

# Use of A Hospital Practice Management System to Provide Initial Data for a Pediatric Immunization Registry

Robert A. Jenders, MD, MS<sup>\*</sup>; Balendu Dasgupta, MS<sup>\*</sup>; Dario Mercedes, MS<sup>\*</sup>;  
Frank Fries, BA<sup>+</sup>; Kevin Stambaugh, BA<sup>+</sup>

Departments of Medical Informatics<sup>\*</sup> and Pediatrics<sup>+</sup>  
Columbia University, New York, New York

*An ongoing challenge in the creation of clinical information systems is the capture of structured clinical information from health care providers while avoiding duplicate data recording. Because immunizations are reimbursable medical procedures, practice management systems that already capture such procedures may be used as a source of clinical data for information systems. We instituted a method for capturing such data on one campus of a multi-institution pediatric immunization registry. We measured the effectiveness of this capture by comparing it to manual audits of selected paper charts over 26 months. Of the immunizations documented by chart audit, 39.69% were captured by the practice management system. Of those not captured, we estimate that a substantial portion were immunizations administered elsewhere and as a result not submitted as a claim through the practice management system. In turn, this was affected by a rate of patient disengagement from primary care of 49%. We discuss the issues associated with using claims data to capture clinical information in the setting of an immunization registry and review possible explanations for this data capture rate.*

## INTRODUCTION

### The Data Capture Problem

Health care databases that contain a significant amount of clinical information have been touted as a way to provide quality control [1]. Data entry has been identified as a key bottleneck in the creation of such repositories. Workers have advanced novel strategies for data capture, such as computer-based voice recognition, in order to circumvent this hindrance to data capture [2].

On the other hand, relatively few medical practices use an electronic patient record to capture clinical data [3]. By contrast, as of 1994, 75% of physician offices used computers, mostly for billing and other practice management purposes [4]. This penetration certainly has increased since then.

In order to take advantage of this situation, some system developers have used billing and other data from such practice management systems in order to populate clinical databases, including immunization registries [5, 6]. While this has the potential of easing the burden of health care providers in entering clinical data into computer systems, questions have been raised about the accuracy and completeness of such data [7].

### The Immunization Registry Setting

One of every four toddlers in the United States remains underimmunized despite a national campaign to improve vaccination coverage to 90% [8]. In the late 1980s, a survey of immunization coverage rates for children entering the school system in 20 selected urban areas found only 2 areas in which the rate exceeded 50% [9].

In response to this, the Centers for Disease Control and Prevention (CDC) has funded a number of initiatives aimed at increasing pediatric immunization coverage rates. One such effort is the Northern Manhattan Immunization Partnership (NMIP), a coalition of three hospitals and affiliated medical practices in that part of New York City (NYC). A key part of this effort is the development of an immunization registry that is sited on the Columbia-Presbyterian Medical Center (CPMC) campus of the New York Presbyterian Hospital [10]. The catchment area of the NMIP includes 404,000 and has an annual birth cohort of 8800 (1990 US Census Data), potentially making the NMIP registry a high-volume private enterprise.

In order to populate the NMIP registry with immunization data before its user interface was available to clinicians to document immunizations in the course of a patient encounter, we developed mechanisms to capture data from practice management systems at CPMC and upload those data to the registry.

### Goals of the Analysis

Overall, we sought to study the effectiveness of capturing clinical data from billing data. In order to accomplish this, we compared immunization records captured from the CPMC practice management system with the gold standard of immunization records abstracted from a paper chart audit. Ultimately, billing data are used to provide an initial database of immunization histories in order to minimize retrospective data entry when the immunization registry is used in actual practice in 1999.

### METHODS

We wrote a program to retrieve immunization events from the VSAM data files of the practice management system, the primary function of which is the generation of billing claims. This program was executed weekly in batch mode in order to collect immunizations reported to the billing system after January 1, 1997. These immunization events were converted to a structure known as the Uniform Provider Interchange Format (UPIF), the format required for electronic submission of immunization data to the NYC Department of Health (DOH). We created a second program that uploaded UPIF files to the immunization registry's relational database. The overall process of data capture is summarized in Figure 1.

The data elements retrieved for each immunization were the patient medical record number, patient name, patient address, CPT code for the immunization, the date of administration and the name of the provider under whom the billing record was submitted. These were retrieved for all patients under 8 years of age at the time of retrieval because the applicable NYC law authorized disclosure of immunizations only for this age group.

In the first year of data collection, CPMC phased in a new billing system that also used VSAM files for its repository. The pediatric clinics that participate in the NMIP completed their switch to the new system by November 1, 1997. We modified the batch program to extract the same data elements from this second system.

Data entry for both billing systems was performed by clerks in each clinic. They transcribed patient identifiers, clinician identifiers and CPT codes checked on standard encounter forms at the close of each visit. In anticipation of our data collection

effort, the encounter forms were redesigned in order to include the typical pediatric immunizations, some of which were not present on the antecedent form. In addition, we performed orientation sessions and distributed memoranda at the beginning of the data capture effort in order to encourage clinicians to record immunizations on the encounter form and clerks to transcribe those immunizations into the billing system.

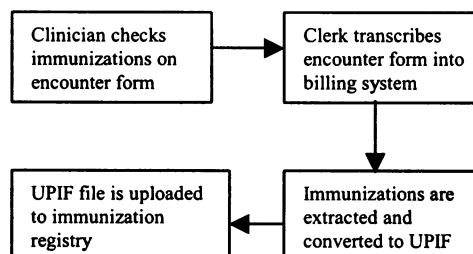


Figure 1. Process of data capture from the billing system.

As part of the overall NMIP effort but not specifically undertaken for comparison with registry data, we conducted periodic paper chart audits in all the CPMC pediatric practices that contributed immunization data to the registry. At each practice site, 200 charts were selected randomly from specific age cohorts (6-11 months, 12-23 months) typically employed in reports of immunization coverage rates. If the practice had fewer than 200 charts, then all the charts in the practice were used. These charts were selected from the group of patients of the appropriate age who had been seen at that practice site at least once. The data elements abstracted from the patient chart included medical record number, vaccine identification and date of administration. The identification of the practice site where the vaccination was administered was not abstracted, so that immunizations given outside the CPMC practices may be captured by the chart audit process. Audit data were stored in a relational database.

In order to capture additional data, we created a process for capturing immunizations recorded on the Lifetime Health Record (LHR). This is a paper document issued by NYC and retained by the parents of pediatric patients. It contains a table on which clinicians may indicate which immunizations were administered to a patient on which date. The LHR was photocopied during a patient's first visit to a CPMC clinic. Key punch operators transcribed these photocopies during spare time. The data files so generated were converted to UPIF and uploaded to

the registry in a manner similar to encounter-form data. After a LHR was photocopied once, it was marked as photocopied in order to minimize duplicate data capture. Because of personnel constraints, data capture from the LHR ended late in 1997. LHR data were combined in the registry with billing data from the first practice management system for the purpose of the current analysis. Capture of LHR data ended before the successor practice management system was used.

In order to analyze the effectiveness of immunization data capture by the billing system process, we compared the gold standard of chart audit immunizations against those immunizations captured by each billing system in turn. For every immunization in the chart audit database, we looked for a match in the billing system data by medical record number, immunization code as standardized by UPIF and date of immunization. Immunizations in the chart audit that occurred before the initiation of billing data collection were excluded from the analysis.

Also, we randomly selected one day's collection of encounter forms from several practices at several points in the study period in order to verify the transcription process and thus isolate potential explanations for a deficiency in the capture rate. We did this because, until the beginning of the NMIP, it was not customary to transcribe encounter-form immunizations into the billing system in the pediatric clinics.

Finally, because visits to multiple clinicians at many different practice sites leads to discontinuity in primary care and potentially to underimmunization, we attempted to quantify the size of the population to which this situation applied. We defined disengagement from the medical home as occurring when a patient under 3 years of age who was seen at least once at a medical practice has not been seen for at least 6 months at that practice.

## RESULTS

We collected data from the billing system files for 26 months. This constituted 46,920 immunizations for 10,907 patients seen in CPMC pediatric clinics during the period January 1, 1997 through February 28, 1999. These data included approximately 200 immunizations that were entered directly via the registry user interface during a test run of the registry system.

The comparison between immunizations detected by chart audit on the one hand and those captured via transcription of encounter forms and the LHR on the other is documented in Table 1. System 1 is the billing system used from January 1 until November 1, 1997. System 2 was used thereafter. Capture of LHR data ended before System 1 was phased out and thus does not contribute to the capture rate for System 2. For the purpose of this analysis we divided the chart audit and billing data into two sets based on whether an immunization was documented during the use of System 1 or 2. Only immunizations that occurred after the beginning of the billing data collection process were used in the comparison.

Billing System	# Billing Immunizations	# Chart Audit Immunizations	Percent Capture
1	1056	24606	4.29
2	3165	7975	39.69

**Table 1. Immunization data capture by billing systems.** # Billing Immunizations is the number of immunizations captured by the billing system that also were documented by chart audit.

To isolate potential transcription errors in the chart audit, we attempted matching immunization dates only by month and year, excluding the exact day from the match. This increased the capture rate slightly but not significantly. Also, for those patients whose charts were audited, we confirmed that all immunizations captured by the billing system were present in the paper chart. By contrast, as indicated in Table 1, not all immunizations in the paper chart were captured by the billing system.

In order to isolate potential errors in the data capture process, we compared immunizations on a random collection of encounter forms to those actually transcribed into the billing system at several practice sites. For System 1, only 16.67% of immunizations on the encounter forms were entered into the billing system files. For the successor System 2, the transcription rate was 100%.

Finally, in the process of performing the chart audits, we calculated an overall rate of disengagement from a CPMC medical home for pediatric patients in the appropriate age cohorts of 49%.

## DISCUSSION

Our rate of capturing immunizations using a data extract from a practice management system was relatively low. It improved in the transition to a newer billing system, but even with that improvement the process did not capture at least half of the immunizations documented in the paper chart.

This is partly explained by limitations present in the chart audit data. The chart audits were designed to assess baseline immunization coverage rates and were not created to assess immunization capture rates by the billing system. Specifically, the auditors did not record the practice site at which an immunization was administered. Now, the disengagement rate for the CPMC practices suggests that significant numbers of patients moved from clinic to clinic, including clinics outside the CPMC network. This suggests in turn that many of the immunizations documented in the chart audit may have been administered elsewhere and thus were not amenable to capture by the CPMC billing system. A process to capture these immunizations was in operation only briefly in the beginning of the period of the current analysis. Thus, some of the discrepancy may be attributable to immunization histories recorded from non-CPMC clinicians. We were able to compensate for this by keypunch entry of LHR data early in the study period, but personnel constraints prevented maintenance of this mechanism. If it persisted, this particular mechanism probably would have improved the capture rate when measured against the chart audit data.

Another possible explanation for the immunization capture rate may be the failure of clinicians to record immunizations on the encounter form that is subsequently transcribed into the billing system. We conducted educational interventions early in the analysis period to encourage recording of ordered immunizations on the encounter form of the visit at which the immunizations were given. However, physician reimbursement did not depend on the documentation of these outpatient procedures. Moreover, most of this effort occurred at a time when data in the registry were unavailable for direct review by clinicians. Thus, clinicians may not have had strong incentives for recording these procedures on the encounter form.

Failure to transcribe immunizations properly recorded on the encounter form also would explain the relatively low immunization capture rate. This seems present early in the effort when the first billing system was being used. However, with time, clerk education and a switch to a newer billing system, the transcription rate rose to 100%. Accordingly,

transcription deficits likely do not explain much of the capture rate, especially in the latter part of the study period.

By contrast, other workers have discovered problems with accuracy and completeness in health care databases derived from billing or claims data [7]. The current analysis confirms such findings. Care is required when data collected for one purpose are used to meet other goals. In particular, our experience suggests that immunization data collected in an administrative system must be viewed cautiously in a clinical setting.

On the other hand, using already established administrative processes, such as encounter form transcription into a billing system file, represents an easy way to capture potentially valuable data without significant change in clinician workflow other than checking a box on an encounter form. It also avoids the duplicate data entry (paper chart and electronic registry) that can frustrate clinicians when using electronic patient records in their practices. However, such data must be used cautiously.

#### **FUTURE WORK**

In order to detect better immunizations performed outside of the CPMC clinics, we will revise the chart audit methodology to record practice site of administration along with previously abstracted data elements. In addition, as the NMIP immunization registry expands to cover the other participating institutions and practices beyond CPMC, we will conduct similar analyses on immunization data captured from their practice management systems. Finally, we plan to retrieve data periodically on NMIP patients from the NYC DOH in order to capture those immunizations administered within NYC but not captured directly by the NMIP registry. This will improve the completeness of the NMIP registry.

#### **SUMMARY**

In order to capture an initial data set for inclusion in an immunization registry, we created an administrative workflow and software to extract immunization data from a practice management system. After switching to a new practice management system, we achieved an immunization capture rate of 39.69% when compared with chart audit data that did not document at which practice site an immunization was administered. Possible

explanations include immunizations that were included in the paper chart but were administered at practices outside of those that use the billing system. This is suggested by the disengagement rate of 49% from primary care within our clinic system. An additional explanation is a failure by clinicians to document immunizations on billing system encounter forms because of a lack of incentives to do so. Transcription omissions from encounter forms by clerks seem not to be a factor, at least in the latter part of our study.

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#### References

1. Palmer RH. Process-based measures of quality: the need for detailed clinical data in large health care databases. *Ann Intern Med* 1997;127:733-738.
2. Grasso MA, Ebert D, Finin J. Acceptance of a speech interface for biomedical data collection. *J Am Inform Assoc* 1997; supplement:739-743.
3. Ornstein S, Bearden A. Patient perspectives on computer-based medical records. *J Fam Pract* 1994;38(6):606-610.
4. Wynekoop JL, Finan JA. A survey of office computing in medical practices. *MD Comput* 1994;11:107-113.
5. Root R, Popovich ML. Developing links between private provider billing systems and immunization registries. *Am J Prev Med* 1997;13(Suppl 1):82-85.
6. Baker AM, McCarthy B, Gurley VF, Yood MU. Influenza immunization in a managed care organization. *J Gen Intern Med* 1998;13:469-475.
7. Iezzoni LI. Assessing quality using administrative data. *Ann Intern Med* 1997;127(8 Pt 2):666-674.
8. Lieu TA, Black SB, Sorel ME, Ray P, Shinefield HR. Would better adherence to guidelines improve childhood immunization rates? *Pediatrics* 1996;98:1062-68.
9. LeBaron CW, Chaney M, Baughman AL, Dini EF, Maes E, Dietz V, Bernier R. Impact of measurement and feedback on vaccination coverage in public clinics, 1988-1994. *JAMA* 1997;277:631-5.
10. Jenders RA, Dasgupta B, Mercedes D, Clayton PD. Design and implementation of a multi-institution immunization registry. In Cesnik B, McCray AT, Scherrer J-R eds. *MEDINFO '98 - Proceedings of the Ninth World Congress of Medical Informatics*. Amsterdam: IOS Press, 1998; 45-49.