

# ELECTRONIC MEDICAL RECORDS: QUALITY CANCER CARE AND COST-EFFECTIVENESS

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## BACKGROUND

- There is a pressing need to evaluate and improve the quality and efficiency of cancer care in the United States due to associated cost increases.<sup>1,2</sup>
- The Institute of Medicine recommended that information technology products replace most handwritten clinical data to remove impediments to care, such as records that are:
  - Poorly organized
  - Illegible
  - Hard to retrieve.<sup>3</sup>
- Quality of cancer care may improve with information technology products such as electronic medical records (EMRs).

## OBJECTIVES

- To identify the value of EMRs to providers in assessing and improving quality cancer care.
- To identify issues in cost and cost-effectiveness of EMRs from the provider perspective.

## METHODS

- Conducted systematic literature review about quality of cancer care in PubMed, Embase, and Cochrane Reviews; considered only articles published in English in the last 10 years.
- Conducted supplemental review; searched PubMed and conference abstracts from the American Society of Clinical Oncology (ASCO) from 2005 to 2009.
- Gave some leeway for potentially relevant subjects even if cancer was not the specific focus.
- Identified 16 sources.

## RESULTS

### Descriptive Studies

- Four studies described the benefits and issues with EMR and drew the following conclusions:
- EMRs could monitor compliance with cancer guidelines.<sup>4</sup>
  - G2C-clin, an EMR application system integrated into a hospital information system:
    - Satisfied requirements for procedure standardization and data distribution.
    - Allowed monitoring of numerous outcomes of care.<sup>5</sup>
  - To realize the potential of clinical decision support, EMR vendors must develop systems that can communicate with external modular niche programs.<sup>6</sup>

- Much of hospital data transferred from point-of-care testing (POCT) devices is not integrated into EMR or other hospital or laboratory information systems for the following reasons:
  - Lack of interoperability of multiple devices with EMR or other information systems, all produced by multiple vendors.
  - Inability to capture manually read outcomes.<sup>7</sup>

### Stakeholder Perspectives

Three studies presented stakeholder perceptions on the impact of EMR on quality cancer care and drew the following conclusions:

- In a systematic literature review, most studies found a neutral impact of EMR on patient satisfaction.<sup>8</sup>
- EMR may be an essential component of cancer care by providing access to records, reducing unnecessary repeat of tests, and promoting patient safety. Most patients agreed to have EMRs.<sup>9</sup>
- A literature review of interview studies<sup>10</sup> found that nurses perceived improved documentation with EMR, but they also had the following negative perceptions:
  - Not designed to fit with nurses' workflow
  - Takes time away from actual patient care
  - Does not provide a useful output for nurses.

**Table 1. Costs and Cost Benefits of EMR**

Study/Setting	Key Points
Costs and resource use associated with developing an EMR system adapted to evaluate tumor- and stage-specific compliance in oncology treatments as a mechanism to improve quality cancer care <sup>11</sup>	<p><b>Direct costs:</b></p> <ul style="list-style-type: none"> <li>\$25,000 computer hardware</li> <li>\$12,500 EMR licensing</li> <li>\$10,900 personnel training</li> </ul> <p><b>\$48,400 Total</b></p> <p><b>Annualized operational costs:</b></p> <ul style="list-style-type: none"> <li>\$76,900 providers' time for entering data and continued EMR training</li> <li>\$67,900 senior physician and administrative supervision</li> <li>\$30,000 senior administration coordination</li> <li>\$23,500 clerical data analysis</li> <li>\$ 5,500 IT consultants and EMR maintenance fees.</li> </ul> <p><b>\$202,800 Total</b></p> <p><b>Costs per life covered:</b> Developmental costs of adapted EMR system, \$0.645; operational costs, \$2.704.</p> <p><b>Conclusions:</b> Providers' costs for implementing EMR systems to assess quality of care are substantial and must be reimbursed by health insurance plans and HMOs. Efficiencies could be improved by standardizing EMR data sets and oncology practice methodologies.</p>
EMR adoption by 14 primary care practices (mean of 3.3 full-time providers, range 1 to 6) <sup>12</sup>	<p><b>Initial costs:</b> \$43,800 (software training and installation, hardware, lost revenues).</p> <p><b>Ongoing costs per provider per year:</b> \$8,400 (maintenance, support, replacement, staffing, other).</p> <p><b>Time to recover EMR initial and cumulative ongoing costs:</b> Average, 2.5 years (1 practice would take 9 years; 2 of 14 practices would not recover costs of EMR).</p> <p><b>Average profits after cost recovery:</b> \$23,000 per provider per year (not including coding levels and greater efficiency).</p> <p><b>Benefits to providers:</b> More personal time, remote and immediate access to records.</p> <p><b>Financial risks:</b> 3 of 14 practices experienced considerable financial risk, including no revenue for several months and EMR system issues resulting in lost data for several weeks.</p> <p><b>Quality care improvement in 14 practices:</b></p> <ul style="list-style-type: none"> <li>13 practices used templates to document patient encounters.</li> <li>7 practices had templates allowing extensive reminders and reporting.</li> <li>5 practices had specific targets for quality improvement.</li> <li>5 practices had reminders set for at least one type of chronic care patient.</li> </ul> <p><b>Conclusions:</b> More quality improvements from EMR adoption could be realized. EMR adoption results in coding-related gains because of the structure of the current reimbursement system, which rewards more extensive coding. A structure with more emphasis on pay-for-performance than fee-for-service could help correct the limited quality improvement use of EMR.</p>
Cost-benefit analysis of EMR adoption at University of Texas MD Anderson Cancer Center <sup>13</sup>	<p><b>Benefit</b></p> <p>Data capture and access</p> <p>Decision support: effect of providing physicians with additional information during the order-entry process.</p> <p>Business management</p> <p>Streamlining (patient flow and communication among caregivers)</p> <p>Additional savings are possible from reduction of medical records staff by almost 75%.</p> <p><b>Conclusions:</b> Implementing EMR use may take years and millions of dollars. Executives can make informed decisions about EMR use by conducting a cost-benefit analysis.</p>
Costs per life covered	Developmental costs of adapted EMR system, \$0.645; operational costs, \$2.704.
Conclusions	Providers' costs for implementing EMR systems to assess quality of care are substantial and must be reimbursed by health insurance plans and HMOs. Efficiencies could be improved by standardizing EMR data sets and oncology practice methodologies.

EMR = electronic medical records; HMO = health maintenance organization; IT = information technology.

**Table 2. EMR in Guideline Adherence**

Study/Setting	Key Points																				
Using template in EMRs to improve documentation of care for cancer patients treated by Duke University's Hematology and Oncology fellows <sup>14</sup>	<p>Quality of care assessed in spring and fall using ASCO's Quality Oncology Practice Initiative (QOPI) survey; wQOPI is a program to improve quality of care.</p> <p>Attending and fellow physicians abstracted data from EMRs into the online QOPI tool; each abstraction took 15 minutes.</p> <p>Spring QOPI survey identified areas needing improvement (i.e., documentation that needed to improve).</p> <p>Template was created within the EMR to capture details of care for patients who were to receive chemotherapy or biotherapy for lung or colorectal cancer.</p> <p>Between surveys, improvements were seen in the proportion of patients with a documented number of chemotherapy cycles (spring, 54%; fall, 60%) and documentation of pain assessment (spring, 78%; fall, 87%) and chemotherapy intent discussions (spring, 72%; fall, 86.5%).</p> <p><b>Conclusion:</b> Documentation improved by incorporating the required template into the EMR.</p>																				
Evaluation of breast cancer guideline compliance at a multi-specialty institution	<p>Guidelines assessed were from the NCCCO and the NCCN<sup>15</sup></p> <p><b>Goal:</b> Assess the time and accuracy of physician and nonphysician reviews of EMRs for quality measure information regarding adherence to breast cancer guidelines.</p> <p><b>NCCO compliance:</b></p> <ul style="list-style-type: none"> <li>Number of quality measures with compliance &lt; 85%: Physician reviews, 7 of 36; nonphysician reviews, 6 of 36</li> <li>Percentage of patients receiving recommended care: Physician reviews, 91.5%; nonphysician reviews, 89.8%</li> </ul> <p><b>NCCN guideline compliance:</b></p> <ul style="list-style-type: none"> <li>For preoperative workup, nonphysician reviews were more accurate than physician reviews; no other significant differences.</li> <li>Nonphysician reviews: NCCO guideline measures, 6.3 minutes per chart; NCCN guideline measures, 6.8 minutes per chart.</li> <li>Physician reviews: NCCO guideline measures, 6.3 minutes per chart; NCCN guideline measures, 6.8 minutes per chart.</li> </ul> <p><b>Average time for EMR review:</b></p> <ul style="list-style-type: none"> <li>Physicians reviews: NCCO guideline measures, 6.3 minutes per chart; NCCN guideline measures, 6.8 minutes per chart.</li> <li>Nonphysician reviews: NCCO guideline measures, 6.3 minutes per chart; NCCN guideline measures, 6.8 minutes per chart.</li> </ul> <p><b>Conclusions:</b> Physicians conducted the reviews slightly faster than nonphysicians, but this difference was offset by the cost of the physician time. Compliance of noncompliance. Integration of EMR with the billing information system would avoid incorrect diagnosis code by oncologists or staff.</p>																				
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A community oncology practice in California	<p>Community oncology practice in California evaluated guideline compliance and quality care for colon cancer patients before and after adopting EMR<sup>16</sup></p> <p><b>Patient tracking:</b></p> <ul style="list-style-type: none"> <li>25% of 345 patients were seen in a hospital but not in the office (reasons: insurance, transfer of care, hospice, no show)</li> </ul> <p><b>Error tracking in records:</b></p> <ul style="list-style-type: none"> <li>9.6% of 345 patients' records with incorrect ICD code for diagnosis.</li> <li>No disease stage (N = 234), before EMR: 8.9%; after EMR: 2.3% (P = 0.05).</li> </ul> <p><b>Percentage of patients receiving chemotherapy per national guidelines:</b></p> <table border="1"> <thead> <tr> <th>Disease Stage</th> <th>Before EMR</th> <th>After EMR</th> <th>P Value</th> </tr> </thead> <tbody> <tr> <td>I</td> <td>4</td> <td>0</td> <td>NR</td> </tr> <tr> <td>II</td> <td>12</td> <td>44</td> <td>0.02</td> </tr> <tr> <td>III</td> <td>20</td> <td>52</td> <td>0.008</td> </tr> <tr> <td>IV</td> <td>81</td> <td>75</td> <td>0.6</td> </tr> </tbody> </table> <p><b>Conclusions:</b> EMRs can be used to monitor compliance to national guidelines, although explanatory codes are needed to document reasons for instance of noncompliance. Integration of EMR with the billing information system would avoid incorrect diagnosis code by oncologists or staff.</p>	Disease Stage	Before EMR	After EMR	P Value	I	4	0	NR	II	12	44	0.02	III	20	52	0.008	IV	81	75	0.6
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Implementation of EMR in an oncology department in Italy <sup>17</sup>	<p>EMR includes a clinical instrument panel (OncoQual), which allows exploration of clinical data and real-time process and outcomes measurements</p> <p><b>Objective:</b> Evaluate the performance on OncoQual.</p> <p><b>Outcome assessed:</b> Adherence to ASCO recommendations on adjuvant endocrine therapy for hormone-positive breast cancer.</p> <p><b>Measures:</b> Percentage of patients receiving tamoxifen and aromatase inhibitors before and after the guideline changes.</p> <p><b>Results:</b> Tamoxifen use decreased (76% vs. 50%) and aromatase inhibitor use increased (15% vs. 46%) from 2000-to-2004 period to the 2006-to-2007 period, after the guidelines changed, as expected.</p> <p><b>Conclusion:</b> Collection and analysis of quality assessment data took few hours and allowed incorporation of real-time process-based measures into daily clinical practice through self-assessment.</p> <p><b>Goal:</b> Assess impact of dosing calculator integrated into EMR on dosing errors for acetaminophen and ibuprofen in children.</p> <p><b>Results:</b> Strength overriding errors occurred in 8.9% of 316 children before calculator integration and 4.0% of 224 children (P = 0.028) after calculator integration.</p> <p><b>Conclusions:</b> Weight-based dosing calculator integrated into the EMR program reduced medication errors in children.</p> <p><b>From poster authors:</b> Dosing calculator integration could be useful in oncology practices' EMRs because of the number of oncology drugs requiring weight-based dosing.</p> <ul style="list-style-type: none"> <li>Data from 11 interviews and 490 FOST alerts analyzed.</li> <li>Problem traced to software issue related to patients' failure to provide the laboratory technician with the FOBT card from the ordering provider.</li> <li>Alerts were not sent to PCPs.</li> <li>Lack of PCP response to positive FOBT alerts decreased from 29.9% before software correction to 4.5% after correction.</li> </ul> <p><b>Conclusion:</b> Quality assurance and oversight mechanisms are needed to ensure correct functioning of electronic communication of positive FOBT alerts</p>																				
Use of EMR with an integrated weight-based dosing calculator in a family medicine clinic <sup>18</sup>	<p>Providers were interviewed and EMR software was analyzed to determine why PCPs were frequently failing to respond to colorectal cancer screening alerts (positive FOBT) sent by EMR<sup>18</sup></p>																				

ASCO = American Society of Clinical Oncology; EMR = electronic medical records; FOBT = fecal occult blood test; ICD = International Classification of Diseases; NCCN = National Comprehensive Cancer Network; NCCO = National Initiative for Cancer Care Quality; NR = not reported; PCP = primary care physician.

## CONCLUSIONS

- EMR may be financially challenging for some small physician practices.
- Most medical records staff at cancer centers are made obsolete by EMR.
- EMR can assist providers in assessing whether their patients are receiving guideline-adherent care and aid in more efficient processes of care, thereby improving overall quality of cancer care.
- Patients generally do not view EMR as hindering their interactions with providers, despite some physicians' initial fears that this would be the case.
- Based on nurses' negative experiences with EMR, more types of staff should be involved in the design process to increase efficiency gains and the number of willing users.
- Needed improvements in EMR design include the need to communicate with multiple devices and information systems.
- Continued monitoring of the EMR system is needed to ensure proper functioning (e.g., transmission of alerts).

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