In Support of Emergency Department Health Information Technology

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ABSTRACT
Emergency department visits represent a significant portion of medical care. Emergency physicians require immediate access to clinical information in order to provide quality care. Increased medical errors result when access to the complete medical record is limited. Clinicians' access to clinical information is limited to the greatest extent when care occurs over short time intervals, and between separate healthcare systems. Over the four-year period, the majority (85%) of all patients, stay within the same system; however, of patients with more than one visit, this percentage decreases to 66%. Of patients who return within 24 hours, 75% return to the same hospital or healthcare system. This patient population represents a unique cohort with special healthcare needs. Not only do they represent a disproportionate share of visits compared to those remaining within a single system but they also represent additional, and often underestimated, opportunities to provide quality care.

INTRODUCTION
In 2004, Academic Emergency Medicine sponsored a consensus conference titled Medical Informatics and Emergency Medicine. The inadequacy of immediate access to existing healthcare information for emergency care emerged as a leading concern.

“Like charity, the need for data sharing should begin at home”.
Individual patient care occurs at the local or hospital level. The opportunities for health information exchange to impact patient care must be built upon a solid local or hospital information infrastructure.

Nationally, there were over 115 million visits to emergency departments (EDs) in 2003 representing a significant amount of healthcare delivery. Emergency medicine provides care 24 hours a day. In this environment, timely access to relevant clinical information matters. Studies have shown that providers are more prone to errors when access to the complete case history is limited. ED patients may not be able to recall pertinent medical facts due to new or preexisting conditions. Information on medications, allergies, prior visits and hospitalizations, diagnoses, previous laboratory and radiology data is even more critical when “time is of the essence”.

Unfortunately, even a small delay in retrieving healthcare information makes that information essentially useless for emergency care. While the average emergency visit lasts 3.2 hours, if providers can not retrieve clinical information quickly, it won't be used at all. If it takes hours for the chart to be found, most emergency patients will have received treatment without the benefit of the information contained within those records.

While the majority of emergency patients remain dedicated to a single hospital system -- receiving nearly all their care from one healthcare system, there is still a significant fraction of patients who visit more than one healthcare system. External factors such as job loss, travel, increasing hospital specialization, e.g. heart, stroke, and trauma centers; and hospital ambulance diversion also result in patients being treated at different facilities particularly over time.

Within the subset of patients that visit more than one system, there exists patients with repeat or “return visits” within a short time interval. Early or “return visits” to the ED are often tracked by hospitals as a potential indicator of quality of care. For the clinician, the important elements of the recent visit often are not available when needed. These visits often have higher informational needs and require more time and effort by the clinician to gather the prior visit information. Retrieval of healthcare information, even at the same institution from a visit a short time ago, is often difficult due to departmental quality improvement initiatives and billing processes.

Using data from an established health information exchange, we characterized the patterns of ED care across the community in order to understand the potential role of within and between hospital information exchange.
MATERIALS AND METHODS

The Indiana Network for Patient Care (INPC) is an operational health information exchange founded in 1994 and organized and implemented by the Regenstrief Institute as a collaborative effort starting with Wishard Community and Clarian health care systems and later extending to the major Indianapolis hospitals. The network is centered in the greater metropolitan area of Indianapolis, within which over 1.6 million individuals reside. We originally established the INPC to provide electronic health information originating from all the major Indianapolis hospitals to ED physicians at the point of care, but we continue to add other services over time.

The INPC utilizes real-time HL7 registration messages indicating that individuals are presenting to an ED and a “global patient index” that matches patient identifiers from different institutions based on their demographic data -- name, social security, age, gender, and ethnicity -- allowing for the cross-institutional linking of patient information.

The INPC currently captures data from nineteen distinct facilities. We examined data from five autonomous and competing healthcare systems which have operated and managed twelve EDs (Figure 1) which have been part of the INPC and contributed ED visit data over the last four years. Additionally, these twelve facilities provide almost all of the emergency care in Indianapolis. Two of the twelve facilities are designated level one trauma centers and receive major trauma by protocol.

Data were exported to a PostgreSQL Database (http://www.postgresql.org/). SQL queries were performed to join the individual hospitals information into a single uniform database. Perl and R (http://www.r-project.org/) were used to determine the ED visit volumes from the selected institutions, the distribution of visits among patients, the numbers of patients “crossing over” among the hospital systems, and the number of “return visits” within the specified time interval.

RESULTS

Over a four year period (January 1, 2001 to December 31, 2004) 1,849,460 episodes of emergency care occurred in the target EDs. For this analysis we excluded 3,931 visits (<0.01%) with patient identifiers that were not found in the global patient index file.

A total of 769,535 unique patients (approximately 50% of the Indianapolis population) accounted for the resultant 1,845,529 ED visits. These visits constituted over 94% of all ED visits in Indianapolis during the study period. (Based upon hospital self report of annual ED visit volumes)

On average, each patient had 2.4 (range 1-440) ED visits during the four year study period. Forty-five percent (344,002) of the patients had more than one visit, accounting for 74% (1,356,572) of the total number of visits.

Of the 344,002 patients with more than one visit, 66% always returned to the same hospital or healthcare system; while the remaining 34% returned at least once to a different healthcare system.

The 225,971 (66%) patients who remain within a single healthcare system account for just over half (52%) of the visits, while the remaining smaller share of 118,031 (34%) patients who visit more than one healthcare system account for nearly half (48%) of the remaining visits.
Of the patients with multiple visits, 33,139 had “return visits” within 24 hours, of these, 24,171 (73%) patients returned to the same system or hospital. 8,968 (27%) patients went to a different healthcare system (Table 1). Interestingly, the percentages remain stable up to sixty days after the initial index visit.

Table 1: Comparison of return visits to a healthcare system within a specified time interval

<table>
<thead>
<tr>
<th>Time (days)</th>
<th>Cumulative Visits (N)</th>
<th>Same Healthcare System (%)</th>
<th>Different Healthcare System (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>33,139</td>
<td>24,171 (73)</td>
<td>8,968 (27)</td>
</tr>
<tr>
<td>3</td>
<td>79,853</td>
<td>60,111 (75)</td>
<td>19,742 (25)</td>
</tr>
<tr>
<td>7</td>
<td>140,513</td>
<td>108,205 (77)</td>
<td>32,308 (23)</td>
</tr>
<tr>
<td>10</td>
<td>173,338</td>
<td>134,662 (78)</td>
<td>38,676 (22)</td>
</tr>
<tr>
<td>14</td>
<td>209,725</td>
<td>163,967 (78)</td>
<td>45,758 (22)</td>
</tr>
</tbody>
</table>

The number of ED visits to other hospitals and hospital systems may be spatially related to the distance from the index visit.

Figure 2: Patients seen at one hospital (the small yellow dot in the center of this figure) tend to have their other encounters at nearby hospitals. The number of ED visits at each of the other hospitals is proportional to the dots’ size.

Figure 2 illustrates the importance of exchanging health information at the local level. Each circle represents a hospital, while each color represents a distinct hospital system. The volume of the circle represents the number of ED visits using the yellow hospital as the index patient visit.

Patients with more than one visit have the opportunity to either stay within the same healthcare system, or “cross-over” to a separate healthcare facility. Figures 3 and 4 represent the percentage of “cross-over” by patients and visits respectively. The percentage of patients who “crossed-over” to another healthcare system ranged from 22% to 44%. The percentage of visits ranged from 22% to 44%.

Overall, 15% of all ED patients visited more than one of the five hospital systems during the four year period.

DISCUSSION

Emergency department visits represent a substantial portion of healthcare delivered. In Indianapolis alone, approximately 50% of the population sought care in at least one of the EDs over the four year study period. While the majority of patients visit a single hospital or healthcare system, a substantial fraction visits a separate healthcare system.

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Repeat or “return visits” represent a unique opportunity to optimize healthcare delivery. These patients represent a sizable cohort with special healthcare needs. Not only do they represent a disproportionate share of visits compared to those remaining within a single system but they represent additional, and often underestimated, opportunities to provide quality care.

Our data emphasize the importance of timely access to electronic health information both within and among healthcare systems. While the majority, 85% of all patients, stay within the same system; 75% (a substantial percentage) return to the same hospital or healthcare system within a short time interval. While some of these visits may reflect direct instructions from the clinician, patient transfer, wound care / suture care) many may represent missed opportunities to improve the quality of emergency care delivered.

Emergency visits are just one of the many compelling reasons why the foundation to exchange healthcare information must first be built within local or hospital information infrastructure. Developing acceptable and helpful health information technology within hospitals to effectively communicate relevant information at the point of care requires intensive effort. Systems must incorporate: 1) the ability to identify unique patients accurately, 2) ensure the correct patient’s data is provided when accessed by those from another healthcare system, 3) authenticate the identification of the provider, 4) provide real time data exchange, 5) provide a consistent patient record delivered to clinicians, public health, regulatory and reporting agencies, and consumers, and 6) ensure confidentiality as patient data moves between disparate healthcare systems, handling different levels of security, confidentiality and privacy concerns.

Individual hospitals cannot afford to create separate systems for sharing data in a timely fashion with other facilities. They need to build health information exchange upon existing information repositories and existing flows of clinical data using agreed upon clinical data standards to facilitate the exchange of health information. Adhering to the standards faithfully may cost more and may not be essential when creating healthcare information technology within a hospital or health system but it will dramatically simplify health information exchange with other institutions.

There is an immediate “return of investment” for hospital systems to create the infrastructure necessary to exchange health information. Institutions will first need to focus upon the connections among departmental systems, hospital-wide systems, and integrate existing health care enterprise systems. Transparent and secure national data sharing will ultimately require that a variety of political and technical problems be overcome at many different levels, but these problems should not be allowed to complicate immediate local data solutions.¹

Through sharing clinical data nationally, the National Health Information Infrastructure (NHII) has positioned itself as a means to improve the effectiveness, efficiency and overall quality of health and health care in the United States. There exists tremendous opportunities to improve patient safety, healthcare quality, and to better understand overall healthcare costs.

Figure 5 illustrates the current state of fragmented emergency healthcare and emphasizes the potential opportunities for sharing health information nationally across disparate systems. Each point represents the home address of a patient presenting to a single Indianapolis ED over a seven-year period. This representation of patient visits is apt to be replicated in a similar fashion across the other US 4,078 EDs.

Many describe the NHII as a network of local health information infrastructures (LHIIs), each facilitating exchange of health information in a community. These LHIIs would be connected to each other to form the NHII.

In addition to providing additional clinical information at the point of care, LHIIs are likely to
prove invaluable for epidemiologic and other forms of research. They can also help justify efforts necessary to identify unique patients, standardize messages, merge clinical data, and provide the underlying infrastructure necessary to construct and maintain such a network.

The Institute of Medicine report suggests exchange of electronic health records could result in both time and cost savings for both the patient and physician. A system to share healthcare information across disparate healthcare systems may well reduce diagnostic testing and its attendant discomfort and cost, better prescribing, as well as the epidemiologic research and outcomes management opportunities.

We have characterized the potential opportunities to exchange health information across a single community. Some of the more serious challenges facing our healthcare system today: medical errors, inconsistent quality, and rising costs; can be addressed through effective application of readily available information technology that links providers and health information throughout a community and throughout the country.

These results confirm and extend our previous findings of sharing healthcare data across disparate healthcare systems. Further opportunities exist for a health information exchange to directly influence medical care. The fully realized value of such a system will be a complex function of cross-over rates, the richness of the data available, and the presentation of the data.

“Data is information, and information is knowledge – when seen in the right context by the right person at the right time.”

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REFERENCES


