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PERSPECTIVE ARTICLE

From Data Deficiency to Evidence-Based Interventions: The Case for a Poisoning Incident Database in India

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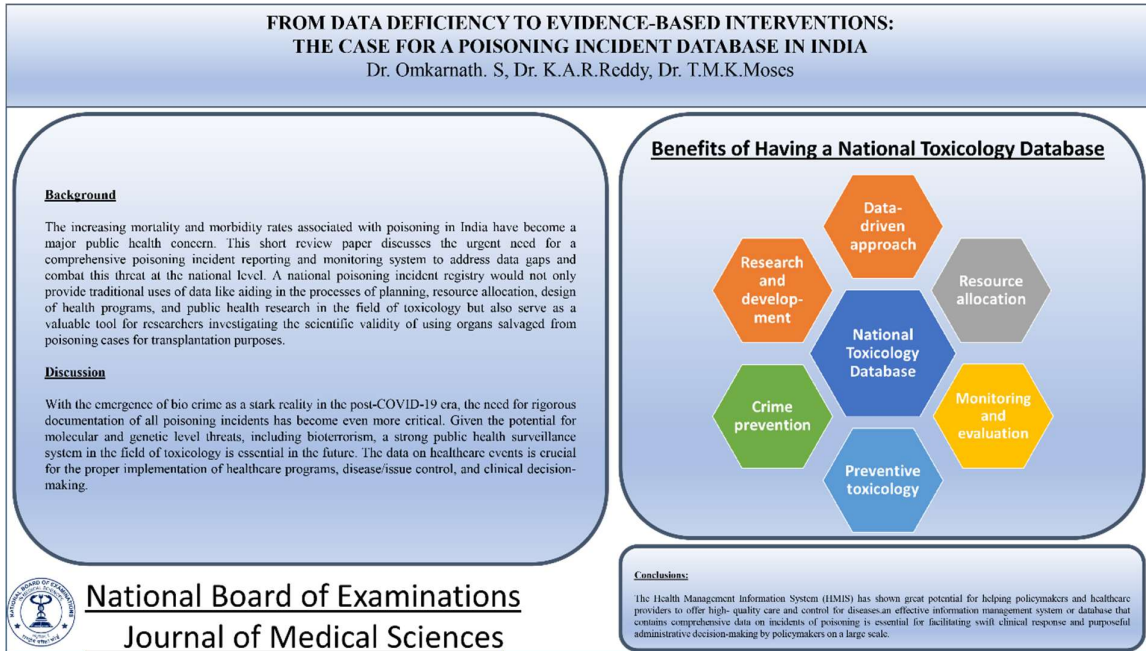
Abstract

Background: The increasing mortality and morbidity rates associated with poisoning in India have become a major public health concern. This short review paper discusses the urgent need for a comprehensive poisoning incident reporting and monitoring system to address data gaps and combat this threat at the national level. A national poisoning incident registry would not only provide traditional uses of data like aiding in the processes of planning, resource allocation, design of health programs, and public health research in the field of toxicology but also serve as a valuable tool for researchers investigating the scientific validity of using organs salvaged from poisoning cases for transplantation purposes. **Discussion:** With the emergence of biocrime as a stark reality in the post-COVID-19 era, the need for rigorous documentation of all poisoning incidents has become even more critical. Given the potential for molecular and genetic level threats, including bioterrorism, a strong public health surveillance system in the field of toxicology is essential in the future. **Conclusion:** The data on healthcare events is crucial for the proper implementation of healthcare programs, disease/issue control, and clinical decision-making. The Health Management Information System (HMIS) shows great promise in supporting decision-makers and healthcare professionals in providing high-quality care and reducing illness burden. The integration of toxicology event-related data in a registry on the lines of HMIS has a huge potential in improving the quality of health care in clinical toxicology scenarios in India. In conclusion, the implementation of a national toxicology incident registry is a categorical imperative to address the growing threat of poisoning fatalities in India.

Keywords: Poisoning, Epidemiology; Poisoning Incident Database; Digital Health; Clinical Toxicology.

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Graphical Abstract



Background

India is wrestling with a heavy burden of poisoning-related mortality and morbidity which is a matter of huge public health concern. The spectrum of poisoning in our country is extremely diverse ranging from envenomations, and suicidal consumption of agrochemical substances to the recreational abuse of several hard and soft drugs. Occupational exposure and environmental contamination with several poisons lead to significant health outcomes which are frequently unreported or underreported in health databases. A dearth of healthcare infrastructure and resources for prompt management of poisonings, along with difficulties in data collection and reporting are some of the reasons attributable to hampered progress in fighting this menace at a national level. The severity of poisoning incidents and their consequential events in India necessitates a comprehensive strategy to control and

manage them. The measures include policy interventions, stringent enforcement of regulations, revision of existing laws in tune with public health needs, public education, and a robust poison incident reporting and surveillance system.

There are various sources of information that report on poisoning incidents in India, such as news agencies, standard-mandated government reports, and stray research studies. The National Crime Records Bureau (NCRB), which operates under the Ministry of Home Affairs, is responsible for gathering and releasing information on homicides, accidental fatalities, and suicides in India, some of which may involve instances of poisoning.

Additionally, the National Institute of Occupational Health (NIOH) under the Indian Council of Medical Research (ICMR) maintains a National Poison Information Centre (NPIC) that provides

information on poisoning cases, including their causes, symptoms, and treatment. However, they hold very little real-time data on the actual poisoning incidents across the country.

The Indian Pharmacopoeia Commission (IPC), a self-governing organization overseen by the Ministry of Health and Family Welfare, Government of India, is responsible for establishing guidelines for drugs and pharmaceuticals within the nation and works closely in association with the Central Drug Standard Control Organisation (CDSCO). They maintain a database of adverse drug reactions, which includes cases of poisoning due to pharmaceuticals, i.e., Pharmaceutical Toxicology events.

Under the Integrated Disease Surveillance Programme (IDSP), the Integrated Health Information Platform (IHIP) collects the data on snake bite cases throughout the country which provides the repository of such snake bite cases in India. Similarly, the data on common types of poisoning cases may be collected.

However, since there is no centralized database, the information available on poisoning incidents in India may be limited, fragmented, and held in silos of different governmental agencies. It is also important to note that not all poisoning incidents may be reported or documented, especially in rural areas where healthcare facilities may be limited. Aligning with the current trends of digitalizing healthcare, we can aspire for a digital repository of poisoning incidents that can capture the data on commonly encountered poisoning incidents in India. The present article discusses in detail the establishment of a comprehensive reporting and surveillance system that is imperative

in India to address data gaps and effectively tackle the significant burden of poisonings.

Discussion

Data pertaining to healthcare-related events is crucial for proper systems management and appropriate health governance in any country. We live in the age of *data currency* where every minute detail of activity is essential in the broader planning perspective for ensuring optimal institutional and individual performance in public health. In recent times, the importance of data in health has been a topic of huge discussion amongst academicians and practitioners. Data science and big data analytics offer valuable insights and support strategic decision-making in healthcare systems, enabling a holistic understanding of the interaction between stakeholders in the industry and opening up new opportunities to enhance healthcare quality [1].

Suicidal poisoning is one of the important causes of unnatural deaths in our country. The toxicoepidemiology of poisonings in our country is generally studied by forensic pathologists, general physicians, and emergency physicians in a hodgepodge manner. Any systematic review or meta-analysis conducted by considering such data is also biased and can be misleading at times. We are aware of the dictum, '*Our data quality determines our results.*' In this regard, the data provided by the National Crime Records Bureau (NCRB, Ministry of Home Affairs, Government of India) only includes the number of cases registered under specific sections of procedural law (Cr. P.C) or penal law (IPC), which lacks key details from a clinical or health policy perspective. There is a notable absence of information on the circumstantial aspects which influence the

cause of death, the toxicity of the compound, and healthcare or treatment-related matters, which limits the utility of this data for planning interventions at various levels. Similarly, the data registered by the registrar of deaths are of no use for research in the field of toxicology thanks to the improper documentation of many deaths in the Medical Certification of Cause of Death (MCCD) forms as '*cardiorespiratory arrest/cardiorespiratory failure.*' The data procured and which is available with pharmacovigilance agencies, ICMR institutions, and other designated agencies are not sorted scientifically or cleaned and curated for usage in medical research.

Although few researchers attempted to solve the question of data need in the realm of poisoning-related health events in India, they seem to be partially successful which is yet too far from what is needed in this arena [2,3].

The existing network of poison control centers in India does not have comprehensive data on the trends of poisoning because they have no access to all the poisoning-related data, they respond only to the instances in which they receive a request for help. However, the role of poison information and control centers in reducing mortality due to poisoning cannot be understated in any way [4,5]. The national poison information and control center at AIIMS New Delhi and other WHO-assisted centers in the country like the NIOH, ICMR are doing a yeoman service in the field of clinical toxicology from the public health point of view.

A database of incidents involving poisoning in our country would be extremely helpful for creating policies, allocating resources, and conducting research in this field. A poisoning incident

database would make it easier to gather and examine information on clinical and forensic poisoning episodes, causes, trends, and patterns of poisoning cases in India. To successfully prevent and manage poisoning occurrences, evidence-based policies and interventions can be generated using this knowledge. The potential benefits of having a national toxicology database that has up-to-date details of all events of poisoning are:

- **Data-driven approach:** This helps to formulate evidence-based policies related to poisoning prevention, management, and design of standard treatment guidelines/Clinical workflows.
- **Resource allocation:** A centralized database allows for better allocation of resources, including medical personnel, emergency services, and medical supplies, to areas with higher incidences of poisoning cases.
- **Research and development:** A comprehensive database shall serve as a valuable resource for researchers to conduct a plethora of studies with emphasis on aetiology, risk factors, clinical outcomes, designing new management workflows, and also frame appropriate research questions from the bedside. The database shall function as a bridge between the preclinical and clinical researchers in novel antidote development.
- **Monitoring and evaluation:** A database would enable continuous monitoring and evaluation of the effectiveness of healthcare interventions, allowing for timely adjustments to improve outcomes. For instance, the availability and

procurement of antidotes to several poisonings can be optimized with proper data on the subject.

- **Preventive toxicology:** A database would help us know more about emerging trends, new toxic agents, geo-profiling of incidents, and changes in poisoning patterns. This could enable planning prompt responses to reduce the incident burden.
- **Crime prevention:** A database could also help us analyse food poisoning, occupational toxicology, environmental toxicology, drug abuse, and other events from a forensic epidemiology perspective which can help us plan prevention activities through interdepartmental coordination.
- **Improving Connected Health Solutions:** A database would enable easy interactions between the different categories of the stakeholders. It will provide a basis for the telemedicine consultations for the poisoning cases in both patient-doctor and doctor-doctor teleconsultations.

The data to be sourced through the digital infrastructure in this context includes the sociodemographic data, the name of the compound involved in poisoning(if known), the clinical toxidrome data (if categorizable or a record of clinical presentation), circumstances of poisoning (suicidal, accidental, homicidal), the source of availability of substance(in suicidal, homicidal cases), route of exposure, the severity of exposure, availability, and use of antidote, the time lapse between incident and reaching the point of care, contact with

poison information and control center, discharge/death particulars of the patient, etc. For practical purposes, the registry should have all the information necessary to do a *critical incident analysis* or a *psychological autopsy* of the event at a later date. Any other data desired by the public health experts from time to time may be included in the light of new requirements.

The different stakeholders involved with fatal poisoning events apart from treating medical personnel should also be entrusted with the responsibility of updating the database in accordance with the needs of the case. Some agencies like the police authorities, scientific officers at forensic science laboratories, forensic medicine practitioners, or autopsy surgeons are to be encouraged to update relevant portions of the national database about toxicology events.

This whole exercise involves several privacy issues and creating a new database for this purpose requires strong statutory backing as well. Nevertheless, scientifically procured sensitive data in this regard will help us a lot to deal with the menace of agrochemical substance poisoning, which is very rampant in India. We will also get an opportunity to pressurize the regulating agencies to ban extremely hazardous agrochemical substances and persuade them to look for substitution and safer alternatives. Moreover, we can likewise request the companies for financing antidote availability to the hospitals and antidote research as part of their corporate social responsibility.

The existing poison incident report systems in countries like the UK and the USA are worth a mention at this juncture. In the UK, The National Poison Information System (NPIS) is a

professional organization that provides expert advice on poisoning management. The National Health Service (NHS) Digital collects data on poisonings which contains information on diagnoses, procedures, and health-related outcomes from patients treated at their hospitals. The Office for National Statistics (ONS) has all data regarding the poisoning deaths. The Health and Safety Executive (HSE) is responsible for executing workplace safety and health which deal with overall surveillance and issues in the occupational toxicology domain.⁶

In the USA, the National Poison Data System (NPDS) is a comprehensive electronic database managed by the American Association of Poison Control Centres (AAPCC) for real-time professional communication and guidance to healthcare personnel. The Toxic Exposure Surveillance System (TESS) collects data on acute chemical exposures and poisonings from multiple sources, including poison control centers, hospitals, and other health agencies. TESS uses this data to identify trends, assess the public health impact of toxic exposures, and develop prevention strategies. The National Electronic Injury Surveillance System (NEISS) is a surveillance system administered by the Consumer Product Safety Commission (CPSC) that monitors injuries and adverse events related to consumer products, including those caused by poisoning [7,8].

In Korea, the Poisoning Information Database (PIDB) offers clinical toxicology data related to frequently encountered toxic substances. Launched in 2007, the PIDB has been expanding steadily, with the number of toxic substances listed growing from 50 to 470 by 2014. While the PIDB accounts for a significant portion of actual

poisoning incidents in Korea, it is essential to continually expand the database to provide information on even the rarest toxic substances [9].

TOXBASE serves as the primary poisons information database for the National Poisons Information Service (NPIS) across the United Kingdom. It has been accessible to registered National Health Service users free of charge since its establishment, and as of 1999, contained details about roughly 12,000 substances and products. Moreover, TOXBASE has a collection of monographs on different facets of poison management, including pediatric poisoning, slang drug names, and pregnancy-related poisoning [10]. In India, only apex tertiary healthcare institutions currently utilize toxicology databases to provide information to healthcare personnel and the general public. It is important to note that our poison control centers rely on toxicology databases from international sources, highlighting the need to develop our indigenous poison information database. To establish a robust indigenous toxicology information database that can meet clinical needs, it is crucial to begin by creating a database containing details of poisoning incidents in India for at least a few years.

ToxBASE Lanka is a National Poison Centre (NPC) in Sri Lanka that offers round the clock poisons information service to all its citizens. The NPC possesses a comprehensive and up-to-date database of nearly all the poisonous substances present in the country and offers expert and prompt guidance in the event of poisoning cases [11].

Looking at the above-mentioned examples, we identify a glaring lacuna in our system dealing with poisoning and managing them both at the incident and

national levels. The current global practices underscore the need for generating more data in the fields of both occupational toxicology and preventive toxicology. 'Agadha Tantra', the ancient Ashtanga ayurvedic form of toxicology studied and practiced in the Vedic times shows the expertise and mettle of Indians in understanding the field of toxicology from a diverse perspective. It is time we rededicate ourselves to live up to the standards of our ancient forefathers [12].

The task at hand is integrating the existing fragmented hospital-based surveillance systems into a national one and using the existing national health information systems infrastructure to serve our purpose. These systems may include electronic health records (EHRs), health information exchanges (HIEs), or other health information management systems that can capture data on poison exposures or poison-related injuries. Data from these systems can be used for surveillance and research purposes, with appropriate privacy and security measures in place [8]. Similarly, we should also explore the feasibility of incorporating the element of toxicology-related events in the existing public health reporting programs and pharmacovigilance/toxicovigilance mechanisms. The authors also suggest the use of a similar virtual infrastructure used for reporting several Adverse Events Following Immunisation (AEFI) in public health for bringing out a toxicology registry in India.

For instance, as per Section 89 of The Factories Act, 1948, it is mandatory to notify occupationally acquired toxicological health conditions. Similarly, abiding to the World Health Organisation's International Health Regulations 2005, the Department of Health and Family Welfare,

Government of India has identified certain diseases of significant public health importance under the Integrated Disease Surveillance Program - Integrated Health Information Platform (IDSP-IHIP). Notably, most of the poisoning cases are not included in this list except for animal bites and snake bites as mentioned above. It would be beneficial to formulate a separate national policy or program specifically addressing the reporting of poisoning incidents. Additionally, incentivizing the notification of cases and monitoring treatment outcomes pertaining to such incidents could enhance the overall effectiveness of this initiative.

The Way Forward

In the past ten years, the field of digital health has undergone a significant transformation, with the Government of India playing a significant role in promoting eHealth through initiatives such as Ayushman Bharat Digital Mission, e-hospitals, and telemedicine. Similarly, the government may encourage digital reporting of poisoning incidents from various sources, such as hospitals, poison control centers, and emergency services across the country ensuring privacy and confidentiality. Existing digital infrastructure like HMIS, Integrated Health Information Portal (IHIP), and Ayushman Bharat Digital Mission (ABDM) may be used to collect the data from the sources and analyse them to identify patterns, trends, and risk factors associated with poisoning incidents. The findings should be disseminated to relevant stakeholders such as public health authorities, medical professionals, and the general public to help them make informed decisions. The government should also encourage data sharing and dissemination of the same to

relevant stakeholders. The database should be continually updated and improved based on feedback from users and changes in the types and sources of poisoning incidents.

The establishment of a poison information and control center in every state is necessary, and it is crucial to emphasize the importance of using poison incident data to determine the most suitable location for each center. The availability of a poison incident database is essential to provide timely and accurate guidance in the event of poison cases, and to ensure that up-to-date information regarding poisoning incidents is disseminated to the general public.

Apart from the traditional uses of this data, the national toxicology event registry can also serve as a valuable resource for researchers working to evaluate the scientific basis of salvaging organs from poisoning cases and the feasibility of utilizing them for transplantation purposes [13]. Moreover, the phenomenon of biocrime has emerged as a stark reality in the post-COVID-19 world, necessitating the collection of meticulous data pertaining to all poisoning events. From a forensic epidemiology perspective, robust public health surveillance is imperative, given the escalating criminogenic potential of molecular and genetic level threats, including bioterrorism [14].

Conclusion

Health information data is basic for diagnosing, treating, and controlling diseases, effectively implementing healthcare programs, and supporting clinical decisions. Therefore, the design and implementation of an effective information management system are a high priority for the healthcare system of every country. The

Health Management Information System (HMIS) has shown great potential for helping policymakers and healthcare providers to offer high-quality care and control for diseases. Similarly, an effective information management system or database that contains comprehensive data on incidents of poisoning is essential for facilitating swift clinical response and purposeful administrative decision-making by policymakers on a large scale. We wish that a National Poisoning Incident Reporting System (NPIRS) will soon become a reality in our country.

Ethics Committee Approval

Not applicable

Conflict of interest

The authors declares that they do not have conflict of interest.

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