INTRODUCING TRAINING TO RESPOND TO CHEMICAL INCIDENTS IN THE PHARMACY DEGREE AT THE UNIVERSITY OF SAN PABLO CEU (SPAIN)

A. Peña-Fernández¹, M.D. Evans¹, A. Magnet², F. Izquierdo², C. del Águila²

¹ Faculty of Health and Life Sciences, De Montfort University, The Gateway (UNITED KINGDOM)
² Facultad de Farmacia, Universidad San Pablo CEU (SPAIN)

Abstract

The recent incident involving chemical warfare agents in Syria has highlighted the relevance of teaching medical preparedness and first response to manage these serious threats. Moreover, incidents involving chemical agents are increasing in prevalence (e.g. the Toledo tyre landfill fire in Spain in 2016). These incidents require a prompt response to minimise morbidity and mortality in the population affected that also considers a complete intervention programme to decontaminate and restore the impacted environment(s). A teaching group at De Montfort University (DMU, UK) and at the University of Alcalá (Spain) has created specific teaching content to train undergraduate human health students how to respond to chemical incidents following similar training previously developed for postgraduate students [1]. Part of this training is to provide knowledge about how to tailor an appropriate recovery response considering the chemical(s) involved and the environment affected; we have observed high levels of engagement within biomedical and medical science students at DMU exposed to this training. To validate this training (a research-led workshop), we delivered it to pharmacy students enrolled in the module on Toxicology (fourth year module) at the University of San Pablo CEU (Spain) in 2016/17. The pharmacy degree programme at University of San Pablo CEU is 5 years long and is validated by the Spanish Agency for Quality Assessment and Accreditation (ANECA). Briefly: students enrolled in this module (n=14) were provided with a chemical incident scenario involving pharmaceutical drugs and personal care products (diclofenac, UV filters, benzylparaben). By working in pairs, these students developed a recovery and restoration response for two different environments: open water and food production systems. Students used the novel tool developed by Public Health England (PHE) the ‘Chemical Recovery Navigation Tool (CRNT)’ (PHE, 2015). This tool follows the same methodology and resources described in the UK Recovery Handbook for Chemical Incidents [2]. The workshop delivered was 2 hours long, and students received a 20 minute introduction about the PHE tools. The specific feedback questionnaire distributed gave the following results: 85.7% of students enjoyed the workshop provided (14.3% reported that they neither agree nor disagree). All of the students indicated that they would be able to establish some interventions to protect the public in the event of a chemical incident. Despite 42.9% of students reporting that the CRNT was not easy to understand, all of them considered it aided their learning about environmental recovery and restoration (85.7% agreed; 14.3% strongly agreed). Up to 86% of students indicated that they have learnt how to develop an appropriate recovery response. Finally, 42.9% students suggested the incorporation of more, similar workshops within their course (42.9% agreed; 57.1% neither agree nor disagree) as well as more time to complete the exercise (3 hours instead 2) would be useful.

Keywords: Pharmacy undergraduate students, chemical incident training, public health, environmental recovery and restoration.

1 INTRODUCTION

Chemical incidents can be defined as a release of chemical agents from accidental or deliberate releases as well as from natural disasters. These types of events can be on a minor or large scale and can have a dramatic effect on national capabilities, the economy, present serious adverse effects to humans and the environment and overwhelm healthcare systems [3]. The International Federation of Red Cross and Red Crescent Societies (IFRC) reported that approximately 100,000 people died and nearly 2 million were injured in technological disasters involving chemical agents between 1998-2007 [4].
Incidents involving chemical agents are infrequent but the probability of them happening is increasing due to advances in technology and the terrorism threat [5]. Recent examples of chemical incidents in Spain include the Toledo tyre landfill fire in 2016 [6]. Planas et al. (2014) [7] provide an analysis of major chemical incidents in Spain in the process industry and in the transportation of chemical products occurred. In relation to deliberate incidents, recent events include the use of unconventional chemical weapons in Syria [8].

The European Union (EU) prompted implementation of accident prevention legislation with the publication of Council Directive 82/501/EEC in 1982 [9], following the major incident in which about 2 tons of chemicals, including dioxins, were released in Seveso (Italy) in 1976. The EU has recently improved the Seveso Directive to create consistent legislation to reduce the likelihood of chemical incidents and regulations aimed at mitigating and preparing for industrial accidents [2012 Seveso-III directive; 10]. The Seveso-III directive also considers latest changes on the classification of chemicals.

A multi-faceted process is needed to respond to chemical incidents to protect human health. The preliminary response during the acute phase is usually coordinated and managed by first responders including police, fire and rescue personnel, medics and paramedics. Local, national or international response may be needed depending on the scale of the incident [3]. Moreover, appropriate intervention programmes should also consider the decontamination and restoration of the environment(s) affected [11]. In the United Kingdom (UK), Public Health England (PHE) has covered a gap in the literature with the publication of the UK Recovery Handbook for Chemical Incidents (UKRHCI) [2], which provides novel guidance and advice to recover environments affected by chemicals.

1.1 Chemical incident response training

An innovative teaching group from De Montfort University (DMU, UK) and University of Alcalá (UAH, Spain) is undertaking an educational project to create basic and specific teaching content to train undergraduate and postgraduate human health students on how to respond to minor chemical incidents. This novel training follows a previous short educational course developed by our group to teach basic environmental toxicology and how to recover and restore environments affected by chemicals for postgraduate pharmacists at UAH in 2013/14 [1]. This short educational course at UAH produced high levels of student satisfaction and engagement (>88%), hence rationalising the use of this course structure as a model.

The first step of this educational project was the preliminary identification and development of a series of basic competences that we consider any healthcare student should acquire to respond to minor chemical incidents to protect human health, for the following domains (Table 1) [12]: identification of the risk and risk analysis; toxicological effect of the chemical substances; planning and organisation of an intervention programme; communication of risks; protective equipment; societal and ethical considerations. These basic competences are based on the core competences that the European Commission has described for medical first responders to face chemical, biological, radiological and nuclear (CBRN) incidents, which have been identified in the CBRN Threat Identification and Emergency Response project [13].

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<td>Identification of the risk and risk analysis</td>
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<td>Safety and personal protective equipment (PPE)</td>
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We consider that the basic competences proposed in Peña-Fernández et al. (2016) [12] might provide a basis for curricula and training development in undergraduate and postgraduate human health programmes. However, wider comment from experts from other universities will need to be sought.
The aim of such a discourse is to ensure that there is common agreement on the competences created and that they reflect the knowledge, abilities and skills required by future health professionals to respond to minor chemical incidents.

To date, we have created two research-led workshops (training) and tested them within the following programmes at DMU this academic course (2016/17): BMedSci Medical Science degree (basic training) and the MSc. in Advanced Biomedical Science (specialised training). These training programmes follow a similar scheme but with different levels of difficulty according to the background of students. We have observed high levels of engagement and student satisfaction through using a validated feedback-questionnaire (data not published). The main purpose of this work was to validate the training created (research-led workshop) as a second step of our educational project.

2 METHODOLOGY

To meet the aims of this study, we delivered the designed training to students enrolled in the module of Toxicology (fourth year module) in the bilingual pharmacy degree at the University of San Pablo CEU (USP-CEU, Spain) in April 2017. The Bachelor Degree in Pharmacy programme at USP-CEU is 5 years long and is validated by the Spanish Agency for Quality Assessment and Accreditation (ANECA). The curriculum of the pharmacy programme at the USP-CEU comprises 300 ECTS (European Credit Transfer and Accumulation System; a credit system designed to facilitate student movement within Europe as they are based on the learning achievements and workload of a course); it can be found here: http://www.uspceu.com/es/oferta-academica/grado/04-farmacia-bilingue/index.aspx More information about the compulsory Toxicology module (6 ECTS) is available here: http://www.uspceu.com/_docs/oferta-academica/fac_far/farmacia/guias-docentes/GD-5-a402-Toxicology.pdf

Owing to the fact that USP-CEU pharmacy students receive comprehensive information about toxicology, public health and some knowledge of medical preparedness, throughout their degree, we considered it appropriate to deliver the specialised training to these students but simplifying it to make it more accessible for them. The training consisted of a research-led workshop of two hours' length, in which students needed to tailor a protection plan (during the acute phase of the chemical incident), and a decontamination and restoration (for the post-acute phase) intervention response [14] for a case scenario similar to that described in Peña-Fernández et al. (2015) [1] but with simplifications. Briefly, pharmacy students were provided with a case scenario of a chemical spill impacting a shoreline involving two different environments: food production systems (fish and shellfish) and open waters (sea). The chemical spill was related to pharmaceutical drugs and personal care products (e.g. diclofenac) that have been described as contaminants of emerging concern in the watch list of substances to monitor in water [15]. Students used the new on-line resource "Chemical Recovery Navigation Tool" (CRNT) [16], a web-based resource that follows the same methodology and guidance described by Wyke-Sanders et al. (2012) [2,14] in the recovery handbook (UKRHCi) [2]. This methodology aids users in selecting appropriate protection and recovery options as a function of the physicochemical properties of the chemical(s) involved (pharmaceutical drugs) and the affected environment [2,11,14]. To overcome time constraints, students were provided with a small workbook with detailed information about the physicochemical properties of the contaminants involved in the case scenario. Students were also provided with a short introduction about the relevance of implementing a recovery response using the Minamata disaster [17] as an example, and an introduction to the CRNT tool from PHE. Students worked in pairs and each group tailored a preliminary response for one of the environments affected randomly. Students critically analysed their responses in the last 20 minutes of the workshop.

2.1 Context, participants and instruments

Our study was carried out in April 2017 at USP-CEU. The training was prepared and delivered by a DMU academic as part of an Erasmus+ staff mobility grant for teaching for the 2016/17 scheme. Erasmus teaching staff mobility has been reported as a successful and relevant tool to improve internationalisation of the content and delivery of programmes, on the acquisition and development of teaching methods and as a resource to strengthen curricula development [18]. We have used this staff mobility grant as a potential tool to “validate” or test our novel training in a human health degree programme other than Medical or Biomedical Sciences and in a non-English European university.

A total of 14 students are enrolled in the module of Toxicology of the USP-CEU’s Bachelor Degree in Pharmacy in the academic course 2016/17. Comprehensive feedback was collected using a feedback-
questionnaire as these can measure the degree of satisfaction of the teaching and learning processes [1]. The questionnaire developed contained 17 different questions using the Likert scale (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree) in conjunction with 2 open-questions (free-response). Ethical approval was provided by the Research Ethics Committee at DMU (Ref. 1729) and from the Ethics Committee at the USP-CEU (Ref. 143/17/01). This feedback was also used to determine the potential applicability of our training to other undergraduate programmes within the EU.

3 RESULTS & DISCUSSION

Only 7 students completed the voluntary feedback-questionnaire (50% response rate). The training provided a satisfactory level of student engagement and satisfaction (57.1% agreed; 42.9% neither agreed nor disagreed; Figure 1). None of the undergraduate students reported dissatisfaction with the workshop provided (Figure 1). A high number of students enjoyed the session (Figure 2): 85.7% of participants (14.3% neither agreed nor disagreed), which could be attributed to the novelty of the workshop provided and the use of new technologies in the classroom.

![Figure 1. Student satisfaction (%). Absence of a Likert category indicates no responses for that category.](image)

![Figure 2. Student enjoyment (%). Absence of a Likert category indicates no responses for that category.](image)

42.9% of students reported that the PHE CRNT was difficult to understand (Figure 3). This could be attributed to the difficulty of students in understanding some of the recovery terms used in these PHE recovery tools, which are highly specific. However, all students considered the CRNT aided their learning about environmental recovery and restoration (85.7% agreed; 14.3% strongly agreed). Therefore, the difficulty described by students could be more related with the terminology rather than with the tool by itself. This fact is in agreement with the participants’ feedback provided in the open questions in the feedback questionnaire. Thus, some students have reported that “some concepts were not easy to understand”.

![Figure 3. Students’ opinion on the PHE tool (%). Absence of a Likert category indicates no responses for that category.](image)

In relation to the development of an intervention plan, students successfully completed an appropriate protection and remediation responses despite the short time available (2 hours); students showed a full understanding of the case study proposed during the discussions of each plan. All of students have indicated that they would be able to establish some interventions to protect the public in the event of a chemical incident (Figure 4). Moreover, up to 86% of students indicated that they had learnt how to develop an appropriate recovery response (Figure 4).
Finally, 42.9% students suggested the incorporation of more, similar workshops within their course (57.1% neither agree nor disagree); all of them considered the training relevant to their module. In relation to things to improve, students complained about the duration of the workshop (85.7% students), suggesting more time to complete the exercise (3 hours instead 2) so they could navigate through the CRNT properly. The students also suggested a reduction in the theoretical component of the workshop. We consider that the short time available for students to complete the case scenario could have impacted on the overall student satisfaction (Figure 1).

4 CONCLUSIONS

The research-led workshop, methods and tools described in this paper have shown to be effective in improving students’ knowledge and skills to respond to minor chemical incidents and to decontaminate and restore environments impacted by chemical agents. The novel training created at DMU, an English University and the guidelines used, specifically developed for the UK, might be useful to develop training in these topics in any human health degree in the European Union.

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DISCLAIMER

The views in this article are those of the authors, not Public Health England.

REFERENCES


