Status and trends in poisonings in Denmark 2007-2009

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ABSTRACT

INTRODUCTION: The Danish Poison Information Centre (DPIC) provides information to the public and health care professionals on acute poisonings. The DPIC received 41,000 enquiries during the first three years of its existence as an open 24h telephone service. The aim of this data register study was to classify all substance exposures, to gain knowledge of the status and trends in poisonings (toxico-surveillance) and to evaluate the development in the number of contacts.

MATERIAL AND METHODS: Information and inquiries were continuously entered into a poison-centre database. A new classification system was established during the study to ensure that all agents were properly classified. A total of 41,139 calls were divided into 18 substance categories, each consisting of 3-11 subgroups.

RESULTS: The number of contacts per year increased by 70% from 2007 to 2009. Three contacts per thousand individuals in the Danish population were registered in 2009. For all groups, except drugs of abuse, the data showed an increase in the actual number of exposures from 2008 to 2009. Pharmaceuticals represent one third of substance exposures, and analgesics constitute a third of these poisonings. A relative increase in contacts concerning household substances, plants and vitamins was observed.

CONCLUSION: The classification gave detailed knowledge of the current poisoning status. Evaluation of subgroups showed a need for a larger number of subgroups to ensure a sufficient level of toxico-surveillance. Compared to other national poison centres, we predict a doubling in enquiries during the next ten years, mainly from the public.

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The Danish Poison Information Centre (DPIC, Giftlinjen) opened in August 2006 and by the end of 2009 it had received more than 45,000 enquiries. The DPIC is run by a collaboration between the Departments of Occupational Medicine, Clinical Pharmacology and Anaesthesiology and provides a 24-hour toxicological information service for both the public and health care professionals. Data collected from the DPIC (2007-2009) are presented in the present article.

The aim of this database register study was to:

a) Classify all substance exposures
b) Gain knowledge of the current status of poisoning in Denmark
c) Explore new trends in poisoning (toxico-surveillance)
d) Evaluate enquiries, i.e. their current and expected future level.

The DPIC provides guidance for the public and for health care professionals on acute poisoning, including all aspects related to the management of the poisoned patient.

The DPIC serves as first-line filter and is often able to avoid unnecessary contacts between the enquirer and other health care emergency facilities [1]. The guidance includes risk assessment of the acute poisoning followed by advice on first aid and triage.

Furthermore, the DPIC is involved in research within clinical toxicology, optimization of treatment guidelines, regulatory activities and in providing services such as clinical toxicology training to health care professionals.

Telephone calls to the DPIC are answered by experienced nurses who have all received additional training in clinical toxicology.

The main backup is provided by physicians specialized in anaesthesiology, occupational medicine or clinical pharmacology, and by pharmacists. The physicians and pharmacists maintain, update and prepare guidelines and action cards on specific poisonings. Further information sources include computerized databases; POISINDEX [2], guidelines from the Swedish Poison Information Centre (Giftinformationscentralen, GIC), textbooks and journals.

The experienced nurses who take the calls at the Danish Poison Information Centre have all received additional training in clinical toxicology. Photo: Søren Bøgevig.

ORIGINAL ARTICLE

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MATERIAL AND METHODS

All telephone enquiries are registered in a local database with detailed information about the poisoning and registration of the enquirer and/or the patient. Registration includes demographic patient data, a description of the poisonous agent (amount, mode of exposure, etc.), clinical status, risk assessment and management.

In this database register study which was guided by other national poison centres, all DPIC enquiries were classified into subgroups and arranged in main groups (substance categories) [2, 3]. Contacts were classified according to the involved agent, here referred to as substance exposure. The frequency of each substance exposure was found by searches in the internal database. Substances with a low frequency (below five per year) could not be found by this search and a hand count of approximately 17,000 substance exposures was therefore necessary to ensure proper classification.

We analyzed data from all contacts to the DPIC in 2007, 2008 and 2009 and relevant substance exposures were divided into 18 substance categories, each with 3-11 subgroups, resulting in 113 subgroups in total.

RESULTS

Table 1 shows the actual number of enquiries to the DPIC in 2007-2009. Ten percent of the enquiries were not related to acute poisoning but to theoretical questions, misdials, etc. The number of enquiries to the DPIC rose by approximately 70% from 2006 to 2009. Some enquiries (a tenth of the cases) involved more than one substance; therefore, the total number of substance exposures exceeded the number of contacts.

Figure 1 shows the 18 main categories of substance exposures presented as a percentage of the total of relevant substance exposures that year. In all categories, except drugs of abuse, there was an increase in the actual number of exposures from 2008 to 2009. In total, pharmaceuticals represented a third of all substance exposures with paracetamol as the single drug with the largest contribution in number, representing 4% of all reported exposures (**Table 2**). Analgesics (opioids and non-opioids) constituted a third and psychoactive drugs constituted four tenths of pharmaceutical substance exposures. Psychotherapeutic agents as a whole constituted one out of every seven exposures. Easily available household products were the largest category. The data showed a relative increase in enquiries concerning household products, plants and vitamins from 2007 to 2009. Non-pharmaceutical exposures represented 65-68% of all exposures within the period.

In all of the 113 specific subgroups presented in Table 2, a noticeable change was observed in three subgroups (representing > 5% in a category). During the three-year period data showed: A decreasing incidence of enquiries concerning exposure to multivitamins; A three-fold increase in exposure to iron; And an almost three-fold increase in exposure to clozapine. Only minor changes were noticed in the other 110 subgroups within the period.

TABLE 1

Calls to the Danish Poison Information Centre (DPIC) in 2007, 2008 and 2009. The total number of contacts is reported per year. Extracted are contacts with actual toxicological relevance, and where advice was given, followed by the total number of potentially poisoning agents involved in the contacts. Each of these agents is referred to as a substance exposure. Year 2007 serves as index 100.

Year	Total no. of contacts to DPIC/index	No. of contacts concerning human exposure (% of total contacts)	No. of substance exposures/index
2007	10,464/100	9,604 (92.3)	11,860 /100
2008	13,241/127	11,885 (89.8)	14,156 /119
2009	17,434/167	15,716 (90.1)	19,884 /168
Total, all 3 years	41,139	37,205 (90.4)	45,900

DISCUSSION

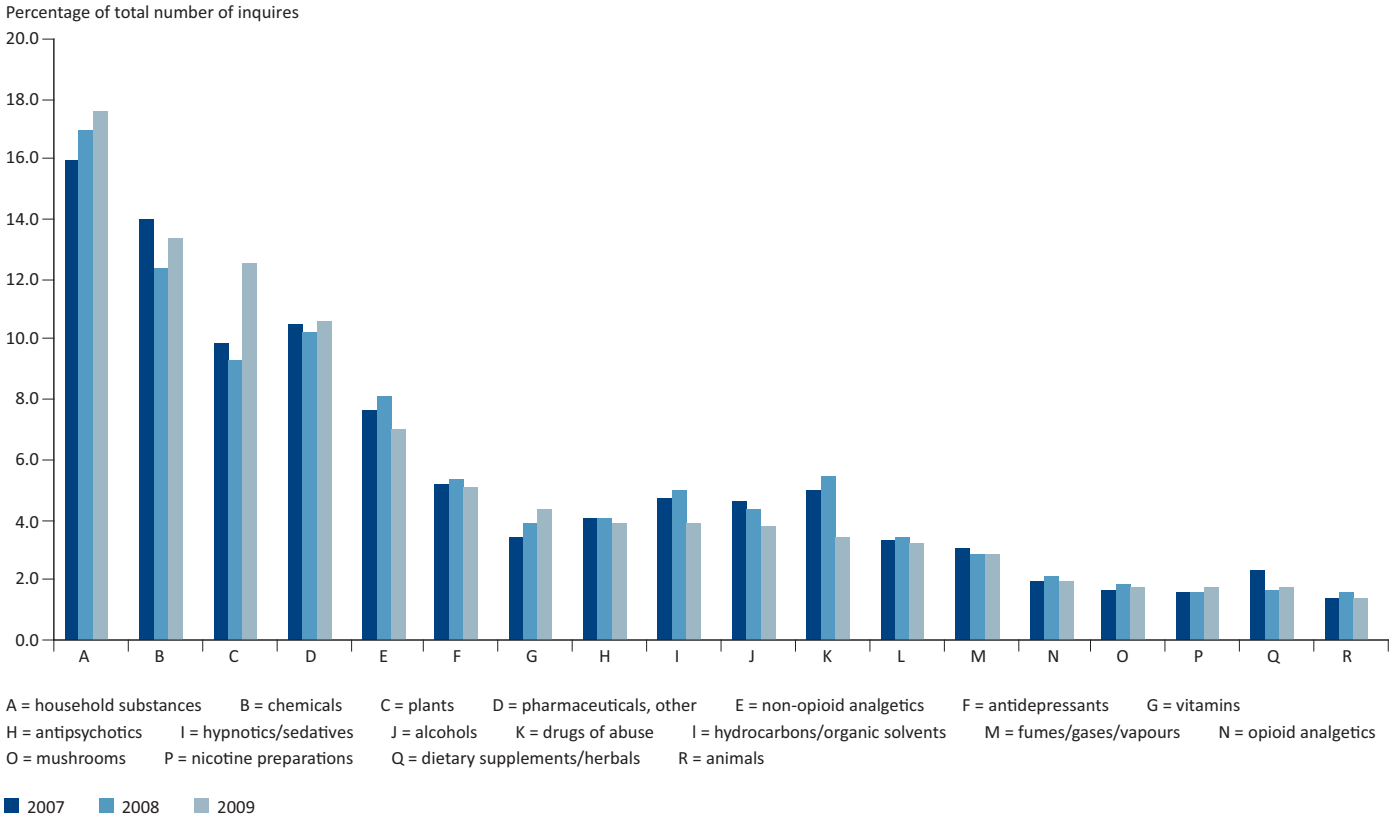
For the past three years, the DPIC has been functioning as a 24-hour advisory service for both health care professionals and the general public. The total of 45,900 substance exposures with a poison description were present in all enquiries. Registration of patient demographics, route of poison exposure and severity of the poisoning were found to be partly missing in the records and therefore not suitable for evaluation and presentation in the present paper. It is, of course, important to stress that the substance exposures presented to the DPIC only represents part of the total number of poisonings in Denmark during the period – many patients are poisoned and hospitalised with no contact to the DPIC.

The 70% increase in enquiries to the DPIC may well be explained by an increase in public knowledge of the 24-hour toxicological service. In 2009, the DPIC received three enquiries per thousand population members served. In Sweden a similar poison information centre (GIC) has been functioning as a public service for more 25 years. In 2009, the GIC received seven enquiries per thousand population members served [4]. The American Association of Poison Control Centers (AAPCC) reports that the equivalent figure in the USA is around eight enquiries per thousand, which has remained constant for ten years [2]. In 2009, roughly half of the enquiries to the DPIC came from non-health care professionals. Both the AAPCC and the SPIC have reported that three out of four enquiries came from non-health care professionals and that this figure has remained constant over time.

When evaluating the 18 categories, we assume that the increases in enquiries that concerned household products and plants was due to changes in contact pro-

FIGURE 1

Each category represented as a percentage of all substance exposure that year.



file, with an increasingly larger part of contacts coming directly from the public during the first three years. Detailed information on 2.5 million human exposures was published in the annual report from the AAPCC. However, direct comparison with our data records was impossible for the majority of categories due to differences in substance classification. Comparable categories were analgesics, antidepressants, antipsychotics, hypnotics, sedatives and plants. The AAPCC reported a higher level of analgesic exposures (13% versus 9-10%), similar level of antidepressants and a lower level of a substance category comprising antipsychotics, hypnotics and sedatives with 7% compared to 9-10% at the DPIC during all three years. Most striking is the difference in exposures to plants, where the AAPCC report only 3% in this category, less than one fourth of the DPIC registrations in 2009. More than one substance was involved in 10% of the AAPCC cases, and this is similar to the DPIC data records. Among specific substance exposure subgroups, the aforementioned increase in the antipsychotic clozapine led to an analysis of the total number of drug prescriptions in this category [5]. This analysis showed a major increase in clozapine alone (47% from 2007 to 2009). The prescription of other subgroup drugs in the antipsychotics category changed by less than 25% in quantity in the same period. This change may explain the observed trend in clozapine poisoning. The increase in iron exposures and decrease in multivitamin exposures most probably arose from an internal DPIC change in database registration over the three-year time period. Being the potentially most toxic component, iron was the only component registered in the multivitamin exposure that displayed a constantly increasing frequency.

The DPIC database study has some clear limitations due to the quality of the information extracted from the data records. The system was designed primarily for documentation and feedback within the DPIC. The systematic categorization within this study, using the given data from the DPIC database, provides no relevant information concerning hospitalization or mortality. Furthermore, supplementary information, such as the reason for the exposure, route of exposure (ingestion, dermal, inhalation, etc.) or the age distribution was not extractable during this substance categorisation process. A new and more suitable registration system for DPIC is currently being considered.

In poisoning cases where the DPIC was contacted, the registrations made were real-time surveillances, but

TABLE 2

Eighteen substance categories with subgroups. n represents the total number of substance exposure in each category per year. Each substance subgroup is presented as % of all substance exposures within the substance category.

Household substances	2007 (n = 1,891)	2008 (n = 2,406)	2009 (n = 3,498)
Cleaning substances (household)/soap	33	36	34
Decalcification	22	20	20
Cosmetics/personal care products	15	13	14
Automatic dishwasher detergents	8	9	10
Detergents	8	7	7
Hypochlorite	10	6	6
Drain cleaner	3	5	4
Other	1	5	5
Chemicals	**2007 (n = 1,665)**	**2008 (n = 1,742)**	**2009 (n = 166)**
Paint/glue	17	16	16
Foreign bodies/toys	12	7	11
Silica gel	9	10	9
Insecticides	12	8	9
Herbicides	4	4	5
Detergents cationic	5	5	4
Fertilizers	2	4	3
Super warfarins	5	4	3
Mercury	1	2	1
Building materials	1	1	1
Other	31	41	39
Plants	**2007 (n = 1,175)**	**2008 (n = 1,316)**	**2009 (n = 2,484)**
Berries, unknown	7	7	8
Spottet arum (*Arum maculatum*)	9	11	8
European privet (*Ligustrum vulgare*)	11	11	7
Cherry laurel (*Prunus laurocerasus*)	1	1	6
Golden chain (*Laburnum anagyroïdes*)	7	5	5
Honey suckle (*Lonicera*)	3	3	5
Yew (*Taxus*)	3	2	2
Nightshade black (*Solanum niger*)	2	2	1
Other	58	57	59
Pharmaceuticals, other	**2007 (n = 1,241)**	**2008 (n = 1,444)**	**2009 (n = 2,106)**
Anticonvulsants	13	14	11
Antihistamine	7	7	9
Cardiovascular drugs	13	13	9
Hormones	10	8	7
Antimicrobials	8	8	6
Proton pump inhibitors	2	3	2
Musclerelaxants	1	2	2
Vaccines	1	1	0
Other	45	45	55
Non-opioid analgetics	**2007 (n = 910)**	**2008 (n = 1,154)**	**2009 (n = 1,386)**
Paracetamol	49	50	51
Nonsteroidal antiinflammatory drugs	36	34	33
Acetyl salicylic acid	13	16	15
Other	2	0	1

Antidepressants	2007 (n = 610)	2008 (n = 754)	2009 (n = 1,003)
Selective serotonin reuptake inhibitors	41	40	42
Serotonin/norepinephrine reuptake inhibitors	23	25	28
Noradrenergic and specific serotonergic antidepressant	15	17	15
Tricyclic antidepressants	9	8	8
Lithium	6	6	4
Other	7	4	3
Vitamins	**2007 (n = 409)**	**2008 (n = 543)**	**2009 (n = 856)**
Multivitamins	73	61	56
Iron	9	21	27
D-vitamin	9	10	10
Other	9	8	8
Antipsychotics	**2007 (n = 479)**	**2008 (n = 571)**	**2009 (n = 764)**
Chlorprothixene	38	39	36
Quetiapine	11	19	28
Olanzapine	13	9	9
Levomepromazine	8	8	5
Clozapine	6	4	5
Risperidone	5	5	3
Aripiprazole	5	5	2
Cisordinol	5	3	2
Ziprasidone	2	3	2
Other	8	5	7
Hypnotics/sedatives	**2007 (n = 554)**	**2008 (n = 711)**	**2009 (n = 761)**
Benzodiazepines	72	66	66
Other	28	31	28
Phenobarbital	0	3	6
Alcohols	**2007 (n = 544)**	**2008 (n = 617)**	**2009 (n = 759)**
Ethanol	83	90	84
Ethylenglycol	6	6	11
Methanol	2	2	2
Other	9	2	3
Drugs of abuse	**2007 (n = 587)**	**2008 (n = 766)**	**2009 (n = 686)**
Amphetamine	19	19	20
Cocaine	18	16	15
Cannabis	13	14	13
Gamma-hydroxybutyric acid/ gamma-butyrolactone	8	9	11
Ecstasy	14	10	9
Ketamine	4	4	5
Heroin	5	5	4
Thermapower	4	3	3
Other	14	15	16
Unknown	1	4	6

Continues

with the limitation that the information gained by the DPIC was user-dependent. The actual national incidence of each poisoning type could not be identified in this way and the DPIC registration of a change in poisoning trends should therefore be further investigated. When assessing the actual incidence of poisoning, one may as-

TABLE 2

Continued.

Hydrocarbons/organic solvents	2007 (n = 394)	2008 (n = 477)	2009 (n = 649)
Nonane	27	27	23
Firelighter	16	19	17
Gasoline	15	14	16
Turpentine	7	6	8
Acetone	3	3	3
Other	32	30	32
Fumes/gases/vapours	**2007 (n = 356)**	**2008 (n = 406)**	**2009 (n = 566)**
Fire smoke	49	37	33
Chlorine	10	9	18
Town gas	8	6	8
Ammonia	6	7	8
Carbon monoxide	4	8	4
Other	22	33	29
Opioid analgetics	**2007 (n = 229)**	**2008 (n = 306)**	**2009 (n = 379)**
Tramadol	34	32	40
Oxycontin	7	8	14
Codeine	19	10	12
Metadone	15	16	11
Morphine	10	14	11
Ketobemidone	5	5	5
Dextrometorphane	2	8	3
Other	7	8	3

Mushrooms	2007 (n = 192)	2008 (n = 262)	2009 (n = 355)
Death cap (*Amanita phalloides*)	3	4	3
False morel (*Gyromitra esculenta*)	0	3	1
Destroying angel (*Amanita virosa*)	2	1	1
Other	33	29	43
Unknown	62	64	52
Nicotine preparations	**2007 (n = 185)**	**2008 (n = 228)**	**2009 (n = 345)**
Tobacco (cigarettes)	72	80	66
Nicotine chewing gum	16	10	16
Other	12	11	18
Dietary supplements/herbals	**2007 (n = 274)**	**2008 (n = 237)**	**2009 (n = 344)**
Food products	51	28	38
Sodium chloride	5	6	10
Other	44	66	52
Animals	**2007 (n = 165)**	**2008 (n = 216)**	**2009 (n = 283)**
Greater weever (*Trachinus draco*)	35	26	34
European viper (*Vipera berus*)	19	18	13
Hymenoptera stings	7	15	12
Jelly fish (*Cyanea capillata*)	0	4	2
Other	38	37	39

sume that poisoning with a rare chemical agent or new previously unknown drug of abuse had a higher probability of resulting in conferring with the poison centre than a single drug exposure to a well-known pharmaceutical. The same limitation has been observed in other national poison centres, where reporting poisoning was not mandatory [2, 3, 6]. However, in conclusion, the classification of all substance exposures yielded detailed knowledge of the current status in poisoning.

Our findings were that the calls most commonly concerned a household substance in which the majority of agents possessed low toxicity, but a few were quite harmful. Pharmaceuticals constituted one third of the reported poisonings and paracetamol was the single agent most frequently reported. An increase in the actual number of contacts in 17 out of 18 categories from 2008 to 2009 was observed. We also assume that a future poison registration system should be more detailed and that the number of subgroups should be even higher for a shift in poisoning trends is to be noticed at an earlier stage than allowed by the present registration system; this would secure continued surveillance at a proper level. Future detailed poisoning monitoring will provide the DPIC with the capability to inform the public and healthcare authorities and medical industries, and, where necessary, make proposals for regulation or reformulation of products.

However, the results of the present study show that there is a large preventive potential, since most of the calls to the DPIC concerned products easily available to the general public whose proper storage is essential.

Exact prediction of the level of future contacts cannot be made. However, we estimate a doubling in the total number of contacts compared with other countries [2, 4]. The largest increase is expected to derive from public contacts and only a minor increase is expected from within the health care system.

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CONFLICTS OF INTEREST: none

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