Emergency Medicine Provider Impressions of Novel SMS-Based Toxicology Module

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Abstract

The diagnosis and treatment of common toxicologic disorders is an area of core content that emergency medicine (EM) resident physicians and physician assistants (PA) are required to demonstrate competence in order to become proficient practicing clinicians. Even when EM programs have a required toxicology elective, learners do not encounter all core toxicologic presentations. To supplement these knowledge gaps, many toxicology curriculums rely on internet learning modules which have variable uptake in practice. With remote learning and education becoming more common, we aim to perform a need-based assessment of EM resident and PA toxicology education and use the results to develop and deploy a text message-based, interactive toxicology supplemental program for EM residents and PAs and measure its acceptability and preliminary effectiveness to teach core toxicology principles.

Keywords: Education, asynchronous learning, toxicology

1. Introduction

Medical toxicology is a core component of emergency medicine (EM) education. In the United States (US), poisoning is the leading cause of injury-related mortality with yearly increases in poisoning-related emergency department (ED) visits [1, 2]. These patients often present with high acuity, requiring significant ED resources, prompt recognition of toxidromes and judicious antidote administration [2]. Despite adequate training, many EM providers may miss less commonly encountered poisonings which may lead to increased resource utilization, morbidity, and mortality. Therefore, it is essential for EM providers to be proficient in caring for poisoned patients.

Despite the importance of medical toxicology education, current EM curriculums are heterogeneous leading to inconsistent exposure to the core components of medical toxicology [3]. In 2019, a survey of EM residency programs across the US demonstrated that only 37% of programs had direct access to a toxicologist who provided core content education and 46% of programs relied on a regional poison center for toxicology experience. In this investigation, 12% of respondents expressed dissatisfaction with their current toxicology education [4]. Another survey found that 13% of EM programs have no toxicology rotation available for resident physicians [3]. Most recently, a survey in 2020 of residents in 9 EM residency programs found that only 29% of residents were comfortable with their toxicology experience [5].

Even less is known about the current status of physician assistant (PA) training in medical toxicology. While PAs have been integrated in caring for patients in the ED since the 1970s, they have not had specific training in toxicologic exposures that are frequency encountered in the ED. [6]. PAs are not required to undergo specialty training and are typically exposed to

URI: https://hdl.handle.net/10125/103017
978-0-9981331-6-4

EM during their clinical training; those who do choose to complete a residency in EM still do not get structured toxicology teaching [7]. In 2009, a survey of PAs who work in EM found that only 11% had completed formal EM training, with majority receiving on demand training as their primary source of EM education [8]. As of 2018, there were 29 post-graduate training programs in EM for PAs, and of those, only 10 programs (34%) had a dedicated clinical experience in toxicology [9].

The wide disparity surrounding toxicology education is unique among other core concepts in EM where standardized teaching occurs in most programs. Furthermore, regional variation in drug exposure, natural toxins, and occupational exposures makes encountering cases that cover the medical toxicology core curriculum difficult to achieve [10, 11]. In order to fill in these knowledge gaps, most programs rely on asynchronous teaching strategies, such as online modules, textbook reading, webinars, and simulation cases [4]. It is unclear what the uptake of these modalities is and their impact on the ability of learners to understand and apply core toxicology principles.

During the COVID-19 pandemic, remote learning has become increasingly important and accepted in medical education. Asynchronous learning modalities like podcasts, journal club, case review, and online resources have been demonstrated to be well accepted and effective tools for medical education [4, 12-14]. While these alternative curricula may be effective in facilitating access to important EM knowledge on demand, they require time for the learner to listen to recorded podcasts in full or participate virtually in journal clubs and case conferences at select times. The unpredictable clinical hours of EM may render these modalities difficult to engage with. There is therefore still an important need to develop alternative learning platforms that permit interactive, asynchronous and engaging toxicology education for trainees. One innovative mechanism that caters to on-demand learning in EM is the use of short message service (SMS) text-messaging to provide brief, educational teaching cases. There is near ubiquitous smart phone use among young adults, yet to date, there have been few studies examining the use of smartphones as a modality for delivering medical education [15, 16]. Text-messaging is a technology that the majority of learners are comfortable using, therefore, it is plausible that leveraging this platform to deliver toxicology education is feasible [17]. Additionally, SMS messaging allows for easily accessible teaching points to be delivered in a format that will not be lost in the myriad of communications providers receive and with the short format can be completed without distractions, unlike other asynchronous modalities. With smart phones, it can also include pictures, schematics and video links and further serves as a reminder to participate in daily or longitudinal learning [15].

Using REDCap, we have developed a series of educational toxicology cases [18]. The cases are designed to be interactive, take approximately 5-10 minutes to review, and cover specific teaching points in the EM resident curriculum. They can be securely delivered via text messaging using Twilio, a third-party web service integrated into REDCap. By delivering interactive case-based learning to trainees, this platform serves as an innovative learning tool that can be accessed asynchronously anywhere.

2. Methods

This study was a quantitative assessment of EM learners (residents and physician assistants) to understand the willingness to engage in SMS-based toxicology cases for the purposes of learning toxicology. We recruited EM residents of post graduate year (PGY) 1-4 and PAs via email. Learners were given a sample case prompt followed by diagnostic and therapeutic data that had to be selected by the user, with automated feedback given based on user choices (Figure 1). After viewing the module, providers were asked about interest, preferred frequency, and clinical areas that were most amenable to teaching using this system. A System Usability Scale (SUS) was integrated into the survey to evaluate standardized usability.

3. Results

Fifty-five participants responded to the survey, with 38 completing the module and survey in its entirety. 22 respondents were PAs (PA 1: 4; PA 2: 5; PA 4+: 13) and 16 were EM residents (PGY 1: 5; PGY 2: 4; PGY 3: 3; PGY 4: 4). 15 respondents were male, 22 were female and 1 identified as non-binary. The sample was predominately white with an average age 33 years (range 25-48). 38 (100%) respondents indicated they would want to use the toxicology cases in its current format again. 11/16 (69%) residents preferred to receive cases daily on weekdays for a 2-week rotation while 13/22 (59%) of PAs preferred to receive the cases monthly. The SUS score for the module was 83.6/100 indicating high usability.

4. Discussion

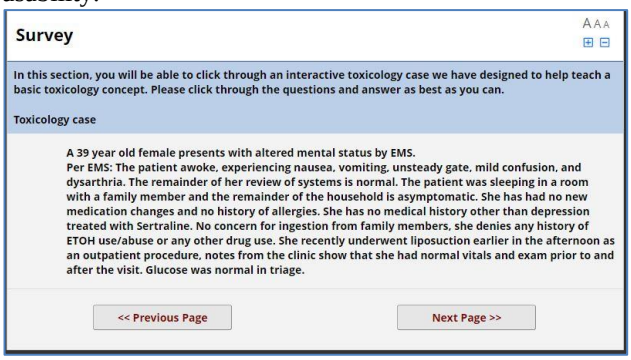
Both EM residents and PAs at various stages of training found this interactive case-based module to be highly usable and indicated that they would like to receive similar modules in the future. We have expanded the modules to 10 new cases and are in the process of assessing learning and retention of key concepts to identify long-term usability of this tool for asynchronous learning.

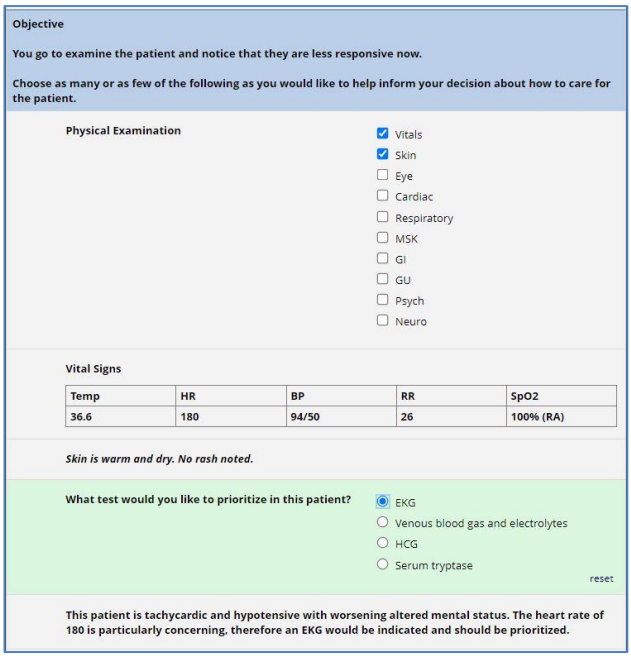
While access to core content medical toxicology material is increasing, key factors such as time available to utilize content, and modality of learning have yet to be defined. A survey in 2015 found that 96% of residents use smartphones in clinical practice, and yet, there is limited data of SMS being used as a tool for medical education [19]. Given near ubiquity of smartphones and text messaging among EM trainees, crafting a text message-based curriculum may help address important gaps in medical toxicology knowledge while providing it in a format that can be integrated into shift work schedules of emergency medicine.

Additionally, access to a new way of education could help residents and PAs that do not learn well with traditional didactic or textbook-based assignments improve their toxicologic knowledge. Understanding if learners prefer these educational modules to traditional curriculums could lead to further expansion of this system to other EM departments that do not have access to as robust of a toxicology curriculum or do not have dedicated toxicology faculty. This innovative modality is easily adaptable to the knowledge gaps for a specific program. Given the open architecture platform and device agnostic nature of the system, we anticipate that if successful, this system can additionally be leveraged across medical education to develop SMS-based curricula for trainees. Within medical toxicology, the plug and play nature of our SMS curriculum permits rapid cycling of novel teaching cases tailored to geographic needs of trainees. For example, in a training program that encounters numerous snake bites, but less adverse events related to calcium channel blockers, the educational modules can be switched and tailored based on local needs. Future directions will be aimed at piloting this technology at additional EM sites and expanding the library of teaching modules with the ultimate goal of providing an asynchronous learning tool that can be used nationally to help improve access to toxicology education. Showing that this platform is effective and accepted by different types of learners will enable an easy to deploy resource for education. This technology can further the widespread dissemination of toxicology knowledge to help improve the care of poisoned patients.

5. Conclusion

Both EM residents and PAs at various stages of training found this interactive case-based module to be highly usable and indicated that they would like to receive similar modules in the future. This method can be used to increase accessibility to toxicologic education that learners may prefer over traditional methods. Future studies will aim to disseminate this module and evaluate its efficacy in learning retention and long-term usability.





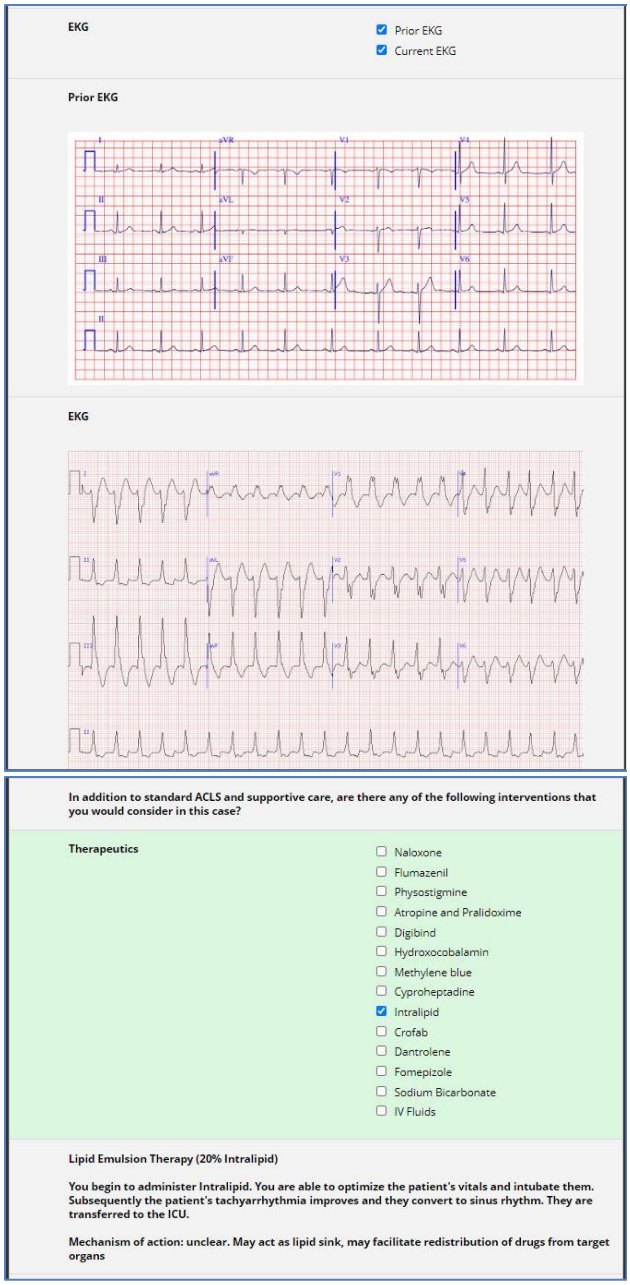


Figure 1. Sample Case

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