HIE DRIVEN SUBSCRIPTION AND NOTIFICATION SERVICES:
MARKET ASSESSMENT AND POLICY CONSIDERATIONS

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Executive Summary

As infrastructures to enable varying types of health information exchange activity are increasingly deployed by hospitals, health systems, and regional/statewide exchange organizations, new opportunities to support powerful notification solutions become possible. Within this briefing, notifications (or alerts) will be defined loosely as messages that are *pushed* to interested parties within the confines of existing laws and regulations. The technical methods and standards to push those messages, the processes to define who should receive them or who can "subscribe" to them, the content of the messages, and the rights of the patient who is the subject of the message will be discussed below. Each of these issues adds independent layers of technical, legal, policy, and workflow complexity; however, as with many topics related to health information exchange, there are solutions available. While these solutions may not be perfect, they are progressive and should be embraced. Many of them are deployed today in various HIE domains at varying levels of maturity and adoption.

Existing solutions to electronically (or manually) fax discharge summaries to primary care physicians (when noted as a "physician of record" by the discharging facility) and/or long-term or post-acute care providers, rely on accurate provider identification (the "who") and accurate provider directory information (the "where"). The notification infrastructure (whether an HIE solution or other technology) will have evolving responsibilities to answer the "what, how, and when" questions related to notifications. Inherent in this discussion is the ability to accurately identify patients when identifying providers and others to whom to send messages. As with many HIE services today, most notification solutions are not standards based (or are only loosely standards based) and rely on use of a common platform. Direct could play an important role in moving beyond that shortcoming. Additionally, if HIE vendors continue to move towards offering APIs to their underlying infrastructure, services can be developed by third parties to enable notifications without relying on the vendor to prioritize and develop the solution.

An important concept to note is the increasing value of notifications in the context of value-based payment models. While providers have always had a clinical interest in knowing about (and, in turn, some care coordination responsibilities with regards to) patient encounters and care outside of their practice or facility, new models are shifting financial incentives and risk to providers, making "patient panel intelligence" increasingly central to financial success. Infrastructures that support notifications also have the potential to better engage patients, families, and care givers.

The ability to establish and maintain provider-to-patient relationships and the ability to assert preferences (or configure) the types and content of notifications is critical. There are rational approaches that can isolate certain high-value notification use cases, such as admission or discharge notifications, which can lead to measurable progress in the near term.

Core Considerations

A number of core concepts and considerations are important for laying the ground work for policy decisions and technical approaches to enabling notification solutions within or between health information exchange organizations (HIOs) or other data exchange domains. They include:

- ➢ Establishing and maintaining the patient/provider relationship, particularly the patient/primary care provider relationship,
- ➢ Asserting preferences for the types of notifications providers are interested in receiving
- ➢ Defining the possible notification pathways (fax, portal, Direct, etc.) for a provider, and which best fit into that provider's (or office staff's) workflow,
- ➢ Assessing the importance of standards-based solutions, and
- ➢ Supporting patient choice of which providers receive notifications in which they are the subject.

Proprietary Approaches vs. Unused Standards

Existing Standards-Based Approaches

Integrating the Healthcare Enterprise (IHE) has published the Publish/Subscribe Infrastructure within the XDS.b set of profiles. While the standard is at some level of development within many vendor solutions, it is not widely used in production (primarily due to inconsistent implementations, and a current vendor focus on other areas). But it holds promise for HIE infrastructures as they mature to support true interoperability with EHR products. In the Publish/Subscribe standard, providers must be using the same cross-enterprise document sharing (XDS) affinity domain. This domain can be provided through connection to an HIO. There are three main actors: subscriber, notification broker, and notification consumer. Typically the subscriber and notification consumer will be the same entity. However, this may not be the case in models where the organization at financial risk for poor coordination is subscribing for providers on their behalf. The notification broker may be an HIO. The subscriber sends subscription requests to the notification broker. The notification broker manages the subscriptions in the XDS affinity domain and uses security assertion markup language (SAML) assertions to ensure the identity and role of the subscriber. The notification broker must be connected with the XDS registry and be aware of documents being added to the registry. When documents are registered in the registry, a notification is triggered by the notification broker based on the subscriptions it maintains. The notification broker then sends a notification to the notification consumer that a document is available in the registry. A deficiency of the standard is that the subscriber, notification consumer, and document source must all be using the same XDS affinity domain. In addition, the notification consumer must access the document in the registry, rather than in the notification they receive.

There are two other approved IHE profiles that enable notifications in other ways. The DSUB (Document Metadata Subscription) is an older profile that uses subscription and notification mechanisms for use within an XDS Affinity Domain and across communities, much like the Publish/Subscribe discussed earlier but with some major limitations. The NAV (Notification of Document Availability) profile supports out-of-band notifications of documents of interest between systems or users.

Customized Solutions Predominate

Like all IHE profiles, the profiles discussed above only describe the actors and standard interactions between them. The implementation of actors is left to software and solution providers. This allows the existing proprietary solutions to become standards compliant if they so choose, by layering standards compliance on top of underlying customer solutions, while enabling new solutions to be developed with the standards in mind. It also enables a heterogeneous set of systems to play the roles of different actors without knowing the inner workings of each other.

While the IHE profiles exist, there are few, if any, organizations that have implemented the IHE's Publish/Subscribe Infrastructure for XDS.b in a production environment. Some have implemented NAV and DSUB profiles with varying degrees of success. But in most instances alert/notification use cases are implemented using customer-developed solutions that do not support the IHE standards.

Technical Analysis and Implications

Within HIE there is a rational orientation towards standards that ease the challenges of system integration, enable true interoperability, reduce the costs to the owners of those systems when integrating, and enable development of higher-level services on top of a standards-based "stack." When HIE implementers discuss standards these days, they often make distinctions among completely proprietary approaches, approaches that use standards but with implementation variability, and those approaches that rely on tightly constrained Nationwide Health Information Network (NwHIN) / IHE profiles. On top of this distinction, there is the question of whether a given solution is "open" or "closed," meaning the solution either has or does not have the ability to integrate with third parties through well-documented application programming interfaces (APIs).

A holistic or solution-wide adherence to the existing, highly constrained standards will limit progress in the near term. First, the reliance on underlying XDS.b deployments as a prerequisite for use of those IHE profiles creates problems from the start, considering that standard's current level of adoption (and more specifically its adoption without significant variance from the specification). However, that should not necessarily be the goal. Most organizations that have deployed these solutions do indeed believe they are standards-based. This appears to be based on the fact that the HL7 standard is used as an underpinning message format. It is also because approaches that are thoroughly *not* standards-based are generally looked down upon in the industry.

Stripping notification solutions down to a few basic ideas, they must allow for signing up a provider to receive a notification, capturing the event that is relevant, and then notifying the provider. Within this conceptual-level framework, there are components of notification solutions that fit well into standards-based approaches and those that may not. The use of a multi-purpose provider directory that seeks to be compliant with the evolving standard on provider directories is a good focus area for standards-compliance. A notification solution that is architected to access a standards-based provider directory made available as a service could be powerful. Additionally, enabling the ability to send outbound Direct messages is a significant step toward enabling a broader community of potential notification recipients.

Limitations caused by proprietary and closed solutions pose the biggest risk. Some solutions are closed intentionally by their developers, others because the first development priority was getting the solution up and running. Often, making APIs available is an afterthought, but not something that is problematic for the developer from a business perspective, at least initially. Based on our market knowledge and research for this report, the alert solutions that are currently used seem to be mostly developed locally by the

HIOs. Some components of the HIE infrastructure may be leveraged, but the rules engine and other parts of the solution are custom, with the exception of the Louisiana Health Information Exchange (LaHIE). This is likely a function of the need to move more quickly than their vendor would allow. However, a risk inherent in this approach is that the development process does not include higher-level architectural decisions, like accessing directories as a service or publishing APIs.

In summary, the lack of use of the tightly constrained standards is not itself necessarily problematic; however, ensuring that customer solutions are open and being developed in the context of evolving standards is important. Flexibility, modularity, and openness are key features of HIE solutions that can stand the test of time.

Key Challenges and Opportunities

Establishing and Maintaining Relationships

Establishing patient-provider and/or patient-entity relationships is a foundational capability in enabling notification services. Someone must be able to control which providers are allowed to subscribe to notifications for a given patient or patient panel. Then there must be a process for providers to be able to subscribe. There are generally two existing approaches that providers and HIOs have implemented to manage these relationships; automatically pushing data to the "provider of record" when that provider is identified in the message or document (i.e. the HL7 message carries either the local identifier or NPI) or providing a solution to allow for subscription to specific patients. The subscription solution is typically a manual process, wherein a provider sends her patient panel to the HIO via a spreadsheet or text file, and the HIO checks the patient panel list against incoming data feeds.

Unreliable provider information is a major challenge to the first model. When patients are admitted to the hospital, they are asked for their primary care physician (PCP). Unfortunately, patients often do not know who their PCP is, or they provide incorrect information. Even if the patient provides the correct PCP name, the wrong provider or no provider at all may be entered into the hospital's system. The second model, allowing providers to subscribe to notifications for their patients, presents its own challenges; for instance, patients in a long-term care setting may be treated by a team of providers, with the PCP only playing a peripheral role.

Ensuring HIPAA Compliance

There are a number of HIPAA and privacy considerations organizations must review prior to implementing a notification or alerting system. The potential issues are different for provider notifications and payer notifications. Notifications to providers are considered treatment or health care operations under HIPAA since they are used for care coordination and may therefore contain PHI. However, a HIPAA violation technically occurs if a notification containing PHI is sent to a provider who does not provide care for the patient. This can be solved by excluding PHI from the notification itself, and requiring a provider to log in to a system and verify they are treating the patient, prior to accessing PHI. This method, while HIPAA compliant, may lead to fewer providers accessing the information due to the additional time and work necessary to access the information. This same issue would also apply to payers when a patient provides incorrect insurance information or information is entered incorrectly, and the notification is sent to the incorrect payer.

Payers face an additional HIPAA issue. Under the Patient Protection and Affordable Care Act (PPACA), if a patient pays out of pocket for a service, information about the service cannot be shared with their payer. Consequently, sending a notification to a payer of a hospital admission that a patient pays for, even if it will improve care coordination, is a HIPAA violation. Separating the notifications that can be sent from those that cannot, may prove to be technically challenging for organizations.

Alignment with Direct

The evolving care coordination responsibilities, driven by value-based payment models, will create demand for services that enable improvements in the provider's ability to manage their patients' health, and in turn, manage their financial risk. Tools traditionally reserved for payers will become more integral core competencies for providers. Some of the risk identification and risk management activities will occur within the patient data sets inside of the provider's EHR, and some will require cross-domain coordination. Direct can simplify and accelerate how cross-domain notification services are deployed (and communication more generally), and how they are consumed by providers, improving the usability of the service. Since Direct is a component of Meaningful Use Stage 2 EHR certification and beyond, it will likely become a natural message standard to leverage in supporting notification services, due to its ease in comparison to HL7-based integrations. Additionally, Direct is an important standard in enabling cross-domain (or HISP to HISP) notifications, without requiring providers to manage use of different portals or domain-specific solutions.

A Consumer-Driven Direct-Based Model

A model not currently deployed, and perhaps a bit more radical, would rely on consumer-driven notification preferences and Direct as enablers of the notification solution. Relying on the power of a ubiquitously adopted standard, Direct enables a patient controlled application to become the rules engine to manage notifications. During an encounter, a patient could provide his or her Direct address, and messages such as admissions, discharges, and discharge summary data would be sent to that patient's personal health record (PHR) via Direct and unwrapped and reviewed by the application. When the message arrived, the patient could have preset rules about which providers and family members to notify, depending on the circumstance. The PHR application would then bundle the message back into a Direct compliant message and send it outbound to the predefined recipient list. This model and the issues of patient choice more generally, raise interesting challenges in the context of provider responsibility of risk management and a patient's ability to disable important aspects of a provider's risk management plan.

Facilitating Patient Choice

Patient choice around notifications poses challenges for all stakeholders. There seems to be a stark divide between the options afforded to patients in a hospital system model and those within a more broadly and diversely governed HIO. Stricter policy rules at the HIO level may drive a portion of the hospital market to rely on their own solutions, rather than relying on an HIO, due to concerns about constraints on their ability to manage risk.

Organizations must first determine whether patients will have an active role in notifications being sent to their providers. Under current HIPAA regulations, patients do not need to give permission for notifications to be shared for treatment, payment, and healthcare operations purposes. However, if organizations decide that patients should have a choice, then they need to determine how that choice will be exercised. Most HIOs (particularly opt-out models) draw a contrast between "pushing" and "pulling"

messages, with patients not having an ability to opt-out of the former. In a model where notification messages are pushed to providers, there is a feeling that patient choice is a somewhat moot point in light of how push messages are currently treated (i.e., you cannot opt-out of a lab being sent to the ordering physician). However, given the challenges described above in how provider-to-patient relationships are managed, there is a need to address the distinction between order-based push messages (such as labs and radiology orders) and other types of pushed notifications.

Supporting Provider Preferences

Allowing providers to establish preferences and choose which notifications they would like to receive is important for avoiding alert fatigue. EHR systems can bombard providers with alerts, making them less effective. If notifications of hospital encounters and lab results are added to the EHR, the alerts may become overwhelming for providers. It is important to allow providers to establish preferences about which patients they would like to see notifications for and which encounter types for each patient. Most providers would probably elect to see notifications for their chronic patients, but not for their entire patient panel. Additionally, based on the conditions the patients have, some notifications may be more important than others. Providers would benefit from business intelligence tools that can mine patient data from the EHR and the HIO and make recommendations to providers on patients that would benefit from increased care coordination. Facebook and Twitter both use data-mining tools to identify and recommend individuals their members should friend or follow. These same types of tools can be used to identify patients that have had multiple hospital readmissions within a given timeframe. That patient would be highlighted to the provider, who could then choose to subscribe to notifications for that patient. With ever-increasing patient loads, it will be important that providers have these types of services, so that they can find the patients that require the most support and be notified when care is required.

Appendix A: Current Use Cases

We have selected several HIOs that are, in our view, most advanced in their planning and implementation of alert or notification functionality. We conducted interviews with each HIO to ascertain the subscription and notification services they provide, and each HIO was provided an opportunity to review and edit its information.

HealthBridge

HealthBridge has implemented an emergency department admission alert system through Mirth as part of their Beacon program. The program began in one practice in November 2011, and currently has 33 primary care providers live with alerts, with 85 being added throughout June 2012. Primary care providers (PCPs) who participate in the program create a patient panel of their diabetic or pediatric asthma patients. The patient panel is a CSV file that contains specific data elements used to tether a patient to their PCP. PCPs must update the file on a weekly basis and can send it electronically to HealthBridge via a number of secure channels. When a patient is admitted to the ED, an ADT message is sent to HealthBridge. If the patient is listed as active on a PCP's patient panel, an alert is triggered and sent. PCPs can choose how they would like to submit their patient panels to HealthBridge: either through a PDF of all patients from the previous day or a CSV file of all of the patients from the previous day. PCPs receive alerts in one of three ways: 1) PCPs with an EHR can receive an HL7 message to their EHR; 2) PCPs that use the OptumInsight clinical messaging system can receive their alerts through that system; or 3) the alerts can be delivered via MirthMail email using secure Direct protocols. HealthBridge is live with Direct and is an active HISP. The alert includes the information on the diagnosis and reason for admission. The system does not utilize the IHE Publish/Subscribe Infrastructure, but HealthBridge does utilize CONNECT and Direct protocols in addition to proprietary standards.

HealthBridge and privacy and security staff from participating providers reviewed the technical and policy framework for implementing the alert system and agreed the proposed alerts are part of treatment and operations. Participating providers have signed updated data agreements with HealthBridge to ensure HIPAA and HITECH compliance. In addition, patients involved in the program have been given a notice from their providers related to their provider's participation in Beacon program activities. Providers send a weekly list of their active patients to HealthBridge to document the patient-provider relationship.

Moving forward, HealthBridge is also implementing strong business intelligence tools to help expand capabilities to improve care through timely provider notifications targeted to specific populations of high-risk patients. Providers will not want to receive notifications on all of their patients, just those with a selected condition. Using business intelligence tools, providers will be able to use risk stratification to identify the patients that need higher levels of monitoring. Business intelligence tools will allow providers to better customize their subscriptions as well.

Indiana Health Information Exchange (IHIE)

IHIE currently has the capability for physicians to be alerted when patients are admitted to the hospital, but not many providers use the service today. The lack of provider adoption is due to the admission information being less important to providers than the discharge summary. As part of the alert system, providers will receive the admission information in a format similar to a registration face sheet. When patients are admitted to the hospital, they are asked for the primary care physician's information. This information is used to determine the provider that should be notified. One of the challenges of the current

system is that many patients do not remember their primary care provider's (PCP) information or the information is not entered accurately at registration. IHIE uses a standards-based approach to send the notification, but it is not the IHE Publish/Subscribe standard. IHIE is considering building the capability for providers to subscribe to notifications for their patients. It is also planning to use information from the Quality Health First program, in which patients are attributed to a PCP. IHIE will leverage that information to assist in determining the provider-patient relationship.

IHIE does not consider delivery of the discharge summary to be a notification. It is a delivered report much like a lab result or transcribed report. In the IHIE system, discharge summaries are delivered as they are received from the hospital. The only lag time would be in the hospital sending the discharge summary to IHIE. IHIE currently offers three mechanisms for delivery: a clinical inbox that is web based, directly into the EMR, or via fax for providers that are typically rural and low volume. The discharge summary is sent based on who the hospital requests for follow-up, whether it is a PCP, a specialist, or both. When the discharge summary is sent to providers, they are notified of its receipt. The messaging system allows providers to choose which types of documents they want delivered to their inbox. All documents are archived if the provider chooses to view them at a later date.

IHIE is developing a use case for notification of payers when their members are admitted to the hospital or visit the emergency department. This use case is a high value-add for payers, especially managed care organizations (MCOs) and their care managers. IHIE is working on a pilot project with the Regenstrief Institute and an MCO to notify the care managers when a member presents at the hospital or emergency department. There are a few policy issues to be addressed with this use case. First, under new HIPAA regulations, data for patients that self-pay cannot be shared with their insurance carrier and separating out these encounters may prove to be difficult.

Louisiana HIE (LaHIE)

LaHIE went live with its subscription and notification service on November 4, 2011. LaHIE is utilizing the Orion HIE subscription/notification module to manage the service. The module does not utilize the IHE Publish/Subscribe standard, but it is standards based. Providers have the ability to log onto the LaHIE portal and choose six possible notification events: patient presents to emergency department, admission or discharge from the hospital, final lab results, final micro results, and/or final radiology results. Patients are linked to a provider in the EMPI. The link is established via an ADT message, with a field for provider ID, which comes from the participating organization's EHR. When providers subscribe to an event type, they are automatically subscribed to all patients in the EMPI that are linked to them. Providers can choose which patients, based on their relationship (PCP, attending, admitting, consulting physician, etc.), they would like to subscribe to. When LaHIE receives a message for an event, it is automatically run through the rules engine, and a notification is triggered based on the rules. Providers can choose to receive real-time notifications or receive a batch delivery of events from the day. Providers can subscribe to a combination of real-time and batch notifications.

Providers currently receive notification via an email, which does not contain PHI, or in their Direct message inbox on the LaHIE portal. To view PHI, providers must be logged into the LaHIE portal. The system also has the capability to send the notification to a provider's EHR via an HL7 CCD message. However, no EHRs currently have an HL7 CCD interface built to LaHIE.

Since providers must have a relationship with the patient in the EMPI, and they must be logged in to the LaHIE portal and therefore authenticated prior to viewing PHI, HIPAA issues have been mitigated.

While patients cannot yet set preferences on provider notifications, if they have opted-out of the HIE, they will automatically be opted-out of the notification system.

Appendix B: Opportunities in the Context of Payment Reform

There is national recognition that the health system cannot continue down the same path of disjointed, expensive care. Pay-for-performance (P4P) programs have been in place since the late nineties. These programs incentivize providers and hospitals by rewarding them with payments from payers for meeting specific quality measures. P4P programs support increased care coordination, especially of the chronically ill. Coordinating care among all of a patient's providers, as well as including the patient in her care, is pivotal to P4P programs as well as the programs being developed under PPACA. PPACA directs the Centers for Medicare and Medicaid Services to create a number of value-based payment programs. The goal of these programs is to incentivize hospitals and providers to provide higher quality of care, rather than quantity of care. The following programs are in the process of being established.

➢ The Hospital Readmission Reduction Program began October 1, 2012. Hospitals face a 1% reduction in Medicare reimbursements in FY2013 if they do not meet or decrease their readmission rates.

➢ The Medicare Hospital Value-Based Payment program begins incentive payments in FY2013 for discharges after October 2012 for improvement in clinical and patient quality measures.

➢ The Medicaid Bundled Payment Demonstration Projects provide bundled payments for episodes of care. The program began January 1, 2012 in eight states.

➢ The Medicare Shared Savings Program allows providers to form Accountable Care Organizations that share in the cost savings obtained through increased care coordination and adherence to specific quality measures. In April 2012, 27 ACOs were awarded grants to participate in the program.

➢ The Pioneer Accountable Care Organization (ACO) Program awarded grants to 32 ACOs with January 1, 2012 beginning the performance period. The program is testing a shared savings model that has a higher risk than the traditional Medicare Shared Savings Program.

➢ The Advanced Payment ACO Program allows providers to form an ACO and receive an advance payment for the shared savings they expect to generate. The program awarded five grants in April 2012, with additional awards to be announced in July 2012.

➢ The Comprehensive Primary Care Initiative awards bonus payments to primary care providers for better coordinating the care of their patients. Both private and public payers are involved in the program. The initiative is currently live in eight states.

➢ The Community-based Care Transitions Program provides funding to community-based organizations to improve care transitions across the continuum of care for patients who are discharged from the hospital and help prevent avoidable readmissions. Thirty community-based organizations have been awarded grants.

➢ The Medicare Bundled Payment Pilot Program provides bundled payments for an episode of care. The program begins January 1, 2013.

Appendix C: Relevant Reference Materials

"Development and Evaluation of Notifications to Inform Primary Care Providers of Summary Documentation for Their Patients' Hospital Visits," Dissertation by Jacob Stewart Tripp, University of Utah, May 2009. http://www.grin.com/en/doc/269352/development-and-evaluation-of-notifications-to-inform-primary-care-providers.

"IHE IT Infrastructure Technical Committee White Paper 2008-2009: Publish/Subscribe Infrastructure for XDS.b, Version 2.0," August 22, 2008. http://www.ihe.net/Technical_Framework/upload/IHE_ITI_Whitepaper_XDS-b_pub_sub_2008_08_22-2.pdf.

"Impact of a Standardized Communication System on Continuity of Care Between Family Physicians and the Emergency Department," Marc Afilalo et al., Canadian Journal of Emergency Medicine, 2007;9(2):79-86. http://www.cjem-online.ca/v9/n2/p79.

"Information Primary Care Physicians Want to Receive About Their Hospitalized Patients." Kenneth Smith, Sunday Clark, Wishwa Kapoor, and Steven Handler. *Journal of the Society of Teachers of Family Medicine, 2012;*44(6):425-430. http://www.stfm.org/fmhub/fm2012/June/Kenneth425.pdf.