Experience of Indian emergency physicians in management of acute poisonings

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ABSTRACT
Indian Emergency Departments (EDs) encounter a significant number of toxicologic cases each year, approximately half of which are attempts at deliberate self-harm. The objective of this study was to understand trends in the presentation and use of resources for the treatment of poisonings in the emergency department setting. Between September 2015 and May 2016, we administered an online survey to Indian emergency department (ED) physicians. We queried respondents about common poisonings, treatments, and educational resources, including use of Indian poison centers. A total of 152 individuals responded to the survey. Respondents living in the eastern (64% of respondents) and southern (57% of respondents) regions of India were most likely to report not having a poison center as compared to respondents from the north. Most physicians instead used hospital protocols, textbooks, or online resources to guide treatment and education efforts. Despite frequent presentations of potentially life-threatening ingestions, often EDs do not rely on extensive poison center consultation. Although India has a poison center hotline, most physicians in the south and east were unaware of this resource, suggesting an opportunity for better physician education.

KEYWORDS
India; toxicology; poison center

Introduction
Toxic ingestions, both intentional and unintentional, represent a significant public health issue worldwide [1]. In India, poisoning leads to significant morbidity and mortality each year. The number of total poisonings that occur in India each year is difficult to quantify since these events are widely unreported and most prior studies have focused on regional data. According to the National Crime Records Bureau of India, there were 27,657 deaths and suicides by poisoning in 2015 [2, 3]. The World Health Organization estimates that India’s mortality rate from poisonings is 31.3 per 100,000 individuals [3]. Intentional overdoses cause more than half of acute poisoning cases in India [4]. According to a ten-year analysis of data from the National Poisons Centre of India, the most common poisonings in India involve the use of household products, followed by pharmaceuticals, pesticides, and industrial chemicals [5].

A number of studies have addressed the epidemiology of poisonings in India with data largely derived from hospitals or poison centers [4–27]. Most of the studies published have focused on describing the distribution of cases by region or demographic group. Few studies have examined approaches to poisoning treatment by physicians in the emergency department (ED) setting. Emergency physicians frequently provide the initial evaluation and management of acute poisonings. In the United States, for example, there are over 1 million annual visits to the ED for poisonings (CDC) [28]. India lacks similar published data for ED visits for poisonings. However, given the burden of disease, this is likely a common occurrence. Emergency physicians may need to rely on a wide variety of reference tools to manage such poisonings, especially for the treatment of ingestions by substances infrequently encountered. However, the types of resources used by Indian emergency physicians to aid in the management of acute poisoning is largely unknown.

Our objective was to understand the poisonings physicians working in Indian Emergency Departments
frequently encounter. In addition, we sought to
describe the educational tools used in the acute care
setting to assist in the management of poisonings by
physicians in India.

Methods
We designed a survey of emergency physicians in
India to assess their experiences and resources of
managing poisoned patients. We developed and
piloted the survey with a group of emergency physi-
cians and international toxicology experts, and we
modified it based on feedback received. The George
Washington University Institutional Review Board
reviewed and determined the study to be exempt
from consent.

We distributed the survey to emergency depart-
ment physicians in India between November 2015
and May 2016. We recruited respondents for the sur-
vey via two methods: (1) recruitment via existing
e-mail databases (email distribution list for an emer-
gency medicine conference and database of emer-
gency medicine residency graduates) and (2) in-
person recruitment at a national emergency medicine
conference in India (cards containing the link to the
online survey were distributed at the conference). We
collected data online via SurveyMonkey.com, an inter-
net-based survey data collection tool. We offered par-
ticipants the chance to enter a raffle of a toxicology
textbook as an incentive for participation in the study.
We included participants at all levels of practice
including attending level physicians (consultants,
which are the most senior attending level trained
physicians), junior consultants (who have completed
training and operate at the attending level but are less
senior), registrars (physicians who have recently com-
pleted training), and post-graduate trainees (physi-
cians in residency training). Our email list had 1522
e-mail addresses, however some of these emails repre-
sented alternate contacts for the same person.

We queried respondents about their experiences
with poisonings presenting to emergency departments
in India. We asked them to select the five most com-
mon poisonings from a list of those poisons that had
been commonly reported from prior Indian literature
[4–27]. We also asked respondents about what resour-
ces they commonly used in making treatment deci-
sions. Specifically, we asked whether participants used
textbooks (emergency medicine and/or toxicology),
internet resources (social media/free online access
medical education materials [FOAM], online and/or
smartphone content), hospital consultants, or poison
center/toxicologist consultation. Respondents could
select more than one resource. We collected demo-
graphic data about the physician completing the sur-
vey, including the number of years in practice since
completion of medical school (grouped into 0–5,
6–10, and 11 or more years), level of training (con-

tultant, junior consultant, registrar, or post-graduate

trainee) as well as information about the clinical prac-
tice setting, including state (divided into south, west
and east and north regions), size of the hospital in
which he/she practiced (<350 beds, ≥350 beds) and
the urbanity and size of the practice location (rural,
suburban or small city versus medium or large city).

First, we evaluated our sample demographics and
the distribution of the most common poisonings
encountered. Next, we reported mean percentages of
respondents reporting use of specific types of resour-
ces for the acute management of poisonings.

Finally, we explored the limitations reported on the
use of a poison center as a treatment resource.
Specifically, we asked respondents to identify any lim-
itations to accessing a poison center or toxicologist
(lack of a poison center in area, limited poison center
hours, perception that the poison center was not use-
ful, or belief that a call to a poison center would take
too long). We analyzed data using STATA
Version 13.1.

Results

Demographics of physicians
A total of 152 respondents completed the survey.
Based on our email list, this was a response rate of
10%. Because some of our emails were duplicates, and
because we could not track links accessed through
social media, the exact response rate was likely higher
than 10%. Demographics appear in Table 1. Over half
(51%) of respondents were post-graduate trainees
(n = 78), 22% were consultants (n = 24), 11% were
junior consultants (n = 16), and 14% were registrars
(n = 21). The majority of respondents (61% or
n = 92 respondents) had been in practice for 0–5 years
since the completion of medical school.

Practice environment and region of respondents
Ninety three percent of all respondents worked at pri-
vate hospitals (n = 141) and the majority worked at
hospitals with over 350 beds (57%, n = 87). The
majority of respondents lived in states in the south of
India (55%, n = 83), followed by the east (18%,
n = 28), west (16%, n = 24), and north (10%, n = 15).
Frequency of poisonings

Figure 1 shows the five most commonly reported poisonings, from the list of the poisonings presented in the survey, both accidental and intentional. Consistent with other studies [4–6, 18] pesticides were the most frequent accidental poisonings (88%), followed by sedative hypnotics (81%) and household cleaning agents (67%). The most frequent intentional poisonings were from household cleaning agents (69%), followed by pesticides (60%) and sedative hypnotics (59%). Other frequently encountered poisonings included acid/alkali agents (57% of intentional and 51% of accidental poisonings), aluminum phosphide (15% of intentional and 48% of accidental poisonings), and paracetamol (52% of intentional and 48% of accidental poisonings).

Most respondents relied on the use of either emergency medicine or toxicology textbooks as sources to aid in the acute treatment of poisonings, with 71% of respondents using these materials (see Table 1). Respondents also frequently used internet resources such as those available through online web searches, social media, and/or FOAM as well as through smartphones (69% of respondents). Fifty-one percent of respondents used hospital consultants. Respondents were least likely to use poison centers, with only 8% of all respondents stating that they used this as a regular resource. Persons with 0–5 and 6–10 years of practice were significantly less likely to use poison centers as compared to the use of textbooks and online resources. Consultants, registrars, and trainees were also more likely to report the use of online sources and textbooks rather than poison center use. By region, individuals in the north (80%) were much more likely to use poison centers than other regions. Individuals in the south were least likely to use poison centers, with only 8% of respondents in this region using this resource (see Table 1).

Respondents gave various reasons for the lack of use of poison centers. The most common reason reported was because there was no poison center available (44%, n = 67). Almost 10% of respondents cited limited poison center hours (n = 15), and 9% of respondents felt that the calls took too long to complete (n = 14). By demographics, respondents living in the east (64% of respondents) and south (57% of respondents) were most likely to report not having a poison center as compared to respondents in the north (Table 2).

Discussion

Our study showed a similar pattern of ingestions to previous work in India, with insecticides, sedatives and household cleaning agents as the most common causes of poisonings [4–6, 18]. These poisonings are common in India due to the frequency of use and...
ease of availability [4–6, 18]. Many of these agents can have devastating clinical effects that require close monitoring and management. For example, organophosphates are among the most frequent pesticides implicated in poisonings with a mortality rate of 10–20%, exacerbated especially with treatment delays [29–31]. Although many Indian physicians likely have extensive knowledge of the treatment of such agents, use of resources such as poison centers expedite evidence-based treatment.

Our study showed that textbooks and online resources play a major role in providing information

### Figure 1. Most common poisons encountered by sample respondents.

*Respondents were asked to select the top 5 most common poisons and therefore the response rate does not add to 100%.

### Table 2. Reasons poison centers not used by respondents.

|                          | n (%) | No poison center | Limited hours | Not helpful | Takes too long | No limits | Unknown |
|--------------------------|-------|------------------|---------------|-------------|---------------|----------|---------|
| **Entire Sample**        | 152   | 44.1             | 9.9           | 2.0         | 9.3           | 27.6     | 7.2     |
| **Years in practice since medical school** |       |                  |               |             |               |          |         |
| 0–5                      | 92    | 44.6             | 12.0          | 2.2         | 9.8           | 22.8     | 8.7     |
| 6–10                     | 35    | 48.6             | 2.9           | 0           | 5.7 (-2.4-13.8) | 37.1     | 5.7     |
| 11+                      | 25    | 36.0             | 12.0          | 4.0         | 12.0          | 32.0     | 4.0     |
| **Highest level of training** |       |                  |               |             |               |          |         |
| Consultant               | 33    | 45.5             | 18.2          | 3.0         | 9.1           | 24.2     | 0       |
| Junior Consultant        | 16    | 56.3             | 0             | 0           | 6.3           | 25.0     | 12.5    |
| Registrar                | 25    | 52.0             | 12.0          | 0           | 12.0          | 16.0     | 8.0     |
| Post-graduate trainee    | 78    | 38.5             | 7.7           | 2.6         | 9.0           | 33.3     | 9.0     |
| Other                    | 5     | 55.0             | 5.0           | 0           | 10.0          | 30.0     | 0       |
| **Type of hospital practice** |       |                  |               |             |               |          |         |
| Private                  | 141   | 45.4             | 9.2           | 2.1         | 9.2           | 26.2     | 7.8     |
| Government public        | 11    | 27.2             | 18.2          | 0           | 9.1           | 45.5     | 0       |
| **Total beds**           |       |                  |               |             |               |          |         |
| <350                     | 65    | 44.6             | 9.2           | 3.1         | 13.8          | 23.1     | 6.2     |
| >=350                    | 87    | 43.7             | 10.3          | 1.1         | 5.7           | 31.0     | 8.0     |
| **Region**               |       |                  |               |             |               |          |         |
| East                     | 28    | 64.3             | 7.1           | 3.6         | 10.7          | 14.2     | 0       |
| West                     | 24    | 8.3              | 20.8          | 0           | 12.5          | 45.8     | 12.5    |
| South                    | 83    | 56.6             | 8.4           | 2.4         | 7.2           | 18.1     | 7.2     |
| North                    | 15    | 0                | 6.7           | 0           | 13.3          | 66.7     | 13.3    |
| **Size city/town**       |       |                  |               |             |               |          |         |
| Rural/suburban/small city| 41    | 65.9             | 2.4           | 2.4         | 4.9           | 17.1     | 7.3     |
| Medium/large city        | 111   | 36.0             | 12.6          | 1.8         | 10.8          | 31.5     | 7.2     |
to help guide physicians in treatment decisions. The use of FOAM is increasingly popular in emergency medicine settings across the globe [32–34]. In a study of usage of 12 popular FOAM sites in 20 countries, India accounted for the fourth highest number of sessions initiated [35]. The use of FOAM in clinical practice is particularly attractive, especially when other resources may not be readily available [36]. Smartphones allow clinicians to have ready access to such content using local cellular networks, without the reliance on the physical availability of textbooks or internet connectivity in remote locations.

Poison centers, although highly important in the treatment of poisonings across the globe, were less likely to be used in our sample population. Poison centers also serve other purposes, such as the provision of epidemiologic data used to track the number and type of poisonings in a region. Poison centers can help guide policy decisions for prevention and can aid in the event of a public health threat that may involve a toxic substance [37]. Despite this potential, poison centers are still not universally used in the United States, despite data showing improved outcomes and cost savings [38]. In one study, about 67% of US primary care physicians and 99% of emergency physicians reported using a poison center in the past year but in only 50% of cases [39]. Globally, the World Health Organization reports that only 46% of its member states have poison centers (WHO) [40].

Our study showed low rates of use of poison centers in our sample, especially in the south of India. Poison centers in India are not as widely distributed as they are in the United States, which has over 55 poison centers in existence today, each providing support for callers anywhere in the country [41]. According to the World Health Organization, as of September 2017, there were a total of 6 poison centers located in India; one national poison center in the north (Delhi), as well as 5 regional centers – two in the west (Gujarat) and three of which were in the south (Karnataka, Kerala, and Tamil Nadu) of India [40]. The All India Institute of Medical Sciences (AIIMS) runs the National Poisons Information Centre (NPIC), which operates 24 hours a day, 7 days a week, and provides a toll-free phone number available countrywide for consultation. Founded in 1995, NPIC is the oldest and most well established poison center in the country and is run by faculty trained in pharmacology and includes staffing by scientists and resident physicians [4, 42]. Less information is available about the regional poison centers, however, three of these regional centers had 24-hour availability per the WHO website [40]. AIIMS has published a number of epidemiologic studies outlining the most common poisonings that have presented to Indian poison centers [4, 5, 43]. Historically, the AIIMS National Poisons Information Centre has seen relatively low rates of the use compared to use of poison centers in other countries, possibly due to medical legal issues or a lack of awareness of its availability [43]. For example, suicide was illegal in India until 2017. As a result, families may be less likely to report intentional ingestions due to fear of further investigation as a criminal activity [44, 45]. It is unclear how physicians nationwide use this poison center, or whether physicians are more likely to use the regional poison information centers reported by the WHO. In our study, respondents from the south had the lowest rates of the use of poison centers, with only 8% using them as a resource. Although these respondents were from states that also had regional poison centers, the scope and catchment area of such centers is unknown. Although an Indian state may have a poison center, physicians not located in the same city as the center may be less likely to use it or unfamiliar with its existence or capacity.

This study had a number of limitations. It included a small sample of physicians, and our survey response rate was low. We collected respondents from samples of physicians who attended conferences, who completed emergency medicine training or who used email. As a result, we may have had a response bias with our respondents being younger or having access to online resources as compared to non-respondents. Because of the sample size and sample characteristics, we may have not captured information generalizable to India as a whole. The study used self-reported data, rather than the use of chart review to confirm the epidemiology about the distribution of poisonings reported by survey respondents. Although there is a national poison center in India, we do not have information about the characteristics of the regional poison centers in each state so we cannot evaluate the relationship of staffing, hours, fees, or catchment area to the use and perceived utility of such centers by emergency medicine physicians.

**Conclusion**

Our study highlights physician perspectives on the frequency and treatment of poisonings in India. Despite the availability of poison centers in India, emergency medicine physicians rarely use this
resource in the management of acute poisonings. Indian emergency physicians have extensive experience with poisonings, but they need better access to and education about the scope and availability of Poison Control Centers. Future studies should focus on how the use of resources affects physician comfort level with the treatment of poisoning as well as the clinical outcomes of presenting cases.

Disclosure statement

No potential conflict of interest was reported by the authors.

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