

BMJ Open Evaluation of types of poisoning exposure calls managed by the Malaysia National Poison Centre (2006–2015): A retrospective review

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ABSTRACT

Objective Accidental or intentional poisoning is a public health concern requiring intervention. The current study designs to evaluate the types of poisoning exposure calls received by the Malaysia National Poison Centre (NPC) over a 10-year period.

Settings and data sources The poisoning enquiries database (2006–2015) from the Malaysia NPC was used for the analysis.

Participants The NPC records all telephone calls that it manages using a validated and standardised form. Demographics and types of the poisoning exposure calls were extracted and descriptive analysis was applied.

Primary and secondary outcomes The primary outcome of this study is to evaluate NPC data for trends in the poisoning exposure calls based on the types and modes of poisoning over a 10-year period. The secondary outcome is to evaluate the characteristics of human exposure cases based on the calls received by the NPC.

Results There was a notable increase in the number of poisoning exposure calls noticed during the 10-year period but dropped significantly in 2012. The highest number of poisoning exposure calls came from Selangor (21.0%), Perak (18.0%) and Negeri Sembilan (9.8%). More than half of the exposure was intentional (53.8%) involving more women (50.3%) as compared with men (41.9%), and in the 20–29 years age group category (33.5%). Exposure mostly occurred at home (96%) through the ingestion route (94.1%). Pharmaceutical products (40.5%), pesticides (31.7%) and household products (20.1%) were the common agents implicated for intentional exposure.

Conclusions There is an increasing trend in enquiries on poisoning exposure calls made to the NPC. Most of the intentional poisoning exposures occurred among younger women and involved pharmaceuticals, pesticides or household products. Poisoning safety education and other interventions are needed to curb poisoning incidents.

INTRODUCTION

WHO deems poisoning to be a globally significant threat to public health. The WHO Global Burden of Disease project revealed an estimated 345 814 people of all ages died

Strengths and limitations of this study

- This study revealed a long-term trend on poisoning exposure calls received at a national poison centre in a South-East Asian country over a 10-year period.
- The data reported depend on the self-reported calls made by healthcare providers based on the calls received relating to exposure to a substance that required management in the healthcare facilities.
- The common types of poisoning, the causative agents and characteristics of patients were confirmed through telephone conversation.
- The data set lacks complete follow-up on the patient's management, outcomes and severity of poisoning.
- The causes of and reasons for the exposure are also not investigated in detail, indicating a general lack of complete poisoning surveillance in the country.

worldwide as a result of 'accidental' poisoning in 2004.¹ Low-income and middle-income countries have higher poisoning death rates than high-income countries.¹ The prevalence and types of poisoning vary considerably across the world and depend on socioeconomic status and cultural practices, as well as on local industrial and agricultural activities.²

Poison centres are established to provide assessment, triage, management and continued monitoring of poisoning cases in a country.³ Concurrently, the available data can be used for planning of suitable interventional strategies to reduce both intentional and unintentional poisoning in a population. However, of all 11 countries currently making up the South-East Asia region, only a mere 7 have an operational poison centre as of August 2016. Burma, Cambodia, Indonesia, Malaysia, Philippines, Thailand and Vietnam have functional poison centres, while Laos, Singapore, Brunei and East Timor lack such a

facility.⁴ The Malaysia National Poison Centre (NPC) was first established in 1994.⁵ It is the main centre providing toxicological information to healthcare providers and the general public, serving a population of over 31 million people.

In relation to data collection and publication of findings by the aforementioned poison centres, the few reports that currently exist focus on specific poisoning agents, modes or demographic factors associated with poisoning within these countries.⁶ What is apparent following literature searches on this topic, however, is the absence of reporting of the wider profile of poisoning enquiries within countries and a lack of overviews detailing the national trends seen by South-East Asian poison centres in their respective countries. An overall depiction of the type of enquiries received by these poison centres would prove most valuable in highlighting national trends associated with poisoning cases in the respective countries. Hence, the primary aim of this study is to evaluate the types of poisoning exposure calls received by the Malaysia NPC for the period from 2006 to 2015.

METHODS

Data source

A retrospective review of the NPC database was conducted. The entire population of Malaysia is served by only one poison centre. The Drug and Poison Information Service of the NPC has attended to a wide continuum of poisoning-related enquiries since its inception in 1994, and has received over 42 000 poisoning exposure calls to date. Since then, the centre has noted an annual increase in the number of calls received.

All telephone calls received by the centre are entered into a standardised Poison Case Report Form (PCRF), adapted from the WHO IPCS INTOX system.⁷ The PCRF has been modified and updated thrice since 1995. The face and content validity were previously established by several academicians and nine pharmacists. The PCRF consists of five domains: administrative records, patient's background, poisoning information, clinical features and patient management. Information on clinical features and patient management on admission before contact with the centre were obtained at the centre's initiative previously but this segment is now officially incorporated in the PCRF after 2011.

Call details obtained from the caller uses a systematic approach that includes the enquirer's contact details, patient's age, sex and weight (kg), type(s) of poisoning agent involved, quantity ingested (if applicable), location of the incident, circumstances of exposure, route of exposure and the time elapsed after the patient's initial exposure to the interlocutor agent.

Classification of poisoning agents are based on the WHO INTOX system classification.⁷ Each agent is classified as either agricultural/garden, environmental contaminant, food and beverages, household/leisure, industrial/commercial, natural toxins, pharmaceuticals,

pesticides, or substances of abuse. Additionally, each poisoning enquiry is classified either as intentional, unintentional or adverse reactions based on the WHO INTOX classification.⁷ An intentional incidence is defined as 'an exposure by any route (or incident) where there was an intention to cause harm'. An unintentional incidence is defined as 'an exposure by any route (or incident) where there was no intention to cause harm'. An adverse reaction is defined as 'an unwanted effect of a drug, food or other agent occurring after the normal use of that agent'. In this study, exposures do not necessarily represent a poisoning or overdose.⁸

A team of nine specially trained inhouse pharmacists handles all poisoning exposure calls and the information on each call is documented. Information sought by the caller is conveyed based on reference from databases such as, Micromedex (Poisondex) and Toxinz or primary literature for unique cases. For enquiries that can be dealt with via general measures including certain snakebites, pharmaceutical overdoses (eg, acetaminophen/certain prescription medications) and pesticide ingestion for instance, the pharmacists provide immediate treatment advice and guidance to the caller. They assist in the triage of a patient, advise on first aid and signpost to nearby healthcare facilities equipped to deal with such cases.

Inclusion and exclusion criteria

Poisoning exposure calls made by the healthcare providers from healthcare institutions across Malaysia between January 2006 to December 2015, complete with information on the PCRF and database, were included in this study. General poisoning enquires both by the general public and healthcare providers were excluded in this study.

Data analysis

Data analyses were performed using the Statistical Package for Social Sciences (SPSS) V.24.0. Descriptive statistics was performed and results were presented in frequency and percentages.

Ethical approval

The patient case data collated between January 2006 and December 2015 were used as a component of this study. All personal details pertaining to the patients were removed prior to descriptive analysis, to ensure anonymity of individuals.

Patient and public involvement

Patients and public were not involved in the development of the research questions and also in the design of this study. All information was obtained through the poisoning exposure calls received by the NPC from the healthcare providers. The results will be disseminated via our local authorities, conference presentations and shared through patient and public involvement initiatives by the NPC.

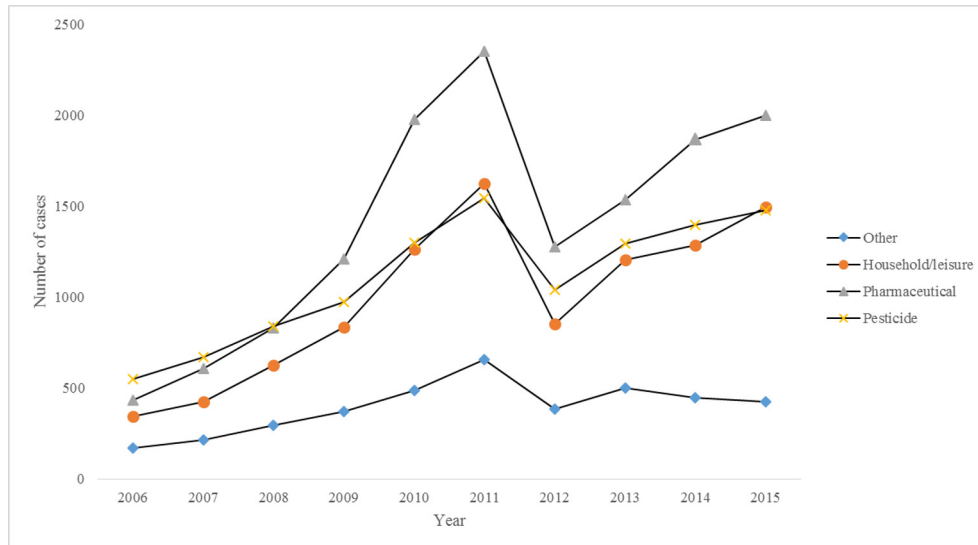


Figure 1 Trends of the three most common poisoning exposure agents based on the calls received by the Malaysia National Poison Centre between 2006 and 2015. The series titled; 'other' was inclusive of the remainder of poisoning agent categories. These were: agricultural/garden, environmental contaminant, food and beverages, industrial/commercial, natural toxins, substances of abuse, mixture of agents, other and unknown.

RESULTS

During the study period, the NPC had handled 39088 poisoning exposure calls for consultation. **Figure 1** demonstrates an increasing trend of poisoning exposure calls made to the NPC from the years 2006 to 2011, followed by a sharp drop in the year 2012 and a steady increase 2013 onwards. The highest number of calls were received from Selangor (21.0 %), Perak (18.0 %), and Negeri Sembilan (9.8 %). The least calls were received

from Terengganu (0.6 %); Labuan (0.1 %), followed by Perlis (0.1%) (**table 1**). Of the total poisoning exposure calls received, 63.1% were calls outside office hours and 72.5% of calls were made on weekdays.

In terms of demographic distribution, men and women constitute almost equal number of poisoning exposure calls (47.0% vs 41.5%). There were more poisoning exposure calls related to Malay ethnicity (28.4%), followed by Indian (26.1%), Chinese (13.5%) and others. In general,

Table 1 Total number of poisoning exposure calls received by the National Poison Centre from each state in Malaysia between 2006 and 2015

State	Population ('000)	Total number of calls	Percentage of calls received, % (n=38451)
Perlis	248.5	54	0.1
Kedah	2096.50	1764	4.5
Pulau Pinang	1698.10	2253	5.8
Perak	2466.90	7028	18.0
Selangor	6178.00	8216	21.0
Kuala Lumpur	1780.40	2897	7.4
Putrajaya	83	441	1.1
Negeri Sembilan	1088.80	3849	9.8
Melaka	889	1049	2.7
Johor	3610.30	3404	8.7
Pahang	1607.90	3241	8.3
Terengganu	1161.00	253	0.6
Kelantan	1760.60	585	1.5
Sarawak	2701.50	1310	3.4
Sabah	3720.50	2150	5.5
Labuan	95.1	47	0.1

The total Malaysian population was 31 186.10million in 2015 (Department of Statistics, Malaysia).

the majority of the poisoning exposure calls were related to exposure of pharmaceutical products (36.0%), pesticides (28.4%) and household products (25.5%). Poisoning exposure occurring at home stood at 92.8%. Poisoning exposure at the agriculture or horticulture site accounted for 48.5% and at factories 27.4%. The number of intentional poisonings outweighed unintentional poisonings (53.8% vs 44.0%, respectively) with only 1.0% of cases due to adverse reactions. Most poisoning exposure calls were associated with acute exposure (95.3%), primarily through oral ingestion (94.1%) (table 2).

Under the intentional poisoning category, half of the poisoning exposure calls received involved women (50.3%) as compared with men (41.9%). The highest number of intentional poisonings occurred in the 20–29 years (33.5%), 30–39 years (19.7%) and 40–49 years (10.3%) age groups. On the other hand, unintentional poisoning involved more men (53.3%) as opposed to women. Majority of the unintentional poisoning cases occurred in the 1–9 years age group (46.7%), followed by 19–29 years (13.4%) and 30–39 years (8.8%) (table 3).

Table 4 demonstrates that the pharmaceutical products (40.5%) and pesticides (31.7%) are common agents implicated in intentional poisoning. As for the unintentional poisoning category, household or leisure products (32.7%) and pharmaceuticals (30.0%) are the contributory factors. A high proportion of poisoning exposure calls were related to adverse reactions attributed to pharmaceuticals (64.4%).

DISCUSSION

This study details poisoning trends identified over a 10-year period based on the poisoning exposure calls received at the Malaysia NPC. As observed, there is a sharp rise in the number of poisoning exposure calls received from 2006 to 2011, and a significant decline in the year 2012. The decline in the number of calls in the latter year was concurrent with a change of operating hours at the NPC during that time. Faced with budgetary constraints, the NPC Drug Poison Information Service was forced to temporarily withdraw its 24/7 service, limiting it to regular office hours. The NPC reverted to its previous operational arrangement after a 6-month break.

Majority of the poisoning exposure calls serviced by the NPC over the 10-year period were from the state of Selangor. Selangor is Malaysia's most economically developed state and has the highest population density relative to the country's other states. Fewer calls were received from East Malaysia that has experienced urbanisation to a lesser degree. Previously published literature has investigated the relationship between the extent of urbanisation and poisoning exposure. A previous US study highlighted that urbanisation rate has an effect on deaths due to drug poisoning in particular.⁹ An Irish study further confirmed a higher mortality rate due to poisoning in urban areas during 1980–2000.¹⁰

In this study, it is evident that a higher proportion of women was involved with intentional poisoning whereas

Table 2 Sociodemographic characteristics of the human exposure cases which led to the poisoning exposure calls received by the National Poison Centre (total=39088)

Sociodemographic characteristics	Frequency (%)
Gender	
Male	18 374 (47.0)
Female	16 208 (41.5)
Unknown	4 506 (11.5)
Race	
Malay	11 107 (28.4)
Chinese	5 263 (13.5)
Indian	10 190 (26.1)
Other	3 135 (8.0)
Non-Malaysian	578 (1.5)
Unrecorded/unknown	8 815 (22.6)
Type of poisoning	
Pharmaceutical	14 081 (36.0)
Pesticide	11 087 (28.4)
Household leisure	9 957 (25.5)
Others	3 963 (10.1)
Location of incident	
Home	36 258 (92.8)
Workplace	1 094 (2.8)
Open place	267 (0.7)
Hospital/clinic	245 (0.6)
Academic institution	64 (0.2)
Other	1 159 (2.9)
Incidence category	
Intentional	21 017 (53.8)
Unintentional	17 195 (44.0)
Adverse reaction	374 (1.0)
Unrecorded	502 (1.3)
Exposure type	
Unknown	277 (0.7)
Acute	37 260 (95.3)
Chronic	251 (0.6)
Acute on chronic	1 295 (3.3)
Exposure route	
Ingestion	36 764 (94.1)
Inhalation	1 000 (2.6)
Cutaneous	276 (0.7)
Ocular	137 (0.4)
Bite/sting	632 (1.6)
Injection	133 (0.3)
Mucosal	34 (0.1)
Placental	9 (0)
Otic/aural	2 (0)
Others	23 (0.1)
Unrecorded	78 (0.2)

Table 3 Frequency of poisoning modes (intentional poisonings, unintentional poisonings and adverse reactions) by different age categories based on poisoning exposure calls received at the Malaysia National Poison Centre, 2006–2015

Variable	Intentional poisonings	Unintentional poisonings	Adverse reactions
	N (%)	N (%)	N (%)
Gender			
Male	8803 (41.9)	9242 (53.7)	137 (36.6)
Female	10566 (50.3)	5348 (31.1)	123 (32.9)
Unknown	1648 (7.8)	2605 (15.1)	114 (30.5)
Age group			
<1 year (infant)	28 (0.1)	957 (5.6)	31 (8.3)
1–9 years (child)	251 (1.2)	7906 (46.0)	47 (12.6)
10–19 years	3794 (18.1)	1418 (8.2)	43 (11.5)
20–29 years	7044 (33.5)	2304 (13.4)	57 (15.2)
30–39 years	4149 (19.7)	1511 (8.8)	54 (14.4)
40–49 years	2170 (10.3)	854 (5.0)	34 (9.1)
50–59 years	1000 (4.8)	621 (3.6)	30 (8.0)
≥60 years	742 (3.5)	658 (3.8)	17 (4.5)
Unclassified adult	1650 (7.9)	731 (4.3)	43 (11.5)
Unrecorded	189 (0.9)	235 (1.4)	18 (4.8)
Poison type			
Pharmaceutical	8512 (40.5)	5157 (30.0)	241 (64.4)
Pesticide	6669 (31.7)	4196 (24.4)	31 (8.3)
Household/leisure	4228 (20.1)	5617 (32.7)	23 (6.1)
Other	1608 (7.7)	2225 (12.9)	79 (21.1)

The unclassified adult age category pertains to individuals aged over 19 years, without a confirmed record of date of birth in the form.

unintentional poisoning was more associated with men. Consistent with other studies, women were found more likely than men to be at risk for self-inflicted poisoning admissions.¹¹ Findings from USA similarly demonstrated a greater proportion of boys in poison exposures occurring in children younger than 13 years, then switching to a female

predominance in teens and adults.¹² Several international studies have highlighted that violent methods of self-harm, alcohol use disorders and economic stressors are associated with suicide attempts in men, whereas a history of sexual trauma and anxiety disorders are commonly associated with suicide attempts among women.^{13–15}

Table 4 Distribution of poisoning exposure by poison subtypes

Poison type	Intentional poisonings	Unintentional poisonings	Adverse reactions
	N (%)	N (%)	N (%)
Unknown function	48 (0.2)	58 (0.3)	0 (0)
Agricultural/garden	150 (0.7)	218 (1.3)	2 (0.5)
Environmental contaminant	2 (0)	9 (0.1)	0 (0)
Food and beverages	48 (0.2)	38 (0.2)	13 (3.5)
Household/leisure	4228 (20.1)	5617 (32.7)	23 (6.1)
Industrial/commercial	157 (0.7)	794 (4.6)	2 (0.5)
Mixture of agent	317 (1.5)	24 (0.1)	2 (0.5)
Natural toxin	65 (0.3)	855 (5.0)	52 (13.9)
Pharmaceutical	8512 (40.5)	5157 (30.0)	241 (64.4)
Pesticide	6669 (31.7)	4196 (24.4)	31 (8.3)
Substance of abuse	765 (3.6)	66 (0.4)	8 (2.1)
Others	56 (0.3)	163 (0.9)	0 (0)

The current study shows that there is a high proportion of unintentional poisoning cases involving children. Children are more susceptible to toxic chemicals because of the immaturity of many organ systems in detoxifying poison and their greater body surface that contributes to the fast rate of absorption through the skin.¹⁶ A WHO report revealed that common poisoning agents among children in high-income countries include pharmaceuticals, household products (eg, bleach, cleaning agents), pesticides, poisonous plants, and bites from insects and animals, whereas, common poisoning agents in low-income and middle-income countries are fuels such as paraffin and kerosene, pharmaceuticals and cleaning agents.¹⁷ Although the subtypes of causative agents for unintentional poisoning among children was not investigated further in this study, the main categories identified includes pharmaceuticals, household items and leisure products.

Ingestion remains the most common route of exposure for intentional poisoning. According to a previous report, pesticide ingestion constituted the greatest percentage of poisoning cases in Malaysia prior to 2008.¹⁸ However, the current study revealed that there is a change in this trend with pharmaceuticals topping the chart as the main poisoning causative agents in both the intentional and non-intentional categories. Enhanced exposure and easy availability of pharmaceutical products to the general public undoubtedly fuels a rise in the popularity of using such means for self-poisoning.^{19 20} Several reports from other poison control centres and hospitals revealed that the most common agents implicated in poisoning cases in developed countries and some developing countries were medicines sold over the counter such as paracetamol, cough and cold remedies, iron tablets, antihistamines and anti-inflammatory drugs.^{21 22} Interestingly, studies also found that a vast majority of suicide attempters from the urban areas use psychotropic drugs such as tranquillisers and antipsychotics,²³ whereas in rural areas, pesticides or other chemicals used in agriculture dominate.^{24 25}

From the outset, NPC has engaged and continues to engage in the education and training of healthcare professionals and the general public. Efforts are made to enable capacity building in the local community as well as awareness of issues surrounding poisoning. Activities organised by the NPC include workshops (eg, clinical management of pesticide poisoning), providing inhouse lectures to staff in tertiary healthcare settings, training community pharmacists, exhibitions and poison centre road shows.

Although the NPC is continuously improving its outreach strategies, financial restrictions have proven to be a hindrance in achieving its full potential as the prime organisation to help combat poisoning exposure in Malaysia. Online quizzes on the NPC website, as well as development of a poison centre mobile application are both examples of how the NPC could disseminate poisoning information to healthcare professionals and

the general public in the future. More intense collaborations with governmental organisations such as the Ministry of Agriculture could give rise to annual health checks for those with occupations in the agricultural sector exposed to pesticides on a regular basis. Continued collaboration with national and internal organisations would ensure the development of outreach/educational programmes that are as dynamic as the poisoning trends being identified.

This study is subject to limitations. The trends observed in this study may not be wholly reflective of those currently present in Malaysia. The actual number of poisoning exposures may indeed have been higher during the study period (2006–2015) and may have been under-reported, as reporting of poisoning exposure to the NPC is not mandatory. The data documented in this study are derived from recorded calls by healthcare providers throughout the country and their enquiries relating to an actual or potential exposure to a substance requiring management in their respective healthcare facility. Not all poisoning exposures and overdoses have been reported to the NPC, especially if the cases are treatable and do not require additional assistance in terms of information on poisoning management and treatment. While the data undoubtedly provide a basis for the trend in cases of poisoning in Malaysia itself, important sociodemographic and regulatory differences might exist in different countries, hence the trends observed or the potential impact of these trends might be very different in other South-East Asian countries.

An important limitation worth highlighting is the lack of information on patients' outcomes and the severity of the poisoning based on any available poisoning severity scores. Additionally, the clinical features and patient management including the medical outcomes and therapies that were used were also not discussed in the current study. Medical outcomes could be of special interest as it is vital to know how severe these cases of poisoning were, in view of the fact that most were intentional exposures. This information, if available, could provide better insight into the depth of the problem; for example, a case of fatal intoxication could provide a basis for the implementation of strategies to reduce poisoning exposure.

Other information can be valuable for identifying strategies to reduce cases of poisoning. For example, information on single substance and polysubstance exposures was not available for analysis. It is also not possible with the current data to differentiate between cases of intentional abuse versus self-harm, an important detail that can provide an insight into the trend observed of the high number of intentional cases. Steps have been taken to include this information for future use.

CONCLUSION

Generally, the trend shows an increase in the number of poisoning exposure calls being handled by the poison centre, particularly those involving pharmaceuticals,

pesticides and household items. The findings of this study show that emphasis and attention need to be given to poisoning induced due to pharmaceuticals, pesticides and household items. Using this as a reference, the NPC will be better informed on recent poisoning trends in Malaysia, thus enabling it to plan for more effective intervention strategies and public education programmes. Public awareness on the role of the NPC could also attract greater public participation towards poisoning control.

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