based on the sorting results. Third, four bilingual graduate students translated the questionnaire to Chinese and then translated it back to English. The translated version was compared with the original questionnaire, and changes were made where necessary. Fourth, three experienced physicians in the studied hospital reviewed the survey questionnaire to ensure the face validity. Fifth, to ensure that the length of the survey was acceptable to the respondents, a pilot test was conducted on 10 medical students to determine

the time needed to complete the survey. This assessment is important because physicians are usually busy. Completing a lengthy survey may hinder their work or generate haphazard responses to the survey.

4.1. Administering the Field Survey

We assembled a survey package that comprised a cover letter stating the research objectives, survey instructions, and the survey questionnaire. A list of physicians with EMR system access was obtained from the IS department of the hospital. The survey package was distributed to 250 physicians by the first author, who was stationed at the field site for six weeks. We included the description of the EMR system in the survey to improve response validity. A mobile phone number and an email address were provided on the cover page to enable respondents to contact the first author in case of any questions. An incentive of RMB 50 (equivalent to USD 7.5) was donated to the welfare fund of the hospital staff for each completed survey. This incentive was considered attractive, considering that the average monthly salary of a physician ranged from RMB 2,000 to RMB 3,000 (equivalent to USD 315 to USD 472). The supervisors and physicians who participated in the case study or in the scale development were excluded from the survey. To protect the respondents' privacy, we did not collect any personal information, such as name and email address. Among the 250 physicians, 220 completed and returned the questionnaire, yielding a response rate of 88%, which is very high given the busy schedule of the physicians. Given the anonymous nature of our survey, we could not recover the missing data.

Table 6. Demographic Information of the Physicians

Variables	Category	Frequency	Percentage (%)	Cumulative percentage (%)
Gender	Female	66	30.99	30.99
	Male	147	69.01	100
Age	20 years to 24 years	1	0.47	0.47
	25 years to 29 years	49	23	23.47
	30 years to 34 years	42	19.72	43.19
	35 years to 39 years	41	19.25	62.44
	40 years to 44 years	37	17.37	79.81
	45 years to 49 years	18	8.45	88.26
	≥ 50 years	25	11.74	100
Education	Bachelor	52	24.41	24.41
	Master	100	46.95	71.36
	Ph.D.	61	28.64	100
Rank	Resident physician	52	24.41	24.41
	Attending physician	59	27.70	52.11
	Assistant chief physician	67	31.46	83.57
	Chief physician	35	16.43	100

We hence excluded seven incomplete responses from further analysis and eventually recorded 213 complete entries. Table 6 presents the demographic information of the respondents. Unlike physicians in the United States, those in China need only a bachelor's degree to establish a practice.

5. Data Analyses and Results

All multi-item constructs were modeled as reflective constructs. We took the mean value for the multi-item constructs and then input it into the seemingly unrelated regression (SUR) for model testing. SUR employs feasible generalized least squares techniques and can estimate the coefficients of multiple linear equations simultaneously and efficiently while accounting for correlated errors (Wooldridge 2001). This capability enabled us to account for the partially substitutive nature of direct and indirect IS use. Our analysis was conducted in two major steps, namely, (1) assessing the reliability and validity of the constructs and (2) performing SUR analysis for hypothesis testing. The hypotheses were tested using the following equations:

$$\begin{aligned}
 \text{DIRECT} = & \alpha_1 + \beta_{101} \text{PU} + \beta_{102} \text{PEOU} + \beta_{103} \text{APPWORK} \\
 & + \beta_{104} \text{EDUCATION} + \beta_{105} \text{DPT} \\
 & + \beta_{106} \text{REWARD} + \beta_{107} \text{COERCION} \\
 & + \beta_{108} \text{PLEGSUPER} + \beta_{109} \text{INFO} \\
 & + \beta_{110} \text{PLEGSELF} + \beta_{111} \text{AGE} \\
 & + \beta_{112} \text{GENDER} + \varepsilon_1, \quad (1) \\
 \text{INDIRECT} = & \alpha_2 + \beta_{201} \text{PU} + \beta_{202} \text{PEOU} + \beta_{203} \text{APPWORK} \\
 & + \beta_{204} \text{EDUCATION} + \beta_{205} \text{DPT} \\
 & + \beta_{206} \text{REWARD} + \beta_{207} \text{COERCION} \\
 & + \beta_{208} \text{INFO} + \beta_{209} \text{PLEGSELF} \\
 & + \beta_{210} \text{AGE} + \beta_{211} \text{GENDER} + \varepsilon_2, \quad (2)
 \end{aligned}$$

where *DIRECT* denotes direct IS use, *INDIRECT* denotes indirect IS use, *PU* denotes perceived usefulness, *PEOU* denotes perceived ease of use, *APPWORK* denotes appraisal of work impact, *DPT* denotes department, *REWARD* denotes reward power of the supervisor, *COERCION* denotes coercive power of the supervisor, *PLEGSUPER* denotes positional legitimacy power of the supervisor, *INFO* denotes informational power of others, and *PLEGSELF* denotes positional legitimacy power of oneself.

Table 7 presents the descriptive statistics, variance inflation factor (VIF), intercorrelation of the variables, and the Cronbach's alpha of the reflective variables. The VIF values for all variables were less than 10 (Hair et al. 1998), implying that multicollinearity was not likely to be a problem. All Cronbach alpha values exceeded 0.7, indicating the reliability of the measurements. Table 8 shows the scores for the principal component analysis with oblimin rotation. Those items within the same construct were loaded highly among themselves, and the loadings on their intended constructs were larger than the loadings on other constructs, thereby supporting adequate convergent and discriminant validity.

5.1. Model Testing

We adopted SUR to test the hypotheses using Stata version 13.1. All hypothesis tests were assessed at the 5% significance level. The first two models in Table 9 present the SUR analysis results for the proposed research models, namely, the control model (Model 1) and the full model (including control and theoretical variables, Model 2). The Breusch–Pagan test of independence was performed to assess the extent of correlation between the residuals of the two equations. The test results for both models (control model, $\chi^2 = 49.793$, $p < 0.001$; full model, $\chi^2 = 23.618$, $p < 0.001$)

Table 7. Descriptive Statistics, VIFs, Cronbach Alphas, and Correlations

	Mean (std. dev.)	VIF	Cronbach's alpha	1	2	3	4	5	6	7	8	9	10	11	12	13
Direct IS use (1)	5.21 (1.66)	—	0.86	1												
Indirect IS use (2)	3.49 (1.82)	—	0.90	−0.46	1											
Perceived usefulness (3)	6.03 (1.18)	2.25	0.93	0.18	−0.11	1										
Perceived ease of use (4)	5.55 (1.32)	2.18	0.72	0.28	−0.15	0.68	1									
Appraisal of work effect (5)	2.81 (1.66)	1.29	0.88	0.00	0.05	−0.39	−0.29	1								
Education (6)	2.04 (0.73)	1.11	—	0.00	0.06	−0.17	−0.03	0.15	1							
Reward power of the supervisor (7)	4.33 (1.61)	1.96	0.96	0.38	−0.20	0.35	0.38	−0.04	−0.06	1						
Coercive power of the supervisor (8)	3.61 (1.77)	1.62	0.95	0.31	−0.21	0.04	0.09	0.11	0.09	0.53	1					
Positional legitimacy power of the supervisor (9)	5.77 (1.39)	1.27	0.92	0.29	−0.09	0.21	0.26	−0.13	0.01	0.36	0.22	1				
Informational power of others (10)	5.16 (1.31)	1.44	0.83	0.17	−0.03	0.27	0.27	−0.09	−0.04	0.45	0.41	0.33	1			
Positional legitimacy power of oneself (11)	5.36 (1.41)	1.16	0.95	−0.28	0.31	0.12	0.04	0.00	0.08	0.01	0.01	0.04	0.03	1		
Age (12)	5.02 (1.66)	1.31	—	−0.49	0.33	−0.16	−0.32	0.04	−0.07	−0.29	−0.15	−0.21	−0.07	0.25	1	
Gender (13) (coded as 0, Female; 1, Male)	0.69 (0.46)	1.29	—	−0.04	0.13	−0.07	−0.11	0.02	0.09	0.10	0.14	0.07	−0.03	0.13	0.03	1

indicated that the residuals were not independent, thereby supporting the necessity of using SUR. The results indicated that four of the seven hypotheses were fully supported (i.e., H2, H3, H5, and H6) and that three hypotheses were partially supported (i.e., H1(a), H4(b), and H7(b) were supported, but not H1(b), H4(a), and H7(a)). To verify our argument that the positional legitimacy power of the supervisor does not have a significant effect on indirect IS use, we added this type of

power in the equation of indirect IS use (Model 3). As shown in the last column of Table 9, the relationship between the positional legitimacy power of the supervisor and indirect IS use was not significant.

5.2. Post Hoc Analyses

Risk tends to be a prominent concern when designated users engage in indirect IS use. According to agency theory, the intermediary users may hold different desires or goals from those of the designated users (Eisenhardt 1989). Such a conflict may generate a risk in which the intermediary users may not be fully committed to the system-related interaction or their behavior may depart from the expectation of designated users. Information asymmetry may also occur because the designated users may lack sufficient information to determine whether the intermediary users have behaved appropriately (Shapiro 2005). Considering that the responsibility for proper use was borne by the designated physicians, we further analyzed the data by splitting direct and indirect IS use according to the level of clinical accountability risks. Clinical accountability risks refer to the legal and moral consequences that the designated users bear if the process and the data are erroneous and result in wrong medical outcomes. The features of inputting diagnosis/summary and inputting prescriptions have high clinical accountability risks, whereas the features of searching for test results and bills have low clinical accountability risks. Table 10 provides descriptive statistics for direct use and indirect use of these two types of tasks. Interesting patterns can be observed in Table 11. Task behaviors related to low clinical accountability risks were more highly subjected to the influence of social and physiological power compared with

Table 8. Principal Component Analysis (Oblimin Rotation)

Construct	Factor				
	1	2	3	4	5
Reward power of the supervisor					
Reward1	−0.915				
Reward2	−0.973				
Reward3	−0.979				
Reward4	−0.897				
Coercive power of the supervisor					
Coercion1		0.926			
Coercion2		0.964			
Coercion3		0.914			
Coercion4		0.900			
Positional legitimacy power of the supervisor					
PositionSup1			0.953		
PositionSup2			0.944		
PositionSup3			0.883		
Informational power of others					
Information1				0.695	
Information2				0.921	
Information3				0.922	
Positional legitimacy power of oneself					
PositionSelf1					0.949
PositionSelf2					0.961
PositionSelf3					0.943

Table 9. Results of SUR Analyses (Coefficient and Significance)

	(1) Control model		(2) Full model		(3) Full model + positional legitimacy power of supervisor	
	Direct IS use	Indirect IS use	Direct IS use	Indirect IS use	Direct IS use	Indirect IS use
<i>Perceived usefulness</i>	0.036	0.016	0.078	−0.084	0.078	−0.085
<i>Perceived ease of use</i>	0.362**	−0.201	0.094	0.004	0.093	−0.010
<i>Appraisal of work effect</i>	0.074	0.012	0.036	0.060	0.037	−0.058
<i>Education</i>	0.009	0.155	0.016	0.124	0.015	0.125
<i>Department</i>			Estimated but not shown			
<i>Reward power of the supervisor (H1)</i>			0.140*	−0.067	0.138*	−0.058
<i>Coercive power of the supervisor (H2)</i>			0.149**	−0.220**	0.149**	−0.219**
<i>Positional legitimacy power of the supervisor (H3)</i>			0.151**	—	0.166**	−0.053
<i>Informational power of others (H4)</i>			−0.028	0.169*	−0.031	0.180*
<i>Positional legitimacy power of oneself (H5)</i>			−0.266**	0.292**	−0.266**	0.294**
<i>Age (H6)</i>			−0.291**	0.255**	−0.290**	0.249**
<i>Gender (H7)</i>			−0.230	0.655**	−0.235	0.676**
<i>R²</i>	0.112	0.027	0.406	0.241	0.406	0.243
<i>Breusch–Pagan test of independence</i>	$\chi^2 = 49.793^{**}$		$\chi^2 = 23.618^{**}$		$\chi^2 = 23.658^{**}$	

* $p < 0.05$; ** $p < 0.01$.

Table 10. Descriptive Statistics for Individual Use Behavior

Variable	Mean	Std. dev.	Min.	Max.
Tasks with high clinical accountability risks				
Direct use	5.469	1.889	1	7
Indirect use	3.589	1.956	1	7
Tasks with low clinical accountability risks				
Direct use	4.948	1.702	1	7
Indirect use	3.397	1.931	1	7
Sum of direct IS use and indirect IS use	8.702	1.816	2	14
Relative amount of direct over indirect IS use	1.716	2.963	−6	6

task behaviors with high clinical accountability risks. In particular, for direct IS use, the reward power of others, positional legitimacy power of the supervisor, and gender had stronger influences on task behaviors with low clinical accountability risks than on those with high clinical accountability risks. For indirect IS use, the informational power of others had a significant effect on tasks with low clinical accountability risks but not on those with high clinical accountability risks.

Besides separating direct and indirect IS use, an alternative way of modeling these two types of IS use behaviors is to take a single dependent variable approach. We therefore conducted two additional post hoc analyses by operationalizing the dependent variable into (1) the sum of direct and indirect IS use and (2) the relative amount of direct IS use over indirect IS use. Table 10 includes the descriptive statistics for the sum and relative amount of direct and indirect IS use.

The last two columns of Table 11 show the hypothesis testing for these two models. Note that none of the social powers can significantly predict the sum of direct and indirect IS use. Social power can influence the relative amount of direct IS use over indirect IS use and also exhibit different patterns when these two types of IS use are treated as separate dependent variables.

6. Discussion

Our findings empirically support our theoretical conceptualization that direct IS use and indirect IS use are partially substitutive. Various forms of harsh power and soft power have different influences on the direct and indirect use of the EMR system by physicians in the focal hospital. Harsh power (including the reward, coercion, and positional legitimacy powers of the supervisor) appears to promote the direct IS use

Table 11. Results of Post Hoc Analysis (Coefficients and Significance)

	Tasks with high clinical accountability risks		Tasks with low clinical accountability risks		Sum of direct IS use and indirect IS use	Relative amount of direct over indirect IS use
	Direct IS use	Indirect IS use	Direct IS use	Indirect IS use		
<i>Perceived usefulness</i>	0.062	−0.001	0.094	−0.168	−0.007	0.163
<i>Perceived ease of use</i>	0.119	−0.105	0.067	0.113	0.102	0.083
<i>Appraisal of work effect</i>	0.056	0.071	0.017	0.050	0.094	−0.021
<i>Education</i>	−0.084	0.100	0.116	0.147	0.141	−0.110
<i>Department</i>	Estimated but not shown					
<i>Reward power of the supervisor (H1)</i>	0.107	−0.006	0.170**	−0.128	0.080	0.196
<i>Coercive power of the supervisor (H2)</i>	0.142*	−0.217**	0.157**	−0.222**	−0.070	0.368**
<i>Positional legitimacy power of the supervisor (H3)</i>	0.096	—	0.230**	—	0.113	0.218 ⁺
<i>Informational power of others (H4)</i>	0.035	0.071	0.096	0.267**	0.149	−0.211
<i>Positional legitimacy power of oneself (H5)</i>	−0.328**	0.355**	−0.204**	0.228**	0.028	−0.561**
<i>Age (H6)</i>	−0.341**	0.246**	−0.239**	0.264**	−0.040	−0.539**
<i>Gender (H7)</i>	0.069	0.728**	−0.537**	0.583**	0.440	−0.911**
<i>R²</i>	0.350	0.241	0.361	0.201	0.084	0.394
Breusch–Pagan test of independence	$\chi^2 = 234.610^{**}$					

* $p < 0.05$; ** $p < 0.01$; + $p < 0.1$.

behavior of physicians but not their indirect IS use. However, the influence of soft power (i.e., informational power of others) is not salient for physicians' direct IS use but significant for indirect IS use. Raven et al. (1998) found that in Western countries, the effect of soft power is more salient than that of harsh power. However, we argue that harsh power may have a more prevailing effect than soft power in fostering direct IS use by physicians in China. Such a discrepancy may be attributed to the different value systems embedded in Western and Confucian societies (e.g., equity versus hierarchy).

The post hoc analysis results allow us to further explore the boundary conditions of the effects of social power and physiological power. Our findings suggest that system tasks with low clinical accountability risks are more subjected to influence from social power compared with tasks that involve high clinical accountability risks. Social power and physiological power appear to have strong effects on less risky behaviors. Furthermore, although previous literature reveals that managers who recognize the value of a system tend to engage in indirect IS use (Kraemer et al. 1993), the informational power of others only has a significant effect on behaviors with low clinical accountability risks. This result suggests that as a type of soft power, the informational power of others may not strongly induce risky or demanding behaviors.

By contrast to coercive power, the reward power of the supervisor has no significant relationship with the

indirect EMR system use by a physician (contrary to H1(b)). Such inconsistency may be attributed to the different effects of these two forms of power. Although reward and coercive power often share the same notion of "sanction" (Mulder et al. 1986), their effects on the targets may vary (French and Raven 1959). A physician could have a high tendency to exhibit risk aversion when confronted with a threat-framed problem, such as disapproval from supervisors. This situation might also be explained by our context in that Chinese people generally behave according to the Doctrine of the Mean (中庸之道) and strive for a status of balance, such as no reward, no punishment (Ames and Hall 2001). Noncompliance with coercive power, which entails negative consequences, is more threatening than noncompliance with reward power, which entails the sacrifice of positive outcomes.

Previous studies demonstrate that age and gender can represent the physiological aspects of power and have important effects on IS use (e.g., Venkatesh and Morris 2000, Venkatesh et al. 2012). We found that age influences direct and indirect IS use, whereas gender influences only indirect IS use. This observation is consistent with the viewpoint of Halford and Leonard (2001), who argue that males have higher social power than females in a work setting, which creates the enabling condition for indirect IS use. However, the insignificant effect of gender on direct IS use warrants

further empirical investigation beyond the bounds of this study.

In the full model, various forms of social power remain significant, but perceived usefulness, perceived ease of use, and appraisal of work impact are not significant (except for the effect of perceived ease of use in the control model). In other words, those themes traditionally employed to predict direct IS use in the volitional context are not significant predictors in the organizational context, where direct and indirect IS use coexist. Therefore, when an IS has been assimilated within an organization, social power may be more essential than perceptions on system characteristics in predicting system use, particularly in highly hierarchical environments such as hospitals. This finding concurs with previous evidence showing that the characteristics of the system per se, such as its apparent ease of use or usefulness, may be irrelevant in explaining the reactions of physicians toward healthcare information systems (Lapointe and Rivard 2005).

6.1. Limitations and Future Research

There are several limitations of this research, which create the opportunities for future research. First, direct and indirect IS use were assessed separately at the aggregated level through perceptual means. This study can be extended in several ways. The R^2 values of our hypothesis tests in Table 9 show that social power explains direct IS use better than indirect IS use. This finding provides an interesting opportunity for future work, that is, to better explain indirect use. Based on our post hoc analysis results in Table 11, future work could theorize the relationships between social power and IS use on the basis of the system features, or theorize the circumstances to one dependent variable (direct or indirect use, sum, difference). In this context, accurately capturing direct and indirect IS use through the system access logs would not be feasible because the account is shared for indirect IS use. This move could cause a certain amount of common method bias. We encourage future researchers to verify our findings by using objective measures of direct and indirect IS use in the contexts where indirect IS use can be accurately captured through logs.

Second, we did not further differentiate physicians in this study. Future research can extend this study by considering the dynamics of the clinical characteristics of physicians, such as their specialization (general practitioners and specialists) or clinical rank. We also encourage future researchers to continue exploring the nuances of Confucian culture versus Western culture in the physicians' use of EMR systems. For instance, the greater respect for seniority (elders) could be a salient notion of Chinese culture and differ from Western culture. Hence, it will be interesting to explore whether the dominant force for physicians' use of EMR systems

is hierarchical authority or seniority (greater age, experience, or wisdom), that is, whether a younger supervisory physician (and, likely, a physician with fewer years in medicine) has supervisory power over a significantly older physician. To fully address this question, researchers need to conduct a series of studies with additional and different measurements. Nevertheless, with the contextual setting, future studies that replicate this study should be cautious about the context-specific assumptions applied in this study.

Third, considering that our findings established the antecedents of direct and indirect IS use, future research can also examine the consequences of such use behaviors. Procedural and medical errors may arise when tasks are delegated to "unqualified" individuals. These organizational consequences must be considered seriously.

Fourth, we did not include the terms "direct use" and "indirect use" in the item development of the social power constructs. While doing so could reduce the opportunity to skew the physician responses toward a specific form of IS use, including them explicitly in the items may enhance the measurement clarity. Future work may consider other forms of operationalization and compare against our findings to add further instrument development insights.

6.2. General Theoretical Implications

As one of the first studies to theorize and empirically assess direct and indirect IS use concomitantly, this study presents several theoretical implications for the IS use and social power literature. First, our findings contribute to the cumulative research on the antecedents of IS use in organizations, in which system use is considered to be integral to the job requirements of the users. Previous qualitative studies have recognized the importance of system features and characteristics of organizational users (e.g., power and skills) in shaping IS use in an organizational setting (Leonardi 2011, Orlikowski 2000). Although system-related factors, such as perceived usefulness, have been empirically recognized as antecedents of individual IS use (Venkatesh and Davis 2000), our results imply that when a system has been assimilated within an organization for a long period of time, contextual influences from social power may become more important than system-related factors in explaining system use behavior. This finding increases our knowledge in the stable postadoptive stage and responds to the call for the inclusion of a social setting to improve the relevance and richness of theories in explaining IS use behaviors in organizations (Lamb and Kling 2003).

Second, this study contributes to the social power literature (e.g., Koslowsky et al. 2001, Schwarzwald et al. 2005) by suggesting that the previously identified social power influences can be refined in contexts

where more than one form of compliance exists, such as two manifestations of IS use behavior. Our findings indicate that different patterns of social power have various effects on direct and indirect IS use. A nuanced social power theory can be built to explain the different effects of social power on the various manifestations of compliance.

Third, this study broadens the assumptions of the social power lens. Our findings imply that an important implicit assumption in the social power literature—that subjects need only be considered in terms of their role in one part of the agent–target dyad (either as an agent or a target) and from a single-agent perspective—should be revised. The IS use behaviors of an organizational employee are subjected to power not only from others but also from himself or herself. Social power research that incorporates different influencing agents, such as supervisors and peers, can predict the use behavior of a physician more effectively. Future studies can treat focal subjects as an agent and target, and adopt a multiagent perspective to offer a comprehensive and reliable representation of the social power inside an organization.

6.3. Context-Specific Theoretical Implications

Responding to the call for theory-driven research in the healthcare setting (Fichman et al. 2011), the current study adopts social power theory and suggests theoretical extensions to enhance its applicability in predicting hospital phenomena, particularly in a Confucian society. While indirect IS use by physicians is also prevalent in Western hospitals (Davidson and Chisasson 2005, Kane and Alavi 2008), this study focuses on a less studied context, namely, Chinese hospitals. Most of the previous studies on system use and health IT are conducted in the Western context. Researchers suggest that with different cultural, philosophical, and managerial perspectives, the previously established relationships in Western countries may not hold in the Eastern society (Chen and Zahedi 2016, Farh et al. 1998, Xie et al. 2008). Recent calls in the IS and management fields advocate the conduct of additional research to advance the theory development in the Eastern setting (Barkema et al. 2015, Levina et al. 2011).

This study responds to this call by starting with an established theoretical perspective, namely, the “social power lens” (Raven et al. 1998), and then exploring the new effects of social power situated in the Confucian context. The attitudes of supervisory physicians reflect the Confucian philosophy of the Doctrine of the Mean, which influences the effect of the positional legitimacy power of the supervisor on direct and indirect IS use. Such a management philosophy is echoed in a recent study examining the paradoxical behaviors of Chinese leaders regarding employees’ proactive behaviors (Zhang et al. 2015). In addition, the stronger effect of harsh power over soft power manifests the

deeply rooted philosophy of adhering to authority in Confucian society. Such effects are in contrast to prior findings of social power conducted in the Western society (Raven et al. 1998).

6.4. Practical Implications for Hospitals in General

This study offers general practical implications for system designers and hospital managers to promote IS use. From a system design perspective, designers must acknowledge the ubiquitous indirect IS use by physicians within the hospital. System designers should gather the opinions of physicians and intermediaries and then incorporate indirect IS use into the system design. For instance, the system can be designed in such a manner as to allow the designated physicians to maintain a list of authorized intermediary users. System designers can also facilitate the job of intermediaries, such as by allowing them to access the templates (e.g., medication lists) of designated users. However, accountability must be ensured for indirect IS use. For example, when an activity involving indirect IS use is a prerequisite for another activity (i.e., ordering medication before dispensation), the system must ask for the consent of the designated user through several mechanisms, such as digital signatures, before proceeding to the next activity.

Top managers of hospitals must acknowledge that even when system use is mandated in the hospital, designated physicians still have the opportunity to modify the intended manner of its use, such as indirect IS use. Therefore, a strict and one-sided insistence on the direct use of the EMR system may be impractical and can even be counterproductive in some situations. As physicians are generally subjected to the social power of their peers and supervisors, top managers can employ supervisors and physicians to promote the use of the system.

6.5. Practical Implications for Hospitals in a Confucian Society

Our findings also provide hospital managers in a Confucian society specific strategies to influence their system use objectives. When hospital managers perceive indirect IS use as undesirable and consequently aim to enhance direct IS use only, the coercive power of the supervisor, which is positively related to direct IS use and negatively related to indirect IS use, could be employed. However, employing coercive power may not be associated with an increase in the total use of the system. Employing other forms of harsh power, such as the reward and positional legitimacy powers of the supervisor, may be associated with an increase in direct IS use. Hence, when specifically promoting direct IS use, management could appoint supervisory physicians as champions to personally advocate for or explicitly request their subordinates to use the system.

A physician's own power can also affect his or her system use in various respects. Physicians with positional legitimacy power over others can easily delegate system-related work. When system work is allocated to those physicians with high positional legitimacy power, management should expect a high possibility of indirect IS use. Auditing controls can be used if necessary because having senior physicians in the hospital may result in indirect IS use. If the goal is to increase the productivity of "powerless" physicians, then management should provide senior physicians with competent assistants for interacting with the EMR system.

7. Conclusion

As a discipline, information systems has made remarkable progress in understanding how and why users utilize a system. This research extends the theoretical understanding of IS use by demonstrating the coexistence of direct and indirect IS use and identifying their antecedents. Equipped with this nuanced understanding of IS use, system champions in organizations can be more effective in employing strategies to foster the desired system use behaviors.

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Endnotes

¹ Physicians refers to doctors in general with different ranks (including emergency doctors and surgeons but excluding department heads) who work in different inpatient departments of the hospital.

² Supervisory physicians refers to the heads of clinical departments. They hold administrative authority, such as evaluating fellow physicians' performance, and assume a clinical role by leading medical teams in their respective departments.

³ Certain features, such as searching for bills, are not typically considered core features of the EMR system (Wager et al. 2013). However, searching for patient bills was deemed an important feature by the physicians in our context. The role of clinical pharmacists in hospitals in China is limited. Physicians often check the bills of the patients to control medication costs because patients can have different extents of insurance coverage on medications and tests.

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