

Foodborne outbreak simulation to teach field epidemiology: the Moroccan Field Epidemiology Training Program

Simulation d'une épidémie d'origine alimentaire pour enseigner l'épidémiologie de terrain: Programme Marocain de formation en épidémiologie de terrain.

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R É S U M É

Introduction: Le Maroc en 2010 a lancé un nouveau programme de formation en épidémiologie de terrain pour renforcer les compétences des professionnels de santé chargés de la surveillance épidémiologique en investigation des épisodes épidémiques, dont les toxi-infections alimentaires représentent un charge de morbidité très importante. But: Décrire l'expérience de l'École Nationale de santé publique sur le développement et la mise en œuvre d'un exercice de simulation d'une toxi-infection alimentaire dans un environnement contrôlé.

Méthodes: Un scénario décrivant des symptômes digestifs évoquant une épidémie d'origine alimentaire qui aurait une incidence sur le personnel de l'école a été conçu et confié aux participants de la filière Épidémiologie de Terrain pour évaluer leur capacité d'organisation et d'application des étapes d'investigation épidémiologique.

Résultats: Les neuf participants ont conçu le protocole d'investigation d'une épidémie, ont développé la base de donnée, classé les cas et les témoins, identifié les agents pathogènes, rédigé le rapport d'investigation et ont émis des recommandations de prévention de contrôle. La satisfaction globale de la méthode d'apprentissage était de 67%.

Conclusion: La simulation d'une toxi-infection alimentaire collective dans un milieu académique est une étape d'apprentissage préalable qui permet aux participants du programme d'épidémiologie de terrain d'acquérir des compétences nécessaires pour mener une investigation d'un épisode épidémique réel.

M o t s - c l é s

Investigation d'une épidémie, Épidémiologie de terrain, toxi-infections d'origine alimentaires, Simulation.

S U M M A R Y

Background: Morocco in 2010 launched a new field epidemiology training program to enhance the skills of health professionals in charge of epidemiological surveillance and to investigate outbreaks; including foodborne diseases that represent a very substantial burden of disease.

Aim: To apply an active learning method to teach outbreak investigation within a controlled environment for field epidemiology trainees program at the Moroccan National school of public Health.

Methods: A scenario describing digestive symptoms evoking a restaurant-associated foodborne outbreak that would affect the school staff was designed for the residents to investigate, to assess their organizational capacity and application of all stages of epidemiological investigation.

Results: Nine Residents applied study design, database management and statistical analysis to investigate the foodborne outbreak, to estimate attack rates, classify cases and controls, to identify the contaminated foods and pathogens and to issue preventive recommendations for the control and the prevention of further transmission. The overall resident's satisfaction of the learning method was 67%.

Conclusion: A simulation of an outbreak investigation within an academic setting is an active learning method to be used in the curriculum for introducing the residents on field epidemiology program to the principles and practices of outbreak investigation before their implication in a real situation.

Key - words

Food born outbreak, Outbreak investigation, Field epidemiology training program, Simulation.

Field Epidemiology Training programs (FETP) are two year, in-service training programs modeled after the Epidemic Intelligence Service, an applied epidemiology training program created by Center of Diseases Control and prevention (CDC) in 1951. FETPs emphasize practical experience, with residents spending about 25% of their time in the classroom and the remaining 75% of time conducting mentored field work.

The classroom instruction focuses on epidemiology, disease surveillance, outbreak investigation, and biostatistics. In the field, residents conduct epidemiologic investigations and field surveys, design and evaluate surveillance systems, collect and analyze data using appropriate statistical tools and methods, report their findings to decision- and policymakers, and train other health workers (1). The CDC has established latterly at low- and middle-income country access to FETP, either by having its own in-country program (1). The CDC, through its Division of Public Health Systems and Workforce Development (DPHSWD), is supporting the Moroccan Ministry of Health (MMoH) to build public health work force capacity, strengthen public health systems, and strengthen public health institutions. Areas of focus of this collaboration, includes a two-year Morocco Field Epidemiology Training Program (FETP), associated short-courses for officers at the regional, national and sub-national level, and supporting outbreak investigations and response throughout the country. The overarching goal of the partnership is to reduce the burden of major public health problems in Morocco.

According to that, The Moroccan Field Epidemiology Training Programs (FETP) was launched during the academic year 2010-2011 and was incorporated into the master's public health program (MPH) offered at the National school of public health (ENSP- Ecole Nationale de Santé Publique, French acronym of National school of public health), a Morocco Ministry of Health (MOH) school responsible for training public health professionals (2). The ENSP belongs to the Ministry of Higher Education and should apply its academic requirements in the development and dispensation of its educational program, which implies that residents should spend 52% of in class activities and 48 % of internship in a professional environment. However, to comply with the educational principles of its ministry and its CDC partner, Moroccan FETP program need to fulfill both the academic requirements of the national Masters of public health (MPH) and achieve the field based competencies of the FETP (3-5).

Indeed, FETPs are distinct from traditional academic MPH programs in that they use a service-based, apprentice-style model of learning. The instructional component of FETP is usually based on a set of skills that connect to the expected responsibilities of the future epidemiologist (5). In this direction, The Moroccan FETP works to develop skilled field epidemiologists capable of

detecting, investigating, and responding to public health threats, conducting integrated surveillance, evaluating public health programs, and using data for decision making. Thus, conducting a field investigation of a disease outbreak is a key ability of FETPs (6).

The content of an epidemiologic investigation is chosen to timely address and important public health problem in a community. Its employs appropriate methods of descriptive and or analytical epidemiology and engages expertise when necessary from other public health sciences such as statistics and microbiology. It attempts to uncover causality to a sufficient degree that would enable the identification of the source of the problem. It aims to identify evidence-based options for immediate control and long term interventions (7). All of this is conducted through active collaboration with colleagues who have policy, legal, communication or administrative roles to ensure that the evidence collected from the investigation is used appropriately (7-10).

When one considers the amount and complexity of knowledge and skills required to effectively investigate an outbreak, encompassing mastery in areas such as biostatistics, epidemiologic methods, computer technology, management and communication, it is clear that attaining even a basic level of proficiency solely in the classroom is not possible (10-12). Still, the primary aim of classroom instruction in an FETP is to provide the resident sufficient foundational ability to complete field work under the guidance of a mentor.

For this reason, as well as the challenges of designing instruction within the context of an academic schedule, case studies and simulations deserve particular consideration as active teaching methods based on experiential learning and reflective practice, when teaching future field epidemiologists how to conduct an outbreak investigation.

In fact, the academic schedule for the Moroccan FETP is fixed at the beginning of the academic year to enable residents to share the core curriculum with two already-established masters programs: a master on management of health programs and a master on management of health organizations. Given the constraints of this academic schedule, as well as the inability to plan for an outbreak, it was suggested that a simulation of an outbreak within an academic setting will be an active learning method that would provide an early opportunity for residents to gradually develop the skills and tools necessary in conducting an investigation (Figure 1) during the first year of their training. This will be scheduled after the classroom course and before their internship.

Hereby, we report the Moroccan FETP experience on Food borne outbreak simulation to teach field epidemiology to first cohort of FETP residents.

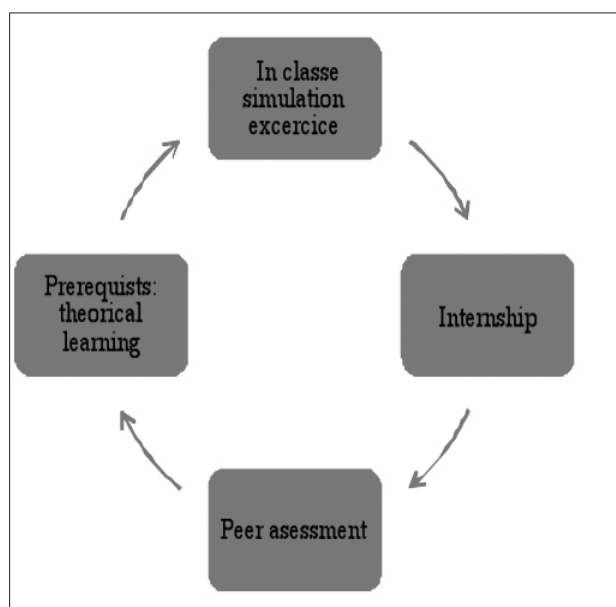


Figure 1 : Learning process of outbreak investigation in Moroccan field epidemiology training program, first cohort 2010-2012.

METHODS

Population and setting

The simulation exercise involved three groups of participants: Nine residents from the first cohort of the Moroccan FETP, who would conduct the investigation. These residents are mostly physicians, one of them was biologist. An instructor, and the actors that would be made up of restaurant staff and patrons (cases and controls), who would be played by the faculty and staff of ENSP (n=100).

The exercise was conducted within the School, the second semester of the first year of FETP program and included all participants in the cohort, which numbered nine.

Instruments

The simulation session was organized and scheduled in three steps as described in the figure 2.

The preparatory phase (day 1): the conduct of this phase consists in two actions, the introduction of the outbreak scenario to the residents and the actors and residents staging, which implies the organization of the investigation team, the action plan and the evaluation of needs.

Activity development (days 2 and 3): completion of the investigation

Back on the activity (day 4): Restitution of the investigation results and evaluation of the exercise.

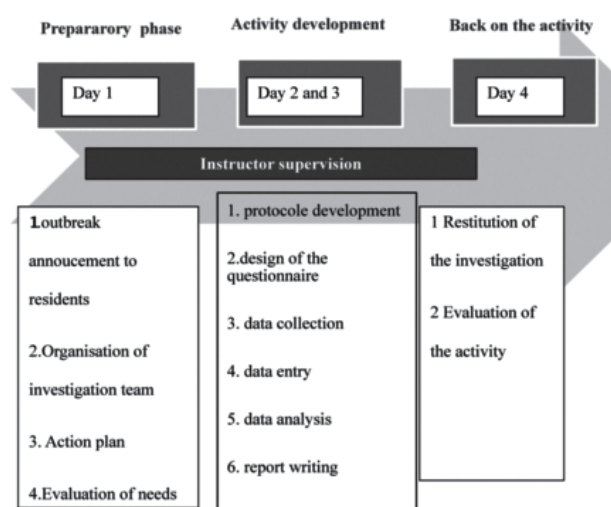


Figure 2 : Timetable of the foodborne outbreak simulation exercise conducted by the Moroccan field epidemiology trainee program at national school of public health, first cohort 2010-2012.

Preparatory phase

During the preparatory phase, specific documents were distributed to all groups of participants. (Figure3).

Simulation of outbreak investigation exercise instruments		
Notes card (description symptoms, start time, duration, food eaten)	1. Guidelines for conducting the scenario,	1. Scenario
1. cases (sick) or	2. Lunch menu.	2. Activity Schedule.
2. control (not sick)	3. List of patrons.	3. List of available documents,
	4. Authorization letter.	4. Logistic support
	5. Laboratory results.	5. Recommended reading

Figure 3 : Instruments used by the different participant at the Simulation of outbreak investigation exercise in the context of the Moroccan field epidemiology training program at national school of public health, first cohort 2010-2012.

The residents received the simulation outbreak scenario and some additional information. The activity Schedule, the list of available documents, and Recommended reading (13-14)

The actors were given note cards.

The instructor had in his file: the guidelines for conducting the scenario, the lunch menu, the list of patrons. And the laboratory results.

Scenario

"Few hours after a banquet offered at the ENSP at noon, five guests visited a hospital emergency room for acute digestive symptoms, among them two were admitted. These cases have been noticed to the Ministry of to Health, which has contacted the school."

All information regarding: The population that would be made up of restaurant staff and patrons (cases and controls), who would be played by the faculty and staff of ENSP (n=100). the pathogens that would be the source of illness (*Staphylococcus aureus* and *Norovirus*); The foods that would be designated as the vehicles of infection (oysters, prawns, hamburger, and turkey); the restaurant menu and list of foods served at the "restaurant"; the number of restaurant patrons who would be exposed to the contaminated food; the number of cases (who would get sick), the number of controls, and food-exposure histories of each; were provided to the resident when they request them. They would also be information from the restaurant inspection (food storage, handling and cooking procedures). No laboratory samples were available for testing.

The card identified each person as an exposed case, exposed control, non-exposed case or non-exposed control. Each card contained additional information about the status of exposure, the list of foods consumed, the time of exposure, the date of symptom onset and a description and evolution of the symptoms. Also a list of patrons was prepared, mentioning their addresses and their telephone numbers.

Activity development

Residents were asked to execute the operational steps of an outbreak investigation, based on a cluster of cases in a ENSP community: They should be able to determine whether an epidemic exists, verify the diagnosis, count cases, determine the attack rate and develop a biologically plausible hypothesis. They should be able to list the types of evidence that need to be collected in the field, collect the data, present it in a line listing, as well as constructing and interpreting an epidemic curve. Using that, they should be able to identify the essential roles and responsibilities of outbreak investigation and response. Finally they should be able to recommend control and prevention strategies in response to an outbreak, before communicating investigation activities to different audiences, including scientific, community and political groups.

Evaluation of the simulation exercise

Exercise completion, was based on the evaluation of the

investigation report and the oral presentation. It would measure resident's ability to show that they were able to address this important public health problem within the ENSP community, to employ the appropriate methods of descriptive and analytical epidemiology to investigate the outbreak, to use statistical analysis to test the hypothesis of exposure and disease, and finally to identify evidence-based options for immediate control measure.

To measure the residents' satisfaction regarding this exercise, the school teaching evaluation questionnaire form was used: The residents were asked if the educational objectives were clearly stated at the beginning of the course. If the course content has been relevant to the learning objectives, if the learning activity was relevant to learning objectives, and if the teaching methods used were adequate to achieve the objectives. Residents completed the evaluation form anonymously the same day following the close of training. The resident had to choose between five responses, which correspond to five ascending ordinal scale: **1** very dissatisfied, **2** dissatisfied, **3** neutral, **4** satisfied and **5** very satisfied. The Percentage of each scale was calculated and presented in the table 1.

Table 1: Teaching content satisfaction of a Foodborne outbreak simulation exercise among Moroccan Field epidemiology training program Resident's.

Items	Satisfaction scale *	Effectif
Educational objective clearly stated	4	2/6
	5	4/6
Accuracy of the course content	4	3/6
	5	3/6
Relevancy of the course activity	3	1/6
	4	4/6
Adequacy of teaching method	5	1/6
	4	2/6
Adequacy of the documents provided	5	4/6
	4	5/6
Overall satisfaction about the course	5	1/6
	4	4/6
Satisfaction regarding the educational needs	5	2/6
	4	2/6
Chronology and themes meets the elements of the syllabus	5	4/6
	4	3/6
Added value in terms of knowledge and Skills useful for career.	5	3/6
	4	4/6
	5	2/6

*1: Very dissatisfied, 2: Dissatisfied, 3: Neutral, 4: Satisfied, 5: Very satisfied

Ethical considerations

No formal ethical approval was sought. Participating to the simulation experience was voluntary. And the Consent was given by the residents. The evaluation of the activity was anonym. The experience had no consequences for grading the residents.

RESULTS

The simulation exercise ran during four days. The participation rate among ENSP staff "actors" was 100%. To investigate the outbreak, residents performed the following activities: Day one, they developed the protocol to investigate the outbreak. They fixed the case definition and designed the questionnaire. And then, asked for logistical support to conduct the investigation. The nine Residents organize themselves into three teams and worked in tandem to conduct the investigation: 1) One resident's task was to support the field team, providing photocopies of questionnaires and collecting those completed for their digitalization. 2) Two residents were responsible for the designing the Epi info™ database from the questionnaire and entering it once collected. 3) Six residents were charged with interviewing the staff of ENSP and conducting all the field components of the investigation.

On day two, they collected the data, interviewed cases and controls and finally, entered the data into the Epi Info™ database. The day three; they created food-specific tables and identified the foods designated as vehicles. They conducted the following analyses: Univariate analyses and the creation of an epidemic curve to describe the basic characteristics of the exposed population by person, place and time, then, bivariate analyses to calculate the Odd ratio. They were able to use the clinical and epidemiologic information to postulate the correct two pathogens. They held in-class discussion to identify the variety of problems at the restaurant, including deficiencies in food storage, food handling and hygiene. And they proposed control and prevention recommendations appropriate for the restaurant-associated foodborne outbreak and finally they prepared the written report and an oral presentation.

Day four, they presented the investigation to ENSP's faculty and the head of the outbreak investigation unit from the MOH, who attended the debriefing session to provide comments, particularly regarding the regulatory and field organizational aspects of an outbreak investigation. During the debriefing, they got a feedback regarding all the tasks they had carried out; the formulation of their hypothesis, the choice of the study design, the usefulness of the variables collected, the presentation of results and the discussion of their results and of the control measures they recommended, with emphasis placed on the learning objectives of this activity. The course evaluation form, were filled and returned by 6/9 (67%) residents. It shows that 33 % of residents were very satisfied, while 67 % were satisfied. The main results are represented in the table 1.

DISCUSSION

In accordance with a scenario simulating a food born outbreak that would affect the school staff, FETP's residents had to investigate it in order to complete the module of investigation of epidemics. The residents had correctly identified the source and etiologic agents behind the outbreak. Their control and prevention recommendations were consistent with the epidemiologic and environmental information they has collected and with best food-handling practices.

Foodborne outbreak was used as a model of the simulation exercise because of its high burden in Morocco. According to the MOH, around 1009 cases of Food borne outbreaks are reported each year throughout the kingdom (15) consequently, the likelihood that participants will have to investigate a real foodborne outbreak during their work is high.

This investigation required the residents to identify two different pathogens involved in the outbreak. While multi-agent foodborne outbreaks are fairly common in Morocco, having two different organisms increased the level of difficulty of this exercise. The selection of *Norovirus* was purposeful. Moroccan epidemiologists are not used to systematically identifying it. The aim of its inclusion in this exercise was to draw their attention to its possible presence and to ensure that it is never excluded from consideration.

This active learning method requires that residents engage in their own learning process through thinking, and then they had to carry out what was taught in class in this situation. It also allows them a better understanding and recall of the concepts taught. (11).

Other benefit of this experience for the residents was the fact that they did not have to worry about the logistics and administrative issues of conducting an outbreak investigation. This was beyond the goal of the exercise; however we did ask residents to think through these aspects prior to beginning the "investigation". In fact, the safety of the learning environment, which is one of the strengths of a simulation, could also be seen as a weakness. The lead instructor, was present at all times, monitoring and adjusting the situation and reinforcing theoretical concepts as needed. This element of control and planning would obviously make the experience different from a real public health emergency.

A further limitation of this exercise is that they did not experiment to investigate the outbreak with a collaborative team, as working with anthropologist, media, environmental microbiologist and field health worker. In some situations where there is a big economic or political issue, working with such team, while in it posing its own particular challenges, could be a useful didactic tool. In this actual simulation, these interactions were not explored. Indeed, the act of driving the investigation into

the secure area of the Institute missed the possibility of experimenting with communities' perceptions of outbreak control measures. These aspects should be developed in a similar exercise in the future, to give the opportunity to residents to explore the way they would deal with these aspects that may hinder their investigation and the implementation of control measures (16-17).

More practically, a simulation provides an economical method of practicing new skills, one that is easy to implement and easily replicable in other academic settings. In fact, outbreak simulations have already been conducted within an academic context in the United States and have been shown to be an effective method for MPH students to learn in an experiential way the methods of investigating a foodborne outbreak (18-19). It would have been very interesting to compare this course with other active teaching methods, to be able to evaluate its efficiency. However, as it was the first cohort of FETP held in ENSP, no other data was available to compare. Similarly, since there were such a small number of participants, -nine- it was impossible to establish subgroups for further comparison.

For the evaluation of this activity the standard form-evaluation document of all courses offered by the school was used. Therefore, its validity has not been tested.

However, to improve the evaluation process of this exercise, an evaluation plan including a pre- and post-knowledge based exam and a self-assessment of core competencies gained could be used. The pretest could be administered following a didactic lecture on the topic, to determine the ability of the simulation exercise to enhance the learning concepts beyond a classical presentation or case studies (19).

CONCLUSION

Simulations are training methods based on experiential learning and reflexive practice that address the skills required to conduct outbreak investigations as an early and initial step in the preparation of the field epidemiology training program residents for an actual investigation.

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