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A Synthetic Representation of Inter-Organizational Multi-Actor Collaborative Structures: A Pragmatic Look at U.S. E-Prescribing

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A SYNTHETIC REPRESENTATION OF INTER-ORGANIZATIONAL MULTI-ACTOR COLLABORATIVE STRUCTURES: A PRAGMATIC LOOK AT U.S. E-PRESCRIBING

Research-in-Progress

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Introduction

Ambulatory e-prescribing in the United States attempts to computer-mediate a heretofore communicative activity between outpatient prescribers, patients, and pharmacies centered on the exchange of a paper artifact. Despite employing information system (IS) best practices (McDonnell, et al. 2010), early e-prescribing pilots studied in 2006 were plagued by many problems including the unintended use of surrogate e-prescribers (Moiduddin, et al. 2007). Such usage reflects a failure to anticipate the impact of created artifacts with an apparent imbalance between contextual theories reflecting the behavioral and the design of technological capabilities (Hevner, et al. 2004). This imbalance also occurs in healthcare informatics where policy implications of the study of healthcare IT (HCIT) are overshadowed by the contextual limitations of positivist approaches that focus on the instantiated artifact (Greenhalgh and Russell 2006; Lomas 2005).

Adoption of e-prescribing has been driven by policy more than technology. After nearly a decade of payer-driven initiatives, 12% of eligible prescriptions were finally sent electronically in 2009 by 25% of office-based prescribers (Surescripts 2010). The increased usage reflects recent incentives and looming penalties from the Centers for Medicare & Medicaid Services (CMS) (Lowes 2008). Yet healthcare research has generally not embraced policy implications nor informed design. For example, Kaushal et al (2010) found that e-prescribing substantially reduces errors from incomplete dosing or missing instructions on the sent prescription. But the study fails to address that paper-based prescribers are routinely called back to provide such information when a pharmacist processes an incomplete paper prescription. Left unclear is the impact of e-prescribing technology on medication errors that reach the patient – the true measure of an inter-organizational system. In fact, the collaborative relationship between prescriber-pharmacist working in tandem through computer-mediation may actually be the technological and behavioral component that determines the efficacy of an e-prescribing system.

This research-in-progress paper suggests that understanding the collaborative relationships of manual prescribing can inform designers and policy makers of changes to be expected with the introduction of e-prescribing. This research focuses on the collaborative structure rather than the artifacts. Studying anticipated changes of interest to users (e.g., prescribers and pharmacies) and policy makers departs from the current positivist research approaches in both information systems and healthcare informatics research which rely upon data from an existing instantiation. A pragmatist approach provides greater freedom for examining more than theory but also process and relationships (Lee and Nickerson 2010). A comparison of the (synthetic) collaborative structure representations for both manual and e-prescribing viewed through various research lenses may lead to explanations for unintended usage, such as role changes, already observed.

Collaborative Structures

How does one study the collaborative structure of e-prescribing where each and every transaction involves a different combination of medical practice (and prescriber), pharmacy, and patient? In 2009, there were 190 million e-scripts (e-prescribing transaction) with each involving actors from these different organizations (Surescripts 2010). Each e-prescribing transaction involves some combination of 600,000+ office-based prescribers, 62,000+ pharmacies, 300+ million patients, and hundreds of payers (Surescripts 2010). Over many years of paper-based prescribing, roles and responsibilities for carrying out various tasks were allocated among the various parties. For example, the handoff of a paper prescription from prescriber to patient signals an end to the office visit (Hunt, et al. 2008). That same handoff also signifies that the patient is responsible for getting it to their pharmacy of choice. E-prescribing changes these roles such as the prescriber being responsible for getting an e-script to a pharmacy.

Collaborative structures constitute a meta-theoretical lens that allow one to make visible the role differences between these synthetic structures as prescribing transitions from a manual to electronic environment. Studies of groups of organizations in which collective and coordinative behaviors predominate are under-represented in the recent IS literature on digital cross-organizational collaboration (Madlberger and Roztocki 2010). Understanding these changes in collaboration may prove more insightful for encouraging nationwide adoption than an existing focus on poor usability, unintended workflow, or poorly aligned organizational changes and incentives that have been identified to date (Cusack 2008). The study builds on the definition of collaboration provided by Pick et al (2009) as cross-organizational electronically enabled collaboration which involves the integration of people, systems, processes, and infrastructure across organizations to enable the accomplishment of mutual goals. Key to this integration across organizations is communicative activities that involve language and action.

The language-action tradition emphasizes patterns of inter-related business acts (Bussler, et al. 2006). Gerfalk et al (2006) call for researchers to search for social grounds and social purposes of user actions. Several approaches used in language-action research help build a model of collaborative structures in prescribing. The action workflow approach builds upon a theory of work structure as language action (Medina-Mora, et al. 1993). A representation of the inner workings of an organization based on communicative actions are the basis of the DEMO modeling (Van Reijswoud, et al. 1999). The core of DEMO is the business transaction performed by initiatior and executor. The coordination processes are seen to be more critical than those for production (Dietz 2006). The BAT approach emphasizes different logics of business interaction (process variants) (Bussler, et al. 2006). Goldkuhl (2006a) writes that for inter-organizational interaction "The BAT model acknowledges that business interaction consists not only of communication, but also of an exchange of value." (p. 54). Both parties are seen as active in the exchange and value different things. Various models of the language-action tradition are likely to provide meaningful lenses to view collaborative structures.

Interpretive Synthesis Approach

E-prescribing implies simplicity. A prescriber just fills in a form and sends an e-script to a pharmacy. Yet there are a number of upstream and downstream actors and their respective information systems that are involved before a patient receives the medication. The sequence of prescribing-transmitting-dispensing addresses medication management which speaks to a web of collaborative relationships. The simplest form being the prescriber-patient-pharmacist. Yet the healthcare literature is fragmented generally by professional or research affiliation.

Studies of e-prescribing in a positivist tradition are hard-pressed to address relationships. Few studies look at the relationship between prescriber and pharmacist even though the pharmacist is "interceptor, detector, and reporter of medication errors to the physician" (Brown, et al. 2006, p. 22). Less obvious relationships are also missed even by large studies. One study, funded by Centers for Medicare & Medicaid Services (CMS), tracked 146,709 prescriptions from 47 medical practices and three pharmacy chains that filled half of those prescriptions (Barich 2007). One relational finding was the increase in phone calls at the medical practice due to patients arriving at pharmacies who had no record of an e-script. They attributed this to lack of training. There was also the surprising finding that 77% of e-scripts were entered by surrogates (e.g., medical staff). However, these researchers stumbled upon this key discovery requiring modification of their study protocol to collect this additional data. The interesting findings and unanswered research questions center on the connection between systems and actors. Do pharmacies wait for a signal of intent to fill (e.g., patient arrives)? Why do prescribers need a surrogate? Will pharmacists be less vigilant when the e-script has fewer errors? Synthesis of existing literature offers a means to explore these types of questions.

Rationale for Synthesis

This study tries to identify changes in collaborative structures consistent with a pragmatist outlook that "implies an interest in change and how people bring about and respond to change" (Ågerfalk 2010, p. 251). Collaborative structures can be viewed as both the action itself and a representation of such action (e.g, intermediate design artifact). Many of these actions are invisible without context and understanding of the phenomena. Representations as an abstraction of actions are more difficult to observe than the instantiation itself (Magalhães and Silva 2009). These two aspects of collaborative structures demand some interpretive research elements especially in establishing the contextual boundaries of new phenomena. Furthermore, the inter-organizational and multi-system nature of the e-prescribing transaction creates many obstacles to designing a primary observation study due to breadth of actors and number of variables, even well-funded ones like Barich et al (2007).

Even if a large body of e-prescribing studies existed, a conventional systematic review would provide only a summary of findings in the literature (Dixon-Woods, et al. 2006). Collaborative phenomena, such as surrogates which have little to do with the artifact, would likely be overlooked as an outlier in a systematic review. Rousseau et al (2008, p. 477) laments "the misuse of existing research, the overuse of limited or inconclusive findings, and the underuse of research evidence with substantive implications for understanding and working with organizations."

A research synthesis seeks to utilize the wealth of narrowly focused quantitative and/or qualitative studies but connect them pragmatically into a reasonable representation of underlying phenomena to get started. The full body of relevant empirical evidence is subject to systematic accumulation, analysis, and reflective interpretation

(Rousseau, et al. 2008). Such an approach may not reach the gold standard of either qualitative or quantitative research traditions, but collectively creates "effective" representations in the design science paradigm (Hevner, et al. 2004) and insightful to healthcare policy makers (Lomas 2005).

Synthetic Approaches

Rosseau et al (2008) introduced synthesis to management and organizational science by presenting a classification of existing synthesis approaches: aggregation, integration, interpretation and explanation. All of these approaches seek to optimize use of primary studies so that their collective insights provide evidence to decision makers. The key attributes of their categories are summarized in Table 1.

Aggregation requires a body of data but ambulatory e-prescribing is relatively new so few articles have been published to date. They also address different tasks and populations of e-prescribing including impact on prescriber and staff time (Devine, et al. 2010; Hollingworth, et al. 2007), adherence to pediatric prescribing standards (Davis 2007), avoiding inappropriate medications to elderly (Raebel, et al. 2007), implementation practices (Crosson, et al. 2008), clinician attitudes (Fortuna, et al. 2008), and error rates (Kaushal, et al. 2010). For the foreseeable future, aggregation will have to wait until a body of literature develops.

Table 1. Characteristics of Synthesis Research

Type	Objective	Common Method	Typical Data	Limitations
Aggregation	Summarizing an overall effect on specific question	Statistical meta-analysis	Favors randomized controlled trials but rarely homogenous pool of studies	Overlook organizational, behavioral, contextual factors
Integration	Patterns across primary studies; context	Systematic review	All epistemologies	Requires careful selection of studies and expertise of synthesizer
Interpretation	Tell a story – higher order concepts	Meta-ethnography	Comparable body of (typically) qualitative data	Feasible explanation – not definitive
Explanation	Model of causal relationships and contextual factors	Critical realist	No hierarchy of evidence – includes interpretation and explanation of authors	What is quality amongst fragmented and diverse fields

From Rousseau et al (2008)

Integrative syntheses are useful for contextualization. The exemplar used by Rosseau et al (2008) is the systematic review of information systems outsourcing (Dibbern, et al. 2004). The output was an assemblage of the diverse definitions of outsourcing into constructs and relationships with respect to an array of research questions (e.g., why outsource?). Related to e-prescribing, a systematic review by Moxey et al (2010) identified organizational factors leading to clinical decision support usage (e.g., drug interaction alerts). The synthesized studies used primarily surveys and interviews although other methods were used on occasion (e.g., log-file analysis).

According to Rosseau et al (2008), synthesis by interpretation has traditionally sought to understand human experience and social phenomena, especially when there is a comparable body of qualitative data. The focus is on contextualization and generalizability, not to the exclusion of quantitative studies, but in order to "translate key interpretations from one study to another" (p. 496). The output is a collective story of the studies considered (Popay, et al. 2006) obtained through a process of conceptual innovation and reinterpretation (Campbell, et al. 2003). The closest example to e-prescribing in the healthcare literature is a meta-narrative of electronic patient record (EPR) adoption. Greenhalgh et al (2009) concluded that human work will always be required to re-contextualize knowledge for different use so EPRs for primary clinical work will likely be less efficient. For e-prescribing, the artifact appears to embody communicative actions taken on by different actors at different times.

The last category, explanation, moves towards theory building rather than just description or painting a picture. Synthesis by explanation identifies causal mechanisms and how they operate (Rousseau, et al. 2008). A specific research question is tackled taking care to incorporate the researchers' interpretations and explanations (Rousseau, et

al. 2008). The categories of Rosseau et al (2008) described above are intended to be illustrative rather than definitive and targeted at management and organization science. Interpretive synthesis as used in healthcare crosses these categories depending upon the nature of the study.

Interpretive Synthesis in Healthcare

Healthcare, especially for nursing (Paterson, et al. 2001) and evidence-based medicine (Sandelowski and Barroso 2007), has embraced research approaches that synthesize diverse sets of qualitative and/or quantitative data. Variations include meta-data analysis, meta-theory, meta-method, meta-synthesis, narrative synthesis, meta-ethnographic, and meta-narrative (Denyer, et al. 2008; Dixon-Woods, et al. 2007; Paterson, et al. 2001). These approaches are ideal tools for healthcare IT researchers who must understand both the complexity of the healthcare domain and an increasingly sophisticated inter-organizational multi-actor usage of healthcare information systems. Yet many of these are either quantitative or qualitative focused. Critical interpretive synthesis (CIS), sometimes called meta-interpetation, seeks to draw on the strengths of conventional systematic review while grounded in the tradition of qualitative inquiry (Dixon-Woods, et al. 2006; Weed 2008).

Synthesis research in healthcare tries to place existing bodies of literature into context. Paterson et al (2003) found that qualitative investigations of chronic fatigue shared methodological assumptions with a parallel body of quantitative research that focused on measurable factors rather than meaning and context. They concluded that current methods were not fully capturing the complexity of fatigue. Sandelowski et al (2008) synthesized both qualitative and numerous quantitative studies on stigmas facing HIV positive women. The synthesized qualitative finding of disclosure decision making pointed to a dynamic evaluative process. Dixon-Woods et al (2006) looked beyond the measures of equitable access to health services. The focus was on a synthetic construct of candidacy that is the determination for eligibility to such services. Candidacy is a negotiated property of individuals subject to multiple influences and social context.

Methodology

The synthetic comparison approach draws upon several research methods as shown in Figure 1. The goal of the research is to offer explanations as to why a new technology does not perform as intended using collaborative structures for framing the problem. After summarizing the steps of the method outlined in the figure, several of the steps will be explained in more detail.

The first step presumes that the researcher understands the problem domain and can identify the body of literature. For e-prescribing the domain is the broader area of medication management. The actual writing of a prescription is only the most visible part of generating, transmitting, dispensing, and paying for a prescription. Research on medication management is found in medicine (e.g., physician journals), medical informatics, pharmacy, and healthcare economics. Many studies in medication management are positivist-oriented whose findings describe the practice of medicine (e.g., number and type of handwriting errors). As information system researchers working in healthcare, theoretical lenses found in IS need to be employed such as language-action models, routines, boundary objects, and actor-network theory. Step one identifies relevant articles that are appropriate to the toolkit of lenses being used to view the phenomena described in the domain literature.

Step two builds a synthetic (integration) model of the existing phenomena for one or more lenses from the domain literature. This step is analogous to "as-is" models used in process mapping. The term "synthetic" means that relevant data collected by other researchers becomes the basis for constructing an understanding of a broader problem domain using interpretive synthesis previously described. One is unlikely to know a priori which lens is most suitable, hence the need to build several synthetics models. Each lens may emphasize a different set of articles. Analogous to system architecting, the researcher connects together existing peer-reviewed articles that collectively build an understanding of the problem domain. For example, handing a prescription to the patient signals the end of the office visit for family practice researchers who don't care what happens downstream. However, the e-prescribing researcher see this handoff as the start of a patient's determination to fill the prescription (or not) and subsequently hands off the prescription to a pharmacy.

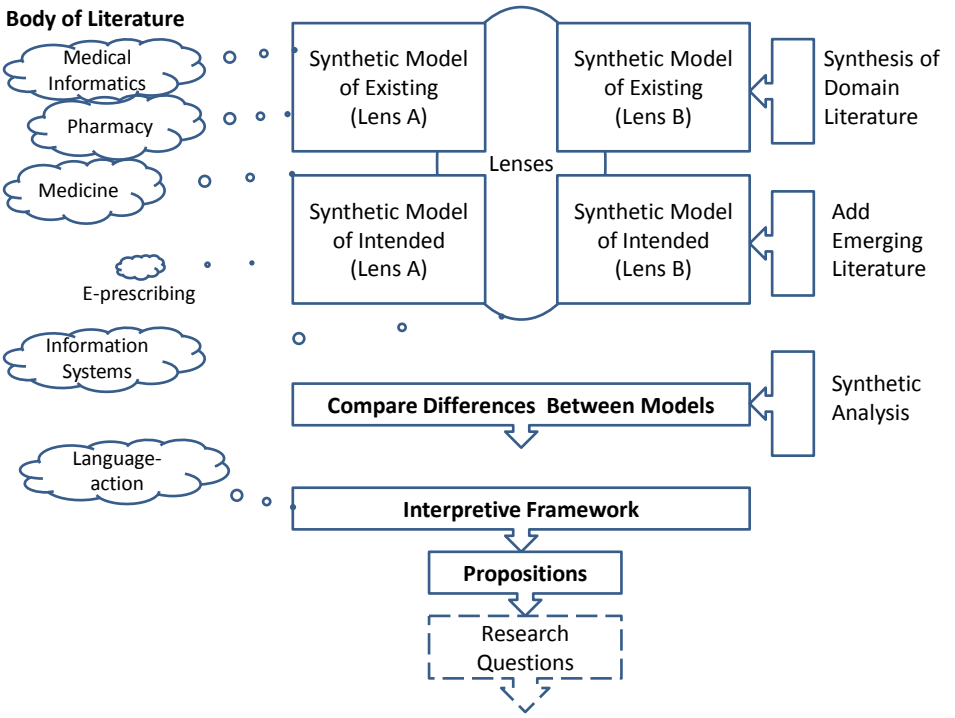

Figure 1. Synthetic Comparative Framework

The third step adds the emerging literature on a new technology (e.g., e-prescribing). Researchers build an intended synthetic model of emergent phenomena. The term "intended" emphasizes that the domain literature studying a new technology takes years to develop. Rather than waiting for the breadth and depth of literature to develop, an intended synthetic model builds upon insights published by advocates of a new technology and the published standards upon which multiple vendors connect to a nation-wide e-prescribing transmission infrastructure. This step is analogous to a "to-be" model that reflects an improved computer-mediated process.

Step 4 performs a synthetic (interpretive) comparative analysis on the differences between the existing and intended synthetic models for the selected lens. The analogy to process improvement breaks down at this point. Rather than seeking improvements for an existing process, the researcher is trying to find differences that may explain unintended usage. They also reconcile findings in the literature inconsistent with the intended model. For example, physicians are known to delegate sub-professional tasks. Given the pervasiveness of surrogate prescribers seen in the early e-prescribing systems (Moiduddin, et al. 2007), a reasonable explanation for unintended usage.

Before suggesting propositions for future research, an interpretive framework allows for conceptualizing behavior that underlies the unintended phenomena that has appeared in early e-prescribing systems. Only then can propositions grounded in an in-depth understanding of the phenomena be generated. Those propositions lead to research questions that can then be explored in more traditional means of investigation. These last steps are no different than a traditional IS study except the findings are based on synthetic data.

Finding the Literature – Step 1

The focus of e-prescribing is an e-prescriber who generates and transmits an e-script to a pharmacy. Thus the starting point in building a synthetic structure for e-prescribing is to analyze the "prescriber-pharmacy" dyad (Johnson and FitzHenry 2006; King, et al. 2007). An iterative snowball style of following leads gathered through in-depth review of the literature and further literature search is employed to identify variances. For example, handing a prescription to the patient signals the end of an office visit ([B] in Figure 2) was identified through a focus group study of physicians discussing the implications of dispensing medications within their medical practice and the accompanying changes in workflow (Hunt, et al. 2008).

Table 2. Breakdown of Data Sources					
Type	Medicine	Pharmaceutical	Informatics	Other Topics	Total
Academic Article	55	89	78	21	243
Government Report	6	3	7	2	18
Trade Association Report	9	19	8	6	42
Magazine/Newspaper	10	7	8	7	32
Company Report	0	0	1	3	4
Total	80	118	102	39	339

Opportunistic interviews of informants from key actor groups provided additional evidence of variances between the intended workflow and what was being implemented in practice. For example, designers presumed that an e-script sent by an e-prescriber will be immediately processed by a pharmacy. Yet a pharmacist working within a supermarket chain (store) pharmacy said "[I] don't want to process [an e-script] if I don't know them because then they'll have to reverse" and "often the [e-]script is for a nearby store [of the same chain]" ([E] in Figure 2). Such an insight led to the role of the artifact in signaling intent.

Keyword searches for each of the variances (insights) are the starting point. For example, e-prescribing relies upon an e-prescriber to look up the formulary for a patient and prescribe a generic rather than brand name drug. So the researcher has to find the literature that describes why prescribers prefer to write the brand name drug (e.g., don't have to memorize generic variants) to understand a potential area of under-utilization in e-prescribing. "Snowballing" via reference reviewing, "cited by" tracking, and reviewing journal table of contents are integral steps in this kind of literature search (Greenhalgh and Peacock 2005).

The set of literature grew quickly as each variance resulted in a search that added more articles about a new topic. Over a thousand entries were added to a citation manager based on an initial screening of relevance. A subsequent two-author abstract review narrowed the set to 339 working articles shown in Table 2. These include over 72% (243) from academic journals. Among these academic articles, 23% (55) are from medicine, 37% (89) related to pharmacy and pharmacist, and 32% (78) from healthcare informatics.

Building Synthetic Models from the Literature – Steps 2 and 3

The collaborative structure for e-prescribing is expected to differ from that structure for manual prescribing because of the changes in workflow which are embedded in the e-prescribing software. The two synthetic structures are assembled with the foreknowledge that one or more pre-existing lenses found in the information systems and organization sciences literature will be used for comparison.

Underlying an interpretive synthesis method is the desire to piece together from the existing research a fairly coherent picture of the focal phenomena despite the disparity of data and methods of the underlying studies. It is a study of studies that takes research findings, whether quantitative or qualitative, as synthetic primary data that can be woven into a plausible outcome (Britten, et al. 2002; Sandelowski and Barroso 2003). The synthetic collaborative structure combines actors, roles, actions, and flow of information.

Comparative Framework – Step 4

Figure 2 shows that four dyads (links [A], [B], [E], [C]) are needed to represent the roles and relationships that surround the activity of writing a prescription. The actors involved are medical staff, prescriber, patient, and pharmacy. The literature that explains each end of the dyad (e.g., actor) and the collaborative relationship must first be identified and then synthesized. Activities that are peripheral to generating, transmitting, and dispensing a prescription must also be included. For example, some patients are likely to shop around (comparing prices) before deciding to fill a prescription and choosing a pharmacy. This is apparent from the linkage between [D] and [E] in manual prescribing. What happens in e-prescribing is unclear. The design action of pushing an e-script to a

pharmacy assumes that every patient chooses to fill every prescription ([D] in Figure 2) so there is no need to ascertain an intent to fill ([E] in Figure 2). The reality of manual prescribing suggests otherwise. This is but one way the synthetic comparison provides insight into the role changes induced by e-prescribing.

Finding Changes in E-prescribing Collaboration

In manual prescribing, the roles and handoffs between actors are clearly demarcated (top of Figure 2). The prescriber writes a prescription [P] and passes a copy to her medical staff for updating the patient's record [A] (Johnson and FitzHenry 2006). The prescriber passes the paper prescription to the patient signaling the end of the office visit [B] (Hunt, et al. 2008). There is little or no interaction between prescriber and patient regarding the prescription [C] (Khan, et al. 2008; Wilson, et al. 2007). The patient first decides if the prescription will be filled [D] before deciding where it will be filled [E] which is typically a local pharmacy.

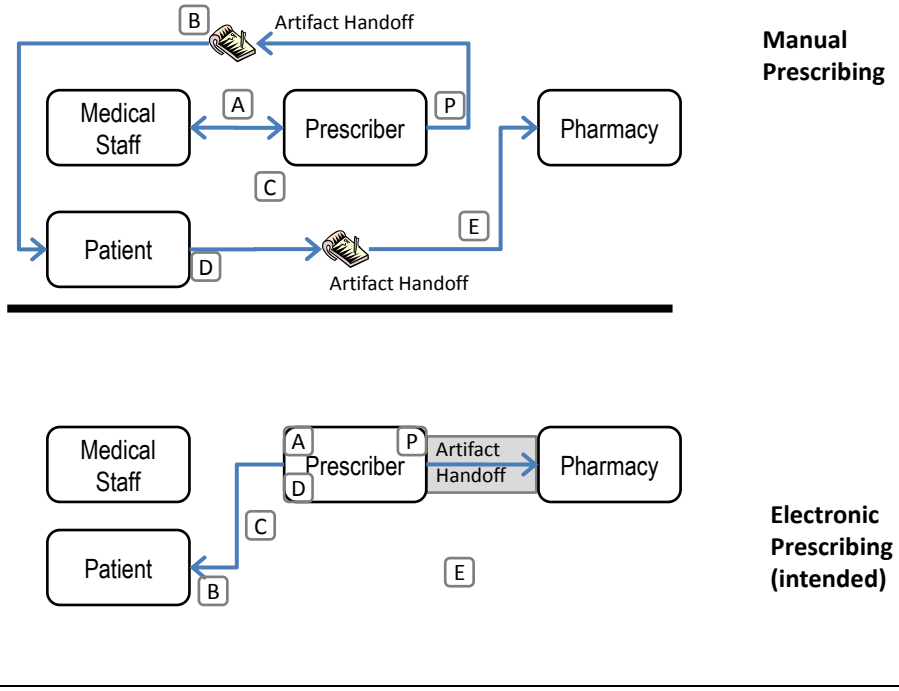

Figure 2. Role Relationships – Manual versus Electronic Prescribing

While the prescriber typically writes the paper prescription, her medical staff makes this happen in practice. The medical staff updates the chart with current medications reported by the patient and pre-prints a label with patient information that prescriber sticks on the prescription (rather than writing the name) saving precious seconds for the prescriber. The paper prescription is often a duplicate form so the copy is placed into the paper chart. The prescriber-medical staff dyad is the first one directly tied to the writing of a prescription (link [A] in Figure 2).

Looking upstream, a handoff takes places from prescriber to patient (link [B] in Figure 2). Hidden in the literature is the meaning of this action which signals an end to the office visit (Hunt, et al. 2008). More important, the prescriber no longer has any involvement with the remaining steps needed to fill a prescription. The importance of this handoff became clear as prescribers weigh the financial benefits of dispensing medications from their own medical practice with the disruption of workflow by getting involved in filling a prescription (Hunt, et al. 2008).

It is the patient who delivers the prescription to the pharmacy (link [E] in Figure 2). But before the patient signals an intent to fill by the act of delivery, a decision has to be made to fill a prescription in the first place ([D] in Figure

2. The delivery of a prescription to a pharmacy means there is a patient-pharmacy relationship that has to be explored in manual prescribing. It appears the intended design of e-prescribing bypasses this relationship by having the prescriber transmit the e-script directly to the pharmacy. This transmission represents a new e-prescribing dyad that did not exist in manual prescribing. One will note that the patient can no longer freely decide to fill or not

The intended roles and relationships of e-prescribing are identified through piecing together the published literature on various aspects of the prescribing workflow. Software vendors adhere to prescribed standards that embody a sequence of activities in addition to data exchange protocols (Bell and Friedman 2005). The e-prescriber inputs the e-script [P] and completes the record keeping [A] before pushing the e-script electronically to a pharmacy [D] whose location must be obtained from the patient [C]. The pharmacy must then determine if the patient is going to pick up the medication as many do not [E] (Kirking, et al. 2006).

Whether intended or not, e-prescribing alters many of the role relationships of manual prescribing (compare top and bottom of Figure 2). For example, the prescriber now has a direct link with the pharmacy when there was none in the past. This means the prescriber now takes on the role of selecting a pharmacy which previously was a patient's responsibility. E-prescribing also changes the role of the artifact. A paper prescription allows information to be distributed around the environment at a time chosen by participants (e.g., patient) (Paul, et al. 1992). An e-script, when pushed from prescriber to pharmacy as in the US, limits such mobility. Delivery of a paper prescription signified to a pharmacy the patient intends to fill it. Delivery of an e-script only indicates that one has been sent. Other means of ascertaining an intent to fill must now be established (e.g., good customers) since many prescriptions are never filled. A further understanding of these changes in role relationships and their impact is the objective of this exploratory synthetic comparison method.

Discussion

A synthetic comparison of collaborative structures provides visibility into the role changes in the transition from manual to electronic prescribing. These role changes are embodied in a dyad of actors in the model of this paper. These observations are based on models synthesized from peer-reviewed literature that collectively embodies the field of medication management. While only the collaborative activities needed to write (type) a prescription is described in this paper, upstream activities of formulary check (e.g., save healthcare system costs by prescribing generics) and a critical activity for patient safety – drug-to-drug interaction check are being explored.

Those reading this research might ask whether or not a synthetic comparative framework can lead to relevant synthetic findings. Reviewers of an early version of this research suggested that primary data collection would discover the same insights and more. While there are certainly challenges in using interpretive synthesis identified by its proponents (Dixon-Woods, et al. 2006; Voils, et al. 2008; Weed 2008), an e-prescribing field study poses its own research design issues. For example, every e-script transaction involves a different set of inter-organizational actors in the typical outpatient setting. A prescriber sees dozens of patients on a daily basis who fill their prescription in dozens of pharmacies. The smallest pharmacies have hundreds of prescribers in their database just as prescribers have hundreds of patients. Does the researcher follow the patient from medical office to home to pharmacy in order to observe the collaborative actions of each e-script transaction (e.g., a few transactions a day)?

The challenge of this work has been to make sense of 240+ academic studies with their corresponding depth (e.g., hundreds of survey responses or chart review of thousands of prescriptions) that cover dozens of topics related to medication management. How many of these topics could a researcher observe or address in a single study? How many questions would subjects be willing to answer? The large study of Barich et al (2007) described earlier did not initially consider the possibility of surrogates. Yet evidence of surrogates, or more precisely the tendency of physicians to delegate, is common knowledge in healthcare. Such delegation is especially true in repeat (refill) prescriptions (De Smet and Dautzenberg 2004). One wonders if published findings based on synthetic analysis might have enabled these researchers to explore why surrogate prescribers exist – not discover what has already been known.

Using a pragmatic pluralism research approach combines the best of both worlds – identifying through interpretive synthesis what is important to study before allocating primary data collection resources. This synthetic approach also allows for IS research to be relevant to informing design and policy. Policy decisions are created dynamically through human interaction using the best evidence available (Greenhalgh and Russell 2006). While perhaps not meeting the "gold standard" of research, giving our best guess based upon a synthesis of other findings may do less harm than our silence.

While pluralistic pragmatism is used for inquiry, the study focus is on referential pragmatism which is knowledge about action (Goldkuhl 2006b). The emphasis in the US has been on the correct transfer of information similar to the work of Öhlund and Goldkuhl (2008) in Swedish that found e-prescribing underestimates the complexity of communication that envelops the artifact. Language-action models help describe a collaborative structure. The workflow loops in action workflow analysis (e.g. Medina-Mora, et al. 1993) are particularly germane to modeling callbacks between pharmacy and physician to clarify a prescription. Other workflow loops might be the resolution of patient eligibility. The commitment aspect of handing a paper prescription is evidence of coordination processes in manual prescribing (e.g., Van Reijswoud, et al. 1999). The process variants of BAT (e.g., Bussler, et al. 2006) help model the decisions that are made. For example, patients may value the personalized knowledge of their local community pharmacist even if it costs more than a chain pharmacy. Their choice of pharmacy may also depend upon price or convenience of a particular kind of drug (e.g., chronic versus acute). The methodology offered in this paper offers the potential to further build language-action models or socio-pragmatic conceptualization of communication actions such as the work of Öhlund and Goldkuhl (2008).

Conclusion

Research synthesis has been gaining increasing attention, especially among healthcare researchers. Pragmatism is driving the growing recognition that numerous published studies from different epistemological traditions can collectively inform designers and policy makers about phenomena of interest. This study describes an integrative and interpretive approach to synthesis that has been adopted to explore the collaborative structure of e-prescribing. The defining characteristic of interpretive synthesis "…is its concern with the development of concepts, and with the development and specification of theories that integrate those concepts" (Dixon-Woods, et al. 2005, p. 46). As shown in Figure 1, the methodological sequence shows how the targeted domain literature that "envelops" the prescribing activity is synthesized into collaborative structures for both manual and e-prescribing. Comparative analysis identifies changes to the structure especially role changes and collaborative relationships. Any of these changes can result in unintended consequences that hinder adoption. Existing theoretical lenses offer some preliminary explanations especially the language-action tradition which needs to be explored. Such insights enable designers to improve their technology and give policy makers early evidence so that incentives can be properly targeted.

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