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Complementary core competencies for master of science in epidemiology students

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Abstract

Introduction: Competency-based education has been recommended in training and education of public health to reduce the gap between traditional teaching and the competencies required in practice. Epidemiology as a fundamental of public health science has come to attention. The aim of this study was to introduce a complementary core competency program for Master of Science (MSc) in epidemiology students in Iran.

Methods: A workgroup in the department of statistics and epidemiology of Tabriz University of Medical Sciences including five epidemiologists and three biostatisticians prepared an outline of complementary core competencies for epidemiology MSc students. In the first step several discussion rounds were done to review the current curriculum, then the workgroup sought students' opinions to find out about their needs. In addition, a review of the current literature around the topic was done. In the final step the program components were developed by the workgroup and initially implemented.

Results: A complementary program consists of eight domains: general knowledge, problem finding, data analysis and interpretation, communications, management, consultation, leadership skills and professionalism. This program focused on basic competencies and those competencies outside the major field for a graduate of epidemiology to enhance their knowledge, attitude and skills. The program was scheduled to run in the third semester and approximate time for completion was three months.

Conclusion: The development and initial implementation of the complementary core competency program was successful and the authors will attempt to extend the program and evaluate the implementation phase.

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Introduction

Epidemiology as a fundamental of public health is defined as: "The study of the distribution and determinants of health-related states or events in specified populations and the application of this study to the control of health problems".¹

Epidemiology graduates (MSc/PhD) are expected to perform a variety of tasks, from educational and research tasks to working as a field epidemiologist or performing a management role. They need to use various methods to conduct descriptive studies and a surveillance system to

study distribution. The more complex methods require studying determinants and efficacy of intervention.^{2,3} To perform successfully in their future career either in the public health setting or an academic/research environment, epidemiology graduates need to show acquisition of most or all particular competencies prior to the award of their degree. Therefore, in order to acknowledge the depth and complexity of epidemiology, the focus should be toward enhancing competencies to improve performance.^{4,5} Over the last decades there has been considerable growth in the size and diversity of contents of epidemiology as a

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core of public health science.⁶⁻⁹ It has had a major effect in solving a variety of health concerns in societies, but concerns have arisen about the competencies required to perform as an epidemiologist.⁸⁻¹⁰

Competency-based education has been recommended for public health training and education in order to minimize the gap between traditional programs and the practice of competency requirements.⁹ Several frameworks have been proposed for competency-based medical education.¹¹⁻¹³ In developed countries, the basis of training of the majority of medical students is according to these frameworks.¹⁴ Although there is evidence of development of such competencies,¹⁵⁻¹⁷ the competency-based education approach in public health is very new and there is little evidence about its application and effectiveness. Therefore, it is important to explore future directions for this approach to prepare health professionals and translate these competences into specific learning objectives with measurable outcomes.

Currently in Iran, a number of medical universities offer the MSc degree in epidemiology.¹⁸ Although the main element of curriculum is overall the same, the manners of teaching, assessment and expectations are different. There is variability in delivering courses, teaching methods, assignments and expectations among faculties. Moreover, the method of teaching and training is mostly traditional and without any link to actual demands of the student's future job requirements as an epidemiologist in public health settings or an academic/research environment. In addition, there is no evaluation system for assessment of graduates' competencies and exact job prospects.¹⁸

The idea of this work dates back to 2013 when the first group of epidemiology students began their research work to fulfill their thesis requirements. We found that their performance in conducting, managing and analysis of data as well as communication and management was not sufficient and the coursework had not covered adequately the required competencies. The aim of this work was to develop a complementary core competency program for MSc students of epidemiology before commencement of their thesis.

Materials and Methods

The department of statistics and epidemiology of Tabriz University of Medical Sciences in Northwest Iran has offered a MSc in epidemiology since 2012. To enter the program, students must take a National Entry Exam that is held annually.

In 2013, a workgroup in this department including five epidemiologists and three biostatisticians began to develop complementary core competencies for epidemiology graduates. In order to design the program, the workgroup members first discussed the topic and reached a conclusion about the expected competencies based on a review of the current curriculum and the job description and expectations for epidemiologists in different settings. The workgroup assessed the current MSc program catalogue, the course plans for each topic, the way the course is delivered, assessment and examination methods, facilities

and the method of teaching and learning. Secondly, a literature review was done to find out about similar works in other countries and, finally, they sought the students' opinions to find out about their expectations and needs. The main focus used to develop a set of core competencies was based on Harden's three-circle model for medical education, which was developed in 1999 by Harden et al.¹⁹ According to this model the learners move from basic competencies to meta-competencies.²⁰ Although this model was first developed for medical education, it is an educational philosophy that can be used at any level of education from undergraduate to continuing levels of education by health professionals.²¹

Finally, the workgroup proposed the initial program based on these initial steps.

In order to conduct initial implementation of the program, a laboratory was equipped with computers, and a timetable for research meetings, workshops, consultation sessions, epidemiology and biostatistics hour (epi & biostat hour) as well as field work was scheduled. Students received the program materials and instructions early in semester three. The approximate time for completion of the program was three months. Students were required to complete a range of tasks and participate in scheduled practical sessions and field work. Although the main educational approach was outcome-based education, several methods of education were used such as problem-based learning, task-based learning, field work and practical sessions. The aim of practical sessions was to enhance specific competencies such as consultation skills, presentation and interpretation competencies. Attending relevant workshops like sample size calculation, epidemiology and biostatistics hour (this is a fortnightly session in which the advance concepts in epidemiologic studies are discussed and presented by members of the department) was also desired in order to improve specific competencies such as presentation. Students were required to participate in epidemiologic and statistical consultation sessions run by academic members of the department and take part in specified field work in order to improve problem finding competencies, enhance their abilities in relation to collection of data in different types of studies, to identify issues around the administration of different study instruments by participation in different projects and visit the research field of large epidemiologic studies.

The evaluation was based on students' performance in each domain. Assessment was based on both formative and summative evaluation depending on the output required for each domain. Students were required to achieve 70% of expectations for selected domains based on their performance of specific tasks and fulfill the required practical sessions.

The provisional program was designed based on outputs of discussion group rounds, the literature review and students' opinions and then finalized after evaluation of initial implementation of the program. Students' needs and satisfaction were also considered.

This work has received the approval for implementation

from the education and research council of the Health Faculty with no funding received.

Results

In the first step, the assessment of the current course catalogue was done by the workgroup. In the current curriculum, MSc students of epidemiology have to undertake several core courses in the areas of epidemiology and biostatistics and some elective courses over three semesters (32 credits of coursework). There are some additional basic courses such as research methodology, literature searching and how to write a paper in English that all MSc students in the university have to pass as general courses. Then students must complete a research-based thesis followed by a prestigious thesis defense session. The program is full-time and in order to meet the coursework requirements students must undertake an exam for each course as the main evaluation at the end of each semester and receive a grade of 14 and higher out of 20, otherwise the course is failed and should be taken again. The methods of teaching are: lectures, assignments or presentations and group discussion in most epidemiologic courses, and lectures, problem-solving using computers and assignments in statistical courses.

The workgroup found that these course plans have not been updated based on the national and local demands in public health settings. Although expert opinion was used in developing the program catalogue, it has limited public health focus and it follows traditional education methods. Some competencies such as communication and leadership skills, consultation and interdisciplinary focus received the least credits.

The next step was conducting a literature review. The results of the literature review showed that this is not only a challenge in Iran and competency-based education has been recommended for training and education of public health in recent years. The search was focused on finding relevant projects worldwide aiming at the development of core competencies in this field. Most efforts were focused toward enhancing epidemiologic competencies of non-epidemiologist public health practitioners, MSc of public health students and applied epidemiologists.

Students' opinions were important in finding out what they think about their abilities to perform effectively in their future jobs. A variety of comments were received, but the most important comments were that they were not feeling they could perform well practically in real situations in areas of doing expected statistical analysis, research consultation, management of large projects, working with real data and making a conclusion for health providers, and, finally, they felt they had a lack of leadership skills.

The workgroup assessed the outputs of these steps and proposed the initial program as complementary core competencies for MSc in epidemiology students. The proposed program is divided into seven domains as illustrated in Table 1.

In order to initially evaluate the program, two groups of students from different enrollment years took part in the

implementation phase. They completed the program and its requirement successfully and achieved the expected score (at least 70% in some domains) and fulfilled the practical sessions according to the plan.

Discussion

The eight members of the workgroup provided a list of complementary core competencies for epidemiology MSc students in order to enhance their knowledge, ability and skills for their future careers. It should be mentioned that this program is in addition to current coursework in order to increase the level of students' competencies. The final program was developed and it was divided into eight domains. The initial implementation of the program was successful and students were satisfied; however, this is the initial program and the program needs to be refined before further extension and introduction to other faculties. Epidemiology is a fundamental of public health sciences, and has a major effect on solving a variety of health concerns in society. However, there is diversity in the level of expertise and experience among public health epidemiologists.²² The world is facing new health challenges: non-communicable diseases, population aging,¹⁹ public awareness, globalization, new technologies and the sudden arrival of new infectious diseases such as HIV/AIDS,²³ which all bring into attention that the traditional way of teaching in public health institutes does not adequately address these challenges. There is a need to modify and look further to train competent people for the public health workforce.

Epidemiology competencies have been regarded as important for public health practitioners.¹⁶ The Northwest Center for Public Health Practice (NWCPHP) at the University of Washington started the Epidemiology Competencies Project with the goal of developing competency-based epidemiology training for non-epidemiologist public health practitioners in the northwestern United States in 2002. NWCPHP has found the epidemiology competencies useful for training development.¹⁵ In 2004, the Centers for Disease Control and Prevention (CDC) and the Council of State and Territorial Epidemiologists (CSTE) developed competencies for applied epidemiologists in governmental public health agencies to improve and increase the practice of epidemiology in the public health workforce. Applied epidemiologists could classify into entry level (Tier 1), midlevel (Tier 2), senior epidemiology management (Tier 3a) and scientist positions (Tier 3b), on the basis of these competencies.²⁴

In the United Kingdom, a Public Health Skills and Career Framework²⁵ has been developed, which is an attempt to define competencies for seven levels of public health employment. In addition, through a year-long process, ASPHER developed six main domains of public health competencies.²⁵⁻²⁷ The European Centre for Disease Prevention and Control (ECDC) together with a group of experts ('core competencies group') announced a list of suggested core competencies for field epidemiologists working in public health institutions in the European

Table 1. Complementary epidemiology core competency domains and sub-domains

Domain	Sub-domain	Prerequisite	Evaluation
1. General knowledge and information extraction	1.1 National and international epidemiologic databases and studies 1.2 Literature searching/organising and making summary table 1.3 Epidemiologic study types, advantages and limitations 1.4 Critical appraisal of different types of studies (cross-sectional, case-control, cohort, clinical trials, and systematic review 1.5 Bias and confounding in epidemiologic studies	Basic and advance epidemiology and biostatistics courses, Excel, Word, Endnote	Task-based activities
2. Problem finding	2.1 Assessment of an epidemic 2.2 Identification of a health problem in a population 2.3 Identification of determinants of the health problem 2.4 Identification of steps towards prevention and control 2.5 Identification of the health service use 2.6 Define the health problem using appropriate epidemiologic measures	Basic and advance epidemiology/biostatistics	Task-based activities Field work
3. Management skills	3a Project management 3a.1 Documentation, monitoring study progress and preparing status reports 3a.2 Recruitment and retention of study population 3a.3 Evaluation of administration of various study instruments 3a.4 Timetable to meet deadlines and to do task accordingly 3a.5 Identifying key persons and resources 3a.6 Independent function and ability to work in a team environment 3b Data management 3b.1 Development and maintaining a database 3b.2 Cleaning and monitoring database 3b.3 Make a data book, user guide 3b.4 Identification of limitation of available data	Excel, Word, statistical software	Develop management strategy through the task-based activities
4. Data analysis and interpretation	4.1 Calculate the major epidemiologic measures 4.2 Standardization method 4.3 Descriptive and analytic analyses (univariate, stratified analyses) 4.4 Statistical modelling (multivariate analyses) 4.5 Calculation and interpretation of measures of association 4.6 Sample size/ power calculation 4.7 Randomization 4.8 Preparing summary results in an appropriate way 4.9 Translate the data analyses output into public health implications, proposed areas and directions of further research	Basic and advance epidemiology and biostatistics courses Excel, relevant statistical software, sample size calculator	Task-based activities using

Table 1. Continued

5. Consultation	<p>5.1 Epidemiologic consultation skills (proposal/report/manuscript review)</p> <p>5.2 Statistical consultation skills (proposal/report/manuscript review)</p> <p>5.3 Epidemiologic and statistical advice to other researchers from different disciplines</p> <p>5.4 Manuscript review</p>	Epidemiology and biostatistics, statistical software	Practical sessions
6. Communication	<p>6.1 Oral presentation, in-writing presentation of research findings</p> <p>6.2 Preparing first draft of a manuscript for publication/ technical report</p> <p>6.3 Present data graphically</p> <p>6.4 Communicate epidemiologic findings to professional and non-professional audience</p> <p>6.5 Effective interaction with various stakeholders using variety of communication methods (letter, in person, Skype, email)</p>	PowerPoint, Word, Excel, relevant statistical software, graphic software, Internet	Presentation in Research meeting, Task-based activities
7. Professional conducts and Ethical practice	<p>7.1 Respectful and professional manner in interacting with others</p> <p>7.2 Ability to respond and work appropriately within a team</p> <p>7.3 Take guidance from the leaders, colleagues and other experts</p> <p>7.4 Identification of Ethical issues in research conduct</p> <p>7.5 Respect to population diversity in research conduct</p> <p>7.6 Respect and follow the ethics guidelines in research</p>	Ethics in medical research & Professional ethics course	Case studies
8. Leadership	<p>8.1 Self-promotion and self-reflection</p> <p>8.2 Describe the research priorities of the public health works, and apply them in practice.</p> <p>8.3 Describe organization missions and promote and support actions towards that</p> <p>8.4 Facilitate a learn session for the interdisciplinary team</p> <p>8.5 Develop and run an educational session for different audience</p> <p>8.6 Participate in a mentoring program within a team</p>	Basic & advanced epidemiology, Leadership materials	Case studies, Practical sessions

Union at all levels, ranging from sub-national (provinces, districts, regions) to national and supra-national (European and international).²⁰

In light of evidence from different countries, developing and increasing epidemiology competencies is a key element to facing the new public health challenges successfully.

Our proposed program is complementary and along with the specific coursework could enhance the students' competency to perform in their future careers with more confidence. There is a need for expansion and evaluation of the program before generating a final conclusion. The workgroup has a plan to revise and finalize the program and then introduce the program to other epidemiology departments around the country. We will discuss the topic and invite other experts to participate in a national workgroup to provide a final program based on local needs.

Ethical approval

Not applicable.

Competing interests

None.

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