8-5-2011

Proceedings of the Seventeenth Americas Conference on Information Systems, Detroit, Michigan August 4th-7th 2011 1 A Service Value Approach to the Micro-Organizational Networks of E-prescribing

Nelson King
Olayan School of Business – American University of Beirut, nelson.king@aub.edu.lb

A Service Value Approach to the Micro-Organizational Networks of E-prescribing

Nelson King
Olayan School of Business – American University of Beirut
nelson.king@aub.edu.lb

ABSTRACT

Value realization in service networks, such as healthcare, is receiving increasing attention as governments battle rising costs. But before value realization can be understood, there needs to be a conceptualization of the network so that specific value-creating services and exchanges can be identified. The service value network (SVN) model of Basole and Rouse (2008) has been adapted to explore the network of micro-organizations commonly found in e-prescribing. While the SVN identifies linkages, it does not address the nature of service exchanges that take place. Interpretive synthesis is used to piece together an understanding of each exchange. Once insights into these exchanges exist, they may be helpful to understand some of the adoption challenges that have been encountered (e.g., more callbacks – not less) that relate to value creation.

Keywords

Healthcare Information Technology, Value Creation, Service Network, Inter-Organizational Networks, Micro-Organizations

INTRODUCTION

Before value realization in healthcare can be understood, there needs to be a conceptualization of the service network. The service-dominant (S-D) logic community has called for an understanding of the true nature of economic exchange knowing that information and communication technology (ICT) can influence the creation of value (Vargo, Maglio and Akaka, 2008b; Lusch, Vargo and Tanniru, 2010). Such an understanding is particularly important as service providing inter-organizational networks (ION) take on an increasing role in society. However, the services literature currently relies upon an abstract description of exchanges and few if any in-depth study of services in practice.

E-prescribing is an ION example of a service providing system in healthcare. The healthcare organizations providing the services necessary for e-prescribing, especially solo medical practices and independent pharmacies have been particularly slow to adopt the technology. Despite four in five prescribers favoring the technology (Ayres McHenry & Associates Inc., 2007), adoption by medical practices has been slow despite expiring financial incentives and looming penalties (Au, Menachemi, Panjamapirom and Brooks, 2011). These prescribers are the network analogy of people in organizations rejecting technology they are in favor of (Leonardi, 2009). Little is known about value realization in e-prescribing except for the idealized exchanges embodied in e-prescribing data transfer standards (Bell, Cretin, Marken and Landman, 2004).

This paper suggests that insights into value realization in e-prescribing can be gained if conceptualized as a micro-organizational service value network (MOSVN). Since many organizations in e-prescribing are solo medical practices and independent pharmacies, the paper also introduces the concept of micro-organizations as core elements of an ION. The paper seeks to understand what is exchanged between micro-organizational actors and the enablers to create value.

The paper begins by describing the fit of e-prescribing to various research priorities in the services literature. The service value network is explained and micro-organizations are defined. The use of interpretive synthesis to bring together the literature in medication management, which encompasses all aspects of e-prescribing, is described. The resultant case built using interpretive synthesis is then analyzed to identify specific e-prescribing services and their related exchanges.

BACKGROUND

The study of ICT-enabled healthcare services in an inter-organizational network (ION) responds to several research priorities identified in the services literature. Consumer and societal welfare can benefit from transformative services (Ostrom, Bitner, Brown, Burkhard, Goul, Smith-Daniels, Demirkan and Rabinovich, 2010; Nordgren, 2004). Inter-firm collaboration is necessary to manage upstream and downstream migration of the service value chain (e.g., system orientation) (Vargo and Lusch, 2008a; Ostrom et al., 2010; Spohrer and Maglio, 2010). The service experience can be enhanced through co-creation

(Alter, 2008; Ostrom et al., 2010; Vargo et al., 2008a). In addition, academia has been encouraged to catch up with fast-moving service-driven technologies like service-oriented architectures and web services (Barrett and Davidson, 2008).

The focal phenomenon of this paper, the ICT-enablement of manual prescribing, embodies these research priorities. E-prescribing has been sold on the basis of societal benefit - fewer medication errors and lower healthcare costs (Institute for Safe Medication Practices, 2000). The electronic generation, transmission, and adjudication (dispensing) of prescriptions ties together many organizations to create a service value chain (Bell et al., 2004). The e-prescribing architecture necessitates co-creation by connecting services which had been decoupled in the past (King, Christie and Alami, 2007).

Service Value Networks

The definition of services chosen for this paper reflects the more generalized "entity" as the doer-recipient of an exchange appropriate to computer-mediated services of interest to the IS field. Alter's (2008, p. 3) definition states "Services are acts performed by one entity for another, including the provision of resources that another entity will use". His definition avoids specifying what is performed or who benefits in contrast to the entity to entity definition of Vargo and Lusch (2004).

The role of the service value network (SVN) in this conceptual framework is to map out the relationships between organizations and the services that take place between them. The underlying premise of a value network for services is that organizations want to be a part of a larger network of organizations to co-create value with some form of governance (Basole and Rouse, 2008; Speiser, Blau, Lamparter and Tai, 2008). Furthermore, an efficient service value network can be created by distributing service requests over a network of self-interested and non-cooperative service providers (Speiser et al., 2008). One or more service providers provide services that are supported by enablers within the boundaries of a service value network (Figure 1) (Basole et al., 2008).

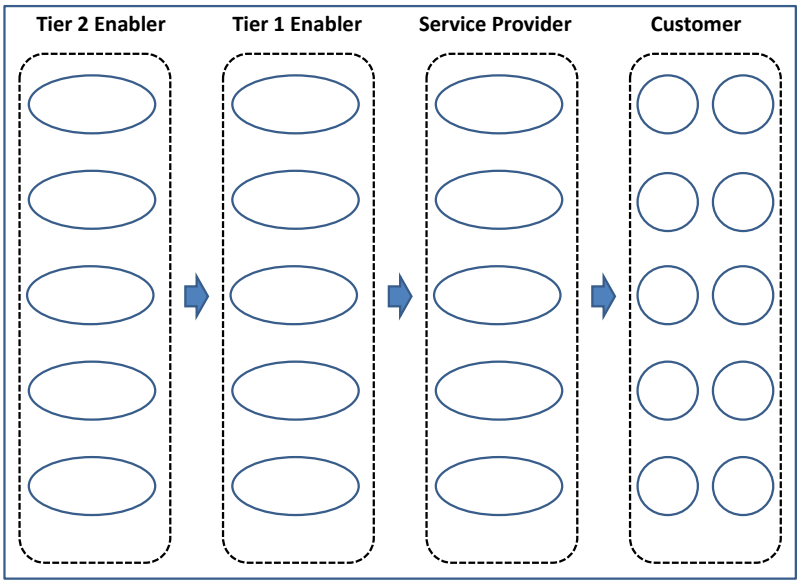

Figure 1 Service Value Network of Basole & Rouse (2008)

The SVN, as conceptualized by Basole and Rouse (2008), embodies five different actors. The customer is seen as the point where value is realized. The service provider is the primary contact point for the customer within the SVN. Tier 1 enablers provide direct goods and services to the service provider. A Tier 2 enabler provides goods and services to Tier 1 enablers. There are also auxiliary enablers (not shown in Figure 1) that span industries. Finally, there are non-actor influences upon the network such as technology or social forces (not shown in Figure 1). Their conceptualization shows value increasing from left to right as Tier 2 enablers provide inputs to Tier 1 enablers who in turn provide direct goods and services to service providers. The highest value is achieved when consumers benefit from these goods and services. The service provider is seen as the focal actor. The notion of consumers as co-producers of value (e.g., Prahalad and Ramaswamy, 2000) are mentioned in this framework but not developed.

Micro-Organizations in US Healthcare

The consumer and service providers in an e-prescribing SVN are the patient, medical practice, and pharmacy. One or more of these actors will be a micro-organization in any e-prescribing transaction. The micro-organization is smaller than the smallest organizational entity usually studied by organizational researchers – the small business. The Small and Medium Enterprise (SME) tag applies to firms beginning with 50 or 100 employees depending on whether it is in the US or European Union (EU). The Small Office – Home Office (SOHO) designation used in information technology applies to businesses with less than 10 employees. SOHO or micro-business better describes the typical pharmacy and medical practice.

The typical prescriber works in a medical practice owned by themselves or one other physician. 42.7% of US office visits went to these solo/partner practices (Hsiao, Cherry, Beatty and Rechtsteiner, 2010). The medical practice with one or two physicians represents 89% of all medical practices (Anderson, 2007). A one or two physician office has a supporting medical staff ratio of about four to one (Reeves, 2002; Miller, West, Brown, Sim and Ganchoff, 2005).

Each pharmacy, whether part of a chain or independently-owned, has one or two pharmacists and a support ratio of about three. About 38% of the pharmacies in the United States are independently owned (SK&A Healthcare Information Solutions, 2007). The average independent community pharmacy has 10.6 full-time employees (Christensen and Farris, 2006).

The patient as consumer of a service is a micro-organization. They act alone or with their designated health advocates (e.g., friend or family members) to choose the level of value creation (e.g., personal health). Business decisions have to be made such as determining if the potential benefit of taking a medication is worth its cost. Such decisions and involvement support the service rationale of co-creation. (Basole et al., 2008) but also co-producers (Prahalad et al., 2000).

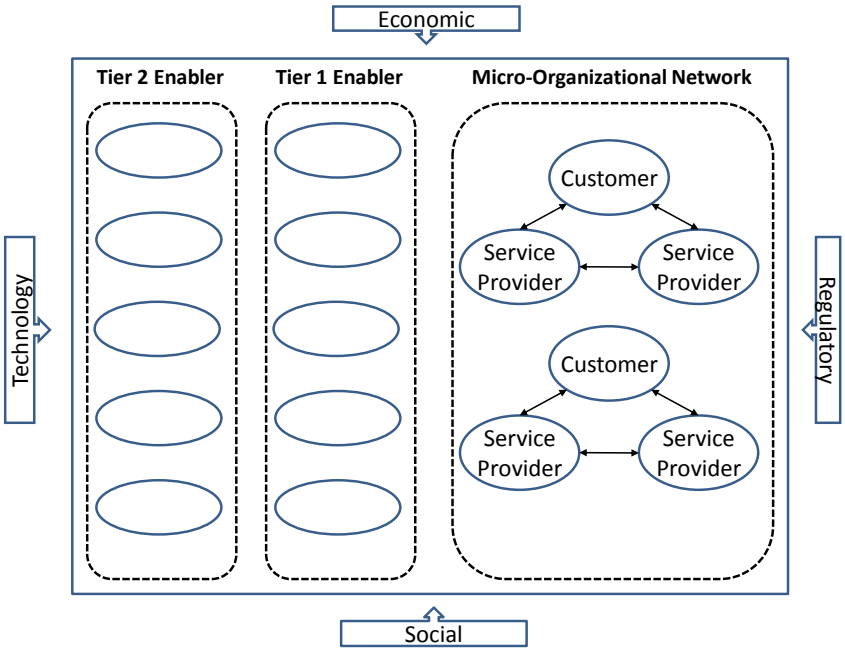

Figure 2 Micro-organizational Service Value Network

Micro-Organizational Service Value Network

The actors in e-prescribing value creation have long been known to consist of the prescriber, patient, and pharmacy (e.g., Bell et al., 2004). This paper suggests these three actors form a micro-organizational network (MON) to create value that in turn relies upon the services provided within a larger service value network (SVN). The micro-organizational service value network (MOSVN) makes explicit the co-creation of value alluded to by Basole and Rouse (2008). This emphasis is shown in Figure 2 where the service provider and consumer distinction of Figure 1 goes away. The paper seeks to understand what is exchanged between MON actors and the enablers.

The MOSVN presumes that actors in the MON have connections between themselves but also directly to the requisite enablers enabled by the e-prescribing infrastructure. With computer-mediated networks, the direct enablers (e.g., Tier 1) may

be bypassed (or serves as a conduit) and service providers get information straight from Tier 2 enablers if necessary. The MOSVN also explicitly recognizes the role of external influences by placing them on the model (Figure 2).

METHODOLOGY

The challenge in exploring network phenomena outside of a firm is the need for case study level of details for a population. While the actors may be known (e.g., Bell et al., 2004), their behavior and the context of their actions is unlikely to be known let alone understood. For at least US e-prescribing, there is a broad body of literature under the umbrella of medication management that studies isolated phenomena (e.g., prescription handwriting errors) but not in a unified way. A recent AIS SPROUTS working paper suggests that interpretive synthesis can be used to bring together a diverse set of literature, both methods and coverage, to serve as a quasi-case (King and Azad, 2010).

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.

Healthcare, especially for nursing (Paterson, Canam, Thorne and Jillings, 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 (Paterson et al., 2001; Denyer, Tranfield and Van Aken, 2008; Dixon-Woods, Booth and Sutton, 2007). These approaches are ideal tools for HCIT researchers who must understand both the complexity of the healthcare domain and an increasingly sophisticated inter-organizational multi-actor usage of HCIT. Yet many of these are either quantitative or qualitative focused. Critical interpretive synthesis (CIS), sometimes called meta-interpretation, 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).

The two analysis sections that follow, conceptual framework and identification of services, are drawn from this quasi-case pulled together by interpretive synthesis. The e-prescribing articles are the basis to begin a snowballing search. For example, e-prescribing claims to reduce prescriber-pharmacist interaction so those historical relationships had to be explored, especially the reasons why such interaction might be necessary. It turns out that third party payer problems are a frequent reason for callbacks from pharmacists. So the literature on prescription adjudication, especially third parties had to be explored. Similarly, e-prescribing claims that generic utilization increases. This requires examining the prescribing of generics by physicians and the pharmacist-authorized substitution required by third party payers. The insights from the articles are synthesized upon the basis of data flow models used for the development of e-prescribing standards. Each insight is associated with a particular data element that in turn corresponds to a workflow sequence. The context of these additional articles allows the determination of stakeholders, actors, and any organizational relationships. Many of these articles are empirical studies so the variability around an insight is also known (e.g., what kind of physician prescribes brand name only).

Over 400 articles have been reviewed over the past four years with two in three from academic journals. Among these academic articles, roughly 23% are from journals related to medicine, 37% related to pharmacy and pharmacist, and 32% from healthcare informatics. The set of articles cluster around the following topics: e-prescribing usage and policies (16%), physician-pharmacist relationship (7%), medication error (12%), drug-drug interaction systems (11%), generics and drug costs (24%), and IT-related such as EMR and CPOE for prescribing (14%). The database of articles can be requested.

CONCEPTUAL FRAMEWORK

The ad-hoc nature of e-prescribing means a different set of organizations comes together to process every prescription: medical practice, patient, and pharmacy. These organizations represent the micro-organizational network (MON) in Figure 2. The number of MON's is large - over 190 million e-scripts involving combinations of 600,000+ office-based prescribers, 62,000+ pharmacies, 300+ million patients, and hundreds of payers in 2009 (Surescripts, 2010). This means there was upwards of 50 million combinations of micro-organizations (roughly three prescriptions per office visit filled at same pharmacy). Tens of millions of MONs reside within the broader SVN. The micro-organizational service value network (MOSVN) model accommodates the existence of these ad-hoc players organized as MONs that individually add limited value to the SVN. However, the e-prescribing transaction has been repeated hundreds of millions of times in 2009 and

collectively account for billions of dollars of prescription drug sales. The number of e-prescribing transactions are expected to reach the billions in the next few years as e-prescribing adoption increases. Each medical practice and pharmacy is connected along multiple paths in these fluid MONs along with the computer-mediated interactions with the enablers of the SVN. The connections between these actors in the MOSVN are explained below (Figure 3).

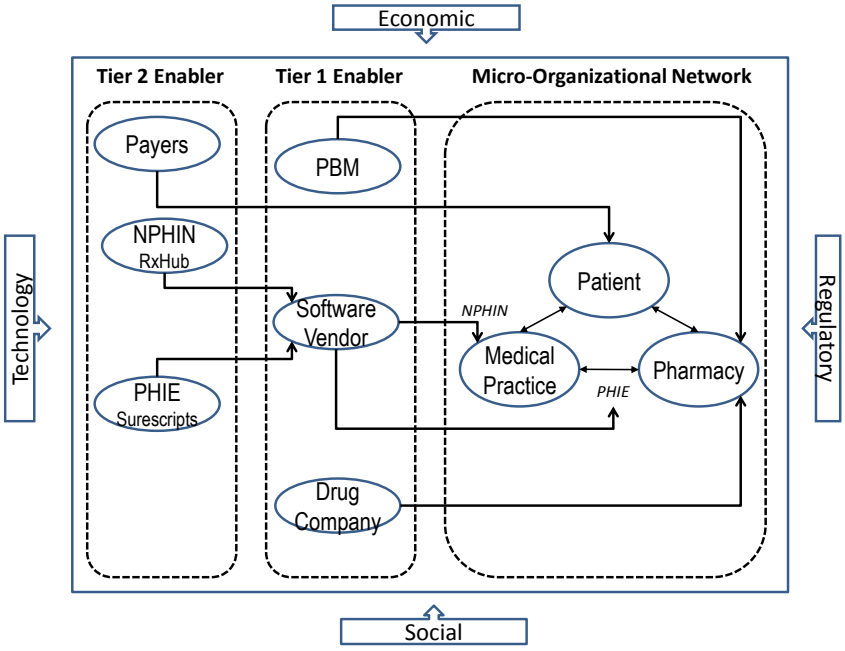

Figure 3 Micro-organizational Service Value Network of E-prescribing

Service Providers

The service providers in an e-prescribing MOSVN consist of medical office and pharmacy. From the perspective of an individual service provider – a prescriber or pharmacy, the SVN is much more localized. Each physician averages 85 office visits per week (Hing and Burt, 2008). Most patients will be given a prescription that has to be filled. These patients go to different pharmacies with the number depending on how far patients travel to visit a physician. Each pharmacy interacts with tens of patients per day (thousands per month). The prescriber can then receive calls from tens of pharmacies depending upon their geographic distribution (King, 2009). The SVN of most actors is limited in practice although still thousands of actor combinations.

Tier 1 Enablers

These are the systems that the service provider directly interacts with. These enablers represent e-prescribing software for the medical practice and pharmacy management software for the pharmacy. In addition, most prescriptions are processed by a pharmacy benefit manager (PBM). The drug distributors provide pharmacies the only physical good in the SVN.

Tier 2 Enablers

The Tier 2 enablers are infomediaries that consolidate information resources at the behest of the value network (King et al., 2007; Lusch et al., 2010). The National Patient Health Information Network (NPHIN), formerly known as RxHub, provides the prescriber information about the formulary (approved medication list) of a patient (RxHub, 2007). The Pharmacy Health Information Exchange (PHIE), formerly known as Surescripts, connects the prescriber to the pharmacy so the e-script can be sent. The payers hold information about patients and the services they are eligible for. The Tier 1 software providers directly connect service providers to Tier 2 enablers.

Contextual Influence

Contextual influence plays a significant role in an e-prescribing MOSVN. The increased usage of e-prescribing in 2009 reflects recent regulatory incentives and looming penalties from the Centers for Medicare & Medicaid Services (CMS) which

is the largest payer in the US (Lowes, 2008). The technical influence comes from e-prescribing standards that embody a sequence of activities (e.g., workflow) in addition to data exchange protocols (Bell and Friedman, 2005). Low adoption rates and proliferation of surrogate prescribers have been attributed to poor implementation (Moiduddin, Dullabh, Espinosa, Frisse, Johnson, Woolley and Pearlstein, 2007). The rising cost of healthcare pressures the e-prescribing SVN to deliver more service with fewer dollars even though consumers don't want to pay an increasing share of their medications or be restricted from receiving brand name drugs rather than cheaper (and more profitable) generics.

IDENTIFICATION OF SERVICES

The e-prescribing transaction is a series of exchanges typically between micro-organizations. The doer-recipient dyad demarcates the various services that are related to e-prescribing. The first service is the generation of the e-script. The patient describes symptoms so the physician can prescribe a treatment embodied in the form of a prescription or e-script. The second service is the transmission of the e-script. In the past, a patient took the prescription to the pharmacy but now the e-script is transmitted electronically at the presumed behest of the patient. The third service is adjudication of the prescription. The pharmacy checks the prescribed medication against the insurance information of the payer before any medication can be dispensed. These three services are consistent with the functions identified in an oft-quoted functional model of medication management (Bell et al., 2004). The following sections describe the exchanges that take place in further detail synthesized from the literature.

Generate

After the diagnosis of a patient, the prescriber initiates the generation of a form-based prescription. The e-prescriber fills in the form on an e-prescribing module of an electronic medical record (EMR) system or a standalone e-prescribing system. There is no longer a need for the medical staff to update the patient's record (Johnson and FitzHenry, 2006). In practice, most e-scripts are generated by surrogate prescribers (Moiduddin et al., 2007).

The intended e-prescribing workflow expects the e-prescriber to check the formulary of the patient so the lowest cost drugs will be prescribed. Before the formulary can be checked, the patient's insurance eligibility must be verified with the NPHIN to ensure the correct formulary is being used. If the eligibility can't be confirmed, the e-prescriber must resolve the problem before the formulary can be checked. Early e-prescribing pilots were plagued by the NPHIN having out of date information so the formulary could not be checked or the information provided was incorrect (Moiduddin et al., 2007).

Once all the required information is collected by the prescriber, the form can be finalized. In the past (manual prescribing), handing the paper prescription to the patient signaled the end of the office visit (Hunt, Siemiencuk and Koch, 2008). There has traditionally been little or no interaction between prescriber and patient regarding the prescription (Khan, Sylvester, Scott and Pitts, 2008; Wilson, Schoen, Neuman, Strollo, Rogers, Chang and Safran, 2007). This handoff no longer exists with e-prescribing as the e-script cannot be sent without a recipient pharmacy (see "transmit" below).

Exchange	Provider (From)	Provider (To)	Enabler 1	Enabler 2
Initiate form	Prescriber	Patient		
Check eligibility	Prescriber	----	Software	NPHIN
Check formulary	Prescriber	Patient (if options)	Software	NPHIN
Finalize form	Prescriber	Patient		

Table 1. Generate Prescription Service

The additional value created in this service with respect to manual prescribing are: a) verifying the eligibility of the patient, b) formalization of the formulary check that was optional in the past, and c) eliminating the data entry tasks of the medical office staff.

Transmit

In the past, the patient takes the prescription away from the medical office and first decides if the prescription will be filled. If they choose to do so, the next step is for the patient to select a pharmacy. The selection would often depend upon the medication that was prescribed. The choices include mail order for chronic medications, chain or discount pharmacies for selected generics (e.g., $4 promotion), a local community pharmacy if they are unfamiliar with the drug. A paper prescription allowed information to be distributed around the environment at a time chosen by participants (e.g., patient)

(Paul, Christian and David, 1992). The decisions to fill a prescription and where to fill the prescription are now made before the office visit is concluded. E-prescribing as configured in the US makes it the prescriber's responsibility to transmit the e-script to the pharmacy.

Delivery of a paper prescription signified to a pharmacy the patient intends to fill it. Delivery of an e-script now only indicates that one has been sent. Other means of ascertaining an intent to fill must now be established (e.g., good customers are filled immediately) since many prescriptions are never filled.

Exchange	Provider (From)	Provider (To)	Enabler 1	Enabler 2
Choose pharmacy	Patient	Prescriber		
Find pharmacy location	Prescriber	Patient	Software	PHIE
Confirm/Send	Prescriber	Patient	Software	PHIE

Table 2. Transmit Prescription Service

The first kind of value created for this service is the electronic transmission of the e-script to a pharmacy ostensibly saving the patient this task. Some time is expected to be saved for the patient. However, most callbacks that e-prescribers now receive seem to be for missing e-scripts (Goldman, Dubé and Lapane, 2010).

An unintended value creation of this service is greater interaction between physician and patient regarding medication costs that ultimately impacts medication adherence. Especially with new medications, physicians often fail to communicate essential information to the patient (Tarn, Heritage, Paterniti, Hays, Kravitz and Wenger, 2006). The prescriber doesn't know where the prescription will be filled (or presumably cares) nor how much it costs (Fortuna, Ross-Degnan, Finkelstein, Zhang, Campion and Steven R. Simon, 2008; Khan et al., 2008). Two in five seniors have not talked with their physician about cost-related non-adherence (Wilson et al., 2007). When costs are discussed, it is often initiated by a patient (Beran, Laouri, Suttorp and Brook, 2007).

Adjudication

The adjudication of prescriptions has been computer-mediated for many years. The first step of the pharmacy is to determine if the patient is going to pick up the medication. Determination of eligibility is significant and serves as an "obligatory point of passage". Early evidence shows that the number of e-scripts abandoned is 64% higher than paper prescriptions (Shrank, Choudhry, Fischer, Avorn, Powell, Schneeweiss, Liberman, Dollear, Brennan and Brookhart, 2010). Once the intent to fill is determined, a pharmacy begins adjudication which requires a check for eligibility, check for formulary coverage, and filing a claim so the pharmacy gets paid.

The patient's eligibility for a prescription plan must be verified before the choice of drug can be checked for adherence with the formulary. This computer-mediated routine is performed every time a prescription involves a third party payer. The pharmacy must call whenever a problem cannot be resolved (e.g., patient name known but not of policyholder). Pharmacists spend 7% of their day resolving third party (payer) eligibility issues (Arthur Andersen LLP, 1999).

Once the verification is received, the formulary for a particular patient becomes available. The prescribed drug is compared against those drugs eligible on the formulary for that patient. The payer allows only certain drugs to be on the list. To assist in formulary adherence, the prescription artifact in many US states has a tick box saying "dispense brand only". This protocol permits pharmacist (e.g., tick box left blank) to substitute a lower cost drug on the formulary (e.g., generic) when such drugs are available without consulting the prescriber (Ross, Papshev, Murphy, Sternberg, Taylor and Barg, 2005).

If not on the formulary, the pharmacist substitutes an equivalent medication or needs to contact the prescriber (Suh, 1999). Pharmacists already change, when a state allows such substitutions, 84% of prescriptions written for brand to generic (Mott and Cline, 2002). This substitution rate is likely the upper limit since pharmacists will not change some prescriptions to generic for various medical and professional reasons (Al-Gedadi and Hassali, 2008). The next step is to check for drug-drug interaction with the other medications being taken by a patient. Finally, the pharmacy proceeds to dispense the medication and collect payment from the patient.

The only additional value creation for the e-prescribing patient during adjudication would be the double-checking of actions now expected of the prescriber. All of these steps at the pharmacy pre-existed the introduction of e-prescribing. E-prescribing advocates claim that the e-script saves the pharmacy time although many pharmacies still must retype the digital prescription that is received.

Exchange	Provider (From)	Provider (To)	Enabler 1	Enabler 2
Determine intent to fill	Pharmacy	Patient		
Check eligibility	Pharmacy		Software	PBM
Check formulary	Pharmacy	Patient (if options)	Software	PBM
Check DDI	Pharmacist	Patient	Software	
Collect payment	Pharmacy	Patient	Software	

Table 3. Adjudication Service

DISCUSSION

The services of e-prescribing and the exchanges that take place in the MOSVN were briefly described in Tables 1 to 3. Almost all of the exchanges involve information, except of course the actual dispensing of medication. Some of these exchanges are necessary to complete the transaction. Others, such as checking for an allergic reaction (e.g., drug-drug or drug-allergy interaction) provide a tangible outcome – avoidance of an allergic reaction. These exchanges typify the service-dominant logic (Vargo et al., 2004). The service actors need to grant access to resources (i.e., information) to realize value co-creation (Spohrer et al., 2010). For example, a patient can only benefit by sharing all the medications they take (e.g., medication history) with a service provider. This means an actor (patient) could endanger the value transaction by intentionally (i.e., recreational drugs) or unintentionally (i.e., forget) omitting some information.

Several observations come to light at examining the exchanges identified in this paper. First, the actors of value creation are constrained by the technology imposed on them. E-prescribing creates value for the SVN (e.g., lower drug costs to payer) not necessarily the actors in the MON. Prescribers are expected to duplicate what pharmacies are already doing in terms of checking eligibility and formulary adherence. Hence, value might be added by double checking or there may be non-value added exchanges taking place. Prescribers are also asked to be involved in helping the patient choose a pharmacy that lowers their costs. While this may add value to the patient this requires uncompensated time on the part of the prescribers. These examples are the more obvious ones that would be candidates for studying value realization.

E-prescribing in at least the US and Sweden (Öhlund and Goldkuhl, 2008) has emphasized the correct transfer of information which underestimates the complexity of communication that occurs. The next step is to study value realization using value network analysis. Allee's (2008) method is a good candidate as it allows exploring the conversion and utilization of tangible and intangible assets. The MOSVN identifies the roles and maps the relationships. What remains is to understand how these roles and relationships create value. More importantly, do these value creation activities contribute to reducing medication errors and increasing generic utilization. Taking a value realization approach has the potential to explain why certain features of e-prescribing are being adopted as intended while other features exhibit unintended uses. For example, S-D logic presumes that the economic exchange is reciprocal in nature based on the co-creation of value (Maglio, Vargo, Caswell and Spohrer, 2009). Perhaps there is no reciprocity and the desired value creation must be compensated.

ACKNOWLEDGMENTS

I am grateful for the support of a University Research Board grant from American University of Beirut and a grant from the IBM Center for the Business of Government. The comments from three reviewers helped to further clarify the paper.

REFERENCES

1. Al-Gedadi, N. A. and Hassali, M. A. (2008) Pharmacists Views on Generic Medicines: A Review of the Literature, *Journal of Generic Medicines*, 5, 3, 209-218.
2. Allee, V. (2008) Value network analysis and value conversion of tangible and intangible assets, *Journal of Intellectual Capital*, 9, 1, 5-24.
3. Alter, S. (Year) Seeking Synergies Between Four Views of Service in the IS Field, In *AMCIS 2008 Proceedings*.
4. Anderson, M. R. (2007) AC Group's 2007 Annual Report: The Digital Medical Office of the Future Computer Systems for the Physician's Office, AC Group, Inc.
5. Arthur Andersen LLP (1999) Pharmacy Activity Cost and Productivity Study, National Association of Chain Drug Stores Education Foundation
6. Au, D. W., Menachemi, N., Panjamapirom, A. and Brooks, R. G. (2011) The influence of payer mix on electronic prescribing by physicians, *Health Care Management Review*, 36, 1, 95-101.

7. Ayres McHenry & Associates Inc. (2007) National Survey of Physicians Regarding E-Prescribing, The Pharmaceutical Care Management Association.
8. Barrett, M. and Davidson, E. (2008) Exploring the Diversity of Service Worlds in the Service Economy, In Barrett, M., Davidson, E., Middleton, C. and DeGross, J. (Eds.) *Information Technology in the Service Economy: Challenges and Possibilities for the 21st Century*, Springer, Boston, 1-10.
9. Basole, R. C. and Rouse, W. B. (2008) Complexity of service value networks: Conceptualization and empirical investigation, *IBM Systems Journal*, 47, 1, 53-70.
10. Bell, D. S., Cretin, S., Marken, R. S. and Landman, A. B. (2004) A Conceptual Framework for Evaluating Outpatient Electronic Prescribing Systems Based on Their Functional Capabilities, *Journal of American Medical Informatics Association*, 11, 1, 60–70.
11. Bell, D. S. and Friedman, M. A. (2005) E-Prescribing And The Medicare Modernization Act Of 2003, *Health Affairs*, 24, 5, 1159-1169.
12. Beran, M. S., Laouri, M., Suttorp, M. and Brook, R. (2007) Medication Costs: The Role Physicians Play with Their Senior Patients, *Journal of the American Geriatrics Society*, 55, 1, 102-107.
13. Christensen, D. B. and Farris, K. B. (2006) Pharmaceutical Care in Community Pharmacies: Practice and Research in the US, *Annals of Pharmacotherapy*, 40, 7, 1400-1406.
14. Denyer, D., Tranfield, D. and Van Aken, J. E. (2008) Developing Design Propositions through Research Synthesis, *Organization Studies*, 29, 3, 393-413.
15. Dixon-Woods, M., Booth, A. and Sutton, A. J. (2007) Synthesizing Qualitative Research: A Review of Published Reports, *Qualitative Research*, 7, 3, 375-422.
16. Dixon-Woods, M., Cavers, D., Agarwal, S., Annandale, E., Arthur, A., Harvey, J., Hsu, R., Katbamna, S., Olsen, R., Smith, L., Riley, R. and Sutton, A. (2006) Conducting a critical interpretive synthesis of the literature on access to healthcare by vulnerable groups, *BMC Medical Research Methodology*, 6, 35.
17. Fortuna, R. J., Ross-Degnan, D., Finkelstein, J., Zhang, F., Campion, F. X. and Steven R. Simon (2008) Clinician Attitudes Towards Prescribing and Implications for Interventions in a Multi-Specialty Group Practice, *Journal of Evaluation in Clinical Practice*, 14, 6, 969-973.
18. Goldman, R. E., Dubé, C. and Lapane, K. L. (2010) Beyond the basics: Refills by electronic prescribing, *International Journal of Medical Informatics*, 79, 7, 507-514.
19. Hing, E. and Burt, C. W. (2008) Characteristics of Office-based Physicians and their Medical Practices: United States, 2005-2006, *Vital and Health Statistics*, 13, 166, 1-34.
20. Hsiao, C.-J., Cherry, D. K., Beatty, P. C. and Rechtsteiner, E. A. (2010) National Ambulatory Medical Care Survey: 2007 Summary, In: *National Health Statistics Report*, National Center for Health Statistics.
21. Hunt, J. S., Siemiencuk, J. and Koch, C. (2008) Physicians Perspectives on Physician Drug Dispensing Using a Qualitative Focus Group Methodology, *Journal of Pharmaceutical Finance, Economics & Policy*, 16, 4, 57-66.
22. Institute for Safe Medication Practices (2000) A Call to Action: Eliminate Handwritten Prescriptions Within 3 Years!, Institute for Safe Medication Practices.
23. Johnson, K. B. and FitzHenry, F. (2006) Activity Diagrams for Integrating Electronic Prescribing Tools into Clinical Workflow (Case Report), *Journal of American Medical Informatics Association*, 13, 4, 391-395.
24. Khan, S., Sylvester, R., Scott, D. and Pitts, B. (2008) Physicians' Opinions About Responsibility for Patient Out-of-Pocket Costs and Formulary Prescribing in Two Midwestern States, *Journal of Managed Care Pharmacy*, 14, 8, 780-789.
25. King, N. (2009) E-Prescribing as a Micro-Organizational Network: In Search of an Analysis Framework, *International Workshop on Organizational Design and Engineering*, December 11-12.
26. King, N. and Azad, B. (2010) A Synthetic Representation of Inter-Organizational Multi-Actor Collaborative Structures: A Pragmatic Look at U.S. E-Prescribing, In *2010 AIS SIGPrag Event at ICIS 2010 in St. Louis*, December 15.
27. King, N., Christie, T. and Alami, K. M. (2007) Process Implications of E-prescribing Information Integration Models: United States versus a Middle East Approach, *E-service Journal*, 5, 3, 15-38.
28. Leonardi, P. M. (2009) Why Do People Reject New Technologies and Stymie Organizational Changes of Which They Are in Favor? Exploring Misalignments Between Social Interactions and Materiality, *Human Communication Research*, 35, 3, 407-441.
29. Lowes, R. (2008) CMS-eRX: Collecting E-Prescribing Bonus Requires Extra Coding, In: *Medpage Today*, Boston.
30. Lusch, R., Vargo, S. and Tanniru, M. (2010) Service, value networks and learning, *Journal of the Academy of Marketing Science*, 38, 1, 19-31.
31. Maglio, P., Vargo, S., Caswell, N. and Spohrer, J. (2009) The service system is the basic abstraction of service science, *Information Systems and E-Business Management*, 7, 4, 395-406.

32. Miller, R. H., West, C., Brown, T. M., Sim, I. and Ganchoff, C. (2005) The Value Of Electronic Health Records In Solo Or Small Group Practices, *Health Affairs,* 24, 5, 1127-1137.
33. Moiduddin, A., Dullabh, P., Espinosa, O., Frisse, M., Johnson, K., Woolley, R. and Pearlstein, J. (2007) Findings from the Evaluation of E-Prescribing Pilot Sites, Agency for Healthcare Research and Quality (AHRQ).
34. Mott, D. A. and Cline, R. R. (2002) Exploring Generic Drug Use Behavior the Role Of Prescribers And Pharmacists in the Opportunity for Generic Drug Use and Generic Substitution, *Medical Care,* 40, 8, 662-674.
35. Nordgren, L. (2004) Value creation in health care services – developing service productivity: Experiences from Sweden, *International Journal of Public Sector Management,* 22, 2, 114-127.
36. Öhlund, S.-E. and Goldkuhl, G. (2008) Towards a socio-pragmatic understanding of ePrescribing In *5th Intl Conference on Action in Language, Organisations and Information Systems*.
37. Ostrom, A. L., Bitner, M. J., Brown, S. W., Burkhard, K. A., Goul, M., Smith-Daniels, V., Demirkan, H. and Rabinovich, E. (2010) Moving Forward and Making a Difference: Research Priorities for the Science of Service, *Journal of Service Research,* 13, 1, 4-36.
38. Paterson, B., Canam, C., Joachim, G. and Thorne, S. (2003) Embedded Assumptions in Qualitative Studies of Fatigue, *Western Journal of Nursing Research,* 25, 2, 119-133.
39. Paterson, B. L., Canam, C., Thorne, S. E. and Jillings, C. (2001) Meta-Study of Qualitative Health Research: A Practical Guide to Meta-Analysis and Meta-Synthesis, Sage, Thousand Oaks, California.
40. Paul, L., Christian, H. and David, G. (1992) Tasks-in-interaction: Paper and Screen based Documentation in Collaborative Activity, In *1992 ACM conference on Computer-supported cooperative work,* ACM.
41. Prahalad, C. K. and Ramaswamy, V. (2000) Co-opting Customer Competence, *Harvard Business Review,* 78, 1, 79-87.
42. Reeves, C. S. (2002) How Many Staff Members Do You Need?, *Family Practice Management,* 9, 8, 45-49.
43. Ross, S. M., Papshev, D., Murphy, E. L., Sternberg, D. J., Taylor, J. and Barg, R. (2005) Effects of Electronic Prescribing on Formulary Compliance and Generic Drug Utilization in the Ambulatory Care Setting: A Retrospective Analysis of Administrative Claims Data, *The Journal of Managed Care Pharmacy,* 11, 5, 410-415.
44. RxHub (2007) RxHub PBM - Payer Providers.
45. Sandelowski, M. and Barroso, J. (2007) Handbook for synthesizing qualitative research, Springer, New York.
46. Sandelowski, M., Voils, C. I., Barroso, J. and Lee, E.-J. (2008) Distorted into clarity: A methodological case study illustrating the paradox of systematic review, *Research in Nursing & Health,* 31, 5, 454-465.
47. Shrank, W. H., Choudhry, N. K., Fischer, M. A., Avorn, J., Powell, M., Schneeweiss, S., Liberman, J. N., Dollear, T., Brennan, T. A. and Brookhart, M. A. (2010) The Epidemiology of Prescriptions Abandoned at the Pharmacy, *Annals of Internal Medicine,* 153, 10, 633-640.
48. SK&A Healthcare Information Solutions (2007) Consumer Access to Pharmacies In the United States, 2007, Pharmaceutical Care Management Association (PCMA).
49. Speiser, S., Blau, B., Lamparter, S. and Tai, S. (2008) Formation of Service Value Networks for Decentralized Service Provisioning, In Bouguettaya, A., Krueger, I. and Margaria, T. (Eds.) *Service-Oriented Computing – ICSOC 2008*, Vol. 5364, Springer Berlin / Heidelberg, 517-523.
50. Spohrer, J. C. and Maglio, P. P. (2010) Toward a Science of Service Systems, In Maglio, P. P., Kieliszewski, C. A. and Spohrer, J. C. (Eds.) *Handbook of Service Science*, Springer US, 157-194.
51. Suh, D.-C. (1999) Trends of Generic Substitution in Community Pharmacies, *Pharmacy World & Science*, 21, 6, 260-265.
52. Surescripts (2010) 2009 Progress Report on E-Prescribing.
53. Tarn, D. M., Heritage, J., Paterniti, D. A., Hays, R. D., Kravitz, R. L. and Wenger, N. S. (2006) Physician Communication When Prescribing New Medications, *Archives of Internal Medicine,* 166, 17, 1855-1862.
54. Vargo, S. and Lusch, R. (2008a) Service-dominant logic: continuing the evolution, *Journal of the Academy of Marketing Science,* 36, 1, 1-10.
55. Vargo, S. L. and Lusch, R. F. (2004) Evolving to a New Dominant Logic for Marketing, *Journal of Marketing,* 68, 1, 1-17.
56. Vargo, S. L., Maglio, P. P. and Akaka, M. A. (2008b) On value and value co-creation: A service systems and service logic perspective, *European Management Journal,* 26, 3, 145-152.
57. Weed, M. (2008) A Potential Method for the Interpretive Synthesis of Qualitative Research: Issues in the Development of Meta-Interpretation, *International Journal of Social Research Methodology,* 11, 1, 13 - 28.
58. Wilson, I., Schoen, C., Neuman, P., Strollo, M., Rogers, W., Chang, H. and Safran, D. (2007) Physician–Patient Communication About Prescription Medication Nonadherence: A 50-state Study of America's Seniors, *Journal of General Internal Medicine,* 22, 1, 6-12.