

DEVELOPMENT AND IMPLEMENTATION OF A PRACTICAL PUBLIC HEALTH TRAINING SYSTEM IN CHINA

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Abstract. Public health education is becoming an increasing priority among educators of medicine. In China, little attention has been paid to public health education reform. A new public health training system was introduced in China in 2007. We conducted this study during 2006-2012 to evaluate the graduate core competencies under the new system. Data were collected from 231 graduates and 49 public health agencies. The 144 graduates who enrolled in 2006 and were trained under the old system constituted the control group; the 87 graduates who enrolled in 2007 and were trained under the new system constituted the experimental group. Surveys of graduate core competencies found analyzing and solving problems in the laboratory, conducting on-site practice and learning new technologies were the top three abilities most expected by public health agencies. After 5-year practical ability training, the graduates in the experimental group had better performance; on-site practical ability and laboratory practical ability increased significantly by 24.5% and 20.0%, respectively. Three other important competencies also improved: designing epidemiologic surveys, collecting information from the literature and doing statistical analyses. However, preventing and controlling common diseases and dealing with emergencies remained weak. These results show the new training system should be continued, but revisions are needed to improve this training system, especially in the areas of preventing and controlling common diseases and dealing with emergencies.

Keywords: public health, education reform, training system, PR China

INTRODUCTION

To paraphrase a statement by Leavell and Clark (1965), all good medicine is

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public health. Public health is the only field in medicine that focuses on the health of populations rather than the health of individuals. Therefore, public health education is unique in that its successes are measured in groups of people, and the effects of prevention can only be seen at the population level (Applegate, 2003). Public health education is increasing in priority among educators of medicine (Pomrehn *et al*, 2000). The Association of American Medical Colleges and other

leaders in the field of public health have stressed the importance of the effective teaching of core competencies in public health in medical school curricula (Sutphen *et al*, 2003). However, the current status of public health education is not ideal. In America during 2006-2008, 34% of graduating medical students believed that their medical school curricula did not devote sufficient attention to key public health topics (Maeshiro *et al*, 2010). Part of the lack of competency of graduates was the low priority placed on practical abilities associated with public health (Cleary, 2003). In China, even in an era of substantial reforms in medical education and health care, little attention has been paid to education reform in public health. Medical knowledge is constantly evolving, but teaching methods and technology in public health have progressed slowly in China. Exam-oriented education is the dominant system for teaching public health in China, which restricts the student's positivity and creativity. Under the traditional educational system, practical public health abilities get less attention. As a result, some public health graduates exhibit a disconnection between theory and practice in practical work. The SARS, avian Flu and melamine-tainted milk powder crises in China exposed incompetency of public health staff.

There have been no formal studies evaluating reforms in public health teaching in China. In order to explore ways to improve public health teaching and elevate core competencies of graduates, we conducted this study during 2006-2012. The results of this study are of interest to people seeking education reform in public health and its relationship with the future of the specialty. Surveys were conducted in public health agencies to determine graduate core competencies expected by

employers. Based on these surveys by the Centers for Disease Control and Prevention (CDC), a revised teaching system for public health was designed that included laboratory practical training and on-site practical training. The graduate core competencies were evaluated prior to and after the implementation of the new training system to assess the preliminary effects of this new training system.

MATERIALS AND METHODS

Study objects

This study was conducted during 2006-2012. Forty-nine provincial public health agencies of the CDC in China were surveyed. Two hundred thirty-one public health students from Tongji Medical College were included in the present study: 144 students who enrolled in 2006 and were trained under the old system constituted the control group and 87 students who enrolled in 2007 and were trained under the new system constituted the experimental group. The new training system began in 2007 with the experimental group.

This study was approved by the Research Ethics Committee of Huazhong University of Science and Technology. All participants gave written informed consent prior to participation in the study.

Survey of graduate core competencies expected by public health agencies

To determine the graduate core competencies expected by public health agencies, a survey was conducted at 49 provincial health centers for disease control in 2006 using questionnaires. Nine core competencies were included in the questionnaire; each competency demand was divided into three levels: very necessary, necessary and not necessary.

Table 1
Graduate core competencies expected by public health agencies (%).

Content	Very necessary	Necessary	Not necessary
Collect information from the literature	53.2	46.8	0
Design epidemiologic surveys	79.6	20.4	0
Conduct on-site investigations	83.7	16.3	0
Prevent and control common diseases	54.2	45.8	0
Perform statistical analyses	78.7	21.3	0
Learn new technologies	83.3	16.7	0
Analyze and solve problems in the laboratory	85.4	14.6	0
Deal with emergencies	75.5	24.5	0
Coordinate skills	75.5	24.5	0

Evaluation of graduate core competencies

Before implementation of the new system, core competencies of students in the control group were evaluated. In order to assess the preliminary effects of this training system after being implemented for 5 years, an evaluation was carried out among students in the experimental group. Each core competency was divided into three levels: poor, fair and good.

Statistical analyses

The software program EpiData (version 3.0, www.epidata.dk) was used for data management. Statistical analyses were performed using SPSS, version 12.0 (SPSS, Chicago, IL). The chi-square test and Fisher's exact test were used to compare categorical data where appropriate. A $p < 0.05$ was considered statistically significant (two-sided test). All data were analyzed anonymously.

RESULTS

Graduate core competencies expected by public health agencies

To determine graduate core competencies expected by public health agencies prior to reform, a survey was carried out at 49 provincial or cantonal CDCs in China. Results indicate that surveyed CDCs put

more emphasis on ability to analyze and solve problems in the laboratory and conduct on-site evaluations (85.4% and 83.7%, respectively) (Table 1).

Evaluation of graduate core competencies

Prior to and after the change in the training system, core competencies were rated by provincial or cantonal CDCs using questionnaires. As indicated in Table 2, five core competencies were significantly improved. Ninety-two point six percent of graduates trained under the new system performed well in the laboratory; while only 72.6% of graduates trained under the old system had good performance. Ninety point four percent of graduates trained under the new system had good on-site practical ability; while only 65.9% of graduates trained under the old system had good performance. Moreover, under the new training system, the abilities of graduates in collecting information, designing epidemiologic surveys, and doing statistical analyses improved by 17.2% ($p = 0.021$), 21.2% ($p = 0.001$) and 16.5% ($p = 0.006$), respectively. However, only 57.0% of graduates trained under the new system had mastered how to prevent and control common diseases. The ability to deal with emergencies was also weak (Table 2).

Table 2
Evaluation of graduate core competencies prior to and after implementation of new training system.

Contents	Control group %			Experimental group %			χ^2	p-value
	Good	Fair	Poor	Good	Fair	Poor		
Collect information from the literature	63.0	34.2	2.8	80.2	18.5	1.3	7.697	0.021
Design epidemiologic surveys	68.3	25.6	6.1	89.5	7.9	2.6	13.967	0.001
Conduct on-site investigations	65.9	30.6	3.5	90.4	6.8	2.8	18.711	< 0.001
Prevent and control common diseases	57.7	39.6	2.7	57.0	40.5	2.5	0.054	0.973
Perform statistical analyses	73.6	25.0	1.4	90.1	8.6	1.3	10.173	0.006
Learn new technologies	73.6	25.0	1.4	82.7	16.1	1.2	2.601	0.272
Analyze and solve problems in the laboratory	72.6	27.4	0.0	92.6	7.4	0.0	14.090	< 0.001
Deal with emergencies	76.4	22.9	0.7	77.8	19.0	3.2	1.383	0.501
Coordinate skills	77.8	22.2	0.0	80.0	18.9	1.1	2.088	0.352

DISCUSSION

Public health is defined as “systematic efforts organized by society to protect, promote and restore the people’s health. It is the combination of sciences, skills and beliefs that is directed to the maintenance and improvement of the health of a population or populations through collective or social actions” (Last, 2001). However, the Chinese public health system has been found weak during a series of public health crises. The outbreaks of SARS and avian influenza and the problem of melamine-tainted milk powder exposed incompetencies of public health staff. Therefore, to improve competencies of public health staff is urgent and necessary. However, our current educational system, exam-oriented education, seriously restrains the innovative thinking of students and weakens their competencies. Although there have been substantial reforms in medical education and the health system in China, little attention has been paid to public health education reform. In order to explore effective ways to improve public health teaching and elevate competencies of graduates, we designed and conducted the new training system. Our findings show that the new training system is an improvement of the old one but there are still deficiencies.

In order to make the teaching reform more targeted and specific, we conducted surveys prior to the teaching reform. The findings show practical laboratory ability and on-site practical ability are two important competencies emphasized by public health agencies, which are weak among public health graduates. In the new training system, we developed and implemented a laboratory practical ability training system and an on-site practical ability training system.

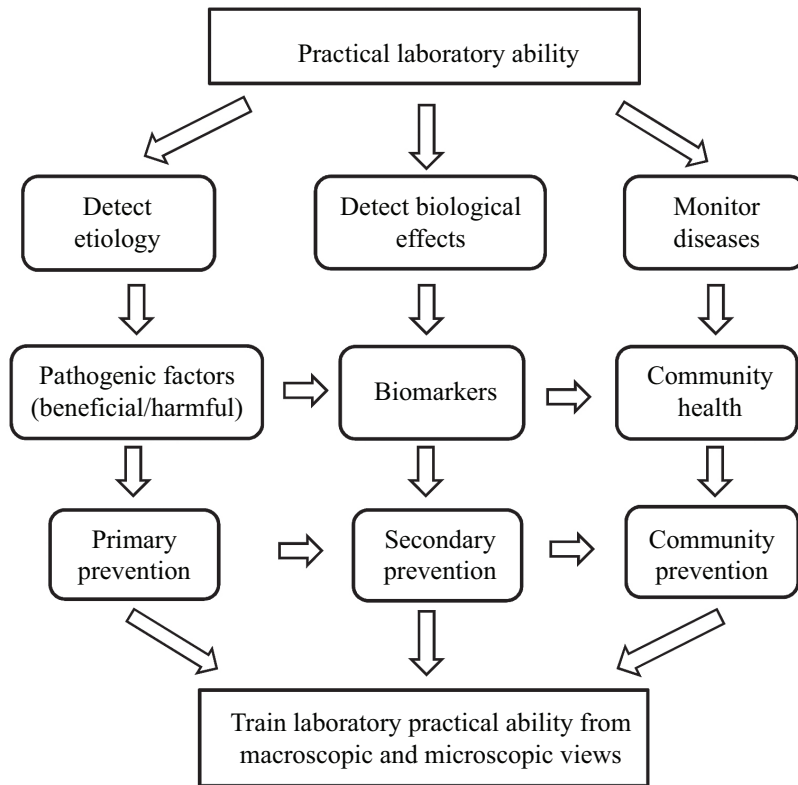


Fig 1–The practical laboratory ability training system.

Our study found competency in epidemiology, toxicology and health statistics are important for public health. In the new training program teaching groups were developed to detect the etiology of health problems, detect biological factors influencing problems and monitor diseases (Fig 1). The teaching group for detecting the etiology of problems trains and promotes the student’s skills in detecting pathogenic factors and strengthens their understanding of primary prevention. The teaching group for detecting biological effects helps the students fully realize the importance of biological effect monitoring in the secondary prevention. The teaching group for monitoring diseases helps the students establish a group concept and macro mode of thinking enabling

the student to analyze and solve problems from the macro perspective and enhance the ability to perform on-site surveys.

Practical ability is a basis for good public health care (Fig 2). To develop this practical ability students were exposed to specialists in public health, they were given the chance to develop and use their skills in various settings, including rural areas, factories, communities and other enterprises, and were given the chance to perform scientific research. They were assigned to a mentor where they could develop a study design, conduct the study and write a thesis.

Laboratory and on-site abilities are important in public health and related to each other. Good laboratory skills are needed to conduct on-site investigations.

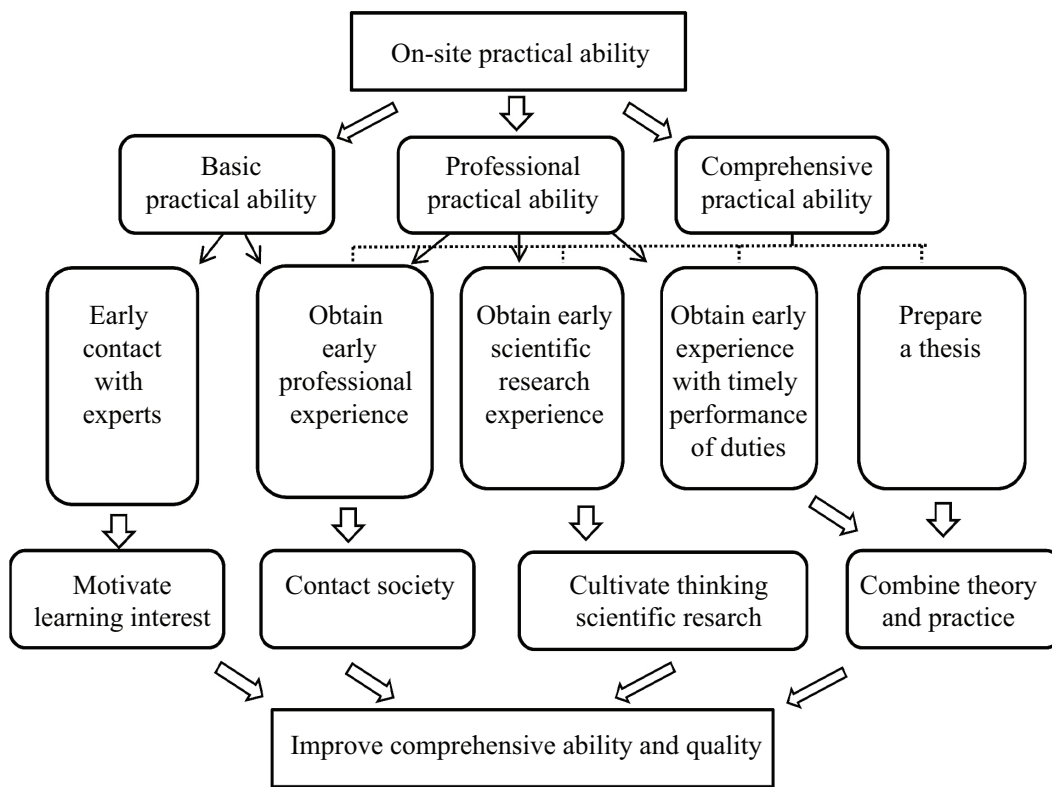


Fig 2–The on-site practical ability training system.

On-site investigations determine what laboratory investigations are needed. After finishing the new 5-year training system, more than 90% of graduates had good practical laboratory abilities and on-site investigation practical abilities. These abilities improved by 20.0% and 24.5%, respectively, compared to the old training system. The ability to collect information, design epidemiologic surveys and conduct statistical analyses also improved significantly under the new training system.

These findings suggest the new training system is an improvement and should be continued. The World Health Organization has emphasized the need for student-centered, problem-oriented community-based training of public health for medical undergraduates (Garg and Zodpey, 2006).

In India, field-based teaching tools, such as the transect walk (Dongre *et al*, 2009), photo-elicitation (Dongre, 2011) and social mapping (Kathirvel *et al*, 2012) have been developed and included in public health teaching. Our study found prevention and control of common diseases and dealing with public health emergencies are weak areas in the training system. The training system needs to not only strengthen the teaching of theories about common diseases but also improve practical abilities of students.

In conclusion, our findings show practice-based public health training is an effective way to improve core competencies among public health students. It should be continued and improved upon. Our study could be of benefit to other developing countries developing

programs to produce high-quality public health staff.

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