The Effectiveness of an Educational Intervention on Clinicians' Knowledge of Pandemic Influenza

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ABSTRACT: **Background:** The growing numbers of H1N1 "swine influenza" cases should prompt national health systems to achieve dual preparedness: preparedness of clinicians to recognize and treat cases of human H1N1 flu, and national preparedness for an influenza pandemic. This is similar to recent contingency planning for an avian flu pandemic.

Objectives: To evaluate hospital personnel's knowledge on avian flu (zoonotic, sporadic, pandemic), comparing among nurses, residents and faculty, and between those who attended lectures or other educational modalities targeted at avian flu and those who did not.

Methods: A 14 item multiple choice questionnaire was designed to test crucial points concerning preparedness for human avian flu. The directors of 26 general hospitals were instructed by the Ministry of Health to improve knowledge of and preparedness for different avian flu scenarios, and to expect an official inspection. As part of this inspection, we distributed the questionnaires to nurses, residents and senior physicians.

Results: Altogether, 589 questionnaires were collected from the 26 hospitals. Examinees who participated in training modules (course, lecture or any training provided by the hospital) did somewhat better (scoring 78 points out of 100) than those who did not attend the training (70 points) ($P < 0.05$). Differences in nurses' knowledge were even more striking: 66 points for the non-attendants compared to 79 for nurses who attended the lecture ($P < 0.05$). Residents had significantly lower scores compared to nurses or senior physicians: 70 compared to 77 and 78 respectively ($P < 0.05$).

Conclusions: The knowledge of hospital clinicians regarding avian flu is moderate, but can be augmented by hospital-based educational efforts aimed at physicians and particularly nurses. Improving attendance rates at lectures and targeting residents will likely yield better results.

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KEY WORDS: avian flu, pandemic, influenza, swine flu, training course

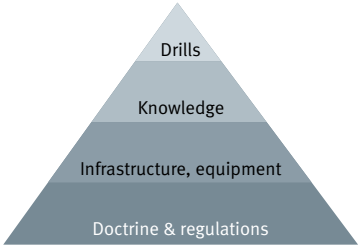
Optimal contingency planning for an influenza pandemic should involve dual preparedness: preparedness of clinicians to recognize and treat sporadic cases of the infectious disease, and national preparedness for an event of epidemic or pandemic spread [1].

The first documented case of human infection with avian influenza A (H5N1) occurred in Hong Kong in 1997. Thirteen years later, on 5 July 2010, there were already 500 documented human cases of avian influenza in 15 different countries with a 60% mortality rate (296 cases) [2]. Preparedness for mass casualty scenarios can be defined by the "preparedness pyramid" [Figure 1], which consists of a doctrine, infrastructure and equipment, knowledge and education of health care workers (and the public), simulations and drills [3]. The optimal way to improve clinicians' knowledge on bioterrorism or emerging infectious diseases remains questionable. Expert guest lectures and grand rounds on bioterrorist threats, though interesting, did not significantly improve clinicians' knowledge; this was probably due to low attendance at lectures, particularly among emergency department physicians [4].

In another national drill initiative that was studied in Israel, mock patients with inhalational anthrax were admitted to emergency departments and a chest X-ray with a wide mediastinum was secretly planted in the hospital's computerized imaging-viewing [5]. ED physicians were given a multiple choice questionnaire on anthrax to complete. In some hospitals the test was given before the day of the drill, and in other medical centers after the drill. In all cases it was given

ED = emergency department

Figure 1. The preparedness pyramid



to ED physicians who did not participate in the drill. The hypothesis was that such a drill in an emergency department will have a "contagious" educational effect, improving awareness and knowledge among all ED physicians in the hospital that was drilled, and that test results will be better in a hospital that had already conducted a drill. Results, however, showed that this was not the case [5].

From an analysis of our previous studies we hypothesize that improving knowledge among health care workers requires a structured obligatory hospital training course, and that such knowledge, being "non-contagious," is dependent on a high attendance rate. Clearly, every clinician must attend a lecture or a series of lectures in order to improve his or her knowledge. Instead of a general lecture on bioterrorism, preferred training would deal specifically with one relevant clinical entity. Based on this premise, we implemented a system to enhance the knowledge of hospital staff regarding avian influenza (zoonotic, sporadic and pandemic), and evaluated this knowledge among different health care workers and among attendants and non-attendants of the training provided by the hospitals.

SUBJECTS AND METHODS

A detailed doctrine on avian flu and the possibility of influenza pandemic was written by expert panels in the Ministry of Health and sent to the directors of all general hospitals in Israel [6]. Attached to this doctrine was a letter from the Director-General of the Ministry of Health, instructing hospitals to translate this "avian flu doctrine" into their own regulations and protocols, and to improve their physicians and nurses' knowledge regarding the relevant threat, the national doctrine and the local protocol. Details of the doctrine were explained to hospital directors at several meetings and in a large-scale multi-organizational tabletop simulation drill.

Hospital directors and emergency preparedness coordinators were notified that an inspection would be conducted in the future but specific dates were not given. Hospitals were also not informed regarding how knowledge and preparedness would be evaluated.

THE INSPECTION

A team of Ministry of Health and Home Front Command personnel arrived at the hospital with a detailed checklist, which comprised different aspects of preparedness for avian flu or a pandemic – namely, laboratory equipment, isolation precautions, disposal techniques, accuracy of protocols, and emergency department preparedness. The inspection also included a 14 item questionnaire [Appendix 1] that was administered, without prior notice, to physicians (residents and seniors in the ED and internal medicine wards) and nurses. The participants were asked whether they were involved in any in-hospital training or had attended any lecture on the subject. The questions were approved by a subcommittee, which included infectious disease specialists, CBRN (chemical, biological, radiological, nuclear) specialists, viral laboratory directors, and an expert in medical education.

The questionnaires were graded from 0 to 100 according to the number of correct answers. The results were analyzed according to the two parallel Student *t*-test. *P* values ≤ 0.05 were considered significant.

RESULTS

We collected 589 questionnaires from 26 hospitals; 198 were answered by nurses (33%), 27% by residents (n=157) and 17% (n= 100) by senior internists or emergency medicine physicians. The rest were from different subspecialties. Reliability coefficient of the test was 0.58.

Only 463 participants clearly stated whether or not they had attended a lecture or participated in training on avian flu. Of the 463 examinees 367 (62% of all examinees) answered positively.

The average test result of examinees who attended at least one lecture was 77.9, while those who were not exposed to any lecture scored only 70.1 points ($P < 0.01$), an 11% difference [Figure 2]. The most striking difference was in the nurses' subgroup, which had an average score of 65.6 for the non-attendants compared to 79.4 for nurses who had attended at least one lecture (a 21% difference, $P < 0.05$) [Figure 3]. Residents had significantly lower scores compared to nurses or senior physicians: 70.2 compared to 76.8 and 78 respectively ($P < 0.05$) [Figure 4]. Residents did not do much better, scoring 72.4, and were still behind the nurses (who scored 79.4) or senior internists (scoring 79.3) ($P < 0.05$).

Figure 2. Effect of lecture attendance on knowledge

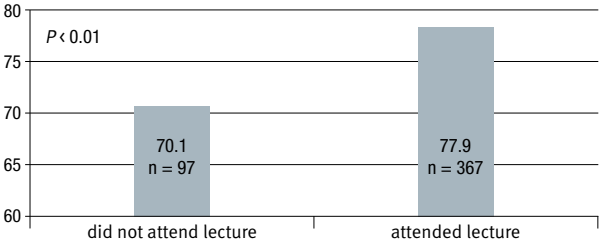


Figure 3. Effect of lecture attendance on knowledge among nurses

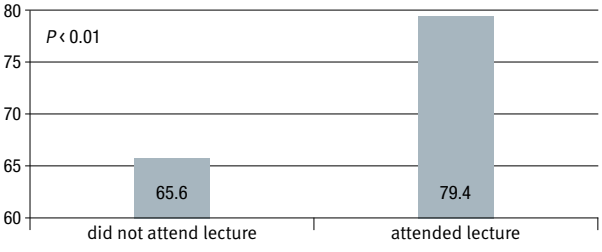
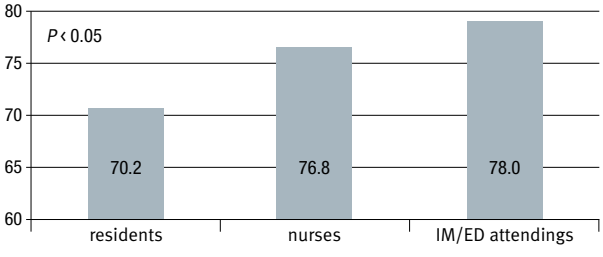


Figure 4. Scores among different health care employees



DISCUSSION

Medical education on emerging infectious diseases, pandemics and agents of bioterrorism differs in many aspects from general medical education. It is a rapidly changing fund of knowledge that is dependent on daily updates and dynamic changes in our understanding of these evolving diseases [7]. Thus, in this regard, textbooks are not a reliable up-to-date resource for educating clinicians. The main obstacle to better education of hospital staff – on avian flu, for example – is either skepticism regarding an "irrelevant" or "non-existing" disease, or the opposite, namely, personal fear of an epidemic or pandemic spread [8,9]. It has already been shown that health workers' greatest fear is of a contagious biological threat [10].

Our study demonstrated that a structured system of preparedness, starting from a unified national doctrine, a well-organized system of inspections and knowledge testing in all general hospitals, together with intra-hospital training courses, can yield a high level of knowledge on emerging infectious diseases. Attendance at specific lectures improved the knowledge of health care workers even more.

We are aware of the study's limitations. The difference in knowledge before and after a lecture was not examined, nor was the decay of knowledge 3 months, 6 months or 1 year after participating in the training. It was also not within the scope of this study to examine whether participation in lectures and higher test scores are related to better performance in a drill and better preparedness. Selection bias among those who answered the questionnaires may also be a factor. It is possible that health care workers who were less confident about their knowledge preferred not to answer at all and avoided taking the test. It is also possible that those who attended lecture/s were highly motivated and knowledgeable prior to the lecture (and were therefore interested in attending the lecture in their hospital), so their superior knowledge is unrelated to the recent training.

We had 126 respondents who did not answer the question about participation in previous training (why they chose not to answer that question is unclear). For that reason, we analyzed only 463 multiple choice question results (and not 589).

It is also likely that the educational interventions differed among hospitals (e.g., one hospital arranged a lecture, another provided a full course, while another distributed written material) and in different locations. Analysis per hospital could elucidate the better educational modules, but this was beyond the scope of our study.

Our results show that residents' knowledge is inferior compared to that of faculty, a finding that is not surprising. However, residents who attended a lecture or training were also inferior to nurses or faculty. Residents are usually fully occupied with night calls, extra jobs or residency exams, and might have less motivation to learn extracurricular data. It is possible that a different educational modality should be planned for residents.

The impressive performance of nurses also validated our prior observations. Nurses in Israeli hospitals are highly motivated in emergency preparedness, and are willing, more than physicians, to take a major role in contingency planning [5].

Despite the educational intervention, improvements can still be made. In order to enhance knowledge, a medical institution must directly target every nurse, intern, resident, senior physician (attending) or primary care physician, as each of them may be a sentinel of the first case of human avian flu in the country [11].

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