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The Addis Ababa toxicology curriculum project: educational needs assessment for the toxicology modules of an emergency medicine training program

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Abstract

Background The Toronto Addis Ababa Academic Collaboration in Emergency Medicine (TAAAC-EM) is a bi-institutional partnership between the University of Toronto (UofT) and Addis Ababa University (AAU) focused on addressing the need for emergency medicine (EM) postgraduate training and care in Ethiopia. Toxicology is a key competency in EM. EM physicians are often the first and sole clinicians to identify and treat patients presenting with a wide range of intoxications. The goal of this project was to conduct an educational needs assessment to inform the development of a context-specific toxicology curriculum for the AAU EM training program.

Methods Our needs assessment employed a survey (available electronically and in paper format) and face-to-face interviews conducted with Ethiopian EM faculty (all graduates of the AAU EM residency training program) and current AAU EM residents. The survey was distributed in October 2018 and the interviews were conducted in November 2018.

Results Of the 63 surveys distributed, we received 17 complete responses and completed 11 interviews with AAU EM faculty and residents. The survey conducted on toxicology training highlighted overall satisfaction with current training, with thematic analysis revealing key areas for growth. System-related themes focused on resource availability, healthcare access, and public health education. Provider-related themes emphasized the need for context-specific training, including common local toxins, and for advanced toxicology training such as poison center rotations. Patient-related themes centered on specific toxicological presentations in Ethiopia, highlighting the importance of public health advocacy, education on safe handling, and governmental regulation of toxic substances. Both survey and interview data highlighted challenges stemming from inconsistent availability of resources and underscored the need for tailored education to manage poisoned patients with locally available resources.

Conclusions Our findings indicate the need to focus on the most prevalent local toxicological presentations and practical management challenges in local contexts, including resource limitations and delayed presentations. Moreover, it emphasizes the importance of public health initiatives such as regulation of the sale and promotion of

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safe handling of toxic substances to mitigate toxicological risks. These findings are likely relevant to other resource-constrained settings outside of Ethiopia.

Keywords Toxicology, Emergency medicine training, Curriculum, Sub-specialty

Introduction

Toxicological presentations make up a significant proportion of emergency department visits worldwide, including intentional and unintentional poisonings. Most deaths resulting from poisonings occur in low- and middle-income countries. [1] This underscores the public health importance and need for of toxicology and emergency medicine training in these settings.

Toxicology is a key subspecialty of EM and is an important component of EM training. EM physicians are usually the first and sometimes the only physicians to provide clinical care for patients presenting with poisonings, both accidental and intentional. Hence the need for specific training in this area is imperative for all EM physicians. In Ethiopia, the practice context poses some unique challenges in managing the poisoned patient, such as limited diagnostics and therapeutic options, and distinctive toxicological presentations. [2] It follows that the educational requirements in this subject in Ethiopia differ somewhat from that in high-income countries and necessitate a tailored approach to the management of the poisoned patient. As such, the development of a context-appropriate curriculum in the subject of EM toxicology was identified as a priority for development.

The Toronto Addis Ababa Academic Collaboration in Emergency Medicine (TAAAC-EM) is a bi-institutional partnership between the University of Toronto (UofT) and Addis Ababa University (AAU) to address the need for EM postgraduate training and care in Ethiopia. The partnership has successfully developed and implemented the first-ever Ethiopian EM postgraduate training program at AAU. Currently, Ethiopian EM residents have receive several recurring lectures on EM toxicology topics including an introduction to toxicology and toxidromes and several specific case-based lectures. Nonetheless, their practice context poses unique challenges in the diagnosis and management of the poisoned patient; therefore, an educational needs assessment to identify content training gaps and target management challenges was developed. The results of this assessment will help inform revisions of the current toxicology curriculum for EM residents at AAU, where the revised educational modules will specifically reflect local needs and resources.

Our specific objectives for this needs assessment were to identify the perceived and expressed educational needs of current residents and recent graduates in the subject area of EM toxicology.

1. To identify perceived needs: What current EM trainees and recent EM graduates think they want to learn, assessed using a survey.
2. To identify expressed needs: What the current EM trainees and recent EM graduates say they want to learn, assessed during semi-structured interviews.

Methods

Study design

There are multiple modalities available to carry out an educational needs assessment in postgraduate medical education. [3] Each of these modalities helps to identify different types of learning needs and can be used in conjunction to obtain a broader and more reliable assessment of actual learning needs. The study design was broadly modelled on Kern's six steps for curriculum design, which aimed to identify different types of learning needs through a mixed-methods approach. [4] Perceived needs are what learners have identified that they want to learn and can be characterized by the sentence, "I know what I don't know". These may be influenced by knowledge, experience, and the environment one works in. [5] Expressed needs are what an individual or group expresses as their needs. [4] Expressed needs may differ from perceived needs depending on actual or perceived barriers to expression, i.e. not wanting to appear unknowledgeable or not being assertive in expressing needs [5]. Using a mixed-methods approach, the study aimed to identify both perceived and expressed toxicology training needs through three modalities: (1) a literature review, (2) a survey and (3) semi-structured interviews of current residents and recent graduates of the EM training program at Addis Ababa University.

The study received ethics approval from the AAU and UHN Research Ethics Boards. We obtained written informed consent from interview participants and implied consent from survey participants.

Data collection

A review of published literature on toxicological presentations in Ethiopia up until January 2018 was conducted to help identify pertinent topics for the teaching modules. A planned database search included: MEDLINE, Embase, Cochrane Central, and the African Index Medicus using the following keywords: Toxicology, Poisoning, Overdose, Suicide attempt, Toxin, Envenomation, and Ethiopia to identify a list of available published articles. A further search of grey literature including local

journals in Ethiopia was also conducted. The results were reviewed independently by two collaborators for relevance to EM care in Ethiopia.

Semi-structured interviews and surveys were administered to current residents and recent graduates to identify gaps in current teaching in the subject area of EM toxicology. The survey was distributed in October 2018 and all interviews were conducted in November 2018. All recent graduates (i.e. having graduated from the inception of the program until October 2018) ($n=34$) and current residents ($n=34$) were invited to participate in the survey; as a result of outdated contact information, only 63 surveys were actually distributed. The semi-structured interviews were only offered to recent graduates who had graduated in the last 5 years ($n=25$), and current residents ($n=34$) who were available in Addis Ababa due to time and logistical constraints.

The survey was developed by AN and LPR and was sent for revisions to the remaining authors. It was made available online and in hard copy. Online survey data were collected and managed using Qualtrics. An initial information email and invitation were sent out with an option to complete an online version of the survey three weeks before the study team's arrival in Ethiopia. There were weekly reminder emails sent out for three weeks. Upon the arrival of the study team in Ethiopia, participants were invited to complete the survey in person (if not already completed online) at a convenient time. At the same time, the study team invited participants to take part in a semi-structured in-depth interview in person at a convenient time during their workday in the Emergency Department.

Current EM residents and local recent EM graduates at AAU were invited to participate in semi-structured in-depth interviews. Verbal consent was obtained at the beginning of each interview and all questions regarding participation were answered fully. Each interview took between 40 and 60 min. The interviews were carried out in-person by Canadian study research assistant (AM) faculty and audio recorded was and transcribed verbatim.

(See Appendix A for the survey, Appendix B for the interview consent form, and Appendix C for the interview guide.)

Of the 63 surveys distributed, we received 17 complete responses and completed 11 individual semi-structured interviews with AAU EM faculty and residents.

Data analysis

The qualitative data from the surveys and interviews was hand-coded and analyzed independently for key themes by two researchers (AN, AM) to determine any perceived learning needs or trends in perceived knowledge gaps. In addition, the quantitative data obtained from the survey was compiled and analyzed by AN and AM to generate descriptive statistics. The survey results were used to identify perceived learning needs, while the interviews were used to identify expressed learning needs of EM trainees in the subject area of toxicology. The analysis aimed to identify perceived needs and expressed needs regarding specific knowledge gaps in toxicological presentations or toxidromes and any clinical management gaps in these cases.

Table 1 Survey respondents Current Level of Training

Current Level of Training	Count
Postgraduate Year 1	4
Postgraduate Year 2	4
Postgraduate Year 3	0
Recent Graduate	9
Grand Total	***17***

Table 2 Survey respondents type of current employment

Type of Current Employment	Count
Public Hospital	14
Private Hospital	0
Both Public and Private Hospital	2
No Response	1
Grand Total	***17***

Results

Demographics data demonstrates proportions of respondents in each year of training/graduates and experience working in public or private institutions (See Tables 1 and 2 below).

Thematic analysis from the survey and interview data resulted in 3 categories of themes: system-related, provider -related and patient-related themes (see Figs. 1 and 2, and 3).

Systems-related themes that emerged included: resources, educational access, access to healthcare and public health education. Within resources, several subthemes emerged. These included access to antidotes, equipment, personal protective equipment and access to a specialist care or poison centre. The following excerpt illustrates some of the system related themes.

> *we have constraints in terms of antidotes for most of the poisonous agents. …we have faced cases of TCA, we don't have sufficient amount of sodium bicarbonate, which is an important antidote. ….*

Provider related themes centred around educational content and revealed overall high level of satisfaction with topics that are being included in teaching, however, a focus on common local toxins as well as a focus on a context-specific approach to the resuscitation of the poisoned patient is needed. Moreover, having some agency

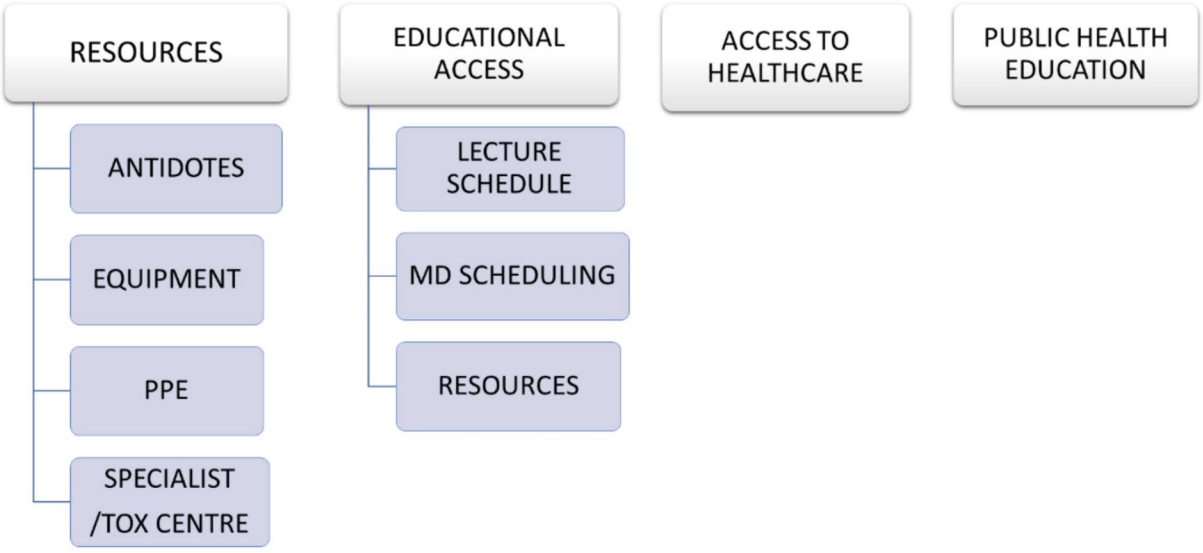

Fig. 1 Themes: System

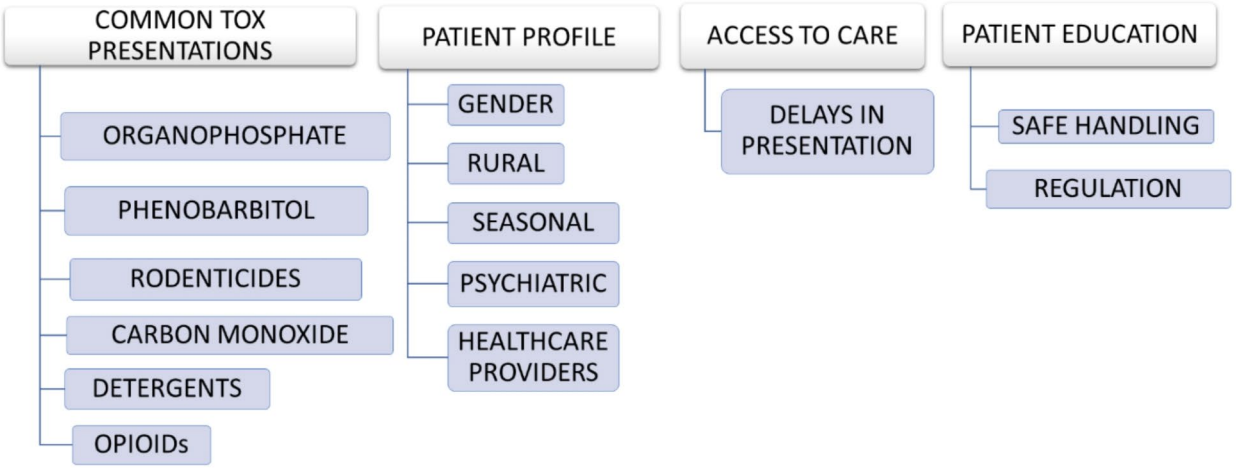

Fig. 2 Themes: Patient

in topic selection would allow for a more context-specific curriculum. The following excerpt illustrates this:

> *…know what the common toxins are in our set-up, in our case. ….it should have been our choice on the specific topics…chance to choose the topic in which we would be interested to learn.*

Educational delivery in the form of bedside teaching combined with case-based teaching was most desired (see Table 3). Moreover, there was a perceived need for an advanced training in toxicology in the form of a poison centre rotation or formal toxicology fellowship. Within the provider theme, there was also an expressed need for cross collaboration with public health and advocacy for safety of agents through increased patient education.

Patient related themes centred around common toxicological presentations which are specific to Ethiopia, along with patients' profile, access to care, and patient education. Common toxicological presentations included: organophosphates, phenobarbital, rodenticides, carbon monoxide, detergents and opioids. These toxicological presentations are consistent with previous epidemiological studies from the region [6]. Patient-related themes included presentations from rural areas as well as presentations that were seasonal. This may have also contributed to another large patient-related theme, namely the delays in presentation to the ED, which led to delays in care. Again, another patient related theme that emerged

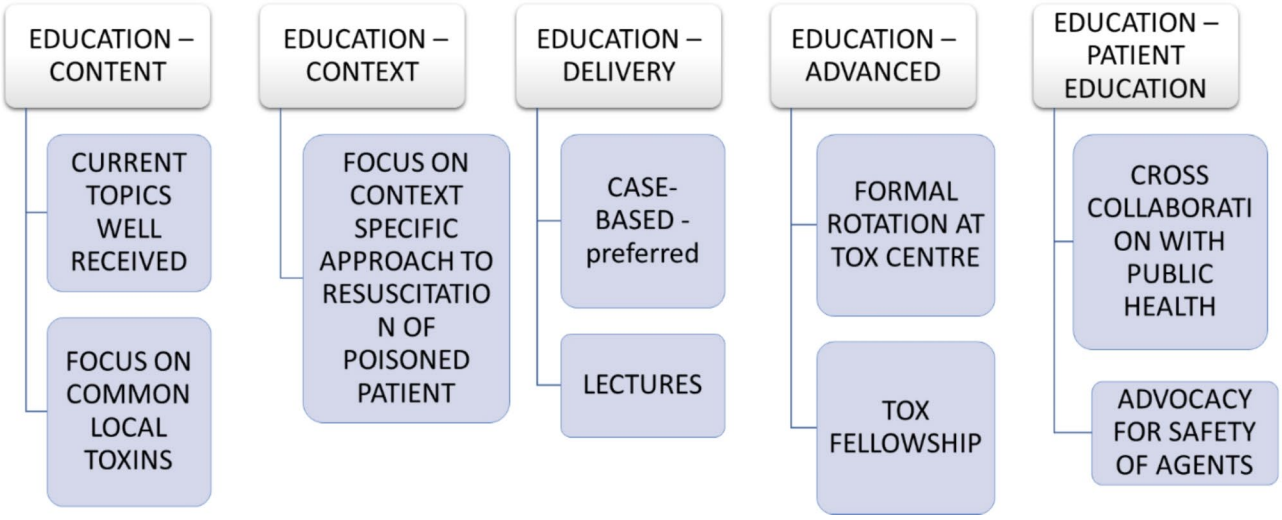

Fig. 3 Themes: Provider

Table 3 Preferred Teaching modality for Toxicology Education

Preferred Teaching Modality for Toxicology Education	Count
Bedside teaching	12
Access to online information	11
Resources (textbooks, lecture notes)	11
Case-based discussions (faculty-led)	11
Applications (palm pilots, smartphones)	10
Case-based discussions (resident-led)	8
Didactic lectures	6
Other	1
Grand Total	***70***

was having to do with public health advocacy and education around safe handling as well as, governmental regulation of toxic substances.

> *teach [] about handling these medications ….they get medication from the market. But there is no such control over that, so multi-sectorial collaboration with different sectors to address poisoning.*

Unsurprisingly, both the survey and thematic analysis of interview data suggested that one of the main issues our Ethiopian colleagues face is a lack of consistent resources such as medication, antidotes, equipment, and personal protective equipment. This could include for example, lack of dialysis or lack of anti-venom to provide treatment for the poisoned patient. The majority of survey respondents (Fig. 4) and interviewees agree that their training to date has given them knowledge and skills to safely manage patients with toxicological presentations in the ED (Fig. 4), however they emphasized the need to address popular local toxins and clearly identified a need for context-specific training, especially addressing how to manage poisoned patients with locally available resources.

Provider-related themes revealed some novel desires of integration with public health and industry to improve patient education in handling toxic substances and medication as well as regulation of the sale of toxic substances (see Fig. 3). Finally, all of the perceived needs and expressed needs of the study participants were summarized in Table 4 (located below Fig. 3). Perceived needs focused on availability of resources and case-based education, while the expressed needs were more explicit, advocating for formal toxicology training or larger-scale public health interventions.

Discussion

Our study is the first published educational needs assessment to specifically consider the perceived and expressed educational needs in toxicology for emergency medicine trainees in Ethiopia. Although some studies have considered emergency medicine curricula as a whole [7], none, to the best of our knowledge, have looked at the unique needs in assessing training needs of emergency medicine practitioners and trainees in managing toxicological presentations in a resource-limited setting. At the onset of this project there was a paucity of published literature on the patterns of acute poisonings in the region. Aside from case reports, there was one larger study [2], which showed the following as the prevalent poisonings presenting locally, listed from most to least frequent documented presentations: sodium hypochlorite (household cleansing agent), organophosphate, Phenobarbitals, mushrooms, amitriptyline, alcohol, chlorpromazine, and mixed substances. This list was similar to the case mix reported by the interviewees and survey respondents, where the poisons most commonly identified were:

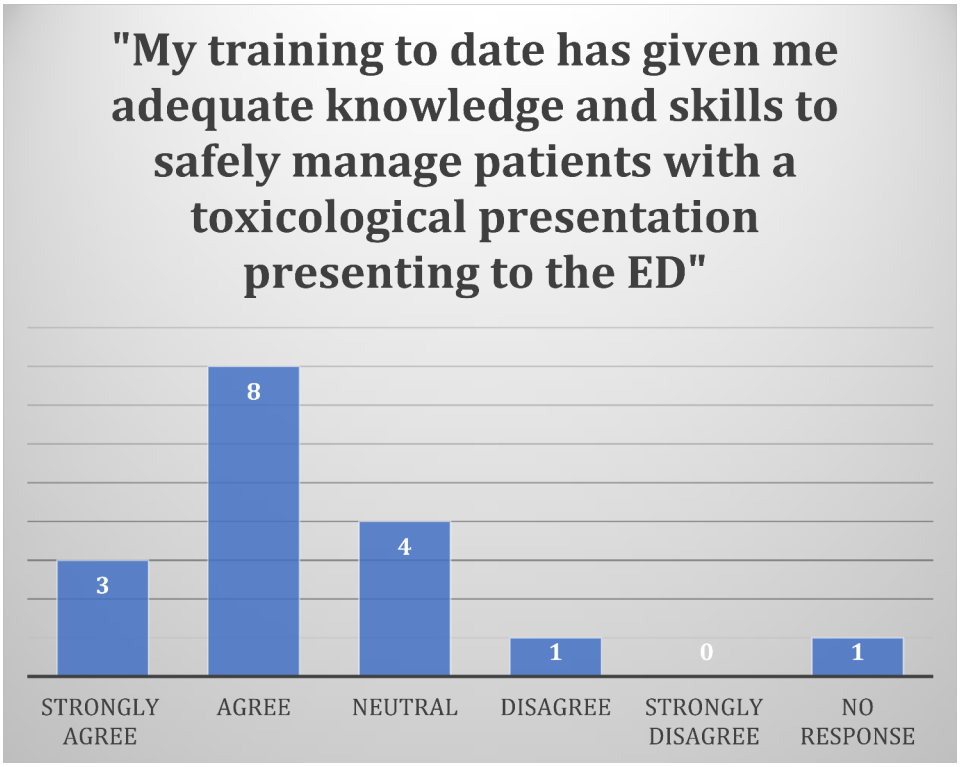

Fig. 4 Survey: Training

Table 4 Summary of the perceived needs and expressed needs of the study participants

Perceived Needs:
• Resources
• Case-based education focused on locally popular toxins and available resources
Expressed Needs:
• Context specific curriculum
• Formal rotation at the Toxicology Centre
• Formal toxicology fellowship
• Need for collaboration with public health
∘ patient education regarding safe handling/storage of toxic substances/medication
∘ a need for regulation of sale and purchase of toxic substance

organophosphates, phenobarbitol, rodenticides, cleaning agents, opioids and carbon monoxide. A more recently published systematic review of poisonings in Ethiopia [6] demonstrated that organophosphates and household cleaning agents remain the predominant agents of acute poisoning in the country.

In our study, the majority of acute poisoning cases were identified as intentional poisonings and found that delayed presentations (possibly due to geographical distribution) contributed to increased case fatality rates. Remaining literature, including case reports, confirm the above findings, citing exposures to household toxins and insecticides as most common causes of acute, mainly intentional poisonings [8–14]. Accidental poisonings reported in the literature included snake bite envenomation, [15] as well as, cases of epidemic dropsy, [16–18] ergot poisoning, [19] and neurolathyrism, which is caused by eating certain legumes of the genus Lathyrus [20]. Recreational use of a herbal stimulant called Khat [21] as well as, sniffing of gasoline [22] has also been reported. There was no specific mention of emergency department collaborations with public health institutions to mitigate accidental exposures, to educate the public or control of substances being sold at public markets. Centralized reporting to determine poisoning patterns could prompt such initiatives. Additionally, we found that seasonal variation affected types of presentations as well as, subsequent outcomes. This type of data could also help prioritize both directions in toxicology education for healthcare professionals as well as, public health resource allocation.

The study also raises awareness of the need for public health education on both dangers of handling toxic substances, as well, the need to seek care promptly if a toxic exposure occurs. In our study, we found that poisoned patients often presented to the emergency department in a delayed fashion, sometimes due to travel from rural or remote regions, or due to a lack of awareness of morbidity and mortality due to exposures. Other factors that affected clinical management and often led to delays in care were a lack of available resources, such as personal protective equipment, lack of antidotes and lack of

specialists as other barriers to provision of care. Though previous studies report poisoning patterns in Ethiopia, none specifically address lack of resources or ways to mitigate these in the education of health practitioners, especially frontline emergency physicians.

In terms of educational resources, the last few years have seen a significant improvement in access to online resources. As the case mix is unique, case-based discussions were identified by the respondents as well-suited for both, discussion of case-specific clinical management and for better knowledge retention. Further scholarly work, however, could explore the best modality for the delivery of toxicology education.

This study faced a number of limitations. Ethics approval delays resulted in significant delays in data collection. All former graduates and current trainees at AAU were invited to participate in the survey, however, many graduates had since moved to practice in geographically dispersed institutions and locations. Low response rate may have in part been due to remote geographical location and technical limitations in accessing the survey and/or physician/trainee workload, but may also represent an element of self-selection bias. Due to geographical and technical limitations, only trainees and staff based at AAU were invited to participate in interviews, therefore findings may be most relevant to the education needs of those working in hospitals within major urban centres, such as Addis Ababa Participation in interviews was also limited by heavy clinical workload of potential participants and scheduling, as well as physician burnout. Although responses appeared candid, the effect of cultural norms and behaviors cannot be excluded.

Conclusions

Our findings indicate that current educational training in toxicology is well-received, but highlighted a need for increased focus on common local toxicological presentations (TCAs, caustics, barbiturates) was identified. Moreover, our findings identified a need to address practical issues in ED management of toxicological presentations in low-resource settings (i.e. limited resources, lack of antidotes, limited dialysis and laboratory capabilities, and delayed presentations), as well as, public health interventions to ameliorate public awareness of poisonings and regulate access to toxic substances.

The results of the surveys and interviews are intended to be compared against identified prescribed and unperceived needs. These needs, what trainees should know and what they do not know they should know, are to be identified by a subsequent retrospective chart review and national and international expert consensus.

The first Toxicology Centre in Addis Ababa opened following the conclusion of this needs assessment, led by one of the authors (SK). Unfortunately, as resources became strained during the COVID-19 pandemic, the Toxicology Centre was repurposed for other clinical needs.

During the operation of the Toxicology Centre, the majority of toxicological cases in the region were managed or consulted there, hence as a next step, the authors intend to compare data from this project with actual patient data from the Toxicology Centre to deepen our understanding of local context, including how to integrate EM training with the Toxicology Centre (rotations, fellowship), and for design of a context specific curriculum and resource development (algorithms/checklists) as well as CME opportunities for practicing physicians.

Abbreviations

AAU	Addis Ababa University
ED	Emergency Department
EM	Emergency Medicine
TAAAC-EM	Toronto Addis Ababa Academic Collaboration in Emergency Medicine
TCA	tricyclic antidepressants
UofT	University of Toronto

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12245-024-00696-0.

Supplementary Material 1

Supplementary Material 2

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Author contributions

Authors contributed as follow to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: AN contributed 50%; SK 20%; AM and LPR contributed 10% each; and MT and AA contributed 5% each. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Approval was obtained from the Research Ethics Boards at the University Health Network (15-9157). Informed consent was obtained from all individual participants included in the study. We certify that the study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Consent to publish

All individual participants signed informed consent regarding publishing their data.

Competing interests
The authors declare no competing interests.

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