Public Health Data Standards Consortium

PHDSC Ad Hoc Task Force on Electronic Health Record-Public Health (EHR-PH)

WHITE PAPER

Electronic Health Record: Public Health Perspectives

Baltimore, MD
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Glossary
(in alphabetical order)

Actor A provider or recipient of public health services

Action Any interaction by an actor with the public health system, including Electronic Health Record system.

Care Setting The physical location or entity providing health care.

CDC Centers for Disease Control and Prevention[1]

DHHS Department of Health and Human Services

Electronic Health Record (EHR) is information, assembled and maintained in an electronic format which pertains to the health status of an individual and the health services delivered to an individual.

Standardization in the field of information for health, and Health Information and Communications Technology to achieve compatibility and interoperability between independent systems. Also, to ensure compatibility of data for comparative statistical purposes (*e.g.*, classifications), and to reduce duplication of effort and redundancies. [2]

Electronic Health Record System (EHRS) includes "(1) longitudinal collection of electronic health information for and about persons, where health information is defined as information pertaining to the health of an individual or health care provided to an individual; (2) authorized users; (3) provision of knowledge and decision-support that enhance the quality, safety, and efficiency of patient care; and (4) support of efficient processes for health care delivery. Critical building blocks of an EHR system are the electronic health records (EHR) maintained by providers (*e.g.*, hospitals, nursing homes, ambulatory settings) and by individuals (also called personal health records).[3]

Electronic Health Record Infrastructure

Databases, programs, software, hardware, servers, firewalls, access rules, Virtual Private Network (VPN) linkages, and web browser capabilities of the electronic health record system.

National Health Information Infrastructure

A comprehensive, knowledge-based system capable of providing information to all who need it to make sound decisions about health. The

[1] Centers for Disease Control and Prevention. URL: http://www.cdc.gov/
[2] International Organization for Standardization (ISO). URL: http://www.iso.ch/
[3] Key capabilities of an Electronic Health Record System. Institute of Medicine. Letter Report. July 31, 2003. URL: http://www.iom.edu/report.asp?id=14391

NHII includes not just technologies but, more importantly, values, practices, relationships, laws, standards, systems, and applications that support all facets of individual health, health care and public health.[4]

NCHS National Center for Health Statistics/CDC

Health Care Provider Refers to a person licensed, certified or otherwise authorized or permitted by law to administer health care in the ordinary course of business or practice of a profession, including a health care facility. This includes primary care providers, other physicians, nurse-practitioners, physician assistants, etc. [5]

Health Level Seven, Inc. (HL7) A standard development organization that supports the development and maintenance of the HL7 protocol. [6]

HL7 Standard An application protocol for electronic data exchange in health care environments.

PHDSC Public Health Data Standards Consortium[7]

Prevention[8] Inhibiting the development of disease before it occurs. The following three levels of prevention are recognized: primary, secondary and tertiary.

Primary prevention: prevention of disease by altering susceptibility or reducing exposure for susceptible individuals.

Secondary prevention: early detection and treatment of disease (applied in early disease, *i.e.*, preclinical and clinical stages).

Tertiary prevention: alleviation of disability resulting from disease and attempts to restore effective functioning.

Public Health Infrastructure CDC has outlined three core areas of the public health infrastructure: public health workforce; information, data, and communications systems; and organizational and systems capacity.[9]

Registry a centralized public health data file pertaining to a defined set of health records for a particular population, *e.g.*, cancer registry, immunization registry, blood lead registry. It is a common management tool used in public health to assist a health care practice in providing appropriate care to a population of patients and/or to evaluate the effectiveness of public health intervention.

SAMHSA Substance Abuse and Mental Health Services Administration

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[4] National Committee on Vital and Health Statistics. URL: http://www.ncvhs.hhs.gov/nhiilayo.pdf
[5] Glossary of Terms. Health Level Seven, Inc. 2002.
[6] Health Level Seven (HL7). URL: http://www.hl7.org/
[7] Public health Data Standards Consortium. URL: http://phdatastandards.info
[8] Mausner & Bahn Epidemiology – Introductory Text. 2nd Edition. 1985. WB Sanders Company. Philadelphia, Pennsylvania, USA.
[9] Public Health Foundation. URL: www.health.gov/phfunctions/public.htm

Executive Summary

National efforts are underway to implement health information technology (HIT) to promote and improve patient safety and quality of health care. The Electronic Health Record (EHR) is a pivotal instrument in this process[10]. Electronic transmission of data from the clinical care settings to public health agencies via the EHR is essential to (1) support key public health functions and services and (2) supply public health data repositories, *e.g.*, registries, research databases, guidelines, and publications. Adoption of the EHR will enhance the public health infrastructure (data, information and communication systems) and the ability of the public health workforce to deliver the best available services to individuals and communities.

Health Level Seven (HL7), Inc.'s Special Interest Group (SIG) on Electronic Health Record is leading a national effort towards establishing functional standards for the EHR[11]. "The health care system would substantially benefit if HL7 were able to identify and define the core EHR functions in an international ballot and achieve a successful voting outcome in March 2004."[12]

The ***Public Health Data Standards Consortium*** (PHDSC or Consortium) - a voluntary confederation of federal, state and local health agencies, national and local professional associations and public and private sector organizations - recognized a need to bring a common voice from the public health community to the national efforts of standardization of health and health care information for HIT implementation via EHR. On December 2, 2003, the Consortium launched a voluntary Ad Hoc Task Force on Electronic Health Record-Public Health (EHR-PH) in an attempt to provide a public health perspective in the evaluation of the HL7 EHR functional model.

Sixty four volunteers participated in the EHR-PH Task Force. The Task Force activities showed a need for a better understanding of informatics perspectives of public health by the various stakeholders. As the result, participants developed this White Paper entitled "Electronic Health Record: Public Health Perspectives". The White Paper represents views of the Task Force participants. ***The purposes of the White Paper is (1) to communicate to the public health community a need for broader involvement in the national effort to standardize clinical and public health data and systems and (2) to describe public health perspectives on the EHR.***

The White Paper includes an attempt to cross-map the HL7 EHR functions to the core public health functions. The cross-mapping demonstrates that at this high level of abstraction, the core public health functions (assessment, policy and assurance) are well represented in the HL7 EHR functional model. However, a more granular level of cross-mapping is needed to assure the ability of the model to support public health work and data flows. The White Paper also includes a list of Use Cases proposed for more granular cross-mapping of the HL7 EHR functions and three examples of those cross maps, *i.e.*, immunization, hypertension and diabetes. This can further lead to Use Case(s) demonstration projects of the EHR application in public health.

Participants believe that the EHR is critical to the integration of primary care and public health data systems and recognize its impact on public health data generation and reporting processes. The response to the call to participate in this voluntary Task Force demonstrates a strong commitment from the public health community to be a part of the EHR standardization process.

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[10] Key capabilities of an Electronic Health Record System. Institute of Medicine. Letter Report. July 31, 2003. URL: http://www.iom.edu/report.asp?id=14391

[11] Health Level Seven (HL7). Special Interest Group on Electronic Health Record. URL: http://www.hl7.org

[12] DHHS' Position Letter with regard to HL7 EHR SIG deliverables and the upcoming ballot. January 7, 2004.

PHDSC Ad Hoc Task Force on the Electronic Health Record – Public Health (EHR-PH):
Rational, Purpose, Work Processes and Challenges, and Outcomes

Rational

The ***Public Health Data Standards Consortium*** (PHDSC or Consortium) - a voluntary confederation of federal, state and local health agencies, national and local professional associations and public and private sector organizations - recognized a need to bring a common voice from the public health community to the national efforts of standardization of health and health care information for HIT implementation via EHR.

Health Level Seven, Inc. (HL7) Special Interest Group (SIG) on Electronic Health Record is leading a national effort towards establishing functional standards for the EHR – the HL7 EHR functional model. In an attempt to provide a public health perspective to the evaluation of the HL7 EHR functional model, on December 2, 2003 the Consortium launched an initiative to form a voluntary PHDSC Ad Hoc Task Force on the Electronic Health Record – Public Health (EHR-PH). This initiative is consistent with the Consortium's role as a convener.

Purpose

The two-fold purpose of this initiative is to:

a) bring the State and local public health agencies and the public health research community's perspectives into the on-going efforts to develop the HL7 functional model for the EHR, and
b) to demonstrate the benefits of an organized interaction between two of our country's most important health care systems: (1) the public health and (2) the clinical health care.

Work Processes and Challenges

Sixty five volunteers from a diverse range of clinical health care, public health, research community, public and the private sector have joined the PHDSC Ad Hoc EHR-PH Task Force to review the HL7 SIG EHR functional model from the perspective of public health users to understand if the model supports core public health functions and data reporting to the public health agencies, and provides data for public health practice and research.

Work Processes. Based on the suggestion from the HL7 EHR SIG, the PHDSC Ad Hoc EHR-PH Task Force activities have been conducted by two working groups: Developers and Validators. The first group (Developers) designed the work process and response documents and the second group (Validators) reviewed the documents. The Developers group worked from December 15, 2003 through February 20, 2004 and the Validators group from February 10 through March 5, 2004.

The Call for Participation in the PHDSC Ad Hoc EHR-PH Task Force was disseminated on December 2, 2003 among (1) about 100 participants of the PHDSC session on the Future of Public Health Vocabulary and Public Health Data Standards held at the American Medical Informatics Association (AMIA) Annual Symposium in November 2003, and (2) via the PHDSC main listserv (about 300 subscribers). Responders identified their interest in joining the Task Force via e-mail, and indicated the group which they were interested in working with. Recruitment for the Developer group (27 persons) was closed on January 4, 2004. Recruitment for the Validator

Group (28 persons) continued through February 5, 2004. Please, see Attachment 1 for the list of participants.

Group activities were conducted via conference calls and e-mail. The first conference call for both groups was held on December 15, 2004 during which HL7 EHR SIG representative provided an overview of the history of the model development and its format. Developers had two other conference calls (January 5 and January 16, 2004) where the scope of the group's activities and the format of the response document (White Paper) to the HL7 were discussed and agreed on. Validators started their work via a conference call on February 10, 2004 followed by a second call on February 26, 2004. The first version of the White Paper was prepared by volunteers from the Developer group. The document went through four revisions (three by the Developer group and one by the Validator group). All e-mail responses from participants have been reviewed for inclusion in the documents and stored in the Task Force files by name of the responder.

Challenges. The challenges of the PHDSC Ad Hoc Task Force on EHR-PH are the following:

A. The voluntary nature of the effort.
B. Aggressive timeline dictated by the timeline of the HL7 EHR model development process.
C. Delays in receiving versions of the EHR model for review.
D. Lack of guidelines from the HL7 EHR SIG on the methods for evaluating the EHR functional model and a format for Task Force participants to respond.
E. The organizational structure of the HL7 EHR functional model. It is organized as a detailed 42-page table of function descriptions without introductory explanation of the scope of the model and its hierarchy. In this format it is difficult to grasp the model purpose and content.

The review of the HL7 EHR functional model has been conducted using the version dated December 23, 2003.

Outcomes

The members of the PHDSC EHR-PH Task Force believe that the EHR is critical to the future integration of clinical health care and public health data systems and recognize its impact on public health data generation and reporting processes.

The Task Force activities show a need for a better understanding of informatics perspectives of public health by the various stakeholders. This includes an understanding of (1) public health organization (domain/programs and hierarchical fragmentations) and stakeholders, (2) commonalities among public health domains/programs and public health settings in term of data sources, users, public health goals and functions, (3) role of the EHR in integrating primary care and public health practices, and (4) involvement of various public health stakeholders in the national effort for the standardization of health care data via the EHR.

To address some of these issues participants developed the White Paper. This document represents the views of the participants of the PHDSC Ad Hoc Task Force on EHR-PH. The original purpose of this document was to build a consensus among the Task Force participants in the Developer group on the above-mentioned issues 1 through 4 prior to conducting the review of the HL7 EHR functional model.

We now believe that this White paper can be used as an educational tool for the public health workforce to better understand the importance of data standardization in public health as they relate to EHR implementation.

The White Paper represents views of the participants of the PHDSC Ad Hoc Task Force on EHR-PH on public health from an informatics perspective and attempts to identify areas where joint efforts by clinical health care providers and public health practitioners are needed in implementing HIT using the EHR. ***The purposes of this White Paper is (1) to communicate to the public health community a need for broader involvement in the national effort to standardize clinical care and public health data and systems and (2) to describe public health perspectives on the EHR.***

The White Paper includes the PHDSC EHR-PH Task Force participants' response to the HL7 EHR SIG on the EHR Functional Model. Attachment 5 of the White Paper shows an attempt to cross-map the HL7 EHR functions to the core public health functions and interventions. The cross-mapping demonstrates that at this high level of abstraction, the core public health functions (assessment, policy development and implementation, and assurance) are well represented in the HL7 EHR functional model. However, a more granular level of cross-mapping is needed to assure the ability of the functional model to support public health workflow and dataflow.

The White Paper also includes a list of potential Use Cases proposed for further cross-mapping of the HL7 EHR functions to the storyboards of the Use Cases (Attachment 7). Also included are three examples of cross-mapping public health and the EHR functions by use case (immunization, hypertension and diabetes) (White Paper, Attachments 8A, B & C). This could further lead to Use Case(s) demonstration projects of the EHR application for public health practices. The two ways of cross-mapping (general and use case-specific) represent the continuum of possible HL7 EHR functional model validation process by the public health workforce.

The Task Force participants view the EHR as a key endeavor in engaging the public health community in the healthcare standards development and implementation processes to integrate clinical and public health data systems. The response to the call to participate in our Task Force strongly demonstrates the interest and commitment from the public health community to be a part of the EHR standardization process. This initiative also builds a collaborative partnership of various stakeholders in the data standards development and implementation processes that are critical for public health. Participants believe that the PHDSC Ad Hoc Task Force on EHR-PH will evolve into ongoing public health participation in the national EHR standardization efforts.

Acknowledgements

We would like to thank HL7 EHR SIG for the opportunity to be a part of this critical endeavor. We specifically would like to thank Dr. Donald Mon, Vice-President of Practice Leadership, American Health Information Management Association, for helping to launch this initiative, presenting a model overview to participants and being a liaison between the Task Force and HL7 EHR SIG.

We are looking forward to continue working with HL7 EHR SIG on refining the EHR functional model and building together integrated clinical care and public health systems.

I. The Field of Public Health: Goals, Organization and Functions – Informatics Perspectives

Public health is defined as a discipline that addresses a "diverse range of problems and, consequently, [involves] a broad scope of activities."[13] It is a field that encompasses an amalgam of science, action, research, policy, advocacy and government.[14] Public health is a multi-disciplinary field of endeavor traditionally represented by (but not limited to) the following areas: epidemiology, environmental health sciences, occupational health sciences, behavioral sciences, health care management and health policy development.[6] The generation of public health information involves clinical data as well as data collected in other fields, *e.g.*, environmental,[15] large-scale demographic, geographic, socio-cultural, and economic data. Therefore, the public health information infrastructure is "broader than [what] is traditionally addressed by medical informatics."[16]

The overall goal of public health is to improve the health of individuals and communities (also known as population health). To achieve public health goals, the public health infrastructure helps health professionals to carry out the public health services under three core functions (assessment, policy and assurance) at all levels of government (local, state and federal). [17,18]

Public Health Goals

Public health is concerned with four broad areas: lifestyle and behavior; the environment; human biology, and the organization of health programs and systems.[19] Its services are targeted to personal health and community health/population health. The overall goals of public health are the following[20]:

1. To improve the health of all individuals, including the achievement of public health goals outlined in Healthy People 2010[21] by
   - 1.1 Preventing epidemics and the spread of disease.
   - 1.2 Preventing environmental hazards.
   - 1.3 Preventing injuries.
   - 1.4 Responding to disasters and assist communities in recovery.
   - 1.5 Assuring the quality and accessibility of health care.

2. To empower the public with respect to their individual health care via
   - 2.1 Education.
   - 2.2 Accessibility and dissemination of knowledge.
   - 2.3 Control over their personal health records.

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[13] Koo D, O'Carrol P, LaVenture M. Public health 101 for informaticians. J Am Med Inf Ass 2001;8(6):585-97.
[14] Yasnoff W, Overhage J, Humphreys B, LaVenture M. A national agenda for public health informatics. J Am Med Inf Ass 2001; 8(6): 535-45.
[15] Yasnof W, Overhage J, Humphrey B, LaVenture M. A national agenda for public health informatics. J Am Med Inf Ass 2001;8(6):535-45.
[16] Friede A, McDonal M, Blum H. Public health informatics: how information-age technology can strengthen public health. Ann Rev Public Health 1995;16:239-52.
[17] Institute of Medicine. Committee for the Study of the Future of Public Health, 1988.
[18] URL: www.health.gov/phfunctions/public.htm
[19] Pickett, G., & Hanlon, J.J. (1990). Public Health: Administration and practice. 9th edition. St. Louis, MI: Times Mirror/Mosby.
[20] David Hollar. University of Tennessee. Personal Communications. January 5, 2004.
[21] Healthy People, 2010. URL: www.healthypeople.gov

3. To improve the health of the population in an efficient and socially acceptable manner[22] by
   3.1 Evaluating current health status.
   3.2 Identifying problems with their frequency and severity.
   3.3 Identifying solutions with their costs and benefits.
   3.4 Implementing best solutions that are politically and culturally acceptable.
   3.5 Re-evaluating health problems, solutions, and implementations.
4. To assist providers with rapid, accurate information for appropriate service delivery to clients by
   4.1 Reducing medical errors, most notably in eliminating redundancies of data entry that introduce errors at multiple stages.
   4.2 Identifying individuals having potentially serious health care needs for location and follow-up service delivery.
   4.3 Using unique individual and family identifiers and patient accessibility/consent.
   4.4 Providing maximum security, authentication, and monitored audit trails for all access to client records.
   4.5 Evaluating and improving lifelong health service delivery for clients.

5. To provide researchers with comprehensive data for understanding relationships between health conditions, genetics, environment, lifespan developmental changes, and behavior.

It is important to remember, that no matter what HIT tools are ultimately used for integrating public health data and systems, these tools should enable the public health workforce to achieve those goals.

Public Health Infrastructure, Core Functions and Essential Services

The CDC has outlined three core areas of the public health infrastructure: public health workforce; information, data, and communications systems; and organizational and systems capacity.[23] To achieve public health goals, this infrastructure must help health professionals to carry out ten essential public health services under the three core functions of public health at all levels of government, as follows: [24,25]

Assessment

- Monitor health status <individual, community/population> to identify community health problems;
- Diagnose and investigate health problems and health hazards in the community;
- Evaluate effectiveness, accessibility, and quality of personal and population-based health services;
- Research for new insights and innovative solutions to health problems

Policy development and implementation

- Develop policies and plans that support individual and community health efforts
- Inform, educate, and empower people about health issues
- Mobilize community partnerships to identify and solve health problems

Assurance

- Enforce laws and regulations that protect health and ensure safety
- Assure a competent public health and personal health care workforce.

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[22] Phillip C Gioia. Children's Health Specialists. Personal Communications. January 5, 2004.
[23] Public Health Foundation. URL: www.health.gov/phfunctions/public.htm
[24] Institute of Medicine. Committee for the Study of the Future of Public Health, 1988.
[25] Public Health Foundation. URL: www.health.gov/phfunctions/public.htm

- Link people to needed personal health services and assure the provision of health care when otherwise unavailable

These core functions have become the standard that health departments are using to deliver public health services. Attachment 2 presents examples of public health interventions.

Public Health Organization

Over the last 40 years, a categorical disease-specialized domain approach has been utilized in public health, *i.e.*, communicable diseases, lead poisoning, injury, community-based mental health, substance abuse, bioterrorism, etc.[26] This domain-specific organization of public health is currently supported by the structure of funding allocations, by the organizational structure of public health agencies, by training of the workforce, by information system development and operation, and by the structure of data collection.[27] The major services (personal health and population-based health) carried out by local health departments (LHD) in 2001 are depicted in Table 1.[28]

Table 1. Personal Health and Population-Based Services Provided by Local Health Departments

Personal Health Services	LHDs Providing Service (%)	Population Level Assurance Services	LHDs Providing Service (%)
Adult Immunizations	91	Communicable Disease Control	94
Childhood Immunizations	89	Health Education/Risk Reduction	87
Tuberculosis Testing	88	Epidemiology and Surveillance	84
STD Testing and Counseling	65	High Blood Pressure Screening	81
HIV Testing and Counseling	64	Tobacco use Reduction	68
EPSDT	59	Cancer Screening	58
Family Planning	58	Diabetes Screening	53
WIC	55	Cardiovascular Disease Screening	50
Prenatal Care	41	Injury Control	37
Dental Care	30	Violence Prevention	22
HIV Treatment	25	Occupational Safety and Health	13
Primary Care	18		

In addition to the programmatic fragmentation of public health, there is an organizational diversity of public health agencies that follow political structure of jurisdictions and/or public health services delivery workflow. In some states, public health is represented by balanced infrastructure of both state and local health agencies. In others states, (1) the state health agency plays the key role in delivering services to communities; or (2) local health departments are taking the leading role. Health coalitions - public/private partnerships – are another organizational entity involved in delivering public health services, *e.g.*, immunization coalitions – community-based groups that include parents.[29]

The programmatic fragmentation and organizational diversity of public health is the main challenge to HIT implementation for integration of public health data and systems. Understanding communalities of dataflow and workflow across (1) public health programs and (2) across various organizational structures of health agencies and health coalition and (3) entire health care

[26] Lasker RD, editor. Medicine and public heath: the power of collaboration. 1997. New York, NY.
[27] Burke TA, Shalauta NM, Tran NL, Stern BS. The environmental Web: a national profile of the state infrastructure for environmental health and protection. J Public Health Manag Pract; 3(2):1-12.
[28] Scutchfield, F.D., & Keck, C.W. Principles of public health practice, 2nd ed. 2003. Thomson/Delmar Learning: Clifton Park, NY.
[29] Artz N. HLN Consulting, LLC. Personal communications. February 11, 2004.

delivery system is a key step in integrating health-related data and systems. Standardization efforts should take into account information structures of other industries/domains to allow flow of relevant information to the Electronic Health Record System, e.g., environmental data, housing data, geographic data, ecological data, etc.

Table 2 provides a non-exhaustive list of examples of public health categorical domains, stakeholders, core functions, services and interventions, and data sources.[30] Attachment 3 contains

Table 2. Examples of Domains, Stakeholders, Core Functions, Services and Interventions and Data Sources in Public Health

Domains	Stakeholders	Core Public Health Functions	Essential Services & Interventions	Data Sources
Infectious diseases Injury/Trauma Sexually transmitted diseases Consumer product safety Environmental health: Lead poisoning Occupational health Substance abuse Mental health Chronic diseases Bioterrorism Disability	Elected official Policy maker Health department Researcher Private sector Clinician Educator Citizen Community Population Community-based organizations	Assessment Policy development and implementation Assurance	Monitoring Surveillance Screening Survey Risk assessment Policy research Policy development and implementation Regulation Outreach Case management Advocacy Social Marketing Education Evaluation	Physician's office patient medical record Registries Patient hospital records Emergency Medical Services records Governmental regulations and guidelines Research databases Peer-reviewed and non-peer-reviewed literature Population-based surveys Client surveys

an informatics-based description of public health as a system of categorical domains depicting commonalities across domains.

II. EHR: Primary Care and Public Health Interactions

Clinical setting is the central point for the generation of data and information for public health services and research. Electronic transmission of standardized data from the Patient Medical Record (PMR) from the clinical care setting to public health agency via the Electronic Health Record (EHR) is essential to (1) support key public health functions and services and (2) supply public health data repositories, *i.e.*, registries, research databases, guidelines, and publications (Table 2). Adopting the EHR would not only enhance the information, data and communication systems within the public health infrastructure, but would also increase the capacity of the organizational and system components of the infrastructure, and improve the ability of the public health workforce to deliver services to individuals and community/population.

[30] Orlova AO and Lehmann HR. A UML-based meta-framework for system design in public health informatics. AMIA 2002 Symposium Proceedings, November 9-13, San-Antonio, TX: 582-586.

Clinical Care and Public Health

The interaction between the clinical care sub-system and the public health sub-system is extremely complex. However, they complement each other on their purpose of maintaining healthy individuals and communities.[31] Figure 1 depicts the natural history of diseases and the clinical care and public health joint interventions aimed to modify their outcome (recovery, disability, death)[32]. These interventions can occur at any of the three levels of prevention (primary, secondary or tertiary).

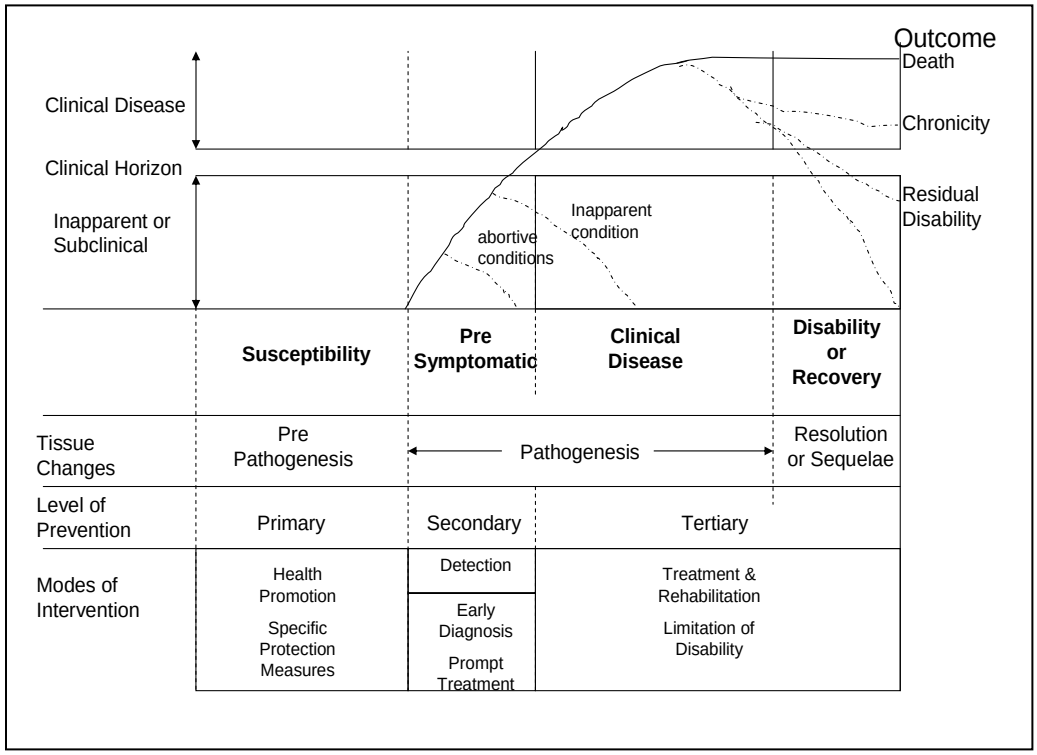

Fig.1. Schematic representation of the natural history of disease

Both public health practitioners and health care providers (HCP) - physicians, nurses, physician assistants, etc. - participate in *primary prevention* by educating the population about health risks and healthy behaviors. For example, public health administers health education programs and health prevention and protection programs, *e.g.*, Lead Poisoning Prevention Programs which include blood lead screening of young children, education on controlling lead exposure, conduct of environmental testing of sources of exposure, case management of children with elevated blood lead levels, and lead abatement interventions. Additionally, public health encourages people to visit their HCP to address new concerns or become better informed about their health. HCPs, in turn, conduct preventive annual check-ups of patients, and administer timely interventions, such as medical treatments to prevent further health consequences.

HCPs carry the heaviest load in the area of *secondary prevention* (pre-symptomatic diagnosis through screening, prompt treatment, prevention of complications of a disease). However, disease

[31] Coto A. Nebraska Health and Human Services Systems. Personal communications. January 16, 2004.
[32] Mausner & Bahn Epidemiology – Introductory Text. 2nd Edition. 1985. WB Sanders Company. Philadelphia, Pennsylvania, USA.

detection can also be done by public health officers through indirect observations for the disease carriers in the area, *e.g*., West Nile Virus, or syndromic surveillance.[33]

Both HCPs and public health practitioners are involved in tertiary prevention dealing with disabilities caused by a disease, and both health care providers and public health practitioners are involved in researching new ways for prevention, treatment and recovery from a disease. ***The EHR will provide a foundation for integration of healthcare and public health services if the EHR includes the necessary functionality for reporting and sharing information, and the appropriate data sharing protocols are established.***

EHR for Public Health Use

The EHR's primary objective is to help facilitate the workflow of HCPs. The EHR is a patient-centered data source. Data generated via the EHR at the point of care delivery will be primarily used for clinical decision support and management of health services at that level, and for administrative perspectives.

Public health will be a secondary user of the EHR, except when it is a direct provider of care. HCPs are the main data providers to public health. In addition, public health utilizes other non-patient-centered data sources, *e.g.*, environmental pollution data, ecological data, research data and survey data, to serve individuals and communities/population. Both HCPs and public health workers use non-patient data sources, *e.g*., inventory of medicines and vaccines.[34] HCPs can also be secondary users of public health data generated via EHR, *e.g*., public health registry data can be used for healthcare services planning.[35] Table 3 presents examples of data types, data providers and users, and primary and secondary uses of data in public health.

What types of public health data will the EHR affect? These include: (a) case management data (lead poisoning prevention case management), (b) reportable diseases surveillance data, registry data (Immunization registry, Blood lead registry), (c) chronic disease and injury surveillance data (Asthma registry, Cancer registry, Traumatic Brain Injury data), (d) vital statistics data, and (e) data collected as a by-product of bills and claims data that may be used for public health surveillance and program planning, implementation and evaluation, as well as public analysis of costs of care and analysis of insurance company efficiencies (Table 3). HIPAA implications should be considered when addressing the healthcare/public health EHR-based data interchange.

How information provided by HCPs is used for public health purposes? The following are some examples:

a) Institutional and ambulatory care databases. Linked outcome data might support cost/effectiveness evaluation of medical care in a community setting. Bills and claims data systems in the public sector might also be used for community-based health care consortia or cooperatives of providers and payors (Table 3). Claims and outcome data in anonymous form may be used by payors to better evaluate their costs and choices for ways of paying for health care.[36]

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[33] Wagner MM, Tsui F-C, Espino JU, Dato VM, Sittig DF, Caruana RA, McGinnis LF, Deerfield DW, Druzdzel MJ, Fridsma DB. The emerging science of very early detection of disease outbreaks. Journal of Public Health Management and Practice 7/6: 51-59, 2001.

[34] Artz N. HLN Consulting, LLC. Personal communications. February 11, 2004.

[35] Same.

[36] Gioia P. Children's Health Specialists. Personal communications. January 5, 2004.

Table 3. Examples of Data Types, Data Uses, and Data Users in Public Health: Data Flow and Work Flow

Data Types (Input Data)		Primary Use (Output Data)			Secondary Use (Output Data)	
		Users	Examples		Users	Examples
Patient medical record	►	Patient	Medications, test results	►	Local, state HDs and CDC	- Case management, - Infectious diseases surveillance, - Registries (Blood Lead registry, Immunization registry, Cancer registry)
		HCP[a]	Ascribed diagnosis, medical history, referrals, etc.		HCP	Prevention, Healthcare planning
		LHD[b] as HCP			LHD[b] as HCP	
		Laboratories	Lab. Results			
	►	Payors: (CMS[c], Insurance Co)	Bills and claims	►	Payor	-Analysis of cost of care -Analysis of insurance company efficiencies -Analysis of quality of care
Community research data & Community surveys Data		Community	CBPR[d]		Policy makers	Regulations and guidelines
		Local and state agencies	Community surveys		Local, state and federal agencies	- Community services programs, - Health education - Budget allocation
			Environ.data			
		Researchers	CBPR			
			Environ.data			
			Clinical Trials		HCP	Healthcare services
					Payors	Financial planning
National research data & National surveys Data	►	Population	National Children Study, NHANES[e], BRFSS[f], NIS[g], NHHCS[h], SEER[i], LSOA[j], YRBS[k],	►	Policy Makers	Regulations, guidelines and international classifications
		Researchers			Local, state and federal health agencies	- Implementation of local, state and federal and global health programs (Immunization, Lead poisoning prevention,
					Local, state and federal environ. protection agencies	
					Local, state and federal housing agencies	
		Federal Agencies			HCP	Healthcare services
					Payors	Financial planning
					Educators	Public health workforce training

[a] HCP - Health care provider
[b] LHD - Local Health Department
[c] CMS - Centers for Medicare and Medicaid Services
[d] CBPR - Community-Based Participatory Research
[e] NHANES-National Health and Nutrition Examination Survey
[f] BRFSS - Behavioral Risk Factor Surveillance Survey
[g] NIS - National Immunization Survey
[h] NHHCS - National Home and Hospice Care Survey
[I] SEER - Surveillance, Epidemiology, and End Results (National Cancer Institute)
[j] LSOA - Longitudinal Study of Aging
[k] YRBS - Youth Risk Behavior Surveillance

b) External cause of injury data. Linked outcome data is also being used to implement interventions to prevent motor vehicle crashes and their health and economic consequences. The Crash Outcome Data Evaluation System (CODES) is being implemented in at least 25 states under the auspices of the National Highway Traffic Safety Administration (NHTSA) using external cause of injury information provided by hospitals and other health care providers.[37]

c) Research data and survey data. Public health programs also generate community and national survey and research data relevant to the health of an individual, community and population (Table 3). This includes environmental data, *e.g*. data on air quality (pollens, pollutants, chemical warfare agents), water quality (chemicals, germs), soil quality (lead, cadmium, chromium), microbial environmental surveillance (anthrax, botulism, algae toxins), ecological surveillance (crow deaths for West Nile Virus, canary deaths for toxic gases); injury data (homicides, violent crimes, suicides, motor vehicle accidents), and weather conditions data (cold, heat, hurricanes, tornadoes, flooding). These data may help health care providers to diagnose and promptly treat a disease.

d) Monitoring of health related activities in the community via *Public Health Syndromic Surveillance*, *e.g*., non-prescribed drug purchases, absences from school, can alert HCPs about up-coming epidemics.[38] The 2001 anthrax episode demonstrated a critical need for better integration of clinical health care and public health.

It is difficult to make a clear distinction between the scope of patient care delivery and community-based/population-based services especially in terms of data needs. Currently, without the EHR and integrated systems, it is difficult to track patients and provide continuum of care services. ***The electronic interchange of data between health care provider and public health via the EHR will enable timely response by providers at the point of care and by public health agencies in the community.***

The following is a non-exhaustive list of ways that the EHR will help improve both clinical health care providers and public health practitioners deliver appropriate services.

1. The EHR will enable the health care providers and public health practitioners to achieve common public health goals stated in chapter I.

2. The EHR will address the discontinuum of care and promote better care coordination among HCPs, public health and users (individual and community/population).[39] Fig. 2 represents the Chronic Care Model that shows the relationship between patient-centered health care and community. [40] Although it was developed for the chronic disease domain, this model is also applicable to community-based care related to other public health domains, *e.g*., lead poisoning,

[37] Coto A. Nebraska Health and Human Services Systems. Personal communications. January 16, 2004.
[38] Tsui FC, Espino JU, Wagner MM, Gesteland PH, Ivanov O et al. Data, Network, and Application: Technical Description of the Utah RODS Winter Olympic Biosurveillance System. American Medical Informatics Association (AMIA), 2002 Annual Symposium, Proceedings, 815-819.
[39] Peeples M. Johns Hopkins University. Personal communications. January 15, 2004.
[40] Improving Chronic Care. URL: www.improvingchroniccare.org/change/model/components.html

reportable disease surveillance, bioterrorism, etc. This model states that "changes in the health care system will only improve chronic illness if active, informed patients work together with provider teams."

3. The EHR will help to better inform patients and solidify the patient–provider effort in finding cures, coping with disease, promoting healthy behaviors, and, thereby, improving the health of individuals as well as communities and the population in general.

4. Current practice patterns of HCP's tend to be reactive and to focus on presenting patient complaints.[41] ***The EHR functions related to public health, e.g., registry, can help to focus HCP's attention on appropriate prevention and chronic care management interventions as well as supporting management of presenting complaints and other acute problems.***

5. The EHR will provide a foundation for integration of healthcare and public health services and will enable patients, HCPs and public health agencies to work together as one team.

6. The EHR will provide a foundation for a consensus among stakeholders in defining their roles and contributions to the national health information infrastructure and to the nation's health.

7. The EHR will help eliminate duplication of efforts related to information management in primary care settings and public health agencies. Improved quality of health information will help manage community resources more efficiently and effectively.

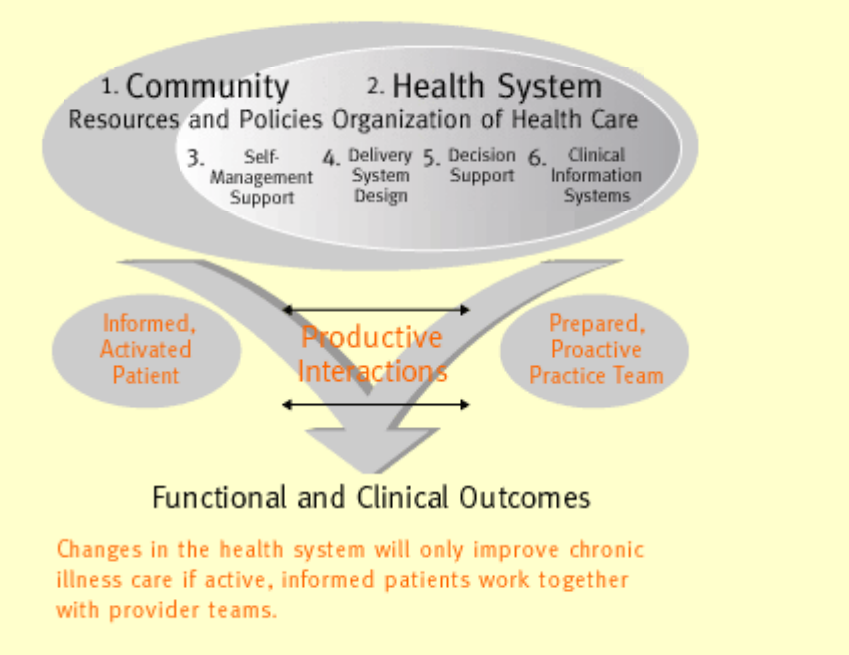

Fig.2. Chronic Disease Patient Care Model: Community and Healthcare System Interactions

[41] Report Brief: Crossing the Quality Chasm. A New Health System for the 21st Century. Institute of Medicine. March 2001. URL: http://www.iom.edu/search_results.asp?qs=Crossing+the+Quality+Chasm

Barriers to EHR Implementation

1. The content of the EHR is still evolving. Health care organizations typically face EHR initiatives with decisions to make about what will be contained in an EHR repository and what additional patient record content must be stored in another media. Many documents in patient records are scanned into document imaging systems because they are not readily captured in digital form. While such documents may be accessible for viewing, their content is not coded. Furthermore, there is not yet a standard for scanned documents of various types. In addition, many currently used electronic medical records have been developed to mimic current paper-based data capture and are not supportive to EHRS.

2. Understanding the HL7 EHR functional model. An introduction document about the HL7 EHR functional model is needed to be developed. It should describe the scope of the model and its various elements (direct care, supportive, information infrastructure). It should specify that the EHR functional model is not a technical specification document but rather a process document. This will allow for (1) a better understanding on how to read the functions, (2) a sounded evaluation process of the model by users, and therefore (3) a better acceptance of the model.

3. Lack of hierarchical structure within the current HL7 EHR functional model. The HL7 EHR functional model represents an intermediate layer of the EHR schema, *i.e.*, how to do things. Additional efforts are needed to formulate a higher (knowledge-based) level of the EHR schema, *i.e.*, what are the EHR objectives? What problems will the EHR address? In this context, the public health goals described in chapter 1 of this White Paper can be considered as examples of the EHR objectives.

4. The nature of healthcare work. While many professions have adopted computer-assisted methods over the past 20 to 30 years, healthcare work, by its very nature, has conspicuously resisted this trend. To a greater degree than many other types of work, healthcare involves multiple types and formats of data input, multiple types and formats of data output, non-linear work processes, strong reliance on human judgment and decision making, and tends to be performed by mobile workers. Computers are best at modeling linear processes. To date, computers have made the most inroads in health care in those work processes that are relatively linear, that have small numbers and types of data inputs and outputs, and that are performed by non-mobile workers. The best example of this is the wide adoption of computers in the medical “front office”, while back in the exam rooms computers are still rarely found. While achievements are being achieved, and new knowledge from informatics research continues to accumulate, so far the complexity of modern clinical healthcare work has in large part defied attempts at computerization.

5. Inadequate understanding of the workflow and dataflow in health care settings including public health settings. Health care teams need to incorporate new (electronic) methods of data capture and access at the point the patient is seen. Until this process is not well understood, the implementation of technology into the process will not be seen as more efficient. In these cases and in those where the EHR product itself is not well designed, the experience may be negative and frustrating for the care team. The EHR must be adaptable to a variety of care setting models and be able to change as processes evolve.

6. Institutions must continue to comply with accreditation and regulatory content requirements in the midst of planning and implementing EHR systems[42]. Requirements are often based on paper standards and are not readily adaptable to the EHR.

7. Legal issues. These range from legal definitions of electronic health record to legally accepted electronic authentication and legal retention requirements. Variation in state laws contribute to this barrier. Lack of standardization for electronic authentication and secure transmission of data is another barrier.

8. Regulatory issues. From the public health perspective, regulatory issues such as the privacy requirements from the Health Insurance Portability and Accountability Act (HIPAA) impact the research potential of anticipated electronic data resources that will be available through the EHR. "Public health has clear legal authority to collect (the minimum necessary) data for surveillance, "without (patient) authorization, for the purpose of preventing or controlling disease, injury, or disability…" without requiring disease or condition specific laws[43]. Barriers to data reporting include regulatory issues, fit with business model, use of IT resources, public relations, accounting for pubic health disclosures, and release of competitive data.[44] Despite legal authority to collect identified data in some states, many system developers have chosen to collect either de-identified or minimally identified data to address some of these practical barriers. A masked or encrypted identifier can be used to address concerns while maintaining data quality. However this approach was challenged by final interpretation of the HIPAA privacy rule.[45] Recent testimony expressed concern about the impact of this interpretation on medical and public health research.[46]

9. Lack of trained staff. Public health practitioners with informatics training are needed to participate in design, implementation, evaluation and maintenance of health information systems employed in public health settings. Public health domain experts need to be involved in the reference information model development for public health that could lead to the development terminology standards and vocabularies.

10. Resources. Additional resources are needed at the state and local levels to assure public health participation in the national health data standardization efforts, particularly in the EHR development and implementation processes.

11. Public Perception. Many citizens are nervous about government intrusion in their personal lives, and may resist granting consent for the movement of their protected health information between parties. The association made between EHR and bio-terrorism preparedness and defense may fuel this fear as the Patriot Act itself has come under increased scrutiny as violating individual freedoms.

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[42] Murphy, GF, Hanken, MA, Waters, KA, Electronic health records: changing the vision, W.B. Sauders, 1999.

[43] Lober WB, Trigg L, Karras B. Information system architectures for syndromic surveillance. Submitted to MMWR, 2004.

[44] Kress A. Data provider relationships: pros, cons, and considerations. National Syndromic Surveillance Conference, October 24, 2003.

[45] Code of federal regulations: standards for privacy of individually identifiable health information; Final Rule, 45 C.F.R. Section 164.514 (a)-(c). August 14, 2002.

[46] Ehringhaus S. Testimony on behalf of the association of American Medical Colleges before the National Committee on Vital and Health Statistics Subcommittee on Privacy. November 19, 2003. National Committee on Vital and Health Statistics. URL: http://www.ncvhs.hhs.gov/031120p2.pdf mber 12,

10. Technical Barriers. The technical infrastructure of health care is very heterogeneous and does not follow consistent standards, though great strides have been made toward standardization in the past few years. The EHR initiative will need to recognize this reality and plan accordingly. Healthcare is under great pressure to reduce cost, so careful and convincing arguments will need to be made for investments in HIT as part of the solution.

III. EHR Functional Model and Public Health

For public health is to evolve from a reactive state to a pro-active state, the EHR is an important step in that direction. The Electronic Health Record System (EHRS) has eight core capabilities: health information and data; result management; order management; decision support; electronic communication and connectivity; patient support; administrative processes; and reporting.[47] The EHRS capabilities will convey various aspects of standardization including multi-directional data transfer between health care system and local, State and national health agencies. Therefore, the EHRS capabilities must provide structure for the core public health functions.[48]

However, the EHR is a product of information science (IS) and so has its own IS functions (capabilities), as follows: (1) data capture, (2) event monitoring, (3) automated notification, (4) escalation, (5) automated measurement.[49] Attachment 4 contains a description of each of these IS capabilities in more detail.

Many will say that these EHR IS capabilities will facilitate timely interventions in the event of a bioterrorism attack. The weapons of mass destruction are really hazardous materials (hazmat), and in this case, public health hazards. A well-developed, robust infrastructure is essential to respond to an attack. The CDC outlines the capabilities that LHDs need to identify and respond to public health emergencies as follows:

1) identify the types of events that might occur in communities;
2) plan emergency activities in advance to ensure a coordinated response;
3) build capacities necessary to respond effectively;
4) identify type or nature of event when it happens;
5) implement planned response quickly and efficiently; and
6) recover from incidents.[50]

These LHD capabilities in the event of an attack will heavily depend on the data obtained via EHR from patients seeking health care.[51] However, the very same infrastructure and capabilities can most definitely be used to implement non-attack intervention. For example, cases of Brucellosis will come through the health channels long before law enforcement gets the confirmatory evidence of a terrorist event. Therefore this infrastructure will equally carry influenza or Ecoli 0157 data. ***The EHR IS capabilities are applicable to various public health domains including lead poisoning prevention, communicable diseases, chronic diseases, bioterrorism, etc., and***

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[47] Key capabilities of an Electronic Health Record System. Institute of Medicine. Letter Report. July 31, 2003. URL: http://www.iom.edu/report.asp?id=14391

[48] Grinsteiner A, North Dakota. Personal communications. January 6, 2004.

[49] Eisenberg F, SIEMENS. Personal communications, January 5, 2004.

[50] Centers for Disease Control and Prevention (CDC) The public health response to biological and chemical terrorism: Interim planning guidance for state public health officials. 2001, July.

[51] Claudio Y, DC Department of Health, and Coto A, Nebraska Health and Human Services Systems. Personal communications. January 14, 2004.

therefore, the EHR will support public health, personal health and population-based health services.

To apply the EHR to public health, we need to look at the core public health functions (assessment, policy development and implementation, and assurance) and services, and determine if the HL7 EHR functional model sufficiently supports these functions and services, and allows for expansion of these functions and services over time. Attachment 5 contains the results of the validation of the capabilities of the HL7 EHR functional model to support core public health functions and essential public health services and interventions. It displays the relationship between EHR IS capabilities, core public health functions and essential services and interventions. Information shown in Attachment 5 demonstrates ***complete integration of EHR IS functions with core public health functions, services and interventions.***

We understand the limitations of cross-mapping of EHR and core public health functions at this high level of abstraction and that more granular level of cross-mapping of public health function and intervention is needed to assure the ability of the functional model to support public health workflow and data flow. Therefore, we considered the possibility of cross-mapping public health and EHR functions as they apply to a specific use case. The section below describes the issues to be considered in developing use cases for the EHR demonstration in public health. Attachment 7 provides examples of potential Use Cases proposed for the EHR demonstration in public health. Attachment 8 presents examples of cross-mapping of the EHR functions to the Use Case storyboard by use case. This case-specific cross-mapping can lead to designing and implementing the Use Case(s) demonstration projects of EHR application for public health practices. Attachment 9 contains additional comments on the HL7 HER functional model.

IV. Developing Use Cases for EHR Demonstration

Use Cases are needed to demonstrate the applicability of the EHR functional model for public health. Use cases attempt to make clear every planned use and user of a system. They document scenarios that describe workflow and dataflow related to a use case. Use cases are descriptive documents that specify requirements for system development, implementation and operation[52]. The following criteria of selecting use cases for demonstration of EHR implementation in public health are under consideration:

1. What is the stage of knowledge of the public health domain within which a use case will be selected?

The first consideration in selecting use cases among various public health domains for the EHR pilot testing should be given to the state of knowledge of the domain -- how comprehensive is our knowledge about various problems within a domain. The better developed domains are, the better developed are the data sources that can be used in the pilot testing.

Attachment 6 describes in detail the life cycle of a public health domain based on the "Problem → Response" public health approach.[53] The ultimate goal of the "response" is to eliminate the Problem. The life of a public health domain includes the following states: Problem Identified →

[52] Cockburn A. Writing effective use cases. Boston: Addison-Wesley, 2001.
[53] Koo D, O'Carrol P, LaVenture M. Public health 101 for informaticians. J Am Med Inf Ass 2001;8(6):585-97.

Problem Characterized → Problem Managed→ Problem Evaluated.[54] At the same time, the domain recognizes the complex interplay between internal and external facilitators and inhibitors of health conditions/wellness[55].

Various public health domains are in various states of knowledge. Lead poisoning and infectious diseases (*e.g.*, polio, measles, etc.) are the examples of the domains that are at the state of the evaluation of implemented interventions (Problem Evaluated). Due to developed regulation, these domains have established State registries (1) to monitor cases of disease, *e.g.*, Blood Lead Registry and Infectious Disease Registry, respectively; and, even further, (2) to control sources of disease, *e.g.*, Housing Registries of older housing that might contain lead-based paint hazard; or (3) to prevent diseases, *e.g.*, Immunization registries. In terms of public health functions, these two domains are at the ***Assurance*** stage. The key interventions here are "(1) to enforce laws and regulations that protect health and ensure safety; (2) to assure a competent public health and personal health care workforce; and (3) to link people to needed personal health services and assure the provision of health care when otherwise unavailable."

Chronic disease domains such as asthma, diabetes and cancer are at the "Problem Characterization" state (***Assessment*** stage). Public health programs maintain registries of incidences of these diseases, *e.g*. Diabetes Registry, Cancer Registry to look for "research for new insights and innovative solutions to health problems". These registries provide data to support **policy development** on how to control/eliminate disease, so the domain can move to the next state "Problem Managed" (***Policy*** stage).

2. Should the use cases be PHIN compliant? In developing use cases, we should look at the CDC's Public Health Information Network[56] (PHIN) initiative and see if these use cases are PHIN compliant or are they in the process of becoming PHIN compliant. All programs of states involved in PHIN would be dramatically affected if another data transfer paradigm is used. No longer are the systems "stovepipe". Rather, with the "base system", each area and/or program will generate data that are PHIN compliant. This means acute and chronic disease programs are being re-written into Program Area Modules (PAMs) that will interact with this base system. Therefore, our efforts should also be PHIN compliant. If not, we are creating another system that will not readily communicate[57].

We should encourage states that do not use PHIN to consider the tremendous benefits from network participation, while in the meantime developing contingency plans for states as they enter PHIN. Consideration should be given on how to facilitate health agencies involvement in PHIN and EHR.

It is also should be noted that acceptance of PHIN concepts and architecture by the wide variety of Federal programs and agencies that fund and are involved in public health is not fully recognized and/or guaranteed. We all should work harder to promulgate PHIN concepts to assure widespread acceptance and implementation of integrated public health systems and support of the national health information infrastructure.

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[54] Orlova AO and Lehmann HR. A UML-based meta-framework for system design in public health informatics. AMIA 2002 Symposium Proceedings, November 9-13, San-Antonio, TX: 582-586.
[55] World Health Organization (2001). The international classification of functioning, disability, and health (ICF). Geneva, Switzerland.
[56] Centers for Disease Control and Prevention. Public Health Information Network. URL: http://www.cdc.gov/phin/
[57] Grinsteiner AP. North Dakota Department of Health. Personal communications. January 6, 2004.

3. Whose perspectives will use cases represent?

The following stakeholders should be considered:

- Individual Patient
- Community
- Community-based Organizations and Public/Private Health Coalitions
- Population in general
- Health Care Provider
- Laboratory
- Payor
- Public Health Agencies [(Local Health Department, State Health Department, Federal Agency(s)]
- Builders of the National Health Information Infrastructure.

Table 4 lists some incentives for stakeholders to adopt the EHR.

4. What are the technical requirements for use cases?

Capacity of current hardware utilized by public health is a recognized problem in implementing the EHR. The EHR use cases developed in a basic generic form to run on a basic, inexpensive, current generation or older hardware owned/used by the HCP or public health worker would be acceptable to most technologically adaptive physicians and other health care providers. Basic information such as billing related procedures, tests and diagnoses are available currently in some digital form from most office visits and all hospital or large group visits[58].

5. How to document costs and benefits in use cases?

The EHR implementation costs and savings or other benefits may not accrue to the same segment of the health system. No matter how good a system we build, there has to be incentive for the HCP, whether private or government, to share this data. [59] The issue we see consistently is that many providers are being asked to do more with less. Staffing issues have reduced the number of individuals entering data thus stopping the sharing of data at the source. Even with mandates from state agencies, the data is not entered at point of contact and often times will be done after the fact. As a result, local providers are overwhelmed with requests for data and do not have the staffing to comply immediately. With the different proprietary schemes for data handling and specifying data content, if the data transfer is not seamless, chances of data exports, whether timely or not, diminish significantly.

6. What administrative functions, if any, should a use case integrate?

For example, use cases can demonstrate integration of several administrative functions, *e.g.*, pharmacy, lab, referrals, reporting to public health agency, reporting to patient.

[58] Gioia PC. Children's Health Specialists. Personal Communications. January 5, 2004.
[59] Grinsteiner AP. North Dakota Department of Health. Personal communications. January 6, 2004.

Table 4. Incentive to Use the EHR by Stakeholder

Stakeholder	Incentives to Use EHR
Individual Patient	EHR will benefit an individual by: • Enabling documentation of all episodes of healthcare in multiple locations, • providing immediate access to their health information at the point of care, • more efficient processing of data to help hold costs down, • supporting better coordination of care among health care providers and public health/prevention resources over time, • connecting patients to reminders and alerts on preventive and intervention health services, • enabling processing of their health information in a variety of ways that help improve the health services they receive and support, • public health surveillance and epidemiology, • necessary research for public health and other purposes, • improving the privacy and security of their personal health information, • improving quality in patient care.[60]
Community/Population	EHR will benefit a community by: • monitoring the health status of the community, • understanding health problems in the community, • providing guidance for resource allocation, • evaluating health care programs.
Health Care Provider	The Health Care Providers will be motivated to use EHR because of: • reduced duplicate/redundant data transcription entry, • reduced notation time, • communication is enhanced among network of providers, • decision support information is provided through EHR (prescriptions, clinical reminders), • easily accessible Internet resources, • increased time to provide patient education, • assured access to relevant information (missing pages/results are reduced in EHRs) including that from public health authorities, • aggregated outcomes data across providers can contribute to evidence-based medicine. • access to administrative information on insurance coverage, prescription coverage and need for prior approval, • timely reimbursement for services, and • aggregated outcomes data across providers can contribute to evidence-based medicine.
Laboratories	Hospital laboratories will benefit from EHR by: • getting access to generalized regional data to have a picture of what is happening in their area and in the state, • using these data they can better prepare themselves with supplies by seeing the trends, • a cost saving mechanism, • familiarity with work on the LOINC/SNOMED codes by laboratory stakeholders allows for the use of a standardized set of codes by all vendors of laboratory information systems. These codes will then be accessible by all information systems in the chain. The HL7 model must accommodate these codes. At the state of North Dakota[61] and at least 15 other states[62], an electronic surveillance system is being developed that uses laboratory test results. It uses HL7 version 2.3.z for transfer of test results. This is an automated process and the state is receiving data

[60] Murphy G. University of Washington. Personal Communications. January 14, 2004.
[61] Grinsteiner AP. North Dakota Department of Health. Personal communications. January 6, 2004.
[62] Coto A. Nebraska Health and Human Services Systems. Personal communications. January 16, 2004.

	daily.
Public Health	EHR will benefit public health by: • access to real-time data to effectively conduct surveillance activities, • automated data facilitates needs assessment activities, • electronically linked information systems ensure complete reporting of relevant data entered in EHR[63] to public health agencies, • improving implementation and evaluation of public health programs, *e.g.*, immunization, lead poisoning prevention, • improving communication between health care providers and public health agencies, and • improving quality of care. Standardized immunizations data reporting will facilitate reporting by physician offices and community based immunizations clinics; increased reporting will increase reimbursement to health care providers; public health departments provide feedback to physician offices and community based immunizations clinics about the observed and the expected immunization rate in their respective communities and the state so they can take appropriate action.[64]
National Health Information Infrastructure[65,66]	*Case Management (help with):* • case management is enhanced as patient history can easily be reviewed—vital signs can be graphed, trended, etc., • facilitates tracking of care, • allows for tracking clients across sites, • provides decision support for diagnosis, prescription, follow-up, • allows data sharing.
	Quality of Care (helps with): • prescription errors are reduced when handwritten notes are eliminated, • unnecessary/duplicate procedures are minimized if a network of key providers seen by patient have access to EHR, • professional satisfaction with improved work efficiency, • marketing, • patient satisfaction, and • decreased liability;
	Health Site Administration (help with): • costs are reduced as unnecessary/duplicative procedures/tests are reduced because patient history is easily accessible, • reduced paperwork, • reporting requirements can be automated, • insurance/employer coverage of service verification, • prior approval, • speeding payment, and • coverage of other ordered services - labs, medicines, x-rays, imaging, physical therapy, home care, durable medical equipment;
	Access to Health Information (helps with): • medical references, • standards of care, • formularies, • public/community health data, health alerts, and • communication to other health professionals, *e.g.*, pharmacists, Emergency Departments (EDs), consultants, hospitals, community care, school health, psychologists, teachers, social services, WIC, health departments etc .

[63] Claudio Y. Washington DC Health Department. Personal communications. January 16, 2004.
[64] Coto A. Nebraska Health and Human Services Systems. Personal communications. January 16, 2004.
[65] Gioia PC. Children's Health Specialists. Personal Communications. January 5, 2004.
[66] Claudio Y. Washington DC Health Department. Personal communications. January 16, 2004.

Examples of Use Cases for EHR Demonstration in Public Health

The following use cases described in Attachment 7 below are proposed for the EHR implementation demonstration projects in public health:

Use Case-I	Immunization: Option - Child has a record in EHR and Immunization Registry
Use Case-II	Infectious Disease: Inhalation Anthrax
Use Case-III	Chronic Disease Screening: Hypertension
Use Case-IV	Chronic Disease: Diabetes and Retinopathy Screening

Additional examples of Use Cases to be developed are the following:

Use Case-V	Traumatic Brain Injuries- external cause of injury reporting
Use Case-VI	Chronic Heart Disease
Use Case-VII	Chronic Pain
Use Case-VIII	Depression
Use Case-IX	Asthma
Use Case-X	Respiratory Disease Surveillance in a Commmunity
Use Case-XI	Environmental Health: Lead Poisoning
Use Case-XII	Share Information with Patients and Providers to Coordinate Care
Use Case-XIII	Organize Patient and Population Data for Care Management
Use Case-XIV	Evaluate Effectiveness, Accessibility, and Quality of Personal and Population-based Health Services
Use Case-XV	Information Transfer from an OBGYN EHR to a Birth Registration Record

Conclusion

Over the past 30 years, healthcare has been going through the process of developing hospital information systems. This has included the development and use of informatics research in the standardization of clinical data and systems. Public health, however, has not received sufficient attention through this process. In fact, the public health informatics agenda was formulated only a few years ago.[67] There is presently a critical need to bring public health practitioners and research communities up to speed, so that HIT can be successfully implemented in each public health function providing a continuum of healthcare for individuals and the community.

The Task Force activities showed a need for better understanding of the informatics perspectives among various stakeholders. This includes understanding of (1) public health organization (domain/programs and hierarchical fragmentations) and its stakeholders, (2) commonalities among public health domains/programs and public health settings in term of data sources, users, public health goals and functions, (3) role of the EHR in integrating primary care and public health practices, and (4) involvement of various public health stakeholders in the national effort of standardization of health care via EHR.

The members of the PHDSC EHR-PH Task Force believe that the EHR is critical to the future of the integration of primary care and public health data systems and recognize its impact on public health data generation and reporting processes.

The Task Force formed a collaborative partnership of various stakeholders in the data standards development and implementation processes critical for public health. It was also the first attempt to bring broader participation of public health governmental and research communities, and public and private sector with public health perspectives into the development and validation of the EHR functional model processes. The participants view this initiative as a key endeavor in engaging the public health community in the national standards development and implementation processes. The response to participate in our voluntary Task Force demonstrates a strong commitment from the public health community to be a part of the EHR standardization process. Participants believe that the PHDSC Ad Hoc Task Force on EHR-PH will evolve into broader public health participation in the national EHR standardization efforts.

Regardless of how good the information system is, it still takes people who care to make things better.[68] This is a huge task, one that is going to take time to resolve. But all channels must remain open and the proprietary trends must adapt or be abandoned if they do not fit into the larger picture. We cannot be “thin skinned” in this matter and must look at all the systems, public and private, and make sure the HL7 EHR functional model transport bridges both and still allows for growth.[69]

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[67] Yasnoff W, Overhage J, Humphreys B, LaVenture M. A national agenda for public health informatics. J Am Med Inf Ass 2001; 8(6): 535-45.
[68] Gioia PC. Children's Health Specialists. Personal Communications. January 5, 2004.
[69] Grinsteiner AP. North Dakota Department of Health. Personal communications. January 6, 2004.

Attachment 1: List of Participants (in alphabetical order)

Developers

Name	Organization	Title	Area of Expertise
Caesar, Craig	HarrisLogic, Inc.	CIO, Community health	Behavioral health care
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Connor, Kathleen	Fox Systems, Inc.	Senior Consultant	PH and financial information
Cortes, Leslie, MD	Texas Department of Human Services	Director	Geriatric
Coto, Arturo, MPH	Nebraska Health & Human Services Systems	Disease Surveillance Coordinator	Disease surveillance
Davis, Robert	PHDSC	Consultant	Health services
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Brown, Kevin	District of Columbia, Department of Health		Health Statistics & administration
Buckeridge, David, MD, MSc	Stanford University	PhD Student	Public health physician
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Gordon, Barry	California Cancer Registry	Director, C/NET Solutions	Cancer surveillance, HL7
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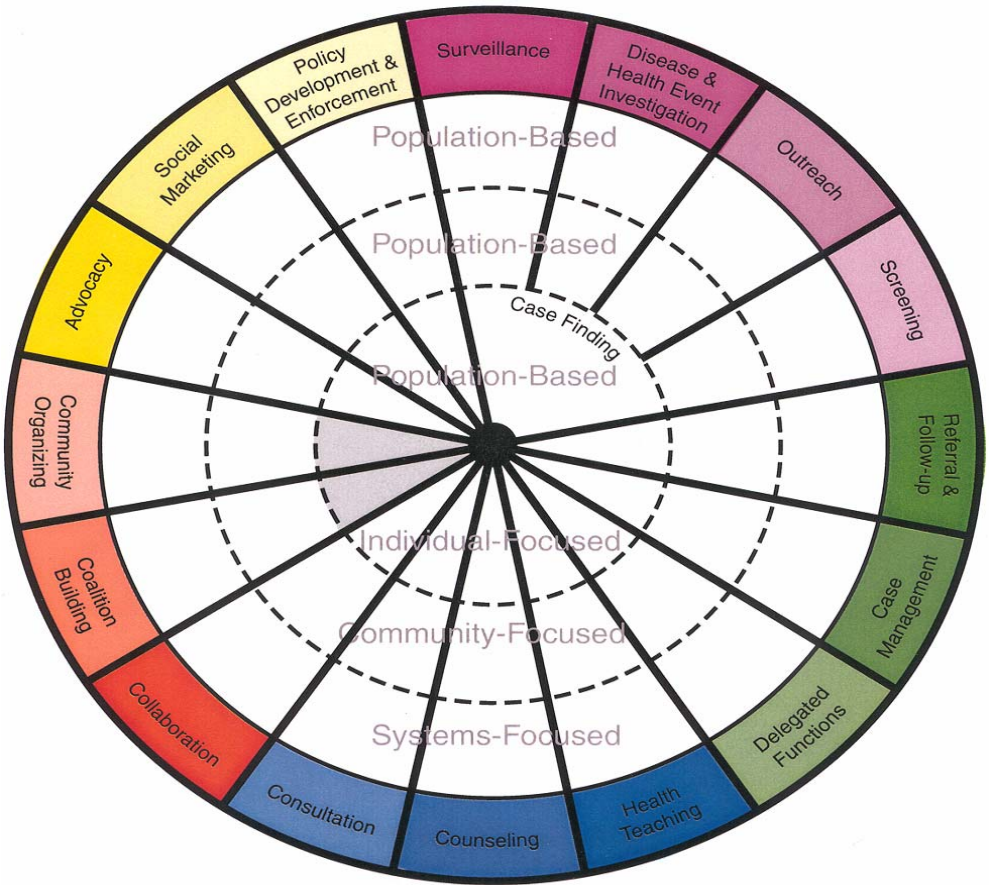
Wangia, Victoria	CDC	PH Informatics Fellow	Health informatics

Attachment 2: Public Health Interventions

Public Health Interventions[70]



[70] Public Health Interventions. Minnesota Department of Health, 2001.

Attachment 3: Public Health as a System: a UML-Based Approach

Public Health as a System: A Unified Modeling Language (UML)[71]- Based Approach[72]

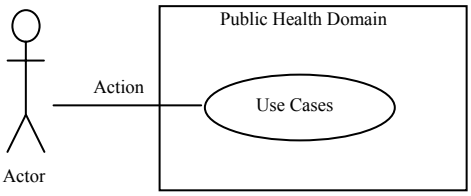


Figure 1. High-level Use Case Diagram for Public Health Domain

Actor = Stakeholders

Policy maker
Health department
Researcher
Private sector stakeholder
Health Care Provider
Educator
Citizen
Community
Population

Actions= Functions & Interventions

Assessment
Policy
Assurance
Monitoring
Surveillance
Screening
Survey
Risk assessment
Research
Evaluation

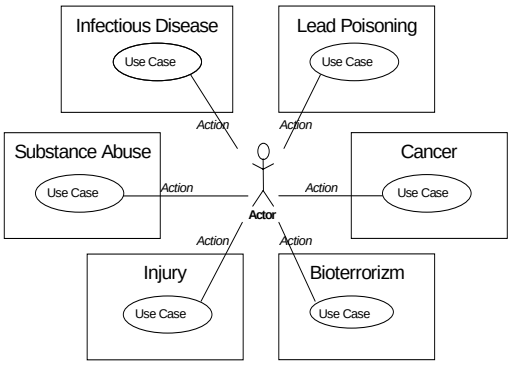


Figure 2. Public Health as a System of Categorical Disease/Event-Specific Domains

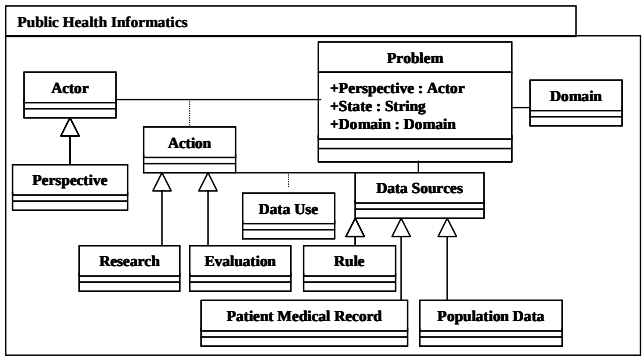


Figure 3. Class Hierarchy in Public Health Domain

[71] Rumbaugh J, Jacobson I, Booch G. The unified modeling language reference manual. Reading, MA: Addison-Wesley; 1999.

[72] Orlova AO and Lehmann HR. A UML-based meta-framework for system design in public health informatics. AMIA 2002 Symposium Proceedings, November 9-13, San-Antonio, TX: 582-586.

Attachment 4: Description of the EHR Information Capabilities

Description of the EHR Information Capabilities[73]

Data capture

Data capture must be non-obtrusive to the individual care delivery process. Key to success is the use of standardized nomenclature with respect to the data elements required for surveillance of results and processes. Standardized surveillance performance measures that are based on known patterns of disease presentation can be identified by aggregating data from multiple input mechanisms. Elements include, but are not limited to, patient demographics, resource utilization, presenting symptoms, acute treatment regimens, laboratory and imaging study orders and results and genomic and proteomic data elements. Identification of known patterns of existing diseases involves aggregation and analysis of these data elements by existing relationships. However, the identification of new patterns of disease requires more sophisticated pattern recognition analysis. Early recognition of new patterns requires data points available early in the disease presentation. Demographics, ordering patterns and resource use (*e.g*., ventilator or intensive care utilization pattern changes) are often available earlier in the presentation of non-predictable diseases. Consumer-generated information is also valuable with respect to surveillance efforts.

Other data sources include environmental, agricultural, vital statistics, etc.

Event monitoring

The second component identified for dynamic, programmatic, process design is event monitoring. For this analysis, an event is defined as the occurrence of a state worthy of a potential change in care delivery. Events may be specific to individual patients and/or generalized to new trends identified for groups of patients (*i.e*., populations). Examples of occurrences that are applicable to event monitoring include, but are not limited to:

- *Individual Events*
    - *Individual results above or below established thresholds (e.g., Serum potassium level ≥ 6 mEq/L, or new incidence of a multiply-resistant or a contagious bacterium in a microbiology culture)*
    - *Trend / rate of significant changes in clinical results whether or not thresholds are met (e.g., Serum creatinine level increase from 0.4 to 1.6 mg/dL within 24 hours)*
    - *New results that have limited consequence individually yet have added level of significance when they occur together (e.g., serum potassium level of 3.0 mEq/L in a patient receiving the medication digoxin)*
    - *New results that require changes in patient management by care providers in multiple roles (e.g., Skin Assessment Braden Scale ≤ 16 <high risk for skin breakdown> requiring pre-determined actions by Nutrition Services, the institution of skin care precautions, the procurement of specific consumable items from Central Supply, and the notification of a health care provider to consider an order for Skin Care Team and/or Physical Therapy Consultation)*
- *Population / Community-based events*
    - *New cluster of events occurring in the organization with sub-detail about the patient care areas, clinical services, individual care providers and patient diagnoses (e.g., ≥ 3 falls within one week on the Neurology Unit)*
    - *Changes in patterns of resource utilization (e.g., ventilator days, intensive care unit admissions, MRI scan utilization, etc.)*

[73] Eisenberg F, SIEMENS. Personal communications. January 6, 2004

- *Routine performance indicators that exceed pre-established upper or lower thresholds (e.g., readmission rates within 30 days of discharge ≥ 5% of discharges, or ventilator days/1000 ≥ 20)*
- *Routine performance indicators that show significant changes whether or not established thresholds are exceeded (e.g., increase in surgical site infections by 10%); with the ability to show the rate of change*
- *New patterns / clusters of symptoms, resource utilization, diagnoses, or results not previously expected (e.g., patients receiving new medication* x *with new elevation in hepatic enzymes and decrease in platelet counts)*

Automated notification

Automated notification, the third of the requirements for dynamic, programmatic, process design is the process by which the system alerts individual care providers or care managers that an event has occurred and requires attention. Standard methods for notification populate existing task lists. Health surveillance methodology should go beyond simple notification by providing the ability for individuals to subscribe to data by category, whether pre-defined or dynamic. This enhanced ability would give a care provider the ability to determine individual preferences for notification with respect to any patient. The ability to subscribe at the time of ordering to individual data-specific preferences adds significant flexibility to the provider and/or care manager. Preferences for notification should be based on the type and urgency of data as well as the individual care provider's specific clinical privileges within the organization. For example, an elevation of HIV-1 RNA viral load from <4000 copies / ml ≥ 20,000 copies / ml might be best managed by the primary care provider privileged to treat AIDS patients and therefore, notification with expectation of action is best sent to that individual. In this example, the Cardiology consultant may be able to subscribe to notification, but with the ability to consult an appropriately privileged primary care provider.

Escalation (Examples are needed)

Escalation, the fourth of the five requirements, has similar prerequisites as automated notification. Of great importance to the escalation process is the ability to match a care provider's clinical privileges with the clinical requirements of the escalation.

Automated measurement

Automated measurement is the last of the five stated requirements, and an essential component of the EHR design. Many of the inefficiencies of clinical care delivery are related to breakdown in communication among care providers and lack of required information at the point of care.[74] Network-based workflow management technology provides the ability to manage patient-centric clinical care delivery across care locations that may involve many human and non-human resources. Monitoring of performance is required with respect to disease state management for populations and sub-populations. Automated measurement should also allow recognition of new patterns of disease presentation and risk.

[74] Stead WW, Miller RA, Musen MA, Hersh WR. Integration and beyond: linking information from disparate sources and into workflow, *Journal of the American Medical Informatics Association*. 2000;7:135-145.

Attachment 5: Examples of Cross-Mapping of EHR Functions and Core Public Health Functions and Essential Services

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
Agent Hazard Exposure Health Outcomes	**Assessment** What is the problem?	Diagnose and investigate health problems and health hazards in the community	Cases: Symptoms and diagnosis; Fish poisoning; Public water contamination; Disasters; Infectious disease outbreak	Data capture: *Ad Hoc calls and Patient visit to PCP and ED, LHDs*	DC1	Care Management	All apply	All apply
					DC2	Clinical Decision Support	All apply	All apply
					DC3	Operations Management and Communications	All apply	All apply
					S 2.1.0	Measurement, monitoring and analysis	Support measurement and monitoring of care for relevant purposes in the EHR	The EHRS supports data collection and linkage between databases.
				Event monitoring: Detection of indicators based on PH surveillance rules by real time & retrospective monitoring of EHR functionalities Reports from the media	S.1.1.0	Disease Registries	Enable the automated transfer of formatted demographic and clinical information to local disease specific registries for patient monitoring and subsequent epidemiological analysis.	The EHR-S supports the addition of new registries through the addition of formatted data transfer protocols but does not necessarily provide support for the disease registry itself.
					S.3.3.6	Health service reports at the conclusion of an episode of care.	Support health service reports to public health entities, such as notifiable condition reports, immunization, cancer registry and discharge data that a provider may be required to generate at the conclusion of an episode of care.	Clinicians do not perform additional data entry to support health management programs and reporting.
					DC3.2.5	Communication with medical devices.	Support communication and presentation of data captured from medical devices.	The EHR links incoming data from multiple devices and sources to improve monitoring and decision-making processes.
				Automated notification Local, State, and Federal agencies	DC3.2.1	Inter-provider communication.	Support inbound and outbound secure electronic communication between providers to trigger or respond to pertinent actions in the care process.	Communication between providers will use synchronous and asynchronous EHR data.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	**Name**	**Statement**	**Description**
					I 1.6.1	Interaction-model -based exchange	The EHRS applications must be able to exchange information with authorized entities using the appropriate interaction model:	This function requires that the EHRS application support a variety of interaction models depending on type of interoperability required. This function recognizes that an application must undergo several state changes to complete the information exchange with another application and that interoperability needs will determine the standard to be used and the interaction mode. For instance, messaging is effective for many near-real time, asynchronous data exchange scenarios but that same mode of interaction may not be applied if the end-user is requesting an immediate response from a remote application. Additionally, even in the case where store-and-forward, message-oriented interoperability is used, the applications may need to support the appropriate interaction mode. For example: Unsolicited Event Notifications, Query/Response, Query for display, Unsolicited summary, structured/discrete, and unstructured clinical documents. .

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	**Name**	**Statement**	**Description**
					S1.1	Disease Registries.	Enable the automated transfer of formatted demographic and clinical information to and from local disease specific registries for patient monitoring and subsequent epidemiological analysis.	The EHR will allow local, state, and federal agencies to access registry data.
					S1.7	Healthcare resource availability.	Support the distribution of local healthcare resource information in times of local or national emergencies.	During emergencies, provide current status of healthcare resources, including, but not limited to, available beds, providers, support personnel, ancillary care areas and devices, operating theaters, medical supplies, vaccines, and pharmaceuticals. The authorized body will use the EHR to distribute resources or patient load to maximize efficient healthcare delivery.
				Escalation Community notification – alerts to key providers in the area of interest – e.g. emergency providers	S3.7.5	Public health related updates	Receive and validate formatted inbound communications to facilitate updating of public health reporting guidelines	Database linkage and GIS formatting of data in a read-only format, with downloadable, de-identified data sent to statistical spreadsheets for informed public health decision-making.
					S3.7.1	Clinical decision support system guidelines and updates	Receive and validate formatted inbound communications to facilitate updating of clinical decision support system guidelines.	Continuously updated emergency health information linked to EHR databases, including inventories of health care resources, disease registries, immunizations, etc., to drive emergency response decision-making.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
				Automated measurement Accumulate evidence regarding an outbreak or abnormality; Confirmed diagnosis; Environ. monitoring	S 2.1.1	Outcome Measures	Analyze outcomes of care provider to populations, in facilities, by providers and in communities.	Database linkage and GIS formatting of data in a read-only format, with downloadable, de-identified data sent to statistical spreadsheets for informed public health decision-making.
					S3.1.4	Support remote healthcare services.	Support remote healthcare services such as telehealth and remote device monitoring by integrating records and data collected by these means into the patient's EHR for care management, billing, and public health reporting purposes.	EHR enables remote treatment of patients using monitoring devices, and two-way communications between provider and patient or provider and provider. Using data standards and technologies that support interoperability, information access functionalities serve primary and secondary record use and reporting with continuous record availability and access that ensure the integrity of the health record, public health reporting, and healthcare delivery processes.
					S3.2	Information access for supplemental use	Support extraction, transformation, and linkage of information from structured data and unstructured text in the patient's health record for care management, financial, administrative, and public health purposes.	The EHRS enables an authorized user to access, aggregate, and analyze the distributed health information needed for reporting.
					I2.4	Extraction of health record information	Manage data extraction in accordance with analysis and reporting requirements, including pre-processing and multiple applications.	

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
		Evaluate effectiveness, accessibility, and quality of personal and population-based health services	Services: Primary care; EMS response care; Environmental control; Community health care (nurses, public health workers, environ. inspectors)	Data capture	1.1.65	EHR Data Extraction	The EHRS must be able to extract data in accordance with analysis and reporting requirements. The data may reside on more that one application and it may be pre-processed (*e.g.* de-identified) before transmission. Data extractions could be to retrospective EHR data or to report public health information.	Informed consent, user authentication, and access rules, followed by de-identification of data and data downloads into SAS, SPSS, GIS, etc. for report generation.
					DC 1.1	Health information capture, management, and review.	Capture all relevant data for patients.	Data are captured using standardized code sets or nomenclature, depending on the nature of the data. Data may also be captured from devices.
					DC3.2.1	Inter-provider communication.	Support inbound and outbound secure electronic communication between providers to trigger or respond to pertinent actions in the care process.	Communication between providers will use synchronous and asynchronous EHR data.
					I1.8	Enforcement of confidentiality	Enforce patient privacy rules as they apply to various parts of the EHRS through the implementation of privacy measures.	The EHRS protects patients records and privacy from harm using maximum protective mechanisms (*e.g.*, PINS, VPN, multiple firewalls and rules).
					I2.1	Data persistence and availability	Retain long-term health record information according to best-practice standards.	Discrete and structured EHRS health record data must be stored and retrieved in a semantically intelligent and useful manner (*e.g.*, chronologically) categorically, retrospectively). Health record data must also be made available to a user in a timely fashion.
						Standard-based interoperability		Interoperability standards extend to

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
				Event monitoring	DC2.4.3.2	Support for referral recommendations	Evaluate patient data and suggest appropriate referrals.	Entry of specific patient conditions may lead to recommendations for referral based upon cumulative EHRS records.
				Automated notification	DC2.5	Support for Health Maintenance: Preventive Care and Wellness	Alerts and notifications for preventive services and wellness.	Identify issues confronting patients and population, and notify all relevant individuals of available services.
				Escalation	DC2.6.2	Support for notification and response.	Upon notification by an external, authoritative source of a health risk within the cared for population, alert relevant providers regarding specific potentially at-risk patients with the appropriate level of notification.	Upon receipt of a health risk within a cared-for population from public health authorities or other external authoritative sources, identify and notify individual care providers or care managers that a risk has been identified and requires attention, including suggestions on the appropriate course of action.
					DC3.1	Clinical workflow tasking	Schedule and manage clinical tasks with appropriate timeliness.	EHRS functions will link patient's health record with specific and appropriate workflow tasks, with designated scheduled tasks being communicated electronically and replacing physical artifacts (*e.g.* handwritten instructions).
				Automated measurement	S2.1.1	Outcome measures.	Support the capture and reporting of information for the analysis of outcomes of care provided to populations, in facilities, by providers, and in communities.	Analyses of individual records by providers or de-identified cumulative health records to assess effectiveness of service delivery to clients based upon conditions.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
				Data capture	I.1.1.5.1	Personal patient-privacy rules	Protect personal privacy according to best-practice standards.	The electronic health record will allow for the assignment, removal, and tracking of anonymous, de-identified, alias, and restricted access status of protected health information. For example: • Make anonymize, de-identify, or apply alias to EHR data provided for public health, clinical research, and population health initiatives. Re-identify specific data in special cases (*e.g.*, disease-outbreak detection). • Include or exclude a subject-of-care's data for specific purposes (such as for research or public health initiatives). An example of "best-practice standard" would be the HIPAA Privacy Rule which requires that covered providers communicate only the minimum necessary information about a patient for payment or operations. With respect to HIPAA transactions, a covered provider may only transmit situational data elements when these are required by a condition stated in the transaction implementation guide. In addition, a covered provider can only communicate the minimum necessary information needed for operations purposes such as quality-related health care activities or fraud and abuse detection.
					DC1.1	Health information capture, management, and review.	Capture all relevant data for patients.	Data are captured using standardized code sets or nomenclature, depending on the nature of the data. Data may also be captured from devices.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	**Name**	**Statement**	**Description**
		Research for new insights and innovative solutions to health problems	Areas: Diagnosis; Treatment; Environ. Monitoring; Causal factors for prevention; Policy development research		**S.3.3.6**	Health service reports at the conclusion of an episode of care.	Support health service reports to public health entities, such as notifiable condition reports, immunization, cancer registry and discharge data that a provider may be required to generate at the conclusion of an episode of care.	Clinicians do not perform additional data entry to support health management programs and reporting.
				Event monitoring	S2.1.2	Aspect of care indicators.	Support the capture and reporting of indicators that suggest further investigation is needed on aspects of care provided to populations, in facilities, by providers, and in communities.	EHRS utilizes broad, standardized indicators for health conditions and procedures, with review and updating as circumstances change.
					S3.1.1	Specialized views.	Present specialized views based on the encounter-specific values, clinical protocols, and business rules.	The user is presented with an interface appropriate t othe context with capture of encounter-specific values, clinical protocols, and business rules. Built-in EHRS situational strategies provide decision-making information for user to deliver most effective services to patients.
				Automated notification	S3.3.3	Service authorizations	Support the creation of requests, responses, and appeals related to service authorization, including prior authorizations, referrals, etc.	EHRS automatically retrieves information needed to support verification of medical necessity and prior authorization of services at the appropriate juncture in the encounter workflow.
					S3.7.1	Clinical decision support system guidelines updates	Receive and validate formatted inbound communications to facilitate updating of clinical decision support system guidelines.	EHRS links inbound information with patient data to provide the care provider with decision-making strategies for health care delivery.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
				Escalation	DC2.2.1.5	Support for condition based care plans, guidelines, protocols.	Information flow directed to automated reports outlining clinically evidence based practices for responding to specific conditions.	EHRS links patient data combinations presenting at examination to library of interventions.
					I1.6	Manage business rules	Manage the ability to create, update, delete (or disable) and version business rules including institutional preferences. Apply business rules from necessary points within the EHRS to control system behavior.	Business rule implementation functions include: decision support, diagnostic support, workflow control, access privileges, and system and user defaults and preferences.
					I3	Unique identity, registry, and directory services	Enable secure use of registry services and directories to uniquely identify, link, and retrieve records and identify the location of subjects of care and providers for health care purposes.	These functions are critical to successfully managing the security, interoperability, and the consistency of the health record data across the EHRS.
				Automated measurement	S2.1.2	Aspect of care indicators	Support the capture and reporting of indicators that suggest further investigation is needed on aspects of care provided to populations, in facilities, by providers, and in communities.	EHRS provides automated measures of health care delivery for feedback in design of services.
					S2.2	Report generation	Provide report generation features for the generation of standard and ad hoc reports.	EHRS enables the user to create standard and ad hoc reports for clinical, administrative, and financial decision-making, and for patient use. Structured and unstructured data links with automated report generation.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
	Policy What is the solution?	Develop policies and plans that support individual and community health efforts	Examples: Non-smoking policies; Lead poisoning prevention; Immunization; Communicable disease reporting; Improvements made in homes and public buildings to prevent falls/ injuries based on external cause of injury reported in UB-92 form	Data capture	**DC1.1**	Health information capture, management, and review.	Capture all relevant data for patients.	Data are captured using standardized code sets or nomenclature, depending on the nature of the data. Data may also be captured from devices.
				Event monitoring	DC3.1.2	Clinical task linking.	Linkage of tasks to patients and/or a relevant part of the electronic health record.	Clinical tasks are linked to a patient or to a component of a patient's medical record.
					DC3.1.3	Clinical task tracking.	Track tasks to guarantee that each task is carried out and completed appropriately.	In order to reduce the risk of errors during the care process due to missed tasks, the provider is able to view and track un-disposed tasks, current work lists, the status of each task, etc.
				Automated notification	DC3.1.3	Clinical task tracking.	Track tasks to guarantee that each task is carried out and completed appropriately.	In order to reduce the risk of errors during the care process due to missed tasks, the provider is able to view and track un-disposed tasks, current work lists, the status of each task, etc.
					DC3.2	Clinical communication.	Automated clinical communication between all providers.	Healthcare requires secure communication between all participants. The EHRS supports communication across all relevant participants, reduces the overhead and costs of healthcare-related communication, and provides automatic tracking and reporting.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
				Escalation	DC3.2.3	Provider and patient or family communication.	Trigger or respond to electronic communication between providers and patients or patient representatives with pertinent actions in the care process.	The clinician is able to communicate with patients and others, capturing the nature and content of electronic communication, or the time and details of other communication.
					DC3.2.4	Patient, family, and caregiver education.	Identify and make available electronically or in print any educational or support resources for patients, families, and caregivers that are most pertinent for a given health condition.	The provider or patient receives print or electronic educational materials.
					S3.1.4	Support remote healthcare services.	Support remote healthcare services such as telehealth and remote device monitoring by integrating records and data collected by these means into a patients EHR.	Remote treatment of patients is made possible by use of monitoring devices linked to EHRS, including two-way communications between provider and patient or between provider and provider.
				Automated measurement	S1.1	Disease Registries.	Enable the automated transfer of formatted demographic and clinical information to and from local disease specific registries for patient monitoring and subsequent epidemiological analyses.	The EHRS enables the user to export personal health information to disease specific registries and add new registries through the addition of standard data transfer protocols or messages.
					S2.1	Measurement, monitoring, and analysis.	Support measurement and monitoring of care for relevant purposes.	EHRS patient data downloadable in de-identified form for analyses.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	**Name**	**Statement**	**Description**
		Inform, educate, and empower people about health issues	Health Education: Breast and cervical cancer prevention program; Public awareness about asthma triggers; Lead hazards;	Data capture	I1.5	Secure data exchange.	Send and receive private data securely.	EHRS encrypts data and provides authentication/access rules for users.
					I1.6	Secure data routing.	Route electronically-exchanged EHR data only to/from known, registered, authenticated destinations/sources.	EHRS encrypts data and provides authentication/access rules for users.
					I1.8	Enforcement of confidentiality.	Enforce patient privacy rules as they apply to various parts of the EHRS through the implementation of privacy mechanisms.	EHRS includes privacy rule protection, as well as audit trails of user accessions to data.
				Event monitoring	S3.2	Information access for supplemental use.	Support extraction, transformation, and linkage of information from structured data and unstructured text in the patient's health record for care management, financial, administrative, and public health purposes.	EHRS uses data standards and technologies that support interoperability, information access across functionalities, primary and secondary record use and reporting with continuous record availability and access that ensure the integrity of the health record, public health, financial, and administrative reporting, and the healthcare delivery process.
					I2.1	Data persistence and availability	Retain long-term health record information according to best-practice standards.	Discrete and structured EHRS health record data must be stored and retrieved in a semantically intelligent and useful manner (*e.g.*, chronologically, categorically, retrospectively). Health record data must also be made available to a user in a timely fashion.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
				Automated notification	S3.7	Maintenance of supportive functions.	Update EHRS supportive content on an automated basis.	All apply.
				Escalation	DC1.1.3	Manage summary lists	Create and maintain patient-specific summary lists.	Patient summary lists can be created or maintained when appropriate for the patient or a particular care setting.
					S1.7	Healthcare resource availability	Support the distribution of local healthcare resource information in times of local or national emergencies.	In times of identified local or national emergencies, and upon request from authorized bodies, EHRS provides current status of healthcare resources, including, but not limited to, available beds, providers, support personnel, ancillary care areas and devices, operating theaters, medical supplies, vaccines, and pharmaceuticals. The authorized body will use the EHR to distribute resources or patient load to maximize efficient healthcare delivery.
				Automated measurement	S2.1	Measurement, monitoring and analysis	Support measurement and monitoring of care for relevant purposes in the EHR	The EHRS supports data collection and linkage between databases.
		Mobilize community partnerships to identify and solve health problems	Community Actions: Smoke-free coalitions; Asthma control coalitions; HIV/AIDS prevention coalitions Lead poisoning prevention	Data capture	DC1.1	Health information capture, management, and review.	Capture all relevant data for patients.	Data are captured using standardized code sets or nomenclature, depending on the nature of the data. Data may also be captured from devices.
					S1.5	De-identified data request management.	Provide patient data in a manner that meets local requirements for de-identification.	When an internal or external party requests patient data, the user can export the data in a fashion that meets the local requirements for de-identification. An audit trail of these requests and exports is maintained.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
			programs	Event monitoring	DC2.6.1	Support for clinical health state monitoring within a population.	Support clinical health state monitoring of aggregate patient data for use in identifying health risks from the environment and/or population.	Standardized surveillance performance measures that are based on known patterns of disease presentation can be identified by aggregating data from multiple input mechanisms.
				Automated notification	DC2.6.3	Support for monitoring and appropriate notifications regarding an individual patient's health.	In the event of a health risk alert and subsequent notification related to a specific patient, monitor if expected actions have been taken, and execute follow-up notification if they have not.	Identifies the expected follow-up for a specific patient event has not occurred and communicate the omission to appropriate care providers.
				Escalation	DC2.7.2	Patient knowledge access.	Enable the accessibility of reliable information about wellness, disease management, treatments, and related information that is relevant for a specific patient.	An individual will be able to find reliable information to answer a health question, follow up from a clinical visit, identify treatment options, or other health care information needs.
				Automated measurement	S 2.1.0	Measurement, monitoring and analysis	Support measurement and monitoring of care for relevant purposes in the EHR	The EHRS supports data collection and linkage between databases.
	Assurance Is the solution working?	Enforce laws and regulations that protect health and ensure safety	Regulations: Screening; Immunization; Speed limit laws, Alcohol consumption	Data capture	**DC1.1**	Health information capture, management, and review.	Capture all relevant data for patients.	Data are captured using standardized code sets or nomenclature, depending on the nature of the data. Data may also be captured from devices.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
			and driving laws; Environ. standards; Impact of community health education, *e.g.*, re: motor vehicle crashes, lead poisoning, etc.	Event monitoring	DC2.6.1	Support for clinical health state monitoring within a population.	Support clinical health state monitoring of aggregate patient data for use in identifying health risks from the environment and/or population.	Standardized surveillance performance measures that are based on known patterns of disease presentation can be identified by aggregating data from multiple input mechanisms.
					S1.1	Disease Registries.	Enable the automated transfer of formatted demographic and clinical information to and from local disease specific registries for patient monitoring and subsequent epidemiological analyses.	The EHRS enables the user to export personal health information to disease specific registries and add new registries through the addition of standard data transfer protocols or messages.
				Automated notification	DC2.6.3	Support for monitoring and appropriate notifications regarding an individual patient's health.	In the event of a health risk alert and subsequent notification related to a specific patient, monitor if expected actions have been taken, and execute follow-up notification if they have not.	Identifies the expected follow-up for a specific patient event has not occurred and communicate the omission to appropriate care providers.
				Escalation	DC2.7.2	Patient knowledge access.	Enable the accessibility of reliable information about wellness, disease management, treatments, and related information that is relevant for a specific patient.	An individual will be able to find reliable information to answer a health question, follow up from a clinical visit, identify treatment options, or other health care information needs.
				Automated measurement	S2.1	Measurement, monitoring and analysis	Support measurement and monitoring of care for relevant purposes in the EHR	The EHRS supports data collection and linkage between databases.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
		Assure a competent public health and personal health care workforce	Examples: Training & Education of culturally competent health care services; Job performance	Data capture	DC1.1	Health information capture, management, and review.	Capture all relevant data for patients.	Data are captured using standardized code sets or nomenclature, depending on the nature of the data. Data may also be captured from devices.
					S1.5	De-identified data request management.	Provide patient data in a manner that meets local requirements for de-identification.	When an internal or external party requests patient data, the user can export the data in a fashion that meets the local requirements for de-identification. An audit trail of these requests and exports is maintained.
				Event monitoring	DC1.1.2	Manage patient demographics.	Capture and maintain demographic information that is reportable and trackable over time.	Contact information including addresses and phone numbers, as well as key demographic information such as date of birth, sex, ethnicity, etc.
				Automated notification	DC2.7.2	Patient knowledge access.	Enable the accessibility of reliable information about wellness, disease management, treatments, and related information that is relevant for a specific patient.	An individual will be able to find reliable information to answer a health question, follow up from a clinical visit, identify treatment options, or other health care information needs.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
				Escalation	DC3.2.3	Provider and patient or family communication.	Trigger or respond to electronic communication between providers and patients or patient representatives with pertinent actions in the care process.	The clinician is able to communicate with patients and others, capturing the nature and content of electronic communication, or the time and details of other communication.
					S1.7	Healthcare resource availability	Support the distribution of local healthcare resource information in times of local or national emergencies.	In times of identified local or national emergencies, and upon request from authorized bodies, EHRS provides current status of healthcare resources, including, but not limited to, available beds, providers, support personnel, ancillary care areas and devices, operating theaters, medical supplies, vaccines, and pharmaceuticals. The authorized body will use the EHR to distribute resources or patient load to maximize efficient healthcare delivery.
				Automated measurement	S2.1	Measurement, monitoring and analysis	Support measurement and monitoring of care for relevant purposes in the EHR	The EHRS supports data collection and linkage between databases.
		Link people to needed personal health services	Networking: PCP, pharmacy and school for treatment of students with	Data capture	DC1.1	Health information capture, management, and review.	Capture all relevant data for patients.	Data are captured using standardized code sets or nomenclature, depending on the nature of the data. Data may also be captured from devices.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
		and assure the provision of health care when otherwise unavailable	asthma; LHD, schools, PCPs, CBOs on lead poisoning prevention Automated inventory of health resources during crisis	Event monitoring	DC2.2.1.6	Support self care	Provide the patient with decision support for self-management of a condition between patient-provider encounters.	Patients with specific conditions need to follow self-management plans that may include schedules for home monitoring, lab tests, and clinical check-ups; recommendations about nutrition, physical activity, etc.
					DC2.4.3.2	Support for referral recommendations	Evaluate patient data and suggest appropriate referrals.	Entry of specific patient conditions may lead to recommendations for referral based upon cumulative EHRS records.
				Automated notification	DC2.5.2	Notifications for preventive services and wellness.	Notify the patient and/or appropriate provider of those preventive services, tests, behavioral actions that are due or overdue between patient-provider encounters.	The provider can generate notifications to patients regarding activities that are due or overdue and these communications can be captured in EHRS.
					DC2.7.2	Patient knowledge access.	Enable the accessibility of reliable information about wellness, disease management, treatments, and related information that is relevant for a specific patient.	An individual will be able to find reliable information to answer a health question, follow up from a clinical visit, identify treatment options, or other health care information needs.

Public Health Threats: Chain of Causality	Core Public Health Functions	Public Health Essential Services	Public Health Examples	EHR IS Capabilities and Examples	Electronic Health Record Functional Model/Descriptors			
					#	Name	Statement	Description
				Escalation	DC3.2.3	Provider and patient or family communication.	Trigger or respond to electronic communication between providers and patients or patient representatives with pertinent actions in the care process.	The clinician is able to communicate with patients and others, capturing the nature and content of electronic communication, or the time and details of other communication.
					S1.7	Healthcare resource availability	Support the distribution of local healthcare resource information in times of local or national emergencies.	In times of identified local or national emergencies, and upon request from authorized bodies, EHRS provides current status of healthcare resources, including, but not limited to, available beds, providers, support personnel, ancillary care areas and devices, operating theaters, medical supplies, vaccines, and pharmaceuticals. The authorized body will use the EHR to distribute resources or patient load to maximize efficient healthcare delivery.
				Automated measurement	S2.1	Measurement, monitoring and analysis	Support measurement and monitoring of care for relevant purposes in the EHR	The EHRS supports data collection and linkage between databases.

Attachment 6: A Life Cycle of Public Health Domain

A Life Cycle of Public Health Domain[75]

The life cycle of the public health domain can be described based on a "Problem → Response" public health approach developed by CDC National Center for Injury Prevention and Control.[76] The ultimate goal of the "response" is to eliminate the Problem. Fig. 1 displays a Unified Modeling Language (UML)[77] Sequence Diagram for a life of a public health domain using and extending the CDC's approach: Problem Identified → Problem Characterized → Problem Managed→ Problem Evaluated.

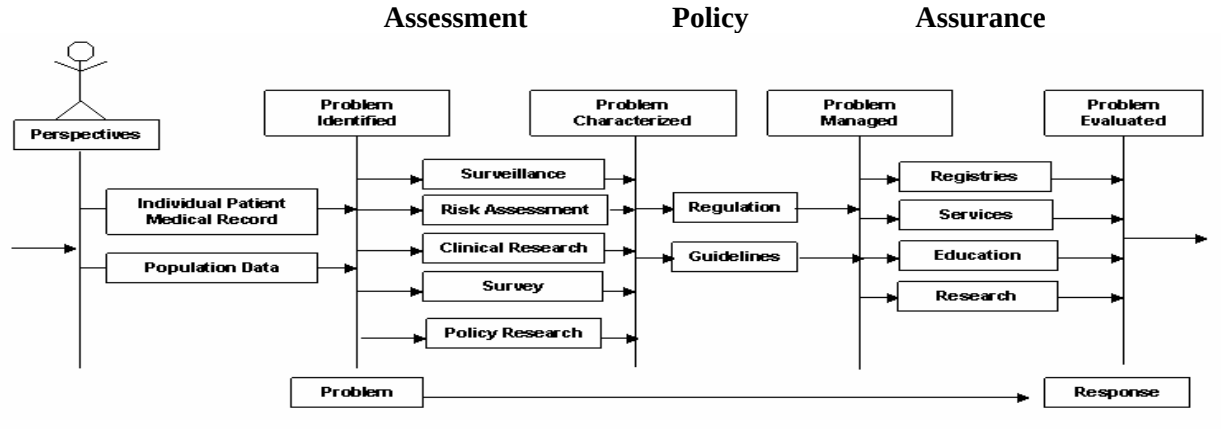


Figure 1. UML Sequence Diagram for a Lifecycle of Public Health Domain

The transitions presented on the diagram are not exhaustive. The Sequence diagram shows public health functions within each state in time. Boxes represent state. Lines with arrows show how generated data feed into the next state. Each next state utilizes data from the previous state, generates new data that help understand previous data and therefore improves overall knowledge about the problem and the ways of addressing the problem. The multiple transitions between states (Problem Identified, Problem Characterized, Problem Managed, and Problem Evaluated) show how different interventions can result in changing a Problem's state. A particular pathway through the diagram leads to, or defines, the information system of an individual problem within a domain. Further improvement of problem management strategies through further actions (*i.e.*, policy development, new research, education and services) may lead to elimination of the problem and to preventing it from re-occurrence. More likely, new Problems are identified, and the cycle begins anew. Therefore, it should be noted that in the Sequence Diagram (Fig. 1), the Problem Evaluated state associates with the starting point of the diagram as well, and, the proper geometry would be a spiral, as time moves forward.

The evaluation and action continually repeating approach (Continuous Quality Improvement (CQI)) is commonly known and used in public health systems/programs. When system/program is designed there should be an continuous evaluation and adjustments as needed for the benefit of the users, *e.g.*, Omaha Nebraska Health Care Systems Committee CQI's activities. The benefit of the adjustments must be weighed against the confusion caused by change (or DUU - dementia under upgrade).[78] The basic conflict is that trying to adapt too fast to new information or a changing environment may make things worse if the stress of change causes more problems than the new problem is causing.

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[75] Orlova AO and Lehmann HR. A UML-based meta-framework for system design in public health informatics. AMIA 2002 Symposium Proceedings, November 9-13, San-Antonio, TX: 582-586.
[76] Koo D, O'Carrol P, LaVenture M. Public health 101 for informaticians. J Am Med Inf Ass 2001;8(6):585-97.
[77] Rumbaugh J, Jacobson I, Booch G. The unified modeling language reference manual. Reading, MA: Addison-Wesley; 1999.
[78] Campbell JR. Mapprint and maintaining standardized vocabularies for CPR systems: Practical Issues. AMIA 2003 Tutorials. T33, November 4, Washington DC.

Attachment 7: Use Cases Proposed for the EHR Implementation Demonstration

Use Case – I [79,80]

Immunization:

Option: Child has a record in EHR and Immunization Registry (IZ) Registry

Storyboard: *A child needs timely and complete immunization. The child is known to the clinic and is already included in the State's immunization registry.*

1. EHR produces clinical reminder for provider indicating that a child needs an immunization.
2. EHR produces and issues communication for parent—sent either through e-mail, or general mail.
3. Parent presents child for immunization.
4. Provider pulls up child's record and clinical reminder indicates immunization history, and highlights immunization required during visit.
5. Provider administers needed immunization—and makes appropriate notation in record.
6. EHR generates new clinical reminder for next immunization.
7. Appropriate data elements are transmitted to SDOH to populate immunization registry—through several key options. 1) data is sent real-time to immunization registry; 2) data at health care site is batched and sent later at a predetermined interval; 3) report is printed and faxed/emailed to DOH where data entry takes place.
8. Obtain consent from parent for sharing information with immunization registry (if required by state law).
9. The State (or local) Immunization Registry is updated—and child is recorded as having met immunization requirements (timely and/or late would be noted as appropriate).
10. Patient is provided with an updated immunization report. If a smart card is available, EHR can update smart card to reflect new immunization history.

Care Settings for Immunizations

Hospital based clinic	Community based clinic
School	Private provider offices

EHR can improve immunization rates—assuming various conditions

- The EHR is accessible to the network of providers that a particular patient will see.
- The software is configured to electronically transmit information to SDOH immunization registry.
- The EHR software incorporates clinical reminders specific to immunization protocols.

Benefits to the Public Health Infrastructure

Assessment

- Immunization rates can be easily determined
- Immunization needs can be easily determined

Policy Development

- Additional resources can be targeted to special communities/populations demonstrating poor immunization rates

Assurance/Research

- Quality of Care--Safety issues can be easily tracked with automated lot information

Information Sharing

- Parent can receive printed copy for their file—and schedule of upcoming needs
- Assuming built in access by school nurse/personnel, compliance with vaccination requirements can be verified
- Automated data can be electronically transmitted to NEDSS/surveillance system

Administrative Benefits

- Provider can document success of efforts
- Automated clinical reminders exist to alert provider of needed/upcoming vaccinations requirements
- Minimal duplicate data notation is required, since patient identifying information is retained
- DOH reporting is generated through EHR—reducing paperwork and effort now needed to report this info.
- Administration can easily produce reports demonstrating effectiveness with assuring timely immunizations

[79] Connon K. Fox Systems. Personal communications. January 10, 2004.
[80] Claudio Y. Washington DC Health Department. Personal communications. January, 16, 2004.

Use Case – II [81]

Infectious Disease: Inhalation Anthrax

Storyboard: *Health care provider (provider) has a patient with non-chronic respiratory distress in an otherwise healthy child who resides in a New Jersey area in which other anthrax victims were identified.*

1. Patient presents to care setting complaining of various conditions.
2. Provider enters clinical information during patient visit.
3. The EHR generates an alert based on the combination of chief complaints—informing provider that anthrax case is apparent
4. EHR outlines appropriate course of action (*e.g.,* look for other symptoms, isolate patient, treatment regimen, alert others).
5. The provider can use the EHR email function to alert other clinic providers/administrator of possible case.
6. The EHR has links to research modules, so provider can further investigate CDC website for relevant visuals, course of action.
7. The EHR is integrated with the NEDSS/State surveillance system—and real time data transmission occurs alerting the SDOH of the notifiable condition. SDOH and provider begin communication—to confirm case/identify course of action.
8. EHR can send electronic information to appropriate level laboratory—and can receive notifications/report from the various laboratories.
9. EHR includes appointment system module, specialists are included as users, so referrals can be generated electronically.
10. EHR prints information for patient relevant to treatment and course of action.

Care Settings for Inhalation Anthrax

Hospital inpatient units	Emergency Departments
Urgent care Centers	Community health centers
Homeless shelter clinics	School-based clinics

EHR will be effective in identifying communicable disease, assuming various conditions

- The nurse must enter chief complaints as patients are seen, so will receive alert early during patient's visit to clinic—in the case of a true communicable disease the patient's mere presence at clinic may put others patients at risk.
- The provider must enter key chief complaint data during visit—so real time information is available to SDOH.
- EHR must be flexible to allow for addition of new clinical alerts that CDC develops
- EHR must be electronically linked to NEDSS/surveillance system
- EHR must be able to communicate with SDOH and the various laboratories levels that would be involved in communicable disease surveillance activities.

Benefits to the Public Health Infrastructure

Assessment

- The incidence and prevalence of inhalation anthrax can be easily determined

Policy Development

- Additional resources can be targeted to special communities/populations demonstrating need.

Assurance/Research

- Automated information systems can alert and enable public health providers to intensify patient safety efforts and quality of care and to practice vigilance in the identification of at-risk individuals.
- Provider and patient have access to most current information from public health authorities.

Information Sharing

- Parent can receive printed copy for their file—and schedule of upcoming needs
- Assuming built in linkage with SDOH and various levels of laboratories, communication is enhanced for all key public health players with responsibility for addressing the outbreak.
- Automated data can be electronically transmitted to NEDSS/surveillance system.

[81] Claudio Y. Washington DC Health Department. Personal communications. January, 16, 2004.

Administrative Benefits

- Paper work is minimized as electronic reporting is possible.
- Automated clinical alert exist to inform provider of imminent risk, and course of action.
- Minimal duplicate data notation is required, since patient identifying information is retained
- DOH required notification is generated through EHR—reducing paperwork and effort now needed to report this info.
- Administration can easily produce reports identifying extent of problem in presenting patients.

Use Case – III [82]

Chronic Disease Screening: Hypertension

Storyboard: *Health Fair staff discover a person with elevated blood pressure, otherwise healthy, and who states she/he has no health care provider.*

1. Patient presents to health fair for screening.
2. Health fair provider enters clinical information during patient visit.
3. The EHR generates an alert based on the combination of chief complaints and BP measurement—informing provider that hypertension is a potential.
4. EHR outlines appropriate course of action (*e.g.*, look for other symptoms, educate patient, possible treatment regimen, alert others).
5. The provider can use the EHR email function to alert other clinic providers/administrator of possible case.
6. The EHR has links to research modules, so provider can further investigate websites for relevant visuals, course of action.
7. EHR includes appointment system module, health care providers and specialists are included as users, so referrals can be generated electronically.
8. EHR prints information for patient relevant to treatment and course of action.

Care Settings for Hypertension Screening

Community health fairs	Emergency Departments
Urgent care centers	Homeless shelter clinics
Pharmacies	Public BP screening kiosks

EHR will be effective in identifying potential chronic disease, assuming various conditions

- The nurse must enter chief complaints and BP measurement as patients are seen, so will receive alert early during patient's visit.
- EHR must be flexible to allow for addition of new clinical alerts.
- EHR must be electronically linked to provider network for referrals.

Benefits to the Public Health Infrastructure

Assessment

- The incidence and prevalence of elevated blood pressure can be easily determined

Policy Development

- Additional resources can be targeted to special communities/populations demonstrating

Assurance/Research

- Automated information systems can alert and enable public health providers to intensify patient safety efforts and quality of care and to practice vigilance in the identification of at-risk individuals.
- Requirement for referral for continuity of care

Information Sharing

- Patient can receive printed copy for his/her file and a schedule of upcoming needs
- Assuming built in linkage with LHD and laboratories, communication is enhanced for all key public health players with responsibility for addressing the risk.
- Automated data can be electronically transmitted to provider to whom patient is referred.

Administrative Benefits

- Paper work is minimized as electronic reporting is possible.
- Automated clinical alert exist to inform provider of imminent risk, and course of action.
- Minimal duplicate data notation is required, since patient identifying information is retained
- DOH required notification is generated through EHR—reducing paperwork and effort now needed to report this info.
- Administration can easily produce reports identifying extent of problem in presenting patients.

[82] Jenkins M. Columbia University. Personal communication. January 16, 2004.

Use Case - IV[83]
Chronic Disease Care: Diabetes and Retinopathy Screening

Storyboard: *Diabetes is a leading cause of blindness. An individual with diabetes presents to primary care provider for upper respiratory infection.*

1. Patient presents to care setting for acute problem – upper respiratory infection.
2. A receptionist enters date of visit into EHR.
3. The EHR generates an alert based on patients's diagnosis history and diabetes care guidelines.- eye exam out of date.
4. Provider sees patient for acute problem but also makes referral for eye exam.
5. Eye care provider adds results of eye exam to EHR.
6. EHR feeds HEDIS report data for provider.

Care Settings for Chronic Disease Care

Primary care offices	Community based clinic
Pharmacies	Ambulatory care services

EHR can improve chronic disease monitoring.

- The EHR is accessible to the network of providers that a particular patient will see.
- The software is configured to electronically transmit information quality reporting bodies such as NCQA.
- The EHR software incorporates clinical reminders specific to diabetes care guidelines

Benefits to the Public Health Infrastructure

Assessment

- Chronic care screening rates can be easily determined
- Chronic care complications can be easily monitored

  Diabetes surveillance. The DPCP collects, analyzes and disseminates data that is used to define the burden of diabetes within Maryland. Communities and population groups in the state with the greatest need are identified for diabetes prevention and control activities. This information is also used to focus the use of limited resources and to measure the impact and effectiveness of the diabetes prevention and control efforts.

Policy Development

- Additional resources can be targeted to special communities/populations demonstrating low disease monitoring activities

Assurance/Research

- Improved health status of individuals with chronic disease- early identification of complications and treatment

Information Sharing

- Patient can receive printed copy for their file and schedule of upcoming needs.
- Reporting agencies can be informed of screening activity.
- Automated data can be electronically transmitted to reporting agencies.

Administrative Benefits

- Provider can document success of efforts
- Automated clinical reminders exist to alert provider of needed screening
- Minimal duplicate data notation is required, since patient identifying information is retained
- LHD reporting is generated through EHR—reducing paperwork and effort now needed to report this info.
- Administration can easily produce reports demonstrating effectiveness with screening

[83] Peeples M. Johns Hopkins University. Personal communications. January 16, 2004.

Attachment 8A: Example of Cross-Mapping the EHR and Public Heath Functions by Use Case I: Immunization[84,85]

Public Health Use Case	Storyboard	HL7 Electronic Health Record Functional Descriptors			
		R[illegible]	Function Name	Function Statement	Rationale
	1. EHR produces clinical reminder for provider indicating that a child needs an immunization.	DC.2.1.1 DC.2.2.1.1			
	2. EHR produces and issues communication for parent—sent either through e-mail, or general mail.	DC.2.5.2			
	3. Parent presents child for immunization.	DC.2.2.1.2	Support for standardized disease based protocols	Identify the appropriate protocols for the management of specific diseases that are adjusted to the patient specific profile.	
	4. Provider pulls up child's record and clinical reminder indicates immunization history, and highlights immunization required during visit.	DC1.1.1 DC.1.1.7	Capture Patient Demographics	Capture demographic information that is reportable and trackable over time.	
	5. Provider administers needed immunization—and makes appropriate notation in record.	DC.1.1.7 DC.1.3.1 DC.1.3.3 DC.2.3.2	Support for medication administration	Alert providers in real-time to potential administration errors such as wrong drug, wrong does, wrong route, wrong time and patient in support of medication administration management and workflow.	
	6. EHR generates new clinical reminder for next immunization.	DC.2.1.1 DC.2.2.1.1			

[84] Williamson M. National Center for Health Statistics. Personal Communications. February 24, 2004.
[85] Artz N. HLN Consulting, LLC. Personal communications. February 11, 2004.

	Storyboard	HL7 Electronic Health Record Functional Descriptors			
		ID*	Function Name	Function Statement	Rationale
	7. Appropriate data elements are transmitted to SDOH to populate immunization registry—through several key options. 1) Data is sent real-time to immunization registry; 2) data at health care site is batched and sent later at a predetermined interval; 3) report is printed and faxed/emailed to DOH where data entry takes place.	S.1.1			
	8. Obtain consent from parent for sharing information with immunization registry (if required by state law).	DC.1.5.1			
	9. The State Immunization Registry is updated—and child is recorded as having met immunization requirements (timely and/or late would be noted as appropriate).	DC.1.1.2			
	10. Patient is provided with an updated immunization report. If a smart card is available, EHR can update smart card to reflect new immunization history.	DC.2.7.2 DC.3.2.3			

* This table includes function IDs based on the most recent HL7 EHR model dated February 16, 2004. Due to limited time this table does not include the description of the function's name, statement and rational as per this latest EHR model. The description of function's name and statement included in this table are from the EHR model dated December 23, 2003.

Attachment 8B: Example of Cross-Mapping the EHR and Public Heath Functions by Use Case III: Chronic Disease Screening: Hypertension[86]

Public Health Use Case	Storyboard	HL7 Electronic Health Record Functional Descriptors			
		ID	Function Name	Function Statement	Rationale
	1. Patient presents to health fair for hypertension screening.				
	2. Health fair provider enters patient demographics to EHR during patient visit.	DC1.1.1	Capture Patient Demographics	Capture demographic information that is reportable and trackable over time.	
	3. Health fair provider enters patient clinical history to EHR during patient visit.	DC.1.1.4	Manage Patient History	Capture, review, and manage medical, procedural, social, and family history including the capture of pertinent negative histories, patient-reported or externally available patient clinical history.	
	4. Health fair provider enters patient BP to EHR during patient visit.	DC.1.1.7	Capture key health data	Capture, manage, and review key health data by a variety of users.	
	5. The EHR generates an alert based on the combination of chief complaints and BP measurement—informing provider that hypertension is a potential.	DC.2.1.3	Support for identification of potential problems and trends	Identify specific problems or trends that me lead to significant problems, which may be based on patient data, providing prompts for consideration at the point of information capture.	
	6. EHR outlines appropriate course of action.	DC.2.2.1.2	Present context sensitive care plans, guidelines, protocols.	Identify the appropriate protocols for the management of specific diseases that are adjusted to the patient specific profile.	

[86] Jenkins M. Columbia University. Personal communications. March 3, 2004

	Storyboard	HL7 Electronic Health Record Functional Descriptors			
		ID	Function Name	Function Statement	Rationale
	7. The provider can use the EHR email function to alert a patient-selected provider of BP and need for follow-up. 1) Data may be sent real-time; 2) data at health fair site may be batched and sent later at a predetermined interval; 3) report is printed and faxed/emailed.	DC.1.4.4	Manage referrals	Enable the origination, documentation and tracking of referrals between care provider or care settings, including clinical guidelines and administrative details of the referral.	
	7. Alternate coding	DC.3.2.1	Inter-provider communication	Support secure e-communication between providers to trigger or respond to pertinent actions in the care process…..	
	8. The EHR has links to research modules, so provider can further investigate websites for relevant visuals, course of action.	DC.2.7.1	Access clinical guidance	Provide relevant evidence-based information and knowledge to the point of care for use in clinical decisions and care planning.	
	9. Patient is provided with a referral to a provider for follow-up.	DC.1.4.4	Manage referrals	Enable the origination, documentation and tracking of referrals between care provider or care settings, including clinical guidelines and administrative details of the referral.	
	10. EHR prints information for patient relevant to treatment and course of action.	DC2.7.2	Patient knowledge access	Enable the accessibility of reliable information about wellness, disease management, treatments, and related information that is relevant for a specific patient.	

Attachment 8C: Example of Cross-Mapping the EHR and Public Heath Functions by Use Case IV: Chronic Disease Care: Diabetes and Retinopathy Screening[87]

Chronic Disease Care: Diabetes and Retinopathy Screening

Storyboard: *Diabetes is a leading cause of blindness. An individual with diabetes presents to primary care provider for upper respiratory infection.*

Assumptions:

A. Patient is a walk-in
B. There exists a Patient Medical Record (PMR) and EHR which are integrated.
C. EHR has a population management function (or registry function) for diabetes which is integrated with EHR, PMS and decision support protocols based on nationally accepted and endorsed standards of diabetes management.

Note: A cross-reference with the HL7 functional specification is referenced only the first step where it is relevant. This is particularly true of patient identifier and demographic information which would be included within nearly every step. If necessary or especially relevant, a function may be listed again.

Storyboard Steps

1. Patient presents to care setting for acute problem – upper respiratory infection.
2. A receptionist enters verifies patient identification and information.
   The receptionist accesses a Practice Management System, PMS, to verify patient's name, address, phone and insurance. The methods of rectifying this information range from receptionist makes all changes to specialists within the practice are required to change specific information.
   A special case of the above is if the patient is not listed in the PMS, then a new record must be created. This PMS record must also populate the EHR at the appropriate point within the process.

Cross map with EHR:

S.1.5.1 or S.1.5.0 Patient Demographics.
C1.1.1 Enable provider to identify and locate patient record. Not clear what information this contains or refers to.
C.1.1.2 Capture Patient Demographics – The display of demographic information is not inherent in this function.
C.2.1.4 Patient and Family Preferences – including language
S.1.4.0 Patient Locator – includes name, address, phone…
C 3.1.0 Clinical Workflow Tasking – Identify initiation of clinical encounter
C.3.1.1 Linking of Tasks With Related Medical Record Entries – Each and every step would need to link to a previous and future or list of potential next steps.
C.3.1.3 Clinical Task Tracking – Tracking each step of prescribed process. Necessary for each step.
S.1.4.2 Patient's residence related to the provision and administration of services –
S.3.1.2 Encounter Specific Functionality – Necessary to create patient specific visit plan.
S.3.3.1 Enrollment of Patients – Enable enrollment of patients.
S.3.3.2 Eligibility Verification and Determination of Coverage.
S.3.4.0 Practitioner/Patient Relationship –Could affect resource allocation.
S.3.4.1 Practitioner Assignment
S.3.4.2 Patient List Management

3. The next step is resource allocation. The resources are visit rooms with appropriate equipment/set up, a provider with availability and with the requisite triage expertise. Currently this is predominantly performed by the front-line staff. The information may be entered into the scheduling section contained within or integrated with the PMS systems.

Cross map with EHR:

C.3.1.1 Linking of Tasks With Related Medical Record Entries – Once resources are allocated associated tasks are assigned.
C.3.2.0 Clinical Communication – Notification of providers of schedule.
S.1.3.0 Provider Locator – Identifying provider information.
S.1.3.2 In-facility Location
S.1.6.0 Scheduling

[87] Sullivan J, and D'Attore T. Hudson Health Plan. Personal communications. February 25, 2004.

4. The receptionist signifies patient present. This could be the trigger to generate an EHR search for relevant information.

Cross map with EHR:

S.1.4.2 Patient's location within a facility – Identify patient at reception, performed after service is scheduled.

5. The receptionist greets patient and reaffirms patient identification with patient demographic information displayed. Upon affirmation a fuller EHR is displayed. This step requires a PMS which integrates with the EHR the patient demographic information, including any information changed in step 2.

Cross map with EHR:

S.1.4.2 Patient's location within a facility – Identify patient at visit room.
S.1.5.1 Patient Demographics – No direct provision for read only.
C1.1.1 Enable provider to identify and locate patient record. Not clear if this includes demographic information.
C.1.1.2 Capture Patient Demographics – The display of demographic information is not inherent in this function.
C.2.1.4 Patient and Family Preferences – including language
S.1.4.0 Patient Locator – includes name, address, phone…
C 3.1.0 Clinical Workflow Tasking – Identify initiation of clinical encounter
C.3.1.1 Linking of Tasks with Related Medical Record Entries – Each and every step would need to link to a previous and future or list of potential next steps.
C.3.1.3 Clinical Task Tracking – Tracking each step of prescribed process. Necessary for each step.
S.1.4.2 Patient's residence related to the provision and administration of services.

6. The EHR displays information and allows for data entry as well. The data entry would include entry of the patient's vitals and chief complaint. The display would include demographic information and alerts on the patient's history. If it is noticed that demographic information should be changed at this point, it is often not editable by the EHR system to help ensure data integrity. Details included within the next 4 steps.
7. The EHR displays a patient has diabetes alert. This alert would be done by the EHR searching through its population management component (registry) and would require that the patient was identified (registered) for diabetes management. The EHR would also search diagnosis history, problem list and laboratory results to identify patients who should possible be entered into the diabetes registry. If patient is not in registry, the provider may be prompted for registry inclusion at some point within the visit. (Building this function might be complex: How often should the provider be prompted to enroll the patient in the registry? Who has authority to override enrollment? Because of the possibility of laboratory aberrations and coding errors, enrollment cannot be based exclusively on laboratory values or previous diagnosis. However, as "pay for performance" models become more widely adopted some providers might be tempted to exclude enrollment of appropriate patients. Laboratory results and diagnosis over time would need to be displayed for appropriate determination.

Cross map with EHR:

C.1.1.3 Manage Problem List
C.1.1.7 Manage Patient History
C.1.2.1 Present Clinical Guidelines
C.2.1.2 Support for Patient Context-Enabled Assessments
C.2.2.2.1 Support for Standard Chronic Disease Management-Based Protocols
C.2.2.2.2 Support for Context Sensitive Chronic Disease Management
S.1.1.0 Disease Registries
S.3.7.1 Clinical Decision Support System Guidelines Updates – Would have been necessary either beforehand or, if feasible, at time of care.

8. The EHR displays an alert that patient needs eye exam. (It is possible that this alert could be used by the receptionist to schedule services, obviously dependent upon the service required and patient input.) This alert is based upon information from the previous step, services history and protocols for diabetes care. The protocols from diabetes care could have been transferred to the practice via a nationally recognized organization. The services history would need to indicate that a diabetic eye exam had been performed. This information might be available in a multispecialty group if eye care professionals in the group use the same EHR.. Even then there would need to be coding to indicate that an eye exam was a diabetic eye exam. In most cases eye exams would be done by providers not linked to the same EHR. In that case, in addition to being scanned into the system for viewing, the consultant notes would need to be coded to indicate the date of service and if the service provided was a diabetic eye exam. Because many specialists fail to send consult letters to referring doctors, or because there may be more than one referring provider, primary care practices will also need to be prompted to request reports when eye exam referrals have been made.

Cross map with EHR:

C.1.1.3 Manage Problem List
C.1.1.7 Manage Patient History
C.1.1.11 Capture External Clinical Documents – Possibly used for lab results and consultant notes
C.1.2.1 Present Clinical Guidelines
C.2.1.2 Support for Patient Context-Enabled Assessments
C.2.2.2.1 Support for Standard Chronic Disease Management-Based Protocols
C.2.2.2.2 Support for Context Sensitive Chronic Disease Management
C.2.2.2.4 Support the identification of Deviations from Chronic Disease Management Protocols-
S.1.1.0 Disease Registries
S.3.7.1 Clinical Decision Support System Guidelines Updates – Would have been necessary either beforehand or, if feasible, at time of care.

9. The medical assistant (MA) gathers chief complaint. The complaint is input into the EHR by the MA.

Cross map with EHR:

C.1.1.10 Capture and creation of Clinical Documents and Notes – Input of chief complaint
C.1.1.12 Capture of Patient-Provided Data – Entry of chief complaint (The commentary mentions patient entered data and not patient provided. Perhaps there should be a separate function for patient entered, such as pain management, and patient provided, such as chief complaint where the patient provides the data and a provider enters the data.
S.3.2.1 Rules-Driven Clinical Coding Assistance – May be necessary at each data entry point, except for input of free format text. It is possible various aspects of chief complaint are systematically coded.
C.3.1.3 Clinical Task Tracking – Chief Complaint was obtained.
S.3.1.0 Encounter/Episode of Care Management – Function that should be included at nearly every step that would be considered part of the clinical encounter.

10. The MA gathers vital signs. The EHR must capture standardized input either directly from medical appliance or as input from the MA.
(Is this where alerts for point of care emergency notifications are incorporated, for example notification of SARS possibility? Who would issue these criteria? Is there information at this point transferred to a central authority?)

Cross map with EHR:

C.1.1.10 Capture and creation of Clinical Documents and Notes – Input of vitals
C.1.1.11 Capture of External Clinical Documents – The function to capture vitals from medical instruments, should they be used and integrated with the EMR.
C.3.2.5 Communication with Medical Device – Should a medical device capture vitals.
S.3.2.1 Rules-Driven Clinical Coding Assistance – May be necessary at each data entry point, except for input of free format text.
C.3.1.3 Clinical Task Tracking – Chief Complaint was obtained.
S.3.1.0 Encounter/Episode of Care Management – Function that should be included at nearly every step that would be considered part of the clinical encounter.
S.3.1.4 Integrate Device Monitoring and Remote Health Services Such as Telehealth Data – Device monitoring may capture vital signs.

11. MA finishes with introductory session. This step signifies a completion of a set of tasks by one practitioner and signifies the readiness of the patient for the next step, including any communications which may be necessary.

Cross map with EHR:

C.3.1.3 Clinical Task Tracking – Signifying completion of introductory session.
C.3.2.0 Clinical Communication – Notification to provider of patient status.

12. Provider sees patient and relevant information, current vitals, chief complain,two alerts (diabetes and need for eye exam), demographics. Assuming the following functions are available for all following practitioner steps.

Cross map with EHR:

C.1.1.1 Enable the Provider to Identify and Locate a Patient Record – May be necessary if the workflow has not pushed the data to the provider.
C.1.1.3 Manage Problem List
C.1.1.4 Manage Medication List
C.1.1.5 Manage Allergy List
C.1.1.6 Manage Other Summary Lists – Patient Specific summary lists
C.1.1.7 Manage Patient History
C.1.1.8 Review Chart Summary – Filterable review of entire clinical history
C.1.2.1 Present Clinical Guidelines
C.2.1.4 Patient and Family Preferences
C.2.2.1.1 Support for Standardized Disease Based Protocols

C.2.2.1.3 Support for On-Going Management
C.2.2.1.4 Identification of Deviations From Standard Protocols
C.2.2.2.1 Support for Standard Chronic Disease Management-Based Protocols
C.3.1.3 Clinical Task Tracking
S.1.1.0 Disease Registries
S1.1.4.1 Patient's Location Within a Facility – If the location has changed from introductory clinical session.
S.3.4.0 Practitioner/Patient Relationship
S.3.4.1 Practitioner Assignment – For verification purposes.

13. Provider sees patient for acute problem. Further information from EHR shows problem, medication and allergy lists and patient history.

Cross map with EHR:

C.1.1.10 Capture and Creation of Clinical Documents and Notes –
C.1.1.12 Capture Patient-Provided Data
C.2.1.1 Support for Standard Assessments –
C.2.1.2 Support for Patient Context-Enabled Assessments – Patient provides additional information regarding acute problem and is documented by practitioner.
C.2.1.3 Support for Identifying Anomalies or Potential Problems – Could be a functional check for any and all identifications of problems.
C.2.2.1.1 Support for Standardized Disease Based Protocols – Standard care protocols
C.2.6.4 Support for Clinical Guidance
C.3.1.3 Clinical Task Tracking
C.3.2.5 Communication with Medical Devices – Should such devices be used to gather additional data
If medication is deemed appropriate:
S.3.2.4 Formulary Communication –
C.1.3.2 Support for Medication Formularies
C.1.3.3 Enable Documentation of Medication Administration – If medication is to be administered at time of care.
C.2.3.2 Support for Medication Ordering -
C.2.3.2 Support for Medication Administration – In the event medication is administered at time of visit
C.2.3.1.1 Support for Standard Drug, Food, Allergy and weight/age-abesed Dosing Interaction Checking –
C.2.3.1 Support for Medication Ordering –
C.2.3.1.2 Other Support for Medication Ordering – Identify other potential issues at point of prescribing.
C.3.2.1 Pharmacy Communication
If additional tests are appropriate:
C.1.4.1 Enable Ordering of Diagnostic Tests
C.1.4.2 Enable Placing of Communication and Other Orders
C.1.4.3 Enable Use of Order Sets – Utilize a standardized set for placing standard orders.
C.1.4.5 Route and Manage Results – Route tests results to provider.
C.2.4.2 Support for Result Interpretation
C.3.1.2 Clinical Task Routing
C.3.1.3 Clinical Task Tracking
C..3.2.0 Clinical Communication
S.1.6.0 Scheduling
S.3.3.3 Service Authorizations
S.3.3.4 Support of Service Requests and Claims – Provide additional data in support of service request

14. Provider makes referral for eye exam incorporating information of patient's insurer and medical needs. Ideally, EHR has a prompt that requires response so that the physician must either make the referral or override the prompt.

Cross map with EHR:

C.1.1.10 Capture and Creation of Clinical Documents and Notes
C.1.4.4 Enable Ordering and Tracking of Referrals
C.1.4.5 Route and Manage Results
C.2.4.0 Orders, Referrals, Results and Care Management
C.2.4.1 Support for Non-Medication Ordering
C.2.4.3 Support for Referrals
C.2.4.3.1 Support for Referral Orders
C.2.4.3.2 Support for Referral Recommendations
S.1.3.0 Provider Locator
S.1.3.1 Maintain Provider Demographics

S.1.6.0 Scheduling
S.3.3.3 Service Authorizations
S.3.3.0 Administrative Transaction Processing – Process to generate necessary data for referral
S.3.3.4 Support of Service Requests and Claims

15. Eye care provider adds results of eye exam to EHR. Ideally an EHR will prompt the eye care professional to complete a brief consultant report that conveys the essential information for the PCP. This is useful because eye professional notes are often incomprehensible to other practitioners. In the majority of cases the eye care professional will not have access to the same EHR as the PCP, therefore the primary care team should be prompted to search for a result from the eye care referral if one has not been registered within a set time period from the date of referral.
16. EHR feeds HEDIS report data for provider.

Notes: Authenticating with EHR system: If the system is designed such that a device is mobile and individual specific, then authenticating once into a system while visiting a series of patients is feasible. If the system is static as each provider sees the patient, they must authenticate with the system. In this case, the MA would authenticate initially. When the doctor sees the patient they would authenticate with the system. This authentication process would establish the necessary rules for authentication and authority for access to information.

Attachment 9

Additional Comments on the HL7 EHR Functional Model[88]

The following are some specific observations about the current HL7 EHR model with the perspective of the American Immunization Registry Association (AIRA):

DC.1: This section do not specifically accounts for the exchange of information required to support reporting of suspected adverse events or contraindications to immunizations. Adverse events are mentioned in DC.3.2.2 but this is only with respect to pharmacy-provider communications. And it is covered somewhat in DC.2.3.1 and DC.2.3.2. With BT vaccines this becomes even more critical. How does the transmission of a smallpox take response fit into the model?

DC.1.3/DC.2.3: Just a nomenclature question: in some circles, vaccine is not included in the term "medication," in some circles it is. Is it presumed that in this section developers include vaccine?

DC.1.5.1: This section about managing consent does not specifically reference consent for *information sharing* which is impotents for many public health practitioners.

DC.2.2.1.5: Word "enrollment" is mis-spelled.

DC.2.6.1: This item on monitoring the status of a population could mention immunization up-to-date status as one of its measures.

DC.3.2: This section on clinical communications does not mention communication with a public health clearinghouse, like a registry, for the purpose of completing provider records to aid in the delivery of care. Section S.1.1 talks about this for surveillance purposes, but the need to support clinical use is (functionally) distinct.

S.1.1: This item is labeled "disease registries" but it is too narrow a term. Immunization or childhood blood lead registries are not the same "disease registries" as a cancer or asthma registry.

S.1.3: This item on "provider directory" needs some clarification. Those who build population-based public health systems know there is often confusion over the useful unit of analysis. Is it the HCP (meaning the individual healthcare practitioner)? Is it the healthcare office or facility? How does the model account for multi-layered organizations? How does the model deal with the constant purchase/sale/reorganization of these institutions? At minimum, the model should define its terms: does "provider" here mean "practitioner"? For some users it may mean "practice".

Lastly, transmission of certain information that is not patient-specific is missing. Best example is the movement of inventory between locations, both public health locations or HCP's locations. Does the model account for these types of data exchange needs which ultimately support clinical and public health services?

[88] Artz N. HLN Consulting, LLC. Personal communications. February 11, 2004.

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