

Healthcare mobile information flow

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Abstract. There are a variety of mobile technologies currently available that have increased the potential for healthcare practitioners to access clinical decision support resources delivered over an array of mobile devices as a component of clinical workflow. Mobile devices ranging from smartphones to iPads, to netbooks are frequently used by clinical practitioners to gain access to vital patient and operational data as a part of their daily regimen. The convergence of mobile technology, pent-up demand by practitioners, and increasingly “smart” devices is spiking the potential for widespread deployment. This paper looks at the market drivers from the perspective of the STM publisher. The conclusion is that of the various mobility options available, the most promising for the publishers is to increase their interest in converging traditional referential content with newer forms of electronic workflow tools that uses an interactive data layer to access patient workflow data from a variety of embedded Hospital Information Systems (HIS). The Thomson Reuters Clinical Xpert solutions are presented as examples of these evolving services. This opportunity should expand the publisher’s legacy position within clinical decision support driven by the healthy forecast adoption rates for mobile e-Services among providers at the hospital and physician level. Given increasing regulatory mandates in the US along with likely improvements in Electronic Health Records (EHR), publishers along with new types of service providers from the Healthcare Ecosystem will likely be competing as they seek to expand their footprint by offering enhanced mobile clinical decision support data driven services in what is forecast to be a growing market opportunity.

Keywords: Mobile devices, healthcare, clinical decision support, smartphones in healthcare, iPads in healthcare, market drivers, EHRs, healthcare mobile technology

Fact: The capabilities of mobile technology are greatly influencing the practice of medicine today.

Forecast: As the technology matures there is potential for a huge amount of workflow content to become available for use over mobile devices.

Question: What will this continue to mean for STM publishers and their customers?

The best way to tackle this question is to define the mobile technologies that are already being used by medical practitioners around the world. In addition, we need to drill down to the applications that are potentially the most suitable for the STM publishers.

Mobile technologies: There are a general mix of converging mobile technologies currently in use including:

- *mHealth:* Is considered to be a component of eHealth [1]. It is best defined as the practice of the medical practitioner and public health services provider supported by mobile devices. mHealth, has been embraced by the UN World Health Organization (WHO) as a way to manage healthcare in third world countries [8]. Although mHealth includes the collection of a patient-related health data, a large component of mHealth involves the use of sophisticated and proactive mobile devices for the monitoring of patients.
- *Telemedicine:* Is an application of clinical medicine where medical information is transferred through interactive audiovisual media for the purpose of consulting, and sometimes for remote medical procedures or examinations. It may be performed on a real time (synchronous) or delayed (asynchronous) basis. Mobile devices may be used, but this technology is truly about the provision of a medical intervention using at least two points of communications between medical specialists connected for the purpose of performing or monitoring patient care [4].

- *Mobile content*: Refers to referential healthcare-related content that may include a variety of information formats including disease monographs, drug-related descriptive content, order sets, protocols and even some social networking content.
- *Workflow content*: Refers to a variety of clinical or operational patient-related content including, electronic health records (EHRs), charge captures, patient index, scheduling, patient alerts, lab data, financial/billing management, performance management data and diagnostic imaging. Workflow content had been confined to storage and retrieval directly from a variety of health information systems (HIS) that are in place within medical institutions. However, due to advances in mobile technology, an increasing array of these data are now available to medical practitioners over mobile or web-based devices.
- *Mobile solutions for interactive data management*: These are the software solutions that are capable of accessing, reformatting and transmitting workflow content from HIS by virtue of an interactive data layer that permits communication with a variety of mobile devices.
- *Mobile devices*: Are the familiar handheld devices ranging from smartphones to netbooks that have advanced in capabilities over the recent past. These devices are now being used to not only review text, but also to perform a variety of healthcare-related tasks at the point-of-care.

Opportunities for the STM publisher: Based on a review of the practice and attributes of these mobile technologies it would appear that the best and most logical opportunities for the STM publishers will be in the domains of referential content and workflow content. The already available capability to “marry” this content with HIS to offer usable options via mobile devices would fit well into the established capabilities and future opportunities available to publishers.

Whereas, mHealth and Telemedicine appear to be more associated with the actual practice of medicine either for some form of intervention or monitoring. Although these areas may be very interesting in terms of coverage and content, it is unlikely that they represent viable options for content publishers. In contrast, the evolving need and expectation that content types will be integrated and accessible over various devices, including wireless should lead to profitable services that support various types of healthcare apps.

Figure 1 illustrates the array of information-based mobile options that publishers may elect to consider.

Market drivers: In addition to the practical reasons for STM publishers to seek opportunities providing value added-content-driven services directly to mobile devices, there are very compelling market developments that speak to the rapid deployment of devices and increasing levels of content that are becoming available. These trends range from both a general mobile market, as well as impressive healthcare practitioner adoption rates:

- (1) Worldwide mobile device sales to end users reached 1.6 billion units in 2010. This represented a 31.8% increase from 2009 [2].
- (2) Smartphone sales to end users were up 72.1% from 2009 and accounted for 19% of total mobile communications device sales in 2010 [2].
- (3) Worldwide mobile phone sales to end users reached 32.7% growth in the fourth quarter of 2010 with sales of 452 million units [2].
- (4) Worldwide mobile application store downloads to reach 17.7 billion in 2011, a 117% increase from an estimated 8.2 billion downloads in 2010 [2].
- (5) A survey from 2009 reported that 53% of physician respondents own a smartphone and 63% of those physicians are using mobile medical applications [5].

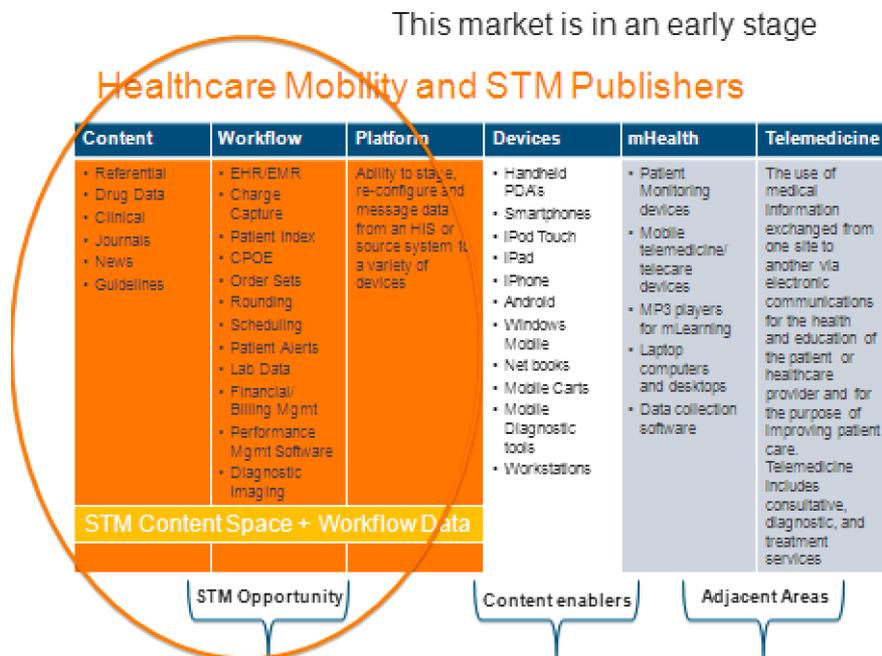


Fig. 1. Healthcare mobility and STM publisher opportunities. (Colors are visible in the online version of the article; <http://dx.doi.org/10.3233/ISU-2011-0626>.)

(6) EHR vendors have begun to offer remote access to EMRs (Electronic Medical Records) via smart-phone applications [6]. For example, an Epic Systems partnership with Apple was announced in 2009 for a mobile EHR pilot.

At this point we should emphasize the distinction we see between EHR, EMR and PHR. EMR’s pertain to medical records that originate within a particular network, system or provider. They are used within the units connected to the system, but not interoperable outside of the native environment. Meanwhile, EHR’s would be interoperable over additional networks and part of a much richer Health Information Exchange (HIE) environment. A third type of electronic record, the Public Health Record (PHR), refers to records populated by individuals that could be useful in a variety of situations but not necessarily as accurate as the practitioner driven record.

The datapoints above illustrate the enormous pace of uptake within commercial markets which has had an impact on all verticals including healthcare. The survey results collected from medical practitioners further illustrate that there will likely be a pent-up demand for mobile content services. These findings are in sharp contrast to previous studies from the past decade that illustrated reluctance on the part of medical practitioners to embrace computer-related innovation. The surge in a new force of computer-literate, or more appropriately stated computer-dependent healthcare practitioner should represent good news to STM publishers and service providers with mobile content, applications and devices.

In fact, a recent publication from Outsell indicated that, “Large healthcare publishers such as Hearst Business Media, Reed Elsevier, Thomson Reuters, and Wolters Kluwer have a portfolio of products that support clinicians, healthcare providers, and payers along the healthcare workflow. These products are still evolving as the technologies mature”. The report further noted that “the most highly competitive area is in clinical decision support tools . . .” [7]. In addition Outsell expects increased focus on

content integration with “work-flow needs and just-in-time delivery driving competitive features and pricing” [7].

Figure 2 lists some of the most notable providers of mobile content.

Current status summary. Table 1 summarizes what we can achieve today along with the potential for future services to offer:

Service example: Thomson Reuters Clinical Xpert. The Thomson Reuters Clinical Xpert Workflow Suite of solutions offers access to real-time patient data to any caregiver directly at the point-of-care via the Web and mobile devices, including the iPhone®, iPad™, as well as Windows Mobile, Palm and BlackBerry smartphones. Clinical Xpert permits hospitals to deploy a single system that is designed to improve clinical efficiency through better access to critical patient information, identification of high-risk patients, charge and procedure management, care team coordination and medication reconciliation. The Clinical Xpert suite includes the Thomson Reuters Pharmacy Xpert, which fulfills the goal of combining real-time surveillance with Micromedex® referential clinical decision support (CDS) content. The goal of this service is to improve medical outcomes, reduce-costs and manage risk. In addition, the suite includes the Clinical Xpert CareFocus tool that provides clinical surveillance by applying hospital-defined



Fig. 2. Selected list of Healthcare mobility service providers of either referential content and/or clinical workflow data. (Colors are visible in the online version of the article; <http://dx.doi.org/10.3233/ISU-2011-0626>.)

Table 1

Current status summary of mobile information capabilities

| Today | Tomorrow |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Relevant information derived from a patient encounter may be documented and transmitted to a mobile device. • However, previous information documented in various disparate medical records may not be readily available. • The available patient data may be combined with value-added referential content delivered to a mobile device at the point of care in a manner useful for clinical management and clinical decision support. | <ul style="list-style-type: none"> • Much more patient-related information will become consistently available at the point-of-care for use during ongoing treatment and prevention. • Anticipated progress based on regulatory requirements in the US and other countries will drive adoption of standardized patient data available for retrieval over mobile devices. |

clinical profiles against real-time patient data. The objective is to identify high-risk patient populations and to alert physicians when immediate intervention is needed [3].

Figure 3 illustrates the way Clinical Xpert incorporates a translation engine, staging database, enterprise conduit and user interface to achieve the goal of transmitting data from HIS systems to mobile devices, and back.

Figure 4 illustrates the components of the solution including the patient data, and mobility capability at the base of the pyramid combined with the addition of Micromedex Content and an application layer at the top.

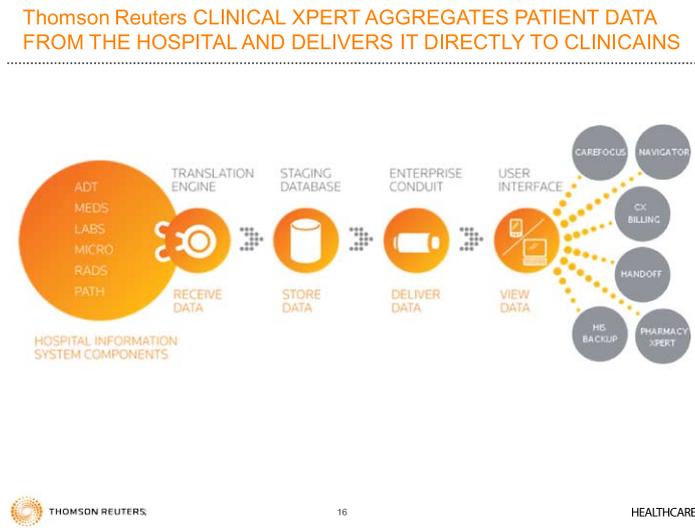


Fig. 3. Thomson Reuters Clinical Xpert dataflow. (Colors are visible in the online version of the article; <http://dx.doi.org/10.3233/ISU-2011-0626>.)

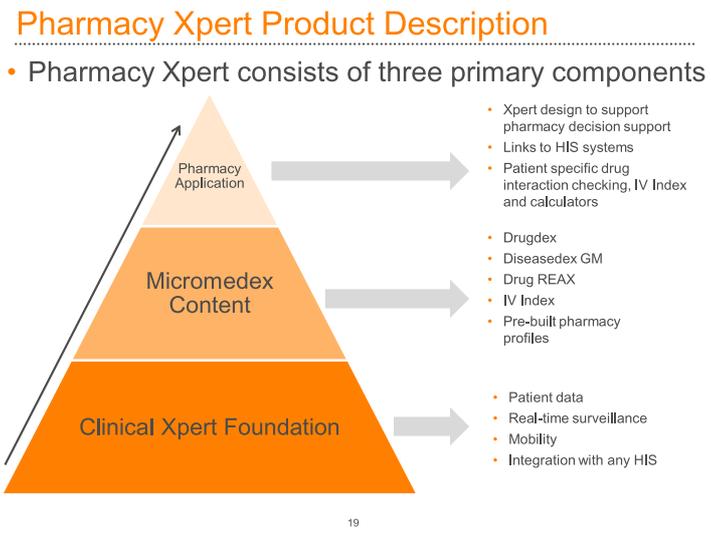


Fig. 4. Pharmacy Xpert product description. (Colors are visible in the online version of the article; <http://dx.doi.org/10.3233/ISU-2011-0626>.)

Table 2
Wireless technical options

| Technical option | Pro's and con's |
|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Web-based approach via a "Browser" | <ul style="list-style-type: none"> • Quickest option to achieve. • Not a complete solution (no off-line capability; may not be able to use various device-related features). |
| <ul style="list-style-type: none"> • Vendor Specific (Publisher picks the Device) | <ul style="list-style-type: none"> • Works well within the capabilities of specific devices/platforms. • However, some platforms may not have specific capabilities or include limits that must be considered. For example, Apple-based devices do not permit Flash as of the time of this writing. |
| <ul style="list-style-type: none"> • Hybrid Digital Platform | <ul style="list-style-type: none"> • Permits services to multiple device platforms. • The challenge is to pick the "right" platform which may have network related implications or user-centric demographic impact. |

Business model: Unlike traditional referential content that may be offered easily via a subscription, transaction, advertising or sponsorship business model, the mobile application of published content and workflow data requires both a software component and content component. A simple subscription would not recover the costs associated with content retrieval from the HIS. Services like Pharmacy Xpert generally require a combination of a software model that is a capital investment along with the potential for a subscription-based model for the more traditional content. The software model may include a perpetual lease with provisions for maintenance and update. However, this type of model requires investment at the institutional level. In addition, users may download applications from an "app" store, however, these apps are merely shells or "skinny" versions of the full solutions. The apps provide full functionality only when the parent institution has made the basic investment to offer data.

Technical issues: There are technical options that must be weighed and finalized before any content may be made available to a mobile device. There are numerous items that must be carefully planned, not the least of which involves decisions about which devices to enable. Regardless, of the device selection there are three important technical options that must be considered before the content will be available to a mobile device. Table 2 illustrates the alternative approaches.

There are various publications that provide a great deal more depth to this discussion, such as "Building Applications for the Mobile Web, Best Practices", at Thomson Reuters Legal, November 2010.

Challenges moving forward: In order to achieve the true potential from the use of mobile devices within healthcare there will need to be technology improvements and user adoption that will increase the availability and quality of available patient-related information. Currently, there are interoperability, data standardization and user-adoption challenges that must be overcome for more robust deployment of these services. It is anticipated that pending regulatory requirements in the US should serve to spur the development of electronic records over time. The following forecasts from industry consultancy Frost & Sullivan provide a healthy prognosis for the adoption of electronic health records among hospitals and physicians (see Figs 5 and 6).

Conclusion: Mobile technology is already providing important services to healthcare professionals that include clinical workflow and referential content delivered directly to the point-of-care. These services permit some degree of clinical decision support. However, there will be a need for progress in the creation and adoption of a ubiquitous EHR. EHRs would permit additional vital information to be made available for use over these devices. As any physician would agree, the lack of certain key data pertaining to allergies, medical conditions and drug consumption could have profound negative influence on patient outcomes. However, there is evidence that the combination of EHR coupled with even more advanced

U.S. Hospital EHR Adoption Forecasts

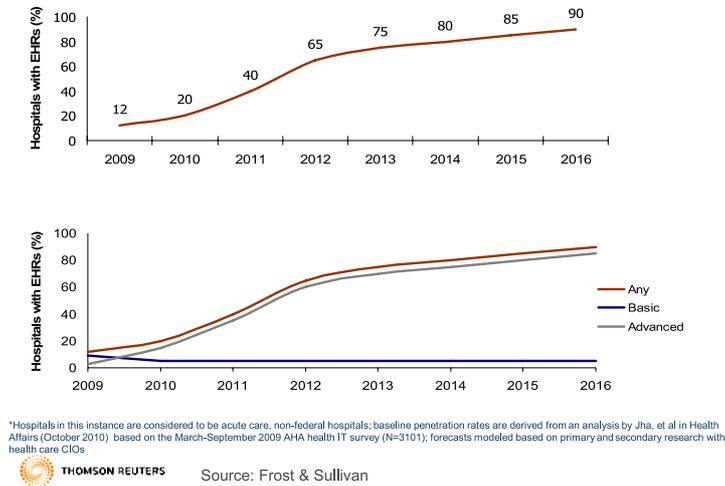


Fig. 5. US Hospital EHR adoption forecasts, Frost & Sullivan. (Colors are visible in the online version of the article; <http://dx.doi.org/10.3233/ISU-2011-0626>.)

U.S. Physician EHR Adoption Forecasts

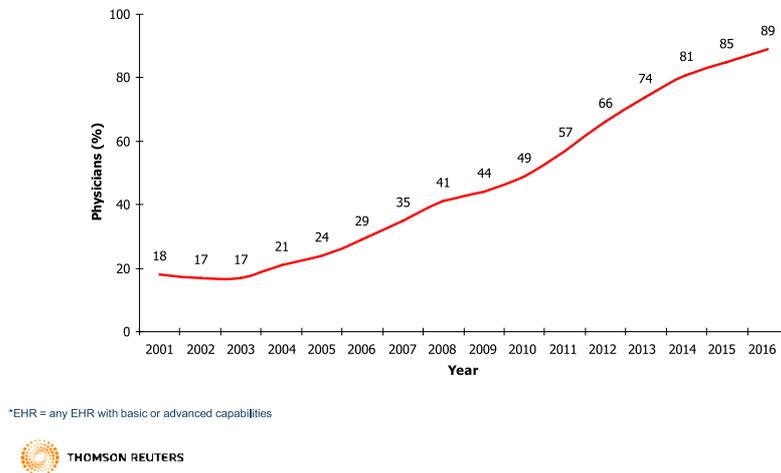


Fig. 6. US Physician EHR adoption forecasts, Frost & Sullivan. (Colors are visible in the online version of the article; <http://dx.doi.org/10.3233/ISU-2011-0626>.)

wireless device features should have a major impact moving forward on both the level of information that will become available and the ability of medical practitioners to access this content.

As mentioned earlier, STM publishers already have a foothold in this emerging business opportunity. However, there are a number of competitors who may join the mix of service providers. The emerging industry ecosystem may include not only traditional publishers, but also other non-traditional content providers. The new world may include participants from the medical equipment, software and insurance

payer industries to add to their incumbent revenues by virtue of breakthrough mobile services aimed at improving patient care and physician or institutional performance. In addition to helping suppliers, these services may serve to improve quality of care for patients and contribute to needed cost savings within the healthcare domain.

References

- [1] Towards the development of an mHealth strategy: a literature review, Original Draft prepared by Patricia N. Mechael for the World Health Organization, August 2007; Updated by Daniela Sloninsky for the Millennium Villages Project, The Earth Institute at Columbia University, August 2008.
- [2] Gartner Research, Forecast: mobile application stores, Worldwide, 2008–2014.
- [3] http://thomsonreuters.com/products_services/healthcare/healthcare_products/clinical_deci_support/clinical_xpert_clin_workflow_solutions/.
- [4] ICUcare LLC, What is Telemedicine?, 2010, available at: <http://www.icucare.com/PageFiles/Telemedicine.pdf>.
- [5] MDSearch Smartphone survey, 2009.
- [6] Mobilehealthnews, Mobile health Q1 2010 state of the industry, 2010.
- [7] Outsell, Inc., Growth trends in the market for clinical decision support tools, June 2010.
- [8] Vital Wave Consulting, mHealth for Development: the opportunity of mobile technology for healthcare in the developing world, UN Foundation – Vodafone Foundation Partnership, Washington, DC, 2009.