(Almost) Everything You Need to Know About Clinical Event Notifications

Introduction

Patients today often find themselves being cared for by an orchestra of separate providers lacking a conductor. Increasing specialization of care has created a fragmented arrangement of disparate providers loosely connected by inadequate means of communication and information exchange.

For example, in approximately 30% of adult emergency department visits, the patient's primary physician was not informed of care they received. Additionally, no information was exchanged between primary and specialty care providers in nearly half of pediatrician referral cases studied [2]. These, and other coordination deficiencies, are major drivers of poor health outcomes, preventable hospital admissions and readmissions, and of the escalating cost of healthcare in the United States [3,4].

Providers and payers are solving this challenge by implementing the use of clinical event notifications (CENs) to improve care coordination and facilitate smooth transitions between care settings and providers. Clinical event notifications are increasingly considered instrumental to improving care coordination and are included as significant components in reform programs such as the Office of the National Coordinator for Health Information IT's (ONC) Beacon Community projects, Project BOOST developed by the Society of Hospital Medicine (SHM), and Delivery System Reform Incentive Payment (DSRIP) financial waiver agreements between the CMS and multiple State Departments of Health.

This paper details CEN functionality, examples of successful use, and possible impediments for future success.

Anatomy of Clinical Event Notifications

Clinical event notifications increase provider awareness and stimulate collaborative decision-making by automatically alerting providers of healthcare events that occur within a defined patient population. The five essential elements of a CEN service includes:

1. a **patient roster** indicating all individuals whose care events will be monitored;
2. a **trigger event**, such as registration of a patient to an ED or inpatient service;
3. a **payload of content** to be delivered in a notification message, including patient demographics, encounter site, date and time of trigger event, and potentially additional clinical information;
4. a **delivery mechanism**, such as automated email, fax, or EHR message generation; and,
5. a **recipient**, such as a durable provider or care manager who may subsequently impact care delivery and care resource allocation [14].

Admit, Discharge, Transfer (ADT) messages, in HL7 format, are widely recognized as an appropriate mechanism to transmit details of care events. EN services receive the ADT messages, which carry a range of content, as described above. Health Information Exchanges (HIE) and Regional Health Information Organizations (RHIOs) receive secure transmission of facility ADT message feeds, and are therefore well-positioned to participate in EN programs [9].

Recipients of CENs

Physicians/Nurses	Non-physicians	Payers	Other
Primary care physician & nurses	Case managers	Care management organization	Admission/discharge/ Transition management teams
Specialty physicians & nurses	Social workers	Health insurance provider	Care improvement teams
	Physical therapists	Employer	Ancillary care site manager
	Lab or imaging personnel	Managed care organization	Pharmacists

Clinical Event Notification Use Cases

Healthcare reform incentive programs and an abundance of opportunity to improve care coordination are driving provider investment in the development and implementation of CEN services. For instance, one study found that patients who were not seen by their primary care physician within 30 days of being discharged were 10 times more likely to be readmitted. Additionally, greater than half of the patients readmitted within 30 days had no record of post-discharge follow-up care. [3,4].

The United States government spends more than $17 billion per year on Medicare patients who are readmitted within 30 days of being discharged from a hospital. [11]. Recent investigations demonstrate that as many as 60 percent of those readmissions could be prevented [6, 7]. As payment reforms emphasize accountable and outcomes-based care, rather than fee-for-service, it becomes more imperative that healthcare providers have a complete picture of their patients' care.

Health systems and providers across the country are identifying opportunities to improve coordination and outcomes through creative and tailored implementation of CEN services. The following selection represents a few of the most prominent CEN pilots currently under investigation.

Lead Organization	Technology	CEN Use	Results
Chesapeake Regional Information System for our Patients (CRISP) Maryland's Statewide HIE	CRISP's Electronic Notification Service® (ENS)	CRISP implemented ENS as part of Maryland's statewide HIE effort to: ▪ Increase PCP follow up rates ▪ Reduce readmission rates	Early results following implementation show: ▪ Increased PCP follow-up within 7 days of discharge ▪ Reduction in readmissions of patients seen by their PCP within 7 days of discharge [15]
Disease Management and Coordination Network (DMCN),	HIE-enabled CEN service, funding provided by the Robert Wood Johnson Foundation	Northern Piedmont Community Care piloted the use of CENs for Nurse-directed asthma management interventions to improve outcomes.	An 11 month pilot yielded: ▪ 12% increase in PCP visits ▪ 43% decrease in asthma-related ED visits ▪ 34% decrease in asthma-related hospitalizations ▪ 23% reduction in asthma Medicaid costs [9] ▪ Plans to expand utilization of CENs in other costly areas
Indiana Health Information Exchange (IHIE); Regenstrief Institute	Indiana Network for Patient Care™	For six months, a Medicaid managed health plan received daily CENs on ED visits by its members. Alternative care settings were recommended when appropriate.	Within the specified patient population: ▪ Non-urgent ED visits decreased by 53% ▪ PCP office visits increased by 68% ▪ Estimated annual health plan savings of $2-4 million [13]

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Lead Organization	Technology	CEN Use	Results
New York Clinical Information Exchange (NYCLIX) [Figure 1]	HIE-Enabled CEN service	3 NYCLIX affiliates participated in a CEN Pilot: ▪ **Institute for Family Health**: PCP notified of a patient ED visit ▪ **Visiting Nurse Service of New York**: Care coordination: ED Visit; Discharge; Home Care ▪ **SelectHealth**, (Medicaid Special Needs Plan): Notified of ED visits to manage care of HIV and AIDS patients	▪ The NYCLIX CEN service identified patients with high ED utilization and hospital services. ▪ Care coordination following CEN requires dedicated personnel or workflow processes to organize subsequent actions. ▪ Sicker patients managed by VNSNY generated more notifications than did the typically healthier patients followed by the IFH primary care teams.

Future of Clinical Event Notifications

Clinical event notification programs are in the nascent stage of development. Further research and development in CEN systems are needed to more completely ameliorate the deficiencies in provider awareness, collaboration, and transitions coordination.

Future improvements to CEN systems will harness existing capabilities of smartphone and smart-tablet devices. This will allow real-time push notifications to the mobile device of providers or care managers, liberating care teams from the tethered and poorly differentiated nature of EHR and email notifications.

Outmoded and ineffective technology

A significant hindrance to current CEN programs is the under-utilization of EHR systems, and the widespread reliance of healthcare organizations on outdated technology including fax machines, landline phone services and pagers. The lack of a bi-directional interface is cited as a major limitation to CEN interventions [13]. Furthermore, delivering CENs across broad networks may be hindered by limited compatibility and interoperability between EHR systems.

Case in point, 71 percent of users in the NYCLIX program checked their EHR in-boxes four or fewer times daily, and were therefore limited in their reception of CENs [10]. The current trend of Bring-Your-Own-Device (BYOD) may further facilitate real time CEN delivery to mobile devices by reducing overhead and implementation costs, and by simplifying implementation on personal devices.

Intelligent Routing of Clinical Event Notifications

Information overload is a common criticism of current CEN capabilities [10]. To address this, CEN systems must intelligently route messages to only appropriate recipients and include clear action plans. This would likely involve an enhanced technical complexity allowing for ADT message feeds to be filtered and parsed, so as to intelligently route only CENs of certain care events to only subsets of recipients, as specified by workflows of care. Examples of intelligent routing may include integration with provider call schedules to limit un-actionable notifications, and routing of different care events, such as admissions vs. discharges, to providers with roles focused upon those critical junctures.

Read Receipt of Clinical Event Notifications

Current programs utilizing CENs are limited by an inability to track receipt and response to the notifications delivered. This "blindness" following delivery may have considerable impact when delivering CENs across broad and disparate organizations. Read receipts viewable to all other recipients of a CEN, and to enterprise managers, will allow for visible accountability to all personnel involved, and may enable the identification of care transition gaps.

Tools to Coordinate Subsequent Care

The greatest impact to care delivery reform will come through pairing clinical collaboration tools with a CEN system. This combination will manifest four components essential to the future of IT for care collaboration: [8].

Component	Necessity	Execution
Identify Collaborators [Figure 2]	Engage appropriate providers or targets for collaborative decision-support discussions	Information may be delivered by CENs or digitally linked to searchable care team directories.
Contact Collaborators	Instantaneous communication platform to support rapid care coordination	Smartphones and smart-tablets can be utilized to enable secure messaging, photo and file sharing.
Collaborate	Real-time discussions based on secure exchange of patient health information among invested providers allows for development and alterations of treatment plans	Participation on the part of all contributors along the care management continuum is key, particularly among acute and primary care providers.
Monitor	Uncovering gaps in care continuity is achieved through monitoring and analyzing CEN delivery and resulting care	Records of CEN delivery and receipt allow organizations to analyze care transitions and manage resources, as well as, identify specific care workflows, care receiving institutions, and partnering providers which may be delaying effective transitions.

CEN + Evidence-Based Checklists

The coupling of CENs with evidence-based, best practice checklists may allow for clear instruction and delegation of tasks shown to improve care transitions [1, 11]. The benefits of this include:

- Uniting providers with clear collaborative instructions on the tasks to be completed and by whom;
- Sharing visibility of checklist progression may allow for accountability to drive task completion;
- Promoting the use of shared and real-time resources; and,
- Multiple providers assigning and ensuring the completion of pre-specified care activities.

This approach was successfully demonstrated by the ReEngineered Discharge (RED) protocol, which reported a reduction in 30-day readmissions of nearly 40 percent, with a concurrent increase in patient satisfaction in one health system [15], and a decrease in overall hospital utilization following discharge in another [12].

Conclusion

Clinical event notifications pose a simple technological strategy to remediate the poor health outcomes, unnecessary healthcare utilization, and excessive healthcare costs that result from inadequate provider and care manager collaboration. Utilizing ADT message feeds and HIE infrastructures, CEN programs are able to inform a broad base of providers and care managers enabling shared-decision support and ensuring continuity of care at care transitions. The evolution of CEN programs may allow for immediate, real-time delivery to mobile devices, and may couple CENs to communication support tools such as searchable directories, secure mobile messaging and file sharing, and shared evidence-based care transition checklists.

The potential ability to draw regional insights on patterns of patient resource utilization and collaborative behaviors among providers may allow for broad and overarching impacts of EN programs on healthcare delivery reform.

Value Conclusion

Clinical event notifications may remediate the lack of shared decision-making, inadequate information transfer and follow-up in post-acute care, and inadequate medication reconciliation and education. Financially, this equates to greater savings in shared risk models, and full reimbursements in value-based purchasing models. Implemented and utilized properly, CENs will ensure providers are all performing in sync with one another.

Figure 1. Event Notification Schematic

The NYCLIX EN program perceives care transition events via ADT message feeds from multiple facilities, all connected centrally to a HIE hub. Following matching of the ADT messages to patient subscription list, EN are generated and routed to appropriate community providers, via secure PDF delivery to email inboxes.

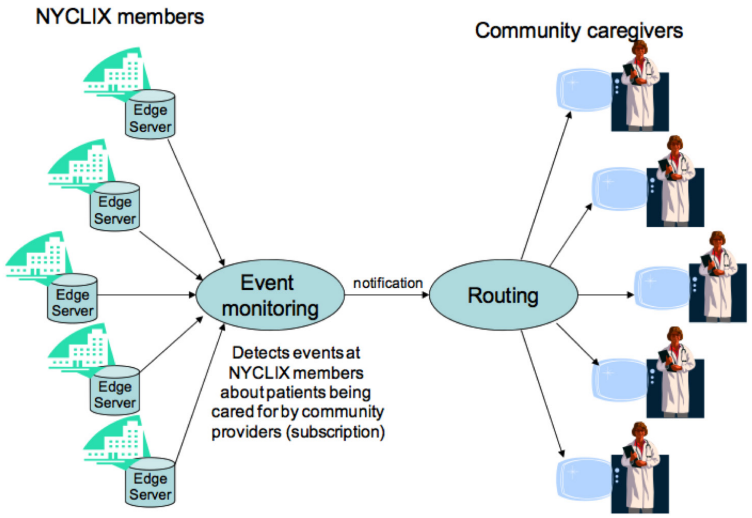
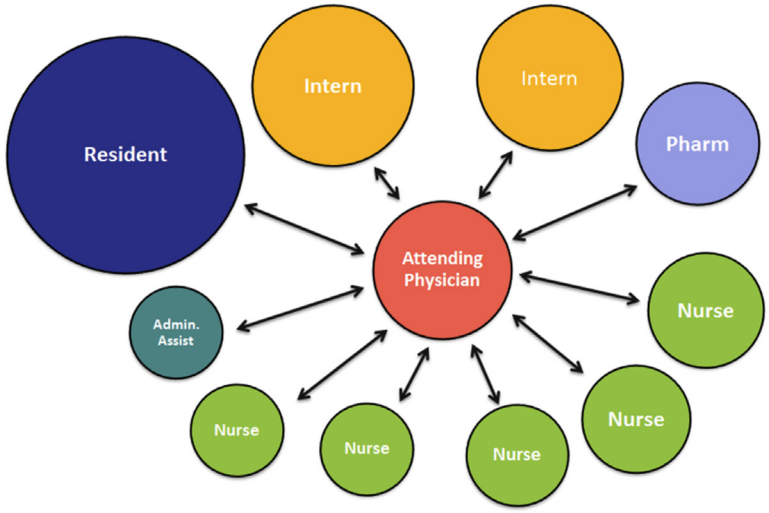


Figure 2. Care Team Communication Mapping

Attending Physician Communication.



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