

How to Teach Health IT Evaluation: Recommendations for Health IT Evaluation Courses

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Abstract. Systematic health IT evaluation studies are needed to ensure system quality and safety and to provide the basis for evidence-based health informatics. Well-trained health informatics specialists are required to guarantee that health IT evaluation studies are conducted in accordance with robust standards. Also, policy makers and managers need to appreciate how good evidence is obtained by scientific process and used as an essential justification for policy decisions. In a consensus-based approach with over 80 experts in health IT evaluation, recommendations for the structure, scope and content of health IT evaluation courses on the master or postgraduate level have been developed, supported by a structured analysis of available courses and of available literature. The recommendations comprise 15 mandatory topics and 15 optional topics for a health IT evaluation course.

Keywords. Evaluation studies, curriculum

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1. Introduction

High-quality and efficient health care seems not possible nowadays without the support of information technology (IT) [1]. Health IT has been shown to improve the quality and efficiency of clinical processes and health outcome, and to reduce morbidity, mortality and costs [2]. However, the impact of health IT may not be optimal, and it can also pose risks to patient safety. To verify that appropriate benefits are forthcoming and unintended side effects of health IT are avoided, systematic evaluation studies are needed to ensure system quality and safety, as part of an evidence-based health informatics approach [3, 4].

To guarantee that health IT evaluation studies are conducted in accordance with appropriate scientific and professional standards, well-trained health informatics specialists are needed. The recently updated recommendations of IMIA, the International Medical Informatics Association, on health informatics education [5] state that the topic “evaluation and assessment of information systems” should be part of health informatics curricula; arguably aspects of it should also be in wider health management and policy curricula so as to ensure achievement of an evidence-based approach in practice. However, the IMIA recommendations do not give details on what should be taught with respect to evaluation as part of a health informatics curriculum.

The objective of this contribution is to provide recommendations for the structure, scope and content of health IT evaluation courses.

2. Methods

The overall approach consisted of an iterative process, coordinated by the working groups on health IT evaluation of EFMI (European Federation for Health Informatics), IMIA (International Medical Informatics Association) and AMIA (American Medical Informatics Association).

First, structure, scope and content of successfully running health IT evaluation courses from ten university courses in Europe, the United States and Australia were collected (openly available at [6]). Also, core literature on health IT evaluation (e.g. [4, 7, 8]) was analysed regarding content. Then, an open workshop at Medical Informatics Europe (MIE2014) in Istanbul with 30 participants collected ideas for recommended core content in a structured way. Results from the course analysis, literature analysis as well as from this workshop were then aggregated to form a preliminary list of initial recommendations comprising 33 content items as well as the structure and scope of the course. This list was verified by discussion among the authors of this contribution.

In a follow-up open workshop at Medical Informatics Europe (MIE2015) in Madrid, the 25 participants were then asked to judge the importance of each of these content item (high, medium, low), and to identify possible missing items. Overall, five new items were proposed. In an updated version of the recommendations, items were now separated into mandatory content (for those considered important by the majority of participants) and optional content (for the rest).

The updated recommendations were then validated in an open workshop at Medinfo 2015 in Sao Paolo. The 16 participants discussed whether they were clear and comprehensive. The resulting version of the recommendations consisted of 14 mandatory and 12 optional content items.

A follow-up open workshop at AMIA 2015 in San Francisco with 15 participants was used to further validate the recommendations. Suggestions for optional content were added, alongside suggested clarifications. After this workshop, the final version of the recommendations consisted of 15 mandatory and 15 optional content items.

3. Recommendations for health IT evaluation courses

3.1. Structure and scope of the course

- **Focus of the course²**: Theoretical & practical introduction into health IT evaluation.
- **Level of the course**: Master or postgraduate level.
- **Course objective**: Students should be able to: i) plan their own (smaller) evaluation study; ii) select and apply selected evaluation methods, iii) perform a study and report its results; and iv) appraise the quality and the results of published health IT evaluation studies.
- **Scale of the course**: The mandatory core topics can be taught in a course of 6 ECTS (European Credit Transfer and Accumulation System³) which is equivalent to 4 U.S. credit hours⁴. U.S. programs may choose to offer the more standard 3-credit hour, semester long course. The duration of the course can be longer if optional content or extended practical training is added.
- **Format of the course**: Courses may be given in various module formats and structures (e.g. traditional class room courses, blended learning courses, or fully online courses that follow best practices).
- **Participants**: The recommendations address multidisciplinary groups of students, with backgrounds for example in computer science, health informatics, medicine, nursing, social science, information sciences, or business.
- **Practical training**: The recommendations suggest that practical evaluation training is included; this training can focus on different aspects, depending on the learning objectives, the level of participants, and the available time.
- **Prerequisites**: Before joining the health IT evaluation course, the students should have obtained sufficient background knowledge in the following basic research topics: Philosophy of science, scientific evidence, literature searching and critical appraisal, designing a research study, ethical principles of research, quantitative research methods and statistics, qualitative research methods, management of research projects, and clinical care delivery processes and health IT. If students do not have this knowledge beforehand, this needs to be added to a health IT evaluation course.

² In these recommendations, the term “course” refers to an identifiable part of an overall degree programme, such as a module or a unit.

³ ECTS is a standard for comparing the study attainment and performance of students of higher education across Europe; 6 ECTS are equivalent to 150 - 180 hours of overall student workload (both classroom time and homework). Six ECTS is roughly equivalent to 10% of an academic year.

⁴ 1 credit hour = 50 minutes spent in class.

3.2. Content of the course

Table 1 presents the recommended core content.

Table 1. Recommendations for mandatory and optional content of health IT evaluation courses.

Mandatory core topics	
Theory	
A1	Need for evidence-based health informatics (i.e. health IT and patient safety, efficiency, quality, user satisfaction), and reasons for undertaking evaluations
A2	Theories of evaluation (e.g. inductive or deductive, formative or summative)
Practice	
A3	Building an evaluation study (e.g. information needs, stakeholder analysis, tailor the evaluation, steps of an evaluation study, obtain permissions)
A4	Study designs for health IT evaluation studies (e.g. experimental, quasi-experimental, observational)
A5	Indicators for health IT quality (structure, process, outcome quality) and their relation to clinical indicators
A6	Practical training in health IT evaluation (e.g. write an evaluation plan based on a realistic case study; conduct a real evaluation project; discuss and criticize a published evaluation study)
Methods and metrics	
A7	Measurement principles (e.g. objectivity, reliability, validity of measurements, types of bias)
A8	Quantitative data collection methods in health IT evaluation
A9	Qualitative data collection methods in health IT evaluation
A10	Multi-methods approaches and triangulation
A11	Quality of health IT evaluation studies
Reporting	
A12	Reporting and publishing of an evaluation study
A13	Finding, appraising and interpreting the evidence from published evaluation studies
A14	Answering “so what...” questions: What do evaluation results mean for IT management and for the quality and safety of clinical processes? How can evaluation results impact health IT practice?
Ethics	
A15	Obtaining ethical approval and other required permissions for evaluation projects
B Optional topics (examples to be chosen based on available time and background of participants)	
B1	Evaluation frameworks for health IT evaluation
B2	Evaluation of user and technology acceptance
B3	Evaluation of usability
B4	Technical evaluation (software testing)
B5	Evaluation of people and organizational issues
B6	Evaluation of clinical impact
B7	Economic evaluation
B8	Socio-technical and implementation-science approaches to evaluation
B9	Evaluation as part of quality and safety management and improvement frameworks
B10	Evaluation of data quality and data analytics
B11	Evaluation of health IT implementation
B12	Health Technology Assessment
B13	Systematic reviews and meta-analysis
B14	Simulation studies as an approach to evaluate health IT
B15	Regulatory issues impacting health IT evaluation (e.g. medical device regulations, FDA)

4. Discussion and conclusion

This paper presents recommendations for a health IT evaluation course as part of a master or postgraduate programme. Their development was coordinated by health IT

evaluation experts from North America, Europe and Australia, all with teaching experience in academic settings. In addition, around 80 workshop participants contributed with their expertise to the recommendations.

The recommended content should not be seen as a cookbook. It does not specify how many hours of lecturing should be invested in each sub-topic. This has to be decided by lecturers and course planners based on overall programme objectives, learning objectives for the evaluation course, background of the students, content of previous education, and available time. It also does not describe specific learning outcomes.

The recommendations assume that all items are taught on an introductory level. Extended knowledge, e.g. in qualitative methods, could be covered in specialized lectures, as well as the listed optional topics. It is also possible to split the content into a basic course (3 ECTS) and an advanced course (3 ECTS).

Riding a bike cannot be taught by theory alone. Thus, we recommend including interdisciplinary practical training – either on an individual basis or even better in interdisciplinary groups of students. When real evaluation projects are conducted by students, a good balance between the available time, the complexities of real-life evaluations and the need to provide meaningful evaluation results is often a challenge.

Follow-on activities which are desirable as part of this continuous educational development program are consulting a wider stakeholder group on the recommendations and validating it through use and review in academic practice.

We invite all teachers of health IT evaluation courses to use these recommendations when designing an evaluation course, to add their course description to [6], and to report on their experiences. We also invite feedback on the use of the principles of this module as a means of instilling an evidence-based approach to health informatics application in wider health policy and health care delivery contexts.

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References

- [1] Haux R, Medical informatics: past, present, future, *Int J Med Inform*, **79**(9) (2010),599-610.
- [2] Lau F, Kuziemsky C, Price M, Gardner J, A review on systematic reviews of health information system studies, *J Am Med Inform Assoc*, **17**(6) (2010),637-45.
- [3] Rigby M, Ammenwerth E, Beuscart-Zephir M, Brender J, Hyppönen H, Melia S, et al., Evidence Based Health Informatics: 10 years of efforts to promote the principle, *Yearb Med Inform*, **8**(1) (2013),34-46.
- [4] Ammenwerth E, Rigby M, editors. Evidence-Based Health Informatics. Amsterdam: IOS Press; 2016.
- [5] Mantas J, Ammenwerth E, Demiris G, Hasman A, Haux R, Hersh W, et al., Recommendations of the International Medical Informatics Association (IMIA) on Education in Biomedical and Health Informatics. First Revision, *Methods Inf Med*, **49**(2) (2010),105-20.
- [6] EFMI WG Eval. Curricula of Health IT Evaluation Courses [Available from: <https://iig.umat.at/efmi/curricula.htm>]. Last access: 10.10.2016.
- [7] Friedman C, Wyatt JC, *Evaluation Methods in Medical Informatics*, 2nd ed, New York: Springer, 2006.
- [8] Brender J, *Handbook of Evaluation Methods for Health Informatics*, Burlington, MA: Elsevier Academic Press, 2006.