

**SPECIAL REPORT**

..... The New Model of Health Information  
..... Exchange: Using Data and Analytics  
..... to Improve Health Care Delivery

2012



**eHEALTH INITIATIVE**  
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Electronic Health Records (EHRs) and the available health information technology have the potential to do more than simply collect, aggregate and report on data to demonstrate compliance with Meaningful Use. EHR data and a new model of health information exchange, using data and analytics, can also be leveraged to improve care delivery and outcomes, reduce healthcare costs, improve drug discovery protocols and provide better information to enhance patient safety.

## I Introduction

The rapidly evolving field of health information technology (health IT) is transforming the healthcare system in the United States, offering new waves of integrated electronic and mobile solutions that solve some of the most challenging aspects of providing, coordinating and delivering health care in a safe, effective, and quality manner. No longer as encumbered by the lumbering, fragmented system of care of the past, today's health providers and caregivers are beginning to harness the potential of data and analytics with integrated health IT innovations that offer new decision frontiers. In the digital health paradigm of the 21<sup>st</sup> century, health IT can help enable informed decisions at the point-of-care within the normal workflow. Customized, real-time clinical and administrative data can be seamlessly accessed and exchanged between providers, patients, insurers, and others to improve the quality, safety, and efficiency of care delivered across the care continuum. This ability has largely been catalyzed by the passage of the American Reinvestment and Recovery Act (ARRA) in 2009, which included the Health Information Technology for Economic and Clinical Health (HITECH) provisions.

## II Background

HITECH legislation provided financial incentives to encourage the adoption and use of electronic health records (EHRs) in health care practices and hospitals across the country through a series of policy levers. HITECH has assisted in accelerating the implementation of a roadmap to improve health care outcomes at an individual and population level through the timely and secure electronic use, exchange, and reporting of health information.<sup>1</sup>

This adoption of EHRs across various health care settings has led to a rich supply of localized data that holds tremendous promise to improve the efficiency and quality of patient care while reducing costs and errors. Studies have revealed that the continued use of EHRs offer the following benefits:

- The elimination of more than two million adverse drug events;
- The reduction of over 190,000 unnecessary hospitalizations a year; and
- The reduction of medication processing time by 68 percent and problem medication orders by 58 percent.

EHRs may access data from varied sources, including labs, radiology and pathology, among others in order to develop a comprehensive and accurate patient record that can be accessed at the point of care. However, access to cross healthcare organizational boundary data, such as acute care, behavioral health and rehabilitation, is complex and the cost of providing this access is often very high. Therefore, as the

EHRs become more standard within medical environments, there is still a concern about how the data within each of the systems can be accessed throughout a community. Aggregating the data from multiple EHR systems to view entire communities will provide a complete, patient-centered view of each individual's healthcare data. Access to results of treatments for similar conditions among individuals will allow for the development of better evidence-based care protocols. The full mobility and availability of a patient-centric view of an individual's healthcare data can lead to better care coordination and more effective care management for both individuals and entire communities.

The first phase of Meaningful Use incentives, Stage 1, has driven a marked increase in the adoption and use of EHR technology nationwide. However, the development of an ecosystem that embraces the diverse EHR solutions to harness digitized data and realize the promise of analytics has been frustrated by the overall lack of availability and mobility of both clinical and financial information between competing organizations. Thus, the power of predictive modeling, clinical decision support, population management, and more has been forestalled except for in areas that have managed to provide for cross-competitive organization integration. Without pre-existing uniform standards, protocols, or guidelines for interoperability in place, a number of adopters have diverged in their approaches. As a result, most EHRs today are siloed, unable to send and receive information across transitions of care or facilitate query-based exchange unless customized solutions are coded at the community, regional, and/or state levels.<sup>ii</sup> Without the ability to conduct health information exchange, it is unclear what entities will do in the future to rectify the ensuing EHR chaos.

### III Purpose of This White Paper

This white paper will expand upon the potential of EHRs to do more than simply demonstrate compliance with Meaningful Use. It will illustrate how EHR data can also be leveraged to improve care delivery and outcomes, reduce healthcare costs, improve drug discovery protocols and provide better data to enhance patient safety. Specifically, the utilization of a new model of health information exchange (HIE) that represents a comprehensive and integrated solution for both clinical and financial information can reduce the ensuing EHR chaos and provide the following advantages to various settings:

- Hospitals and Health Systems can leverage a new approach to HIEs to integrate, aggregate and view data from disparate demographic, clinical and EHR sources. This collective data can be leveraged to manage care, increase physician affinity, reduce readmissions, improve outcomes and strengthen healthcare delivery. The use of this EHR data can also help hospitals and health systems more closely align their inpatient workflow with evidence-based guidelines. For example, the American Heart Association/American Stroke Association leverage EHR data in collaboration with hospitals across the country to more effectively align their treatment of cardiovascular disease and stroke patients with evidence-based guidelines.
- Accountable Care Organizations can leverage the HIE to aggregate data from EHRs used by their affiliated physicians in order to create comprehensive health records for each of their members. This aggregated EHR data in the form of a comprehensive physician record can be used to identify gaps in care. These can subsequently be used to proactively manage care delivery to patients with chronic conditions such as diabetes and hypertension. Health records compiled

with EHR data can also be used to improve performance measurement and facilitate the transformation to new care delivery models, such as Consumer Operated and Oriented Plans (CO-OPs) or patient-centered medical homes (PCMHs).

It will also discuss the evolving technology of an HIE, as it moves from simple collection and exchange of data for patient care, to one that can leverage the data from EHRs to provide insight into population-based care as well as leading to more effective community care management.

#### IV EHRs are often Standalone Systems

Even with the evolution of HIE over the past decade, one of the most significant issues with EHRs continue to be that they are often developed and installed as standalone systems that are part of a larger health information network. An EHR can support the management and coordination of care by providing accurate, complete, secure, and up-to-date information. Moreover, by recording, monitoring, and analyzing a complex combination of clinical, administrative, and claims-based data, EHRs can facilitate the reduction of medical errors and waste, improve communication, and inform decision-making processes. However, fragmented or incomplete patient records can hinder the ability of an EHR to perform critical services, such as sending an alert when a duplicate procedure is ordered or effectively coordinating care among disparate providers. Without interoperable systems that are capable of filling in the digital gaps of a patient’s longitudinal medical history, health providers can be limited by disparate technologies. This becomes a critical deficiency to measure quality within a healthcare organization, which is one of the principal foundations of the meaningful use program.

The first stage of Meaningful Use requires eligible professionals (EPs) and eligible hospitals (EHs) to meet a set of core objectives and menu objectives, which include the use of Computerized Physician Order Entry (CPOE) and electronic prescribing. Providers must choose 5 menu objectives from a set of 12, which include the implementation of drug formulary checks or advanced directives, and one of which must include an objective regarding population health (such as the submission of electronic data to immunization registries). EPs and EHs must also report on core or alternate core clinical quality measures. The proposed rule for Stage two of Meaningful Use has a wide ranging list of 125 potential quality measures for eligible professionals (EPs) and 49 potential measures for eligible hospitals (EHs) and critical access hospitals (CAHs). CMS is committed to aligning quality measurement and reporting among multiple programs. All measures have been assessed against six domains based



Figure 1: Proposed Domains for Clinical Quality Measures

on the National Quality Strategy's six priorities and include the following, as shown in Figure 1.

However, measuring quality in an uncoordinated network of providers' results in a gap between quality and cost, in which treatment protocols are prescribed and reimbursed without a focus on outcomes. As long as payment and outcomes are not aligned, the cost of healthcare will continue to rise, placing the United States long-term fiscal balance at risk. Healthcare spending within the US accounted for 14.9% of gross domestic product in 2007, with projections indicating that number will rise to 20% by 2019. Furthermore, the lack of a coordinated system increases the risk for and probability of medical errors, which can increase healthcare costs and, in some cases, cause harm or the death of a patient. The Inspector General of the US Department of Health and Human Services issued a report in 2007 entitled "*Adverse Events in Hospitals: National Incidence among Medicare Beneficiaries.*" The report, which studied 780 hospitalized Medicare patients, found that over 13.5% experienced preventable errors in care that led to temporary harm, permanent harm or death. Extrapolating that percentage to the entire Medicare population suggests that approximately 15,000 preventable deaths of Medicare patients occur every month.

## V Intersecting EHR data for Care Delivery

Yet, the passage of the Patient Protection and Accountable Care Act (ACA) in 2010 has produced a ripple effect of reform in which care delivery is focused on improved patient outcomes, improved efficiencies in the delivery of care and an emphasis on quality improvement. ACA provisions are fundamentally transforming the practice of healthcare through a team-based, systems approach towards care coordination. The emphasis on quality that was part of the framework for Stage 1 of meaningful use and will be enhanced in Stage 2 can effectively lead to cost efficiencies between providers, payers and patients by reducing medical errors and lowering the risk of preventable deaths. EHRs have evolved from digital records of care into systems capable of advanced data generation to allow for the detection of quality trends over time and identify risk factors that may compromise patients' outcomes. Such trends could be analyzed and monitored by retrospective analytics but increasingly more strategic, predictable analytic capabilities are being utilized that are dependent upon broader data sets across the care continuum than just EHR data. These developments facilitate the creation of a value-based network of care that is a significant component of ACA: the accountable care organization (ACO).

An accountable care organization consists of a provider group that accepts responsibility for the cost and quality of care delivered to a specific population of patients, using self-reported data to assess performance. Changes in the reimbursement model underpin the quality and cost metrics used to assess an ACO's providers. Rather than rewarding providers for the volume of care provided, ACOs compensate providers based on a balanced measurement of quality of care delivered and cost containment achieved. The formation of an ACO has the potential to significantly benefit patients, particularly through care coordination, more efficient care processes, performance measurement and quality improvement.

The ACO is significant in bringing primary care providers into the network, creating the network structure, facilitating communication and other organizational tasks. This model of care delivery

### Case Study:

#### North Texas Specialty Physicians

North Texas Specialty Physicians (NTSP) is an independent physician association in Fort Worth whose core business is managing risk for more than 50,000 capitated Medicare Advantage patients. In an effort to increase the quality, safety, and efficiency of care delivered, NTSP decided to transform its paper-based healthcare system into an electronic and integrated care delivery model with Sandlot Solutions to facilitate the collection, use and distribution of real-time patient data parsed from multiple disparate sources. The system is interoperable with various EHRs and automatically sends and receives Continuity of Care Documents (CCD) prior to a scheduled visit, allowing NTSP physicians to better assess patient medical history at the point-of-care.

HIE has significantly reduced medical errors and waste by improving patient-physician communication, disease management, and administrative workflow. Interoperable with a number of hospitals, laboratory providers, and radiology groups, the HIE processes on average 2.9 million clinical data elements per month. A real-time, gap-in-care prompt has been integrated into Sandlot to further improve quality through data-mining and advanced customizable reporting, supporting population health management. These capabilities support NTSP in not only achieving Meaningful Use, but also supporting *Plus*, their successful CMS Pioneer ACO.

becomes vital in today's era of healthcare. For example, patients with chronic illness are more likely to see multiple providers to manage their conditions, so there is a significant need for the health care delivery system to manage patient care across disparate settings and providers over time. Under the current system, information is often missing at a given point of care, and knowledge about the patient's condition is rarely shared among those caring for the patient. When information is shared between providers, it is frequently incomplete, late or missing, resulting in delays in appropriate treatment, repetition of tests and procedures, and overall inconvenience. ACOs create healthcare teams that act as "receptors" of information from EHRs, who can turn the information into a comprehensive strategy to treat or manage a patient's condition.

However, the capabilities of an EHR system are rendered moot if an ACO is unable to access and share real-time (or near real-time) clinical and administrative data across disparate settings of care. Providers rely upon complete, secure, and up-to-date patient records to deliver a high quality of care, achieve optimal patient outcomes, and avoid medical errors, waste, and misuse that would otherwise be attributable to misinformation. A robust, comprehensive health IT infrastructure can paint a complete picture of a patient's health and history simply by being able to collect, aggregate, and sieve through vast amounts of data for analysis. Real-time access to clinical and financial data can allow for alerts and notifications at the point of care to inform providers about patient medical history, current list of medications, previous operations and/or other factors that significantly impact the decision-making process for everything from screening to diagnosis to surgery. At the population level, data analytics can be further harnessed for population health management and risk stratification to identify at-risk population groups, and help both payers and providers target outreach towards patients that have fallen through the cracks of care.

## VI The Fourth Generation HIE

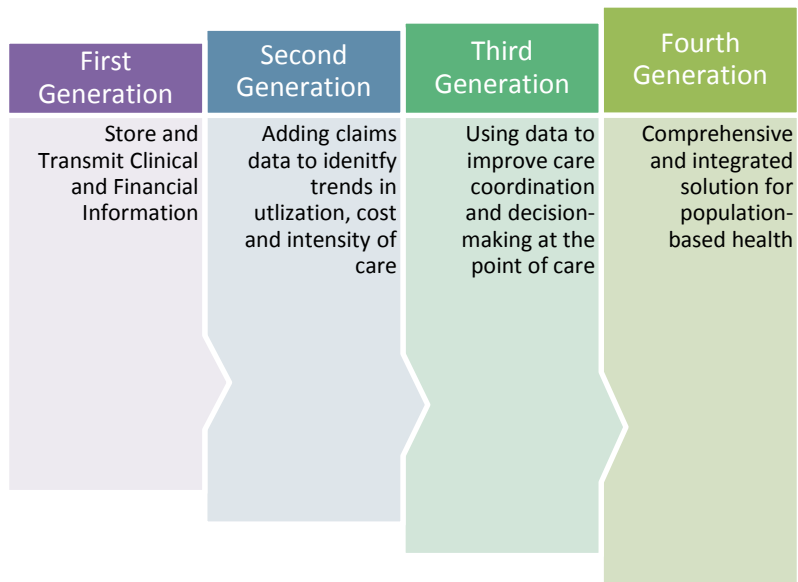
The concept of the ACO stresses accountability at every level of care, which removes the focus from a single provider and instead looks to the network of providers that are responsible for an individual's care, both during an immediate clinical encounter and over time. This approach offers a more thorough and comprehensive assessment of

care as it examines the totality of care provided rather than a single instance. A comprehensive HIT infrastructure is critical to capture and analyze data related to the performance of an ACO because it provides not only an effective method to assess the quality of care delivered by the model as a whole, but also a unique way to share best practices so that the ACO can institute more effective and cost-efficient methods of care for its patients. An infrastructure that can capture, store and analyze data both at the point-of-care and over time grants greater clinical research capabilities necessary to develop protocols for intervention and treatment of conditions, leading more dependable and predictable care. If data captured by an ACO demonstrates a positive trend over time given a specific condition (i.e., diabetes) or specific interventions (i.e., foot and eye exams, Hb1AC tests, etc.), then it is reasonable to assume that adherence to these evidence-based guidelines will lead to the same positive outcomes in the future.

Given this vision, what types of technological solutions exist and what is needed to establish this infrastructure for ACOs and other, new care delivery models? Because the requirements for the EHR incentive program and measures for ACO success are still under development, technological solutions must be variable enough to be usable at both the individual practice level as well as the network level. The transformation of the care delivery system necessitates integrated clinical, financial, administrative and research data from across the provider enterprise, as well as analytic capabilities which are not inherent in all EHR systems that are currently available. Capturing data from each source requires an operational health information exchange (HIE) to transfer real-time data between providers. An HIE capable of bi-directional exchange provides the ability to gather information and to make decisions based on current and up-to-date patient data, rather than on historical or outdated data which can cause inaccurate diagnoses or treatments. Additionally, the repository that holds the data must support multiple interactions, including care management, patient engagement and analytics, among others. Semi-autonomous entities that participate in a de-centralized HIE can share information through defined interfaces and processes in which the interactions are controlled, but can support the same functions as a centralized model.

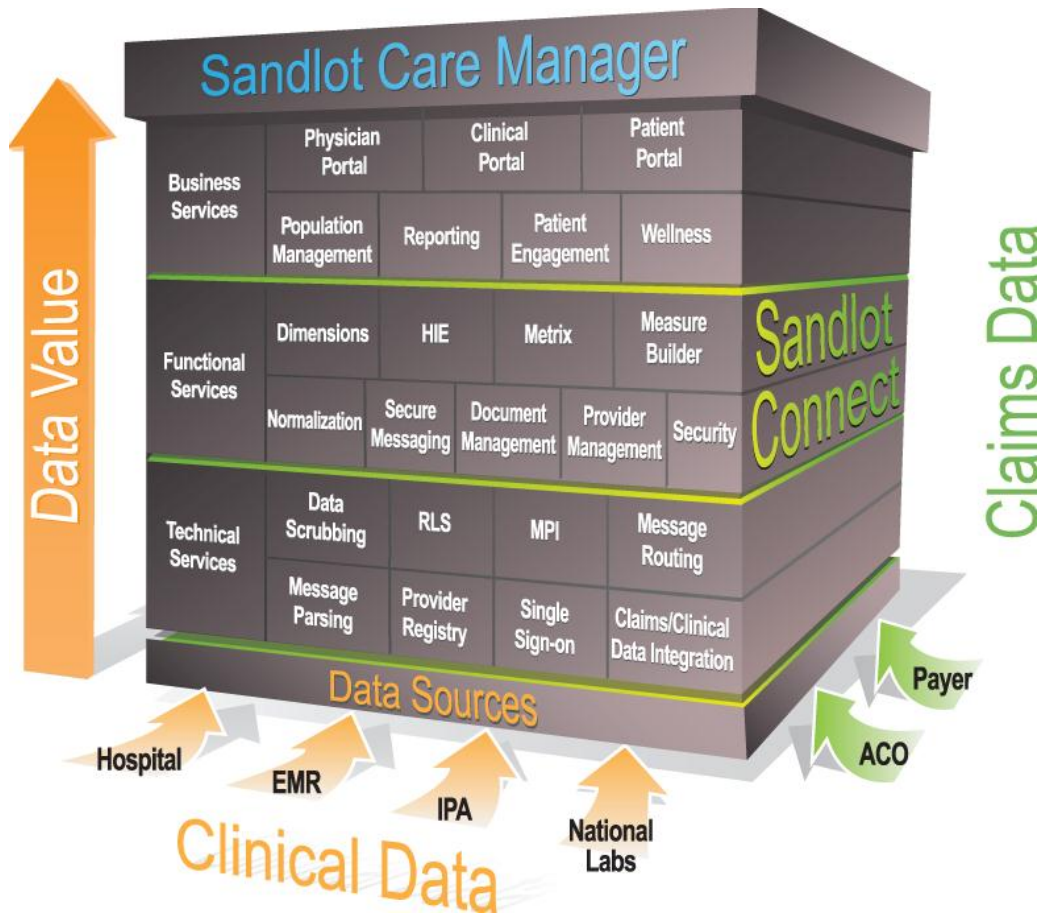
Health information exchange capabilities have advanced through several generations over the years as new functionalities and capabilities are enabled by technological advances. Today, many successful HIEs go beyond the simple bilateral exchange of patient records between entities to extend to the meaningful use of data for the delivery and coordination of care and population health management. The exchange and analysis of data allows organizations to execute point-of-care services such as quality metrics, notifications and clinical pathway guidance support. Advanced HIEs now incorporate the power of the community HIE (first generation) with the strength of managing community risk pools via the addition of claims data (second generation) and the care process management capabilities of a care management solution (third generation) to provide a complete, integrated population risk management and clinical integration solution (fourth generation). Fourth generation HIEs thus offer access to a comprehensive panel of administrative, clinical, and longitudinal patient information that is repurposed from a variety of disparate data sources and formats, as shown in Figure 2.





**Figure 2: Generations of HIE Development**

The analytic platform of this new generation of HIEs provides clinical, claims, and administrative data to produce actionable outcomes for real-time display to health providers and payers. Leveraging the capabilities of a fully integrated HIE solution, providers are notified earlier in the healthcare encounter with information provided at the point-of-care when a patient presents for a specific service. This allows the provider to refer to appropriate care management and disease management programs based on the information they are viewing, as well as supporting appropriate interventions, education and follow-up in a real-time manner. These new HIEs are essential to reducing the ensuing data chaos caused by disparate EHR systems and providing a definitive source of information and custom reports, as well as being flexible enough to comb the clinical and administrative data from multiple EHRs to provide timely information that leads to evidence-based care, increased quality of outcomes and a better healthcare experience overall, which corresponds to the overall goals and objectives of an ACO and other healthcare organizations that hope to reduce costs and improve care.



**Figure 3: Sandlot Solutions Technology Stack**

Illustrated in Figure 3 above is a diagram of the comprehensive healthcare technology infrastructure developed by Sandlot Solutions. The array of products are capable of coordinating care across disparate settings by aggregating health information for a master patient index and HIE (Connect); storing data in warehouses to be shared through HIE and accessed via EHR or physician portal (Dimensions); supporting population health management (Care Manager); and implementing prospective and retrospective predictive analytics (Metrix).





## VII Uses and Advantages of a Digital Envelope

Care givers are familiar with the idea of using folders to transport and secure paper records. This concept can also be expanded to delivering targeted information at the point of care via a digital envelope. This envelope can be filled with contextually aware information about the patient that the care giver is currently seeing, and it can be delivered in a highly secure manner.

The digital envelope is the vehicle that makes data an actionable, valuable asset. Their secure electronic data container is used to protect a message through encryption and data authentication. A digital envelope is sent to various entities through an HIE, and integrates with workflow by presenting item(s) to be acted upon after the display and reporting of data. To illustrate the basic flow of envelope

delivery, a physician is generally notified in their local EMR once pathway information is available. Upon receiving the alert, the physician may search for the patient within the EMR and subsequently receives a Blue Envelope after selecting the patient in question. A pop-up summary of the available pathway information is displayed upon hovering over the Blue Envelope, and physicians can access more specific detail by selecting a pathway of interest (an example of the digital envelope display is shown in the Figure 4 below).



- Default**  This icon is displayed when the application is first launched and any time there are no new alerts that the user needs to be aware of. The icon is returned back to this state after the user opens the alerts window.
- Processing**  This icon is displayed during the retrieval and processing of the alerts.
- Alerts Returned**  This icon is displayed when there were alerts returned from the Metrix web service.
- No Alerts Returned**  This icon is displayed when there are no alerts for the selected patient.

**Figure 4: Sample display of digital envelope**

Sandlot Connect’s digital envelope delivers quality-based metric notifications to care givers while they are in their native EHRs’ workflow. These notifications provide a number of benefits, including:

- Efficiency – using a digital envelope requires less computational resources and does not impede the operation of a system.
- Subscription-Based – a care giver may subscribe to any or all of the various notification services. These notification services are typically constructed using Sandlot Metrix’s Measure Builder tool

and reflect a translation of the contracted measures to meet Health Effectiveness Data and Information Set (HEDIS) or ACO requirements into a computable and reportable format.

- Workflow – since the delivery of the notification is provided within the workflow of the native EHR, the care giver does not have to leave his desktop and login to a different system. The information is delivered in a secure, succinct way.
- Measurable Impact – through retrospective reports and analysis, the impact of the digital envelope can be documented and its return on investment substantiated.

The use of Sandlot’s digital envelopes with a 4<sup>th</sup> generation HIE offer a myriad of benefits. Envelopes can improve clinical quality improvement by enabling the secure, real-time sharing, display, and reporting of a complete patient medical record at the point of care. By facilitating the patient-matching process, this information can improve patient safety by reducing common errors that are otherwise encountered, such as patient misidentification or inaccurate medication history. From an administrative perspective, the security and accessibility of these digital envelopes can seamlessly support the process of admitting and discharging patients, determining their risk for readmission, and producing greater efficiencies in care delivery and coordination. Digital envelopes can not only improve prospective patient tracking by communicating results from risk-based quality metrics to deliver notifications at the point of care, but also retrospectively monitor performance through various measures such as HEDIS, the Physician Quality Reporting System (PQRS), and Meaningful Use that are vital for accountable care organizations. As data is collected, identified, and analyzed, digital envelopes can aggregate disparate sources, formats, and information to facilitate rapid public health surveillance at a population level.

## VIII Conclusion

The present and future applications of clinical integration hold endless promises and benefits. However, to unlock the potential of associated data analytics, it is vital to develop and implement technology that efficiently processes information for optimal use. As more and more information is collected and monitored, new methods and tools are needed to distill information for meaningful use and exchange. A central component of the fourth generation HIE is a digital envelope that drives action through data as it is sent to various entities. By focusing not only the use of data but also its exchange, the new generation of HIE can manage the flow of data from numerous EHRs and the creation of actionable outcomes related to emerging models of care delivery. As health information exchange grows and flourishes at a community, state, and national level, the fourth generation HIE represents a cutting-edge model that will support the completion of the roadmap laid out by HITECH and ACA to ultimately transform health care delivery in the United States through health information technology.

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<sup>i</sup> <http://jamia.bmj.com/content/18/5/678.full>

<sup>ii</sup> <http://content.healthaffairs.org/content/31/3/527.full>