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Review of information technology for surgical patient care



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ABSTRACT

Background: Electronic health records (EHRs), computerized provider order entry (CPOE), and patient portals have experienced increased adoption by health care systems. The objective of this study was to review evidence regarding the impact of such health information technologies (HIT) on surgical practice.

Materials and methods: A search of Medline, EMBASE, CINAHL, and the Cochrane Library was performed to identify data-driven, nonsurvey studies about the effects of HIT on surgical care. Domain experts were queried for relevant articles. Two authors independently reviewed abstracts for inclusion criteria and analyzed full text of eligible articles.

Results: A total of 2890 citations were identified. Of them, 32 observational studies and two randomized controlled trials met eligibility criteria. EHR or CPOE improved appropriate antibiotic administration for surgical procedures in 13 comparative observational studies. Five comparative observational studies indicated that electronically generated operative notes had increased accuracy, completeness, and availability in the medical record. The Internet as an information resource about surgical procedures was generally inadequate. Surgical patients and providers demonstrated rapid adoption of patient portals, with increasing proportions of online versus inperson outpatient surgical encounters.

Conclusions: The overall quality of evidence about the effects of HIT in surgical practice was low. Current data suggest an improvement in appropriate perioperative antibiotic administration and accuracy of operative reports from CPOE and EHR applications. Online consumer health educational resources and patient portals are popular among patients and families, but their impact has not been studied well in surgical populations. With increasing adoption of HIT, further research is needed to optimize the efficacy of such tools in surgical care.

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Introduction

Health information technology (HIT) has experienced rapid evolution and adoption over the last several decades, and the

use of HIT in the process of health care delivery poses new challenges for both patients and providers.¹⁻⁵ A global trend has shown a rise in consumer demand for HIT by patients.⁶ Within the United States, specific legislation has

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dramatically affected the adoption and use of HIT by health care organizations. The Affordable Care Act of 2010 provided financial incentives to health care providers and organizations for demonstrating meaningful use of certified electronic health records (EHRs) and promoted widespread adoption of HIT by health care organizations. In 2015, financial penalties for failure to achieve meaningful use of EHRs began.^{7,8} The emergence of EHRs, computerized provider order entry (CPOE) and patient portals has transformed the way health information is stored, used, and communicated among health care providers, patients, and caregivers.

HIT has been widely adopted across clinical specialties and practice settings. In 2013, 78.4% of office-based physicians reported having an EHR, an increase of 21% between 2012 and 2013.⁹ There is evidence that this rise continues. As of October 2015, over 85% of Regional Extension Centers–enrolled critical access/rural hospitals and eight of 10 primary care providers are demonstrating meaningful use of certified EHR technology.¹⁰ Ninety-seven percent of nonfederal acute-care hospitals have possession of a certified EHR, and 75.5% have adopted a basic EHR system, up from 15.6% in 2010.¹¹

This increase in the implementation and adoption of HIT has prompted substantial growth in research about such systems.¹² The overwhelming majority of research on the effects of HIT has been conducted in primary care and medical specialty settings, with a paucity of data on how the use of HIT affects surgeons and the care of surgical patients.^{13–15} The objective of this study was to review comprehensively the available evidence on the impact of HIT on surgical practice. We aimed specifically to determine the effects of EHRs, CPOE, patient portals, and Internet-based information resources on the care of surgical patients.

Materials and methods

Data sources and search strategy

We performed a systematic search of Medline, EMBASE, CINAHL, and the Cochrane Library to identify published literature on the effects of EHRs, CPOE, patient portals, or online health information resources on surgeons and their patients from 1990 to July 2015. The search was focused specifically on studies performed exclusively in surgical patients or subsets. Medical Subject Heading (MeSH) terms and keywords used for the search included those pertaining to computerized health record systems, EHRs, information technology, medical order entry systems, personal health record, CPOE, patient or web portals, access to information, patient participation, surgery, surgical procedures, or operative care.

The search query used was: (“Medical Records Systems, Computerized” [MeSH terms] or “Electronic Health Records” [MeSH terms] or “personal health record” [title/abstract] or “information technology” [title/abstract] or “Medical Order Entry Systems” [MeSH terms] or “computerized order entry” [title/abstract] or “patient portal” or “web portal” or “Access to Information” [MeSH terms] or “Patient Participation” [MeSH terms] or “Patient Access to Records” [MeSH terms]) and (“surgeons” [MeSH terms] or “surgical procedures, operative”

[MeSH terms] or “surg*” [title/abstract]) AND (“1990” [PDAT]: “2015” [PDAT]).

In addition, we also queried surgeons with expertise in informatics or HIT and mined the bibliographies of all retrieved articles for citations of potentially relevant articles. Prior systematic reviews were used to identify original studies.

Study selection

We selected for analysis all experimental, observational, randomized, or nonrandomized studies published in scientific journals, peer-reviewed conference proceedings, or sources identified by domain experts. Editorials, government reports, letters to the editor, conference abstracts, or non–data-driven studies were excluded. Articles not published in English and without full-text availability were excluded. We included only studies that examined the HIT-related effects specifically to surgical practice or contained a separate surgical subgroup analysis.

Two authors independently reviewed the abstracts of all retrieved articles to identify publications meeting inclusion criteria and then performed full-text review of relevant articles. Disagreements were resolved with assessment by a third reviewer and discussion to achieve consensus.

Data analysis and grading criteria

Study classification was performed in a similar manner as prior systematic reviews in HIT.^{12,15–17} We classified articles into descriptive qualitative studies, descriptive quantitative studies, and hypothesis-testing studies. Articles were classified as “hypothesis-testing” if the investigators used statistical analysis to compare data between groups. Hypothesis-testing studies were further classified by study design (e.g., randomized controlled trial [RCT] and retrospective or prospective observational studies).

The authors summarized the data available for each category of HIT, which allowed formulation of a general consensus and determination of what areas were lacking evidence. Due to the heterogeneity of the studies identified, a meta-analysis was not performed.

Results

The systematic database search retrieved 2909 potentially relevant publications. An additional 24 articles were identified from expert recommendations and bibliographies of retrieved articles. After removal of duplicate articles and abstract review, 201 potentially eligible articles underwent full-text review, of which 34 studies were retained for data analysis (Figure). Most articles were excluded based on the lack of data-driven evidence.

The table below summarizes the evidence for the effects of HIT in surgical care. Of the 34 studies analyzed, 15 examined the impact of EHRs; five, CPOE; five, electronic operative notes; six, online health information resources; and three, patient portals. The vast majority of the evidence was low (nine studies) or very low (20 studies) in quality. Five

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