Health Informatics for Colorectal Cancer Screening

COMMENTARY

Health Informatics & Information System: An Integrated Evidence-Base Tool for Colorectal Cancer Screening

Maserat Elham*, Zali Nasraran, Zali Mohamad Reza

Abstract

Application of health informatics, especially for screening process of colorectal cancer, is a most effective and cost efficient method for monitoring, management and prevention of disease. Information systems have capability for sharing and integration of information among the many stakeholders involved in colorectal cancer control (participant, family physician, specialist, hospitals, laboratories, and pharmacist). In this paper, we provide comprehensive survey applications and functions of health informatics and information systems in preventing colorectal cancer and management of screening process. Furthermore, we cover different models, infrastructures and standards for reporting and distribution of information at the international level, with due attention to security and privacy issues. The information furnished in this article was collected from valid medical databases by medical librarians.

Key Words: Health Informatics - management - colorectal cancer - screening

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Introduction

Colorectal (CRC) is one of the most common neoplasms in worldwide (Safaee et al., 2008) especially in developed countries (Szczerbinska et al., 2008). The lifetime risk of developing CRC is estimated at approximately 5-6%. Colorectal cancer is the second leading cause of cancer-related deaths (behind lung cancer) in the United States, yet it is one of the most preventable cancers, since screening can detect pre-cancerous polyps. The removal of polyps often eliminates progression to cancer (Atkinson, 2008). It has been estimated that some 60% of deaths from colorectal cancer could be prevented if people aged 50 or older were regularly screened.

Population-based cancer screening is most effective and cost efficient when offered through an organized screening program that incorporates all elements of the screening process, including information systems that support optimal program operation, monitoring, and evaluation (Aramini et al., 2008). In addition, a key requirement for a national colorectal cancer screening program is a population based register and information system to manage invitation, recall and tracking of participants through the pathway (Shaw et al., 2008). Computerized clinical information systems have capability of identify patients due for screening and to calculate baseline rates of colorectal cancer screening by patient characteristics and by primary care physician and practice group (Ayanian et al., 2008).

Application and Requirements of Health Informatics infrastructure in Colorectal Cancer Screening

National cancer research institute board defined informatics as the research, development, or application of computational tools and approaches for expanding the use of biological, medical, or health data, including those to acquire, store, organize, archive, analyze, or visualize such data (Kerr, 2003).

Five functions of an information system for colorectal cancer are:
a) The most efficient and effective means of identifying the “real” of the users;
b) Developing information processing systems for satisfying these needs;
c) Ensuring that the resulting information processing systems to satisfy changing user needs by the most efficient means of acquiring, storing, processing, disseminating and presenting information;
d) Supporting operational, control and strategic organizational issues;
e) Providing facilitates and a learning environment for users and information systems specialists to improve the effectiveness of their decision model (Weller et al., 2003).

With the development of various international clinical medical terms and health messaging, colorectal cancer screening information system should be familiar with
health organization standard for successful sharing information especially transformation standard reports.

This health organization standard including:

**HL7**: Health Level Seven (HL7) is one of several American National Standards Institute (ANSI) -accredited Standards Developing Organizations (SDOs) operating in the health care arena. Most SDOs produce standards (sometimes called specifications or protocols) for a particular health care domain such as pharmacy, medical devices, imaging or insurance (claims processing) transactions. The HL7 domain is clinical and administrative data. HL7 develops specifications; the most widely used being a messaging standard that enables disparate health care applications to exchange key sets of clinical and administrative data. [California Office of HIPP A implementation,2008] If pathology results are requested electronically in HL7 format, the results will automatically populate the correct fields in medical software of colorectal cancer (Australian Divisions of General Practice, 2008)

**LOINC**: The LOINC (Logical Observation Identifier Names and Codes) database provides a set of universal names and ID codes for identifying laboratory and clinical observations (Degoult et al.,1988). They are mainly intended to identify the test results. LOINC was developed to facilitate the electronic transmission of laboratory results to hospital, physician, third party payers, and other users of laboratory data. Each record in the LOINC database identifies a clinical observation and contains a formal six-part name and identifying code with a check digit, synonyms, and other useful information (Wager, 2005).

**SNOMED CT**: SNOMED (Systematized Nomenclature of Medicine Clinical Terms), a system of standardized medical terminology. SNOMED Clinical Terms®, or SNOMED CT®, is a comprehensive computerized clinical terminology covering clinical data for diseases, clinical findings, and procedures. It is a “comprehensive and precise clinical reference terminology that provides unsurpassed clinical content and expressivity for clinical documentation and reporting”. It allows a consistent way to index, store, retrieve, and aggregate clinical data across specialties and sites of care. It also helps structure and computerizes the medical record, reducing the variability in the way data is captured, encoded and used for clinical care of patients and research. SNOMED created a common clinical language that is a necessary element of a health care Information Infrastructure (Website SNOMED, 2007).

Two data issues in computing system are lack of data standards and lack of interoperability between databases (Kerr, 2003). Using these standards can overcome lack of interoperability between colorectal cancer databanks in national and international level. In addition, users can use standard data elements into their databases. Examples of these data elements are illustrated in Table 1.

### Security and Privacy Issues as Infrastructure Colorectal Cancer Information System

Areas that require protective safeguards in colorectal cancer screening information system include:

a) personnel (controlled entry or movement in the computer area);

b) physical objects (logging and cataloguing of diskettes, destruction of hard copy containing individual-identifying information);

c) procedures (granting access to system, assigning and changing pass words);

d) management oversight (periodic review of safeguards, policy guidance, staff training, unannounced system audits);

e) communications (outside incursion, interactions with other system, networks, and applications);

f) software (audit trails, logon procedures, data

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**Table 1. Standard Code and Datasets for Colorectal Cancer**

<table>
<thead>
<tr>
<th>Core Data Items</th>
<th>Macroscopic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Site of tumor</td>
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<tr>
<td></td>
<td>Maximum tumor diameter</td>
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<tr>
<td></td>
<td>Distance to the near nearer end resection margin</td>
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<tr>
<td></td>
<td>Tumor perforation</td>
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<td></td>
<td>Relation of rectal tumors to the potential reflection</td>
</tr>
<tr>
<td>Microscopic</td>
<td>Histological type</td>
</tr>
<tr>
<td></td>
<td>Histological differentiation</td>
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<tr>
<td></td>
<td>Maximum extent of local invasion (pT stage)</td>
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<tr>
<td></td>
<td>Lymph node status</td>
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<tr>
<td></td>
<td>Extramural venous invasion</td>
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<tr>
<td></td>
<td>Evidence of regression following therapy</td>
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<td></td>
<td>Histologically confirmed distant metastases</td>
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<tr>
<td></td>
<td>Background abnormalities</td>
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</tbody>
</table>

**Non-Core Data Items**

| Macroscopic     | Specimen dimensions                |
|                 | Precise anatomical location of non-peritonealised margin involvement |
|                 | Quality of the surgical resection plane in abdomino-perineal excisions |
| Microscopic     | Separate identification of mucinous tumors |
|                 | Nature of advancing margin (infiltrative versus expansive) |
|                 | Tumor Budding                      |
|                 | External tumors nodules less than 3mm in diameter |
|                 | Intramural venous invasion         |
|                 | Immunohistochemical data           |

**Other**

- TNM stage
- Dukes stage
- Completeness
- SNOMED codes

**SNOMED Codes of Colorectal Tumors**

<table>
<thead>
<tr>
<th>T codes (T-66000 Appendix, T-67000 Colon, T-68000 Rectum)</th>
</tr>
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<tbody>
<tr>
<td>M codes (M-81400 Adenoma, M-74000 Dysphasia, M-80103 Carcinoma , M-81403 Adenocarcinoma, M-84803 Mucinous adenocarcinoma, M-84903 Signet ring cell adenocarcinoma, M-85603 Adenocarcinoma mucinous, M-80703 Squamous cell carcinoma, M-8013 Small cell carcinoma, M-80203 Undifferentiated carcinoma, M-82443 Goblet cell carcinoma, M-82443 Mixed carcinoid-adenocarcinoma)</td>
</tr>
</tbody>
</table>
Integration with Other Information Systems (Clinical and Non Clinical)

Information systems in colorectal cancer screening should support electronic links from geographic information system, laboratories, electronic medical record, and hospital information systems. Relationship colorectal cancer screening information system with other system can help for improving performance of screenings. Totally this Relationship will assist for gathering detail, accurate and complete information in order to better analyzing and preventing of colorectal cancer.

a) Electronic link with geographic information system: Sigmoidoscopy and colonoscopy are methods for early detection can therefore actually prevent colorectal cancer (Ladabaum, 2004). Unfortunately, access to sigmoidoscopy and colonoscopy may be limited, and diagnosis may be delayed if facilities offering these endoscopic procedures are not available. These factors illustrate the need to explore the relationship between the stage of colorectal cancer at diagnosis and the proximity of endoscopy facilities. Therefore, the geographic distribution of colorectal cancer at stage of diagnosis is being evaluated by using geographic information system (GIS) techniques that incorporate sigmoidoscopic characteristics and proximity to endoscopy facilities (Bluecross Blueshield of North California, 2008). Furthermore Iowa uses a GIS to define areas with high rates of late-stage CRC (Department of Health and Human Services Center for Disease Control and Prevention, 2005).

b) Electronic link with electronic medical record: EMR systems can integrate evidence-based recommendations for preventive services (such as age, sex, and family history) to identify patients needing specific services. The system can remind providers to offer the service during routine visits and remind patients to schedule care. Reminders to patients generated by EMR systems have been shown to increase patient’ compliance with preventive care recommendations when the reminder are merely interjected into traditional outpatient workflows (Rushton et al., 2005).

c) Electronic link with laboratory information system: Community laboratories are playing a significant role in the recently launched province-wide program to provide early detection of colorectal cancer. Laboratory information systems have been modified to report test results and program information to the Colorectal Cancer Screening Registry in addition to usual results reporting to the ordering primary care physicians (Ontario Association of Medical Laboratories, 2008).

Conclusion

In fact, colorectal cancer is over 90 per cent preventable. Screening of this disease is key solution for detecting and preventing of colorectal cancer. New technologies improve colorectal cancer screening as health informatics and information system. Health informatics can effectively reduce mortality and increasing successful
treatment by evidence – base screening. Colorectal cancer screening information system to share appropriate information electronically introduces integration, synchronization, testing, and support challenges. Applications of this technology were developed to handle data entry, editing, trial management, reporting, telecommunications, and data sharing. Furthermore health informatics has cost efficient manner for patient management, provider management, documentation management and material management in field of colorectal cancer. This tool facilitates data access, integration with other.

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References


