Factors that trigger emergency physicians to contact a poison centre: findings from a Swiss study

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ABSTRACT

Objective Poison centres offer rapid and comprehensive support for emergency physicians managing poisoned patients. This study investigates institutional, case-specific and poisoning-specific factors which influence the decision of emergency physicians to contact a poison centre.

Methods Retrospective, consecutive review of all poisoning-related admissions to the emergency departments (EDs) of a primary care hospital and a university hospital-based tertiary referral centre during 2007. Corresponding poison centre consultations were extracted from the poison centre database. Data were matched and analysed by logistic regression and generalised linear mixed models.

Results 545 poisonings were treated in the participating EDs (350 (64.2%) in the tertiary care centre, 195 (35.8%) in the primary care hospital). The poison centre was consulted in 62 (11.4%) cases (38 (61.3%) by the tertiary care centre and 24 (38.7%) by the primary care hospital). Factors significantly associated with poison centre consultation included gender (female vs male) (OR 2.99; 95% CI 1.69 to 5.29; p<0.001), number of ingested substances (>1 vs 1) (OR 2.84; 95% CI 1.65 to 4.9; p<0.001) and situation (accidental vs intentional) (OR 2.76; 95% CI 1.05 to 7.25; p=0.039). In contrast, age, medical history and hospital size did not influence poison centre consultation. Poison centre consultation was significantly higher during the week, and significantly less during night shifts. The poison centre was consulted significantly more when patients were admitted to intensive care units (OR 5.81; 95% CI 3.25 to 10.37; p<0.001). Asymptomatic and severe versus mild cases were associated with more frequent consultation (OR 4.48; 95% CI 1.78 to 11.26; p=0.001 and OR 2.76; 95% CI 1.42 to 5.38; p=0.003).

Conclusions We found low rates of poison centre consultation by emergency physicians. It appears that intensive care unit admission and other factors reflecting either complexity or uncertainty of the clinical situation are the strongest predictors for poison centre consultation. Hospital size did not influence referral behaviour.

INTRODUCTION

Poisoning is an important cause for emergency department (ED) consultations within European countries. Compared with all hospital admissions, rates of poisoning-related admissions vary from 0.7% (Spain) to 1% (France).[1 2] If telephone consultations of EDs are considered, poisoning-related cases account for up to 10% of all consultations.[3] In Switzerland, the national poison centre was consulted 31933 times in total during the year 2007 and in 8768 (27.5%) of these, the poison centre was contacted by a treating physician, also including emergency physicians.[4]

Previous studies suggested that rates of poisons centres consultation by emergency physicians vary between 26% and 34%[5 6] and are as low as 4%–12% for lethal poisonings.[7 8] Moreover, preliminary observations from our centre indicate that poisonings with unusual substances such as plants or chemicals are reported more frequently than poisonings with well known and frequently used substances such as alcohol (Schurter *et al*, unpublished data), and this is partially supported by analyses of lethal poisonings.[7] We therefore hypothesised that analyses based on poisons centre data only may not reflect the real occurrence of certain types of poisonings. The literature on factors that trigger emergency physicians to consult a poison centre is very scarce. In order to address the factors influencing the decision of emergency physicians to consult a poison centre, we aimed at identifying case-specific, circumstance-specific and institutional factors influencing this decision. In particular, our objective was to identify factors that trigger emergency physicians to contact the local poison centre, and we focused on investigating factors such as circumstances of poisoning, involved substance class, poisoning severity and hospital size.

METHODS

Study design

For our retrospective consecutive review of poisoning-related consultations and ED admissions between January and December 2007 we chose EDs of the *GZO Regional Health Centre* and the *University Hospital of Berne*. Characteristics of participating study sites are mentioned in box 1. The two EDs were chosen because they are both covered by the same poison centre, but differ largely in their size and referral population. None of the emergency physicians in both EDs works also in the poison centre or has direct connections with it. Analysis of a whole year was performed in order to control for a possible confounder due to the potential seasonal variability of some poisonings (eg, toxic alcohols during winter months).

Inclusion criteria

The following criteria had to be met for cases to be included in the study:

- Patient age ≥16 years
- Consultation between 1 January and 31 December 2007
- Consultation at the ED of one of the participating hospitals
- Consultation due to any acute or chronic poisoning.

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Box 1 Context of the study: characteristics of participating study sites

Swiss Toxicological Information Centre
- Provides 24-h 7-days-a-week advice on diagnostic and treatment procedures in cases of poisoning
- Nationwide and free of charge, provided by physicians trained in clinical toxicology
- For health professionals and the general public
- Referral population of about 7.9 million people
- Clinical information is collected in a systematic and standardised manner[13]
- Covers entirely both other study sites

GZO Regional Health Centre
- Primary care hospital
- Referral population of about 150000

University Hospital of Berne
- Tertiary care teaching centre
- Referral population of about 352000

Data collection

Demographic and detailed clinical information on exposure cases were manually searched within the clinical information systems of the participating EDs. The list of all obtained data including the respective definitions is shown in table 1. Each case found in the EDs was matched with the poison centre database to verify if the poison centre was contacted for that specific case, and clinical details were then verified by means of the standardised records of the poison centre. All data obtained from the EDs and the poison centre were entered into a standardised EXCEL datasheet. Data collection and verification were performed by DS and MJ, under the supervision of AE, UE and AC.

Data analysis

Statistical analysis was performed using R V.2.12.2.[9] To identify which factors trigger emergency physicians to contact a poison centre and to investigate the effect of the various factors (predictors) on whether the poison centre was consulted or not, also providing ORs and 95% CI with corresponding p values, logistic regression models were performed. For continuous variables like age, the OR is expressed as the ratio of the odds from the third to the first quartile, representing a typical above average to a typical below average value. In order to evaluate the most potent factors, a logistic regression model with the given factors was conducted. Analysis of poison centre consultation rates per weekday was performed using Wald's test as well as logarithmic regression for the reference day. For the analysis of the involved substance classes, generalised linear mixed models using the logit link with the substance code as fixed factor and patient number as random factor were performed due to multiple poisons per patient yielding ORs and 95% CIs as well as the corresponding p values.[10]

Table 1 Recorded data and definitions

Data	Definition
Age	As at time of emergency department consultation/admission (years)
Gender	Male, female
Previous (relevant) medical condition	Presence of an active medical problem or history of a previous medical condition influencing the present physiological status, for example, previous nephrectomy
Admitting hospital	Name of the admitting hospital
Consultation/admission time	Time of first medical contact within the hospital
Consultation/admission	Outpatient, general ward, continuous care unit, intensive care unit
Substance(s), number of substances and route of exposure	Substance class, total number of substances, route of exposure
Circumstances of exposure	Intentional (suicide, abuse, criminal) versus accidental
Severity	According to the Poisoning Severity Score[11]
Consultation of the poison centre	Emergency physician calling the poison centre any time during management of the case (yes/no)

RESULTS

Demographics

During the study period, a total of 545 poisonings were treated in the participating EDs, 350 (64.2%) in the tertiary care centre and 195 (35.8%) in the primary care hospital. Overall, 54% (294/545) of the patients were male, and the median age was 34 years (range 16–87, IQR 23–46 years). Male patients were slightly younger than female patients (median 33 vs 35 years). The poison centre was contacted in 62 (11.4%) of all 545 cases. Emergency physicians in the tertiary care centre contacted the poison centre in 10.9% (38/350) of the cases and those in the primary care hospital in 12.3% (24/195). In all, 54.7% of all cases (298/545) had—at the time of initial ED contact—a previously known medical condition as defined in table 1. The poison centre was consulted in 11.7% (35/298) of the cases in which a previous medical condition was known, and in 10.9% (27/247) of the cases in which a previous medical condition was not known; the difference was not significant. Overall, 27.9% (152/545) of all poisoning-related ED contacts led to hospital admission, and 65.8% (100/152) of them were treated in intensive care units (ICUs) or similar wards with continuous monitoring of vital signs (eg, intermediate care units).

Circumstances and patient characteristics

Patients were exposed to 1–10 different poisons (mean 1.7, SD 1.2). In all, 61.1% (333/545) of the cases were single substance poisonings, 62.6% (341/545) were due to abuse, 27.5% (150/545) were suicide attempts and 9.9% (54/545) were due to various circumstances (eg, accident, crime). A total of 44 of 150 suicidal poisonings and 10 of 341 accidental poisonings were referred to the poison centre. With exclusion of possible confounders through logarithmic regression, a significantly higher referral rate for suicidal compared with accidental poisonings was identified ($p=0.039$).

Further factors influencing the decision to consult the poison centre were identified and are reported in table 2. Female sex of the patient and ingestion of multiple substances led to a significantly higher rate of poison centre consultation.

Institutional factors

No difference in poison centre consultation behaviour was identified between the two hospitals included in this study. ED visits due to poisonings were evenly spread through weekdays, while cases were nearly twice as high during weekends. In contrast, poison centre consultations were significantly more frequent during the first two days of the week, with a similar trend for

Table 2 Factors influencing referral to the poison centre

Factor	OR (95% CI)	p Value
High age	1.03 (0.71 to 1.50)	0.89
Female sex	2.99 (1.69 to 5.29)	<0.001
Primary care hospital	1.15 (0.67 to 1.99)	0.61
Multiple substances	2.84 (1.65 to 4.9)	<0.001
Suicidal circumstances	2.76 (1.05 to 7.25)	0.039
Uncertain causality	0.77 (0.35 to 1.69)	0.52
Previous medical history	0.93 (0.55 to 1.59)	0.79

Wednesday and Thursday (table 3). Overall, 70.3% (383/545) of the patients had their first hospital contact outside the regular day shift (ie, 09:00—18:00). Cases with consultation of the ED during night shifts were associated with significantly lower poison centre consultations rates compared with those during day shifts (table 4). With consideration of the involved substance, the difference in poison centre consultation related to senior staff availability no longer shows any significance.

Further patient care

Patient disposition after ED admission and evaluation are shown in table 5. Cases admitted to the ICU were significantly more often discussed with the poison centre, while this seldom occurred for cases managed as outpatients.

Severity of poisoning and type of poison

Poison centre consultation in relation to severity of poisoning (according to Poisoning Severity Score (PSS)[11]) is shown in table 6. Asymptomatic and severe cases (PSS=0 and 3, respectively) were associated with a more frequent consultation of the poison centre than mild cases (PSS=1 and 2). The poison centre was not consulted in the only fatal case which occurred during the study period. Poisonings with alcohol and recreational drugs were more rarely followed by poison centre consultation compared with medications (OR=0.006 (CI 0.002 to 0.17), p<0.001).

Data quality

Completeness of data in this study is very high and no case had to be excluded due to missing values.

DISCUSSION

Our data show low rates of consultation of the local poison centre. In fact, only 11.4% of all poisoned patients treated by emergency physicians were referred to the poison centre. This finding is in contrast to previously published data, in which poison centre referral rates between 26% and 34% were reported.[5 6] We hypothesise that the currently low referral rates might reflect changed patterns of poison exposures being treated by emergency physicians nowadays. In fact, of major importance were overdoses of alcoholic beverages often in combination with cannabis and other drugs of abuse.

Another relevant finding of our study is that no difference was identified between a large tertiary referral centre and a primary care hospital. Therefore, we provide evidence that different organisational structures, especially in terms of senior staff availability, do not account for significant differences in poison centre referral rates. This finding has to our knowledge not been described before in the literature. It might indicate that higher referral rates by emergency physicians in a certain area may be due to a higher incidence of poisonings rather than a different referral behaviour of treating physicians in that area. Nevertheless, our analysis included two hospitals in Switzerland only, and further studies with similar results are needed to support this conclusion.

The finding that severe cases were frequently referred to the poison centre is not surprisingly. However, asymptomatic cases were also frequently referred to the poison centre, and this may be due to the cases which ingested low doses of uncommon substances. Another hypothesis is that the treating emergency physician is more prone to seek advice from the poison centre for asymptomatic cases, in order to discharge them home early.

The presence of multiple substance poisoning was associated with a higher rate of poison centre consultation despite the fact that we did not find higher severity scores for multiple substance poisonings in our study. It is plausible that treating emergency physicians perceived poisonings with multiple substances as more complex than those of comparable severity but with only a single substance. The same applies to poisonings in suicidal circumstances which were associated with a significantly higher poison centre consultation rate, and this has to our knowledge not been described before. A possible explanation is the ingestion of larger doses by suicidal patients.

A pre-existing medical history was not associated with an increased poison centre referral rate, neither in direct match nor in regression analysis. This might reflect the fact that maintenance of vital functions, but not analysis of pre-existing or not immediately available complex medical records, has the highest priority in emergency situations. It is the uncertainty of the specific emergency situation which prompts physicians in charge to contact the poison centre.

In all, 70.3% of all poisonings reached the hospital setting during evening or night shifts with limited availability of nursing and senior physician staff resources, especially in EDs of regional hospitals. Nevertheless, poison centre consultation rates were consistently higher during daytime. Regression analysis revealed that night-time poisonings were more often due to recreational drugs and alcohol, and we therefore hypothesise that the lower rate of poison centre consultation during night-time

Table 3 Consultation of poison centre in reference to weekday distribution

Weekday	n	Consultations	% Consultations	OR (95% CI)	p Value
Monday	61	13	21.3	4.10 (1.54 to 10.93)	0.005
Tuesday	63	12	19.0	3.56 (1.32 to 9.59)	0.012
Wednesday	79	11	13.9	2.45 (0.91 to 6.63)	0.078
Thursday	52	7	13.5	2.36 (0.78 to 7.11)	0.130
Friday	74	6	8.1	1.34 (0.43 to 4.15)	0.620
Saturday	103	6	5.8	0.94 (0.3 to 2.88)	0.910
Sunday	113	7	6.2	NA (reference)	NA

Table 4 Poison centre consultation in reference to emergency department admission time

Admission period	n	Consultations	% Consultations	OR (95% CI)	p Value
9:00—18:00	162	27	16.7	NA (reference)	NA
18:00—24:00	182	23	12.6	0.72 (0.4 to 1.32)	0.291
24:00—09:00	201	12	6.0	0.32 (0.16 to 0.65)	0.002

Admission time is divided into daytime, evening and night according to usual availability of emergency medical staff and consultants.

Table 5 Patient disposition after emergency department admission

Disposition	n	Poison centre consultations	% Poison centre consultations	OR (95% CI)	p Value
Outpatient	393	27	6.9	NA (reference)	NA
Ward	52	5	9.6	1.44 (0.53 to 3.93)	0.47
Intensive care unit	100	30	30.0	5.81 (3.25 to 10.37)	<0.001

Table 6 Poison centre consultation rate in relation to Poisoning Severity Score (PSS)

Severity (PSS)	n	Poison centre consultations	% Poison centre consultations	OR (95% CI)	p Value
None (PSS 0)	26	8	30.8	4.48 (1.78 to 11.26)	0.001
Minor (PSS 1)	300	27	9.0	NA (reference)	NA
Moderate (PSS 2)	139	10	7.2	0.78 (0.37 to 1.66)	0.521
Severe (PSS 3)	79	17	21.5	2.76 (1.42 to 5.38)	0.003
Fatal (PSS 4)	1	0	0.0	NA	NA

might be due to a higher incidence of cases which are easier to handle by well-trained physicians.

Female sex was shown to be an individual factor influencing poison centre consultation rates on a large base (OR 2.99). We have found no explanation for this observation, but the ingestion of different doses might be a reason. Further studies are warranted to analyse possible sex-related differences in the amount of ingested substances. In addition, social circumstances, as well as patient and doctor-specific individual and emotional factors might introduce a gender bias influencing the decision to consult the poison centre.

Patients admitted to the ICU had a significantly higher rate of poison centre consultation. On the basis of our data, however, we cannot decide to what extent ICU admission was based on the advice of poison centre consultants.

Limitations

Our study reflects a 'real world' situation in Switzerland. However, only two hospitals contributed to data collection. Thus, our data include a relatively low number of complex cases and poisonings with unknown or rare substances. Moreover, our data mainly include patients being treated as for acute intoxication in the ED and patients with chronic poisoning were clearly under-represented. Moreover, the amount of substance ingested was not taken into account despite the fact that this might influence poison centre consultation behaviour. Economic, structural and social factors within the population were not taken into consideration.[12] Nevertheless, these factors are believed to influence our results only minimally given the relatively uniform population profile in the small areas covered by our study. Time boundaries (weekdays and according to shift hours) are arbitrary to a certain degree but show distinctive trends, nevertheless.

CONCLUSIONS

We found very low poison centre referral rates. Factors reflecting either complexity or uncertainty of the clinical situation are the strongest predictors for poison centre referral, but hospital size, organisation and structure did not influence consultation behaviour.

Main messages

- There were substantially low poison centre consultation rates (11.4%) by emergency physicians in 545 cases of poisoning.
- Intensive care unit admission and other factors reflecting either complexity or uncertainty of the clinical situation are the strongest predictors for poison centre consultation.
- Age, medical history and hospital size do not influence consultation behaviour.

Current research questions

- Are these results applicable to other countries, especially those with different healthcare system structures?
- Do physician-specific factors, such as gender, experience and function, influence poison centre referral rates?
- Which factors influence the decision of physicians to consult a poison centre in patients with chronic versus acute poisoning?
- What is the role of economic, structural and social factors within the population?

Key references

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