COMMENTARY

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

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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

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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 HIPPA 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.

Table 1. Standard Code and Datasets for Colorectal Cancer

Core Data Items
Macroscopic
Site of tumor
Maximum tumor diameter
Distance to the near nearer end resection margin
Tumor perforation
Relation of rectal tumors to the potential reflection
Microscopic
Histological type
Histological differentiation
Maximum extent of local invasion (pT stage)
Lymph node status
Extramural venous invasion
Evidence of regression following therapy
Histologically confirmed distant metastases
Background abnormalities
Other
TNM stage
Dukes stage
Completeness
SNOMED codes
Non-Core Data Items
Macroscopic
Specimen dimensions
Precise anatomical location of non-peritonealised margin involvement
Quality of the surgical resection plane in abdominoperineal excisions
Microscopic
Separate identification of mucinous tumors
Nature of advancing margin (infitrative versus expansive)
Tumor Budding
External tumors nodules less than 3mm in diameter
Intramural venous invasion
Immunohistochemical data
Other
Molecular
SNOMED Codes of Colorectal Tumors
T codes (T-66000 Appendix, T-67000 Colon, T-68000Rectum)
M codes (M-81400Adenoma, M-74000 Dysphasia, M-80103 Carcinoma , M-81403 Adenocarcinoma, M-84803 Mucinous adenocarcinoma, M-84903 Signet ring cell adenocarcinoma, M-85603 Adenosquamous carcinoma, M-80703 Squamous cell carcinoma, M-80413 Small cell carcinoma, M-80203Undifferentiated carcinoma, M-82443 Goblet cell carcinoid tumor, M-82443 Mixed carcinoid-adenocarcinoma)

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

integrity, viruses);

g) hardware (network connections, memory protection); and

h) disaster preparedness (sprinklers, off-site backups) (Hasson et al., 2000).

Two Models Related to Medical Informatics for Colorectal Cancer Screening

Screening organization should be chosen according to its ability to transfer theoretical efficacy into effectiveness. An evidence-based organizational model of colorectal cancer screening (CRCS) can assure feasibility and high compliance by health care professionals and citizens. In this section were described two types of models.

a) Colorectal cancer screening model is current version of a model used in a cost-effectiveness analysis in US. The main outputs of model are average years of life lived and accrued costs per person. It can be converted to an aggregate annual model by combining the estimates for every age group in each year and projecting to the national population. Year-2000 U.S. Census data can be combined with age-specific model outputs to make predictions for the U.S. population (aggregate annual model), as opposed to a hypothetical cohort of a given size starting at age 50 years. The model is a Markov model. For the purposes of the pre-workshop modeling exercise, it followed people from age 50 to 85 years of age, or until death if that came before age 85. The model can incorporate stopping ages up to age 100. It is also possible to treat each sex separately, though most of our work has been with average values for the entire population. Finally it is possible for the model to evaluate the costs and effectiveness of screening in populations with different levels of risk for polyps and cancer. This model has capability for working on making predictions at the level of the entire population. (Ladabaum, 2004).

b) The jurisdiction-wide colorectal cancer screening program described is a unique initiative for organized population- base cancer screening in Canada. A health informatics system to support the progress' screening model includes rule-based decision support to monitor screening frequency. An information system sends reminders to individuals about screening, assists in result analyzing and integration. In designing the cancer screening information system, existing technologies were leveraged to provide the ability to manage patient demographics, provider information, and clinical information, as well as to facilitate integration of rule-based notification and reminder and recall components. In addition, the system must support electronic links from laboratories, electronic medical record, and hospital information systems. Key application components, such as the system administration (including security and auditing), the enterprise Master Patient Index (MPI), Messaging System (MS), and the Vocabulary Services (VS), were adopted from available COTS (commercial off-the-shelf), MOTS (modifiable off-the-shelf) and GOTS (governmental off-the-shelf) tools (Aramini et al., 2008).

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

Aramini JJ, Zhang X, Popovich ML (2008).Colorectal cancer screening - using informatics and compunetics to empower the at-risk individual. *Stud Health Technol Inform*, **137**, 42-8.

Atkinson W (2008). Study aims to improve colorectal cancer screening participation. *AHIP Cover*, **42**, 46-8.

Australian Divisions of General Practice (2008). Item 717-45 year old health check resources. Available from: www.nevdgp.org.au

Ayanian JZ, Sequist TD, Zaslavsky AM (2008). Improving Systems for Colorectal Cancer Screening. Available from: http://www.hcp.med.harvard.edu/research/projects/ayanian_improving_systems

Bluecross Blueshield of North California (2008). Evidence based guideline colon cancer screening., Available from: www.bcbsnc.com/services/medical-policy/pdf/colon_cancer_screening.pdf

California Office of HIPPA implementation (2008). Glossary of the terms used within the HIPAA business areas., Available from:http://www.ohi.ca.gov/state/calohi/ohiGlossary.jsp?alpha=H

Hasson MA, Fagerstrom RM, Kahane DC, et al (2000). Design and evolution of the data management systems in the prostate, lung, colorectal and ovarian (PLCO) cancer screening trial. *Controlled Clinical Trial*, 21, 329s-48s.

Degoult P, Fieschi M (1988). "Introduction to Clinical Informatics". Switzerland: WHO, 74.

Department of Health and Human Services Center for Disease Control and Prevention (2005). Colorectal cancer research and evaluation activities., Available from: http://www.cdc.gov/cancer/colorectal/pdf/colorectal-SB2003.pdf

Hillestad R, Bigelow J, Bower A, et al (2005). Can electronic medical record systems transform health care? Potential health benefits, saving, and costs. *EMR System*, **24**, 1103-17.

Kerr P (2004). Using informatics to maximise the impact of cancer research, ,Available from: www.nesc.ac.uk/action/esi/download.cfm?index=2104

Ladabaum U (2004). Colorectal cancer screening model., Available from: www.brown.edu/Research/ICHP/Modules/Mod6CRCScr/Presentation/ColorectalCaScrng.ppt

Ontario Association of Medical Laboratories (2008). Colorectal Cancer Screening Program. Available from:http://www.oaml.com

Rushton G, Peleg I, Banerjee A, Smith G, West M (2004). Analyzing geographic patterns of disease incidence: rates of late-stage colorectal cancer in Iowa. *J Med System*, **28**, 223-35.

Safaee A, Moghimi-Dehkordi B, Fatemi SR, et al (2008). Colorectal cancer in Iran. *Asian Pac J Cancer Prev*, **9**, 123-6.

Shaw C, Cunningham R, Sarfati D (2008). Next Steps Towards a Feasibility Study for Colorectal Cancer Screening in New Zealand: Report for the Ministry of Health.2008. Available from: http://www.moh.govt.nz/moh.nsf/indexmh/cancercontrol-newsandupdates-bowelcancerscreening

Szczerbinska KB, Lach CH, Stomka M (2008). Colorectal cancer as a health care problem: evaluation of the current diagnostic option. *Polskie Archiwum Medycyny Wewnetrznej*, **118**, 224-6.

Wager KA. "Managing Health Information Systems". USA : Jossey-bass.2005.pp:238-240

Website SNOMED, 2007. Available from: www.snomed.org

Weller D, Weller A (2003). Evaluation of the UK colorectal cancer screening pilot. Available from: www.cancerscreening.nhs.uk/bowel/finalreport.pdf