

Characterizing the Health Information Technology Workforce: Analysis from the HIMSS Analytics™ Database

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Executive Summary

Health information technology (HIT) has been documented to improve quality and safety while reducing costs of health care, yet there remain many barriers to its wider adoption. Although the barriers of finance and implementation issues are most commonly discussed, less attention has been paid to the workforce required to develop, implement, train users of, and evaluate HIT applications in order to achieve quality, safety, and cost savings. The goal of this study was to use a comprehensive HIT database to attempt to characterize this workforce and identify areas where future research and policy is needed.

We categorize three broad groups of the HIT workforce professionals: information technology (IT), health information management (HIM), and biomedical informatics (BMI). Because they have a recognized Standard Occupational Code, HIM professionals are relatively well-characterized. IT professionals have been analyzed in certain settings and applications, but not comprehensively. The new data in this report, based on the HIMSS Analytics™ Database and its EMR Adoption Model™, provide new insights into IT professionals in health care settings. The final category of BMI professionals still has not been well-characterized but has been found situationally to be vital for HIT implementation success. This group often though not exclusively consists of health care professionals who have training or experience in BMI.

The data in this report focus on IT professionals in health care settings. We extracted data from the HIMSS Analytics™ Database and extrapolated our findings to the United States (US) as a whole. We found the following results:

- There are approximately 108,390 IT professionals in health care the US.
- The amount of IT staff hired varies by level of EMR adoption, with the rate of IT FTE per bed started at a level of 0.082 FTE per bed at the lowest level of the EMR Adoption Model (Stage 0) and increasing to 0.210 FTE bed at higher levels (Stage 4).
- To move the entire country to higher levels of adoption (Stage 4) will require an additional 40,784 IT professionals.

There are limitations to this analysis. First, the HIMSS Analytics Database is incomplete. Second, the data are limited to IT professionals who are mainly in hospitals and do not include those who, for example, work for HIT vendors or in non-clinical settings. Finally, data on BMI professionals are still virtually non-existent.

Our analysis adds to data that show there must be increasing attention paid to the workforce that will develop, implement, and evaluate HIT applications. There are substantial career opportunities for a wide variety of professionals. We advocate that continued research explore IT and HIM professionals further for their optimal organization and education in hospitals and other health care settings. We also believe it is essential to initiate research on the role of BMI professionals in these settings as well. Finally, policy development must be undertaken to insure that HIT workforce development is adequately planned and funded.

Introduction

A growing body of evidence supports the use of health information technology (HIT) to improve quality and safety while reducing costs of health care [1]. However, there are still barriers to HIT adoption, such as mismatch of return on investment between those who pay and those who benefit, challenges to workflow in clinical settings, lack of standards and interoperability, and concerns about privacy and confidentiality [2, 3]. Another barrier, lesser studied and quantified but increasingly recognized, is the lack of characterization of the workforce and its training needed to most effectively implement HIT systems [4-6]. We know surprisingly little about the HIT workforce, as most research assessing it has looked only at specific settings or professional groups.

One of the most comprehensive assessments of the HIT workforce was carried out in England [7]. An assessment of the English HIT workforce estimated the employment of 25,000 full-time equivalents (FTEs) out of 1.3 million workers in National Health Service (NHS). This equated to the employment of about one information technology (IT) staff per 52 non-IT workers. The workers were found to be distributed among information and communication technology staff (37%), health records staff (26%), information management staff (18%), knowledge management staff (9%), senior managers (7%), and clinical informatics staff (3%).

Most studies done in the United States (US) have focused on one group in the workforce, such as IT or health information management (HIM) professionals. To our knowledge, no studies have quantified numbers of biomedical informatics (BMI) professionals, although some studies have qualitatively assessed certain types, such as Chief Medical Information Officers [8, 9]. The value of BMI professionals is also hinted at in the context of studies showing flawed implementations of HIT leading to adverse clinical outcomes [10], which may have been preventable with application of known best practices from informatics [11], and other analyses showing that most of the benefits from HIT have been limited to small numbers of institutions with highly advanced informatics programs [1]. Others have documented the importance of “special people” in successful HIT implementations [12].

There is some data regarding IT professionals in the clinical setting. Gartner Research assessed IT staff in integrated delivery systems of varying size [13]. Among 85 such organizations studied, there was a consistent finding of about one IT staff per 56 non-IT employees, which was similar to the ratio noted above in England. The major roles for IT staff were listed as programmer/analyst (51%), support (28%), telecommunications (16%).

Also assessed have been HIM professionals, finding that the primary work setting for these individuals was hospital inpatient (53.4%), hospital outpatient (7.8%), physician office/clinic (7.2%), and consulting firm (4.2%) [14]. For those involved in electronic health record (EHR) implementation, two-thirds were on the planning team and half were on implementation team. Study respondents indicated that the largest need for more education was in areas of IT, legal and regulatory issues, reimbursement methodologies, and healthcare information systems.

One additional workforce study has focused on a specific HIT application, estimating the workforce necessary to deploy a Nationwide Health Information Network (NHIN) in the US.

[15]. For a five-year implementation time frame, there would be an estimated need for 7,600 FTE for installation of EHRs for 400,000 practicing physicians who do not currently have them, 28,600 FTE for the 4,000 hospitals that do not have EHRs, and 420 FTE to implement the infrastructure to connect the network.

In this study, we assessed the HIT workforce using the HIMSS Analytics Database (derived from the Dorenfest IDHS+ Database™, <http://www.himssanalytics.com>). This database contains self-reported data from about 5,000 US hospitals, including elements such as number of beds, total staff FTE, total IT FTE (as well as broken down by major IT job categories), applications, and the vendors used for those applications. A recent addition to the HIMSS Analytics Database is the EMR Adoption Model™, which scores hospitals on eight stages to creating a paperless record environment [16] (see Figure 1). “Advanced” HIT is generally assumed to be Stage 4, which includes computerized physician order entry (CPOE) and other forms of clinical decision support that have been shown to be associated with improvements in the quality and safety of health care [1].

The major limitation of the HIMSS Analytics Database is its reliance on self-reporting from hospitals which is sometimes inaccurate or incomplete (i.e. a hospital may misreport the number of IT employees, or may fail to answer the question at all). In addition, some sites outsource IT to various degrees or have services provided by other entities (e.g., a community hospital that is part of a larger health system network). Another limitation of the database is the lack of FTE categories that would include clinical informatics specialists. Even health care chief information officers acknowledge the importance of understanding health care [17], and clinical informaticians often provide the expertise that spans health care and IT. This has been addressed in a recent update to the database with new fields, although little data has yet been populated in them.

These limitations aside, the HIMSS Analytics Database is the largest and most comprehensive source of data of its kind, and enabled us to investigate three research questions. First, we wanted to quantify the HIT workforce in the US generally. Second, we wanted to explore whether FTE levels for more advanced HIT, as measured by the EMR Adoption Model score, were different than for baseline levels. Finally, we wanted to estimate total HIT workforce needs in the US at present, and what will be required as more health care organizations adopt more advanced HIT. This research is part of our ongoing interest to better characterize the HIT workforce and understand the competencies and educational curricula for that workforce.

Methods

A query of the HIMSS Analytics Database was carried out on March 11, 2008 for the following data elements:

- EMR Adoption Model score
- Number of beds
- Total hospital FTE
- Total IT FTE
- Total physicians
- Number of IT staff by category

Stage 7	Medical record fully electronic; CDO able to contribute to EHR as byproduct of EMR
Stage 6	Physician documentation (structured templates), full CDSS (variance & compliance), full R-PACS
Stage 5	Closed loop medication administration
Stage 4	CPOE, CDSS (clinical protocols)
Stage 3	Clinical documentation (flow sheets), CDSS (error checking), PACS available outside Radiology
Stage 2	CDR, CMV, CDSS inference engine, may have Document Imaging
Stage 1	Ancillaries – Lab, Rad, Pharmacy – All Installed
Stage 0	All Three Ancillaries Not Installed

Figure 1 – Description of stages for the EMR Adoption Model [16].

Some survey respondents did not provide information on the size of their IT staff, or provided estimates that were unreasonably small (such as 0 IT staff for a 340 bed hospital or 1 staff member for a 394 bed hospital). We excluded all hospitals that did not answer the staff size question or that indicated having fewer than 5 IT staff.

We computed IT staffing ratios, defined as the number of IT full-time equivalents (FTE) per hospital bed for each stage of the EMR Adoption Model, and for our dataset overall. In order to allow for generalization, all comparisons were weighted by bed size. We used the staffing ratios to extrapolate the total number of IT staff required for to cover all licensed hospitals beds in the US, estimated at 761,607 according to the American Hospital Directory (http://www.ahd.com/state_statistics.html).

Results

The query of the database yielded a total of 4,929 hospitals for which an EMR Adoption Model score was available. After eliminating hospitals that did not answer the IT FTE question (n=2,490) and hospitals that listed the FTE has fewer than 5 (n=1,121), a total of 1,318 usable hospitals remained. Together, these hospitals had 372,840 licensed beds, representing 49.0% of all licensed hospital beds in the United States.

We found the overall IT staffing ratio to be 0.142 IT FTE per hospital bed. Extrapolating to all hospitals beds in the United States, this suggests a total current hospital IT workforce size of 108,390 FTE. We also found an IT to total staff ratio of 60.7, which was similar to the Gartner and English numbers described above.

Average IT staffing ratios varied based on EMR Adoption Model score. Table 1 shows the average staffing ratio for each of the stages (there are currently no hospitals in the United States at adoption Stage 7). Figure 2 shows a graph of this relationship. Average staffing ratios generally increase with adoption score, but hospitals at Stage 4 have a higher average staffing ratio than hospitals at Stages 5 or 6. The data do not allow explanation of this deviation. If all hospitals were operating at the same staffing ratios as Stage 6 hospitals (0.196 IT FTE per bed), a total of 149,174 IT FTE would be needed to provide coverage – an increase of 40,784 FTE.

Table 1 – Hospitals, beds, and staffing ratios by EMR Adoption Model score.

EMR Adoption Model Score	Number of Hospitals	Total Beds	IT FTE per Bed
0	60	9,069	0.082
1	132	30,391	0.096
2	437	120,315	0.122
3	538	157,383	0.151
4	81	29,439	0.210
5	39	15,256	0.167
6	31	10,987	0.196

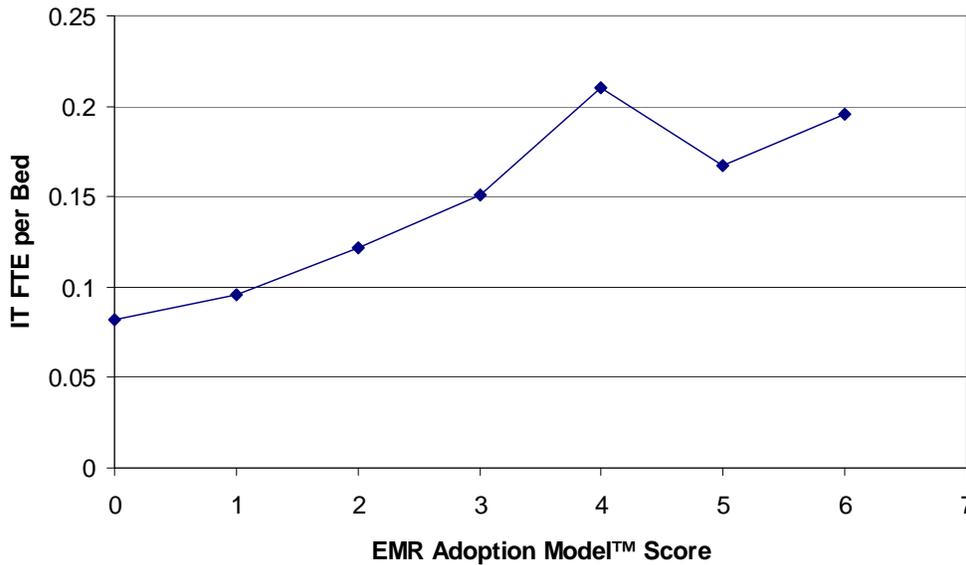


Figure 2 – IT FTE per Bed vs. EMR Adoption.

Table 2 – Summary of HIT workforce data.

Group	Quantitative	Qualitative
IT	~1 FTE per 50-60 non-IT FTE [7, 13]; ~0.1-0.2 FTE per bed, which translates to ~108,000 nationally and increases by ~40,000 for more advanced implementation (this report)	Knowledge of health care deemed essential for success [17]
HIM	~170,000 now, increasing to ~200,000 by 2016 [18]	Evolving role as technology changes [19]
Informatics	Unknown; minimum estimates of ~12,000 clinical (one MD and nurse per hospital) [20] and ~1,000 public health [21]	CMIO is example of a new position and is evolving [8, 9]

Discussion

The results of this study show that the need for IT professionals in HIT settings is large and will increase as more advanced systems are implemented to achieve their promised improvements in quality, safety, and cost reductions. While hospitals with basic implementation are utilizing about 0.1 IT staff per bed, this rises to around 0.2 IT staff per bed as hospitals advance from Stage 1 to Stage 4 implementation based on the HIMSS EMR Adoption Model. If our data represent a correct sampling of the entire US, then the current IT staff workforce is about 108,390 FTE. However, if the US HIT agenda is fulfilled and hospitals move to higher levels of adoption, an additional 40,784 FTE will be required.

There are limitations to the data and our analysis. As described above, the HIMSS Analytics Database is self-reported and incomplete. Even further, however, is that the FTE data are currently limited to hospital IT staff, and in particular exclude BMI specialists who play a growing role in HIT implementations. This is being addressed by the database with the addition of new data elements being introduced in 2008 that attempt to capture these individuals. The data also exclude HIT professionals who work for vendors and in other non-clinical settings.

This makes essential a more concerted research agenda to better characterize the HIT workforce and its job roles, required competencies, and optimal education. This will not only help HIT leaders implement systems better, but also assist educational programs in determining the best curricula for students training to fill these roles. A major component of this research agenda must include further elaboration of the role of BMI professionals in the success of HIT implementations. It is also imperative for policymakers to address issues of planning and funding for this important barrier to more widespread adoption of HIT.

References

1. Chaudhry B, et al., *Systematic review: impact of health information technology on quality, efficiency, and costs of medical care*. *Annals of Internal Medicine*, 2006. 144: 742-752.
2. Hersh W, *Health care information technology: progress and barriers*. *Journal of the American Medical Association*, 2004. 292: 2273-2274.

3. Poon EG, et al., *Overcoming barriers to adopting and implementing computerized physician order entry systems in U.S. hospitals*. Health Affairs, 2004. 23: 184-190.
4. Anonymous, *Building the Work Force for Health Information Transformation*. 2006, American Health Information Management Association and American Medical Informatics Association: Chicago, IL and Bethesda, MD, http://www.ahima.org/emerging_issues/Workforce_web.pdf.
5. Hersh WR, *Who are the informaticians? What we know and should know*. Journal of the American Medical Informatics Association, 2006. 13: 166-170.
6. Perlin JB and Gelinas LS, *Electronic Health Records Workgroup Recommendations*. 2008, American Health Information Community: Washington, DC, http://www.hhs.gov/healthit/documents/m20080115/09-ehr_recs_ltr.html.
7. Eardley T, *NHS Informatics Workforce Survey*. 2006, ASSIST: London, England, http://www.bcs.org/upload/pdf/finalreport_20061120102537.pdf.
8. Leviss J, Kremsdorf R, and Mohaideen MF, *The CMIO - a new leader for health systems*. journal of the American Medical Informatics Association, 2006. 13: 573-578.
9. Shaffer V and Lovelock J, *Results of the 2006 Gartner-AMDIS Survey of CMIOs: Bridging Healthcare's Transforming Waters*. 2007, Gartner: Stamford, CT, http://www.gartner.com/DisplayDocument?ref=g_search&id=504632.
10. Han YY, et al., *Unexpected increased mortality after implementation of a commercially sold computerized physician order entry system*. Pediatrics, 2005. 116: 1506-1512.
11. Sittig DF, et al., *Lessons from "unexpected increased mortality after implementation of a commercially sold computerized physician order entry system"*. Pediatrics, 2006. 118: 797-801.
12. Ash JS, et al., *Implementing computerized physician order entry: the importance of special people*. International Journal of Medical Informatics, 2003. 69: 235-250.
13. Gabler J, *2003 Integrated Delivery System IT Budget and Staffing Study Results*. 2003, Gartner Corp.: Stamford, CT.
14. Wing P, et al., *Data for Decisions: the HIM Workforce and Workplace - 2002 Member Survey*. 2003, American Health Information Management Association: Chicago, IL, http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1_018947.pdf.
15. Anonymous, *Nationwide Health Information Network (NHIN) Workforce Study*. 2007, Altarum Institute: Ann Arbor, MI, <http://aspe.hhs.gov/sp/reports/2007/NHIN/NHINReport.pdf>.
16. Anonymous, *The EHR Adoption Model*. 2007, Healthcare Information Management and Systems Society: Chicago, IL, http://www.himssanalytics.org/docs/EMRAM_att_corrected.pdf.
17. Monegain B, *Healthcare IT: is it a breed apart?*, Healthcare IT News. September, 2004. 4. <http://www.healthcareitnews.com/story.cms?id=1522>.
18. Dohm A and Shniper L, *Occupational employment projections to 2016*. Monthly Labor Review, 2007. 130(11): 87-125. <http://www.bls.gov/opub/mlr/2007/11/art5full.pdf>.
19. Anonymous, *A Vision of the e-HIM Future*. 2003, American Health Information Management Association: Chicago, IL, http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1_020477.pdf.
20. Safran C and Detmer DE, *Computerized physician order entry systems and medication errors*. Journal of the American Medical Association, 2005. 294: 179.

21. Friedman CP, *Building the Workforce: An Imperative for Public Health Informatics*. 2007, Public Health Information Network (PHIN) 2007 Keynote Address: Atlanta, GA.
22. Witter DM, et al., *Oregon Electronic Health Record Survey, Ambulatory Practices and Clinics, Fall 2006*. 2007, Oregon Health Care Quality Corp.: Portland, OR, <http://www.q-corp.org/q-corp/images/public/pdfs/OR%202006%20EHR%20Survey-Final.pdf>.

Appendix - Extrapolating to Oregon

With a population of 3.75 million, Oregon comprises 1.2% of the US population. However, due to the efficiency of its health care system, the state only has 0.73% of all hospital beds in the US (5,606). Although Oregon has a higher rate of EHR adoption than the country in general [22], we can extrapolate from the general figures in this report to determine that Oregon currently has 802 IT staff and would require 302 more in advancing to higher levels of adoption. Because the state is a leader in other aspects of HIT, from industry to academia, there are other opportunities for HIT professionals in the state as well.

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