

When are calories like furniture? Modeling service systems to improve health

Melissa Cefkin

Cheryl A. Kieliszewski

Paul P. Maglio

IBM Research—Almaden

650 Harry Rd

San Jose, California USA

{mcefkin,cher,pmaglio}@us.ibm.com

Abstract—The furniture retailer IKEA provides an example of how understanding the roles and responsibilities of stakeholders in a value constellation can lead to change that improves value creation in a complex service system. In this paper, we apply the same kind of thinking about value creation that worked for IKEA to the complex service systems of population health, including chronic diseases such as obesity. We show how service system thinking—analyzing value constellations to find opportunities for reconfiguring roles and relationships that unlock value—can be applied to real health systems by focusing on accountable care organizations and patient-centered medical homes, models of care delivery that aim to reconfigure provider, patient, and payer relationships to offer better care. We argue that modeling and simulating the value constellations of complex service systems, such as the health system, can help us discover which interventions and reconfigurations will be effective and which will not.

Keywords—Service system, value constellation, health, health care delivery, modeling

I. INTRODUCTION

When are calories like furniture? When they are part of a value constellation. As with the service system revolution in the affordable home furniture value constellation, we are approaching health systems as a service value constellation to effect transformation.

IKEA is a seminal example of how understanding the roles and capabilities of stakeholders in a value constellation can lead to improvement in value creation in a complex service system [17]. IKEA changed how customers relate to home furnishings by harnessing customer capabilities to transport and assemble furniture. To make its changes effective, IKEA worked with suppliers so that the furniture was designed, built, and packaged for easy transport in customers' vehicles along with enclosed tools and graphic instructions for easy assembly, among other changes. IKEA did not simply transform its furniture: it transformed the roles and relationships of its stakeholders in a complex system of service interactions.

Like the ecosystem that IKEA formed, health is composed of interacting and differentially influencing

systems of systems [3]. We see the elements that together create population health as comprising value constellations. The question is what do we need to know—and what do we need to do—to drive effective transformation of the value constellations that make up population health? In other words, how is the health system like IKEA's furniture, amenable to interventions that shift roles and responsibilities to create value for everyone?

Health interventions range from nations trying to manage and optimize overall wellness to individuals trying to control their weight. Obesity, being one aspect of wellness, provides a microcosm of health system challenges. Understanding obesity as an ecosystem beyond the biological—to inform the creation of effective policies to fight obesity—requires models of many real world systems, including food systems (agriculture, processing, transportation, distribution, climate), and social, economic, and physical systems in which people and food operate [9]. Considering each constituent service system separately is a losing proposition. But understanding complex health issues can be enhanced by combining multiple simulation models, statistical models, and data sources to project the effects of policy choices into the future.

We think what IKEA did in transforming the value constellation around furniture can be done for calories and obesity, for the broader health system, and for service systems more generally. In this paper, we show how service system thinking—analyzing value constellations to find opportunities for reconfiguring roles and relationships that unlock value—can be applied to real health systems. Specifically, we focus on a current debate in healthcare delivery around accountable care organizations (ACOs; [19], [22]) and patient-centered medical homes (PCMH; [2][5]), related models of care delivery that aim to reconfigure provider, patient, and payer relationships to offer better and more affordable care in the US [19]. By taking a service system perspective, we describe such reconfiguration not only in terms of delivery, but in terms of larger value-creating systems, identifying opportunities and tradeoffs for health system innovation.

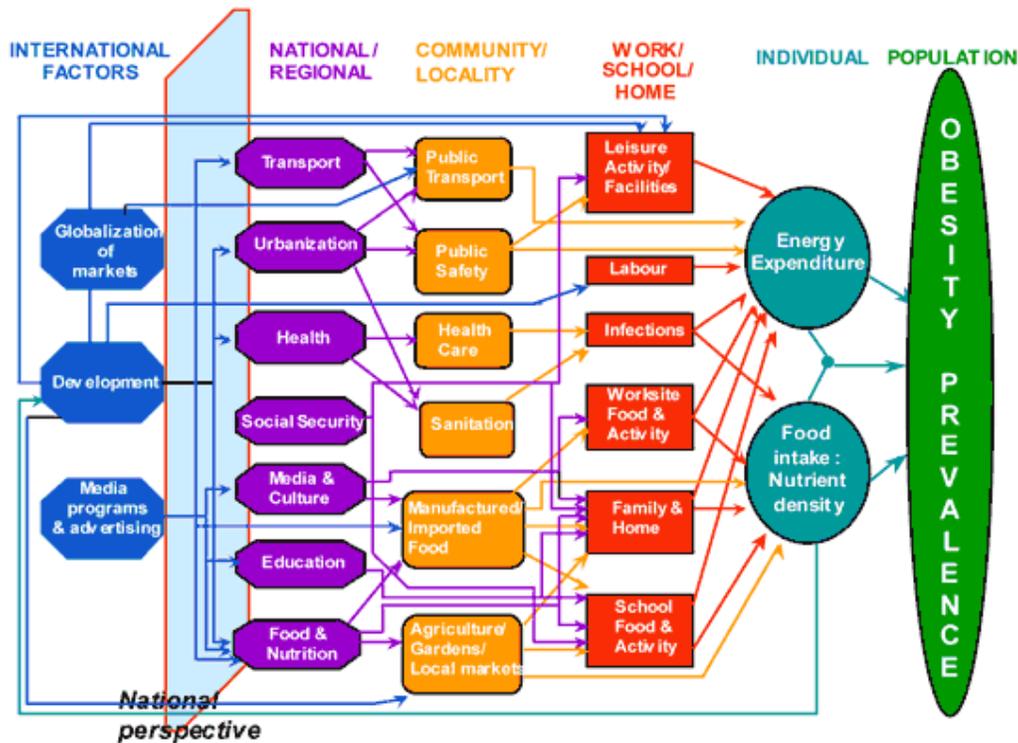


Figure 1. Example of a complex system of systems related to obesity (from [9]). Body mass index is a function of the calories taken in as food and the calories expended as activity, but food choices and activities are themselves dependent on a vast network of real-world relationships. All of health depends on interactions among many different aspects of the world.

In what follows, first we give some background on service systems and on health systems modeling. Second, we describe ACOs and PCMHs in general terms, along with some current context on the healthcare debate in the US. Third, we apply service systems thinking to understand what exactly ACOs and PCMHs aim to do to the broader health system. Finally, we discuss implications and directions for future work. In the end, it is clear to us that modeling value constellations of complex service systems, such as the health system, can help us discover which sorts of interventions and reconfigurations are likely to be effective.

II. SERVICE SYSTEMS

Value emerges when multiple entities work together to create mutual benefit, the key being design and orchestration of these entities (e.g., [17]). For us, all value is cocreated between economic entities [28], collections of resources including people, technologies, organizations, and information [25]. Entities interact by granting access to one another's resources [24]. Interacting entities form *service systems* [14]. Together with the service-dominant worldview, the service system is the basic abstraction of the *study of value cocreation*, which is also known as *service science* [10], [13], [23], [29]. Simply put, the service system is the unit of analysis for value cocreation. It incorporates multiple interacting entities, for instance, a single firm and a single customer working together to create mutual value. Both firm and customer bring together resources—including

capabilities and competences—and take joint actions that, when working effectively towards value cocreation, leave one another better off [30].

Understanding value cocreation means understanding the interactions within the service systems that underlie it. For example, value cocreation among stakeholders in the health system may require looking at how healthcare delivery interacts with transportation and education and many other service systems. A specific healthcare provider may itself be a complex collection of interacting entities, perhaps including primary care practices, pharmacies, hospitals, suppliers, and more. Each specific entity, such as a primary care practice, may be made up of specific resources, such as doctors, nurses, schedulers, accountants, computers, EEG machines, patient records, and more. When arranged together in a specific way, this service system entity is ready to deploy its capabilities to cocreate value with other entities by interacting with patients, laboratories, other providers, and payers. The primary care practice gives patients, labs, and providers access to its competences and capabilities—diagnosis, treatment, etc.—and together they can create economic value and health value. Practices, patients, providers, payers all operate in a complex service system of healthcare delivery, giving one another access to resources (people, technologies, organizations, information) with an aim to enhance health, and perhaps economic, value.

Healthcare delivery, a complex service system itself, represents only one part of the health system. The broader

health system is even more complex. How do diseases work? How do patients and their families choose the foods they eat, how do they get from place to place, what activities do they engage in? How do communities and municipalities decide what sort of programs to invest in? How do farms decide what to grow and restaurants what to serve? How do all of these together create population health? Understanding the health system as a complex service system means understanding all these things and more.

A. Health Systems Modeling

We can approach the redesign of health systems as entities to be unpacked and decomposed, looking at how individual entities interact with one another and how their resources are arranged. But this will not necessarily lead to understanding the potential for value cocreation. This may be especially true for a complex adaptive system, such as a health system, which can be characterized as having no centralized oversight [20] and a seemingly uncountable number of stakeholders, including individual patients and government agencies, among others (e.g., [2], [20], [22]).

The key to new value creation is construction of new, coordinated activities and incentives to create new patterns of business and new patterns of value cocreation [17]. In health, for example, this might mean a focus on wellness rather than on disease detection and treatment, which in turn would mean a different way of looking at the value constellations, partnerships, and incentives needed to keep people healthy. With the focus shifted from disease to wellness, what social and economic entities do we analyze? What are the strategic roles and relationships between entities? What information, knowledge, and interactions need to be supported to establish and sustain cost reduction? Which are needed to improve health locally and globally?

We have started to examine the health system as a complex service system by identifying entity partnerships and patterns, particularly as they influence obesity (Figure 1). Obesity is not seen as simply an imbalance between caloric intake and physical activity, but rather as an imbalance in the supporting ecosystem of an individual, family, and community, including cultural, social, economic, educational and political partnerships [12]. To understand such complex systems and the relationships among entities in the system, we are relying on service system design, modeling, and simulation to comparatively examine the effects of system changes and identify potential value constellation configurations.

III. RECONFIGURING HEALTHCARE DELIVERY

Healthcare systems are excellent examples of service systems, particularly complex service systems. And indeed when the aperture is pulled back to consider overall health—as is essential, for instance, in the case of obesity and other chronic diseases—everything from fast food to physical activity to illegal drug distribution can be seen as part of the equation of health.

So far at the national level in the United States, insurance reform has dominated efforts to reconfigure and improve overall health systems. But what about healthcare delivery

systems? Many argue that achieving meaningful improvements in healthcare will require enhancing the quality of care, and with it, achieving greater effectiveness in the delivery of health services to slow the growth of costs. Such improvements raise essential questions of value: What is deemed of value in healthcare delivery and services by patients and other actors in the system? How do changes in the means of delivering healthcare services—the resources used and the processes followed—result in improvements recognizable to both providers and patients? What are the proper time scales in which to assess value cocreation for participants in health delivery services systems?

Accountable care organizations (ACOs) and patient centered medical homes (PCMHs) are two models being proposed and tested for reform of the healthcare delivery system. An ACO is an organizational and governing model designed to better align accountability across the continuum of healthcare providers. A PCMH is a complementary model designed around an emphasis on primary care. It aims to enhance quality and outcomes through, for instance, a focus on access to care, best practices in chronic disease management, preventative care, and responsiveness to patients. (With the “patient-centered medical home”, “home” refers not to a patient’s domicile or to a resident care facility, but rather to the network of providers *responsible* for overseeing the patient’s care.) Both ACOs and PCMHs are intended to reduce the fragmentation of the healthcare system, thus increasing quality and effectiveness and reducing the growth of spending.

ACOs “are provider groups that accept responsibility for the cost and quality of care delivered to a specific population of patients” [22]. Numerous examples of ACOs have been described, from fully integrated delivery systems of common ownership and payer models (such as Kaiser Permanente and Group Health Cooperative) to looser configurations made up of independent practice groups that form a network to contract health plans jointly [22]. Common features of an ACO include: (a) the willingness and ability to measure costs, productivity, and care outcomes at both individual unit levels and across the system; (b) IT (information technology) systems that are capable of supporting both measurement and work process management; (c) a large enough patient population to yield measurable differences; and (d) leadership and governance structures to enable operation as a “clinically and fiscally accountable” operational structure [21]. A key value proposition to providers is that by operating as a coordinated system, any realized cost savings will in turn be shared by provider participants.

Primary care is viewed to be a key element in the potential success of ACOs [22]. Primary care is also at the heart of the PCMH. One of the key features of the medical home is that a clinician, such as a primary care team, takes responsibility for the continuing care of a patient population, including referrals to specialists, notifications for follow-up treatment, and so on (see Figure 2). Another key feature is that medical homes also have particular measurement, assessment, and tracking requirements and are expected to use electronic-health records. In addition, the PCMH is designed specifically around patients, incorporating a set of

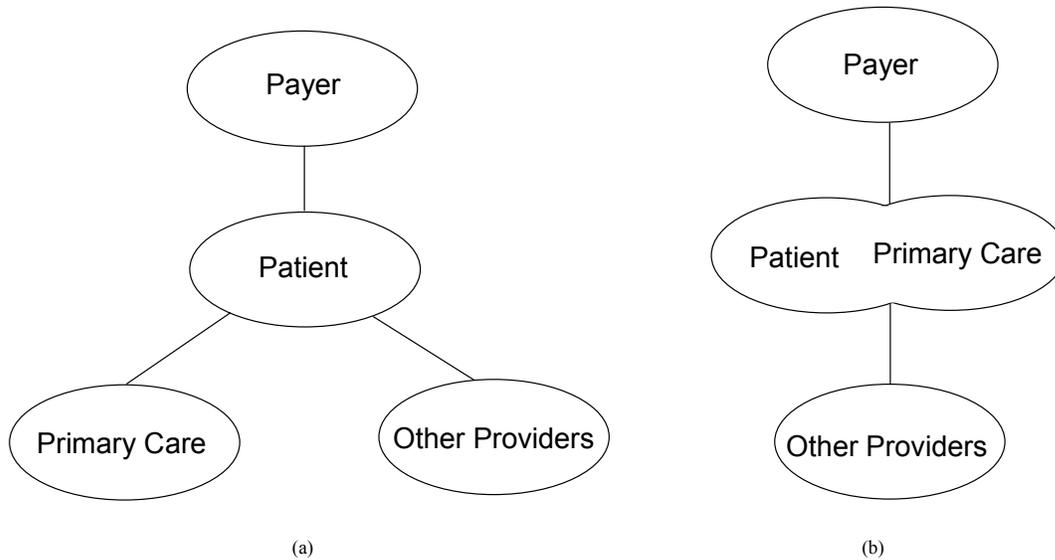


Figure 2. PCMH aims to transform the traditional model of care in which the patient is responsible for coordinating his or her own care, as shown in (a), to a model in which responsibility shifts to the primary care provider along with the patient, as shown in (b). In the traditional system, the patient is (ironically) at the center, but only in the sense that they are responsible for managing all the parts of the system. In the PCMH, patients join with the “medical home”, working in partnership with their primary care providers to manage and align the entire system toward their benefit.

principles that range from enhanced access to care (including, for example, direct email contact with providers or open-access scheduling systems) to greater coordination among care providers to a whole-person mindset and approach [11]. More than 100 demonstration projects across the nation have been conducted to test concepts and implementations of the medical home [2].

A value proposition of the medical home to providers is the potential to gain a share of cost savings that are realized throughout the system. One incentive model being tried out is additional per-patient reimbursements to the PCMH to cover the time and administrative costs of email and phone consultations and the coordination costs of collaboration. In addition, the medical home model promises primary care providers the potential to enhance their ability to help patients’ manage their health over a continuum of services over time, leading to better outcomes and increased satisfaction of both providers and patients. Indeed, some demonstration projects have evidenced measurable improvements. Group Health, a Seattle-based health cooperative, reported improved patient experiences, reduced clinician burnout, fewer emergency room visits and hospitalization in its patient population, and an estimated \$10.30 per patient cost savings after 20 months of a PCMH program [18].

Both ACOs and PCMHs also face challenges. The PCMH model, for instance, must find a way to incent other providers that are not in the medical home to coordinate and collaborate actively with the medical home. This raises questions of the boundaries of the medical home, leading some experts to propose the need for a model of the “medical

neighborhood” [5]. Payment and reward systems must be aligned so that primary care providers can benefit in the savings realized by other organizations, notably hospitals, resulting from medical home improvements. Both models also depend on the creation of and agreement to a set of relevant, common measures of performance [5], [19].

ACOs and PCMHs provide rich models for examining healthcare delivery systems from a standpoint of how value and the configuration and reconfiguration of value constellations may occur. Many of the factors that play into such reconfigurations as examined by Normann and Ramirez [17]—shifts in the use of resources (e.g., increased dependencies on electronic health records), changes in governance (e.g., agreement on decision-making authority), and altered relationships and forms of interaction between both providers and patients (e.g. a greater active role for patients in overall health treatment) and among providers (e.g., collaboration across specialties and enhanced roles for nurse practitioners)—are evidenced

Next, we turn to a deeper exploration of some of these reconfigurations, and begin to probe the ways in which these reconfigurations may give rise to meaningful value constellations.

IV. VALUE CONSTELLATIONS AND THE MEDICAL HOME

To identify places in health service systems for value cocreation potential—the reconfiguration of value constellations—we focus on the case of the PCMH. Specifically, we identify and explore certain dimensions of healthcare delivery that we would expect to be reconfigured if they emerge as envisioned in the PCMH model. We

describe three such areas, identifying what is expected to change as well as the value anticipated or desired from these reconfigurations. We also point to spots in these reconfigurations that open up new potential for value creation, spots made visible by our analysis of change seen through the lens of value constellations.

A. Primary Care

Primary care is at the heart of both the ACO and PCMH. For these to succeed, primary care itself can be expected to undergo reconfiguration. For instance, one of the changes envisioned includes a greater focus on primary care *teams* and with them, an expanded role for practitioners beyond the primary care physician. Group Health Cooperative of Seattle, for instance, designed their test implementation of the medical home with an expanded staffing model to include “greater care management by RNs and clinical pharmacists, as well as pre-visit, outreach, and follow up activities by medical assistants and LPNs” [18]. One of the reasons for this shift was to embrace the patient-centered principle of greater attention to the continuity of care with patients. In the ideal model, patients can expect greater access and more immediate attention, as well as more regular follow-ups and reminders. The larger teams will help enable these shifts.

How will this change itself be enabled? One means is through the potential for efficiency gains, and increased use and deployment of resources such as email and phone to enable “virtual visits” [15]. The promise is that greater investment in resources at the primary-care level will lead to lowered costs throughout the system because of overall improvements in health. Indeed evidence from Group Health showed that in two years, hospital visits for the covered population decreased slightly (6%), while emergency room visits decreased significantly (29%) [18].

At the same time, however, there is currently a shortage of primary care providers in the United States [19], [22]. The causes are complex, but reasons include relatively lower pay and status for primary care providers compared to other specialty practices and provider burnout. One cause of burnout stems from pressures to move patients through their visits quickly to increase the numbers of services provided in a day and thereby increase billable time, resulting in the “treadmill” effect.

The reconfigurations envisioned in the PCMH promises to help the shortage of primary care physicians and the burnout problem as well. For instance, redesigning rewards and incentives so that all providers throughout the continuum of care in the medical home benefit from improvements anywhere in the system may help equalize some of the pay differential. An improved work environment—less treadmill and more satisfaction of providing a fuller continuum of care to patients—is expected to increase provider satisfaction, creating greater enticement to medical students to consider primary care. Indeed, the Group Health case suggested a reduction in physician burnout with the trial of the PCMH model [15]. Even the promise of enhanced status, as primary care regains a reputation for being the heart and soul of

health, medicine, and wellness, may lead to an upsurge of students following a primary care direction.

Considering such reconfigurations through the lens of service systems and processes of value cocreation reveals places in the value constellation that hold the potential for additional value cocreation that did not exist previously. For instance, opportunities for new service providers in the domains of medical and office services supporting coordination and decision-making among and between the medical home team and the broader system of specialists and providers may emerge. The team-based model of the medical home will require greater emphasis on collaboration; education may well be reconfigured to include collaboration experts and facilitators together with curricula that focus on collaborative team projects. The potential value emerging from such changes goes beyond economic benefits to those who step into these new roles, but also have the potential to produce meaningful improvements to overall health. (See Table 1 for summary).

B. Patient-Doctor Interactions

Let us now consider changes to value constellations through another area of anticipated reconfiguration, doctor-patient interactions. The PCMH is intended to be built on an infrastructure of processes and information that is heavily supported by IT. A baseline requirement for becoming a PCMH is to have deployed electronic health records (EHR). Together with other applications and systems, from simple office-visit scheduling systems to complex reporting and analytic tools, EHR will be used to track a range of new measures and standards. They will also more generally help support other possible changes to communications between the primary care provider and patients.

For instance, in line with the patient-centeredness of the model, there is a move towards providing patients greater and more rapid access to providers. Using IT systems to identify and remind patients of follow-up requirements can enable more outreach from providers to patients. A distinct approach to increasing access is through expanded use of telephone consultations and email exchanges between providers and patients, or “virtual visits”.

Such mediated interactions, however, change the experience between patient and doctor. While this development poses understandable fear and risks to providers and patients, it is also possible to envision that it may give rise to new value. For instance, by attending to a percentage of patients daily by email and phone, more time can be allotted to those who necessarily require an office visit, a positive development in light of research that shows that the shortness of visits contributes to poor patient understanding and therefore follow-through on matters affecting their health [2]. In fact, Group Health was able to increase office visits from 20 to 30 minutes per patient [18]. Moreover, increased use of such forms of communication may help realize the continuity of care and improve both provider and patient satisfaction. A physician from Group Health, for example, pointed to her experience in offering tips about infant care to a patient by email. She then heard back from the patient that the tips worked [15], closing the

Primary Care

Reconfiguration	Promise	New Value Potential / New Services
Teams Virtual visits	Overcome Primary Care shortages Improve access Efficiencies	Medical and office services to enable coordination or provide outsourced services Educational reconfiguration—faculty and curricula supporting collaboration

Doctor-Patient Interactions

Reconfiguration	Promise	New Value Potential / New Services
Integrated IT systems Mediated communications— phone and email consultations	Easier and more timely follow-up More readily available and rapid access by patients to providers	Sensor and mobile technology products Monitoring and integration service providers

Information and Standards

Reconfiguration	Risk	Missed Value / New Services
New (prematurely identified) measures	Ineffective practices performed to meet new measures	Entrenchments of inappropriate new products and services

Table 1: Summary of our value constellation analyses for the three scenarios described in the text.

loop on the health incident and deepening awareness of treatment effectiveness.

Here again, viewing such reconfigurations from the standpoint of value constellations can help us envision the potential for as yet unrealized value, and for new participants and resources to enter the constellation. Both sensors and mobile technologies, for instance, are being explored for their potential to monitor (e.g., send alerts if motion detectors identify a patient’s likely fall) and help guide (e.g., prompt for medication reminders) the unwell and the elderly. Will such services fall under the responsibility of the medical home? What support will they need to monitor and integrate such information within their continuity of care? It is possible to envision not only the emergence of as yet unforeseen products, but also service providers who can help monitor and integrate such kinds of information with the medical home.

The potential for improved health from such new developments seems clear—the possibility for more

immediate attention to problems and a greater knowledge of the overall trajectory of patients’ progress. More subtle, perhaps, is the potential for this kind of closed-loop communication and information exchange to enhance both provider learning and experience, and also the patient’s ability to manage his or her own health. The value, then, is not just economic value to new providers of products and services added to the constellation, but also more broadly, health and health-related knowledge and experience. (See Table 1).

C. Information and Standards

So far, our examples suggest the potential for reconfigurations to entity compositions in which new value is being cocreated among multiple stakeholders. The potential for the opposite is of course also present: reconfigurations of actors and resources create constellations that have the potential to diminish value to the stakeholders in the system. Indeed, realistically one can expect that

changes as significant as the ACO and PCMH are likely to create both kinds of reconfigurations at the same time. The goal will be to minimize the value-diminishing cases.

To explore this scenario, let us focus on the reconfiguration of information. As noted, one of the directives of both the ACO and PCMH is that providers must operate according to a number of “must pass” standards (still under development) related to characteristics such as access, communications, and patient tracking [2]. Though we suppose the aim will be to design these standards around elements shown to improve health outcomes, it is possible that they may also put in motion behaviors and practices that do not lead to positive outcomes in all cases. In a way, this may create a situation akin to “teaching to the test”—performing actions that will ensure the providers meet requirements of the system, whether or not the results enhance care quality overall or in particular cases. Indeed, a recent study of over 200 physicians found that measurements relating to the practice structure of the medical home were insufficient to assess care quality [8].

Again consider this scenario from the standpoint of value constellations. It is conceivable that new products and services—new software packages, for instance, or auditing or accounting services—will be created to support these practice measures. These have the potential to temporarily provide economic value for providers, but may lead to sustained practices that are ultimately unproductive to health. Our point is not to suggest that changes to the information resources in the value constellation are inherently dangerous or undesirable, but rather to show that not all reconfigurations of resource and actor constellations lead to value cocreation. Specifically, the aim will be to ensure that the measures are the right ones before the new configurations settle in fully. (See Table 1).

V. DISCUSSION

Our argument is simple: Because health systems are complex service systems, value constellations involving multiple stakeholders and multiple opportunities for value cocreation, we can apply concepts and methods of service science to understand how the systems work and to develop innovations that improve or enhance system operation. Through several examples of specific transformations to healthcare delivery currently being tried in the US, we applied service systems thinking to understand what exactly ACOs and PCMHs aim to do to the broader health system, and to find additional potential transformations and places for value creation (summarized in Table 1). The sorts of qualitative analyses illustrated in this paper are only the beginning.

In the context of healthcare reform, most current attention is focused on providing increased access to healthcare through insurance coverage expansion and reform [27]. But because health is a consequence of complex dynamic relationships among many systems in addition to healthcare [9], policy decisions by government agencies, healthcare providers, insurers, and other stakeholders may lead to unforeseen interactions and consequences [26].

In health, models and simulations have been used to understand specific issues such as disease progression [4]. In contrast to the tradition of developing isolated models of individual physiological or financial models of treatment options, systems, modeling and simulation techniques have increasingly been used to address broad health issues, including HIV prevention [1], obesity [7], and healthcare management [16].

Our broader effort aims at quantitative modeling and simulation of the real-world complexities of population health by integrating models and data of component systems together into bigger and more encompassing models through our Smarter Planet Platform for Analysis and Simulation of Health (Splash) [12]. Splash aims to build a framework that supports integration of multiple models, simulations, and data in health ecosystems. It comprises mechanisms for cataloging, describing, connecting, and executing a set of models together. The goal is to create a platform that takes models of real-world systems related to health, synthesizing and integrating them into an interoperating complex composite system model with which policy-makers can try out alternatives. For a chronic disease such as obesity, for example, location of stores, available transportation, demographics, healthcare, advertising and marketing, and regulations are among the many components of the complex real-world system that affects health. Policy-makers need to predict the health effects of changes in these components. Up to now, service system analyses tend to consider individual provider-customer dyads in isolation (e.g., [14]), as entire value constellations are simply too complex for the emerging methods to handle (cf. [6]). We expect Splash to help overcome these challenges.

When are calories like furniture? When they are part of a value constellation. Here we considered health systems as value constellations to understand opportunities and risks of health system transformation. This is only a start. There is much left to do.

ACKNOWLEDGMENTS

We thank the rest of the Splash team, including Brian Arthur, Susanne Glissmann, Peter Haas, Leila Jalali, Pat Selinger, and Wang-Chiew Tan for discussions on this general topic and for comments on this specific paper.

REFERENCES

- [1] Brandeau M. L., Zelic G. S. (2009). Optimal investment in HIV prevention programs: More is not always better. *Health Care Mgmt Sci*, 12, 27–37.
- [2] Cassidy, A. (2010). Patient-Centered Medical Homes. *Health Affairs*, Sept. 14.
- [3] Collins, J. L., Marks, J. S. & Koplan, J. P. (2009). Chronic disease prevention and control: coming of age at the Centers for Disease Control and Prevention. *Prevention of Chronic Disease*, 6(3).
- [4] Epstein, J. M. (2009). Modelling to contain pandemics. *Nature*, 460, 687.
- [5] Fisher, E. S. (2008) Building a Medical Neighborhood for the Medical Home. *The New England Journal of Medicine*, 359(12): 1202 – 1205.

- [6] Glushko, R. J. (2010). Seven contexts for service system design. In P. P. Maglio, C. A. Kieliszewski, & J. C. Spohrer (Eds.) *Handbook of Service Science*. New York: Springer, 219–249.
- [7] Hammond, R. A. (2008). *A Complex Systems Approach to Understanding and Combating the Obesity Epidemic*. Washington, DC: Brookings Institution.
- [8] Holmboe, E. S., Arnold, G. K., Weng, W. & Lipner, R. (2010). Current Yardsticks May Be Inadequate For Measuring Quality Improvements From the Medical Home. *Health Affairs*; 29(5); 859–856
- [9] Huang, T. T., Drewnowski, A., Kumanyika, S.K., & Glass, T. A. (2009). A systems-oriented multilevel framework for addressing obesity in the 21st century. *Prevention of Chronic Disease*, 6(3).
- [10] IfM & IBM (2008). *Succeeding through service innovation: A service perspective for education, research, business and government*. Cambridge, UK: University of Cambridge Institute for Manufacturing. ISBN: 978-1-902546-65-0
- [11] Kirschner, N. & Barr, M.S. (2009). Specialists/Subspecialists and the Patient-Centered Medical Home. *Chest* 137, 200–2004.
- [12] Maglio, P. P., Cefkin, M., Haas, P., & Selinger, P. (2010). Social factors in creating an integrated capability for health system modeling and simulation. In *Proceedings SBP 2010*. New York: Springer, pp. 44–51.
- [13] Maglio, P. P. & Spohrer, J. (2008). Fundamentals of service science. *Journal of the Academy of Marketing Science*, 36, 18–20.
- [14] Maglio, P. P., Vargo, S. L., Caswell, N. & Spohrer, J. (2009). The service system is the basic abstraction of service science. *ISEBM* 7, 395–406.
- [15] Meyers, H. (2010). Group Health's Move to the Medical Home: For Doctors, its often a Hard Journey. *Health Affairs* 29(5): 1–8.
- [16] Milstein B. & Homer, J. (2010). Analyzing National Health Reform Strategies With a Dynamic Simulation Model. *American Journal of Public Health*, 100, 811–819.
- [17] Normann, R. & Ramirez, R. (1993). From value chain to value constellation: Designing interactive strategy. *HBR*, 71, 65 – 77.
- [18] Reid, R. J., Coleman, K., Johnson, E.A., Fishman, P. A., Hsu, C., Soman, M. P., Trescott, C.E., Erikson, M., & Larson, E. B. (2010). The Group Health Medical Home at Year Two: Cost Savings, Higher Patient Satisfaction, and Less Burnout for Providers. *Health Affairs*, 29(5), 1–9.
- [19] Rittenhouse, D. R., Shortell, S. M., & Fisher, E. S. (2009). Primary Care and Accountable Care—Two Essential Elements of Delivery-System Reform, *The New England Journal of Medicine*, 361(24): 2301–2303.
- [20] Rouse, W.B. (2008). Health care as a complex adaptive system: Implications for design and management. *The Bridge: Linking Engineering and Society*, 38 (1): 17–25.
- [21] Shortell, S. M. (2009). Organizing Health Care for Higher Quality and Lower Cost. Presented at *The Capstone Conference*. Available at <http://www.slideshare.net/capstoneconference09/stephen-shortell-organizing-health-care-for-higher-quality-and-lower-cost-1456226>.
- [22] Shortell, S. M., Casalino, L.P. & Fisher, E.S. (2010) How the Center for Medicare and Medicaid Innovation Should Test Accountable Care Organizations. *Health Affairs* 29(7): 1293–1298.
- [23] Spohrer, J. & Maglio, P. P. (2010a). Service science: Toward a smarter planet. In W. Karwowski & G. Salvendy (Eds.), *Introduction to service engineering*. New York: Wiley & Sons, pp. 3–30.
- [24] Spohrer, J. & Maglio, P. P. (2010b). Toward a science of service systems: Value and symbols. In P. P. Maglio, C. A. Kieliszewski & J. C. Spohrer (Eds.), *Handbook of Service Science*. New York: Springer.
- [25] Spohrer, J., Maglio, P. P., Bailey, J. & Gruhl, D. (2007). Steps toward a science of service systems. *Computer*, 40, 71–77.
- [26] Stermann, J. D. (2006). Learning from Evidence in a Complex World, *American Journal of Public Health*, 96(3), 505–514.
- [27] US Government. Patient Protection and Affordable Care Act. Public Law 111–148. Available at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_public_laws&docid=f:publ148.111
- [28] Vargo, S. L. & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, 68, 1–17.
- [29] Vargo, S. L., Lusch, R. F. & Akaka, M. A. (2010). Advancing service science with service-dominant logic: Clarifications and conceptual development. In P. P. Maglio, C. A. Kieliszewski & J. C. Spohrer (Eds.), *Handbook of Service Science*. New York: Springer.
- [30] Vargo, S. L., Maglio, P. P., & Akaka, M. A. (2008). On value and value co-creation: A service systems and service logic perspective. *European Management Journal*, 26(3), 145–152.