# Health Information Technology Coordination to Support Patient-centered Care Coordination

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## Summary

**Objective**: To select papers published in 2014, illustrating how information technology can contribute to and improve patient-centered care coordination.

**Method**: The two section editors performed a literature review from Medline and Web of Science to select a list of candidate best papers on the use of information technology for patient-centered care coordination. These papers were peer-reviewed by external reviewers and three of them were selected as "best papers".

**Results**: The first selected paper reports a qualitative study exploring the gap between current practices of care coordination in various settings and idealized longitudinal care plans. The second selected paper illustrates several unintended consequences of HIT designed to improve care coordination. The third selected paper shows that advanced analytic techniques in medical informatics can be instrumental in studying patient-centered care coordination.

**Conclusions**: The realization of true patient-centered care coordination is dependent upon a number of factors. Standardization of clinical documentation and HIT interoperability across organization and settings is a critical prerequisite for HIT to support patient-centered care coordination. Enabling patient involvement is an efficient means for goal setting and health information sharing. Additionally, unintended consequences of HIT tools (both positive and negative) must be measured and taken into account for quality improvement.

## Keywords

Medical Informatics; continuity of patient care; patient care planning; interprofessional relations; patient-centered care

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## Introduction

A review commanded by the Agency for Healthcare Research and Quality defines care coordination as "the deliberate organization of patient care activities between two or more participants involved in a patient's care to facilitate the appropriate delivery of health care services" [1]. According to this review, care coordination requires an efficient flow of information and responsibility between providers. The coordination of preventive, acute, chronic and end-of-life cares needs to be supported across time, participants, and settings.

According to the Institute of Medicine (IOM), "patient-centered care" refers to "providing care that is respectful of and responsive to individual patient preferences, needs, and values, and ensuring that patient values guide all clinical decisions" [2]. Patient- (and family-) centeredness sets a goal but also a means for care coordination: the patient is a special participant of care activities, whose needs are the focus of coordinated care. Health information technology (HIT) can be used to study or improve care coordination and its patient-centeredness. More pointedly, HIT provides an opportunity to organize disparate data sources into one cohesive, patient-centered record. It can enable the engagement of patients, improve the collaboration with and between caregivers and contribute to efficient and safe personalized care.

HIT enables sharing health information - like health care plans, pre-visit assessments, personal health records, and discharge summaries and instructions - between patients, informal caregivers and professional caregivers. However, HIT can also have unintended consequences and may deteriorate care coordination or its patient centeredness. Built-in evaluation processes are therefore important and HIT helps monitoring the appropriate care coordination of individual patients or patient groups. The three "best papers" selected this year for the special section of the Yearbook "Patient-Centered Care Coordination" illustrate these three areas [3–5].

## About the Selection Process

A comprehensive search was performed in two bibliographic databases, Pubmed/Medline (National Center for Biotechnology Information) and Web of Science (Thomson Reuters). The queries used keywords focused on (i) information systems and (ii) patient care coordination. Performed at the beginning of January 2015, the search returned 991 references. References were independently screened by the two section editors on the basis of title, abstract, and keywords to exclude irrelevant articles. Discrepancies were resolved by consensus among section editors and 115 references were kept for further examination. A list of 15 candidate best papers was finally generated, 11 originating from the USA and 4 from Europe. Each one of these 15 papers entered then into a peer-review process involving Yearbook editors and one to three

external reviewers. Three papers were finally selected as "best papers" (Table 1). A content summary of these three papers can be found in the appendix of this synopsis.

**Table 1** Best paper selection of articles for the IMIA Yearbook of Medical Informatics 2015 in the section '**Patient-centered Care Coordination**'. The articles are listed in alphabetical order of the first author's surname.

| Section<br>Patient-Centered Care Coordination |
|---|
| ▪ Dykes PC, Samal L, Donahue M, Greenberg JO, Hurley AC, Hasan O, O'Malley TA, Venkatesh AK, Volk LA, Bates DW. A patient-centered longitudinal care plan: vision versus reality. J Am Med Inform Assoc 2014;21(6):1082-90. |
| ▪ Melby L, Hellesø R. Introducing electronic messaging in Norwegian healthcare: unintended consequences for interprofessional collaboration. Int J Med Inform 2014;83(5):343-53. |
| ▪ Popejoy LL, Khalilia MA, Popescu M, Galambos C, Lyons V, Rantz M, Hicks L, Stetzer F. Quantifying care coordination using natural language processing and domain-specific ontology. J Am Med Inform Assoc 2015;22(e1): e93-e103. |

## Conclusions and Outlook

Longitudinal care plans (LCPs) are trans disciplinary and patient-centered plans of care. They are ideally generated by the patient and close caregivers and must subsequently be communicated, referred to and updated across organizations and levels of care. Standardization and interoperability of electronic health records (EHRs) are mandatory to achieve these goals. In the first best paper, Dykes et *al*. have reported a qualitative study exploring the gap between current practices of care coordination in various settings and the ideal longitudinal care plans [3]: paper and fax are still the most common formats used to communicate care plans; the structure of care plans is heterogeneous and not patient-centered; care plans are seldom updated across settings. The authors conclude that LCPs remain an ideal that still needs to be realized. Other communication tools embedded within EHRs have been studied, like handoffs to improve care coordination within a team [6, 7] or automatic discharge notifications to improve care coordination across settings [8]. These studies suggest that there is much room to improve HIT meaningful use in order to communicate all the information necessary for patient-centered care coordination. Sharing the same EHRs may be useful, but certainly not sufficient to ensure care coordination. The benefits of shared EHRs depend on team cohesion [9] and are achieved in the context of more widespread reorganizations of care, like patient-centered medical homes [10] or even "villages" of patient-centered medical homes [11]. The experience of a shared electronic portal for preoperative assessment underscores that organizational factors are major success factors that should be carefully considered [12].

The second best paper, authored by Melby et *al*., illustrates the unintended consequences of HIT originally implemented to improve care coordination [4]. Previously reported unintended consequences of HIT were mostly negative but this paper also demonstrates some positive unintended effects of electronic messaging between homecare nurses and general practitioners. Electronic messaging allowed for more efficient interprofessional communication (intended consequence) but reduced face-to-face communication and hence interpersonal relationships (unintended negative consequence). The documentation of nurses' messages in the EHR gave weight to their requests and empowered their collaboration with general practitioners (unintended positive consequence). This study again underscores that organizational changes are paramount to the acceptance and outcome of new HIT tools. Since many of these changes cannot be anticipated, the evaluation of their impact on workflow and processes, and not only outcomes, must be evaluated from the onset to allow corrective actions.

In the third best paper, Popejoy et al. analyzed how medical informatics can be instrumental to study patient-centered care coordination [5]. The authors screened a large corpus of nurse notes using natural language processing techniques to identify activities pertaining to care coordination. They organized these activities into an ontology, used to quantify the global amount and the type of care coordination per patient (mainly communication and management activities). Other authors parsed event logs in gynecologic oncology departments to picture what was done to patients and in which order [13]. The analysis of this low level administrative data was able to generate interesting insights into prototypic and sometimes problematic (with reference to guidelines) patient pathways.

Many other works published in 2014 deserve mention. For instance, direct involvement of patients in the generation and communication of their personal health records increases patient engagement and the appropriate and timely information of caregivers [14]. Two studies illustrate this effect. In the first one, parents were offered the possibility to interact with an automated voice response system to input data in the EHR of their child or to express concerns to be addressed during the upcoming visit [15]. In the second study, patients from the Department of Veterans Affairs who used the opportunity to download a comprehensive extract of their EHR were able to better understand their own medical history and to share it efficiently with caregivers outside the organization [16]. There is still no evidence that these beneficial effects of patient involvement translate into better health outcomes [17, 18]. However, patient satisfaction may be a better measure of patient-centeredness than health outcomes [19].

A study performed in Zanzibar shows that even low tech interventions like text messaging can improve the quality of care (regular attendance to antenatal care) [20]. However, this study once again illustrates the importance of context when care coordination is at stake: first, pregnant women were identified at the time of their first visit to the healthcare facility, missing those who did not attend this first visit; second, text messaging leaves out illiterate women, who are many in low income countries and among the most vulnerable. Several low

level universal features are paramount for care coordination tools to perform securely and confidentially, but may be a challenge to address automatically. For instance, a promising automated access control model seems able to manage most access configurations encountered in collaborative processes [21].

In conclusion, we would like to rephrase four important points concerning patient-centered care coordination challenges. First, documentation standards and HIT interoperability are important prerequisites: HIT tools need to be coordinated across settings and organizations to contribute to care coordination across settings and organizations. Second, patients must be involved for appropriate goal setting and are an efficient vehicle of their own health information, if they are given access to it and educated to understand it. Third, unintended consequences of HIT tools must be systematically investigated from the onset and continuously sought during development and maintenance. Positive unexpected consequences can hint toward new uses and new functionalities to achieve the same effect on purpose. Fourth, when it comes to the evaluation of patient-centered care coordination, patient and user satisfaction is at least as important as health outcomes.

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# Appendix: Content Summaries of selected best papers for the 2015 IMIA Yearbook, special section "Patient-Centered Care Coordination"

### Dykes PC, Samal L, Donahue M, Greenberg JO, Hurley AC, Hasan O, O'Malley TA, Venkatesh AK, Volk LA, Bates DW

### A patient-centered longitudinal care plan: vision versus reality

### J Am Med Inform Assoc 2014;21(6):1082-90

**Question**: To which degree does the current state of documentation, communication and reconciliation of care plans across settings and levels of care meet the definition of a longitudinal care plan?

**Methods**: Qualitative study. US care providers from emergency departments, acute care hospitalization, skilled nursing facility, and home health agency, were interviewed about care coordination, care plans, transitions across levels of care, and electronic tools to support these processes.

**Main results**: Teamwork focused on coordination exists in some organizations but the patient and informal caregivers are often left out when forming and updating the care plan.

Tools to assist the management of care and medication exist but are often specific to each site, without true reconciliation when patients transition across settings. Electronic tools are often of limited help with regard to care coordination across transitions, even if they are sometimes useful within a single setting. Documentation is not standardized and HIT systems are not interoperable, with heavy use of phone, fax and email as a result. Moreover, HIT systems often lack the necessary functions to record patient preferences and support patient-centered care coordination.
**Conclusion**: Longitudinal care plans are still an ideal to be reached. From a clinical point of view, the first steps are to promote a care plan used by all disciplines within individual settings, and taking patient and informal caregiver perspectives into account. From a technical point of view, the main prerequisites are to adopt standards of documentation across settings and to achieve interoperability across systems.

### Melby L, Hellesø R

### Introducing electronic messaging in Norwegian healthcare: unintended consequences for interprofessional collaboration

### Int J Med Inform 2014;83(5):343-53

**Questions**: How is the collaboration between general practitioners (GPs) and homecare staff affected by the use of a new communication tool like e-messaging? What are the unintended consequences of this HIT tool?
**Methods**: Qualitative study. The e-message system is a module that can be integrated in different EHR systems to send messages via a national closed and secure health net. Standardized messages were prepared for specific purposes and free dialogue messages were also possible. Some information stored in EHRs can be included in messages without re-typing. Open interviews with 23 nurses, 11 GPs, 5 secretaries and 4 project managers in Norway were directed toward collaboration and communication in general, and the implementation and the assessment of e-messaging in particular.
**Main results**: Information exchange improved by easing the communication that already took place and allowing more communication with more information (intended consequence). Communication became less personal and face-to-face meetings decreased (unintended negative consequence). Professional tasks and responsibilities were reconfigured: e-messaging allowed nurses to organize and facilitate GPs' work (intended consequence); the related cognitive load was transferred from GPs to nurses (unintended negative consequence). The automatic documentation of communication gave more weight to nurses' requests (unintended positive consequences).
**Conclusion**: Unintended consequences of HIT must be investigated. Positive unexpected consequences can hint toward new systems and new benefits to the organization of care.

### Popejoy LL, Khalilia MA, Popescu M, Galambos C, Lyons V, Rantz M, Hicks L, Stetzer F

### Quantifying care coordination using natural language processing and domain-specific ontology

### J Am Med Inform Assoc 2015;22(e1): e93-e103

**Questions**: What specific activities do homecare nurses and coordinators use when caring for older community-dwelling adults? How can those activities be quantified?
**Methods**: Natural language processing and text mining. 11,038 narrative notes written by US homecare nurses were used to build an ontology of care coordination. The ontology was then used to semi-automatically label 139,173 narrative notes found in the EHRs of 908 patients, extract the corresponding coordination activities, and establish patient-problem profiles. The amount of coordination activities was then computed for each patient in the year following their admission to the homecare program.
**Main results**: A broad range of possible coordination activities and foci was established but most of the actual activities pertained to communication and management. It was possible to measure the amount of coordination activities per patient. The measure was able to clearly distinguish patients who benefited from an enhanced care coordination program from those who did not.
**Conclusion**: Nurse care coordinators spend most of their time communicating about patients and managing problems. Whether the approach and the results can be replicated in other settings is an open and fruitful question.