Pointing the Way: Competencies and Curricula in Health Informatics

Applied Health Informatics (AHI)
Research & Development Health Informatics (RDHI)
Clinician Health Informatics (CHI)

Version 1.0

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Dedicated to Our Students

*Sine Qua Non*
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- **Naomi Mensink** and Grace Patterson who both provided advice and support throughout the project.

DISSEMINATION POLICY

It is our hope that the work of the AHI and RDHI Working Groups be used to guide the development of Applied Health Informatics and Research and Development Health Informatics Programs, offering curriculum developers, teachers, students, and potential employers a perspective on the skills, knowledge, and experience required to function competently as an Applied Health Informatician or a Research and Development Informatician, as well as defining the educational content of a life-long educational experience in these areas.

It is our hope that the work of the Clinician Health Informatics (CHI) Working Group be used to help guide the development of programs for clinicians who will regularly use informatics tools and technology for their clinical work. The material should be a useful guide to clinicians who wish to learn about the knowledge and skills which would help them make better use of current tools.

We believe this material will also help health organizations and the vendors of products and services to the health sector to identify the requisite knowledge, skills, and experience of the health informaticians they require to support their organizational objectives.

As per the agreement among participants:

This work is considered to be in the public domain rather than being the property of any organization or individual. It is our desire that this work be as available and influential as possible.

Duplication of this material by anyone other than the participants, however, is restricted to internal organs of organizations.

HOWEVER, AFTER JANUARY 1, 2002 THE MATERIAL CAN BE FREELY DISTRIBUTED WITH APPROPRIATE CREDIT.

Unilateral publication by selected participants in peer-reviewed journals or in books and monographs is not permitted.

Publication of parts of this work by participants is permitted in health industry magazines and in proceedings of meetings with appropriate acknowledgement.

This is an evolving document. We welcome suggestions for additions and changes. Please forward these to dcovvey@sprynet.com.
PROJECT OVERVIEW

INTRODUCTION

Health Informaticians (HIs) are professionals that develop and/or deploy systems and methods based on information and communications technologies in support of health care, research, health system administration, and teaching. HIs require a well-developed knowledge base that encompasses the health system, computer science, and health information systems-related topics, as well as a set of intellectual and procedural skills, and preparatory experiences. The availability of skilled and knowledgeable HIs has become a critical issue in today’s health system.

THE NEED FOR HEALTH INFORMATICIANS

Because Health Informaticians require knowledge and skills from such diverse disciplines, fully capable professionals are few and far between. Few people have the broad education and training necessary to fully understand, design, develop, deploy, and use the many techniques and technologies. Serious consequences include that health organizations often make unproductive investments in IT, and find it difficult to identify and recruit professionals to deploy and maintain systems. In addition, systems developers often lack for professionals that are capable of mastering the complexities of healthcare systems development, and health professionals lack access to the most suitable decision support tools for clinical care, health services administration, research, and teaching. Additionally, systems are implemented which don’t meet the needs of diverse constituencies.

But the need for Health Informatics education goes beyond IT professionals. Today’s clinicians need to effectively use computer-based records and decision support tools, administrators need to be able to link health care activities with the results they produce, and researchers need data which they can manipulate to develop new concepts and practices of health care.

THE TYPES OF HEALTH INFORMATICIAN

We have proceeded with three distinct groups of professionals in mind. There are the Applied Health Informatics (AHI) professionals who are the solution deployers; the Research and Development Health Informatics (RDHI) professionals who are the researchers and teachers who create new capabilities and produce new professionals; and the Clinicians with Health Informatics (CHI) competence who are the users of the systems in patient care, research, and teaching.

This document addresses the competencies required by these three categories of professionals, and the contents of educational programs that are required to prepare them for their roles.
OUR FRAMEWORK FOR CURRICULUM DEVELOPMENT

Each health Information Technology/Information Management (IT/IM) professional is conceived as fulfilling a role (for clarity we term these macro-roles and examples include CIO, Researcher, and Consultant). A professional in a macro-role faces challenges (challenges equate to major job functions, and examples include strategic planning and technology procurement). In order to address these challenges, the IT/IM professional performs micro-roles (micro-roles are job sub-functions; micro-roles related to the challenge “technology procurement” include requirements definition and options analysis). Each of these micro-roles requires that the professional have specific skills, knowledge, and experience (these are the required professional competencies). We have defined a curriculum to be the content and sequencing of educational modules that impart these skills, knowledge elements, and experiences.

PROGRESS ON THE CURRICULUM DEVELOPMENT PROCESS

The model curriculum development process, co-directed by D. Covvey and D. Zitner, began in December 1999 with a kick-off videoconference at 11 sites (with approximately 100 participants selected based on a stakeholder analysis). Two focus groups in the Spring and Fall of 1999 related to AHI skills preceded the process. The participants were introduced to the framework and brought up to speed regarding HI curriculum development issues and methods.

Starting in March 2000, Working Group sessions were convened every three weeks. In addition, a plenary progress review session involving all groups was held on June 26, 2000. These sessions have been supported using document (Sprint’s “On-Line Presenter”, using the “Live Demo” feature that allows real-time, on-line editing) and audio conferencing tools. The final Working Group meeting occurred in mid-September 2000.

DETAILED WORKING GROUP METHODOLOGY

Workshop participants (see the list of AHI Working Group participants below) were selected based on a stakeholder analysis, and include HI curriculum developers, HI teachers, potential and current HI students, employers (health and health-related industries), representatives of professional organizations, and potential certifiers of HI professionals. Each Working Group has been facilitated by a member of the core team of curriculum developers (AHI: D. Covvey, RDHI: D. Zitner, CHI: R. Bernstein).

After an initial preparatory session, each Working Group worked with a template containing straw versions of the macro-roles, challenges, micro-roles, and skills, knowledge, and experience elements (the latter, collectively: competencies). These Working Groups (approximately 30 participants per group) comprised both on-line participants supported by document and audio conferencing technologies, and off-line participants interacting via e-mail. Working Group participants added to, modified, or deleted items in the templates. A plenary session to review progress to date was held on June 26, 2000 during the InFocus meeting in Vancouver. Overall, approximately ten on-line sessions as well as e-mail interaction provided the basis for the refinement of the templates. The basic work of the Working Groups was completed in sessions on September 12-14, 2000.
Each working Group has produced detailed lists of the macro-roles, of the micro-roles (functions) associated with each macro-role, of the detailed skills and knowledge (competencies) required to address each micro-role, of the experience components associated with each challenge, and of the mapping of challenges to macro-roles. Each Working Group has also prepared a document that combines skills and knowledge into course-like categories (approximately 20 for each curriculum). The RDHI Working Group has developed, in addition, a set of Guidelines for Graduate RDHI Program Content that is being prepared for circulation. All material is available on the project website: [http://healnet.mcmaster.ca/nce/workshops.htm](http://healnet.mcmaster.ca/nce/workshops.htm) As produced, it has also been circulated to all participants via e-mail.

**SUMMARY**

The health system needs effective IT/IM solutions to the challenges it faces. However, realizing these solutions depends on the availability of capable IT/IM professionals. The products we have developed provide curriculum developers and teachers with models on which they can base the design of their health informatics education programs. But they also directly support the health system by helping employers, prospective health informaticians, and clinicians to understand the competencies they require to create, deploy, manage, and improve health IT/IM techniques and systems.

**NOTES TO THE READER**

This document should be seen as a living document – a work in progress. Strong interest in Health Informatics program development motivated us to release this document at the earliest possible date, but while doing so we wish to recognize the following:

- We have not yet standardized the terminology across the three sections, so the reader will see several variants of the name of a knowledge item or a skill.

- The tables that show the relationship between different macro-roles and the importance of the challenges to each macro-role, and the relationship between challenges and the experience required to address them, are the subject of on-going revision and validation.

- No meaning should be associated with the order in which skills and knowledge items appear.

- We have at times been inconsistent with regard to repeating a skill or knowledge item under each micro-role associated with a challenge. Generally we elected to not repeat these, but sometimes they are repeated. This means that each micro-role cannot yet be looked at independently, but rather that skills and knowledge elements are associated with addressing the challenge. The micro-roles, although we believe that they are complete, are at this time merely a tool we used to ensure we determined as complete a set of competencies as possible.

- Personal skills and knowledge elements are repeated only very selectively. In early work, we found that many of these applied to virtually all challenges and their micro-roles, and repeating them wasted space and distracted attention from the other items.

- We have constructed the main sections of the document (the AHI, RDHI, and CHI sections) so that they can be read and used independently. We did this because we believe that, in general, users will work with one section and not the others. This has introduced a measure of redundancy into the section introductions. We hope this will not prove to be too annoying.
• Having such a wealth of participation also confronted us with the challenge of maintaining up-to-date information on all participants. Some personal items are obsolete. We encourage participants to update their personal information via either [dcovvey@sprynet.com](mailto:dcovvey@sprynet.com) or [david.zitener@dal.ca](mailto:david.zitener@dal.ca). We will attempt to re-version the document regularly to address this, or at least to provide forwarding information.

• As we review the document, we continually discover skill and knowledge elements that we either missed or would now prefer to see repeated. Future versions of the document will undoubtedly contain additional items that others and we recommend for inclusion.

Finally, we emphasize that producing this material was akin to multiple artists collaborating on a painting. Each of us contributed strokes that gradually filled in a scene that only took its final shape as the work progressed. Each of us had his or her own perspectives, objectives, and styles. So, what is here is a compromise, but one developed with real thought behind each choice. It is no one person’s work, a reality that protected it from the bias that any one of us might have wanted to put on it. It is a true collaboration, and one many of us put our hearts into and thoroughly enjoyed even as we slogged through the grueling process.

What it is finally is a product that is incomplete, that will remain incomplete, and that needs the skills of others. We turn it over to you now, asking you to join the collaboration with the hope that you will take it the next steps and bring out its full value to the field. If we give you a better starting point than you had before this work, then we succeeded. Now it is your turn.
Section A

APPLIED HEALTH INFORMATICS
(AHI)
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AUTHORSHIP

THE AHI WORKING GROUP

This work represents the thinking and advice of numerous collaborators and could not have been accomplished without their participation. The AHI Working Group participants come from diverse professional and geographic areas and represent a broad range of thinking. In addition to recognizing their participation, the names and e-mail addresses of the participants are listed here to encourage those who would like additional information to contact someone from their own geographic area.

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SECTION A1 – Introduction
ABSTRACT

Applied Health Informaticians are professionals that deploy information technologies in support of health system processes. They require both a well-developed knowledge base that encompasses the health system, computer science, and health information systems-related topics (what is known as the “Body of Knowledge”), as well as a set of intellectual and procedural skills (what we call the “Body of Skills”) and preparatory experiences. The availability of skilled and knowledgeable Applied Health Informaticians has become a critical issue in today’s health system.

Herein we describe the work we have done related to the specification of the required AHI skills, knowledge, and experience, and the development of a curriculum in Applied Health Informatics.

THE NEED FOR APPLIED HEALTH INFORMATICIANS

While it is true that many health organizations allow some excursions into system development, most today are either as-is technology deployers or limited innovators that are merely early adopters of commercial off the shelf (COTS) offerings. The reason for this is that many organizations have decided that their line-of-business is healthcare, not IT development. Consequently, most health organizations need IT professionals with the knowledge and skills that will support the usage portion of the life cycle of COTS technology, with far less demand for deep informatics and system development capabilities. On the other hand, since much of COTS technology has been developed for other health systems, it is important that applied health informaticians be able to facilitate the development of the organization’s vision of what a health information system can do or may be required to do for the health enterprise.

Consequently applied informaticians need broad health system knowledge, management knowledge and skills, and interpersonal skills, as well as computer science and information technology competencies.

OUR FRAMEWORK FOR CURRICULUM DEVELOPMENT

We call our framework for curriculum development a “roles-based” approach.

Our curriculum development framework is as follows:

Each IT professional is conceived as fulfilling a role (for clarity we term these “macro-role”. AHI examples include: CIO, IS Director, Manager, Analyst, Consultant, etc.) An IT professional in a macro-role faces challenges (example: strategic planning, technology deployment, IS resource management, etc.) In order to address these challenges, the IT professional performs “micro-roles” (example: micro-roles related to the challenge “technology deployment” include: needs analysis, industry capabilities surveying, procurement, etc.), and each of these micro-roles requires that the professional have specific skills, knowledge, and experience.

We define a curriculum to be the content and sequencing of educational modules that impart these skills, knowledge elements, and experiences.

THE AHI CURRICULUM DEVELOPMENT PROCESS

Over the last several years we have addressed several key steps related to this framework:

• We apprised ourselves of existing health informatics education programs in terms of their objectives, candidates, content, and products, and we have reviewed existing curricula.

• We specified an initial working set of applied health informatics IT professional macro-roles and the challenges faced by professionals in these roles.
• We identified an initial listing of the micro-roles performed by AHI IT professionals in response to each challenges.

• We developed an initial list of skills, mapped to these micro-roles, and presented this list to several focus groups for critique.

This material was the basis for a set of “straw version” templates provided to the AHI Working Group.

The AHI model curriculum development process began in December 1999 at the kick-off Health Informatics Model Curriculum Development videoconference and was completed in the Fall of 2000.

METHODOLOGY

The AHI model curriculum development workshops were carried out in the following way: The workshop participants were selected based on a stakeholder analysis, and included HI curriculum developers, HI teachers, potential and current HI students, employers (health and health-related industries), representatives of professional organizations, and potential certifiers of HI professionals. Each workshop, facilitated D. Covvey, was given a template that contained straw versions of the macro-roles, challenges, micro-roles, and skill, knowledge and experience elements. Individual workshop sessions were approximately of 2-hour duration, during which time participants proposed alterations to the templates and sought consensus on changes. Between meetings these templates were edited to reflect proposed changes.

Between 10 and 20 on-line participants were supported by document and audio conferencing technologies. Approximately 10 on-line sessions as well as e-mail interaction provide the basis for interaction and refinement of the templates. All input and produced material was made available on the project website.

AHI PROFESSIONAL ROLES

In order for an AHI curriculum to be relevant, it must encompass both current and future potential roles of IT professionals in all types of health organizations. The complete set of macro-roles with their definitions is given below. Applied Health Informaticians in these macro-roles are confronted by a set of challenges within the scope of their jobs.

AHI CHALLENGES

Although the number of challenges that will be faced by an Applied Health Informatician over his/her career is large, there is a finite set of challenge types or “IT proto-challenges” (basic, recurring, non-reducible problems that require effective responses from IT professionals). The complete set of challenges is presented below.

It is important to note that many of the listed challenges can be characterized as challenges that require thinking skills, structured methods, and formal processes, all of which we will subsume under the term “Intellectual and Procedural Skills”, as well as knowledge, and a set of preparatory experiences.

MICRO-ROLES PERFORMED TO ADDRESS THE CHALLENGES
In order to address each of these challenges, the AHI must be capable of performing a set of what we have termed micro-roles. In the material below, we provide list the micro-roles for each challenge.

AHI COMPETENCIES: TOOLS TO ADDRESS THE AHI MICRO-ROLES

If we examine the challenges Applied Health Informaticians face, and determine the micro-roles that they must perform, we come to the conclusion that Applied Health Informaticians must have methodological skills as well as a significant body of domain (health, Computer Science, systems instance, etc.) knowledge. These domain knowledge elements are the conceptual objects (the components of the professional’s elaborated knowledge base 2). By “elaborated knowledge”, we mean a conceptual network of knowledge elements wherein each element is linked to related elements) required to support reasoning about problems and solutions. Below we have listed the skills and knowledge elements for each of the AHI micro-roles.

MOTIVATION FOR AN AHI CURRICULUM

We started from the premise that informatics-based solutions are essential to our health system if it is to survive and thrive. We concluded that Applied Health Informaticians are the dominant type of IT professionals needed by health organizations, as they are the finders and deployers of informatics-based solutions.

Applied Health Informaticians are, by their very nature, appliers, akin to practicing physicians, whose primary measure of success is the production of quality deliverables as perceived by health system “needers”. The Applied Health Informaticians is driven by the needs of the health environment. Similar to physicians, Applied Health Informaticians must be able to understand the problem and the need for solutions, consider alternate solutions and determine the optimal solution, and deliver the solution that addresses the need.

The health system needs effective IT solutions to the challenges it faces. The deployment of solutions is dependent on IT professionals with the requisite competencies.

Reviewing medical and health informatics programs reveals that most education target the development of Theoretical (Research and Development) Health Informaticians 3, 4, 5.

We believe that, given the needs of the health system, the emphasis of existing educational programs on producing Theoretical Health Informaticians is non-responsive. At the very least, greater emphasis should be put on the preparation of Health Informaticians that are qualified to address the day-to-day challenges of the health IT environment, i.e., that are steeped in the requisite intellectual and procedural skills needed for the successful deployment of systems.

We have concluded that there is the need for new or modified curricula for educational programs that produce qualified Applied Health Informaticians.

The AHI Working Group offers the material that follows as their response to that need.

References

KEY OPERATIONAL TERMS

Macro-Roles: Major organizational roles undertaken by IT professionals; functional positions. Examples: CIO, Manager of Systems, and Analyst.

Challenges: Aspects of the health and/or systems environment requiring attention or intervention; incursions or difficulties to which the professional must respond. Examples: the need for planning, procuring, and evaluating systems.

Micro-Roles: Sub-functions/tasks that must be performed to address the challenges.

Skills: Thinking, procedural, methodological, personal, or technical abilities required to successfully perform the specific micro-role. Includes: the techniques, methods, templates, frameworks, etc. Mostly learned by doing.

Knowledge: Inter-related (elaborated) data, facts, meanings, concepts, and principles that provide the basis for understanding, comparisons, conclusions, decisions, advice, and the like. Mostly learned by listening, reading, and discussion.

Experience: Involvement in the application of knowledge and skills though discussions, projects, or work.

Competencies: The aggregate of skills, knowledge, and experience required to address a challenge.
OPERATIONAL FRAMEWORK

Identification of **Macro-Roles** (e.g., CIO)

Identification of IT-Relevant **Challenges** faced by individuals performing these Macro-Roles

Identification of **Micro-Roles** (or Macro-Tasks) that must be performed to address these challenges

Identification of relevant **Skills**, **Knowledge & Experience** needed to competently perform these Micro-Roles

Definition of Competency Categories
AHI MACRO-ROLES

We have identified the following AHI macro-roles:

1. **IT Leader (CIO, VPIS,) at Deployment Organization (ITL):**
   A strategist who provides the high-level leadership to determine the IT/IM needs of the organization based on both the current situation and the organizational strategic plan as well as the potential program enablement of IT and IM capabilities; identifies required IT/IM capabilities and resources; and oversees their procurement, implementation, management, maintenance, support, evaluation, and continuous improvement.

2. **Director IS (DIS):**
   Tactical-level leader of an IS department. Manages day-to-day tactical/logistical aspects of the IS function.

3. **Clinical Informatician (CLI):**
   Conceptualizes, designs, implements, and promotes information structures and systems for use by clinical professionals.

4. **IT/IM Resources/Project Manager (ITM):**
   Manager of a team within the IS department. Manages personnel, facilities, information resources, and projects related to a portion of the IS function.

5. **Internal Health IT Consultant (CON):**
   Methodologist, advisor, and process facilitator.

6. **System/Applications Expert (EXP):**
   Expert in specific applications (e.g., the HIS, a departmental system), in a specific software tool or set of such (e.g., a database package, a data warehouse package), in a specific area (e.g., security, database management, data warehousing), or related to a specific technology (e.g., networks, integration technology).

7. **Process Analyst (ANA):**
   An analyst of complex health processes. Able to characterize, design, and re-engineer health system processes.

8. **Evaluator (EVL):**
   An expert in the design, implementation, and interpretation of the results produced by objective techniques to determine the impacts of systems and processes.

9. **Educator/Trainer (TRN):**
   A teacher of IT/IM concepts and/or skills.
10. **Programmer-Deployment Support (DPR):**
   An individual able to use various system customization tools provided with applications: query packages, report contents and formats, screen formats, scripts, macros, and the like. This is not intended to be the type of individual qualified to develop major applications or their components using industry-standard language or program development environments (see the RDHI Curriculum).

11. **Policy Planner (POL):**
   A definer of IT/IM-related policy at the regional, provincial/state, or national levels.

**AHI CHALLENGES**

The following are the challenges faced by the Applied Health Informaticians in the identified macro-roles:

1. Collaboration
2. Understanding of the Nature of the Health System and Current Issues, and Identification of Desired Outputs
3. Formulation of IT/IM Components of the Strategic Plan
4. IT/IM Strategic Business Planning, IT/IM Strategic Market Planning
5. IT/IM Needs Analysis
6. Determination of the Organization’s IT/IM Situation (IT/IM Audit)
7. Definition and Implementation of Organizational Approach to IT/IM, IT/IM Organizational Structure/Culture, and IS Department Structure/Culture
9. IT/IM Technology Assessment
10. Evaluation, Adoption, and Implementation of Standards
11. IT/IM-Related Policy Development
12. Development of the Justification For and the Value of Systems
13. Obtaining Consensus on Solutions, Budget, Plan
14. Procurement of Solutions (Products and Services)
15. Re-engineering of Work and Information Management Processes
16. Implementation of Solutions
17. Planning and Day-to-Day Management of IT/IM Resources
18. Management of Other’s (e.g., Population, System) Data (Quality Audits, Combining Data, Transmission, etc.)
19. Integration of Multiple Systems
20. Maintenance and Support of Solutions
21. Evaluation of Solution Outcomes
22. Management of Change (Acting as Change Agent)
23. User, Customer, Inter-Departmental and Public Liaison, Relations, Communications, and Publication
24. Continuing Education
25. System and Methods Customization and Ad Hoc Development
26. Utilization of Technology (Personal Productivity, Specific Tools)
27. General Day-to-Day Issues
AHI CHALLENGES & MICRO-ROLES

In order to address each of these challenges, the AHI professional will need to perform specific micro-roles. The list that follows identifies the micro-roles for each AHI challenge:

1. Collaboration
   1.1. Identifying and Building Collaborative Relationships

2. Understanding of the Nature of the Health System and Current Issues, and Identification of Desired Outputs
   2.1. Understanding the Nature and Requirements of Health System Components and Professionals
   2.2. Recognizing the Complexity/Heterogeneous Nature of the Requirements
   2.3. Triage of Doable (long-term/short-term) and Setting Priorities
   2.4. Understanding the Organizations’ Mission, Goals, Objectives, Cultures, Values, Leadership Preferences, etc.
   2.5. Understanding Continuous Refinement, the Dynamic of Change
   2.6. Understanding the Processes (e.g., Work and Decision Processes) and the Usage of Information
   2.7. The following apply to all micro-roles associated with this challenge

3. Formulation of IT/IM Components of the Strategic Plan
   4.1. Comprehension of Organizational
   4.2. Interpretation (e.g., Translating IT Concepts + Industry to Management; bridging)
   4.3. Presentation of Potential Strategic Opportunities for IT/IM
   4.4. Involvement of Senior Management in IT/IM Strategic Planning (SP) Process
   4.5. Involvement of Other Stakeholders in the IT/IM SP Process
   4.6. Development of IT/IM Responses (IT/IM Strategic Requirements)
   4.7. Strategic Options Analysis
   4.8. Development of Multi-Year Budget
   4.9. Promoting the Plan and Budget Throughout the Organization and to the Board
   4.10. Management of Expectations

4. IT/IM Strategic Business Planning, IT/IM Strategic Market Planning
   4.1. Define Product(s) or Service(s) Offerings (Overall Business and/or Specific Offerings)
   4.2. Perform Market Research and Analyze Results
   4.3. Comprehend Market Need for Product or Service and Fit With Corporate Strategy
   4.4. Define Product/Service Development Process and Required Resources and Schedule
   4.5. Assessment of the Capability of the Client to Make an Informed Decision of the Product re: Implementation and Use of the System
   4.6. Determine Required Investment and ROI
   4.7. Development of Multi-Year Plan and Budget
   4.8. Promoting the Plan and Budget, e.g., to Senior Management
   4.9. Management of Expectations
   4.10. Selling Systems and Services

5. IT/IM Needs Analysis
   5.1. Identification of Needs for IT/IM Capabilities

6. Determination of the Organization’s IT/IM Situation (IT/IM Audit)
   6.1. Documentation of in Situ IT/IM and Systems Capabilities
   6.2. Review of Systems Capabilities Versus Strategic Requirements
   6.3. Identification of Corrective Actions

7. Definition and Implementation of Organizational Approach to IT/IM, IT/IM Organizational Structure/Culture, and IS Department Structure/Culture
7.1. Definition and Implementation of Committee/Team Structure for the Oversight of the IT/IM Organization
7.2. Definition and Implementation of the IT/IM Organizational Structure, Roles, and Accountabilities
7.3. Definition and Implementation of IS Department Structure
7.4. Participation in Committee/Team Activities

8.1. Review of Industry Reports, Overviews, and Assessments
8.2. Emission of RFIs and Documentation of Systems’ Capabilities
8.3. Survey of Peer Experience

9. IT/IM Technology Assessment
9.1. Identification of Desired Outcomes (e.g., Diagnostic Accuracy, Efficiency)
9.2. Identification of Technology--Sophisticated Collaborators to Assist with Assessment
9.3. Options Identification, Characterization, Analysis, and Selection
9.4. Assessment of Interoperability
9.5. Assessment of Vendor and Product Viability

10. Evaluation, Adoption, and Implementation of Standards
10.1. Determining the Business Value of a System/Product
10.2. Assessment of Risk
10.3. Assessment of Vendor/Product Compliance with Requirements
10.4. Identification of the Need, Requirements for, and Benefits of Standardization
10.5. Identification and Evaluation of Competing Standards and Selection of Best
10.6. Determining the Business Value of a System/Product
10.7. Monitoring the Adherence to Standards

11. IT/IM-Related Policy Development
11.1. Identification of the Need for Policy
11.2. Identification, Inclusion, and Participation of Affected Stakeholder Groups
11.3. Establish Policy Objectives
11.4. Participate in Collaborative Policy Development/Develop Policy
11.5. Consult and Validate With Stakeholder Groups
11.6. Promulgate Policy
11.7. Monitor Adherence to the Policy
11.8. Maintenance of Awareness of Developments in Health Information Policy

12. Development of the Justification For and the Value of Systems
12.1. Identification and Documentation of Qualitative and Quantitative Costs (e.g., dollars, disruption, impacts, effort, delay)
12.2. Identification and Documentation of Qualitative and Quantitative Benefits
12.3. Creation of a Decision-Maker-Compatible Proposal
12.4. Presentation of Case to Decision-Makers (broadly construed)

13. Obtaining Consensus on Solutions, Budget, Plan
13.1. Presentation of Proposed Plan of Action, Budget, and Justification Case
13.2. Discussions and Negotiations with Stakeholder Groups

14. Procurement of Solutions (Products and Services)
14.2. Development of Statement of Required Capabilities (Functional and Informational), Required Performance, Technologies, Other Requirements, and System Architecture
14.3. RFP or Other Procedure for Obtaining Vendor Responses
14.4. (Vendors) Preparing Response to RFP
14.5. (Vendors) Presentation of RFP Response
14.6. Management and Documentation of Site Visits, Demos, and Other Assessments
14.7. Assessment or Definition of Business Ethics Environment and Applicable Laws
14.9. Identification of Preferred Solutions
14.10. Preparation and Negotiation of Contracts
14.11. Contract Finalization and Ordering

15. Re-engineering of Work and Information Management Processes
   15.1. Identification of Desired Re-engineering Outcomes
   15.2. Documentation of Existing Work Processes
   15.3. Restructuring of Macro-Processes and Products
   15.4. Process Streamlining
   15.5. Documentation of Revised Work Processes
   15.6. Documentation of Case for Improvements (Costs and Benefits)
   15.7. Planning and Implementation of New Work Processes Training
   15.8. Training
   15.9. Evaluation of Achievement of Desired Outcomes

16. Implementation of Solutions
   16.1. Implementation Planning
   16.2. Implementation Project Management
   16.3. System Reception and Installation
   16.4. Hardware and OS Implementation and Testing
   16.5. Applications Software Set-up
   16.6. Applications Customization
   16.7. Applications Software Testing
   16.8. User Training
   16.9. Vendor and Participant Relations Management
   16.10. Applications Acceptance Testing
   16.11. System Go-Live

17. Planning and Day-to-Day Management of IT/IM Resources
   17.1. Identification and Articulation of Requirements
   17.2. Definition and Implementation of Management Framework
   17.3. Management Policy and Procedure Development and Implementation
   17.4. IT/IM Acquisition and Implementation Planning
   17.5. Definition and Assignment of Roles and Accountabilities
   17.6. Staff Recruitment
   17.7. Staff Motivation, Development and Retention (Education and Training)
   17.8. Staff and Team Leadership and Management
   17.9. Staff Performance Evaluation
   17.10. Self-Assessment
   17.11. Program (Multi-Project) Management
   17.12. IT/IM Resources Management Policy and Procedure Development and Implementation
   17.13. Oversight of Systems and Information Management
   17.14. Systems and Information Management
   17.15. Development, Promotion", and Management of Annual IT Budget (capital and operating)
   17.16. Financial Management of IT/IM Resources
   17.17. Asset Management
   17.18. Business Continuance Planning (Disaster Planning)

18. Management of Other’s (e.g., Population, System) Data (Quality Audits, Combining Data, Transmission, etc.)
   18.1. Reception, Integration and Management of Data
   18.2. Setting Up of Database (Using Toolset)
   18.3. Identification of User Needs and User Modeling
18.4. Creation of Data Dictionary, Data Model, and Metadata
18.5. Audit, Quality Assurance, Quality Control of Data
18.6. Maintenance of Security and Confidentiality
18.7. Development of User Queries and Views

19. Integration of Multiple Systems
19.1. Adoption of Common Definitions (Data Standards) and Spanning Data Model
19.2. Analysis and Selection of Middleware
19.3. Maintenance of Multiple Systems and of the Middleware
19.4. Perform Integration: Interfacing, Implementation of Middleware
19.5. Use of Middleware Tools

20. Maintenance and Support of Solutions
20.1. Applications Upgrading and Up-Versioning
20.2. Addressing of Regulatory Requirements
20.3. Vendor Liaison and Relations Corrective Maintenance
20.4. Corrective Maintenance
20.5. Adaptive Maintenance- Hardware
20.6. Adaptive Maintenance- Software
20.7. End-User Group Formation and Management
20.8. Perfective Maintenance (e.g., functionality upgrades, new modules)
20.9. Management of Maintenance and Support
20.10. Applications End-User Support
20.11. End-User Applications Training
20.12. Applications Re-Setup and Re-Implementation
20.13. System Monitoring and Utilization Management
20.15. Systems Security Definition, Management, and Oversight
20.16. Systems Currency Maintenance
20.17. Disaster Planning and Management

21. Evaluation of Solution Outcomes
21.1. Id of Evaluation Objectives and Techniques (e.g., Qualitative, Quantitative)
21.2. Compliance Analysis
21.3. Survey Design, Testing, and Administration
21.4. Interview Design, Testing, and Administration
21.5. Observation of Actual Users (Ethnographic Observation)
21.6. Results Collation and Analysis
21.7. Evaluation Report Production

22. Management of Change (Acting as Change Agent)
22.1. Identification of Stakeholders and Operations Desired Outcomes
22.2. Definition of Management of Change Process
22.3. Understanding of the Organizational Culture/Environment and Leadership Commitment to the Process
22.4. Assessment of the Potential of the Organization to Change
22.5. Identification of Other Collaborators and Supporting Experts (e.g. HR, other members of executive team, consultants, etc.)
22.6. Engagement, Education, and Involvement of Stakeholders Assessment of the Existence of Skilled Staff Within Organization
22.7. Identification of Other Collaborators and Supporting Experts (e.g. HR, other members of executive team, consultants, etc)
22.8. Implementation of Change Process
22.9. Monitoring of Process and Outcomes
22.10. Evaluation of Outcomes

23. User, Customer, Inter-Departmental and Public Liaison, Relations, Communications, and Publication
   23.1. Participation in Committee and Team Activities
   23.2. Inter-departmental Communications
   23.3. Presentations at Meetings, Conferences, and Seminars
   23.4. Article, Report, Newsletter, and Working Paper (etc.) Publication
   23.5. Website Definition and Development

24. Continuing Education
   24.1. Continuing Education Stakeholder Identification and Involvement (Self, Staff, User/Client)
   24.2. Assessment of New Continuing Education Models and Opportunities
   24.3. Definition of Stakeholder-Specific Education Plan
   24.4. Management and Monitoring of Continuing Education Process
   24.5. Continuing Education: Execution

25. System and Methods Customization and Ad Hoc Development
   25.1. Needs Analysis
   25.2. Requirements Definition
   25.3. Options/Approaches Research
   25.4. Options/Approaches Analysis And Selection
   25.5. System/Methods Design And Specification
   25.6. System/Methods Prototyping
   25.7. Coding/Documentation
   25.8. Hardware Adaptation (If Required)
   25.9. System/Methods Testing And Validation
   25.10. Addressing Regulatory Requirements
   25.11. User Testing And Acceptance

26. Utilization of Technology (Personal Productivity, Specific Tools)
   26.1. Identify Requirements for Technology
   26.2. Obtain Access to the Technology
   26.3. Learn Use and Gain Proficiency

27. General Day-to-Day Issues
SECTION A3 – The Importance of the Challenges to Each AHI Macro-Role

Not every Applied Health Informatician faces and therefore must address each of the above challenges. The table below identifies the degree to which a professional in each macro-role must address the challenges. Based on this table, one can determine the importance of each of the competencies for each of the macro-roles.

Key: The Definition of Importance Levels

<table>
<thead>
<tr>
<th>H</th>
<th>A person in this role has a primary responsibility for addressing this challenge. The addressing this challenge is critical to the success of the person in this role. The competencies identified with the micro-roles of this challenge are essential. (Working Group Ratings 4.0 – 5.0)</th>
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<tr>
<td>M</td>
<td>A person in this role has some direct responsibility for, or a part to play in, addressing this challenge. A person in this role may be responsible for another person's addressing of this challenge. The competencies identified with the micro-roles of this challenge are useful and required to a limited degree. (Working Group Ratings 2.0 – 4.0)</td>
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<td>L</td>
<td>A person in this role has at least a minor role to play in addressing this challenge. The competencies (particularly the knowledge elements) identified with the micro-roles of this challenge may prove useful background. (Working Group Ratings 1.0 – 2.0)</td>
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<td>V</td>
<td>A person in this role may be able to perform successfully without addressing this challenge. A person in this role has little or no part to play in the addressing of this challenge. The competencies (particularly the knowledge elements) identified with the micro-roles of this challenge may prove to be useful preparation for someone seeking advancement. (Working Group Ratings 0.0 – 1.0)</td>
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Key: The AHI Micro-Roles and Abbreviations

<table>
<thead>
<tr>
<th>ITL</th>
<th>Information Technology Leader (CIO/CTO)</th>
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<tr>
<td>DIS</td>
<td>Director IS</td>
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<tr>
<td>CLI</td>
<td>Clinical Informatician</td>
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<tr>
<td>ITM</td>
<td>IT/IM Resources/Project Manager</td>
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<td>CON</td>
<td>Internal Health IT Consultant</td>
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<tr>
<td>EXP</td>
<td>System/Applications Expert</td>
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<td>ANA</td>
<td>Process Analyst</td>
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<tr>
<td>EVL</td>
<td>Evaluator</td>
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<td>TRN</td>
<td>Educator/Trainer</td>
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<tr>
<td>DPR</td>
<td>Programmer-Deployment Support</td>
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<tr>
<td>POL</td>
<td>Policy Planner</td>
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The Importance of the Challenges to Each AHI Macro-Role

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<tr>
<th>Challenge</th>
<th>ITL</th>
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<th>CLI</th>
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<th>CON</th>
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<td>Collaboration</td>
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<td>Identification of Desired Outputs</td>
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<td>Formulation of IT/IM Components of the Strategic Plan</td>
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<td>IT/IM Strategic Business Planning, IT/IM Strategic Market Planning</td>
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<tr>
<th>Challenge</th>
<th>Level of Importance of the Challenges to Relative to Each Macro-Role</th>
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<tbody>
<tr>
<td>IT/IM Needs Analysis</td>
<td>ITL</td>
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<tr>
<td>Determination of the Organization’s IT/IM Situation (IT/IM Audit)</td>
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SECTION A4 - AHI Challenges, Micro-Roles, & Required Competencies

Applied Health Informaticians, in order to address their professional challenges (CH: - challenge or major job function), must perform specific micro-roles (MR: - micro-role or job sub functions or tasks), and these in turn require specific skills (SK: - skill), knowledge (KN: - knowledge), and experience, collectively known as “competencies”. In the material below the skills and knowledge elements required to address each challenge, are listed with each micro-role that the professional must perform to address that challenge. Experience requirements are associated with challenges, and are shown in the table in section 5.

Skills: Thinking, procedural, methodological, or technical abilities required to successfully perform the specific micro-role. Includes: the techniques, methods, templates, frameworks, etc. Usually learned by doing.

Knowledge: Inter-related (elaborated) data, facts, meanings, concepts, and principles that provide the basis for understanding, comparisons, conclusions, decisions, advice, and the like. Usually learned by listening, reading, and discussion.

Experience: The “hands on” interaction with and addressing of challenges in case studies, in projects, or on-the-job in actual work settings (co-op, contract, or employment).

SPECIFICATION OF REQUIRED SKILLS & KNOWLEDGE FOR EACH MICRO-ROLE

1. CH: Collaboration
   1.1. MR: Identifying and Building Collaborative Relationships
      1.1.1. SK: Team Building Skills, Group Management Techniques, Facilitation Skills, Interpersonal Skills
      1.1.2. KN: Knowledge of Potential Collaborators

2. CH: Understanding of the Nature of the Health System and Current Issues, and Identification of Desired Outputs
   2.1. MR: Understanding the Nature and Requirements of Health System Components and Professionals
      2.1.1. SK: Listening Skills
      2.1.2. KN: The Nature and Operation of the Health System, Health System Management and Organization
   2.2. MR: Recognizing the Complexity/Heterogeneous Nature of the Requirements
   2.3. MR: Triage of Doable (Long-Term/Short-Term) and Setting Priorities
      2.3.1. SK: Prioritization/Triage Techniques, Use of Managerial Decision-Making Tools
      2.3.2. KN: Knowledge of Project Successes and Failures
2.4. MR: Understanding the Organizations’ Mission, Goals, Objectives, Cultures, Values, Leadership Preferences, etc.
   2.4.1. SK: Information Finding Skills
   2.4.2. KN: Knowledge of Specific Organization

2.5. MR: Understanding Continuous Refinement, the Dynamic of Change

2.6. MR: Understanding the Processes (e.g., Work and Decision Processes) and the Usage of Information

2.7. The following apply to all micro-roles associated with this challenge
   2.7.1. SK: Life-Long Learning, Systems Thinking
   2.7.2. KN: Understanding of the Strategic Plan of Specific Organization, Understanding the Culture and Politics of the Specific Organization, Understanding the Foci for Resistance Within the Organization, Principles of Strategic Planning and Management, The Nature and Operation of the Health System, Principles of TQM and CQI, Principles of Knowledge Management

3. CH: Formulation of IT/IM Components of the Strategic Plan
   3.1. MR: Comprehension of Organizational Strategy
      3.1.1. SK: Listening Skills, Synthesizing Skills, Systems Thinking
      3.1.2. KN: The Nature and Operation of the Health System, Health System Management and Organization, Understanding Corporate Culture (regarding acceptable approaches, methods, values), Systems Thinking
   3.2. MR: Interpretation (e.g., Translating IT Concepts + Industry to Management; bridging)
      3.2.1. SK: Forecasting Skills, Communications Skills, Failure Analysis
   3.3. MR: Presentation of Potential Strategic Opportunities for IT/IM
      3.3.1. SK: Presentation Skills, Data Analysis Skills, Leadership Skills, Communication Skills, Interpretation, Teaching Skills
   3.4. MR: Involvement of Senior Management in IT/IM Strategic Planning (SP) Process
      3.4.1. SK: Motivation Techniques, Leadership Skills, Facilitation Skills, Communication Skills
      3.4.2. KN: Health System Management and Organization, Understanding Business and Clinical Processes, The IT/IM Strategies of Other Organizations
   3.5. MR: Involvement of Other Stakeholders in the IT/IM SP Process
      3.5.1. SK: Stakeholder Analysis, Motivation Techniques, Staff Involvement Techniques, Leadership Skills, Marketing Skills, Facilitation Skills, Teaching Skills, Communications Skills
      3.5.2. KN: The Roles and Functions of Health System Professionals, Health System Management and Organization
3.6. MR: Development of IT/IM Responses (IT/IM Strategic Requirements)
   3.6.1. SK: IT/IM Strategic Planning Methods
   3.6.2. KN: The Nature and Operation of the Health System, Strategic Planning Theory and Practice

3.7. MR: Strategic Options Analysis
   3.7.1. SK: IT/IM Strategic Planning Methods, Options Analysis, Risk Analysis, SWOT Analysis
   3.7.2. KN: The Roles, Capabilities, and Limitations of Health IT/IM Vendors and Products and Infrastructural Technologies, The Impacts of Systems on Operations and Work

3.8. MR: Development of Multi-Year Budget
   3.8.1. SK: Budgeting Methodology, Costing Methodology, Cost-Benefit Analysis Method
   3.8.2. KN: Principles of Budgeting, Basic Finance and Economics

3.9. MR: Promoting the Plan and Budget Throughout the Organization and to the Board
   3.9.1. SK: Leadership Skills, Presentation Skills, Professional Writing Skills, Persuasion/Lobbying Skills, Negotiation Skills, Communications Skills, “Money-Finding” Skills, Benefits Realization Methodology (e.g., “Early Beneficial Occupancy [benefits unfold with system implementation], Expectation Management Techniques;
   3.9.2. KN: The Nature and Operation of the Health System, Health System Management and Organization, The Roles and Functions of Health System Professionals, The Impacts of Systems on Operations and Work, Understanding of the Existing Specific Systems (how well it’s being used and how well it’s being accepted)

3.10. MR: Management of Expectations
   3.10.1. SK: Expectation Management, Assessing and Addressing Retrograde Effects of New System (e.g., functionality losses)
   3.10.2. KN: As Above, Understanding of Existing Systems and How They are Used, Accepted

4. CH: IT/IM Strategic Business Planning, IT/IM Strategic Market Planning
4.1. MR: Define Product(s) or Service(s) Offerings (Overall Business and/or Specific Offerings)
   4.1.1. SK: Product/Service Planning Method
   4.1.2. KN: Principles of Product/Services Planning, Domain-Specific and Product/Service-Specific Knowledge

4.2. MR: Perform Market Research and Analyze Results
   4.2.1. SK: Market Research Method, Statistical Analysis Techniques
   4.2.2. KN: As Above, Knowledge of Customer Needs and Issues, Basic Statistics for Surveys, Principles of Marketing, Knowledge of Vendor Marketplace

4.3. MR: Comprehend Market Need for Product or Service and Fit With Corporate Strategy
   4.3.1. SK: As Above
   4.3.2. KN: Knowledge of Corporate Strategy and Current Offerings
4.4. MR: Define Product/Service Development Process and Required Resources and Schedule
   4.4.1. SK: Product Development Planning Framework
   4.4.2. KN: Principles of Product and Service Planning and development

4.5. MR: Assessment of the Capability of the Client to Make an Informed Decision of the Product re: Implementation and Use of the System
   4.5.1. SK: Interviewing Techniques; Capability Assessment Methodology
   4.5.2. KN: Knowledge of Specific Application Domain; Knowledge of Specific Products

4.6. MR: Determine Required Investment and ROI.
   4.6.1. SK: Financial Analysis Method
   4.6.2. KN: Basic Finance and Economics

4.7. MR: Development of Multi-Year Plan and Budget
   4.7.1. SK: Budgeting Template
   4.7.2. KN: As Above

4.8. MR: Promoting the Plan and Budget, e.g., to Senior Management
   4.8.1. SK: Leadership Skills, Presentation Skills, Professional Writing Skills, Persuasion/Lobbying Skills, Negotiation Skills, Communications Skills, “Money-Finding” Skills
   4.8.2. KN: Knowledge of Corporate Culture and Values, Principles of Corporate Management and Organization, The Roles and Functions of Corporate Professionals

4.9. MR: Management of Expectations
   4.9.1. KN: As Above

4.10. MR: Selling Systems and Services
   4.10.1. SK: Selling Techniques, Presentation Skills, Writing Skills, Listening Skills, Client Education
   4.10.2. KN: The Nature and Operation of the Health System, Domain-Specific and Product/Service-Specific Knowledge

5. CH: IT/IM Needs Analysis
   5.1. MR: Identification of Needs for IT/IM Capabilities
      5.1.1. SK: Needs Analysis Method, Listening Skills
      5.1.2. KN: See IT/IM Strategic Business Planning

6. CH: Determination of the Organization’s IT/IM Situation (IT/IM Audit)
   6.1. MR: Documentation of in Situ IT/IM and Systems Capabilities
      6.1.1. SK: Audit/Review Methodology, System Inventory Technique, Structured Interviewing/Observation Techniques, Assessment of the Perceptions of an IT/IM Organization
6.2. **MR: Review of Systems Capabilities Versus Strategic Requirements**
   6.2.1. **SK:** Audit/Review Methodology, Structured Observation Techniques

6.3. **MR: Identification of Corrective Actions**
   6.3.1. **SK:** Prioritization Techniques, Professional Writing Skills, Presentation Skills
   6.3.2. **KN:** As Above

7. **CH: Definition and Implementation of Organizational Approach to IT/IM, IT/IM Organizational Structure/Culture, and IS Department Structure/Culture**
   7.1. **MR: Definition and Implementation of Committee/Team Structure for the Oversight of the IT/IM Organization**
      7.1.1. **SK:** Organizational Planning Skills, Negotiation Skills, Persuasion/Lobbying Skills, Presentation Skills, Leadership Skills
      7.1.2. **KN:** Health System Management and Organization, Principles of IS Organization and Management.
   7.2. **MR: Definition and Implementation of the IT/IM Organizational Structure, Roles, and Accountabilities**
      7.2.1. **SK:** Staff Mobilization and Motivation Techniques, Listening Skills, Accountability and Reward Methods, Operations Management skills
      7.2.2. **KN:** As Above
   7.3. **MR: Definition and Implementation of IS Department Structure**
      7.3.1. **SK:** Department Structuring Method/Template
      7.3.2. **KN:** Principles of IS Organization and Management
   7.4. **MR: Participation in Committee/Team Activities**
      7.4.1. **SK:** Group Management Techniques, Project Management Techniques, Persuasion/Lobbying Skills, Negotiation Skills, Presentation Skills, Communications Skills
      7.4.2. **KN:** Health System Management and Organization, Principles of IS Organization and Management, Principles of Management.

8. **CH: Determination of the State of the Industry, Analysis of the Competition, and Identification of Viable Vendors and Solutions**
   8.1. **MR: Review of Industry Reports, Overviews, and Assessments**
      8.1.1. **SK:** Critical Thinking and Critical Analysis Skills, Interpretation Skills, Information Finding Skills, Critical Thinking Skills, Use of Search Engines
      8.1.2. **KN:** Sources of and Access to Health IT Industry Information Resources, IT/IM and Health Taxonomies, The Principles and Use of Search Engines, The Structure of Information
   8.2. **MR: Emission of RFIs (Request for Information) and Documentation of Systems’ Capabilities**
      8.2.1. **SK:** RFI Method, Capability Matrix Development
      8.2.2. **KN:** Basic Health IT Product Knowledge
8.3. MR: Survey of Peer Experience
   8.3.1. SK: Survey Design Method, Survey Techniques
   8.3.2. KN: Knowledge of Specific Situations

9. CH: IT/IM Technology Assessment
9.1. MR: Identification of Desired Outcomes (e.g., Diagnostic Accuracy, Efficiency)
   9.1.1. SK: Listening Skills, Needs Analysis Method
   9.1.2. KN: The Nature and Operation of the Health System, Principles of Technology Assessment, Knowledge of Specific Technologies, Knowledge of Specific Requirements

9.2. MR: Identification of Technology--Sophisticated Collaborators to Assist with Assessment
   9.2.1. SK: Information Finding Skills
   9.2.2. KN: Knowledge of Potential Collaborators

9.3. MR: Options Identification, Characterization, Analysis, and Selection
   9.3.1. SK: Options Analysis Method
   9.3.2. KN: As Above

9.4. MR: Assessment of Interoperability
   9.4.1. SK: Effective RFP Writing
   9.4.2. KN: Principles of Cooperative Information Systems

9.5. MR: Assessment of Vendor and Product Viability
   9.5.1. SK: Vendor Comparison or Product Comparison Framework, Effective RFP Writing, Vendor Viability Assessment Framework
   9.5.2. KN: Knowledge of Product/Vendor State-of-the-Art

10. CH: Evaluation, Adoption, and Implementation of Standards
10.1. MR: Determining the Business Value of a System/Product
   10.1.1. KN: Business Value of IT/IM Systems (quantitative and qualitative value)

10.2. MR: Assessment of Risk
   10.2.1. SK: Risk Assessment Technique
   10.2.2. KN: Principles of Risk Management

10.3. MR: Assessment of Vendor/Product Compliance with Requirements
   10.3.1. SK: Scenario and RFP Writing

10.4. MR: Identification of the Need, Requirements for, and Benefits of Standardization
   10.4.1. SK: Information Finding Skills
   10.4.2. KN: Knowledge of Standards and Standards Development Activities, The Nature and Operation of the Health System
10.5. MR: Identification and Evaluation of Competing Standards and Selection of Best
10.5.1. SK: Information Finding Skills, Options Analysis Method
10.5.2. KN: As Above

10.6. MR: Determining the Business Value of a System/Product
10.6.1. KN: Business Value of IT/IM Systems (quantitative and qualitative value)

10.7. MR: Monitoring the Adherence to Standards
10.7.1. SK: Management Skills
10.7.2. KN: As Above, Principles of Management, Principles of Quantitative and Qualitative Assessment

11. CH: IT/IM-Related Policy Development
11.1. MR: Identification of the Need for Policy
11.1.1. SK: Ability to identify potential misuse & security issues
11.1.2. KN: Privacy and consent legislation, ethics, agreements & protocols, security needs

11.2. MR: Identification, Inclusion, and Participation of Affected Stakeholder Groups
11.2.1. SK: Coordination and facilitation skills
11.2.2. KN: Knowledge of broader HS system and stakeholder interests

11.3. MR: Establish Policy Objectives
11.3.1. SK: Concise and clear communication
11.3.2. KN: Familiarity with IT policy realm

11.4. MR: Participate in Collaborative Policy Development/Develop Policy
11.4.1. SK: Facilitation, communication
11.4.2. KN: Knowledge of internal & external policy realms

11.5. MR: Consult and Validate With Stakeholder Groups
11.5.1. SK: Facilitation & Communication skills
11.5.2. KN: Understanding of stakeholder issues

11.6. MR: Promulgate Policy
11.6.1. SK: Facilitation & Communication skills
11.6.2. KN: Knowledge of policy implementation strategies

11.7. MR: Monitor Adherence to the Policy
11.7.1. SK: Observation and Assessment
11.7.2. KN: Evaluation and Monitoring methods

11.8. MR: Maintenance of Awareness of Developments in Health Information Policy
11.8.1. SK: Research, networking and communication skills
11.8.2. KN: National, Provincial, Regional and Regulatory body Policy and Policy Directions
12. CH: Development of the Justification For and the Value of Systems

12.1. MR: Identification and Documentation of Qualitative and Quantitative Costs (e.g. Dollars, Disruption, Impacts, Effort, Delay)
   12.1.2. KN: Basic Finance and Economics, The Costs and Benefits of IT/IM Systems and Their Supporting Infrastructure

12.2. MR: Identification and Documentation of Qualitative and Quantitative Benefits
   12.2.1. SK: Opportunity Analysis, Benefits ID and Estimation Technique, Risk Analysis, Valuation Techniques
   12.2.2. KN: The Roles and Functions of Health System Professionals, The Roles, Capabilities, and Limitations of Health IT/IM Vendors and Products and Infrastructural Technologies, The Impacts of Systems on Operations and Work

12.3. MR: Creation of a Decision-Maker-Compatible Proposal
   12.3.1. SK: Professional Writing Skills, Communication Skills, Funding Proposal Framework, Promotion and Marketing
   12.3.2. KN: Health System Finance and Budgeting

12.4. MR: Presentation of Case to Decision-Makers (Broadly Construed)
   12.4.1. SK: Presentation Skills
   12.4.2. KN: Knowledge of Specific Values and Decision Criteria

13. CH: Obtaining Consensus on Solutions, Budget, Plan

13.1. MR: Presentation of Proposed Plan of Action, Budget, and Justification Case
   13.1.1. SK: Action Planning Technique, Professional Writing Skills, Presentation Skills, Leadership Skills, Decision-Promo Skills

13.2. MR: Discussions and Negotiations with Stakeholder Groups
   13.2.1. SK: Stakeholder Analysis, Group Management Techniques, Presentation Skills, Negotiation Technique, Communications Skills, Lobbying Skills

14. CH: Procurement of Solutions (Products and Services)

   14.1.2. KN: Health System Management and Organization, The Roles and Functions of Health System Professionals
14.2. MR: Development of Statement of Required Capabilities (Functional and Informational), Required Performance, Technologies, Other Requirements, and System Architecture
   14.2.1. SK: Requirements Identification and Analysis Method

14.3. MR: RFP or Other Procedure for Obtaining Vendor Responses
   14.3.1. SK: RFP or Equivalent Technique, Scenario Development
   14.3.2. KN: As Above, Knowledge of Industry Marketing/Promo and Sales Techniques

14.4. MR: (Vendors) Preparing Response to RFP
   14.4.1. SK: RFP Response Template, Questioning Techniques
   14.4.2. KN: Knowledge of Customer Needs, Constraints and Policies, Knowledge of Specific Systems

14.5. MR: (Vendors) Presentation of RFP Response
   14.5.1. SK: Presentation Skills
   14.5.2. KN: As Above

14.6. MR: Management and Documentation of Site Visits, Demos, and Other Assessments
   14.6.1. SK: Procurement Method (Site Visit Design and Analysis Technique, Demo Design and Analysis Technique), Interviewing Technique
   14.6.2. KN: As Above, Principles of Objective Observation and Review

14.7. MR: Assessment or Definition of Business Ethics Environment and Applicable Laws
   14.7.1. KN: Principles of Business Ethics, Principles of Business Etiquette and Culture

   14.8.1. SK: Compliance Analysis Techniques
   14.8.2. KN: The Roles, Capabilities, and Limitations of Health IT/IM Vendors and Products and Technological Infrastructure, Systems Architectures

14.9. MR: Identification of Preferred Solutions
   14.9.1. SK: Information Finding Skills
   14.9.2. KN: Knowledge of Health Information Systems

14.10. MR: Preparation and Negotiation of Contracts
   14.10.1. SK: Contract Framework, Negotiation Skills, Vendor Management Skills, Contract Negotiation Technique
   14.10.2. KN: Principles of Negotiation, Principles of Contract Development

14.11. MR: Contract Finalization and Ordering
   14.11.1. SK: Negotiation Technique, Closing Technique
   14.11.2. KN: As Above, Knowledge of Vendor Values
15. **CH: Re-engineering of Work and Information Management Processes**

15.1. **MR: Identification of Desired Re-engineering Outcomes**
   - 15.1.1. **SK:** Negotiation Technique, Questioning Techniques

15.2. **MR: Documentation of Existing Work Processes**
   - 15.2.1. **SK:** Process Mapping technique, Interviewing Technique, Writing Skills, Ethnographic Observation Skills
   - 15.2.2. **KN:** The Nature and Op of the Health System, The Roles and Functions of Health System Professionals, The nature of (Specific) Departmental Operations, Principles and Practice of Process Analysis

15.3. **MR: Restructuring of Macro-Processes and Products**
   - 15.3.1. **SK:** Process and Product Innovation Methods, Leadership Skills, Negotiation Technique, Staff Mobilization and Motivation Techniques (Group Dynamics)
   - 15.3.2. **KN:** As Above

15.4. **MR: Process Streamlining**
   - 15.4.1. **SK:** Process Improvement methods (Value Chain Analysis, Rational Analysis, IT-Facilitated Process Analysis.
   - 15.4.2. **KN:** As Above

15.5. **MR: Documentation of Revised Work Processes**
   - 15.5.1. **SK:** Process Mapping Techniques; Process Documentation Techniques
   - 15.5.2. **KN:** As Above

15.6. **MR: Documentation of Case for Improvements (Costs and Benefits)**
   - 15.6.1. **SK:** Case Justification Framework, Cost Id and Analysis Method, Benefits Id and Estimation Technique
   - 15.6.2. **KN:** As Above

15.7. **MR: Planning and Implementation of New Work Processes**
   - 15.7.1. **SK:** Work Process Implementation Planning Method/Template
   - 15.7.2. **KN:** As above, Understanding of the Ergonomics

15.8. **MR: Training**
   - 15.8.1. **SK:** Process Training Method, Motivation and Mobilization
   - 15.8.2. **KN:** As Above

15.9. **MR: Evaluation of Achievement of Desired Outcomes**
   - 15.9.1. **SK:** Quantitative and Qualitative Evaluation Methods
   - 15.9.2. **KN:** Principles of Quantitative and Qualitative Evaluation

16. **CH: Implementation of Solutions**

16.1. **MR: Implementation Planning**
   - 16.1.1. **SK:** Systems Implementation Planning Technique, Expectation Management
   - 16.1.2. **KN:** Principles of Project Planning, Organization, and Management
16.2. MR: Implementation Project Management
   16.2.1. SK: Project Management Techniques, Implementation Management skills, Contract/or Management Skills, Staff Mobilization and Motivation Technique, Leadership Skills, Documentation Skills, Questioning and Communication Skills
   16.2.2. KN: As Above

16.3. MR: System Reception and Installation
   16.3.1. SK: System Checklist, Installation Checklist
   16.3.2. KN: Specific Installation Process of Vendor

16.4. MR: Hardware and OS Implementation and Testing
   16.4.1. SK: Hardware and OS Testing Method
   16.4.2. KN: Principles of System Testing and Validation

16.5. MR: Applications Software Set-up
   16.5.1. SK: System-specific Setup Methods
   16.5.2. KN: Specific System Setup Protocol

16.6. MR: Applications Customization
   16.6.1. SK: Requirement Definition, Programming, Testing
   16.6.2. KN: Principles of Software Engineering, Knowledge of Specific Language or Programming Environment, Principles of System Testing

16.7. MR: Applications Software Testing
   16.7.1. SK: Software Testing Methods
   16.7.2. KN: As Above

16.8. MR: User Training
   16.8.1. SK: Staff Mobilization and Motivation Technique, Training Skills
   16.8.2. KN: Principles of Education and Training

16.9. MR: Vendor and Participant Relations Management
   16.9.1. SK: Customer Relations Management Skills, Interpersonal Skills, Staff Mobilization and Motivation Technique, (possibly) CRM Software Use, Change Management and Problem Resolution Skills
   16.9.2. KN: Principles of PR and Communications, Knowledge of Specific Systems, Customer Domain Knowledge

16.10. MR: Applications Acceptance Testing
   16.10.1. SK: Acceptance Testing procedure
   16.10.2. KN: Principles of System Testing and Validation

16.11. MR: System Go-Live
   16.11.1. SK: Staff Mobilization, Vendor Motivation Techniques, Incremental Implementation (Including Training)
   16.11.2. KN: Specific Go-Live Protocol
17. CH: Planning and Day-to-Day Management of IT/IM Resources

17.1. MR: Identification and Articulation of Requirements
   17.1.1. SK: Requirements Definition Skills, Interpersonal Skills, Staff Mobilization...etc.
   17.1.2. KN: Principles of IS Technology Management

17.2. MR: Definition and Implementation of Management Framework
   17.2.1. SK: Management Planning and Management Skills, IT Management Framework
   17.2.2. KN: As Above

17.3. MR: Management Policy and Procedure Development and Implementation
   17.3.1. SK: Policy and Procedure Development Frameworks, Professional Writing Skills
   17.3.2. KN: Principles of Policy and Procedure Development

17.4. MR: IT/IM Acquisition and Implementation Planning
   17.4.1. SK: See Procurement
   17.4.2. KN: See Procurement

17.5. MR: Definition and Assignment of Roles and Accountabilities
   17.5.1. SK: Management Skills, IS Management Framework, Communication Skills
   17.5.2. KN: principles of Management, Principles of Technology Management

17.6. MR: Staff Recruitment
   17.6.1. SK: Recruitment Technique, Interviewing Skills
   17.6.2. KN: Principles of HR Management

17.7. MR: Staff Motivation, Development and Retention (Education and Training)
   17.7.1. SK: Staff Development Framework, Education and Training skills, Mentoring Skills, Staff Management Skills
   17.7.2. KN: As Above

17.8. MR: Staff and Team Leadership and Management
   17.8.1. SK: Leadership Skills, Staff Management Skills
   17.8.2. KN: Principles of Management

17.9. MR: Staff Performance Evaluation
   17.9.1. SK: Staff Performance Evaluation Method, Interpersonal Skills
   17.9.2. KN: As Above

17.10. MR: Self-Assessment
   17.10.1. SK: Self-Assessment Techniques

17.11. MR: Program (Multi-Project) Management
   17.11.1. SK: Multi-Project Management Skills, Prioritization Methods, Staff Scheduling and Schedule Management Skills
   17.11.2. KN: Principles of Project Management
   17.12.1. SK: Policy and Procedure Development Frameworks
   17.12.2. KN: Principles Of HR Management, Principles of Policy and Procedure Development

17.13. MR: Oversight of Systems and Information Management
   17.13.1. SK: Oversight/Progress Measurement, Review, and Reporting Method
   17.13.2. KN: Principles of Technology Management

17.14. MR: Systems and Information Management

17.15. MR: Development, Promotion, and Management of Annual IT Budget (Capital and Operating)
   17.15.1. SK: Budgeting Methodology, Presentation Skills, Professional Writing Skills, Persuasion/Lobbying Skills, Interpretation (Bridging) Skills, Communications Skills
   17.15.2. KN: Basic Finance

17.16. MR: Financial Management of IT/IM Resources
   17.16.1. SK: Financial Management Framework
   17.16.2. KN: As Above

17.17. MR: Asset Management
   17.17.1. SK: Asset Management Framework
   17.17.2. KN: Principles of Technology management

17.18. MR: Business Continuance Planning (Disaster Planning)
   17.18.1. SK: Disaster Planning Framework, Negotiation Skills, Communication Skills, Problem Resolution Skills, Change Management Skills
   17.18.2. KN: Principles of Technology management

18. CH: Management of Other’s (e.g., Population, System) Data (Quality Audits, Combining Data, Transmission, etc.)

18.1. MR: Reception, Integration and Management of Data
   18.1.1. SK: Use of DBMS, presentation, data mining, mapping and statistical Tools
   18.1.2. KN: Principles of File Management, Principles of Database Management, Principles of Data Quality Assessment and Control, sampling theory & statistics

18.2. MR: Setting Up of Database (Using Toolset)
   18.2.1. SK: As Above, Use of Specific System
   18.2.2. KN: Knowledge of Specific System and Tools

18.3. MR: Identification of User Needs and User Modeling
   18.3.1. SK: User Modeling Technique
   18.3.2. KN: Principles of User Modeling, needs assessment & evaluation

18.4. MR: Creation of Data Dictionary, Data Model, and Metadata
   18.4.1. SK: Use of Specific System
   18.4.2. KN: As Above
18.5. MR: Audit, Quality Assurance, Quality Control of Data
18.5.1. SK: Quality Assurance Method
18.5.2. KN: Principles of Data Quality Assessment and Control

18.6. MR: Maintenance of Security and Confidentiality
18.6.1. SK: Use of Specific Security Tools
18.6.2. KN: Principles of Privacy and System Security

18.7. MR: Development of User Queries and Views
18.7.1. SK: SQL Query Skills, Use of Specific Query Tools, presentation skills
18.7.2. KN: Principles of Database Management, intra and Internet data query applications

19. CH: Integration of Multiple Systems
(Consider as special case of solution procurement and Implementation; All micro-roles apply here with following additions)

19.1. MR: Adoption of Common Definitions (Data Standards) and Spanning Data Model
19.1.1. SK: Standards Evaluation and Selection Technique
19.1.2. KN: Knowledge of Data Standards, Principles of Data Modeling

19.2. MR: Analysis and Selection of Middleware
19.2.1. SK: See Procurement
19.2.2. KN: Knowledge of Middleware Requirements and Capabilities

19.3. MR: Maintenance of Multiple Systems and of the Middleware
19.3.1. SK: (See Maintenance and Support of Solutions)
19.3.2. KN: Specifics of Middleware Maintenance and Support

19.4. MR: Perform Integration: Interfacing, Implementation of Middleware
19.4.1. SK: Interface Development Skills, Interface Development Tool Usage
19.4.2. KN: Principles of Software Engineering, Knowledge of Specific Systems Being Interfaced

19.5. MR: Use of Middleware Tools
19.5.1. SK: Using Middleware Tools
19.5.2. KN: Knowledge of Specific Tools

20. CH: Maintenance and Support of Solutions

20.1. MR: Applications Upgrading and Up-Versioning
20.1.1. SK: Project Management, Staff Mobilization and Motivation Technique, Implementation Planning Skills, Implementation Management Skills

20.2. MR: Addressing of Regulatory Requirements
20.2.1. SK: Information Finding Skills
20.2.2. KN: Knowledge of Regulatory Requirements
20.3. MR: Vendor Liaison and Relations
   20.3.1. SK: Vendor Relations Framework, Negotiation Skills, Communications Skills
   20.3.2. KN: The Roles, Capabilities, and Limitations of Health IT/IM Vendors and Products and Infrastructural Technologies, Principles of Negotiation

20.4. MR: Corrective Maintenance
   20.4.1. SK: Fault Identification Skills, Programming Skills
   20.4.2. KN: Principles of Software Engineering

20.5. MR: Adaptive Maintenance- Hardware
   20.5.1. SK: OS and Hardware Adaptive Maintenance Skills (System-Specific)
   20.5.2. KN: Knowledge of Specific Hardware Systems, Knowledge of Specific System

20.6. MR: Adaptive Maintenance- Software
   20.6.1. SK: Applications Software Adaptive Maintenance Skills (System-Specific)
   20.6.2. KN: Principles of Software Engineering, Knowledge of Specific System

20.7. MR: End-User Group Formation and Management
   20.7.1. SK: Staff Mobilization and Motivation Technique, User Group Framework
   20.7.2. KN: Principles of Management, Principles of Technology Management

20.8. MR: Perfective Maintenance (e.g., Functionality Upgrades, New Modules)
   20.8.1. SK: Programming Skills

20.9. MR: Management of Maintenance and Support
   20.9.1. SK: Staff Management Skills, Use of System-specific Maintenance Tools
   20.9.2. KN: Principles of Management, Principles of Technology Management, Knowledge of Specific applications

20.10. MR: Applications End-User Support
   20.10.1. SK: End-User Support Framework, Customer Relations Skills
   20.10.2. KN: Principles of Management, Principles of Customer-Oriented Services, Knowledge of Specific Applications

20.11. MR: End-User Applications Training
   20.11.1. SK: Staff Mobilization and Motivation Technique, Staff Training Skills
   20.11.2. KN: Principles of Management, Principles of Education and Training

20.12. MR: Applications Re-Setup and Re-Implementation
   20.12.1. SK: Project Management Skills, System Set-up Skills (System-Specific)
   20.12.2. KN: Principles of Project Management, Knowledge of Specific System

20.13. MR: System Monitoring and Utilization Management
   20.13.1. SK: System Performance and Utilization Method, Data Collection and Review Skills, Variance Analysis Technique, Use of System Monitoring Tools
   20.13.2. KN: Principles of Technology Management, Principles of Measurement, and Data Collection and Development
20.14.1. SK: System Operation...etc. Skills (System-Specific), Capacity Planning Technique, System Operations Management Framework, See Above
20.14.2. KN: Principles of Technology Management, Knowledge of Specific System

20.15. MR: Systems Security Definition, Management, and Oversight
20.15.1. SK: Security Management Framework (Physical and Logical Security), Security Threat Assessment, Assessment of Effectiveness of Security Systems
20.15.2. KN: Principles of Privacy and Confidentiality of Health Information, Principles of Security Management, Knowledge of Regulations
20.15.3. SK: Security Management Framework (Physical and Logical Security)
20.15.4. KN: Principles of Security Management

20.16. MR: Systems Currency Maintenance
20.16.1. SK: Technology Currency Maintenance Framework
20.16.2. KN: Principles of technology Management

20.17. MR: Disaster Planning and Management
20.17.1. SK: Disaster Planning Framework
20.17.2. KN: As above

21. CH: Evaluation of Solution Outcomes
21.1. MR: Id of Evaluation Objectives and Techniques (e.g., Qualitative, Quantitative)
21.1.1. SK: Requirements Identification Technique, Evaluation Framework
21.1.2. KN: Principles of Quantitative and Qualitative Evaluation

21.2. MR: Compliance Analysis
21.2.1. SK: Compliance Analysis Method (with Requirements, with Performance Targets, with Regulations, etc.)
21.2.2. KN: As above

21.3. MR: Survey Design, Testing, and Administration
21.3.1. SK: Survey Design Skills, Surveying Techniques, Survey Instrument Validation Techniques
21.3.2. KN: As above, Principles of Survey Design, Execution, and Analysis, Principles of User Acceptance Analysis

21.4. MR: Interview Design, Testing, and Administration
21.4.1. SK: Structured Interview Design Skills, Interviewing Skills
21.4.2. KN: Principles of Interview Design, execution, and Analysis

21.5. MR: Observation of Actual Users (Ethnographic Observation)
21.5.1. SK: Ethnographic Observation Technique and Skills
21.5.2. KN: Basic Systems Ergonomics, Principles of Objective Observation

21.6. MR: Results Collation and Analysis
21.6.1. SK: Data Analysis Techniques (e.g., Statistical)
21.6.2. KN: Principles of Measurement, and Data Collection and Development, Basic Statistics
21.7. MR: Evaluation Report Production
   21.7.1. SK: Report Writing Skills, Professional Writing Skills
   21.7.2. KN: Principles of Quantitative and Qualitative Evaluation

22. CH: Management of Change (Acting as Change Agent)
22.1. MR: Identification of Stakeholders and Operations Desired Outcomes
   22.1.1. SK: Stakeholder Analysis, Requirements Definition Skills, Interpersonal Skills, Negotiation Skills
   22.1.2. KN: Diffusion of Innovation Theory, Principles of Change Management

22.2. MR: Definition of Management of Change Process
   22.2.1. SK: Change Management Technique, Project Management Technique
   22.2.2. KN: Principles of Project Management

22.3. MR: Understanding of the Organizational Culture/Environment and Leadership Commitment to the Process
   22.3.1. SK: Listening Skills, Structured Interviewing Techniques
   22.3.2. KN: The Nature and Operation of the Health System, The Roles and Functions of Health System Professionals, Knowledge of Specific Organization’s Culture

22.4. MR: Assessment of the Potential of the Organization to Change
   22.4.1. SK: Changeability/Adaptability Assessment Technique (see Lorenzi)
   22.4.2. KN: As above

22.5. MR: Engagement, Education, and Involvement of Stakeholders
   22.5.1. SK: Stakeholder Analysis, Teaching Skills, Staff Mobilization and Motivation Techniques
   22.5.2. KN: Principles of Education and Training, (See Education and Training)

22.6. MR: Assessment of the Existence of Skilled Staff Within Organization
   22.6.1. SK: Human Networking Skills, Skills Requirements Matrix

22.7. MR: Identification of Other Collaborators and Supporting Experts (e.g. HR, Other Members of Executive Team, Consultants, etc.)
   22.7.1. SK: Human Networking Skills, Interpersonal Skills
   22.7.2. KN: Knowledge of Specific Situation and Resources

22.8. MR: Implementation of Change Process
   22.8.1. SK: Change Management Implementation Framework, Project Management Skills
   22.8.2. KN: Principles of Project Management, As Above

22.9. MR: Monitoring of Process and Outcomes
   22.9.1. SK: Progress Measurement and Tracking Technique, As above
   22.9.2. KN: As above

22.10. MR: Evaluation of Outcomes
   22.10.1. SK: Evaluation Method
   22.10.2. KN: Principles of Quantitative and Qualitative Evaluation
23. CH: User, Customer, Inter-Departmental and Public Liaison, Relations, Communications, and Publication

23.1. MR: Participation in Committee and Team Activities

23.1.1. SK: Group Management Technique, Communications Skills, Presentation Skills, Listening Skills, Inter-personal Skills

23.1.2. KN: Principles of Group and Program Management, Principles of Communication and Public Relations

23.2. MR: Inter-departmental Communications

23.2.1. SK: Communications Skills, Professional Writing Skills, Inter-personal Skills

23.2.2. KN: As Above

23.3. MR: Presentations at Meetings, Conferences, and Seminars

23.3.1. SK: Professional Writing Skills, Presentation Skills

23.3.2. KN: As Above

23.4. MR: Article, Report, Newsletter, and Working Paper (etc.) Publication

23.4.1. SK: Professional Writing Skills

23.4.2. KN: As Above

23.5. MR: Website Definition and Development

23.5.1. SK: Website Building Skills

23.5.2. KN: Principles and Practice of Website Development

24. CH: Continuing Education

24.1. MR: Continuing Education Stakeholder Identification and Involvement (Self, Staff, User/Client)

24.1.1. SK: Stakeholder Identification, Continuing Education Framework

24.1.2. KN: Knowledge of AHI Curriculum, Knowledge of Educational Offerings

24.2. MR: Assessment of New Continuing Education Models and Opportunities

24.2.1. SK: Information Finding Skills, Educational Program Assessment Framework

24.2.2. KN: Principles of Education and Training, Multimedia Educational Methods

24.3. MR: Definition of Stakeholder-Specific Education Plan

24.3.1. SK: Education/Training Planning Framework, Negotiation Skills

24.3.2. KN: As Above

24.4. MR: Management and Monitoring of Continuing Education Process

24.4.1. SK: Education Progress Assessment Techniques

24.4.2. KN: Principles of Management

24.5. MR: Continuing Education: Execution

24.5.1. SK: Study Skills

25. CH: System and Methods Customization and Ad Hoc Development

25.1. MR: Needs Analysis

25.1.1. SK: Needs Analysis Method, Listening Skills, Interviewing Skills, User Modeling Skills

25.1.2. KN: Principles of Software /Process Engineering, Knowledge of Specific Domain of Application and Needs of Users
25.2. MR: Requirements Definition
   25.2.1. SK: Requirements Definition Framework/Method
   25.2.2. KN: As Above

25.3. MR: Options/Approaches Research
   25.3.1. SK: Information Finding Skills
   25.3.2. KN: Knowledge of Previous Approaches

25.4. MR: Options/Approaches Analysis And Selection
   25.4.1. SK: Options Analysis, Risk Analysis, Decision-Making Skills
   25.4.2. KN: As Above

25.5. MR: System/Methods Design And Specification
   25.5.1. SK: Structured Design Technique
   25.5.2. KN: Principles of Software/Process Engineering, Knowledge of Specific Domain of Application and Needs of Users

25.6. MR: System/Methods Prototyping
   25.6.1. SK: Prototyping Method
   25.6.2. KN: As Above

25.7. MR: Coding/Documentation
   25.7.1. SK: Programming Skills, Program Documentation Skills
   25.7.2. KN: As Above, Knowledge of Specific Programming Language, Knowledge of Specific Applications Development Environment

25.8. MR: Hardware Adaptation (If Required)
   25.8.1. SK: Skills Equivalent to Others in This Section Re Hardware Development
   25.8.2. KN: Knowledge Equivalent to Other Knowledge Elements in This Section Re: Hardware Development, Knowledge of Hardware Components

25.9. MR: System/Methods Testing And Validation
   25.9.1. SK: Testing Method
   25.9.2. KN: Principles of Software Engineering, Knowledge of Specific Domain of Application and Needs of Users, Testing Methodologies

   25.10.1. SK: Information Finding Skills
   25.10.2. KN: Knowledge of Specific Regulatory Requirements

   25.11.1. SK: Acceptance Testing Method
   25.11.2. KN: As Above

26. CH: Utilization of Technology (Personal Productivity, Specific Tools)
26.1. MR: Identify Requirements for Technology
   26.1.1. SK: Needs Analysis Method, Listening Skills, Requirements Definition and Analysis
   26.1.2. KN: Knowledge of Personal Productivity Applications and their Capabilities, Knowledge of Specific Environment
26.2. MR: Obtain Access to the Technology
   26.2.1. SK: Information Finding Skills, See Procurement
   26.2.2. KN: See Procurement

26.3. MR: Learn Use and Gain Proficiency

27. CH: General Day-to-Day Issues
   27.1.1. SK:
       27.1.2. Interpersonal Relations
       27.1.3. Thinking and General Problem Solving (Critical Reading, Summarization Skills, Thinking
               Techniques: [e.g., deBono CoRT Tools], Group Thinking/Management Techniques, and
               [Nominal Group Technique, Consensus Mapping Technique, Delphi Method])
       27.1.4. Conflict Resolution (Negotiation Skills, Conflict Resolution Framework)
       27.1.5. Consensus Development (Consensus Mapping Technique, Facilitation Skills, Negotiation
               Skills, Leadership Skills)
       27.1.6. Interviewing (Structured Interview Design, Interviewing Skills)
       27.1.7. Professional Writing
       27.1.8. Professional Presentation
       27.1.9. Enhancing and Maintaining Personal Productivity (Time Management and Personal
               Organization)
       27.1.10. Personal IT Tools Proficiency
       27.1.11. Idea and Option Generation
       27.1.12. Problem Valuation and Prioritization
       27.1.13. Information Research
SECTION A5 – AHI Required Experience

The table below documents the AHI Working Group’s recommendations regarding the type and minimum level of experience required to prepare a student for an entry-level position for each macro-role. Note that, wherever possible, students should have all other types/levels of experience up to the minimum level.

### Key: The Type and Level of Experience Required to Address Each AHI Challenge
(NB: List is in decreasing order of depth and quality)

<table>
<thead>
<tr>
<th>Exp. Type</th>
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<tbody>
<tr>
<td>8-OJL</td>
<td>On-the-Job Experience in a Leadership Role</td>
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<tr>
<td>7-OJP</td>
<td>On-the-Job Experience in a Team Participant Role</td>
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<tr>
<td>6-FEL</td>
<td>Field Experience/Practicum Addressing the Challenge in a Leadership Role</td>
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<tr>
<td>5-FEP</td>
<td>Field Experience/Practicum Addressing the Challenge in a Team Participant Role</td>
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<tr>
<td>4-TRP</td>
<td>Program Thesis/Research Project</td>
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<tr>
<td>3-CPR</td>
<td>Course Project</td>
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<tr>
<td>2-CAS</td>
<td>Class Assignment</td>
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<tr>
<td>1-GDC</td>
<td>Group Discussion/Case Study Analysis</td>
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<tr>
<td>0-NOE</td>
<td>No Experience Required in Addressing the Challenge</td>
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### Key: The AHI Macro-Roles and Abbreviations

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<tr>
<th>Macro-Role</th>
<th>Abbreviation</th>
<th>Description</th>
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### AHI Experience Requirements by Macro-Role

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<td>Understanding of the Nature of the Health System and Current Issues, and Identification of Desired Outputs Formulation of IT/IM Components of the Strategic Plan</td>
<td>7-OJP</td>
<td>3-CPR</td>
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<td>Management of Other's (e.g., Population, System) Data (Quality Audits, Combining Data, Transmission, etc.)</td>
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<td>Integration of Multiple Systems (Consider as special case of solution procurement and implementation; All micro-roles apply here with following additions)</td>
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Once the required individual competencies were identified, the AHI Working Group organized the required skill and knowledge elements into natural competency categories. These categories roughly correspond to courses, parts of courses, or possibly groups of related courses that would be offered in an AHI Education Program.

**AHI COMPETENCY CATEGORIES**

1. Personal Competencies for AHI Professionals
2. General Computing Competencies for AHI Professionals
3. Health Computing Competencies for AHI Professionals
4. Key IT Usage Competencies for AHI Professionals
5. General Health System-Related Competencies
6. General Business and Management Competencies
7. General IS Department Management Competencies
8. Team and Human Resources Management Competencies
9. Re-Engineering and Management of Change Competencies
10. Strategic and Operational Planning Competencies
11. Assessment of the Value, Effects, and Cost of IT (Competencies)
12. General Technology/Systems Life-Cycle Management Competencies
13. Procurement Competencies
14. Systems Implementation and Integration Competencies
15. Systems Maintenance and Support Competencies
16. System Customization/Ad Hoc Development Competencies
17. Project Management Competencies
18. Education and Training Competencies
19. Vendor/Service Provider Competencies
20. User and Process Observation and Assessment Competencies
21. Security Management Competencies
22. Information and Data Collection, Analysis and Management Competencies

**AHI COMPETENCY CATEGORIES WITH DETAILED COMPETENCIES**

The following listing shows the detailed competencies (identified above with the micro-role associated with a challenge) that have been subsumed under the AHI competency categories. We have called them “Competency Categories”. We note that they are likely to be taught together in a major section of a course, a full course, or distributed over more that one course with (a) course title(s) roughly corresponding to the Competency Category name.

1. Personal Competencies for AHI Professionals
   1.1. Skills
      1.1.1. Communication Skills
      1.1.2. Critical Thinking and Critical Analysis Skills
      1.1.3. Human Networking Skills
      1.1.4. Interpersonal Skills (Listening Skills, People-Reading Skills)
      1.1.5. Personal Information Management Framework
1.1.6. Life-Long Learning Skills
1.1.7. Persuasion/ Lobbying Skills
1.1.8. Presentation Skills
1.1.9. Problem Resolution Skills
1.1.10. Questioning Techniques
1.1.11. Negotiation Skills and Technique
1.1.12. Reading Comprehension + Summarization Skills (Including Critical Reading)
1.1.13. Resume Framework
1.1.14. Study Skills
1.1.15. Self-Assessment Techniques
1.1.16. Synthesizing Skills
1.1.17. Systems Thinking
1.1.18. Thinking Techniques: CORT Tools, Six Thinking Hats, etc.
1.1.19. Time Management and Personal Organization
1.1.20. Writing Skills, Professional (Including Report Writing)

1.2. Knowledge
1.2.1. Negotiation, Principles of
1.2.2. Principles Underlying Each Skill, Technique, or Method, Knowledge of
1.2.3. Software Packages or Tools That Support the Skill, Technique, or Method, Knowledge of Specific
1.2.4. Systems Thinking, Principles of

2. General Computing Competencies for AHI Professionals

2.1. Skills
2.1.1. Information Finding Skills and Techniques
2.1.2. Personal IT Productivity Tools Proficiency
2.1.3. Research Skills and Techniques, General
2.1.4. See “Key IT Usage Competencies”

2.2. Knowledge
2.2.1. Applications, Knowledge of Specific
2.2.2. Artificial Intelligence in Health Systems, Principles of
2.2.3. Communications Systems, Multimedia, WANs, LANs, VPNs, CHINs, and Other Health Information Networks, Principles of
2.2.4. Encryption, Decryption, and Compression, Principles of
2.2.5. Virtual Conferencing and Collaboration
2.2.6. Internet-Based Systems, and the Nature and Operation of the Internet and WWW
2.2.7. Interactive Systems: Interfaces for Providers, Provider Workstation, Interactive Technologies; User-Adaptive Systems
2.2.8. Human Factors (Ergonomics) in Health Information Systems
2.2.9. Data Mining, Principles of
2.2.10. Data Modeling, Database Management, and File Management, Principles of
2.2.11. Data Warehousing, Principles of
2.2.12. Database and File Management
2.2.13. Hardware Components and Capabilities, Knowledge of
2.2.14. IT and IM, Basic Concepts of
2.2.15. Non-Health Organizations’ Approaches to Addressing IT/IM, Knowledge of
2.2.16. Operating Systems and Languages (Non-Derived)
2.2.17. Personal Productivity Applications and Their Capabilities, Knowledge of
2.2.18. Search Engines, Principles and Use of
2.2.19. Software Packages or Tools That Support the Skill, Technique, or Method, Knowledge of Specific
2.2.20. Standards and Standards Development Activities, Knowledge of
2.2.21. Systems and Modules, Knowledge of Specific
2.2.22. Systems Architectures: Distributed Systems, Client-Server Systems, 3-Layer Architectures, Systems Integration
2.2.23. Technologies, Knowledge of Specific
3. Health Computing Competencies for AHI Professionals

3.1. Knowledge

3.1.1. Enterprise-Level Systems (CDR, CPR, ADW, Health Portals, Health Data Mining, etc.),
    Nature and Capabilities of
3.1.2. Previous Approaches/Work in Health Systems, Knowledge of
3.1.3. Roles, Capabilities, and Limitations of Health IT/IM Vendors, Products, and Infrastructural
    Technologies, The
3.1.4. Health Information Systems: Hospital, Clinical, Ambulatory, Office, Community, etc.
3.1.5. Departmental Information Systems: ADT, LIS, RIS, Pharmacy, Nutrition, Health Records,
    etc.
3.1.6. Image Management and Access Systems; Image Processing and Reconstruction; PACS
3.1.7. Health Administration Support Systems: Financial Information Systems; HRIS; ERP
    Systems
3.1.8. Management and Executive Information Systems in Health
3.1.9. Computer-Based Patient Records
3.1.10. Patient Interviewing
3.1.11. Health Status Evaluation, and Other Direct Patient-Used Systems
3.1.12. Clinical Trial Management Systems
3.1.13. Experiment Management Systems
3.1.14. Telehealth, Telemedicine

4. Key IT Usage Competencies for AHI Professionals

4.1. Skills

4.1.1. Data Mining System, Use of Specific
4.1.2. DBMS, Use of Specific
4.1.3. SQL Query Skills
4.1.4. Query Package, Use of Specific
4.1.5. Middleware Tools, Use of Specific
4.1.6. Presentation Graphics Package, Use of Specific
4.1.7. Product-Specific Tools Skills
4.1.8. Query Tools, Use of Specific
4.1.9. Search Engines, Use of
4.1.10. Security Tools, Use of Specific
4.1.11. System Tools, Use of Specific
4.1.12. Statistical Analysis Techniques, Basic Skills
4.1.13. Statistical Package, Use of Specific
4.1.14. System Monitoring Tools, Use of Specific
4.1.15. Maintenance Tools, Use of System-Specific

4.2. Knowledge

4.2.1. Inter/Intranet Data Query Applications, Knowledge of
4.2.2. Software Packages or Tools That Support the Skill, Technique, or Method, Knowledge of
    Specific
4.2.3. Statistics, Basic

5. General Health System-Related Competencies

5.1. Knowledge

5.1.1. Strategic View of the Health System: Health System Mission, Goals, Objectives, Strategies,
    Tactics, Cultures, and Values
5.1.2. Nature, Components, and Operation of the Health System, The
5.1.3. Organization and Management of the Health System, The
5.1.4. Decision-Making Principles and Processes in the Health system
5.1.5. Roles, Responsibilities, and Accountabilities of Health Systems Professionals, The
5.1.6. Nature, Prerogatives, and Rights of Patients, The
5.1.7. Health-Related Regulation, Legislation, Policy, and Custom
5.1.8. Funding and Governance of the Health System: Federal, Provincial, Regional, and Institutional, The
5.1.9. Health System Finance and Budgeting
5.1.10. Health System and Stakeholder Interests, Knowledge of
5.1.11. Enterprise-Level Systems (CDR, CPR, ADW, etc.), Nature and Capabilities of

6. General Business and Management Competencies

6.1. Skills
6.1.1. Accountability and Reward Methods
6.1.2. Assessment (General) Skills
6.1.3. Assessment of the Organization’s Perceptions of the IT/IM Organization, Framework for
6.1.4. Asset Management Framework
6.1.5. Benchmarking Techniques
6.1.6. Budgeting Methodology and Template(s)
6.1.7. Compliance Analysis Method (with Requirements, with Performance Targets, with
Regulations, etc.)
6.1.8. Crisis Management Skills
6.1.9. Corporate Cultural Assessment Skills (regarding acceptable approaches, methods, values)
6.1.10. Contract/or Management Skills
6.1.11. Customer Relations Management Skills
6.1.12. Decision-Making Skills
6.1.13. Decision-Promotion Skills
6.1.14. Decision-support Tools, Use of Managerial
6.1.15. Financial Analysis Method
6.1.16. Financial Management Framework
6.1.17. Funding Proposal Framework
6.1.18. Management Planning Skills
6.1.19. Money-Finding Skills
6.1.20. Opportunity Analysis
6.1.21. Options Analysis and Comparison Technique
6.1.22. Organizational Planning Skills
6.1.23. Policy and Procedure Planning, Development, Implementation, Monitoring, and
Evaluation Frameworks
6.1.24. Prioritization/Triage Techniques
6.1.25. Promotion and Marketing Skills
6.1.27. Risk Assessment/Analysis Technique
6.1.28. Stakeholder Analysis
6.1.29. Variance Analysis Technique

6.2. Knowledge
6.2.1. Budgeting, Principles of
6.2.2. Communication and Public Relations, Principles of
6.2.3. Corporate Culture and Values, Knowledge of
6.2.4. Corporate Management and Organization, Principles of
6.2.5. Culture and Politics of the Specific Organization, Understanding the
6.2.6. Ethics
6.2.7. Law and Regulation, Knowledge of Applicable
6.2.8. Management, Principles and Practices of
6.2.9. Organization’s Culture, Knowledge of Specific
6.2.10. Policy and Procedure Development, Principles of
6.2.11. Policy Implementation Strategies, Knowledge of
6.2.12. Policy Realms, Familiarity with National, State/Provincial, Regional, and Regulatory Body
Policy and Policy Directions, Knowledge of IT
6.2.13. Policy Realms, Knowledge of Internal and External
6.2.14. Regulatory Requirements, Knowledge of
6.2.15. Risk Management, Principles of
6.2.17. Roles and Functions of Corporate Professionals, The
6.2.18. Values and Decision Criteria, Knowledge of Specific

7. General IS Department Management Competencies

7.1. Skills
7.1.1. IS/IT Management Framework
7.1.2. IS Department Structuring Method/Template
7.1.3. Service-Level Agreement Framework
7.1.4. Vendor Management Skills
7.1.5. Vendor Motivation Techniques
7.1.6. Vendor Relations Management Framework

7.2. Knowledge
7.2.1. IS Organization and Management, Principles of

8. Team and Human Resources Management Competencies

8.1. Skills
8.1.1. Capability Assessment Methodology
8.1.2. Capability Matrix Development Skills
8.1.3. Conflict Resolution Framework
8.1.4. Consensus Mapping Technique
8.1.5. Coordination Skills
8.1.6. Facilitation Skills
8.1.7. Group Management and Thinking Techniques: Nominal Group Technique, Consensus Mapping Techniques, Delphi Method
8.1.8. Leadership Skills
8.1.9. Motivation Techniques
8.1.10. Recruitment Technique (Role and Position Description, Selection Criteria, etc.)
8.1.11. Skills Requirements Matrix
8.1.12. Staff Development Framework
8.1.13. Staff Involvement Techniques
8.1.14. Staff Management Skills
8.1.15. Staff Mobilization and Motivation Skills and Techniques (Group Dynamics)
8.1.16. Staff Performance Evaluation Method
8.1.17. Staff Scheduling and Schedule Management Skills
8.1.18. Staff Training Skills
8.1.19. Team Building Skills

8.2. Knowledge
8.2.1. Human Resources Management, Principles of
8.2.2. Group and Program Management, Principles of

9. Re-Engineering and Management of Change Competencies

9.1. Skills
9.1.1. Change Management and Problem Resolution Skills
9.1.2. Change Management Implementation Framework
9.1.3. Change Management Technique
9.1.4. Changeability/Adaptability Assessment technique (e.g., See Lorenzi)
9.1.5. Management of Change Skills
9.1.6. Process and Product Innovation Methods (Re-Engineering)
9.1.8. Process Improvement Methods (Value Chain Analysis, Rational Analysis, IT-Facilitated Process Analysis)
9.1.9. Process Planning and Implementation Techniques
9.1.10. Process Training Method
9.1.11. Work Process Implementation Planning Method/Template

9.2. Knowledge
9.2.1. Business and Clinical Processes, Understanding of
9.2.2. Change Management, Principles of
9.2.3. Departmental Operations, The Nature of (Specific)
9.2.4. Diffusion of Innovation Theory
9.2.5. Ergonomics, Principles of
9.2.6. Impacts of Systems on Operations and Work, The
9.2.7. Organizational Change Theory
9.2.8. Process Analysis, Principles and Practice of
9.2.9. Process and Product Re-engineering (Innovation), Principles of
9.2.10. Resistance Within the Organization, Understanding the Foci for
9.2.11. TQM and CQI, Principles of
9.2.12. Situation and Resources, Knowledge of Specific
9.2.13. Specific Environment, Knowledge of

10. Strategic and Operational Planning Competencies
10.1. Skills
   10.1.1. Action Planning Technique
   10.1.2. Interpretation (Bridging) Skills
   10.1.3. IT/IM Strategic Planning Methods
   10.1.4. SWOT Analysis
   10.1.5. Forecasting Skills
10.2. Knowledge
   10.2.1. Strategic Plan of Specific Organization, Understanding of the Strategic Planning and Management, Principles and Practice of
   10.2.3. Strategies of Other Organizations Related to IT/IM

11. Assessment of the Value, Effects, and Cost of IT (Competencies)
11.1. Skills
   11.1.1. Benefits Identification and Estimation Technique
   11.1.2. Benefits Realization Methodology (e.g., Early Beneficial Occupancy – Benefits Unfold with System Implementation)
   11.1.3. Business Case/ Justification Analysis Method
   11.1.4. Business Value Assessment Framework
   11.1.5. Cost Identification and Analysis Method
   11.1.6. Cost-Benefit Analysis Method
   11.1.7. Costing Methodology
   11.1.8. IT Cost Analysis Method
   11.1.9. Quantitative and Qualitative Evaluation Methods
   11.1.10. Valuation Techniques
11.2. Knowledge
   11.2.1. Business Ethics, Principles of
   11.2.2. Business Etiquette and Culture, Principles of
   11.2.3. Business Value of IT/IM Systems (Quantitative and Qualitative Value), The
   11.2.4. Costs and Benefits of IT/IM Systems and Their Supporting Infrastructure, The
   11.2.5. Finance and Economics, Basic
   11.2.6. Quantitative and Qualitative Evaluation/Assessment, Principles of
   11.2.7. Technology Assessment, Principles of

12. General Technology/Systems Life-Cycle Management Competencies
12.1. Skills
   12.1.1. Audit/Review Methodology
   12.1.2. Capacity Planning Technique
   12.1.3. Disaster Planning Framework (Business Continuance Planning)
   12.1.4. Documentation Skills
   12.1.5. Evaluation Framework and Methods
   12.1.6. Expectation Management Framework and Techniques
12.1.7. Failure Analysis Techniques
12.1.8. System Inventory Technique
12.1.9. Standards Evaluation and Selection Technique
12.1.10. System Operations Management Framework and Skills (Including System-Specific)
12.1.11. System Performance and Utilization Measurement and Assessment Method
12.1.12. Systems Management Framework

12.2. Knowledge
12.2.1. Information Technology Management, Principles of
12.2.2. Existing Specific Systems (e.g., How Well Used and Accepted), Understanding of
12.2.3. Failure Analysis, Principles of

13. Procurement Competencies
13.1. Skills
13.1.1. Acceptance Testing Method/Procedure
13.1.2. Compliance Analysis Techniques
13.1.3. Contract Framework
13.1.4. Contract Negotiation Technique
13.1.5. Procurement Method (Including RFI/Q and RFP Writing, Site Visit Design and Analysis

Technique, Demo Design and Analysis Technique)
13.1.6. Needs Analysis Method
13.1.7. Scenario Development Skills
13.1.8. User Group Framework
13.1.9. User Satisfaction and Acceptance Analysis and Management
13.1.10. Vendor Viability Assessment Framework
13.1.11. Vendor/Product Comparison Framework

13.2. Knowledge
13.2.1. Application Domain, Knowledge of Specific
13.2.2. Contract Development, Principles of
13.2.3. Corporate Strategy and Current Offerings, Knowledge of
13.2.4. Health IT Product Knowledge, Basic
13.2.5. Health IT/IM Vendors and Products, The Nature and Capabilities of
13.2.6. Industry Marketing, Promotion, and Sales Techniques, Knowledge of
13.2.7. Needs Assessment and Evaluation, Principles of
13.2.8. Product/Vendor State-of-the-Art, Knowledge of
13.2.9. Products, Knowledge of Specific
13.2.10. Requirements, Knowledge of Specific
13.2.11. System Testing and Validation, Principles of
13.2.12. User Acceptance Analysis, Principles of
13.2.13. User Modeling, Principles of
13.2.14. Vendor Marketplace, Knowledge of
13.2.15. Vendor Values, Knowledge of

14. Systems Implementation and Integration Competencies
14.1. Skills
14.1.1. Hardware and OS Testing Methods
14.1.2. Implementation Planning Management Skills
14.1.3. Incremental Implementation Method (Including Training)
14.1.4. Interface Development Skills and Tool Usage
14.1.5. Set-up Methods and Skills (System-Specific)
14.1.6. Implementation Planning Technique
14.1.7. User Training Skills

14.2. Knowledge
14.2.1. Middleware and Internet Solutions, Nature and Capabilities of
14.2.2. Middleware Requirements and Capabilities, Knowledge of
15. Systems Maintenance and Support Competencies

15.1. Skills
15.1.1. Applications Software Adaptive Maintenance Skills (System-Specific)
15.1.2. End-User Support Framework
15.1.3. Fault Identification Skills
15.1.4. OS and Hardware Adaptive Maintenance Skills (System-Specific)
15.1.5. System Upgrade Timing and Value Assessment, Method for the Determination of Optimal
15.1.6. Technology Currency Maintenance Framework

15.2. Knowledge
15.2.1. Upgrade Process, Knowledge of Specific
15.2.2. Maintenance and Support Requirements of Specific Middleware, Knowledge of
15.2.3. Optimal Upgrade Timing and Value, Knowledge of

16. System Customization/Ad Hoc Development Competencies

16.1. Skills
16.1.1. Hardware Development/Configuration Skills
16.1.2. Needs Analysis Method
16.1.3. Program Documentation Skills
16.1.4. Programming Skills
16.1.5. Requirements Identification, Definition, and Analysis Method/Framework and Skills
16.1.6. Prototyping Method
16.1.7. Structured Design Technique
16.1.8. Testing Methods (Software, Hardware, Systems, Processes)
16.1.9. Website Design and Building Skills
16.1.10. Website Building Tools, Use of Specific
16.1.11. User Modeling Skills and Techniques

16.2. Knowledge
16.2.1. Applications Development Environment, Knowledge of Specific
16.2.2. Programming Language, Knowledge of Specific
16.2.3. Requirements, Knowledge of Specific
16.2.4. Software Engineering, Principles of
16.2.5. Testing of Systems and Components, Principles of
16.2.6. User Modeling, Principles of
16.2.7. Website Development, Principles and Practice of

17. Project Management Competencies

17.1. Skills
17.1.1. Multi-Project Management Skills
17.1.2. Project Management Skills and Techniques
17.1.3. Oversight/Progress Measurement, Reporting and Review Method
17.1.4. Monitoring Method

17.2. Knowledge
17.2.1. Project Planning, Organization, Management, and Evaluation, Principles of
17.2.2. Project Successes and Failures, Knowledge of

18. Education and Training Competencies

18.1. Skills
18.1.1. Client Education Skills
18.1.2. Continuing Education Framework
18.1.3. Education and Training Skills (Teaching Skills)
18.1.4. Education Program Assessment Framework
18.1.5. Education Progress Assessment Techniques
18.1.6. Education/Training Planning Framework
18.1.7. Mentoring Skills

18.2. Knowledge
  18.2.1. Curriculum, Knowledge of
  18.2.2. Education and Training, Principles of
  18.2.3. Educational Sources and Offerings, Knowledge of
  18.2.4. Multimedia Education, Principles of

19. Vendor/Service Provider Competencies
  19.1. Skills
    19.1.1. Closing Technique
    19.1.2. Market Research Method
    19.1.3. Marketing Skills
    19.1.4. RFP Response Framework (Vendors)
    19.1.5. Product Development Planning Framework
    19.1.6. Product/Service Planning Method
    19.1.7. Selling Techniques (Vendors)
    19.1.8. Strategic Market Planning (Vendors)
  19.2. Knowledge
    19.2.1. Customer Domain Knowledge
    19.2.2. Customer Needs, Issues, Constraints, and Policies, Knowledge of
    19.2.3. Customer-Oriented Service, Principles of
    19.2.4. Domain-Specific and Product/ Service-Specific Knowledge
    19.2.5. Marketing and Sales, Principles of
    19.2.6. Product and Service Planning and Development, Principles of
    19.2.7. Vendor Values, Knowledge of

20. User and Process Observation and Assessment Competencies
  20.1. Skills
    20.1.1. Ethnographic Observation Techniques and Skills
    20.1.2. Structured Interview/ Observation Design Skills and Techniques
    20.1.3. Structured Interviewing/ Observation Techniques
    20.1.4. Survey Design
    20.1.5. Survey Design Method
    20.1.6. Survey Instrument Validation Techniques
    20.1.7. Surveying Techniques
    20.1.8. User Modeling Technique and Skills
  20.2. Knowledge
    20.2.1. Interview Design, Execution, and Analysis, Principles of
    20.2.2. Objective Observation and Review, Principles of
    20.2.3. Sampling Theory and Statistics; Statistics for Surveys, Basic
    20.2.4. Survey Design, Execution, and Analysis, Principles of
    20.2.5. Survey Methods, Limitations of

21. Security Management Competencies
  21.1. Skills
    21.1.1. Misuse and Security Issues, Ability to Identify Potential
    21.1.3. Security Systems Effectiveness, Method for the Assessment of
    21.1.4. Security Threat Assessment Method
  21.2. Knowledge
    21.2.1. Security Management, Principles of
    21.2.2. Security Needs, Knowledge of
    21.2.3. Privacy and Consent Legislation, Knowledge of
    21.2.4. Privacy, Confidentiality, and Security of Health Information, Principles of
    21.2.5. Privacy/Security Legislation and Regulation, Knowledge of
    21.2.6. Security Tools, Knowledge of System-Specific
22. Information and Data Collection, Analysis and Management Competencies

22.1. Skills
   22.1.1. Data Analysis Skills and Techniques (e.g., Statistical)
   22.1.2. Data Collection and Review Skills
   22.1.3. Health Information Finding, Including use of Search engines
   22.1.4. See “General Computing Competencies for AHI Professionals”
   22.1.5. See “Key IT Usage Competencies for AHI Professionals”

22.2. Knowledge
   22.2.1. Data Quality Assessment and Control, Principles of
   22.2.2. Data Standards, Knowledge of
   22.2.3. Information Management, Principles of
   22.2.4. Information Resources Content, Location, Access Methods, Knowledge of
   22.2.5. Information Resources Management, Principles of
   22.2.6. IT/IM and Health Taxonomies, Controlled Vocabularies, Terminologies/Nomenclatures, and UMLS
   22.2.7. Knowledge Discovery and Management, Principles of
   22.2.8. Measurement, Data Collection, and Data Development, Principles of
   22.2.9. Sources of and Access to Health IT Industry Information Resources
   22.2.10. Nature, Structure and Use of Information, The
   22.2.11. Health Knowledge Representation
APPENDIX A - Publications


Guidelines for the Selection of Content for a Graduate Program in Health Informatics, Covvey HD, Zitner D., Proceedings of the Annual Conference of the American Medical Informatics Association, November 2001 [submitted].
Section B

RESEARCH & DEVELOPMENT
HEALTH INFORMATICS
(RDHI)
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AUTHORSHIP

RDHI WORKING GROUP:

This work represents the thinking and advice of numerous collaborators and could not have been accomplished without their participation. The RDHI Working Group participants come from diverse professional and geographic areas and represent a broad range of thinking. In addition to recognizing their participation, the names and e-mail addresses of the participants are listed here to encourage those who would like additional information to contact someone from their own geographic area.

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SECTION B1 - Introduction
This section presents a summary of the roles of professionals engaged in Research and Development Health Informatics (RDHI), the challenges they face in these roles, the micro roles they must perform to address these challenges, and the skills, knowledge, and experience required to perform them. It is meant to support not only curriculum development, but also to guide the learning of individuals with Health Informatics responsibilities.

Health Informatics is the discipline which studies, formulates, designs, develops, implements and evaluates information tools, concepts, methods, and technology to support clinical care, research, health services administration, and education.

All industries require appropriate information for management. However, health care has lagged other industries\(^1\). Consequently healthcare managers cannot routinely identify who is waiting for care, or which interventions are most likely to be beneficial or harmful. Data warehousing and mining techniques commonly used in other industries are seldom available to health system governors and managers because existing systems have not been developed or implemented to facilitate the collection of appropriate information about access and results. Recent reports in the United States\(^2\) recognize high rates of preventable health system error, and the situation in Canada is similar\(^3\). It has been demonstrated that decision support tools lead to substantial improvements in clinical performance in regards to drug dosing, clinical, and preventive care\(^1\). We believe that new information strategies will also improve communication, facilitate care and support the acquisition of new knowledge by patients and providers.

The healthcare community desperately needs appropriate information tools to support clinical care, research, teaching, and health services administration.

There was, and is, a crying need for people who can understand how information and information technology can help us to improve access to health services and improve results in terms of better health, through:

- Better policies at the governance level
- Better administration and allocation of services based on evidence of effectiveness of services; and
- Timely provision of decision-support information for care givers to make effective decisions.

In a recent letter from Gil Sampson, Vice President, COACH, to Diana Royce, Managing Director, HEALNet, the following concerns were put forward:

“Several industry leaders opine that there is now, or soon will be, insufficient human resources (numbers of people and their skill levels) to implement and manage the enhanced information systems and technologies to be deployed rising from CHIPP grants, the recently announced half billion dollar federal commitment, and several ongoing provincial health informatics initiatives such as those in Ontario, British Columbia and Alberta.”

In addition, this need was noted specifically for Nova Scotia in the Minister’s (of Health) Task Force on Regionalized Health Care in Nova Scotia (July 1999):

“…few systems are available to help health care providers within health facilities track patient information, and fewer still can track patient progress between institutions as treatment progresses from the primary or secondary level to tertiary care. If decisions on how to improve the health care system and the treatment patients receive are to be soundly based, accurate information produced in a timely and efficient way is essential. The most obvious way this can be achieved is through increased investment in information technology.”
Moreover, there is a desperate need for people who are able to develop, implement and use these new tools to support health care.

There are few formal programs in existence that deal with this area on an academic level. There are no programs to our knowledge that examine the origin, collection, aggregation, use, and mining of information from care, to inform policy, administration, and clinical care.

This curriculum is intended to specifically address the education of professionals in, at least, the effective use of information for a) governance and policy formulation, b) administration, and c) health care and clinical decisions. It also addresses supportive matters such as the structuring, collection, and use of information from care for performance indicators, and the use of information for quality improvement, and issues around clinical decision support tools and methodologies.

This curriculum is one of three. The other two, supported by the same grant, are Clinician Health Informatics and Applied Health Informatics. Research and Development Health Informaticians must be able to recognize the information problems that are faced by clinicians and Applied Health Informaticians, and must be able to develop support tools and strategies to sustain progress in the field.

References
2  US Senate Bill 2038 Medical Error Reduction Act
3  Myers, M. G., Compliance in hypertension: Why don't patients take their pills? CMAJ 1999;160:64-5

KEY OPERATIONAL TERMS

Macro-Roles: Major organizational roles undertaken by IT professionals; functional positions. Examples: HI Teacher, Researcher, System Designer/Architect.

Challenges: Aspects of the health and/or systems environment requiring attention or intervention; incursions or difficulties to which the professional must respond. Examples: designing, developing, and evaluating HI tools.

Micro-Roles: Sub-functions/tasks that must be performed to address the challenges.

Skills: Thinking, procedural, methodological, personal, or technical abilities required to successfully perform the specific micro-role. Includes: the techniques, methods, templates, frameworks, etc. Mostly learned by doing.

Knowledge: Inter-related (elaborated) data, facts, meanings, concepts, and principles that provide the basis for understanding, comparisons, conclusions, decisions, advice, and the like. Mostly learned by listening, reading, and discussion.

Experience: Involvement in the application of knowledge and skills though discussions, projects, or work.
Competencies: The aggregate of skills, knowledge, and experience required to address a challenge.

OPERATIONAL FRAMEWORK

Identification of **Macro-Roles** (e.g., Teacher, Researcher)

Identification of IT-Relevant **Challenges** faced by individuals performing these Macro-Roles

Identification of **Micro-Roles** (or Macro-Tasks) that must be performed to address these challenges

Identification of relevant **Skills, Knowledge & Experience** needed to competently perform these Micro-Roles

Definition of **Competency Categories**

Selection of Graduate vs. Undergraduate **Curriculum content**
SECTION B2 – RDHI Macro-Roles & Challenges

RDHI MACRO-ROLES

The following are the RDHI macro-roles we identified and addressed:

1. **HI Informatics Researcher (RES):**
   A conceiver and developer of new IT/IM ideas, structures, methods, systems, processes, techniques, or approaches.

2. **HI Informatics Teacher (TCHR):**
   A health informatics educator; a professor teaching health informatics in an undergraduate, graduate, or diploma program.

3. **IT Leader (CIO, VPIS) at Research + Development Organization (RDL):**
   A strategist who provides the strategic leadership to determine the IT/IM research and development directions and focuses for a development-oriented organization (e.g., a vendor, an academic laboratory, a hospital engaged in development [e.g., an academic medical center], and who guides and oversees these efforts. This individual may also function as the strategist for the deployment of technologies in support of the organization itself.

4. **System/Information Designer/Architect (DES):**
   An individual responsible for defining the overall structure, content, and uses of systems, systems components, and/or information resources that will be developed and/or configured for use in a health environment.

5. **Health Applications Development Team Leader (TL):**
   A systems development expert that configures, guides, and manages a development team.

6. **Research Clinician Informatician (CRES):**
   A health domain expert (nurse, physician, technologist, etc.) capable of developing and/or configuring new/novel IT/IM systems to address the needs of a clinical department or program.

7. **Evaluation Scientist (EVSC):**
   The developer of new methods for evaluation of IT/IM effectiveness; a scientist performing evaluation research related to IT/IM.

8. **Health IT/IM Policy Developer (POL):**
   A conceiver, developer, integrator, and maintainer off new policy related to IT/IM (e.g., privacy and security policy) at regional, provincial/state, or national levels.

9. **Librarian Researcher (LIB):**
   A health librarian engaged in research (e.g., the structure of information, knowledge representation, controlled vocabularies). Note: distinguished from a health librarian in strictly a researcher support role.

10. **Programmer (DEV):**
    A developer of health systems or major components of health system.

RDHI CHALLENGES
The following are the challenges faced by the Research and Development Health Informaticians in the identified macro-roles:

1. Identifying, Maintaining and Gaining Competence
2. Development of Teaching and Learning Methods
3. Supervising Students (Includes Research. Assistants, Visitors, Postdocs, etc.)
4. Basic/Theoretical Research
5. Applied Research (Using Tools in Innovative Ways)
6. Collaboration (With Researchers, Research Assistants etc.)
7. System Development
8. System/Capability Review and Evaluation
9. Information Architecting
10. Justification Case Building (Quantitative and Qualitative)
11. Development of Standards for Professionals (Knowledge, Competence, Ethics, Certification, Cross-Border Issues)
14. Understanding Health and the Health Sector
15. Concept and Methodology Development
16. Re-engineering and Designing of Work and Information Management Processes
17. Team and Project Leadership and Management
18. Team/Committee Participation
19. Obtaining Funding
20. Planning, Administration, and Management of IT/IM Resources
21. Planning, Administering, and Managing an Academic/Development Department
22. Communication (Including Presentations, Marketing, Dissemination of Research and Research Findings)
23. Article and Report Publication

RDHI CHALLENGES & MICRO-ROLES

In order to address each of these challenges, the RDHI professional will need to perform specific micro-roles. The list that follows identifies the micro-roles for each RDHI challenge:

1. Identifying, Maintaining and Gaining Competence
   1.1. Accessing Information (Books, Articles, E-Resources, Databases, Etc.)
   1.2. Learning What It Means To Be Competent Today
   1.3. Attending and Presenting at Conferences, Seminars, Workshops, Etc.
   1.4. Maintaining Personal Information Resources.
   1.5. Continual Self-Assessing
   1.6. Life-Long Learning
   1.7. Maintaining Currency (Updating SKE)

2. Development of Teaching and Learning Methods
   2.1. Defining Teaching and Learning Objectives
   2.2. Curriculum Design
   2.3. Course Design and Development
   2.4. Evaluation Methods Design and Student Evaluation
   2.5. Student Education
   2.6. Student Guidance
   2.7. Development of New Modalities of Curriculum Delivery

3. Supervising Students (Includes Research. Assistants, Visitors, Postdocs, etc.)
3.1. Student Capabilities And Capacity Assessment
3.2. Student Guidance And Mentoring
3.3. Student Project (And Other) Assignment
3.4. Student Project Management And Progress Evaluation
3.5. Project Team Building And Management
3.6. Student Evaluation
3.7. Teaching How to Develop Presentations (Including Articles, Reports, Posters, etc.)

4. Basic/Theoretical Research
   4.1. Identifying Viable Research Areas And Topics
   4.2. Formulating Questions/ Hypotheses
   4.3. Determining Research Methods
   4.4. Reviewing Existing Knowledge
   4.5. Designing Research Project
   4.6. Performing Research And Documenting Results
   4.7. Maintaining the Researcher’s Curiosity
   4.8. Analyzing and Understanding Benefits
   4.9. Generalization and External Validation
   4.10. Submitting To Peer Review
   4.11. Critical Thinking (Including Critiquing Research)

5. Applied Research
   5.1. Identifying and Selecting Appropriate Tools
   5.2. See Basic/Theoretical Research
   5.3. Post Implementation Evaluation of the Appropriateness of Tools Used to Develop System
   5.4. Impact Assessment

6. Collaboration (With Researchers, Research Assistants etc.)
   6.1. Identifying And Building Collaborative Relationships
   6.2. Developing Collaboration Support Technologies
   6.3. Formulation of Business or Research Partnerships

7. System Development
   7.1. Needs Analysis
   7.2. Requirements Definition
   7.3. Options/Approaches Research
   7.4. Options/Approaches Analysis And Selection
   7.5. System/Methods/Concept Design And Specification
   7.6. Understanding User Needs and User Modeling
   7.7. System/Methods/Concept Prototyping
   7.8. Coding/Documentation
   7.9. Hardware Development (If Required)
   7.10. System/Methods/Concept Testing And Validation
   7.11. Addressing Regulatory Requirements
   7.12. User Testing And Acceptance

8. System/Capability Review and Evaluation
   8.2. Determining Appropriate Review Method(s) And Criteria.
   8.3. Understanding System Capabilities, Methods Used, Resources Consumed, Etc.
   8.4. Identification Of Testing Scenario(s).
   8.5. Observation And Validation Of System/Capability Operation or Execution.
   8.7. Assessment Of User (Customer) Acceptance And Satisfaction.
   8.8. Formulation And Presentation Of Findings And Recommendations
9. Information Architecting
   9.1. Needs Analysis
   9.2. Requirements Definition (Information Uses, Characteristics, Items, Sources, Etc.)
   9.3. Information Architecture Design And Definition
   9.4. Information Architecture Validation
   9.5. Systems Support Requirements Definition
   9.7. Support Systems Testing And Validation
   9.8. Networking Architecture Design
   9.9. Standards and Nomenclature Development and Adoption

10. Justification Case Building (Quantitative and Qualitative)
    10.1. Identification and Documentation of Costs
    10.2. Identification and Documentation of Benefits
    10.3. Development of Quantitative and Qualitative Net Benefits
    10.4. Creation of a Decision-Maker-Compatible Proposal
    10.5. Presentation of Case to Decision-Makers

11. Development of Standards for Professionals (Knowledge, Competence, Ethics, Certification, Cross-Border Issues)
    11.1. Identification of Any Existing Proposals For Model Standards
    11.2. Identification of Objectives and Requirements for Professional Standards.
    11.4. Development of Interim Versions of Professional Standards.
    11.5. Consultation with Affected Professionals.
    11.6. Seeking of the Approval of the Standards.
    11.7. Communicating the Standards.

    12.1. Reviewing and Evaluating Existing Standards and Current Standardization Efforts
    12.2. Determination of the Needs for New Standards
    12.3. Determining the Appropriateness of a New Standard
    12.4. Definition of Requirements for New Standards and the Intended Effects
    12.5. Identification of Essential Partners, Participants, Experts
    12.6. Iterative Prototyping of New Standards
    12.7. Consultation with Stakeholders
    12.8. Testing of New Standards
    12.9. Promulgation of New Standards
    12.10. Monitoring of Use of New Standards
    12.11. Evaluation of the Effectiveness of New Standards

    13.1. Identification of Policy Enactment Strategy
    13.2. Identification of Policy Development Objectives, Requirements and Intended Consequences
    13.3. Identification of Policy Development Methodology.
    13.4. Research and Review of Previous/Similar Policy.
    13.5. Analysis of Previous/Similar Policy.
    13.6. Identification and Involvement of Stakeholders.
    13.8. Consultation with Stakeholders.
13.11. Review of the Effectiveness of Policy.

14. Understanding Health and the Health Sector
14.1. Understanding Health
14.2. Understanding the Nature and Requirements of Health System Components and Professionals
14.3. Recognizing the Complexity/Heterogeneous Nature of the Requirements
14.4. Determination of the Doable (long-term/short-term) and Prioritization of the Actions

15. Concept and Methodology Development
15.1. Comprehending Concept/Methodology Purpose, Objectives, Etc.
15.2. Identifying Existing Concepts, Method(s), and Identifying Gaps.
15.3. Determining Appropriate Review Methods and Criteria.
15.4. Understanding Concept/Methods Expected Effects/Deliverables, the Development Approach to be Used, Resources Required, Etc.
15.5. Developing the Concept/Method.
15.6. Identification Of Testing Scenario(s).
15.7. Observation And Validation Of Concept/Method Execution.
15.8. Evaluation Of Effects/Deliverables, etc. Versus Review Criteria
15.9. Assessment Of User (Customer) Acceptance And Satisfaction.
15.10. Formulation And Presentation Of Results.

16. Re-engineering and Designing of Work and Information Management Processes
16.1. Identification Of Desired Re-Engineering Outcomes
16.2. Documentation Of Existing Work Processes
16.3. Restructuring Of Macro-Processes And Products
16.4. Process Streamlining
16.5. Documentation Of Revised Work Processes
16.6. Documentation Of Business Case For Improvements (Costs And Benefits)
16.7. Planning And Implementation Of New Work Processes
16.8. Training
16.9. Evaluation Of Achievement Of Desired Outcome

17. Team and Project Leadership and Management
17.1. Team Definition and Building
17.2. Team Direction and Leadership
17.3. Team Problem-Solving, and Conflict Management and Resolution
17.4. Team Agenda and Time Management
17.5. Progress Evaluation
17.6. Project Management (Managing + Allocating Multiple Resources)

18. Team/Committee Participation
18.1. Role and Expectation Understanding
18.2. Participation (Including Effort and Effort Commitment)
18.3. Identifying When Teams Are Necessary and When They Are Not
18.4. Team Process Development
18.5. Team Facilitation

19. Obtaining Funding
19.1. Identification of Appropriate Funding Sources
19.2. Surveying New Funding Sources and Their Requirements
19.3. Research Content, Methods, Processes, Required Resources, etc. Definition
19.4. Team Specification and Construction  
19.5. Grant Proposal Writing (Possibly Develop Presentation)  
19.6. Obtaining of Internal Approvals  
19.7. Proposal Submission (Possibly With Presentation)  
19.8. Development of Justification Case and Business Operation (Internal + External Funding Generation)

20. Planning, Administration, and Management of IT/IM Resources  
20.1. Identification and Articulation of Requirements  
20.2. Definition and Implementation of Management Framework  
20.3. Management Policy and Procedure Development and Implementation  
20.4. IT/IM Acquisition and Implementation Planning  
20.5. Definition and Assignment of Roles and Accountabilities  
20.6. Self-Assessment  
20.7. Program (Multi-Project) Management  
20.8. IT/IM Resources Management Policy and Procedure Development and Implementation  
20.9. Oversight of Systems and Information Management  
20.10. Systems and Information Management  
20.11. Development, Promotion and Management of Annual IT Budget (Capital + Operating)  
20.12. Financial Management of IT/IM Resources  
20.13. Asset Management

21. Planning, Administering, and Managing an Academic/ Development Department  
21.1. Identification of Department Mission, Vision, Goals etc. in an Organizational Context  
21.2. Identification and Articulation of Requirements  
21.3. Definition and Implementation of Management Framework Including Policy and Procedure Development and Implementation  
21.4. Equipment and Services Acquisition  
21.5. Definition and Assignment of Roles and Accountabilities  
21.6. Staff Recruitment  
21.7. Staff Development (Education and Training)  
21.8. Staff and Team Leadership and Management  
21.9. Liaison and Accountability Outside the Department  
21.10. Staff Performance Evaluation  
21.11. Self-Assessment  
21.12. Program (Multi-Project) Management  
21.14. Oversight of Department Function  
21.15. Development, Promotion and Management of Annual Budget (Capital + Operating)  
21.16. Financial Management  
21.17. Asset Management

22. Communication (Including Presentations, Marketing, Dissemination of Research and Research Findings)  
22.1. Presentations and Dissemination at External Meetings, Conferences, and Seminars  
22.2. Presentations to Funders (External) and to Board of Directors (Internal)  
22.3. Website Development

23. Article and Report Publication  
23.1. Determination of Appropriate Publication  
23.3. Obtaining Peer Review  
23.4. Self-Assessment of Competencies
SECTION B3 - The Importance of the Challenges to Each RDHI Macro-Role

Not every Research and Development Health Informatician faces and therefore must address each of the above challenges. The table below identifies the degree to which a professional in each macro-role must address the challenges. Based on this table, one can determine the importance of each of the competencies for each of the macro-roles.

Key: The Definition of Importance Levels

<table>
<thead>
<tr>
<th>Key</th>
<th>Definition</th>
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<tbody>
<tr>
<td>H</td>
<td>A person in this role has a primary responsibility for addressing this challenge. The addressing this challenge is critical to the success of the person in this role. The competencies identified with the micro-roles of this challenge are essential. (Working Group Ratings 4.0 – 5.0)</td>
</tr>
<tr>
<td>M</td>
<td>A person in this role has some direct responsibility for, or a part to play in, addressing this challenge. A person in this role may be responsible for another person’s addressing of this challenge. The competencies identified with the micro-roles of this challenge are useful and required to a limited degree. (Working Group Ratings 2.0 – 4.0)</td>
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<tr>
<td>L</td>
<td>A person in this role has at least a minor role to play in addressing this challenge. The competencies (particularly the knowledge elements) identified with the micro-roles of this challenge may prove useful background. (Working Group Ratings 1.0 – 2.0)</td>
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<tr>
<td>V</td>
<td>A person in this role may be able to perform successfully without addressing this challenge. A person in this role has little or no part to play in the addressing of this challenge. The competencies (particularly the knowledge elements) identified with the micro-roles of this challenge may prove to be useful preparation for someone seeking advancement. (Working Group Ratings 0.0 – 1.0)</td>
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Key: The RDHI Macro-Roles and Abbreviations

<table>
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<th>Macro-Roles</th>
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<tbody>
<tr>
<td>RES</td>
<td>HI Informatics Researcher</td>
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<tr>
<td>TCHR</td>
<td>HI Informatics Teacher</td>
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<tr>
<td>RDL</td>
<td>IT Leader (CIO, VPIIS) at Research + Development Organization</td>
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<tr>
<td>DES</td>
<td>System/Information Designer/ Architect</td>
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<tr>
<td>TL</td>
<td>Health Applications Development Team Leader</td>
</tr>
<tr>
<td>FHI</td>
<td>Future RDHI Health Informatics</td>
</tr>
<tr>
<td>CLRES</td>
<td>Clinical Research Informatician</td>
</tr>
<tr>
<td>EVLSCI</td>
<td>Evaluation Scientist</td>
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<tr>
<td>POL</td>
<td>High-Level Administrators or Policy Makers</td>
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<tr>
<td>LIB</td>
<td>Researcher Librarian</td>
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<tr>
<td>DEV</td>
<td>Programmer</td>
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## The Importance of the Challenges to Each RDHI Macro-Role

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SECTION B4 - RDHI Challenges, Micro-Roles, & Required Competencies

Research and Development, in order to address their professional challenges (CH: challenge or major job function), must perform specific micro-roles (MR: micro-role or job sub functions or tasks), and these in turn require specific skills (SK: skill), knowledge (KN: knowledge), and experience, collectively known as “competencies”. In the material below the skills and knowledge elements required to address each challenge, are listed with each micro-role that the professional must perform to address that challenge. Experience requirements are associated with challenges, and are shown in the table in section 5.

Skills: Thinking, procedural, methodological, or technical abilities required to successfully perform the specific micro-role. Includes: the techniques, methods, templates, frameworks, etc. Usually learned by doing.

Knowledge: Inter-related (elaborated) data, facts, meanings, concepts, and principles that provide the basis for understanding, comparisons, conclusions, decisions, advice, and the like. Usually learned by listening, reading, and discussion.

Experience: The “hands on” interaction with and addressing of challenges in case studies, in projects, or on-the-job in actual work settings (co-op, contract, or employment).

SPECIFICATION OF REQUIRED SKILLS & KNOWLEDGE FOR EACH MICRO-ROLE

1. CH: Identifying, Maintaining and Gaining Competence
   1.1. MR: Accessing Information (Books, Articles, E-Resources, Databases, Experts, Etc.)
      1.1.1. SK: Information Finding Skills/Literature Search Skills, Appraising the Quality and Relevance of Information
      1.1.2. KN: Knowing the Sources (including asking experts)
   1.2. MR: Learning What It Means To Be Competent Today
      1.2.1. SK: Information Finding Skills/Literature Search Skills
   1.3. MR: Attending Conferences, Seminars, Workshops, Etc.
      1.3.1. SK: Listening Skills
   1.4. MR: Maintaining Personal Information Resources.
      1.4.1. SK: Structured Information Organization and Storage, Use of Personal Information Management Tools
      1.4.2. KN: Principles of Knowledge Organization and Management, Nomenclatures of Organizations
   1.5. MR: Continual Self-Assessing
      1.5.1. SK: Use of Performance Feedback Method
      1.5.2. KN: Knowing What You Don’t Know (Awareness of Ignorance)
1.6. MR: Life-Long Learning and Maintaining Currency (Updating SKE)
   1.6.1. SK: Studying and Learning Skills, Information Finding Skills
   1.6.2. KN: Knowledge of the Current R+DHI Curriculum, Credentialing

2. CH: Development of Teaching and Learning Methods and Teaching
   2.1. MR: Defining Teaching and Learning Objectives:
       2.1.1. KN: Course-Specific Knowledge

2.2. MR: Curriculum Design
   2.2.1. SK: Curriculum Design Framework/Method
   2.2.2. KN: Knowledge of Previous Curriculum Development Work

2.3. MR: Course Design and Development
   2.3.1. SK: Course Design Framework/Method
   2.3.2. KN: Knowledge of Teaching and Learning Methods, Principles of Pedagogy and Educational Psychology, Course-Specific Knowledge

2.4. MR: Evaluation Methods Design and Student Evaluation
   2.4.1. SK: Student Evaluation Method(s), Evaluation Template
   2.4.2. KN: Principles of Student Evaluation (e.g. student performance)

2.5. MR: Student Education
   2.5.1. SK: Teaching Skills
   2.5.2. KN: Course-Specific Knowledge

2.6. MR: Student Guidance
   2.6.1. SK: Student Guidance and Mentoring Technique

2.7. MR: Development of New Modalities of Curriculum Delivery
   2.7.1. SK: Keeping Oneself Up-to-Date

3. CH: Supervising Students (Includes Research Assistants, Visitors, Postdocs, etc.)
   3.1. MR: Student Capabilities And Capacity Assessment
       3.1.1. SK: Capabilities Assessment Technique, Performance Appraisal

   3.2. MR: Student Guidance And Mentoring
       3.2.1. SK: Student Guidance and Mentoring Technique
       3.2.2. KN: Basic Ethics in Health Informatics (use of data sets, privacy)

   3.3. MR: Student Project (And Other) Assignment
       3.3.1. SK: Student Project Framework(s)

   3.4. MR: Student Project Management And Progress Evaluation
       3.4.1. SK: Project Management Skills, Progress Monitoring and Evaluation Technique
3.5. MR: Project Team Building And Management
   3.5.1. SK: Leadership Skills, Project Management Skills, Use of Project Management Tools
   3.5.2. KN: Principles of Project Management

3.6. MR: Student Evaluation
   3.6.1. SK: Student Evaluation Techniques

3.7. MR: Teaching How to Develop Presentations (Including Articles, Reports, etc.)
   3.7.1. SK: Presentation Skills, Teaching Skills

4. CH: Basic/Theoretical Research
4.1. MR: Identifying Viable Research Areas And Topics
   4.1.1. SK: Literature Search Techniques, Thinking Skills, Research Skills

4.2. MR: Formulating Questions/ Hypotheses
   4.2.1. SK: Thinking Skills (e.g., Use of Descriptive Analytical Techniques), Use of Data Mining Tools
   4.2.2. KN: Domain-specific Knowledge

4.3. MR: Determining Research Methods
   4.3.1. SK: Using Research Methodologies
   4.3.2. KN: Principles of Research Design and Methods (quantitative, qualitative, lab experimental, clinical trial, observational, etc.)

4.4. MR: Reviewing Existing Knowledge
   4.4.1. SK: Information Finding Techniques, Critical Review

4.5. MR: Designing Research Project
   4.5.1. SK: Research Methodologies, Using Meta-Analysis Tools
   4.5.2. KN: Principles of Research Methods, Meta-Analysis

4.6. MR: Performing Research And Documenting Results
   4.6.1. SK: Project Management Skills, Documentation Technique, Data Collection Techniques
   4.6.2. KN: Principles of Data Collection and Quality Control

4.7. MR: Maintaining the Researcher’s Curiosity
   4.7.1. SK: Broad Exposure to Diverse Situations in Health Care, Collaborating with Many to Learn What Does not Work and Why
   4.7.2. KN: Sources of Information

4.8. MR: Analyzing and Understanding Results
   4.8.1. SK: Statistical Methods, Context Analysis, Triangulation, Grounded Theory Methods, Tools and Methods for Qualitative and Quantitative Analysis
   4.8.2. KN: Principles of Quantitative and Qualitative Analysis, Domain-Specific Knowledge

4.9. MR: Generalization and External Validation
   4.9.1. SK: Inductive Reasoning, Statistical Methods
4.10. MR: Submitting To Peer Review
4.10.1. SK: Writing Skills, Presentation Skills

4.11. MR: Critical Thinking (Including Critiquing Research)
4.11.1. SK: Thinking Skills, Critical Review Framework

5. CH: Applied Research (Using Tools in Innovative Ways)
5.1. MR: Identifying and Selecting Appropriate Tools
5.1.1. SK: Collaboration in Multi- and Inter-Disciplinary Research
5.1.2. KN: Sources of Information about Existing Tools and Technology

5.2. MR: See Basic/Theoretical Research

5.3. MR: Post Implementation Evaluation of the Appropriateness of Tools Used to Develop System
5.3.1. SK: Recognizing the Need For Evidence
5.3.2. KN: Understanding the Nature of Evidence, Statistical Methods, Epistemology, Philosophy Of Science

5.4. MR: Impact Assessment
5.4.1. SK: Impact Assessment Template
5.4.2. KN: Principles of Quantitative and Qualitative Analysis, Principles of Benefits Realization, Specific Domain Knowledge, the Nature and Operation of the Health System

6. CH: Collaboration (With Researchers, Research Assistants etc.)
6.1. MR: Identifying And Building Collaborative Relationships
6.1.1. SK: Team Building Skills, Facilitation Skills, Leadership Skills, Interpersonal Skills, Project Management Skills
6.1.2. KN: Principles of Collaboration and Negotiation, Principles of Project Management

6.2. MR: Developing Collaboration Support Technologies
6.2.1. SK: Technology Usage Skills, System Development Methodology
6.2.2. KN: Knowledge of Collaboration Support Technologies

6.3. MR: Formulation of Business or Research Partnerships
6.3.1. SK: Leadership Skills, Facilitation Skills, Negotiation Skills, Agreement Framework, Interpersonal Skills, Business Planning Framework, Stakeholder Analysis
6.3.2. KN: Knowledge of the Mutual Interests, Principles of Partnership Formation

7. CH: System Development
7.1. MR: Needs Analysis
7.1.1. SK: Needs Analysis Method, Interviewing Technique, Listening Skills
7.2. MR: Requirements Definition
7.2.1. SK: Requirements Definition Framework/Method

7.3. MR: Options/Approaches Research
7.3.1. SK: Information Finding Skills

7.4. MR: Options/Approaches Analysis And Selection
7.4.1. SK: Options Analysis, Risk Analysis

7.5. MR: System/Methods/Concept Design And Specification
7.5.1. SK: Structured Design Technique

7.6. MR: Understanding User Needs and User Modeling
7.6.1. SK: User Modeling Method, Listening Skills

7.7. MR: System/Methods/Concept Prototyping
7.7.1. SK: Prototyping Method

7.8. MR: Coding/Documentation
7.8.1. SK: Programming Skills, Scripting Skills, Documentation Method

7.9. MR: Hardware Development (If Required)
7.9.1. SK: Hardware Development Skills
7.9.2. KN: Principles of Hardware Design and Implementation

7.10. MR: System/Methods/Concept Testing And Validation
7.10.1. SK: Testing Methods
7.10.2. KN: Principles of System Testing

7.11. MR: Addressing Regulatory Requirements
7.11.1. SK: Specific Regulatory Framework(s)
7.11.2. KN: Knowledge of Regulatory Requirements and Process

7.12. MR: User Testing And Acceptance
7.12.1. SK: Acceptance Testing Method

   For All Above Micro-Roles:

8. CH: System/Capability Review and Evaluation
8.1.1. SK: Reading Skills
8.1.2. KN: The Nature and Operation of the Health System, Department/Provider-Specific Work Processes
8.2. MR: Determining Appropriate Review Method(s) And Criteria
   8.2.1. SK: Thinking Skills

8.3. MR: Understanding System( ) Capabilities, Methods to be Used, Resources Required, Etc.
   8.3.1. SK: As Above
   8.3.2. KN: System-Specific Knowledge

8.4. MR: Identification Of Testing Scenario(s)
   8.4.1. SK: System Testing Techniques
   8.4.2. KN: Knowledge of Appropriate System Behavior, Principles of Environmental-User Testing

8.5. MR: Observation And Validation Of System/Capability Operation or Execution
   8.5.1. SK: See Above
   8.5.2. KN: See Above

   8.6.1. SK: Comparison Template,
   8.6.2. KN: Specific Review Criteria, Specific Knowledge of System Products, Principles of Qualitative and Quantitative Evaluation, Post-Implementation Evaluation Framework

8.7. MR: Assessment Of User (Customer) Acceptance And Satisfaction
   8.7.1. SK: Performance Assessment and Functionality Review Technique, Audit/Review Methodology
   8.7.2. KN: Principles of Human-Computer Interaction

8.8. MR: Formulation And Presentation Of Findings And Recommendations
   8.8.1. SK: Presentation Skills, Writing Skills

9. CH: Information Architecting
9.1. MR: Needs Analysis
   9.1.1. SK: Needs Analysis Methodology and Template

9.2. MR: Requirements Definition (Information Uses, Characteristics, Items, Sources, Items, Etc.)
   9.2.1. SK: Requirements Definition Methodology
   9.2.2. KN: Healthcare System Operations, Knowledge of Specific Area Being Affected

9.3. MR: Information Architecture Design And Definition
   9.3.1. SK: Information Architecting Tools/Framework, Knowledge Representation Methods
9.4. MR: Information Architecture Validation
  9.4.1. SK: Validation Template, See Above
  9.4.2. KN: Specific Domain Requirements, See above

9.5. MR: Systems Support Requirements Definition
  9.5.1. SK: Systems Support Framework
  9.5.2. KN: Principles of Systems Maintenance and Support

  9.6.1. SK: See Systems Development
  9.6.2. KN: See Systems Development

9.7. MR: Support Systems Testing And Validation
  9.7.1. SK: Systems Testing Method
  9.7.2. KN: Principles of System Testing

9.8. MR: Networking Architecture Design
  9.8.1. KN: Principles of Networking and Network Structure, Principles of Systems Architecture (e.g., client-server, distributed, three-layer)

9.9. MR: Standards and Nomenclature Development and Adoption
  9.9.1. SK: Searching Techniques, Comparison/Evaluation Template
  9.9.2. KN: Knowledge of Standards and Nomenclature Systems and Developers

10. CH: Justification Case Building (Quantitative and Qualitative)
  10.1. MR: Identification and Documentation of Costs
    10.1.1. SK: Business Case Analysis Method, IT Cost Analysis Method, Risk Analysis Method
    10.1.2. KN: Basic Finance and Economics, The costs and Ben. Of IT/IM Systems and their Supporting Infrastructure

  10.2. MR: Identification and Documentation of Benefits
    10.2.1. SK: Opportunity Analysis, Benefits Estimation Technique, Valuation Techniques
    10.2.2. KN: The Roles and Functions of Healthy System Professionals, The Roles, Capabilities, and Limitations of Health IT/IM Vendors, Products, an Infrastructure.

  10.3. MR: Development of Quantitative and Qualitative Net Benefits
    10.3.1. SK: Benefits Identification and Estimation Technique
    10.3.2. KN: As Above

  10.4. MR: Creation of a Decision-Maker-Compatible Proposal
    10.4.1. SK: Professional Writing skills, Communication Skills, Funding Proposal Framework
    10.4.2. KN: Health System Finance and Budgeting

  10.5. MR: Presentation of Case to Decision-Makers
    10.5.1. SK: Funding Proposal Framework, Presentation Skills
    10.5.2. KN: Knowledge of Specific Values and Decision Criteria
11. CH: Development of Standards for Professionals  
(Knowledge, Competence, Ethics, Certification, Cross-Border Issues)

11.1. MR: Identification of Any Existing Proposals for Model Standards
11.1.1. SK: Recognition Of Need For Standards
11.1.2. KN: Knowledge of Standards Setting Bodies and Developers/Collaborators with those Bodies.

11.2. MR: Identification of Objectives and Requirements for Professional Standards.
11.2.1. SK: Identification of Stakeholders, Standards Development Framework
11.2.2. KN: Knowledge of the Profession (e.g. health informatics teacher), *Knowledge of the Specific Professional Group, Knowledge of Professions Affected

11.3.1. SK: Standards Setting Process,
11.3.2. KN: knowledge of Existing Standards Setting Processes, *As Above

11.4. MR: Development of Interim Versions of Professional Standards.
11.4.1. SK: Versioning Technique, Stakeholder Participation Process, Team Leadership and Management
11.4.2. KN: Knowledge of Standards Development Processes, Principles of Group Management

11.5. MR: Consultation with Affected Professionals.
11.5.1. SK: Stakeholder Analysis, Interviewing Techniques, Negotiation Techniques
11.5.2. KN: The Nature and Operation of the Health System, The Roles and functions of Health Systems Professionals; Specific Corporate Cultures

11.6. MR: Seeking of the Approval of the Standards.
11.6.1. SK: Consultation Process, Consensus Mapping Technique, Negotiation Technique, Approval Template
11.6.2. KN: Knowledge of Standards Development Processes, Principles of Group Management

11.7. MR: Communicating the Standards.
11.7.1. SK: See MR: Communication
11.7.2. KN: Knowledge of Standards Development Processes, Principles of Group Management, See MR: Communication

12. CH: Development and Testing of Electronic Health Data Standards (Classification Code Development and Integration, Source and Language Development, Interoperability)

12.1. MR: Reviewing and Evaluating Existing Standards and Current Standardization Efforts
12.1.1. SK: Information Finding Skills, Critical Analysis
12.1.2. KN: Existing Standards, Standards Developing Processes, and Standards Developers
12.2. MR: Determination of the Needs for New Standards and the Long-Term Implications of New Standards
   12.2.1. SK: Needs Analysis Technique, Risk Analysis Technique
   12.2.2. KN: Benefits and Limitations of Standardization, Principles of Risk Management, Nature and Operation of the Health system

12.3. MR: Determining the Appropriateness of a New Standard
   12.3.1. SK: As Above
   12.3.2. KN: As Above, Knowledge of Specific Organization and Situation

12.4. MR: Definition of Requirements for New Standards and the Intended Effects
   12.4.1. SK: Information Finding Skills, Analysis of Requirements
   12.4.2. KN: As Above

12.5. MR: Identification of Essential Partners, Participants, Experts
   12.5.1. SK: Stakeholder Analysis, Information Finding Skills, See MR: Collaboration
   12.5.2. KN: Existing Standards Developers and Standards Development Efforts

12.6. MR: Iterative Prototyping of New Standards
   12.6.1. SK: Versioning Technique, Stakeholder Participation Process, Team Leadership and Management, Standards Development Template
   12.6.2. KN: Knowledge of Standards Development Processes, Principles of Group Management

12.7. MR: Consultation with Stakeholders
   12.7.1. SK: Stakeholder Analysis, Interviewing Technique, Negotiation Techniques
   12.7.2. KN: Uses of the Data (clinical care, research, health services administration and teaching) and the Quality of the Data, The Nature and Operation of the Health System, The Roles and functions of Health Systems Professionals; Specific Corporate Cultures

12.8. MR: Testing of New Standards
   12.8.1. SK: Standards Testing Framework
   12.8.2. KN: Methods to Link Activities and Results, Principles of System Testing

12.9. MR: Promulgation of New Standards
   12.9.2. KN: See MR: Communication

12.10. MR: Monitoring of Use of New Standards
   12.10.1. SK: Ethnographic Observation Skills, Monitoring Template
   12.10.2. KN: Principles of Qualitative and Quantitative Evaluation

12.11. MR: Evaluation of the Effectiveness of New Standards
   12.11.1. SK: Quantitative and Qualitative Evaluation Methods, Ethnographic Observation Skills, Impact Assessment Technique
   12.11.2. KN: Principles of Quantitative and Qualitative Evaluation
12.12.1. SK: Identifying Costs and Benefits, Identifying the Appropriate Evaluation Metric
12.12.2. KN: Principles of Quantitative and Qualitative Evaluation

12.13.1. SK: As Above
12.13.2. KN: As Above

13.1.1. SK: Leadership Skills, Information Finding Skills
13.1.2. KN: Knowledge of Potential Enactment Strategies and Successful Processes, Behavioral and Thinking Change Strategies, Principles of Strategic Planning

13.2. MR: Identification of Policy Development Objectives, Requirements and Intended Consequences
13.2.1. SK: Linking Activities to Their Consequences
13.2.2. KN: Knowledge of the Nature and Limitations of Policy Development, Knowledge of Previous Policy and results of various policies, Linking Activities and Results

13.3. MR: Identification of Policy Development Methodology
13.3.1. SK: Information Finding Skills, Policy Development Templates
13.3.2. KN: Existing Policy and Development Methodologies

13.4. MR: Research and Review of Previous/Similar Policy
13.4.1. SK: Information Finding Skills
13.4.2. KN: As Above

13.5. MR: Analysis of Previous/Similar Policy
13.5.1. SK: As Above, Analysis Method, Critical Thinking and Reading Skills
13.5.2. KN: As Above

13.6. MR: Identification and Involvement of Stakeholders
13.6.1. SK: Stakeholder Analysis, Identifying Those Responsible for Policy Development
13.6.2. KN: Knowledge of the People/Domains Affected by the Policy

13.7. MR: Iterative Development of Policy Versions
13.7.1. SK: Versioning Technique, Stakeholder Participation Process, Team Leadership and Management, Standards Development Template
13.7.2. KN: Knowledge of Policy Development Processes, Principles of Group Management

13.8. MR: Consultation with Stakeholders
13.8.1. SK: Stakeholder Analysis, Interviewing Technique, Negotiation Techniques
13.8.2. KN: Uses of the Policy, The Nature and Operation of the Health System, The Roles and functions of Health Systems Professionals; Specific Corporate Cultures
13.9. MR: Execution of Approval Process
   13.9.1. SK: Consultation Process, Consensus Mapping Technique, Negotiation Technique, Approval Template
   13.9.2. KN: Knowledge of Policy Development Processes, Principles of Group Management

13.10. MR: Communication and Promulgation of Policy
   13.10.1. SK: See MR: Communication
   13.10.2. KN: See MR: Communication

13.11. MR: Review of the Effectiveness of Policy
   13.11.1. SK: Quantitative and Qualitative Evaluation Methods, Ethnographic Observation Skills, Impact Assessment Technique
   13.11.2. KN: Principles of Quantitative and Qualitative Evaluation

14. CH: Understanding Health and the Health Sector
14.1. MR: Understanding Health
   14.1.1. KN: Understanding the Dimensions of Health (WHO)

14.2. MR: Understanding the Nature and Requirements of Health System Components and Professionals

14.3. MR: Recognizing the Complexity/Heterogeneous Nature of the Requirements
   14.3.1. KN: As Above

14.4. MR: Determination of the Doable (long-term/short-term) and Prioritization of the Actions
   14.4.1. SK: Prioritization Techniques
   14.4.2. KN: Knowledge of Prioritization Criteria, As Above

15. CH: Concept and Methodology Development
15.1. MR: Comprehending Concept/Methodology Purpose, Objectives, Etc.
   15.1.1. SK: Thinking Skills, Methodology Development Framework
   15.1.2. KN: Problem-Specific Knowledge, Process Consulting
15.2. MR: Identifying Existing Concepts, Method(s), and Identifying Gaps.
   15.2.1. SK: Information Finding Skills, Methodology Comparison/Evaluation Framework
   15.2.2. KN: Knowledge of Information Sources and Methodologists

15.3. MR: Determining Appropriate Review Methods and Criteria.
   15.3.1. SK: As Above, Critical Reading and Thinking Techniques
   15.3.2. KN: As Above

15.4. MR: Understanding Concept/Methods Expected Effects/Deliverables, the Development Approach to be Used, Resources Required, Etc.
   15.4.1. SK: As Above
   15.4.2. KN: As Above

15.5. MR: Developing the Concept/Method.
   15.5.1. SK: As Above
   15.5.2. KN: As Above

15.6. MR: Identification Of Testing Scenario(s).
   15.6.1. SK: As Above
   15.6.2. KN: As Above

15.7. MR: Observation And Validation Of Concept/Method Execution.
   15.7.1. SK: Ethnographic Observation Skills
   15.7.2. KN: Principles of Quantitative and Qualitative Evaluation

   15.8.1. SK: As Above
   15.8.2. KN: Principles of Quantitative and Qualitative Evaluation

   15.9.1. SK: User Acceptance and Satisfaction Assessment Techniques
   15.9.2. KN: Knowledge of Specific User Requirements and Issues

15.10. MR: Formulation And Presentation Of Results.
   15.10.1. SK: Professional Writing Skills, Presentation Skills

16. CH: Re-engineering and Designing of Work and Information Management Processes

16.1. MR: Identification Of Desired Re-Engineering Outcomes
   16.1.1. SK: Negotiation Technique

16.2. MR: Documentation Of Existing Work Processes
   16.2.1. SK: Process Mapping Technique, Interviewing Technique
16.3. MR: Restructuring Of Macro-Processes And Products
   16.3.1. SK: Process and Product Innovation Methods, Leadership Skills, Change Management Techniques
   16.3.2. KN: As Above,

16.4. MR: Process Streamlining
   16.4.1. SK: Process Improvement Methods (Value Chain, Rational, etc. Analysis
   16.4.2. KN: As Above

16.5. MR: Documentation Of Revised Work Processes
   16.5.1. SK: As Above
   16.5.2. KN: As Above

16.6. MR: Documentation Of Business Case For Improvements (Costs And Benefits)
   16.6.1. SK: Case Justification Framework, Cost and Ben. Id and Analysis Method
   16.6.2. KN: As Above

16.7. MR: Planning And Implementation Of New Work Processes
   16.7.1. SK: Work Process implementation Planning Technique
   16.7.2. KN: As Above.

16.8. MR: Training
   16.8.1. SK: Process Training Method
   16.8.2. KN: Principles of Education and Training

16.9. MR: Evaluation Of Achievement Of Desired Outcome
   16.9.1. SK: Quantitative and Qualitative Evaluation Methods

17. CH: Team and Project Leadership and Management

17.1. MR: Team Definition and Building
   17.1.1. SK: Staff Mobilization and Motivation Technique
   17.1.2. KN: Principles of Project Management

17.2. MR: Team Direction and Leadership
   17.2.1. SK: Leadership Skills
   17.2.2. KN: As Above

17.3. MR: Team Problem-Solving, and Conflict Management and Resolution
   17.3.1. SK: As Above
   17.3.2. KN: As above

17.4. MR: Team Agenda and Time Management
   17.4.1. SK: Gantt Chart Usage
   17.4.2. KN: As Above

17.5. MR: Progress Evaluation
   17.5.1. SK: Progress Tracking Technique
   17.5.2. KN: As above
17.6. MR: Project Management (Managing + Allocating Multiple Resources)
   17.6.1. SK: As Above
   17.6.2. KN: As Above

18. CH: Team/Committee Participation
18.1. MR: Role and Expectation Understanding
   18.1.1. SK: Negotiation Technique, Statement of Work Template
   18.1.2. KN: Principles of Team Structuring, Building, and Management, Principles of Project Management

18.2. MR: Participation (Including Effort and Effort Commitment)
   18.2.1. SK: Interpersonal Skills
   18.2.2. KN: As Above

18.3. MR: Identifying When Teams Are Necessary and When They Are Not
   18.3.1. KN: Principles of Team Structuring, Building, and Management, Principles of Project Management, Knowledge of Specific Challenge

18.4. MR: Team Process Development
   18.4.1. SK: Team Building Skills
   18.4.2. KN: As Above

18.5. MR: Team Facilitation
   18.5.1. SK: Team Facilitation Method, Project Management Framework
   18.5.2. KN: As Above

19. CH: Obtaining Funding
19.1. MR: Identification of Appropriate Funding Sources
   19.1.1. SK: Money Finding Skills
   19.1.2. KN: Knowledge of Specific Funding Agencies and Their Requirements

19.2. MR: Surveying New Funding Sources and Their Requirements
   19.2.1. SK: As Above, Information finding skills
   19.2.2. KN: As Above

19.3. MR: Research Content, Methods, Processes, Required Resources Definition
   19.3.1. SK: Research Design Skills, Proposal Framework
   19.3.2. KN: Principles of Research Design

19.4. MR: Team Specification and Construction
   19.4.1. SK: Leadership Skills, Staff Mobilization and Motivation Techniques, Management skills
   19.4.2. KN: As above
19.5. MR: Grant Proposal Writing (Possibly Develop Presentation)
   19.5.1. SK: Professional Writing Skills, Presentation Skills
   19.5.2. KN: As Above

19.6. MR: Obtaining of Internal Approvals
   19.6.1. SK: Navigating the Approval Process
   19.6.2. KN: Knowledge of the Approval Process

19.7. MR: Proposal Submission (Possibly With Presentation)
   19.7.1. SK: As Above
   19.7.2. KN: As Above

19.8. MR: Development of Justification Case and Business Operation
       (Internal + External Funding Generation)
   19.8.1. SK: Case Justification Framework, Management Skills
   19.8.2. KN: Principles of Finance and Budgeting

20. CH: Planning, Administration, and Management of IT/IM Resources

20.1. MR: Identification and Articulation of Requirements
   20.1.1. SK: Requirements Definition Skills, Service Level Agreement Framework
   20.1.2. KN: Principles of Technology Management

20.2. MR: Definition and Implementation of Management Framework
   20.2.1. SK: Management Planning and Management Skills, IT Management Framework
   20.2.2. KN: As Above

20.3. MR: Management Policy and Procedure Development and Implementation
   20.3.1. SK: Policy and Procedure Development Framework, Professional Writing Skills
   20.3.2. KN: Principles of Policy and Procedure Development

20.4. MR: IT/IM Acquisition and Implementation Planning
   20.4.1. SK: Procurement Technique, Implementation Planning Technique, Networking, Communication, Database Development
   20.4.2. KN: As above, Software to Develop Predictive Models, Data Mining, Trends Analysis

20.5. MR: Definition and Assignment of Roles and Accountabilities
   20.5.1. SK: Management Skills, IT Management Framework
   20.5.2. KN: Principles of Management, Principles of Technology Management

20.6. MR: Self-Assessment
   20.6.1. SK: Self-Assessment Techniques
   20.6.2. KN: Knowledge of Requirements of Specific Position/Role

20.7. MR: Program (Multi-Project) Management
   20.7.1. SK: Multi-Project Management Skills, Staff Scheduling And Schedule Management Skills
   20.7.2. KN: Principles of project Management

20.9. MR: Oversight of Systems and Information Management
20.9.1. SK: Oversight/Progress Measurement, Review and Reporting Techniques
20.9.2. KN: Principles of Technology Management

20.10. MR: Systems and Information Management
20.10.1. SK: Systems Management Framework, Information Management Framework
20.10.2. KN: Principles of System Management, Principles of Info Management

20.11. MR: Development, Promotion, and Management of Annual IT Budget (Capital + Operating)
20.11.1. SK: Budgeting Methodology, Presentation Skills, Professional Writing Skills, Persuasion/Lobbying Skills, Interpretation (Bridging) Skills, Communication Skills
20.11.2. KN: Basic Finance and Budgeting

20.12.2. KN: As Above

20.13. MR: Asset Management
20.13.1. SK: Asset Management Framework
20.13.2. KN: Principles of Technology Management

21. CH: Planning, Administration, and Managing an Academic/Development Department.
21.1. MR: Identification of Department Mission, Vision, Goals etc. in an Organizational Context
21.1.2. KN: Context, Principles of Strategic Planning

21.2. MR: Identification and Articulation of Requirements
21.2.1. SK: Requirements Definition, Tactical Planning
21.2.2. KN: Local, Provincial, National and International Context

21.3.1. SK: Framework for Policy and Procedure Development
21.3.2. KN: Principles of Management

21.4. MR: Equipment and Services Acquisition
21.4.1. SK: see Procurement AHI, Negotiating Skills
21.4.2. KN: Marketplace
21.5. MR: Definition and Assignment of Roles and Accountabilities
   21.5.1. KN: Principles of Management, Principles of Social Science and Behavioral Psychology

21.6. MR: Staff Recruitment
   21.6.1. SK: Recruitment Approach Framework, Interviewing Skills, Staff Capability Assessment

21.7. MR: Staff Development (Education and Training)
   21.7.1. SK: Performance Management, Staff Development Framework
   21.7.2. KN: Principles of Performance Management, Human Resources Regulation/Unionization, Requisite Competencies of the Staff Type

21.8. MR: Staff and Team Leadership and Management
   21.8.2. KN: Principles of Management

21.9. MR: Liaison and Accountability Outside the Department
   21.9.1. SK: Communication, Performance Evaluation, Networking, Progress Reporting (Production of an Annual Report)
   21.9.2. KN: As Above

21.10. MR: Staff Performance Evaluation
    21.10.1. SK: Performance Evaluation Framework (including clear objectives for staff)
    21.10.2. KN: Principles of Performance Management

21.11. MR: Self-Assessment

21.12. MR: Program (Multi-Project) Management
    21.12.2. KN: Principles of Project Management, Overall Vision

    21.13.2. KN: Knowledge of Existing Local and Other Policies


21.15. MR: Development, Promotion, and Management of Annual Budget (Capital + Operating)
    21.15.1. SK: Budgeting, Budgeting Template
    21.15.2. KN: Budgeting Plan, Types of Budgets

    21.16.1. SK: See above
    21.16.2. KN: See above
21.17. MR: Asset Management
   21.17.1. SK: Asset Management Framework
   21.17.2. KN: Depreciation Model, Risk Management Model

22. CH: Communication (Including Presentations, Marketing, Dissemination of Research and Research Findings)
22.1. MR: Presentations and Dissemination at Ext. Meetings, Conferences, and Seminars
   22.1.1. SK: Presentation Skills, Assessment of Audience
   22.1.2. KN: Knowledge of Presentation Subject, Communication Theory/Pedagogy (Andrology), Learning Theory,

22.2. MR: Presentations to Funders (External) and to Board of Directors (Internal)
   22.2.1. SK: Assessment of Need for Collaborators/Co-Presenters, Assessment of Audience, See above
   22.2.2. KN: Knowledge of Requirements, See above

22.3. MR: Website Development
   22.3.1. SK: Use of Web Site Building Tools, User-Interface Design, Assessment of Audience
   22.3.2. KN: Communication Theory/Pedagogy

23. CH: Article and Report Publication
23.1. MR: Determination of Appropriate Publication
   23.1.1. SK: Identifying a Target Publication
   23.1.2. KN: Journals, Publishers and Conferences

   23.2.1. SK: Writing Skills, Knowledge Management (Use of Programs to Support Technical Writing), Communication Skills
   23.2.2. KN: Appropriate Vocabulary, Format Publication Requirements, Knowledge of the Writing Style of the Appropriate Journal

23.3. MR: Obtaining Peer Review
   23.3.1. SK: Networking Skills, Communication Skills, See: System/Methods/Concept Review and Evaluation Challenge
   23.3.2. KN: Knowledge of Centers of Excellence, Individual Researchers

23.4. MR: Self-Assessment of Competencies
   23.4.1. SK: Objective Self-Assessment Skills, Ability to Evaluate the Influence of Your Work
   23.4.2. KN: RDHI Curriculum
SECTION B5 – RDHI Required Experience

The table below documents the RDHI Working Group’s recommendations regarding the type and minimum level of experience required to prepare a student for an entry-level position for each macro-role. Note that, wherever possible, students should have all other types/levels of experience up to the minimum level.

Key: Working Definitions of Experience Type:

<table>
<thead>
<tr>
<th>Experience Type</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-the-Job Experience in a Leadership Role</td>
<td>8-OJL</td>
</tr>
<tr>
<td>On-the-Job Experience in a Team Participant Role</td>
<td>7-OJP</td>
</tr>
<tr>
<td>Field Experience/Practicum Addressing the Challenge in a Leadership Role</td>
<td>6-FEL</td>
</tr>
<tr>
<td>Field Experience/Practicum Addressing the Challenge in a Team Participant Role</td>
<td>5-FEP</td>
</tr>
<tr>
<td>Program Thesis/Research Project</td>
<td>4-TRP</td>
</tr>
<tr>
<td>Course Project</td>
<td>3-CPR</td>
</tr>
<tr>
<td>Class Assignment</td>
<td>2-CAS</td>
</tr>
<tr>
<td>Group Discussion/Case Study Analysis</td>
<td>1-GDC</td>
</tr>
<tr>
<td>No Experience Required in Addressing the Challenge</td>
<td>0-NOE</td>
</tr>
</tbody>
</table>

Key: The RDHI Macro-Roles and Abbreviations

<table>
<thead>
<tr>
<th>Macro-Roles</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RES</td>
<td>HI Informatics Researcher</td>
</tr>
<tr>
<td>TCHR</td>
<td>HI Informatics Teacher</td>
</tr>
<tr>
<td>RDL</td>
<td>IT Leader (CIO, VPIS) at Research + Development Organization</td>
</tr>
<tr>
<td>DES</td>
<td>System/Information Designer/ Architect</td>
</tr>
<tr>
<td>TL</td>
<td>Health Applications Development Team Leader</td>
</tr>
<tr>
<td>CLRES</td>
<td>Clinical Research Informatician</td>
</tr>
<tr>
<td>EVLSCI</td>
<td>Evaluation Scientist</td>
</tr>
<tr>
<td>POL</td>
<td>High-Level Administrators or Policy Makers</td>
</tr>
<tr>
<td>LIB</td>
<td>Researcher Librarian</td>
</tr>
<tr>
<td>DEV</td>
<td>Programmer</td>
</tr>
</tbody>
</table>
## RDHI Experience Requirements by Macro-Role

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Experience Types and Levels Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying, Maintaining and Gaining Competence</td>
<td>RES 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP</td>
</tr>
<tr>
<td>Development of Teaching and Learning Methods and Teaching</td>
<td>TCHR 7-OJP 7-OJP 3-CPR 3-CPR 1-GDC 2-CAS 2-CAS 4-TRP 2-CAS 2-CAS 3-CPR 2-CAS</td>
</tr>
<tr>
<td>Supervising Students</td>
<td>RDL 5-FEP 7-OJP 3-CPR 1-GDC 2-CAS 2-CAS 5-FEP 2-CAS 2-CAS 3-CPR 2-CAS</td>
</tr>
<tr>
<td>Basic/Theoretical Research</td>
<td>DES 7-OJP 2-CAS 2-CAS 2-CAS 1-GDC 7-OJP 7-OJP 3-CPR 4-TRP 3-CPR 7-OJP 2-CAS</td>
</tr>
<tr>
<td>Applied Research</td>
<td>TL 7-OJP 3-CPR 3-CPR 2-CAS 1-GDC 7-OJP 7-OJP 7-OJP 5-FEP 4-TRP 7-OJP 2-CAS</td>
</tr>
<tr>
<td>Collaboration</td>
<td>CRES 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 2-CAS 3-CPR 5-FEP 5-FEP</td>
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<tr>
<td>System Development</td>
<td>EVSC 4-TRP 2-CAS 7-OJP 5-FEP 5-FEP 3-CPR 2-CAS 2-CAS 2-CAS 5-FEP 5-FEP 5-FEP</td>
</tr>
<tr>
<td>System/Capability Review and Evaluation</td>
<td>POL 4-TRP 2-CAS 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 2-CAS 3-CPR 5-FEP</td>
</tr>
<tr>
<td>Information Architecting</td>
<td>LIB 5-FEP 1-GDC 5-FEP 5-FEP 3-CPR 5-FEP 4-TRP 2-CAS 5-FEP 5-FEP 5-FEP 5-FEP</td>
</tr>
<tr>
<td>Justification Case Building (Quantitative and Qualitative)</td>
<td>DEV 5-FEP 2-CAS 5-FEP 3-CPR 5-FEP 5-FEP 5-FEP 2-CAS 3-CPR 5-FEP</td>
</tr>
<tr>
<td>Development of Standards for Professionals</td>
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<tr>
<td>Development and Testing of Electronic Health Data Standards</td>
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<tr>
<td>Policy Research + Development</td>
<td>3-CPR 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP 5-FEP</td>
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<tr>
<td>Understanding Health and the Health Sector</td>
<td>1-GDC 2-CAS 3-CPR 1-GDC 1-GDC 2-CAS 2-CAS 7-OJP 1-GDC 2-CAS 2-CAS</td>
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<td>Concept and Methodology Development</td>
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<tr>
<td>Re-engineering and Designing of Work and Information Management Processes</td>
<td>7-OJP 3-CPR 4-TRP 5-FEP 3-CPR 7-OJP 7-OJP 7-OJP 4-TRP 5-FEP</td>
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<td>Team and Project Leadership and Management</td>
<td>2-CAS 2-CAS 4-TRP 5-FEP 5-FEP 5-FEP 5-FEP 1-GDC 3-CPR 4-TRP</td>
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<td>Team/ Committee Participation</td>
<td>5-FEP 5-FEP 7-OJP 2-CAS 7-OJP 5-FEP 5-FEP 5-FEP 2-CAS 5-FEP 5-FEP 5-FEP 5-FEP</td>
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<td>Obtaining Funding</td>
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<tr>
<td>Planning, Administration, and Management of IT/IM Resources</td>
<td>5-FEP 5-FEP 5-FEP 2-CAS 4-TRP 5-FEP 5-FEP 4-TRP 4-TRP 4-TRP 4-TRP 4-TRP</td>
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<tr>
<td>Planning, Administration, and Managing an Academic/Development Dept.</td>
<td>2-CAS 1-GDC 7-OJP 1-GDC 7-OJP 3-CPR 1-GDC 7-OJP 5-FEP 3-CPR 3-CPR 3-CPR</td>
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</tr>
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<td>Article and Report Publication</td>
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<td>5-FEP 4-TRP 5-FEP 3-CPR 3-CPR 5-FEP 4-TRP 4-TRP 3-CPR 3-CPR 3-CPR</td>
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SECTION B6 - RDHI Competencies & Curriculum

Contents

Once the required individual competencies were identified, the RDHI Working Group organized the required skill and knowledge elements into natural competency categories. These categories roughly correspond to courses, parts of courses, or possibly groups of related courses that would be offered in an RDHI Education Program.

RDHI COMPETENCY CATEGORIES

1. Personal Competencies for RDHI Professionals, Including Identifying, Maintaining, and Gaining Competence
2. Teaching and Supervision Competencies
3. Research and Concept/Methodology Development Competencies
4. System Development Competencies
5. Justification Case Building (Quantitative + Qualitative) and Evaluation
6. Standards Development Competencies (including Professional, Data Standards)
7. Policy Research and Development
8. Re-engineering and Designing of Work and IM Processes (Including Change Management)
9. Group Work Competencies: Collaboration and Team/Project Leadership, Management, and Participation
10. Technology Evaluation and Management Competencies
11. General Planning, Administration, and Management Competencies
12. Communication, Presentation, and Publication Competencies
13. General Computing Competencies for RDHI Professionals
14. Health Computing Competencies for RDHI Professionals
15. Key IT Usage Competencies for RDHI Professionals
16. General Health System-Related Competencies
17. Project Management Competencies
18. Information and Data Collection, Architecting, Analysis, and Management Competencies

RDHI COMPETENCY CATEGORIES WITH DETAILED COMPETENCIES

The following listing shows the detailed competencies (identified above with the micro-role associated with a challenge) that have been subsumed under the RDHI competency categories. We have called them “Competency Categories”. We note that they are likely to be taught together in a major section of a course, a full course, or distributed over more that one course with (a) course title(s) roughly corresponding to the Competency Category name.

1. Personal Competencies for RDHI Professionals, Including Building, Maintaining and Gaining Competence
   1.1. Skills
      1.1.1. Assessment Techniques, Self-Evaluating the Influence of Your Work
      1.1.2. Information Finding Skills/Literature Search Skills and Techniques
      1.1.3. Interpersonal Skills
      1.1.4. Interpretation (Bridging) Skills
      1.1.5. Interviewing Skills and Technique
      1.1.6. Listening Skills
      1.1.7. Multi-Tasking Skills
      1.1.8. Observation Skills
      1.1.9. Personal Networking Skills
1.1.10. Personal Information Management Tools, Use of
1.1.11. Persuasion/Lobbying Skills
1.1.12. Maintenance of Currency (Keeping Oneself Up-to-Date)
1.1.13. Maintenance of the Researcher’s Curiosity
1.1.14. Negotiating Skills and Techniques
1.1.15. Reading Skills
1.1.16. Self-Assessment, Objective
1.1.17. Studying and Learning Skills
1.1.18. Technology Usage Skills
1.1.19. Thinking Skills, (e.g., Use of Descriptive Analytical Techniques)

1.2. Knowledge
1.2.1. Ignorance, Awareness of Own
1.2.2. Profession (e.g. health informatics teacher), Knowledge of the Specific

2. Teaching and Supervision Competencies
2.1. Skills
2.1.1. Education and Training Skills
2.1.2. Course Design Framework/Method
2.1.3. Curriculum Design Framework/Method
2.1.4. Learning Objectives Framework
2.1.5. Mentoring Skills
2.1.6. Student Evaluation Method(s) and Template
2.1.7. Student Guidance and Mentoring Technique
2.1.8. Student Project Framework(s)
2.1.9. Teaching Skills

2.2. Knowledge
2.2.1. Credentialing, Knowledge of
2.2.2. Course-Specific Knowledge
2.2.3. Curriculum Development Work, Knowledge of Previous
2.2.4. Education and Training, Principles of
2.2.5. Learning Theory
2.2.6. Pedagogy
2.2.7. Student Capabilities, Knowledge of
2.2.8. Student Evaluation, Principles of
2.2.9. Student, Knowledge of Specific
2.2.10. Teaching and Learning Methods, Media, and Modalities, Knowledge of
2.2.11. Pedagogy and Educational Psychology, Principles of
2.2.12. R+DHI Curriculum, Knowledge of the Current

3. Research and Concept/Methodology Development Competencies
3.1. Skills
3.1.1. Appraising the Quality and Relevance of Information
3.1.2. Context Analysis
3.1.3. Critical Review and Analysis Methods and Framework
3.1.4. Data Mining Tools, Use of
3.1.5. Grounded Theory Methods
3.1.6. Inductive Reasoning
3.1.7. Meta-Analysis Tools, Using
3.1.8. Proposal Framework

3.1.9. Research Design and Execution Skills
3.1.10. Research Methods and Techniques
3.1.11. Statistical Methods and Techniques (Including Use of software)
3.1.12. Triangulation
3.2. Knowledge
3.2.1. Centers of Excellence and Individual Researchers, Knowledge of
3.2.2. Data Mining, Principles of
3.2.3. Funding Agencies and Their Requirements, Knowledge of Specific
3.2.4. Meta-Analysis and Biostatistics, Principles of
3.2.5. Quantitative and Qualitative Analysis, Principles of
3.2.6. Research Design and Methods, Principles of
3.2.7. Research-Support Systems, Knowledge of
3.2.8. Researchers’ Approaches and Tools, Knowledge of Other
3.2.9. Sources (Including Asking Experts), Knowledge of

4. System Development Competencies
4.1. Skills
4.1.1. Acceptance Testing Method
4.1.2. Database Development
4.1.3. Documentation Method
4.1.4. Hardware Development Skills
4.1.5. Implementation Planning Technique
4.1.6. Needs Analysis Skills and Methodology
4.1.7. Prototyping Method
4.1.8. Requirements Definition and Analysis Framework/Method and Skills
4.1.9. Requirements Identification and Analysis
4.1.10. Programming Skills
4.1.11. Scripting Skills, Use of
4.1.12. Structured Design Technique
4.1.13. System Development Methodology
4.1.15. System Testing Techniques/Methods
4.1.16. Systems Support Framework
4.1.17. Testing Methods
4.1.18. Usage Assessment Techniques
4.1.19. User Interface Design
4.1.20. User Modeling Method
4.1.21. Versioning Method

4.2. Knowledge
4.2.1. Application Domain, Knowledge of
4.2.2. Approaches to System Design, Knowledge of Different
4.2.3. Data Modeling, Principles of
4.2.4. Domain Knowledge, Specific
4.2.5. Software Engineering, Principles of
4.2.6. Systems Analysis and Design, Principles of
4.2.7. Systems Architecture (e.g., Client-Server, Distributed), Principles of
4.2.8. Testing, Principles of Environmental-User
4.2.9. Tools, Knowledge of Available
4.2.10. User Expectations, Knowledge of

5. Justification Case Building (Quantitative + Qualitative) and Evaluation
5.1. Skills
5.1.1. Benefits Identification and Estimation Technique, IT/IM
5.1.2. Business Case Analysis Method
5.1.3. Cost Identification and Analysis Method, IT/IM
5.1.4. Case Justification Framework
5.1.5. Depreciation Model
5.1.6. Evaluation Method
5.1.7. Evaluation Metric Identification
5.1.8. Effects/Impacts Measurement Technique
5.1.9. Ethnographic Observation Skills
5.1.10. Impact/Effects/Outcomes Assessment Framework
5.1.11. Quantitative and Qualitative Evaluation Methods
5.1.12. Qualitative and Quantitative Analysis, Use of Tools and Methods for
5.1.13. Valuation Techniques

5.2. Knowledge
5.2.1. Costs and Benefits of IT/IM Systems and their Supporting Infrastructure, The
5.2.2. Qualitative and Quantitative Evaluation, Principles of

6. Standards Development Competencies (including Professional, Data Standards)

6.1. Skills
6.1.1. Impact of New Standards, Identification and Measurement of the
6.1.2. Standards Consultation Process
6.1.3. Standards Development Framework
6.1.4. Standards Development Framework
6.1.5. Standards Identification, Evaluation, and Adoption Framework
6.1.6. Standards Setting Process/Framework/Method
6.1.7. Standards Testing Framework
6.1.8. Consultation Process/Method

6.2. Knowledge
6.2.1. Impacts of Standards, Knowledge of Potential Positive and Negative
6.2.2. Standards Developers and Standards Development Efforts, Knowledge of Existing
6.2.3. Standardization, Knowledge of the Benefits and Limitations of
6.2.4. Standards Setting Processes, knowledge of Existing
6.2.5. Standards, Knowledge of Existing

7. Policy Research and Development

7.1. Skills
7.1.1. Consultation Process/Method
7.1.2. Identification of Stakeholders
7.1.3. Identification of Those Responsible for Policy Development
7.1.4. Policy Analysis Framework
7.1.5. Policy and Procedure Development Framework
7.1.6. Policy and Procedure Development Framework and Process
7.1.7. Policy Review Framework/Process

7.2. Knowledge
7.2.1. Legislation and Regulation, Knowledge of Existing and Pending
7.2.2. Nature and Limitations of Policy Development, Knowledge of the
7.2.3. People/Domains Affected by Policy, Knowledge of the
7.2.4. Policy and Development Methodologies and Development Activities, Knowledge of
Existing
7.2.5. Policy and Procedure Development, Principles of
7.2.6. Policy Consultation Methods, Knowledge of Existing
7.2.7. Policy Impacts, Knowledge of
7.2.8. Policy, Knowledge of Previous

8. Re-engineering and Designing of Work and IM Processes (Including Change Management)

8.1. Skills
8.1.1. Change Management Techniques
8.1.2. Process and Product Improvement Methods (Value Chain, Rational, etc.) Analysis
8.1.3. Process Mapping Technique
8.1.4. Process Training Method
8.1.5. Work Process Implementation Planning Technique
8.1.6. Working Environment/Aligning Your Vision, Creating an Optimal

8.2. Knowledge
8.2.1. Context and Situation, Knowledge of Specific 
8.2.2. CQI/TQM, Principles of 
8.2.3. Healthcare System Operations, and the Specific Area Being Affected 
8.2.4. Impacts of Systems on Operations and Work 
8.2.5. Operations, Knowledge of Department/Area-Specific 
8.2.6. Process and Product Re-Engineering (Innovation), Principles of 
8.2.7. Technology and Process Options, Knowledge of 
8.2.8. Work Processes, Knowledge of Department/Provider-Specific 

9. Group Work Competencies: Collaboration and Team/Project Leadership, Management, and Participation 
9.1. Skills 
  9.1.1. Assessment of Need for Collaborators/Co-Presenters 
  9.1.2. Collaboration in Multi- and Inter-Disciplinary Research 
  9.1.3. Collaboration Technologies, Use of 
  9.1.4. Co-ordination Skills 
  9.1.5. Consensus Development Techniques 
  9.1.6. Facilitation Skills 
  9.1.7. Group Process Management Techniques 
  9.1.8. Leadership Skills 
  9.1.9. Team Building Skills 
  9.1.10. Team Structuring Framework 
9.2. Knowledge 
  9.2.1. Collaboration and Partnership Formation, Principles of 
  9.2.2. Collaboration Support Technologies, Knowledge of 
  9.2.3. Group Process Management 
  9.2.4. Partnership Formation, Principles of 

10. Technology Evaluation and Management Competencies 
10.1. Skills 
  10.1.1. Audit/Review Methodology 
  10.1.2. Asset Management Framework 
  10.1.3. Comparison Matrix/Technique 
  10.1.4. Management Framework for IT 
  10.1.5. Potential Misuse & Security Issues, Ability to Identify 
  10.1.6. Systems Management Framework 
  10.1.7. Technology Evaluation Framework and Method 
10.2. Knowledge 
  10.2.1. Marketplace (Vendors, Products), Knowledge of 
  10.2.2. System Behavior, Knowledge of Appropriate 
  10.2.3. System Maintenance and Support, Principles of 
  10.2.4. System Management, Principles of 
  10.2.5. Technology Evaluation, Principles of 
  10.2.6. Technology Management, Principles of 
  10.2.7. Trends Analysis 
  10.2.8. User Acceptance, Principles of 

11. General Planning, Administration, and Management Competencies 
11.1. Skills 
  11.1.1. Agreement Framework 
  11.1.2. Capabilities Assessment Technique 
  11.1.3. Requisite Business Planning Framework 
  11.1.4. Budgeting Skills, Budgeting Methodology, and Budgeting Template 
  11.1.5. Financial Management Framework 
  11.1.6. Funding Proposal Framework 
  11.1.7. Leadership Skills
11.1.8. Management Planning and Management Skills
11.1.9. Money Finding Skills
11.1.10. Options Identification, Analysis, and Selection Technique
11.1.11. Negotiating Skills and Techniques
11.1.12. Performance Assessment and Functionality Review Technique
11.1.13. Performance Evaluation Framework
11.1.14. Prioritization Techniques
11.1.15. Prioritization/Triage Method
11.1.16. Procurement Technique (See “Procurement” in AHI Curriculum)
11.1.17. Program Management Software, Use
11.1.18. Recruitment Approach Framework
11.1.19. Review and Reporting Techniques
11.1.20. Risk Analysis Method
11.1.21. Service Level Agreement Framework
11.1.22. Staff Capability Assessment
11.1.23. Staff Development Framework
11.1.24. Staff Management Skills
11.1.25. Staff Mobilization and Motivation Techniques
11.1.26. Staff Performance Evaluation Method
11.1.27. Staff Performance Feedback Method, Use of
11.1.28. Staff Scheduling And Schedule Management Skills
11.1.29. Stakeholder Identification and Analysis Technique

11.2. Knowledge
11.2.1. Budgets and Budgeting Plan, Types of
11.2.2. Competencies of Staff by Type, Knowledge of
11.2.3. Human Resources Regulation/Unionization
11.2.4. HR Availability Market and How to Find Staff, Knowledge of
11.2.5. HR Management, Principles of
11.2.6. Management, Principles of
11.2.7. Mutual Interests, Knowledge of the
11.2.8. Negotiation, Principles of
11.2.9. Opportunity Analysis
11.2.10. Organization, Knowledge of the Specific
11.2.11. Performance Appraisal and Management, Principles of
11.2.12. Planning, Principles of
11.2.13. Position/Role, Knowledge of Requirements of Specific
11.2.14. Strategic Planning, Principles of
11.2.15. Tactical Planning
11.2.16. Risk Management, Principles of
11.2.17. Visioning

12. Communication, Presentation, and Publication Competencies

12.1. Skills
12.1.1. Assessment of Audience
12.1.2. Communication Framework/Process
12.1.3. Communication Skills
12.1.4. Professional Writing Skills
12.1.5. Presentation Skills, Including Assessment of Audience
12.1.6. Professional Writing Skills
12.1.7. Web Site Building Tools, Use of

12.2. Knowledge
12.2.1. Communication Media/Methods, Knowledge of
12.2.2. Journals, Publishers, and Conferences, Knowledge of
12.2.3. Media (PR Function), Knowledge of
12.2.4. Peer Expectations, Knowledge of
12.2.5. Presentation Subject, Knowledge of
12.2.6. Publication Format Requirements and Vocabulary, Knowledge of Appropriate 
12.2.7. Target Publication Identification 
12.2.8. Writing Style of the Appropriate Journal. Knowledge of the 

13. General Computing Competencies for RDHI Professionals 
13.1. Skills 
13.1.1. Network Design Framework 
13.1.2. Programing Skills 
13.2. Knowledge 
13.2.1. Computer Science, Principles of 
13.2.2. General Systems Theory 
13.2.3. Hardware Design and Implementation, Principles of 
13.2.4. Human-Computer Interaction, Principles of 
13.2.5. Human Factors 
13.2.6. Networking and Network Structure, Principles of 
13.2.7. Software Engineering 

14. Health Computing Competencies for RDHI Professionals 
14.1. Knowledge 
14.1.1. Health System and Stakeholder Interests, Knowledge of Broader 
14.1.2. Health, Knowledge of the Dimensions and of National and International 
Definitions of 
14.1.3. Roles, Capabilities, and Limitations of Health IT/IM Vendors and Infrastructural 
14.1.4. Social Issues in Health Informatics (Use of Data Sets, Privacy, Ethics), Basic 

15. Key IT Usage Competencies for RDHI Professionals 
15.1. Skills 
15.1.1. Database or Other Appropriate Technologies, Use of 
15.2. Knowledge 
15.2.1. Database Development 
15.2.2. System-Specific Knowledge 

16. General Health System-Related Competencies 
16.1. Knowledge 
16.1.1. Decision-Making Processes and Methods in Health 
16.1.2. Health Finance and Budgeting Principles of 
16.1.3. Health System and Stakeholder Interests, Knowledge of Broader 
16.1.4. Health, Knowledge of the Dimensions and of National and International 
Definitions of 
16.1.5. Legislation and Regulation, Knowledge of Existing and Pending 
16.1.7. Organization, Structure, and Management of the Health System, The 
16.1.8. Roles, Functions, and Responsibilities of Health System Professionals, The 

17. Project Management Competencies 
17.1. Skills 
17.1.1. Concurrent Sharing (Sharing Similar Resources Between Projects) 
17.1.2. Gantt Chart Usage 
17.1.3. Project Management and Monitoring Skills and Techniques 
17.1.4. Project Management Skills, Multi- 
17.1.5. Project Management Tools, Use of 
17.1.6. Progress Reporting (e.g., Production of an Annual Report) 
17.1.7. Progress Tracking Technique 
17.1.8. Oversight/Progress Measurement 
17.1.9. Synergy Finding Among Projects 
17.2. Knowledge
17.2.1. Project Management, Principles of

18. Information and Data Collection, Architecting, Analysis, and Management Competencies

18.1. Skills

18.1.1. Data Collection Techniques
18.1.2. Information Architecting Tools/Framework
18.1.3. Information Management Framework
18.1.4. Knowledge Discovery and Management Techniques
18.1.5. Knowledge Representation Methods
18.1.6. Structured Information Organization and Storage Techniques

18.2. Knowledge

18.2.1. Data Collection and Data Quality Control, Principles of
18.2.2. Data Standards, Knowledge of
18.2.3. Health Information Management, Principles of
18.2.4. Information Management Systems, Knowledge of Existing
18.2.5. Knowledge Discovery, Representation, Organization, and Management, Principles of
18.2.6. Nature, Structure, and Uses of Health Information, The
18.2.7. Nomenclatures of Organizations
18.2.8. Nomenclatures/Vocabularies/Ontologies, Knowledge of Existing
18.2.9. Organization and Structure of Health Information, The
18.2.10. Systems Infrastructure (IM side, not functionality)
18.2.11. Purposes, Uses, and the Quality of the Data, Knowledge of the [Emphasize]

DETAILED COMPUTING AND HEALTH SYSTEM COMPETENCIES FOR RDHI FROM THE AHI CURRICULUM

1. General Computing Competencies for AHI Professionals

1.1. Skills

1.1.1. Information Finding Skills and Techniques
1.1.2. Personal IT Productivity Tools Proficiency
1.1.3. Research Skills and Techniques, General
1.1.4. See “Key IT Usage Competencies”

1.2. Knowledge

1.2.1. Applications, Knowledge of Specific
1.2.2. Artificial Intelligence in Health Systems, Principles of
1.2.3. Communications Systems, Multimedia, WANs, LANs, VPNs, CHINs, and Other Health Information Networks, Principles of
1.2.4. Encryption, Decryption, and Compression, Principles of
1.2.5. Virtual Conferencing and Collaboration
1.2.6. Internet-Based Systems, and the Nature and Operation of the Internet and WWW
1.2.7. Interactive Systems: Interfaces for Providers, Provider Workstation, Interactive Technologies; User-Adaptive Systems
1.2.8. Human Factors (Ergonomics) in Health Information Systems
1.2.9. Data Mining, Principles of
1.2.10. Data Modeling, Database Management, and File Management, Principles of
1.2.11. Data Warehousing, Principles of
1.2.12. Database and File Management
1.2.13. Hardware Components and Capabilities, Knowledge of
1.2.14. IT and IM, Basic Concepts of
1.2.15. Non-Health Organizations’ Approaches to Addressing IT/IM, Knowledge of
1.2.16. Operating Systems and Languages (Non-Derived)
1.2.17. Personal Productivity Applications and Their Capabilities, Knowledge of
1.2.18. Search Engines, Principles and Use of
1.2.19. Software Packages or Tools That Support the Skill, Technique, or Method, Knowledge of Specific
1.2.20. Standards and Standard Development Activities, Knowledge of
1.2.21. Systems and Modules, Knowledge of Specific
1.2.22. Systems Architectures: Distributed Systems, Client-Server Systems, 3-Layer Architectures, Systems Integration
1.2.23. Technologies, Knowledge of Specific

2. Health Computing Competencies for AHI Professionals

2.1. Knowledge
2.1.1. Enterprise-Level Systems (CDR, CPR, ADW, Health Portals, Health Data Mining, etc.), Nature and Capabilities of
2.1.2. Previous Approaches/Work in Health Systems, Knowledge of
2.1.3. Roles, Capabilities, and Limitations of Health IT/IM Vendors, Products, and Infrastructural Technologies, The
2.1.4. Health Information Systems: Hospital, Clinical, Ambulatory, Office, Community, etc.
2.1.5. Departmental Information Systems: ADT, LIS, RIS, Pharmacy, Nutrition, Health Records, etc.
2.1.6. Image Management and Access Systems; Image Processing and Reconstruction; PACS
2.1.7. Health Administration Support Systems: Financial Information Systems; HRIS; ERP Systems
2.1.8. Management and Executive Information Systems in Health
2.1.9. Computer-Based Patient Records
2.1.10. Patient Interviewing
2.1.11. Health Status Evaluation, and Other Direct Patient-Used Systems
2.1.12. Clinical Trial Management Systems
2.1.13. Experiment Management Systems
2.1.14. Telehealth, Telemedicine

3. Key IT Usage Competencies for AHI Professionals

3.1. Skills
3.1.1. Data Mining System, Use of Specific
3.1.2. DBMS, Use of Specific
3.1.3. SQL Query Skills
3.1.4. Query Package, Use of Specific
3.1.5. Middleware Tools, Use of Specific
3.1.6. Presentation Graphics Package, Use of Specific
3.1.7. Product-Specific Tools Skills
3.1.8. Query Tools, Use of Specific
3.1.9. Search Engines, Use of
3.1.10. Security Tools, Use of Specific
3.1.11. System Tools, Use of Specific
3.1.12. Statistical Analysis Techniques, Basic Skills
3.1.13. Statistical Package, Use of Specific
3.1.14. System Monitoring Tools, Use of Specific
3.1.15. Maintenance Tools, Use of System-Specific

3.2. Knowledge
3.2.1. Inter/Intranet Data Query Applications, Knowledge of
3.2.2. Software Packages or Tools That Support the Skill, Technique, or Method, Knowledge of Specific
3.2.3. Statistics, Basic
4. General Health System-Related Competencies

4.1. Knowledge

4.1.1. Strategic View of the Health System: Health System Mission, Goals, Objectives, Strategies, Tactics, Cultures, and Values
4.1.3. Organization and Management of the Health System, The
4.1.4. Decision-Making Principles and Processes in the Health system
4.1.5. Roles, Responsibilities, and Accountabilities of Health Systems Professionals, The
4.1.7. Health-Related Regulation, Legislation, Policy, and Custom
4.1.8. Funding and Governance of the Health System: Federal, Provincial, Regional, and Institutional, The
4.1.9. Health System, Finance and Budgeting
4.1.10. Health System and Stakeholder Interests, Knowledge of

RDHI – UNCATEGORIZED COMPETENCIES

Skills
Regulatory Framework(s), Specific

Knowledge
Affected Professions, Knowledge of
Approaches and Their Outcomes, Preferences, etc., Knowledge of Previous
Communication Theory
Context, Local, Provincial, National and International
Link Activities and Results, Methods to
Predictive Models Software, Knowledge of
Regulatory Requirements and Process, Knowledge of
Values and Decision Criteria, Knowledge of Specific
SECTION B7 – RDHI Graduate Course Design

GUIDELINES FOR THE SELECTION OF CONTENT FOR A GRADUATE PROGRAM IN HEALTH INFORMATICS

The Research and Development Health Informatics (RDHI) Curriculum Development Working Group has developed guidelines that provide the basis for constructing graduate-level courses.

In advancing these guidelines, we recognize that different schools will design graduate programs that are influenced by the interests of their faculty, that are intended to address the needs of the health sector as they perceive them, and that embody specific principles that they value. However, we believe that all such programs should deliver the kind and level of educational experience that has come to be expected in graduate school. These guidelines are an expression of what distinguishes graduate from pre-graduate education.

General Principles

The following are the principles that we believe should shape the guidelines:

1. An undergraduate program imparts those skills, knowledge elements, and experiences that are essential for basic competence in a field.
   1.1. The Applied Health Informatics (AHI) curriculum defines these basic competencies.
   1.2. An undergraduate program emphasizes breadth.
   1.3. Certification programs generally assess undergraduate competencies, e.g., Electrical Engineering, Geology, and Civil Engineering.

2. A graduate program supports the development of advanced competencies, such as acquiring a specialty, becoming a teacher, or engaging in research and development.
   2.1. Examples of specialties in HI include: Clinical Decision Support, Natural Language Understanding in Health, or Health Data Mining.
   2.2. A graduate program emphasizes depth.

3. A graduate program targets the integration of the knowledge learned in an undergraduate program, and often addresses the integration of this knowledge with knowledge from other disciplines.
   3.1. In an undergraduate program the student populates his/her “knowledge base”; in a graduate program the student exercises and inter-relates the knowledge elements, as well as deepening his/her understanding.

4. The deepening of understanding is an essential characteristic of a graduate program.
   4.1. The acquisition of knowledge should go to the limits of the known.
   4.2. The deepening of understanding is accomplished by:
       4.2.1. The detailed defining and disambiguation of concepts.
       4.2.2. Exploring the implications of concepts.
       4.2.3. Discovering conflicts (e.g., logical) among concepts.
       4.2.4. Uncovering inconsistencies among concepts.
4.2.5. Determining the limits of knowledge and its applicability.
4.2.6. Looking at facts and concepts in new ways.
4.2.7. Recognizing redundancies.

5. Core courses taught in a graduate program should directly support independent research.

6. A limited amount of material that can be considered undergraduate level, but that is not taught or addressed adequately at an undergraduate level, can be included in a graduate program.

7. It is possible that some schools will elect to offer a “professional masters” (also called a “terminal masters”) program in addition to or instead of an “academic masters” program. Both types of programs should be geared to stimulating independent thinking, but the latter should stimulate independent research/development.

7.1. A Professional Masters will typically: be more practically oriented, be based on a courses-only or courses-with-practical-project education experience, not offer graduate mentorship, and be focused on the production of specialists.

7.2. An Academic Masters will typically: be more theory oriented, require fewer courses, include a research thesis/project requirement, provide mentorship/apprenticeship via a supervising professor, and focus on the production of researchers and teachers, especially those who will continue on to a Ph.D.

8. A graduate program should exercise students regarding and prepare students to be persuasive.

8.1. To argue and discuss.
8.2. To interact intellectually.
8.3. To actively participate.
8.4. To be more critical.
8.5. To be more challenging (ask relevant, penetrating questions).
8.6. To be open to and unthreatened by being challenged.

9. A significant component of a graduate program involves independent learning by the student, through reading, reviewing, critiquing, analyzing, participating in and leading discussions about, teaching about, and forming conclusions regarding the literature that reports others’ work.

10. A graduate program will, of necessity be shaped by and imaged through the interests of its faculty.

11. A graduate program should produce graduates that are perceived as capable valuable by key stakeholders, and that are enabled to pursue their own career goals.

GUIDELINES FOR THE DEFINITION OF A HEALTH INFORMATICS GRADUATE PROGRAM
We advance the following guidelines for the development of a graduate program in HI, based on the principles articulated above:

1. **Determine the type of program desired, e.g., Professional Masters versus Academic Masters, and whether or not it will include a Ph.D.**
   
   1.1. This will be determined by the needs of the market as perceived by the school, the educational philosophy/orientation of the school, and the interests and capabilities of potential faculty.

2. **Design the program so as to encourage independent work and to develop independent thinking in its students.**
   
   2.1. Foster discussion and debate, intellectual interaction
   
   2.2. In the case of an Academic Masters, require a research project/thesis carried out under the guidance and mentorship of a supervising professor.
   
   2.3. In the case of the Professional Masters, require a project that reviews some aspect of the field in depth and that takes the student to a point of deep expertise in his/her selected area.

3. **Define the type and content of graduate courses based on the following rules:**
   
   3.1. Focus on competencies not included in well-established undergraduate programs; expect these as pre-requisites.
   
   3.1.1. Eliminate or assign to self-study content that is of undergraduate level.
   
   3.1.2. For students judged capable, but who have not participated in an undergraduate program, address their needs for background via pre-requisite survey courses, co-requisites, or self-study with examine-out options.
   
   3.2. Address all material in depth, defining and disambiguating of concepts, exploring the implications of concepts, pointing out conflicts among concepts, uncovering inconsistencies among concepts, recognizing redundancies, delineating the limits of knowledge and of its applicability, guiding students to look at concepts in new ways.
   
   3.3. Stimulate and emphasize the integration of knowledge that may have been learned as an undergraduate and/or that is taught in the graduate program.
   
   3.3.1. Provoke students and engage them in exercises that help them inter-relate the knowledge elements, as well as deepening their understanding.
   
   3.3.2. If appropriate, meld key knowledge from other disciplines into the program to stimulate inter-disciplinary thinking and to bring in different perspectives (e.g., social systems theory applied to the introduction of new technologies into health environments.
   
   3.4. Incorporate a variety of experience elements, including the above mentioned project/thesis, individual and group case studies, discussion groups, literature review groups, presentations, and focused student teaching assignments.

4. **While maintaining basic content excellence, shape your program based on the interests and capabilities of your faculty.**

   4.1. If essential faculty capabilities are lacking, import expertise via adjunct appointments, or recruit the faculty needed to underpin the desired program.
4.1.1. Select faculty with an excellent teaching and supervision track record.
4.1.2. Require faculty to conform their teaching to the program syllabus.
4.1.3. For an Academic Masters program, develop a faculty with HI-related research credibility, strong research interests, peer-reviewed publications, and a successful funding history.

5. Establish working relationships with health facilities that will provide the access to health environments, health data, providers, and potential collaborators needed for the furthering of learning and research.

6. Consider the creation of a Program Advisory Body that comprises key stakeholders and that provides continuing critical review, “sanity check”, relevancy, peer-review, and other quality assurance functions to the program.

OTHER CONSIDERATIONS FOR DETERMINING GRADUATE VS UNDERGRADUATE CONTENT

➤ General Heuristics

• Graduate-level content is any material content not taught in a stable (say 25+ year) undergraduate program.
• Graduate-level content is content that is not essential for general competence in the field, but that is essential for undertaking graduate research thesis or research project.
• Graduate-level content requires the full background and integration of the content of the undergraduate program for its comprehension and application.
• Graduate-level content requires the integration of advanced knowledge from other disciplines with typical undergraduate material before it can be understood and applied.
• Graduate content requires the presentation and discussion of provocative, contentious and conflicting views

➤ Other Heuristics

Following LaPidus (1989):

• Graduate work is generally focused, whereas undergraduate work is concerned with breadth;
• Graduate work is scholarly (that is, involved with the critical analysis of theories, policies, or practice in the area studied), whereas undergraduate work is involved with learning about the range of theories/ideas/practices and methods related to the broad area being studied,
• Graduate work is advanced, that is it builds on a known and defined body of existing knowledge that has been imparted and learned in some codified manner at the undergraduate level.

Thus, those graduate programs that are not focused frequently flounder through lack of depth and resources; if they are not scholarly they soon become hollow artifacts ignorant of recent knowledge and future trends; and if they are not advanced they invariably replicate work that is, or should be, provided at the undergraduate level.

Other Considerations and Criteria (applicable to graduate programs)
• Residency (may be completed virtually in the future)
• Generally, a graduate program requires a Project/thesis Work
• Experiential Component
The CHI Working Group extended its sessions to consider, from the perspective of a clinician, the challenges that may be faced by an RDHI professional, particularly one qualified in a clinical discipline. This work defined a number of challenges that were not addressed by the RDHI Working Group, that were allocated to the level of a micro-role, or that were dealt with somewhat differently.

Because of the additional value they deliver, we have included them as a separate section in this version. We may integrate them with the other RDHI in a future version. Please note that they are not at this time incorporated into the RDHI Competency Categories.

### ADDITIONAL OR ENHANCED CHALLENGES FROM CHI WORKING GROUP

1. Improving and Maintaining Quality
2. Database Definition and Setup
3. Development of, and Participation in, CQI-Type Program
4. General Practice Management (Management Level)
5. Research (Clinician Perspective)
6. Clinical Teaching (Students)
7. Clinical Program Development/Modification
8. Technology Assessment (Drugs, Devices, Health Interventions, Support Systems)
9. Protection of Personal Health Information
ADDITIONAL OR ENHANCED CHALLENGES FROM CHI WORKING GROUP
WITH IDENTIFICATION OF MICRO-ROLES

1. Improving and Maintaining Quality
   1.1. Participating in QA Program
   1.2. Establishing and Maintaining QA Standards
   1.3. Data Management for QA (Understanding Data Quality, Analyzing Data, Interpreting Data)
   1.4. Developing a QA Program
   1.5. Staff Performance Appraisal
   1.6. Practice Evaluation
   1.7. Adverse Event Monitoring, Documentation, and Reporting

2. Database Definition and Set-Up
   2.1. Defining Requirements
   2.2. Designing Database, Views, and Reports
   2.3. Implementing Database
   2.4. Testing Database System
   2.5. Evaluating the Quality and Usefulness of Databases

3. Development of, and Participation in, CQI-Type Program
   3.1. Defining or Developing a CQI, UM, or Like Program
   3.2. Participating in a UM, CQI, or Like Program
   3.3. Evaluating the Effectiveness of a UM, CQI, or Like Program
   3.4. Project Management of a UM, CQI, or Like Program

4. General Practice Management (Management Level)
   4.1. Identification and Articulation of Requirements
   4.2. Maintaining Adequate Records
   4.3. Maintaining Regulatory Documentation and Licenses
   4.4. Scheduling Patients
   4.5. Completing Requested Documentation (e.g., legal, WCB)
   4.7. Equipment and Services Acquisition (If Applies)
   4.8. Definition and Assignment of Roles and Accountabilities
   4.9. Practice Leadership/Team Building (Including IT/IM Change Management)
   4.10. Scheduling and Schedule Management (Including Analyze and Evaluate)
   4.11. Evaluating the Quality of the Practice (Management, Business, Patient Care)
   4.12. Technology Assessment/Evaluation
   4.13. Staff Recruitment
   4.14. Staff Development (Education and Training)
   4.15. Staff and Team Leadership and Management
   4.16. Staff Performance Evaluation
   4.17. Self-Assessment
   4.18. Departmental Resources Management Policy and Procedure Development and Implementation
   4.19. Oversight of Department Function
   4.21. Financial Management
   4.22. Asset Management
   4.23. Billing and Collection (If Applies)
5. Research
  5.1. Identifying Viable Research Areas And Topics
  5.2. Formulating Questions/ Hypotheses
  5.3. Identifying Collaborators and Partners
  5.4. Information Finding (Finding Literature, Databases, Websites, etc.)
  5.5. Determining Research Methods
  5.6. Reviewing Existing Knowledge
  5.7. Critical Thinking (Appraisal, Critiquing Research)
  5.8. Designing Research Project
  5.9. Using Supportive and Collaborative Technologies
  5.10. Performing Research And Documenting Results
  5.11. Analyzing and Evaluating Results
  5.12. Analyzing and Evaluating Technologies
  5.13. Validating Conclusions
  5.14. Presenting Results
  5.15. Documenting Results
  5.16. Submitting To Peer Review
  5.17. Dissemination of Results

6. Clinical Teaching (Students)
  6.1. Access to Information
  6.2. Course/Session Design
  6.3. Teaching Preparation and Material Production
  6.4. On-Line Teaching
  6.5. Student Evaluation
  6.6. Teaching the Utilization of Technology
  6.7. Teacher Evaluation
  6.8. Utilization of Technology in Teaching

7. Clinical Program Development/Modification
  7.1. Definition of Goals and Objectives
  7.2. Evaluation and Selection of Alternatives
  7.3. Definition of Program Structure, Functions, Roles, Requirements
  7.4. Development of Plan and Budget
  7.5. Implementation of Program

8. Technology Assessment (Drugs, Devices, Health Interventions, support systems)
  8.1. All Research Micro-Roles/Macro-Tasks Apply
  8.2. Identification of Desired Outcomes
  8.3. Options Identification, Characterization, Analysis, and Selection
  8.4. Critical Thinking/Appraisal
  8.5. Assessment of Cost-Effectiveness

9. Protection of Health Information
  9.1. Identification of Confidentiality Requirements and Standards
  9.2. Determination of Regulatory Requirements
  9.3. Assessment of Threats
  9.4. Determination of Security Roles and Responsibilities
  9.5. Determination of Security Policies, Procedures, and Methods
  9.6. Implementation of Security Policy, Procedures, and Methods
  9.7. Monitoring of Security Procedures and Systems
  9.8. Reporting and Correction of Violations
ADDITIONAL OR ENHANCED CHALLENGES, MICRO-ROLES, SKILLS & KNOWLEDGE

1. CH: Improving and Maintaining Quality
   1.1. MR: Participating in QA Program
   1.2. MR: Establishing and Maintaining QA Standards
      1.2.1. SK: Information Finding Skills; QA Standards Definition Template/Framework
      1.2.2. KN: Knowledge of Existing QA Standards
   1.3. MR: Data Management for QA (Understanding Data Quality, Analyzing Data, Interpreting Data)
      1.3.1. SK: Data Analysis Skills, Biostatistics; Use of Applications Packages
      1.3.2. KN: Principles of Data Collection, Processing, and Management
   1.4. MR: Developing a QA Program
      1.4.1. SK: Planning Skills, Management Skills
      1.4.2. KN: Knowledge of Approaches to QA, Knowledge of Existing QA Programs
   1.5. MR: Staff Performance Appraisal
      1.5.1. SK: Staff Performance Assessment Framework, Interpersonal Skills, Management Skills
      1.5.2. KN: Principles of HR Management
   1.6. MR: Practice Evaluation
      1.6.1. SK: Practice Evaluation Framework, Management Skills
      1.6.2. KN: Principles of Qualitative and Quantitative Evaluation
   1.7. MR: Adverse Event Monitoring, Documentation, and Reporting
      1.7.1. SK: Event Monitoring Techniques; Use of Event Monitoring Applications Package, Professional Writing Skills
      1.7.2. KN: Specific Domain Knowledge (Knowledge of Event Types and Consequences)

2. CH: Database Definition and Set-Up and Use
   2.1. MR: Defining Requirements
      2.1.1. SK: Needs Analysis, User Scenarios, Requirements Analysis
      2.1.2. KN: Principles of Systems Analysis, Ethical Issues (e.g. confidentiality), Local, Provincial and Federal Policy
   2.2. MR: Designing Database, Views, and Reports
      2.2.1. SK: Database Design, Report Design Skills
      2.2.2. KN: Database System, Query System and Report Writer
   2.3. MR: Implementing Database
      2.3.1. SK: Use of Database Tools
2.4. MR: Testing Database System  
   2.4.1. SK: Testing Technique  
   2.4.2. KN: Principles of Systems Testing  

2.5. MR: Evaluating the Quality and Usefulness of Databases  
   2.5.1. SK: TQM/CQI Framework  
   2.5.2. KN: Principles of Quantitative and Qualitative Evaluation, Principles of TQM/CQI  

2.6. MR: Use of the Database System  
   2.6.1. SK: Data Entry Skills, Database Quality Management  
   2.6.2. KN: Ethical, Confidentiality and Security Issues  

3. CH: Development of and Participation in CQI-Type Program (e.g., CQI, Chart Audit, Peer Review, Resource Allocation, Utilization Management)  
   3.1. MR: Defining or Developing a UM, or CQI, or like Program  
      3.1.1. SK: Programming Skills, Utilization Management  
      3.1.2. KN: Specific Software Resources and Where to Obtain Them, Utilization Management--appropriate classifications, minimal data sets/RUG, ICNP, RUGS, Workload Resources, Hospital Accreditation System CCHSA  

   3.2. MR: Participating in a UM, or CQI, or like Program  
      3.2.1. SK: Software Manipulation and Report Writing  
      3.2.2. KN: As Above, Content of the Healthcare Practices and Standardized Data Collection, Ethics  

   3.3. MR: Evaluating the Effectiveness of a UM, or CQI, or like Programs  
      3.3.1. SK: Selecting Appropriate Model, Data Collection and Analysis, Use of Specific Statistical Software (SPSS/SAS)  
      3.3.2. KN: Evaluation Models, Research Study Design, Ethics of Evaluation and Dissemination  

   3.4. MR: Project Management of a UM, or CQI, or like  
      3.4.1. SK: Communication Skills (of purpose, results), Ability to Obtain Buy-In of People Being Evaluated, Technology Skills, Keeping on Target, Working with Teams, Facilitation  
      3.4.2. KN: Principles of Management, Facilitation Techniques, Team Building Techniques  

4. CH: General Practice Management (Management Level)  
   4.1. MR: Identification and Articulation of Requirements  
      4.1.1. SK: Evaluation Skills for Vendors and Various Products  
      4.1.2. KN: What Current Technologies are Available, Vendors  

   4.2. MR: Maintaining Adequate Records  
      4.2.1. SK: Determining Content of Electronic vs. Paper Record, Transfer of Information from Paper to Electronic Format, Use of Voice and Other Data Input Technologies  
      4.2.2. KN: Requirements of Regulating Bodies, Confidentiality, Privacy and Security Issues, Change Management Process, Unique Provider Numbers/Electronic Signature
4.3. MR: Maintaining Regulatory Documentation and Licenses.
   4.3.1. SK: Internet Skills
   4.3.2. KN: Regulatory Bodies--Nursing and Physician Jurisdictions, OHSA and Other Legislation i.e. Duty to Accommodate, Electronic Resources of the Regulatory Bodies

4.4. MR: Scheduling Patients.
   4.4.1. SK: See Use of Specific Software, Use of Other Technology

4.5. MR: Completing Requested Documentation (e.g., Legal, WCB)
   4.5.1. SK: Specific Forms and Other Software, Database Query and Report Generating
   4.5.2. KN: Legal Requirements, Confidentiality, Privacy and Security Issues (CPS)

4.6. MR: Management Policy and Procedure Development and Implementation
   4.6.1. SK: Developing Policies and Procedures, Finding P & P on-line, Creation of Internet Documentation (add to other places also)
   4.6.2. KN: HTML

4.7. MR: Equipment and Services Acquisition (If Applies)
   4.7.1. SK: How Vendors Can Understand What We Need in Practice, How to Write and Analyze RFPs
   4.7.2. KN: Procurement Processes and Policies,

4.8. MR: Definition and Assignment of Roles and Accountabilities
   4.8.1. SK: Ability to Identify People with the Core Competencies
   4.8.2. KN: Understanding Job Descriptions, Union Issues

4.9. MR: Practice Leadership/Team Building (Incl. IT/IM Change Management)
   4.9.1. SK: Facilitation, Communication, Change Agent, Interpersonal Skills, Organizational Skills with Emphasis on Problem Identification and Information Management,
   4.9.2. KN: Principles in Adult Education, Human Communication Dynamics

4.10. MR: Scheduling and Schedule Management (Incl. Analyze and Evaluate)
   4.10.1. SK: See Scheduling and Schedule Management
   4.10.2. KN: See Scheduling and Schedule Management

4.11. MR: Evaluating the Quality of the Practice (Management, Business, Patient Care)
   4.11.1. SK: See Process and Product Re-Engineering and Management, and Improving and Maintaining Quality
   4.11.2. KN: See Process and Product Re-Engineering and Management, and Improving and Maintaining Quality
4.12. MR: Technology Assessment/Evaluation
4.12.1. SK: See Technology Assessment
4.12.2. KN: See Technology Assessment

4.13. MR: Staff Recruitment (Discipline Specific)
4.13.1. SK: Interviewing Techniques
4.13.2. KN: Recruitment Process, Union Issues, Job Descriptions, Recruitment Model

4.14. MR: Staff Development (Education and Training)

4.15. MR: Staff and Team Leadership and Management
4.15.1. SK: Assessment Skills, Assertiveness, Decision-Making Ability, Motivational Skills, Technically Competent, Delegation, see above
4.15.2. KN: Various Leadership Models

4.16. MR: Staff Performance Evaluation
4.16.1. SK: Ability to Give and Receive Constructive Feedback, Using an Unbiased Tool/Process, Objectivity,
4.16.2. KN: A Variety of Methodologies to Collect Information

4.17. MR: Self-Assessment
4.17.1. SK: Objectivity and see above, Ability to Identify Strengths and Weaknesses, Resources

4.18. MR: Departmental Resources Management Policy and Procedure Development and Implementation
4.18.1. SK: Writing Policies and Procedures, Patience, Facilitation, Ability to Define Policies and Procedures that are Realistic and Implementable, Liaison with Other Decision-Making Bodies, Effective Dissemination of Information
4.18.2. KN: Current Taxonomy Definitions, Good Management Practices, Union Issues

4.19. MR: Oversight of Department Function
4.19.2. KN: Department Goals, Objectives, Performance Indicators, Management Software

4.20. MR: Development, “Selling”, and Management of Annual Budget (Capital, Operating)
4.20.1. SK: Negotiation Skills, Presentation Skills, Persistence, Appropriate Software (presentation and financial), Financial Skill and Budget Management
4.20.2. KN: Appropriate Software (presentation and financial), How Budget is Calculated and What Information is in it, Funding Formulas
   4.21.2. KN: Appropriate Software, Reporting Guidelines internally, provincially and nationally

4.22. MR: (Capital) Asset Management
   4.22.1. SK: Identifying Needs for Capital Assets, Identifying Inventory, Technology Assessment

4.23. MR: Billing and Collection (Discipline Specific)
   4.23.1. SK: Software Evaluation Skills, Interpersonal Skills, Software Meets the Needs of Billing and Reporting Requirements and is Accurate
   4.23.2. KN: Specific Knowledge of Billing Software, Billing and Collection Techniques, Strategies to Maximize Revenue Legitimately, Software Meets the Needs of Billing and Reporting Requirements and is Accurate, Policy and Billing Procedures, Knowledge of Billable Items

5. CH: Research (Clinician Perspective)
   5.1. MR: Identifying Viable Research Areas And Topics
      5.1.1. SK: Literature Search Techniques, Curiosity, Thinking Skills, Research Skills

   5.2. MR: Formulating Questions/ Hypotheses
      5.2.1. SK: Thinking Skills (e.g., Use of Descriptive Analytical Techniques), Use of Data Mining Tools
      5.2.2. KN: Domain-specific Knowledge

   5.3. MR: Identifying Collaborators and Partners
      5.3.1. SK: Communication Skills, Personal Networking Skills, Requirements analysis
      5.3.2. KN: Knowledge of Capable Individuals

   5.4. MR: Information Finding (Finding Literature, Databases, Websites etc.)
      5.4.1. SK: Using Research Methodologies
      5.4.2. KN: Principles of Research Design and Methods (quantitative, qualitative, lab experimental, clinical trial, observational, etc.)

   5.5. MR: Determining Research Methods
      5.5.1. SK: Using Research Methodologies
      5.5.2. KN: Principles of Research Design and Methods (quantitative, qualitative, lab experimental, clinical trial, observational, etc.)

   5.6. MR: Reviewing Existing Knowledge
      5.6.1. SK: Information Finding Techniques, Critical Review

   5.7. MR: Critical Thinking (Appraisal, Critiquing Research))
      5.7.1. SK: Thinking Skills, Critical Review Framework
      5.7.2. KN: Principles of Critical Appraisal
5.8. MR: Designing Research Project
5.8.1. SK: Research Methodologies, Using Meta-Analysis Tools, Meta-Analysis Techniques
5.8.2. KN: Principles of Research Methods, Bio-Statistics, Meta-Analysis

5.9. MR: Using Supportive and Collaborative Technologies
5.9.1. SK: Use of Systems Tools, Use of Collaboration Support Systems

5.10. MR: Performing Research And Documenting Results
5.10.1. SK: Project Management Skills, Documentation Technique, Data Collection Techniques
5.10.2. KN: Principles of Data Collection and Quality Control

5.11. MR: Analyzing and Evaluating Results
5.11.1. SK: Statistical Methods, Context Analysis, Triangulation, Grounded Theory Methods, Tools and Methods for Qualitative and Quantitative Analysis, Use of Statistics Package
5.11.2. KN: Principles of Quantitative and Qualitative Analysis, Domain-Specific Knowledge

5.12. MR: Analyzing and Evaluating Technologies
5.12.1. SK: Requirements Identification and Analysis, Options Analysis and selection
5.12.2. KN: Principles of Technology Evaluation

5.13. MR: Validating Conclusions
5.13.1. SK: Use of Statistics Package, Critical Thinking Skills

5.14. MR: Presenting Results
5.14.1. SK: Presentation Skills, Professional Writing Skills, Communication skills

5.15. MR: Documenting Results
5.15.1. SK: Professional Writing Skills

5.16. MR: Submitting To Peer Review
5.16.1. SK: Writing Skills, Presentation Skills
5.16.2. KN: Knowledge of Peer Reviewers and Requirements

5.17. MR: Dissemination of Results
5.17.1. SK: Professional Writing Skills, Use of Dissemination Technologies
5.17.2. KN: Knowledge of Dissemination Media and Techniques

6. CH: Clinical Teaching (Students)

6.1. MR: Access to Information
6.1.1. SK: Information Finding Skills, Use of Search Engines
6.1.2. KN: Principles of Information Retrieval

6.2. MR: Course/Session Design
6.2.1. SK: Course Design Framework/Method
6.2.2. KN: Knowledge of Teaching and Learning Methods, Principles of Andrology and Educational Psychology, Course-Specific Knowledge, Principles of Adult Education
6.3. MR: Teaching Preparation and Material Production

6.4. MR: On-Line Teaching
   6.4.1. SK: Keeping Oneself Up-to-Date, Continuous Professional Development, Determining the Audience
   6.4.2. KN: Principles of Multi-Media Education

6.5. MR: Student Evaluation
   6.5.1. SK: Student Evaluation Method(s), Evaluation Template
   6.5.2. KN: Principles of Student Evaluation (e.g. student performance)

6.6. MR: Teacher Evaluation
   6.6.1. SK: Teacher Evaluation Method(s), Peer Evaluation, Evaluation Template, Anonymity
   6.6.2. KN: Principles of Teacher Evaluation (e.g. Teacher Performance)

6.7. MR: Teaching the Utilization of Technology
   6.7.1. SK: Hands-On Teaching Skills, Familiarity with Pertinent Technology
   6.7.2. KN: Principles of User/Technology Training

6.8. MR: Utilization of Technology in Teaching
   6.8.1. SK: Authoring Skills, Presentation Skills, Use of Authoring Language
   6.8.2. KN: Principles of Computer-Based Instruction

7. CH: Clinical Program Development/Modification

7.1. MR: Setting of Goals and Objectives of IT/IM in This Program
   7.1.1. SK: Needs and requirements Analysis, General Planning Skills, Info Finding Skills
   7.1.2. KN: Focus on Basic/Intro/Overview Knowledge of Potential Technologies, Knowledge of Specific Content Area, Potential Benefits, Principles of Planning

7.2. MR: Evaluation of IT/IM Alternatives and Selection in Support of the Program
   7.2.1. SK: Options Analysis, Procurement Technique
   7.2.2. KN: Knowledge of Industry Capabilities, Principles of Technology Assessment

7.3. MR: Definition of System Architecture and Workflow

7.4. MR: Development of Plan and Budget
   7.4.1. SK: Budgeting Method/Template
   7.4.2. KN: Basic Budgeting and Finance

7.5. MR: Implementation of Program
   7.5.1. SK: (See Implementation)
   7.5.2. KN: Knowledge and Implementation of Appropriate Technology runs across many areas

7.6. MR: Identification of IT/IM Requirements
   7.6.1. SK: Requirements Identification and Analysis Method
7.7. MR: Assessment of Vendor and Product Viability
   7.7.1. SK: Vendor Comparison or Product Comparison Framework, Effective RFP Writing, Vendor Viability Assessment Framework
   7.7.2. KN: Knowledge of Product/Vendor State-of-the-Art

8. CH: Technology Assessment (Drugs, Devices, Health Interventions, Support Systems)
   8.1. MR: All Research Micro-Roles/Macro-Tasks Apply

   8.2. MR: Identification of Desired Outcomes
      8.2.1. SK: Listening Skills, Needs Analysis Method
      8.2.2. KN: The Nature and Op. of the Health System, Principles of Tech. Assessment, Knowledge of Specific Technologies, Knowledge of Specific Requirements

   8.3. MR: Identification of Technology-Sophisticated Collaborators to Assist with Assessment
      8.3.1. SK: Information Finding Skills; Personal Networking Skills

   8.4. MR: Options Identification, Characterization, Analysis, and Selection
      8.4.1. SK: Options Analysis Method; Critical Thinking/Appraisal
      8.4.2. KN: As Above; Assessment of Interoperability; Assessment of Vendor and Product Viability

   8.5. MR: Evaluation of the Quantitative and Qualitative Impacts (Cost Effect, Cost Ben) Systems
      8.5.1. KN: Principles of Quantitative + Qualitative Evaluation

9. CH: Protection of Personal Health Information
   9.1. MR: Identification of Confidentiality Requirements and Standards
      9.1.1. SK: Forecasting, Assertiveness, Patient/Client Empathy, Risk Analysis, Information Finding, Use of Search Engines
      9.1.2. KN: The Role and Functions of Staff Responsibility For Collection, Use, & Disclosure of Personal Health Information (PHI), Provincial Health Information Networks, Knowledge of Standards and Standards Development Activities, Principles of Privacy and Confidentiality of PHI, Nature and Operation of the Health System

   9.2. MR: Determination of Regulatory Requirements
      9.2.1. SK: Use of Search Engines, Networking
      9.2.2. KN: Awareness of National/Provincial Legislation (Act and Regulations) Pertaining to the Protection of PHI, Regional and Regulatory Body Policy and Procedure, Patient/client Consent to Collect, Use, and Disclose PHI
9.3. MR: Assessment of Threats


9.4. MR: Determination of Security Roles and Responsibilities

9.4.1. SK: Organizational Planning Skills, Group Management Techniques, Professional Writing Skills, Process Mapping Techniques

9.4.2. KN: Nature and Operation of the Health System, the Roles and Functions of Health System Professionals, Understanding “Need to Know” Basis for the Collection/Use/Disclosure of PHI

9.5. MR: Determination of Security Policies, Procedures and Methods

9.5.1. SK: Needs Analysis, Professional Writing Skills, Project Management, Communication Skills

9.5.2. KN: IT/IM Product Knowledge, Principles of Technology Management (Firewalls, Encryption, PKI), Unique Person Identifiers, Principles of Privacy and System Security, Information Management Service Provider Legal Agreements/contracts


9.6.2. KN: Organizational Behavior, Change Management, National/provincial/regional and Regulatory Body Policy and Procedure

9.7. MR: Monitoring of Security Procedures and Systems

9.7.1. SK: Compliance Analysis Techniques, Audit Trail, Management Skills, Accountability/reward Methods, Leadership, Staff Motivation Techniques

9.7.2. KN: Management Principles, Principles of Quantitative and Qualitative Assessment, Evaluation and Monitoring Methods, Agreements and Protocols, Accountability

9.8. MR: Reporting and Correction of Violations

9.8.1. SK: Forms and Templates Creation, Auditing, Assertiveness, Fact Finding, Objectivity, Interpersonal Skills, Reporting Methods Skills, Interviewing Techniques

9.8.2. KN: Ethics and Ethical Conduct of Health Professionals, Provincial/national Legislation for Reporting Violations (Office of the PHI Privacy Commissioner), Breach of Confidentiality, Internal Vs External Violations of Confidentiality
Section C

CLINICIAN HEALTH INFORMATICS

(CHI)
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AUTHORSHIP

THE CHI WORKING GROUP:

This work represents the thinking and advice of numerous collaborators and could not have been accomplished without their participation. The people come from diverse professional and geographic areas and represent a broad range of thinking. It is important to place the names at the beginning of this document to indicate the context for readers and also to provide guidance to those who would like to contact someone from their own geographic area for further information.

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Information is the currency of healthcare. Clinicians capture, process, and store information about particular patients, and search for information to facilitate care. Clinical research is an effort to link healthcare activities with the results they produce. Consequently, it is essential that practicing clinicians be familiar and proficient with existing information tools so they can be used to develop individual patient records, search for answers to patient problems, and collect information that could be used to further our knowledge of how healthcare works. In particular, we are concerned with how care activities influence the comfort, function, and life expectancy of individuals and groups of patients.

Beyond using technologies in support of their clinical work, Clinicians need to be able to communicate their needs to Applied Health Informaticians and to Research and Development Health Informaticians. Consequently, it is essential that clinicians have a basic understanding of the nature, capabilities, and uses of existing health informatics tools and the potential for health information technology to influence care.

The CHI Working Group had as its primary objective the definition of the competencies that clinicians should acquire in order to be optimally prepared for the challenges of clinical practice. The competencies identified would generally be learned during clinical training, although some might be acquired through continuing education and self-study.

In launching the project, the CHI elected, after careful thought, to not distinguish among the different types of clinicians, e.g., physicians, nurses, and other allied providers. This important decision removed barriers that have historically frustrated the development of a unified curriculum for clinicians. As a result, the products of the CHI Working Group, itself composed of a spectrum of clinicians, are applicable to all clinicians.

The CHI Working Group made another major contribution by applying the curriculum development process to the question: “From the perspective of clinicians, for those who want to become professional Health Informaticians, what are the challenges they must address, the micro-roles they must perform to address these challenges, and competencies required to perform these micro-roles?” The material they developed was integrated with and used to enhance the products of the AHI and RDHI working Groups.

**KEY OPERATIONAL TERMS**

**Macro-Roles:** Major organizational roles undertaken by IT professionals; functional positions. Examples: CIO, Manager of Systems, and Analyst.

**Challenges:** Aspects of the health and/or systems environment requiring attention or intervention; incursions or difficulties to which the professional must respond. Examples: the need for planning, procuring, and evaluating systems.

**Micro-Roles:** Sub-Functions/tasks that must be performed to address the challenges.

**Skills:** Thinking, procedural, methodological, or technical abilities required to successfully perform the specific micro-role. Includes: the techniques, methods, templates, frameworks, etc. Learned by doing.
Knowledge: Inter-related (elaborated) data, facts, meanings, concepts, and principles that provide the basis for understanding, comparisons, conclusions, decisions, advice, and the like. Learned by listening, reading, and discussion.

Experience: Involvement in the application of knowledge though discussions, projects, or work.

Competencies: The aggregate of skills, knowledge, and experience required to address a challenge.

OPERATIONAL FRAMEWORK

Identification of **Macro-Roles** (e.g. Clinician)

Identification of IT-Relevant **Challenges** faced by individuals performing this Macro-Role

Identification of **Micro-Roles** (or Macro-Tasks) that must be performed to address these challenges

Identification of relevant **Skills, Knowledge & Experience** needed to competently perform these Micro-Roles

Definition of **Competency Categories**
CHI CHALLENGES

The following are the informatics-relevant challenges faced by Clinicians:

1. Maintaining Professional Competence and Information Currency
2. Improving and Maintaining Quality
3. Maintaining and Using Personal Experience Register
4. Patient and Care Management
5. Communication with Patients
6. Complex Decision-Making (Re: Diagnosis, Transfer, Intervention)
7. Individual, Group, and Population Education and Guidance
8. Diagnostic Testing
9. Clinical Alert Systems Monitoring
10. Record Management (Record-Keeping and Record Access)
11. General Patient Care Not Otherwise Specified
12. Collaboration
13. Consultation (To Provider, From Provider)
14. Scheduling and Time Management
15. Participation in CQI-Type Program (e.g., CQI, Chart Audit, Peer Review, Resource Allocation, Utilization Management)
16. General Practice Management
17. Clinical Research Participation
18. Technology Assessment (Drugs, Devices, Health Interventions, support systems)
19. Outcome Evaluation
20. IT/IM Planning and Implementation
21. Utilization and Proper Use of Technology (e.g.: Telehealth, PACS, RIS)

See Section B8 for:

Participation in Process and Product Re-Engineering and Management Clinical Teaching (Students)

Clinicians should have at least an awareness of the skills and knowledge necessary to be participants in the involved processes.
CHI CHALLENGES & MICRO-ROLES

In order to address each of these challenges, the CHI professional will need to perform specific micro-roles. The list that follows identifies the micro-roles for each CHI challenge:

1. Maintaining Professional Competence and Information Currency
   1.1. Accessing Books, Articles, Guidelines, Data, etc.
   1.2. Learning via Distance Education Techniques
   1.3. Being Evaluated
   1.4. Participating in Professional CQI Program
   1.5. Accessing Books, Articles, Guidelines, Data, etc.
   1.6. Identifying Sources and Resources
   1.7. Critical Appraisal
   1.8. Data/Information Interpretation and Synthesis

2. Improving and Maintaining Quality
   2.1. Participating in QA Program
   2.2. Establishing and Maintaining QA Standards
   2.3. Data Management for QA (Understanding Data Quality, Analyzing Data, Interpreting Data)
   2.4. Developing a QA Program
   2.5. Staff Performance Appraisal
   2.6. Practice Evaluation
   2.7. Adverse Event Monitoring, Documentation, and Reporting

3. Maintaining and Using Personal Experience Register
   3.1. Keeping an Experience Book (E-Book), including Indexing Patients
   3.2. Accessing Register

4. Patient and Care Management
   4.1. Locating/Tracking Patient
   4.2. Accessing/Contacting Patient
   4.3. Patient Disposition
   4.4. Co-ordination of Care
   4.5. Evaluating Care Processes and Outcomes

5. Communication with Patients
   5.1. With Individuals, Groups and Populations
   5.2. Assessment Aggregation
   5.3. Multi-Disciplinary Decision-Support Collaboration
   5.4. Information Sharing (Clinical, Personal Information)
   5.5. Patient Information Access
   5.6. Knowledge Dissemination (Bi-Directional)
   5.7. Surveying Patients
   5.8. Finding, Accessing, Preparing, and Developing Information (e.g., For Pamphlets)
   5.9. Evaluating the Impact and Quality of Communications
   5.10. Complex Decision-Making (Re: Diagnosis, Transfer, Intervention)
   5.11. Hypothesis Setting
   5.12. Characterizing Decision Parameters
5.13. Obtaining Decision Support
5.14. Understanding Rationale for Advice
5.15. Validating the Advice
5.16. Interacting Evaluating the Quality of Decision-Making

6. Complex Decision-Making (Re: Diagnosis, Transfer, Intervention)
   6.1. Hypothesis Setting
   6.2. Characterizing Decision Parameters
   6.3. Obtaining Decision Support
   6.4. Understanding Rationale for Advice
   6.5. Validating the Advice
   6.6. Interacting with Individuals, Groups and Populations
   6.7. Evaluating the Quality of Decision-Making

7. Individual, Group, and Population Education and Guidance
   7.1. Accessing Information
   7.2. Obtaining Education Materials for Individuals, Groups, and Populations
   7.3. Communicating Information or Material to Individuals, Groups, and Populations
   7.4. Dealing with Advanced Directives (e.g., DNR)
   7.5. Evaluating the Quality and Impact of Education and Guidance

8. Diagnostic Testing
   8.1. Identifying and Qualifying Diagnostic Services
   8.2. Preparing Individuals, Groups, and Populations
   8.3. Communicating With Diagnostic Services
   8.4. Obtaining Feedback From Consultants
   8.5. Incorporating Results in Patient Record
   8.6. Wait List Management

9. Clinical Alert Systems Monitoring
   9.1. Specifying Monitoring Parameters and Rules
   9.2. Responding to Clinical Event Notifications

10. Record Management (Record-Keeping and Record Access)
    10.1. Patient Unique Identification and Record Linkage
    10.2. Patient Documentation
    10.3. Patient Classification
    10.4. Understanding and Use of Standardized Clinical Vocabulary
    10.5. Evaluating the Quality of Record-Keeping
    10.6. Searching for Records
    10.7. Reviewing Records
    10.8. Finding Information (e.g. in repositories, across multiple systems)
    10.9. Aggregating Information (e.g. In a data warehouse)

11. General Patient Care (Not Otherwise Specified)
    11.1. Interviewing Individuals, Groups and Populations
    11.2. Obtaining and Reviewing Existing Records
    11.3. Attending
    11.4. Developing and Communicating Services (e.g., Prescriptions, Lab) Requisitions and Orders
    11.5. Completing Regulatory and Other Administrative Documentation
    11.6. Obtaining Approvals (e.g., Privileges, Certification, etc.)
    11.7. Obtaining and Following Protocols
    11.8. Prescription Writing
12. Collaboration
   12.1. Identifying Potential Collaborators
   12.2. Interacting with Collaborators (e.g., Researchers, Providers, Vendors)
   12.3. Information Sharing
   12.4. Messaging to and From Patients and Patients’ Families

13. Consultation (To Provider, From Provider)
   13.1. Identifying and Qualifying Consultative Resources
   13.2. Preparing and Interacting with Individuals, Groups, and Populations (e.g., about date, time, nature of appointment)
   13.3. Communicating With Consultative Resources
   13.4. Obtaining Feedback From Consultants
   13.5. Incorporating Results in Patient Record
   13.6. Using Tele-Health Technologies

14. Scheduling and Time Management
   14.1. Event Scheduling
   14.2. Coordinating Scheduling
   14.3. Reviewing Schedule
   14.4. Wait-List Management

15. Participation in CQI-Type Program (e.g., CQI, Chart Audit, Peer Review, Resource Allocation, Utilization Management)
   15.1. Defining or Developing a UM, or CQI, or Like Program
   15.2. Participating in a UM, or CQI, or Like Program
   15.3. Evaluating the Effectiveness of a UM, or CQI, or Like Program
   15.4. Project Management of a UM, or CQI, or Like Program

16. General Practice Management
   16.1. Identification and Articulation of Requirements
   16.4. Scheduling Patients.
   16.5. Completing Requested Documentation (e.g., legal, WCB)
   16.7. Equipment and Services Acquisition (If Applies)
   16.8. Definition and Assignment of Roles and Accountabilities
   16.9. Practice Leadership/Team Building (Including IT/IM Change Management)
   16.10. Scheduling and Schedule Management (Including Analyze and Evaluate)
   16.11. Evaluating the Quality of the Practice (Management, Business, Patient Care)
   16.12. Technology Assessment/Evaluation
   16.13. Staff Recruitment
   16.14. Staff Development (Education and Training)
   16.15. Staff and Team Leadership and Management
   16.16. Staff Performance Evaluation
   16.17. Self-Assessment
   16.18. Departmental Resources Management Policy and Procedure Development and Implementation
   16.19. Oversight of Department Function
   16.22. Asset Management
   16.23. Billing and Collection (If Applies)
17. Clinical Research Participation
   17.1. Identifying Candidate Patients
   17.2. Following Protocol
   17.3. Documenting Patients
   17.4. Using Supportive and Collaborative Technologies

18. Technology Assessment (Drugs, Devices, Health Interventions, support systems)
   18.1. All Research Micro-Roles/Macro-Tasks Apply
   18.2. Identification of Desired Outcomes
   18.3. Options Identification, Characterization, Analysis, and Selection
   18.4. Critical Thinking/Appraisal
   18.5. Assessment of Cost-Effectiveness

19. Outcome Evaluation
   19.1. Development of Performance Indicators
   19.2. Measuring Performance
   19.3. Monitoring Performance
   19.4. Analyzing and Reporting of Performance Indicators
   19.5. Assessing Cost-Effectiveness

20. IT/IM Planning and Implementation
   20.1. Definition of Goals and Objectives
   20.2. Implementation Planning
   20.3. Implementation Project Management
   20.4. System Reception and Installation
   20.5. Hardware and OS Implementation and Testing
   20.6. Applications Software Set-up
   20.7. Applications Customization
   20.8. Applications Software Testing
   20.9. User Training
   20.10. Vendor and Participant Relations Management
   20.11. Applications Acceptance Testing
   20.12. System Go-Live

21. Utilization and Proper Use of Technology (e.g.: Telehealth, PACS, RIS)
   21.1. Determining and Selecting Required Technologies
   21.2. Becoming Proficient in Using Technologies and Maintaining Proficiency
   21.3. Usage
   21.4. Determining the Ergonomics of Technologies
   21.5. Teaching/Mentoring the Utilization of Technology
SECTION C3 – CHI Challenges, Micro-Roles, & Required Competencies

Clinicians, in order to address their professional information technology-relevant challenges (CH: - challenge or major job function), must perform specific micro-roles (MR: - micro-role or job sub functions or tasks), and these in turn require specific skills (SK: - skill), knowledge (KN: - knowledge), and experience, collectively known as “competencies”. In the material below the skills and knowledge elements required to address each challenge, are listed with each micro-role that the professional must perform to address that challenge. Experience requirements are associated with challenges, and are shown in the table in section 4.

Skills: Thinking, procedural, methodological, or technical abilities required to successfully perform the specific micro-role. Includes: the techniques, methods, templates, frameworks, etc. Usually learned by doing.

Knowledge: Inter-related (elaborated) data, facts, meanings, concepts, and principles that provide the basis for understanding, comparisons, conclusions, decisions, advice, and the like. Usually learned by listening, reading, and discussion.

Experience: The “hands on” interaction with and addressing of challenges in case studies, in projects, or on-the-job in actual work settings (co-op, contract, or employment).

SPECIFICATION OF REQUIRED SKILLS & KNOWLEDGE FOR EACH MICRO-ROLE

1. CH: Maintaining Professional Competence and Information Currency
   1.1. MR: Accessing Books, Articles, Guidelines, Data, etc.
      1.1.1. SK: On-Line Literature Searching, Web-Browsing, Computer Literacy
      1.1.2. KN: Evidence-Based Practice (e.g. Relevant and Timely), On-Line Search Strategies, Taxonomy of the Literature, Sources, Meta-Knowledge (knowledge of the limits of the application of just about anything)

   1.2. MR: Learning via Distance Education Techniques
      1.2.1. SK: Use of Distance-Education System, Self-Directed Learning, Attitude of the Learner (Willingness to Learn)
      1.2.2. KN: Limits of Appropriateness, Applicability, and Effectiveness

   1.3. MR: Being Evaluated
      1.3.1. SK: Openness to Being Evaluated, Culture (in person, objective), Use of Evaluation Tool (e.g. Template), Self-Evaluation
      1.3.2. KN: Principles of Professional Evaluation (Summative and Formative)

   1.4. MR: Participating in Professional CQI Program
      1.4.1. SK: Use of Specific System
      1.4.2. KN: Principles of Professional TQM/CQI, Specific Systems
1.5. MR: Identifying Sources and Resources
   1.5.1. SK: Information Finding Skills, Usage of Search Engines and Browsers

1.6. MR: Critical Appraisal
   1.6.1. SK: Critical Analysis Skills
   1.6.2. KN: Principles of Critical Appraisal

1.7. MR: Data/Information Interpretation and Synthesis
   1.7.1. SK: Thinking Skills

1.8. Information and Knowledge Acquisition
   1.8.1. SK: Accessing Books, Articles, Guidelines, Data, etc., Identifying Sources and Resources, Critical Appraisal, Data/Information Interpretation and Synthesis

2. CH: Improving and Maintaining Quality
   2.1. MR: Participating in QA Program
      2.1.1. See: Improving and Maintaining Quality

   2.2. MR: Staff Performance Appraisal
      2.2.1. SK: Staff Performance Assessment Framework, Interpersonal Skills, Management Skills
      2.2.2. KN: Principles of HR Management

   2.3. MR: Practice Evaluation
      2.3.1. SK: Practice Evaluation Framework, Management Skills
      2.3.2. KN: Principles of Qualitative and Quantitative Evaluation

   2.4. MR: Adverse Event Monitoring, Documentation, and Reporting
      2.4.1. SK: Event Monitoring Techniques; Use of Event Monitoring Applications Package, Professional Writing Skills
      2.4.2. KN: Specific Domain Knowledge (Knowledge of Event Types and Consequences)

3. CH: Maintaining and Using Personal Experience Register
   3.1. MR: Keeping an Experience Book (E-Book), including Indexing Patients
      3.1.1. SK: Appropriate Utilization of an E-Book System/Technology
      3.1.2. KN: Knowledge of Personal Experience Registry Concept

   3.2. MR: Accessing Register
      3.2.1. SK: Use of E-Book Technology

4. CH: Patient and Care Management
   4.1. MR: Locating/Tracking Patient
      4.1.1. SK: Use of a Patient Tracking System, Use of a Browser, Computer Literacy
      4.1.2. KN: Understanding of Patient Problem and Identification System

   4.2. MR: Accessing/Contacting Patient
      4.2.1. SK: Use of E-Mail Systems, Use of a Browser
4.3. MR: Patient Disposition
   4.3.1. SK: Discharge Planning, Use of Specific Systems

4.4. MR: Co-ordination of Care (relates to teams)
   4.4.1. SK: Inter-Personal Skills, Use of Collaborative Technologies, Use of Single Care Plan System (by entire team), Coordination of Care and Scheduling, Preparing and Interacting with Individuals, Groups, and Populations (e.g., about date, time, nature of appointment)
   4.4.2. KN: Knowledge of Possible Technologies, Roles

4.5. MR: Evaluating Care Processes and Outcomes
   4.5.1. KN: Evaluation and Evaluation Methods, Actual Relevant Existing Resources (e.g. Peer Databases), Use of Appropriate Supporting Resources

5. CH: Communication with Patients [Note: Possibility of Combining With Patient Education]
5.1. MR: Information Sharing (Clinical, Personal Information)
   5.1.1. SK: Use of Appropriate Technologies (e.g. browsers), Communication Skills

5.2. MR: Patient Information Access
   5.2.1. SK: Use of Patient Database Tools

5.3. MR: Knowledge Dissemination (Bi-Directional)
   5.3.1. SK: Use of Patient Database Tools, Decision-Making Skills, Information-Finding Skills

5.4. MR: Surveying Patients
   5.4.1. SK: Questioning Skills, Assessment Skills (observation, decision-making), Interviewing Skills
   5.4.2. KN: Survey Design

5.5. MR: Finding, Accessing, Preparing, and Developing Information
   5.5.1. SK: Information Finding Skills

5.6. MR: Evaluating the Impact and Quality of Communications
   5.6.1. KN: Principles of Quantitative and Qualitative Evaluation

6. CH: Complex Decision-Making (Re: Diagnosis, Transfer, Intervention)
6.1. MR: Hypothesis Setting
   6.1.1. SK: Clinical Decision-Making, Inductive Reasoning (clustering etc.)
   6.1.2. KN: Principles of Clinical Decision-Making and Inference

6.2. MR: Characterizing Decision Parameters
   6.2.1. SK: Analysis Skills

6.3. MR: Obtaining Decision Support
   6.3.1. SK: Using Decision Support Tools
   6.3.2. KN: Performance and Limitations of Decision Support Systems
6.4. MR: Understanding Rationale for Advice
   6.4.1. KN: Evidence-Based Practice

6.5. MR: Validating the Advice
   6.5.1. SK: Information Finding Skills (accessing sources etc.), Evaluation Skills, Use of Decision Support System Explanation Capability, TQM/CQI Skills

6.6. MR: Interacting with Individuals, Groups and Populations
   6.6.1. SK: Interviewing Skills, Group Processing Techniques, Communication Skills, Use of Appropriate Technology, Consultation Skills

6.7. MR: Evaluating the Quality of Decision-Making
   6.7.1. SK: Use of Technologies, TQM/CQI Skills
   6.7.2. KN: Principles of Quantitative and Qualitative Evaluation

7. CH: Individual, Group, and Population Education and Guidance
   7.1. MR: Accessing Information
      7.1.1. SK: Information Finding Skills

7.2. MR: Obtaining Education Materials for Individuals, Groups, and Populations
   7.2.1. KN: Intellectual Property Issues

7.3. MR: Communicating Information or Material to Individuals, Groups, and Populations
   7.3.1. SK: Obtaining Appropriate Material and Use of Appropriate Technologies/Media, Presentation Skills,
   7.3.2. KN: Supporting Resources

7.4. MR: Dealing with Advanced Directives (e.g., DNR)
   7.4.1. SK: Patient Guidance/Counseling Skills, Empathy
   7.4.2. KN: Legal, Ethical and Privacy Issues, Policies, Supporting Resources

7.5. MR: Evaluating the Quality and Impact of Education and Guidance
   7.5.1. SK: Evaluation Framework
   7.5.2. KN: Principles of Quantitative and Qualitative Evaluation

8. CH: Diagnostic Testing
   8.1. MR: Identifying and Qualifying Diagnostic Services/Tests
      8.1.1. SK: Information Finding Skills, Use of Practice Guidance System
      8.1.2. KN: Practice Guidelines

8.2. MR: Preparing Individuals, Groups, and Populations

8.3. MR: Communicating With Diagnostic Services
      8.3.1. SK: Use of Ordering Systems
8.4. MR: Obtaining Results/Feedback From Consultants/Services and Incorporating into Patient Record
8.4.1. SK: Appropriate Use of Feedback Results Systems, Use of Provider Inquiry Systems
8.4.2. KN: Confidentiality Issues

8.5. MR: Wait List Management
8.5.1. SK: Use of Wait List Management Systems

9. CH: Clinical Alert Systems Monitoring
9.1. MR: Specifying Monitoring Parameters and Rules
9.1.2. KN: Mathematics and Logic

9.2. MR: Responding to Clinical Event Notification

9.3. MR: Documentation of Adverse Patient Events
9.3.1. SK: Use of Event Documentation Systems

10. CH: Record Management (Record Keeping and Record Access)
10.1. MR: Patient Unique Identification and Record Linkage
10.1.1. SK: Data Entry, Use of Appropriate Record Keeping System, Use of Appropriate Access Technologies (e.g. wireless etc.), See CH: Protection of Health Information, Use of EMPI System
10.1.2. KN: Data Quality Issues (errors, integrity etc.), See CH: Protection of Health Information

10.2. MR: Patient Documentation
10.2.1. SK: As Above, Multi-Tasking
10.2.2. KN: As Above

10.3. MR: Patient Classification (e.g., Nursing Classification; Risk Class)
10.3.1. SK: As Above
10.3.2. KN: As Above

10.4. MR: Understanding and Use of Standardized Clinical Vocabulary
10.4.1. SK: As Above
10.4.2. KN: As Above, Appropriate Vocabulary that will be selected

10.5. MR: Evaluating the Quality of Record-Keeping
10.5.1. SK: As Above
10.5.2. KN: As Above

**Note: In general, Knowledge of Applicable Provincial/Federal Standards

10.6. MR: Searching for Records
10.6.1. SK: Use of EMPI System
10.7. MR: Reviewing Records
    10.7.1. SK: As Above

10.8. MR: Finding Information (e.g. in Repositories, Across Multiple Systems)
    10.8.1. SK: As Above, Use of a Query System (SQL)
    10.8.2. KN: Query Logic, Principles of Database Management

10.9. MR: Use of Aggregated Information (e.g. In a Data Warehouse)
    10.9.1. SK: As Above
    10.9.2. KN: Understanding Info Aggregated

11. CH: General Patient Care Not Otherwise Specified
    11.1. MR: Attending
        11.1.1. SK: Use of Point-of-Care Systems, Use of Telehealth Systems for Remote
        11.1.2. KN: Knowledge of Specific Systems

    11.2. MR: Completing Regulatory and Other Administrative Documentation
        11.2.1. SK: Use of Documentation System
        11.2.2. KN: Administrative Requirements

    11.3. MR: Obtaining Approvals (e.g., Privileges, Certification, etc.)
        11.3.1. KN: Knowledge of Approval Process and Required Documentation

    11.4. Obtaining and Following Protocols
        11.4.1. SK: Use of Practice Guidelines Support Systems, Information Finding Skills
        11.4.2. KN: Specific Systems, Evidence-Based Practice

12. CH: Collaboration
    12.1. MR: Identifying and Interacting with Collaborators (e.g., Researchers, Providers, Vendors)
        12.1.1. SK: Use of Collaboration Support Technologies, Group Management Techniques,
                     Team Building Skills, Facilitation Skills, Interpersonal Skills, Negotiation Skills,
                     Conflict Management Skills

    12.2. MR: Information Sharing
        12.2.1. SK: Use of Technology
        12.2.2. KN: Privacy, Confidentiality and Security Issues (principles and legislation, regulation)

    12.3. MR: Messaging to and From Patients and Patients’ Families
        12.3.1. SK: Use of Technology
        12.3.2. KN: Privacy, Confidentiality and Security Issues (principles and legislation, regulation)
13. CH: Consultation (To Provider, From Provider)

13.1. MR: Identifying, Qualifying and Managing Consultative Resources
   13.1.1. SK: Database Management, Internet Skills, Attention to Detail
   13.1.2. KN: Where the Consultative Resources Exist

13.2. MR: Bi-Directional Communication With Consultative Resources
   13.2.1. SK: Generating Patient-Care Information From Electronic Repositories,
           Generating Patient-Care Information From Electronic Repositories, Incorporating
           Results in Patient Record, Appreciation of Unique Identifiers
   13.2.2. KN: Database Access and Design, Confidentiality, Privacy and Security
           Standards, Prompting and Alerting Systems, Medical Records, Standards for
           Data Transmission, Confidentiality, Privacy and Security Standards

13.3. MR: Using Tele-Health Technologies (SEE Sheri)
   13.3.1. SK: Selecting and Using the Appropriate Technology,
   13.3.2. KN: Tele-Health Communication Protocol

14. CH: Scheduling and Time Management

14.1. MR: Event Scheduling
   14.1.1. SK: Attention to Detail, Patience, Multi-Tasking, Using Scheduling Systems
   14.1.2. KN: Specific Hardware (e.g. PDAs), Shared Scheduling Systems, Confidentiality,
           Privacy and Security Issues

14.2. MR: Coordinating Scheduling
   14.2.1. SK: As Above, (See messaging to/from patients)

14.3. MR: Reviewing Schedule
   14.3.1. SK: As Above

14.4. MR: Wait-List Management
   14.4.1. SK: Use of Appropriate Technology (Wait-List Management Software), Report
           Generation
   14.4.2. KN: Alerting and Prompting Systems, Wait-List Management Software

15. CH: Participation in CQI-Type Program (e.g., CQI, Chart Audit, Peer Review, Resource Allocation, Utilization Management)

15.1. MR: Participating in a UM, or CQI, or like Program
   15.1.1. SK: Software Manipulation and Report Writing
   15.1.2. KN: As Above, Content of the Healthcare Practices and Standardized Data
           Collection, Ethics

16. CH: Practice Management in General

16.1. MR: Identification and Articulation of Requirements
   16.1.1. SK: Evaluation Skills for Vendors and Various Products
   16.1.2. KN: What Current Technologies are Available, Vendors
   16.2.1. SK: Determining Content of Electronic vs. Paper Record, Transfer of Information from Paper to Electronic Format, Use of Voice and Other Data Input Technologies
   16.2.2. KN: Requirements of Regulating Bodies, Confidentiality, Privacy and Security Issues, Change Management Process, Unique Provider Numbers/Electronic Signature

   16.3.1. SK: Internet Skills
   16.3.2. KN: Regulatory Bodies--Nursing and Physician Jurisdictions, OHSA and Other Legislation i.e. Duty to Accommodate, Electronic Resources of the Regulatory Bodies

16.4. MR: Scheduling Patients.
   16.4.1. SK: See Use of Specific Software, Use of Other Technology

16.5. MR: Completing Requested Documentation (e.g., Legal, WCB)
   16.5.1. SK: Specific Forms and Other Software, Database Query and Report Generating
   16.5.2. KN: Legal Requirements, Confidentiality, Privacy and Security Issues (CPS)

   16.6.1. SK: Developing Policies and Procedures, Finding P & P on-line, Creation of Internet Documentation (add to other places also)
   16.6.2. KN: HTML

16.7. MR: Equipment and Services Acquisition (If Applies)
   16.7.1. SK: How Vendors Can Understand What We Need in Practice, How to Write and Analyze RFPs
   16.7.2. KN: Procurement Processes and Policies,

16.8. MR: Definition and Assignment of Roles and Accountabilities
   16.8.1. SK: Ability to Identify People with the Core Competencies
   16.8.2. KN: Understanding Job Descriptions, Union Issues

16.9. MR: Practice Leadership/Team Building (Including IT/IM Change Management)
   16.9.1. SK: Facilitation, Communication, Change Agent, Interpersonal Skills, Organizational Skills with Emphasis on Problem Identification and Information Management,
   16.9.2. KN: Principles in Adult Education, Human Communication Dynamics

16.10. MR: Scheduling and Schedule Management (Including Analyze and Evaluate)
   16.10.1. SK: See Scheduling and Schedule Management
   16.10.2. KN: See Scheduling and Schedule Management
16.11. MR: Evaluating the Quality of the Practice (Management, Business, Patient Care)
   16.11.1. SK: See Improving and Maintaining Quality, Patient and Care Management, General Practice Management
   16.11.2. KN: See Improving and Maintaining Quality, Patient and Care Management, General Practice Management

16.12. MR: Technology Assessment/Evaluation
   16.12.1. SK: See Section B8: Technology Assessment
   16.12.2. KN: See Section B8: Technology Assessment

16.13. MR: Staff Recruitment (Discipline Specific)
   16.13.1. SK: Interviewing Techniques
   16.13.2. KN: Recruitment Process, Union Issues, Job Descriptions, Recruitment Model

16.14. MR: Staff Development (Education and Training)

16.15. MR: Staff and Team Leadership and Management
   16.15.1. SK: Assessment Skills, Assertiveness, Decision-Making Ability, Motivational Skills, Technically Competent, Delegation, see above
   16.15.2. KN: Various Leadership Models

16.16. MR: Staff Performance Evaluation
   16.16.1. SK: Ability to Give and Receive Constructive Feedback, Using an Unbiased Tool/Process, Objectivity,
   16.16.2. KN: A Variety of Methodologies to Collect Information

16.17. MR: Self-Assessment
   16.17.1. SK: Objectivity and see above, Ability to Identify Strengths and Weaknesses,
   16.17.2. KN: Resources

16.18. MR: Billing and Collection (Discipline Specific)
   16.18.1. SK: Software Evaluation Skills, Interpersonal Skills, Software Meets the Needs of Billing and Reporting Requirements and is Accurate
   16.18.2. KN: Specific Knowledge of Billing Software, Billing and Collection Techniques, Strategies to Maximize Revenue Legitimately, Software Meets the Needs of Billing and Reporting Requirements and is Accurate, Policy and Billing Procedures, Knowledge of Billable Items

17. CH: Clinical Research Participation
17.1. MR: Identifying Candidate Patients
   17.1.1. SK: Patient Contact, Management of Demographic Database,
   17.1.2. KN: Ethical Issues re: the Research, FOIPPA (Freedom of**), Inclusion and Exclusion Criteria, Bill C6 (private information) and/or Other Government Privacy and Confidentiality Acts
17.2. MR: Following Protocol--roll up into MR: Data Collection
   17.2.1. **KN**: Knowledge of Protocol and Best Practices

17.3. MR: Documenting Patients --roll up into MR: Data Collection
   17.3.1. **SK**: Use of Patient Documentation System
   17.3.2. **KN**: Knowledge of Medical Records Standards, Data Protocols

17.4. MR: Using Supportive and Collaborative Technologies
   17.4.1. **SK**: Using Specific Hardware and Software, Internet Skills
   17.4.2. **KN**: Specific Hardware and Software, Data Communications Strategies

18. CH: Technology Assessment (Drugs, Devices, Health Interventions, Support Systems)
   18.1. MR: Note All Research Micro-Roles/Macro-Tasks Apply (See Section B8: Research)

18.2. MR: Identification of Desired Outcomes
   18.2.1. **SK**: Listening Skills, Needs Analysis Method
   18.2.2. **KN**: The Nature and Operation of the Health System, Principles of Technology Assessment, Knowledge of Specific Technologies, Knowledge of Specific Requirements

18.3. MR: Identification of Technology-Sophisticated Collaborators to Assist with Assessment
   18.3.1. **SK**: Information Finding Skills; Personal Networking Skills
   18.3.2. **KN**: Knowledge of Potential Collaborators

18.4. MR: Options Identification, Characterization, Analysis, and Selection
   18.4.1. **SK**: Options Analysis Method; Critical Thinking/Appraisal
   18.4.2. **KN**: As Above; Assessment of Interoperabilty; Assessment of Vendor and Product Viability

18.5. MR: Evaluation of the Quantitative and Qualitative Impacts (Cost Effectiveness, Cost Benefit) Systems
   18.5.1. **KN**: Principles of Quantitative + Qualitative Evaluation

19. CH: Outcome Evaluation
   19.1. MR: Selection or Development of Performance Indicators
      19.1.1. **SK**: Use of Data Mining System (for Development)
      19.1.2. **KN**: Knowledge of Clinical Content; Knowledge of Possible Indicators

   19.2. MR: Measuring and Monitoring Performance
      19.2.1. **SK**: Use of Monitoring Software and Other Tools
      19.2.2. **KN**: As Above; Principles of Data Collection, Processing, and Management

   19.3. MR: Analyzing and Reporting of Performance Indicators
      19.3.1. **SK**: Use of Data Warehousing System/Management Reporting System
      19.3.2. **KN**: As Above
19.4. MR: Evaluation of the Value/Clinical Significance of the Outcome
19.4.1. SK: Critical Appraisal
19.4.2. KN: Principles of Quantitative + Qualitative Evaluation

20. CH: IT/IM Planning and Implementation (Discipline-Specific)

20.1. MR: Definition of Goals and Objectives of IT/IM
20.1.1. SK: Needs and requirements Analysis; General Planning Skills; Info Finding Skills
20.1.2. KN: Focus on Basic/Intro/Overview Knowledge of Potential Technologies; Knowledge of Specific Content Area; Potential Benefits; Principles of Planning

20.2. MR: Implementation Planning
20.2.1. SK: Systems Implementation Planning Technique, Expectation Management
20.2.2. KN: Principles of Project Planning, Organization, and Management

20.3. MR: Implementation Project Management
20.3.1. SK: Project Management Techniques, Implementation Management skills, Contract/or Management Skills, Staff Mobilization and Motivation Technique, Leadership Skills, Documentation Skills, Questioning and Communication Skills
20.3.2. KN: As Above

20.4. MR: System Reception and Installation
20.4.1. SK: See Procurement (AHI)
20.4.2. KN: See Procurement (AHI)

20.5. MR: Hardware and OS Implementation and Testing
20.5.1. SK: Hardware and OS Testing Method
20.5.2. KN: Principles of System Testing and Validation

21. CH: Utilization and Proper Use of Technology (e.g.: Telehealth, PACS, RIS)

21.1. MR: Determining Required Technologies
21.1.1. SK: Information Finding Skills;
21.1.2. KN: Knowledge of Technologies and Characteristics; Understanding Use of Technology and Which Processes Are Influenced by the Technology

21.2. MR: Using and Becoming Proficient in Using Technologies and Maintaining Proficiency
21.2.1. KN: Understanding the Purpose of the Technologies; Knowledge of Alternative Systems

21.3. MR: Determining the Ergonomics of Technologies
21.3.1. KN: Human Computer Interface Issues

21.4. MR: Teaching/Mentoring the Utilization of Technology
21.4.1. SK: Mentoring Techniques
21.4.2. KN: Teaching Methods, and Knowledge of Technologies; Knowledge of Needs of specific User Group
The table below documents the CHI Working Group’s recommendations regarding the type and minimum level of experience required to prepare a clinician as a capable user of Health Informatics tools in his or her professional practice. Note that, wherever possible, students should have all other types/levels of experience up to the minimum level.

<table>
<thead>
<tr>
<th>Guidance Regarding the Type of Experience Required for Each Challenge:</th>
<th>Exp. Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-the-Job Experience in a Leadership Role</td>
<td>8-OJL</td>
</tr>
<tr>
<td>On-the-Job Experience in a Team Participant Role</td>
<td>7-OJP</td>
</tr>
<tr>
<td>Field Experience/Practicum Addressing the Challenge in a Leadership Role</td>
<td>6-FEL</td>
</tr>
<tr>
<td>Field Experience/Practicum Addressing the Challenge in a Team Participant Role</td>
<td>5-FEP</td>
</tr>
<tr>
<td>Program Thesis/Research Project</td>
<td>4-TRP</td>
</tr>
<tr>
<td>Course Project</td>
<td>3-CPR</td>
</tr>
<tr>
<td>Class Assignment</td>
<td>2-CAS</td>
</tr>
<tr>
<td>Group Discussion/Case Study Analysis</td>
<td>1-GDC</td>
</tr>
<tr>
<td>No Experience Required in Addressing the Challenge</td>
<td>0-NOE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Required Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintaining Professional Competence</td>
<td>5-FEP</td>
</tr>
<tr>
<td>Improving and Maintaining Quality</td>
<td>3-CPR</td>
</tr>
<tr>
<td>Maintaining and Using Personal Experience Register</td>
<td>2-CAS</td>
</tr>
<tr>
<td>Patient and Care Management</td>
<td>5-FEP</td>
</tr>
<tr>
<td>Communication with Patients</td>
<td>5-FEP</td>
</tr>
<tr>
<td>Complex Decision-Making (Re: Diagnosis, Transfer, Intervention)</td>
<td>5-FEP</td>
</tr>
<tr>
<td>Individual, Group, and Population Education and Guidance</td>
<td>5-FEP</td>
</tr>
<tr>
<td>Diagnostic Testing</td>
<td>5-FEP</td>
</tr>
<tr>
<td>Clinical Alert Systems Monitoring</td>
<td>2-CAS</td>
</tr>
<tr>
<td>Record Management (Record-Keeping and Record Access)</td>
<td>5-FEP</td>
</tr>
<tr>
<td>General Patient Care Not Otherwise Specified</td>
<td>5-FEP</td>
</tr>
<tr>
<td>Collaboration</td>
<td>4-TRP</td>
</tr>
<tr>
<td>Consultation (To Provider, From Provider)</td>
<td>5-FEP</td>
</tr>
<tr>
<td>Scheduling and Time Management</td>
<td>3-CPR</td>
</tr>
<tr>
<td>Participation in CQI-Type Program (e.g., CQI, Chart Audit, Peer Review, Resource Allocation, Utilization Management)</td>
<td>4-TRP</td>
</tr>
<tr>
<td>General Practice Management</td>
<td>3-CPR</td>
</tr>
<tr>
<td>Clinical Research Participation</td>
<td>4-TRP</td>
</tr>
<tr>
<td>Technology Assessment (Drugs, Devices, Health Interventions, support systems)</td>
<td>3-CPR</td>
</tr>
<tr>
<td>Outcome Evaluation</td>
<td>4-TRP</td>
</tr>
<tr>
<td>IT/IM Planning and Implementation</td>
<td>3-CPR</td>
</tr>
<tr>
<td>Utilization and Proper Use of Technology (e.g.: Telehealth, PACS, RIS)</td>
<td>2-CAS</td>
</tr>
</tbody>
</table>
Once the required individual competencies were identified, the CHI Working Group organized the required skill and knowledge elements into natural competency categories. These categories roughly correspond to courses, parts of courses, or possibly groups of related courses that would be offered as components of a clinician training program.

**CHI COMPETENCY CATEGORIES**

1. Personal Competencies
2. Learning, Critical and Evaluative Thinking, and Reading Competencies
3. Teaching and Supervision Competencies
4. Research and Concept/Methodology Development Competencies
5. Justification Case Building (Quantitative + Qualitative) and Evaluation Competencies
6. Re-engineering and Designing of Work and IM Processes, Including Management of Change
7. Group Work Competencies: Collaboration, Team/Project Leadership, Building, Management, and Participation
8. Technology Selection, Evaluation, and Management Competencies
9. General Planning, Administration, and Management Competencies
10. Communication, Presentation, and Publication Competencies
11. General Computing Competencies
12. Health Computing Competencies
13. General Health System-Related Competencies
14. Information and Data Collection, Architecting, Analysis, and Management, and Distribution Competencies

**CHI COMPETENCY CATEGORIES WITH DETAILED COMPETENCIES**

The following listing shows the detailed competencies (identified above with the micro-role associated with a challenge) that have been subsumed under the CHI competency categories. We have called them “Competency Categories”. We note that they are likely to be taught together in a major section of a course, a full course, or distributed over more that one course with (a) course title(s) roughly corresponding to the Competency Category name.

1. Personal Competencies
   1.1. Skills
      1.1.1. Assertiveness
      1.1.2. Attention to Detail
      1.1.3. Communication Skills
      1.1.4. Ethical Practices
      1.1.5. Interpersonal Skills
      1.1.6. Interviewing Skills
      1.1.7. Listening Skills
      1.1.8. Motivational Skills
      1.1.9. Multi-Tasking
      1.1.10. Objectivity
1.1.11. Patience
1.1.12. Personal Networking Skills
1.1.13. Presentation Skills
1.1.14. Professional Writing Skills
1.1.15. Questioning Skills

1.2. Knowledge
1.2.1. Evidence-Based Practice (Including Understanding Evidence, Statistical Methods, Separating Fact from Fiction)
1.2.2. On-Line Search Strategies
1.2.3. Taxonomy of the Literature
1.2.4. Information Sources
1.2.5. Principles of Ethical Practices and Behavior

2. Learning, Critical and Evaluative Thinking, and Reading Competencies

2.1. Skills
2.1.1. Information Finding Skills
2.1.2. Self-Directed Learning
2.1.3. Willingness to Learn
2.1.4. Ability to Give and Receive Constructive Feedback
2.1.5. Analysis/Critical Analysis Skills
2.1.6. Data/Information Interpretation and Synthesis Skills
2.1.7. Thinking Skills
2.1.8. Critical Thinking/Appraisal
2.1.9. Self-Evaluation
2.1.10. Accessing Books, Articles, Guidelines, Data, etc.
2.1.11. Clinical Decision-Making
2.1.12. Inductive Reasoning
2.1.13. Practice Evaluation Framework

2.2. Knowledge
2.2.1. Principles of Critical Appraisal
2.2.2. Principles of Professional Evaluation (Summative and Formative)
2.2.3. Meta-Knowledge (knowledge of the limits of the application of just about anything)
2.2.4. Limits of Appropriateness, Applicability, and Effectiveness
2.2.5. Actual Relevant Existing Resources (e.g. Peer Databases)
2.2.6. Principles of Clinical Decision-Making and Inference

3. Teaching and Supervision Competencies

3.1. Skills
3.1.1. Teaching Methods
3.1.2. Mentoring Techniques
3.1.3. Use of Distance-Education System
3.1.4. Obtaining Appropriate Material and Use of Appropriate Technologies/Media

3.2. Knowledge
3.2.1. Principles of Adult Education
3.2.2. Empowerment Techniques
3.2.3. Knowledge of Education and Training Resources
3.2.4. Human Communication Dynamics

4. Research and Concept/Methodology Development Competencies

4.1. Skills
4.1.1. Using Specific Hardware and Software Tools
4.2. Knowledge
4.2.1. Principles of Investigation and Research (Including Statistical Methods and Research Design)
4.2.2. Knowledge of Specific Hardware and Software,
4.2.3. Ethical Issues in Research
4.2.4. Knowledge of Law/Regulation (e.g., Freedom of Information and Personal Privacy Act)
4.2.5. Inclusion and Exclusion Criteria
4.2.6. Bill C6 (private information) and/or Other Government Privacy and Confidentiality Acts
4.2.7. Knowledge of Medical Records Standards
4.2.8. Data Protocols
4.2.9. Privacy, Confidentiality, and Security Issues (Principles, Legislation, Regulation)

5. Justification Case Building (Quantitative + Qualitative) and Evaluation Competencies
5.1. Skills
5.1.1. Business Case Framework
5.2. Knowledge
5.2.1. Principles of Quantitative and Qualitative Evaluation
5.2.2. Knowledge of Costs and Potential Benefits

6. Re-engineering and Designing of Work and IM Processes, Including Management of Change)
6.1. Skills
6.1.1. Change Management Process
6.1.2. Change Agent Skills
6.2. Knowledge
6.2.1. Principles of Process and Product Innovation
6.2.2. Principles of Professional TQM/CQI
6.2.3. Understanding Process-Technology Interaction

7. Group Work Competencies: Collaboration, Team/Project Leadership, Building, Management, and Participation
7.1. Skills
7.1.1. Project Management Techniques
7.1.2. Group Management Techniques
7.1.3. Consultation Skills
7.1.4. Use of Collaboration Support Technologies
7.1.5. Team Building Skills
7.1.6. Facilitation Skills
7.1.7. Conflict Management Skills
7.1.8. Staff Mobilization and Motivation Technique
7.1.9. Use of Collaborative Technologies
7.1.10. Ability to Identify People with the Core Competencies
7.1.11. Ability to Identify Strengths and Weaknesses
7.2. Knowledge
7.2.1. Principles of Project Planning, Organization, and Management
7.2.2. Principles of Group Management
7.2.3. Knowledge of Potential Collaborators
7.2.4. Understanding Job Descriptions, Union Issues
7.2.5. Knowledge of Consultative Resources
8. Technology Selection, Evaluation, and Management Competencies

8.1. Skills

8.1.1. Needs and Requirements Analysis
8.1.2. Options Analysis Method
8.1.3. Systems Implementation Planning Technique
8.1.4. Hardware and OS Testing Method
8.1.5. Implementation Management Skills
8.1.6. Expectation Management
8.1.7. Evaluation Skills, Techniques, and Templates re Vendors and Products
8.1.8. Use of Evaluation Tool (e.g. Template)
8.1.9. Procurement Processes and Policies
8.1.10. Software Evaluation Skills
8.1.11. Techniques for Communicating with Vendors

8.2. Knowledge

8.2.1. Principles of Technology Assessment, Selection, Management, and Effective Use
8.2.2. Principles of Qualitative and Quantitative Evaluation
8.2.3. Writing and Analyzing RFPs
8.2.4. Understanding the Purpose of the Technologies
8.2.5. Knowledge of Alternative Systems
8.2.6. Assessment of Interoperability
8.2.7. Assessment of Vendor and Product Viability
8.2.8. Knowledge of Specific Technologies, and Their Characteristics, Availability, and Vendors
8.2.9. Knowledge of Specific Needs and Requirements of Users
8.2.10. Use of Appropriate Supporting Resources
8.2.11. Knowledge of Procurement Processes and Policies
8.2.12. Human Computer Interface Issues
8.2.13. Principles of System Testing and Validation

9. General Planning, Administration, and Management Competencies

9.1. Skills

9.1.1. Management Skills
9.1.2. Leadership Models
9.1.3. Negotiation Skills
9.1.4. Organizational Skills with Emphasis on Problem Identification and Information Management
9.1.5. Delegation Skills
9.1.6. Assessment Skills
9.1.7. Staff Performance Assessment Framework
9.1.8. Decision-Making Ability
9.1.9. Ability to Give and Receive Constructive Feedback
9.1.10. Use of Decision Support System Explanation Capability
9.1.11. Policy and Procedure Finding, Adoption, Implementation, and Evaluation
9.1.12. Contract/or Management Skills
9.1.13. Mentoring Techniques
9.1.15. Job Description Framework

9.2. Knowledge

9.2.1. Principles of HR Management (Including Union Issues)
9.2.2. Principles of Planning
9.2.3. Knowledge of Possible Administrative Indicators
9.2.4. Knowledge of Regulatory Bodies and their Electronic Resources (Nursing and Physician Jurisdictions, OHSA and Other Legislation)
9.2.5. Knowledge of Corporate Culture
9.2.6. Knowledge of Different Cultural Responses
10. Communication, Presentation, and Publication Competencies

10.1. Skills
10.1.1. Professional Writing Skills
10.1.2. Presentation Skills
10.1.3. Use of Presentation Support Software
10.1.4. Communication Skills

10.2. Knowledge
10.2.1. Principles of Effective Writing
10.2.2. Principles of Effective Presentation
10.2.3. Intellectual Property Issues
10.2.4. Supporting Resources
10.2.5. Legal, Ethical and Privacy Issues, Publication Policies

11. General Computing Competencies

11.1. Skills
11.1.1. Use of Appropriate Technologies
11.1.2. Use of Database Management Systems (e.g., Database Access)
11.1.3. Use of Data Mining System
11.1.4. Use of a Browser
11.1.5. Use of E-Mail Systems
11.1.6. Use of Report Generation Systems
11.1.7. Use of Voice and Other Data Input
11.1.8. General Internet Skills
11.1.9. Creation of Internet-Based Documentation
11.1.10. On-Line Literature Searching and Web-Browsing

11.2. Knowledge
11.2.1. Computer Literacy
11.2.2. Basic/Intro/Overview Knowledge of Potential Technologies
11.2.3. Principles of Database Management
11.2.4. Basic Mathematics and Logic
11.2.5. Knowledge of Specific Content Area
11.2.6. Database Query and Report Generating
11.2.7. HTML and Other Mark-up Languages

12. Health Computing Competencies

12.1. Skills
12.1.1. Use of Patient Tracking System
12.1.2. Use of E-Book Technology
12.1.3. Use of Patient Database/Medical Records Tools
12.1.4. Use of Provider Inquiry Systems
12.1.5. Use of Appropriate Record Keeping System
12.1.6. Use of Patient Documentation System
12.1.7. Us of Decision Support Tools
12.1.8. Use of Appropriate Access Technologies (e.g. Wireless Devices.)
12.1.9. Use of Electronic Master Patient Index (EMPI) System
12.1.10. Use of Prompting and Alerting Systems
12.1.11. Use of Patient Status and Outcome Monitoring Software and Other Tools
12.1.12. Use of Point-of-Care Systems
12.1.13. Use of Single Care Plan System (by entire team)
12.1.14. Use of Telehealth Systems for Remote Care
12.1.15. Use of Scheduling/Shared Scheduling Systems
12.1.16. Use of Wait-List Management Software
12.1.17. Use of Practice Guidelines and Practice Guidance System
12.1.18. Use of Practice Management System
12.1.19. Use of Ordering and Results Systems
12.1.20. Use of Rule Specification System
12.1.21. Use of Data Warehousing System/Management Reporting System
12.1.22. Use of Event Documentation Systems
12.1.23. Use of Discharge Planning System
12.1.24. Ability to Manage Demographic Database
12.1.25. Data Entry Skills
12.1.26. Selecting and Using the Appropriate Technology
12.1.27. Generating Patient-Care Information From Electronic Repositories
12.1.28. Ability to Specify Logical and Arithmetic Algorithms
12.1.29. Determining Content of Electronic vs. Paper Record

12.2. Knowledge

12.2.1. Knowledge of Unique Identification Issue (Patient, Provider, Electronic Signature)
12.2.2. Knowledge of Clinical Content
12.2.3. Knowledge of Controlled Vocabularies
12.2.4. Principles of Privacy, Confidentiality, and Security
12.2.5. Knowledge of Performance and Limitations of Decision Support Systems
12.2.6. Knowledge of Standards for Data Exchange
12.2.7. Knowledge Regarding Transferring Information from Paper to Electronic Format
12.2.8. Tele-Health Communication Protocol
12.2.9. Knowledge of Personal Experience Registry Concept
12.2.10. Knowledge of Billing Process and Systems Support of Billing (Specific Knowledge of Software that Addresses the Needs for Accurate of Billing and Reporting, Billing and Collection Techniques, Strategies to Maximize Revenue Legitimately, Billing Policy and Procedures, Knowledge of Billable Items)
12.2.11. Specific Domain Knowledge (Knowledge of Event Types and Consequences)
12.2.12. Knowledge of Possible Clinical Indicators
12.2.13. Basic Knowledge of Supporting Hardware (Workstations, PDAs, etc.)

13. General Health System-Related Competencies

13.1. Knowledge

13.1.1. Principles of Evidence-Based Practice
13.1.2. The Nature and Operation of the Health System
13.1.3. Other Health and Health System-Related Knowledge is Expected to be Included in Clinical Training (If not, see AH/ Health System Related Knowledge)
13.1.4. Principles of Evidence-Based Practice
13.1.5. Knowledge of Specific Systems
13.1.6. Knowledge of Administrative Requirements
13.1.7. Knowledge of Possible Technologies and their Roles
13.1.8. Knowledge of Protocols and Best Practices
13.1.9. Knowledge of Legal and Regulatory Requirements

14. Information and Data Collection, Architecting, Analysis, and Management, and Distribution Competencies

14.1. Skills

14.1.1. Survey Design
14.1.2. Interviewing Skills
14.1.3. Ethnographic Observation Skills
14.1.4. Data/Information Interpretation and Synthesis
14.1.5. Identifying Sources and Resources
14.1.6. A Variety of Methodologies to Collect Information

14.2. Knowledge

14.2.2. Principles of Database Management
14.2.3. Principles of Data Collection, Processing, and Management
14.2.4. Privacy, Confidentiality, and Security Issues (Principles, Legislation, Regulation)
14.2.5. Knowledge of Data Standards
14.2.6. Understanding Aggregated Information
14.2.7. Understanding Data Quality Issues (errors, integrity etc.)
14.2.8. Knowledge of Data Communications Strategies

DETAILED COMPUTING AND HEALTH SYSTEM COMPETENCIES - FROM THE AHI CURRICULUM

Note: The following should not be viewed as required competencies for the clinician, but rather as a list of competencies from among which the clinician might select a few for deeper study when he or she faces particular situations that are IT-intensive. The clinician should likely aspire to at least be aware of these competencies, and use them as an index.

1. General Computing Competencies for AHI Professionals
   1.1. Skills
   1.1.1. Information Finding Skills and Techniques
   1.1.2. Personal IT Productivity Tools Proficiency
   1.1.3. Research Skills and Techniques, General
   1.1.4. See “Key IT Usage Competencies”

   1.2. Knowledge
   1.2.1. Applications, Knowledge of Specific
   1.2.2. Artificial Intelligence in Health Systems, Principles of
   1.2.3. Communications Systems, Multimedia, WANs, LANs, VPNs, CHINs, and Other Health Information Networks, Principles of
   1.2.4. Encryption, Decryption, and Compression, Principles of
   1.2.5. Virtual Conferencing and Collaboration
   1.2.6. Internet-Based Systems, and the Nature and Operation of the Internet and WWW
   1.2.7. Interactive Systems: Interfaces for Providers, Provider Workstation, Interactive Technologies; User-Adaptive Systems
   1.2.8. Human Factors (Ergonomics) in Health Information Systems
   1.2.9. Data Mining, Principles of
   1.2.10. Data Warehousing, Principles of
   1.2.11. Database and File Management
   1.2.12. Database and File Management
   1.2.13. Hardware Components and Capabilities, Knowledge of
   1.2.14. IT and IM, Basic Concepts of
   1.2.15. Non-Health Organizations’ Approaches to Addressing IT/IM, Knowledge of
   1.2.16. Operating Systems and Languages (Non-Derived)
   1.2.17. Personal Productivity Applications and Their Capabilities, Knowledge of
   1.2.18. Search Engines, Principles and Use of
   1.2.19. Software Packages or Tools That Support the Skill, Technique, or Method, Knowledge of Specific
   1.2.20. Standards and Standard Development Activities, Knowledge of
   1.2.21. Systems and Modules, Knowledge of Specific
   1.2.22. Systems Architectures: Distributed Systems, Client-Server Systems, 3-Layer Architectures, Systems Integration
   1.2.23. Technologies, Knowledge of Specific

2. Health Computing Competencies for AHI Professionals
   2.1. Knowledge
2.1.1. Enterprise-Level Systems (CDR, CPR, ADW, Health Portals, Health Data Mining, etc.), Nature and Capabilities of
2.1.2. Previous Approaches/Work in Health Systems, Knowledge of
2.1.3. Roles, Capabilities, and Limitations of Health IT/IM Vendors, Products, and Infrastructural Technologies, The
2.1.4. Health Information Systems: Hospital, Clinical, Ambulatory, Office, Community, etc.
2.1.5. Departmental Information Systems: ADT, LIS, RIS, Pharmacy, Nutrition, Health Records, etc.
2.1.6. Image Management and Access Systems; Image Processing and Reconstruction; PACS
2.1.7. Health Administration Support Systems: Financial Information Systems; HRIS; ERP Systems
2.1.8. Management and Executive Information Systems in Health
2.1.9. Computer-Based Patient Records
2.1.10. Patient Interviewing
2.1.11. Health Status Evaluation, and Other Direct Patient-Used Systems
2.1.12. Clinical Trial Management Systems
2.1.13. Experiment Management Systems
2.1.14. Telehealth, Telemedicine

3. Key IT Usage Competencies for AHI Professionals

3.1. Skills
3.1.1. Data Mining System, Use of Specific
3.1.2. DBMS, Use of Specific
3.1.3. SQL Query Skills
3.1.4. Query Package, Use of Specific
3.1.5. Middleware Tools, Use of Specific
3.1.6. Presentation Graphics Package, Use of Specific
3.1.7. Product-Specific Tools Skills
3.1.8. Query Tools, Use of Specific
3.1.9. Search Engines, Use of
3.1.10. Security Tools, Use of Specific
3.1.11. System Tools, Use of Specific
3.1.12. Statistical Analysis Techniques, Basic Skills
3.1.13. Statistical Package, Use of Specific
3.1.14. System Monitoring Tools, Use of Specific
3.1.15. Maintenance Tools, Use of System-Specific

3.2. Knowledge
3.2.1. Inter/Intranet Data Query Applications, Knowledge of
3.2.2. Software Packages or Tools That Support the Skill, Technique, or Method, Knowledge of Specific
3.2.3. Statistics, Basic

4. General Health System-Related Competencies

4.1. Knowledge
4.1.1. Strategic View of the Health System: Health System Mission, Goals, Objectives, Strategies, Tactics, Cultures, and Values
4.1.3. Organization and Management of the Health System, The
4.1.4. Decision-Making Principles and Processes in the Health system
4.1.5. Roles, Responsibilities, and Accountabilities of Health Systems Professionals, The
4.1.7. Health-Related Regulation, Legislation, Policy, and Custom
4.1.8. Funding and Governance of the Health System: Federal, Provincial, Regional, and Institutional, The
4.1.9. Health System, Finance and Budgeting
4.1.10. Health System and Stakeholder Interests, Knowledge of
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### CHI Working Group – ON-Line Participants

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