Patient-centered care requires a patient-oriented workflow model

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ABSTRACT

Effective design of health information technology (HIT) for patient-centered care requires consideration of workflow from the patient's perspective, termed 'patient-oriented workflow.' This approach organizes the building blocks of work around the patients who are moving through the care system. Patient-oriented workflow complements the more familiar clinician-oriented workflow approaches, and offers several advantages, including the ability to capture simultaneous, cooperative work, which is essential in care delivery. Patient-oriented workflow models can also provide an understanding of healthcare work taking place in various formal and informal health settings in an integrated manner. We present two cases demonstrating the potential value of patient-oriented workflow models. Significant theoretical, methodological, and practical challenges must be met to ensure adoption of patient-oriented workflow models. Patient-oriented workflow models define meaningful system boundaries and can lead to HIT implementations that are more consistent with cooperative work and its emergent features.

INTRODUCTION

Patient-centered care is a philosophy of care delivery in which services are arranged around the needs of the patient. It requires reorienting the way health information systems are planned and implemented from a provider-centric approach to a patient-centered one. Workflow analyses can inform health information technology (HIT) implementations by revealing roles, activities, and other vital data such as information handoffs and requirements for situation awareness. Such data can be captured through workflow methodologies including field observations,[1] interviews,[2] and computer log analyses.[3 4] Data generated from such studies can collectively expose how care is delivered and reveal various factors that affect care delivery. However, workflow studies in healthcare have typically centered around clinicians such as physicians or nurses. These clinician-centered models often describe a series of discrete activities by a specific type of clinician and the amount of time spent for each type of activity. Less common, but equally important, are studies centered around patients, known as 'patient-oriented workflow' studies.[5] The outputs of patient-oriented workflow models are sequences of activities by all involved staff members who care for the patients.

LIMITATIONS OF CLINICIAN-ORIENTED WORKFLOW MODELS

The exclusive use of clinician-oriented workflow models has conceptual limitations when healthcare work is examined because clinician-oriented approaches typically characterize a single clinician's job.[6 7] Workflow is thus an individual construct. This approach focuses on a specific individual's jobs or tasks (eg, a physician's job[8 9] or a nurse's job and tasks[8 10–12]) instead of cooperative work, which is essential in healthcare delivery. Any single job role in a clinical setting likely will not sufficiently represent the patient care provided there. In complex sociotechnical systems like clinical settings, behavior is not centered in individual actors or even in groups of actors, but is distributed among roles in the work setting.

Clinician-oriented approaches can capture the impact of HIT on individual roles and their work. There are differences in the HIT needs of different roles and HIT designers and implementers should not fall into the 'one size fits all' fallacy.[2 13] However, clinician-oriented approaches can lead to local optimization (eg, improving only a physician's work while increasing a nurse's workload) compared to global system optimization, which requires understanding the overall impact of HIT on organizational processes. Focusing only on clinicians' jobs may not be the appropriate unit of analysis to study healthcare work. We propose a patient-oriented workflow in which the unit of analysis is individual patients and their episodes.

PATIENT-ORIENTED WORKFLOW MODELS

Patient-oriented workflow models defines healthcare delivery from the patient's perspective and organizes the building blocks of work around the patient and her care.[5] Patient-oriented workflow models provide the 'true flow of the work perspective.'[1] Historically, Strauss *et al*[14] introduced the idea of 'illness trajectory' which suggests that the patient is central to examining care delivery. Work studies that use the patient as the reference point may provide a comprehensive understanding of care delivery. While illness trajectories focus on the course of illness and activities to shape that course, patient-oriented workflow models focus less on the illness and more on the details of the sequences, activities, and involved roles.

A patient-oriented workflow includes activities by multiple staff members who are involved with the patient's care. Therefore, it is consistent with cooperative work in clinical settings. According to Schmidt and Simone,[15] '[c]ooperative work is constituted by the interdependence of multiple actors

who, in their individual activities, in changing the state of their individual field of work, also change the state of the field of work of others and who thus interact through changing the state of a common field of work.' A patient constitutes the common field of work for clinical and non-clinical healthcare delivery workers. The patient-oriented workflow also captures the temporal order of various roles' contributions to care delivery.[16] Therefore, organization and coordination of healthcare delivery can be examined.

Patient-oriented workflow models support understanding of the emergent factors of healthcare delivery work by defining more meaningful (eg, sensible and holistic) system boundaries. System boundaries are zones between the examined system and another. System boundaries separate relevant work system elements (eg, individuals, tasks, technology, etc) from those that are irrelevant. Precisely identifying system boundaries ensures consideration of all relevant system elements and is critical to examining how the system functions as a whole. Defining meaningful boundaries allows for capturing emergent features of healthcare delivery work such as cooperative work and the organization of unfolding activities by various individuals (eg, articulation work[14]). These emergent features make the care delivery work viable and account for a significant portion of variability in care delivery. Patient-oriented workflow has the potential to characterize the emergent features of care delivery and the resulting variability.

Workflow variability in clinical settings is also relevant to HIT design, implementation, and evaluation.[17] HIT should not reduce the flexibility required for needed variability. Clinician-oriented workflow approaches are successful in capturing the variability between clinician types[2] and clinicians of the same type in various situations.[18] Some of the variability is due to the clinical practice of individuals which can be explained by clinician-oriented workflow. However, another part of the variability is due to various emerging properties from people working together (eg, generative sequences). Zeigler and Weinberg[19] argue that when many tasks are performed cooperatively, they are weakly structured or formalized, which leads to variability. This variability aspect can be examined with patient-oriented workflow. A more complete understanding of variability in care delivery work can inform the design, implementation, and evaluation of HIT.

Patient-oriented workflow models can be instrumental in the study of healthcare delivery which takes place in multiple settings. The boundaries of healthcare work cross multiple formal and informal care settings. The boundaries implied by patient-oriented workflow models include the activities of all individuals involved in the care of the patient. By defining broader boundaries, researchers can carry out comprehensive modeling to develop a more integrated view of fragmented delivery systems than with clinician-oriented models. Coordination is particularly important in care delivery in settings with different characteristics. A patient-oriented workflow facilitates the examination of coordination of care that takes place in those settings.

Workflows across institutions (between and among formal and informal care delivery settings) should be taken into account when the work that is conducted in one institution (eg, use of a medication or management of health information by a patient at home[20]) directly affects the work in another institution (eg, the patient's visit at her primary care provider's office). The work that is conducted in each of the multiple institutions are connected parts of a broader 'whole.' Although healthcare delivery requires workflows across institutions, current health information technologies are insufficient to support them. Patient-oriented workflow studies can support the design and implementation of health information systems by accounting for various health activities in multiple settings.

Patient-oriented workflow models can help to characterize the gap between clinical and non-clinical health practices and inform the information technologies that can bridge that gap. Understanding in an integrated manner the work systems in both traditional clinical settings (eg, emergency departments or anticoagulation clinics) and daily living settings (eg, home or school) supports better development and evaluation of the policy and technology interventions that are required to achieve safe, effective, patient-centered, timely, and efficient health systems.

TWO CASES: HEALTH INFORMATION EXCHANGE AND ANTICOAGULATION MANAGEMENT

We describe unique actual and potential benefits of patient-oriented workflow models in two study contexts: a health information exchange technology implementation and oral anticoagulation therapy.

We used a patient-oriented workflow approach to evaluate a health information exchange technology intervention in terms of how the intervention affects patient care in three emergency departments. We conducted a systematic investigation of patient care, captured in a temporal sequential context.[16] Using a patient-oriented workflow approach was valuable because we were able to monitor the overall organization of care delivery for individual patient episodes, capturing the engagement of multiple staff members and characterizing sequential variability in care delivery across patient care episodes. The patient-oriented workflow approach also allowed us to examine how the health information exchange was integrated into care delivery, particularly the timely availability of information produced and the penetration of information into ongoing care processes.[21–23] We were also able to identify several design and implementation issues that were less evident from the clinician perspective, which ultimately led to a revision of document flow and a re-arrangement of the responsibilities of the staff members in the three study settings.

Oral anticoagulation is a challenging therapy from both the providers' and patients' perspectives because of the narrow therapeutic range and the wide variability of individual responses to the medication due to genetic and various lifestyle factors. The therapy can easily lead to harm from both excessive and insufficient anticoagulation. Activities relevant to anticoagulation therapy occur in both clinical and daily living settings. In clinical settings, pharmacists assess the patient, consult other clinicians, make clinical judgments, and prescribe medications. In daily living settings, patients need to take their medications and monitor their diet and alcohol consumption. Patients also need to communicate with their anticoagulation specialist about changes in their medication list, upcoming clinical procedures, and other issues that may affect anticoagulation. Patients can be overwhelmed with the many responsibilities related to anticoagulation management. Modeling these complex interactions can be challenging, but the patient-oriented workflow model can allow us to understand the needs of patients and to design consumer health informatics (CHI) interventions that support patient engagement and encourage anticoagulation management in patients' daily routines. CHI interventions may provide support for controlling alcohol consumption, promoting appropriate diet, and adherence to the treatment plan by organizing and

presenting timely information to patients and providers. Patient-oriented workflow models can inform CHI interventions that will fit the patient's social, physical, and cultural context.[24]

A patient-oriented workflow model captures patient care activities in both clinics and daily living settings; therefore, it can provide an integrated perspective by revealing the patient's social, physical, and cultural context and the patient's role in care delivery.[25] Data collection focuses on the sequence of various anticoagulation management activities for a patient, as well as the actors involved, who might include the patient, patient's social network, primary care physician, anticoagulation specialist, and other specialists if the patient has comorbidities. The temporal order of the contribution of various actors as well as their interactions can also be examined. The resulting patient-oriented workflow models can potentially lead to better treatment plans and improvements in patient compliance.

CHALLENGES WITH PATIENT-ORIENTED WORKFLOW

Despite the benefits of patient-oriented workflow, such models are challenging to develop. There are difficulties in conducting workflow studies in both formal and informal health settings. Methodological challenges include ensuring the reliability and validity of the collected data due to a high level of variability and complexity in health settings.[26] Theoretical challenges include the lack of comprehensive, robust conceptual frameworks that can be used to guide patient-oriented workflow studies. Additionally, patient-oriented workflows involve a larger scope and more complex work phenomena. More sophisticated modeling techniques are needed to address this escalated level of complexity.

CONCLUSION

Health information technologies should be designed and implemented in a way that is congruent with healthcare delivery work. Understanding healthcare work is, consequently, one of the early steps of HIT design and implementation. Patient-oriented workflow models have three main benefits; they can: (1) lead to HITs that are consistent with cooperative work in health settings by providing a broader understanding than clinician-oriented models; (2) assist in capturing work across settings; and (3) reveal emergent features such as variability.

Practical, methodological, and theoretical challenges related to patient-oriented workflow can be addressed by innovative field studies. Due to the broad scope of a patient-oriented workflow, typical observation and interview studies can be insufficient. Innovative approaches such as patient-collected data,[27] secondary use of electronic health records,[28] and the use of RFIDs[29] can allow us overcome practical challenges, develop systematic and efficient methodologies, and develop and test rigorous theories.

Contributors All authors contributed to the conception, drafting the article and critical revision of it for important intellectual content.

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REFERENCES

1 Zheng K, Haftel HM, Hirschl RB, *et al*. Quantifying the impact of health IT implementations on clinical workflow: a new methodological perspective. *J Am Med Inform Assoc* 2010;17:454–61.
2 Unertl KM, Johnson KB, Lorenzi NM. Health information exchange technology on the front lines of healthcare: workflow factors and patterns of use. *J Am Med Inform Assoc* 2012;19:392–400.
3 Huang Z, Lu X, Duan H. On mining clinical pathway patterns from medical behaviors. *Artif Intell Med* 2012;56:35–50.
4 Bouarfa L, Dankelman J. Workflow mining and outlier detection from clinical activity logs. *J Biomed Inform* 2012;45:1185–90.
5 Ozkaynak M. *Characterizing workflow in hospital emergency departments*. Madison, WI: University of Wisconsin-Madison, 2011.
6 Tang Z, Weavind L, Mazabob J, *et al*. Workflow in intensive care unit remote monitoring: a time-and-motion study. *Crit Care Med* 2007;35:2057–63.
7 Wolf LD, Potter P, Sledge JA, *et al*. Describing nurses' work: combining quantitative and qualitative analysis. Human factors. *J Hum Factors Ergon Soc* 2006;48:5–14.
8 Hollingsworth JC, Chisholm CD, Giles BK, *et al*. How do physicians and nurses spend their time in the emergency department? *Ann Emerg Med* 1998;31:87–91.
9 France DJ, Levin S, Hemphill R, *et al*. Emergency physicians' behaviors and workload in the presence of an electronic whiteboard. *Int J Med Inf* 2005;74:827–37.
10 Brixey JJ, Robinson DJ, Tang Z, *et al*. Interruptions in workflow for RNs in a Level One Trauma Center. *AMIA Annu Symp Proc* 2005;86–90.
11 Brixey JJ, Robinson DJ, Johnson CW, *et al*. Towards a hybrid method to categorize interruptions and activities in healthcare. *Int J Med Inform* 2007;76:812–20.
12 Koppel R, Wetterneck T, Telles JL, *et al*. Workarounds to barcode medication administration systems: their occurrences, causes, and threats to patient safety. *J Am Med Inform Assoc* 2008;15:408–23.
13 Karsh BT, Weinger MB, Abbott PA, *et al*. Health information technology: fallacies and sober realities. *J Am Med Inform Assoc* 2010;17:617–23.
14 Strauss AL, Fagerhaugh S, Suczek B, *et al*. *Social organization of medical work*. Chicago: The University of Chicago, 1985.
15 Schmidt K, Simone C. Coordination mechanisms: towards a conceptual foundation of CSCW systems design. *Comput Supported Cooperative Work (CSCW)* 1996;5:155–200.
16 Ozkaynak M, Brennan PF. Characterizing patient care in hospital emergency departments. *Health Syst* 2012;1:104–17.
17 Carayon P, Wetterneck TB, Hundt AS, *et al*. Evaluation of nurse interaction with bar code medication administration technology in the work environment. *J Patient Saf* 2007;3:34–42.
18 Brixey JJ, Tang Z, Robinson DJ, *et al*. Interruptions in a level one trauma center: a case study. *Int J Med Inf* 2008;77:235–41.
19 Zeigler BP, Weinberg R. System theoretic analysis of models: computer simulation of a living cell. *J Theor Biol* 1970;29:35–56.
20 Moen A, Brennan PF. Health@Home: the Work of Health Information Management in the Household (HIMH): implications for Consumer Health Informatics (CHI) innovations. *J Am Med Inform Assoc* 2005;12:648–56.
21 Ozkaynak M, Brennan PF, Haight D. Do health information exchange technologies cause delay in patient care. Proceedings of AMIA 2010 Symposium, Washington, DC, 2010: 1201.
22 Ozkaynak M, Haight D, Brennan PF. Unexpected users of a health information exchange technology. Proceedings of AMIA 2010 Symposium, Washington, DC, 2010: 1200.
23 Ozkaynak M, Brennan PF. Revisiting sociotechnical systems in a case of unreported use of health information exchange system in three hospital emergency departments. *J Eval Clin Pract* 2013;19:370–3.
24 Marquard JL, Zayas-Caban T. Commercial off-the-shelf consumer health informatics interventions: recommendations for their design, evaluation and redesign. *J Am Med Inform Assoc* 2012;19:137–42.
25 Oudshoorn N. Diagnosis at a distance: the invisible work of patients and healthcare professionals in cardiac telemonitoring technology. *Sociol Health Illn* 2008;30:272–88.
26 Zheng K, Guo MH, Hanauer DA. Using the time and motion method to study clinical work processes and workflow: methodological inconsistencies and a call for standardized research. *J Am Med Inform Assoc* 2011;18:704–10.
27 Valdez R. *Creating a foundation for the design of culturally-informed consumer health IT*. Madison, WI: University of Wisconsin-Madison, 2012.
28 Rea S, Pathak J, Savova G, *et al*. Building a robust, scalable and standards-driven infrastructure for secondary use of EHR data: the SHARPn project. *J Biomed Inform* 2012;45:763–71.
29 Vankipuram M, Kahol K, Cohen T, *et al*. Toward automated workflow analysis and visualization in clinical environments. *J Biomed Inform* 2011;44:432–40.