

The epidemiology of poisoning

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Abstract

The epidemiology of poisoning can be studied from different perspectives. These include overall mortality, hospital admission rates and enquiries to poisons information services. Accidental poisoning is most common in children, but deliberate self-harm becomes predominant in the teenage years and early adulthood. Understanding the patterns of poisoning assists in developing suicide prevention strategies and reducing the risks of accidental poisoning.

Keywords deliberate self-harm; epidemiology; poisoning; suicide

Introduction

Although there are several ways in which poisoning can present, acute poisoning is the presentation with which doctors are most familiar. Poisoning can, however, be chronic, resulting from sources such as the environment, food and water supplies, or the industrial release of waste products (Table 1). The reason for poisoning can be classified as ‘accidental’ or ‘deliberate’.

Data sources from which information on poisoning incidents can be gleaned include mortality data on accidental poisoning and suicide,¹ hospital admission or discharge data, and enquiries to poisons information services.^{2,3} In addition, some countries collect information on chemical exposures, particularly those involving population groups (chemical incidents).

Causes of poisoning

Patterns of poisoning vary with geographical location. In developing countries with rural economies, poisoning by pesticides and herbicides is common. Patterns of habitation and work can also expose populations in warmer countries to toxins from snakes or spiders. Self-harm often involves agents that are readily available and can reflect local tradition. For example, in Sri Lanka pesticide and oleander poisonings are frequently

encountered problems, in China herbicide and pesticide poisonings are common, while in the UK paracetamol (acetaminophen) is the most frequent poison taken deliberately.^{4–6}

Obtaining estimates of the numbers of poisonings resulting from pesticide and agrochemicals is extremely difficult as data collection in developing countries is inconsistent, and probably only the most severe poisonings are treated in hospital. Nevertheless, populations suffering such exposures are likely to run into millions worldwide. In addition, mortality rates in developing countries are high, partly because of the availability of potent, locally produced products that can be poorly labelled and packaged, and partly because of difficulties in accessing therapy where this is likely to affect outcome. The cost of antidotes is also a significant problem, highlighted by the case of oleander poisoning, for which digoxin antibody is effective in treating toxicity but may not be affordable in developing countries.⁵

In developed countries, the epidemiology of poisoning often reflects prescribing practice and availability. From examining poison centre enquiries, it is clear that antidepressants, hypnotics and analgesics are among the most commonly ingested drugs in the UK and USA.^{2,3} Various public health measures, such as changes in product licensing and packaging, have been introduced with the intention of reducing the burden of harm associated with specific agents. In the UK, changes in pack size for paracetamol caused an initial decline in use in overdose,⁷ but this has been short-lived and rates subsequently increased to levels above those before pack size legislation.⁸

Epidemiological data on poisoning were also used to support the withdrawal of co-proxamol (paracetamol with dextro-propoxyphene) in the UK in 2005 after it was demonstrated to possess a significantly higher out-of-hospital mortality rate than other paracetamol–opioid combinations.⁹ Pharmaceutical product withdrawals can take several months to affect patterns of overdose as products in the home are still available to be taken. Nevertheless, a steady increase in deaths from codeine and tramadol poisoning has been observed since the withdrawal of co-proxamol, with a significant increase in tramadol deaths, mirrored by an increase in prescriptions, between 2009 and 2011.¹⁰ Finally, concurrent disease can also have an impact on self-harm, and this has been shown for cancer.¹¹

Information from poisons information centres can overestimate actual poisoning incidents, because many calls relate to patients who have been exposed but not poisoned. These data should, therefore, be interpreted with caution. Nevertheless, the most common cause of calls to poisons information centres within the UK relates to the ingestion of paracetamol.³

Mortality associated with poisoning

Suicide in the UK, as with many other European countries, has been declining since 1995.¹² The UK, Italy, Greece and Spain currently demonstrate a relatively low suicide rate of approximately 8 deaths per 100,000, compared with 18 deaths per 100,000 population in the Baltic States and central Europe (Hungary, Lithuania, Slovenia).¹² In the USA, the suicide rate is approximately 13 per 100,000 population, although suicide by methods other than poisoning is more common, with self-poisoning only accounting for 16% of all suicides in 2013.¹³

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Useful definitions

- **Suicide** – an intentional act resulting in death
- **Accidental poisoning** – an exposure to a poison resulting in symptoms that arises by an accidental action. It is common in young children but can occur in adults in the home, in the workplace or as a result of fire or transport accident
- **Deliberate poisoning** – forms part of the spectrum of disorders now classified as deliberate self-harm. It has also in the past been referred to as parasuicide, although this term is now outdated
- **Occupational poisoning** – occurs in the context of employment
- **Environmental poisoning** – refers to exposure resulting from presence of a chemical in air, food or water

Table 1

Epidemiology of poisoning

In the UK, self-poisoning is an unusual condition in medical practice in that it predominantly affects younger adults, with the highest incidence between the ages of 15 and 35 years.¹¹ Although traditionally considered a disorder of young females, self-poisoning is increasingly affecting men and women to a similar extent. In 2013, 41% of all drug-related deaths in females in the UK were defined as suicide, representing a 9% reduction compared with the previous year and continuing a downward trend since 2009. By contrast, 29% of drug-related deaths in males in 2013 were defined as suicide, representing a 12% increase from 2012 to 587 deaths, the highest number of drug-related male suicides since 2005.¹ Although less common, self-poisoning also affects the elderly population, where the impact on morbidity and mortality can be greater due to the wider availability of toxic medications and greater pre-existing comorbidity in this population.¹⁴

The largest proportion of drug-related deaths in the UK, however, is due to accidental poisonings (66% of male and 55% of female drug-related deaths in 2013).¹ This figure is likely to include many cases where the intent is unclear, such as deaths due to recreational drug use, a particularly important issue currently with the rising use of novel psychoactive substances.¹⁵

Accidental poisonings from non-pharmaceutical agents are also an important source of morbidity and mortality, with 2463 hospital admissions between 2001 and 2010 in England being due to carbon monoxide poisoning.¹⁶ Deliberate carbon monoxide self-poisoning also accounted for 2171 hospital admissions in England over the same period.¹⁶

Patterns of mortality in the UK (Table 2) at least partly reflect the types of agent ingested (Table 3), although figures from 2011 onwards are not directly comparable to those prior to 2010 due to a new version of the International Classification of Diseases 10th edition classification being introduced by the Office of National Statistics.¹ Similar data are available for the USA, demonstrating that of the 83% of poisoning deaths due to pharmaceutical agents in 2012, drugs of abuse, opioid analgesics, cardiovascular and antidepressant medications were most commonly implicated.^{17,18} A comparison of prescribing figures to mortality rates can also provide an index of relative toxicity (Table 4).¹⁹ Mortality associated with antidepressant poisoning has reduced since the introduction of serotonin reuptake inhibitors as first-line agents over tricyclic antidepressants.¹⁷ Further analysis of these data allow identification of specific agents particularly associated with toxicity.¹⁹

In the UK, guidelines on the prescription of dosulepin were adjusted in light of the high incidence of dosulepin-related deaths so that only health professionals with experience in psychiatry should prescribe this drug, with additional advice that its use was discouraged in new patients.¹⁰ Other control measures such as child-resistant blister packs and a maximum dispensary limit were also introduced. Although a reduction in dosulepin-related deaths has been observed, it is unclear to what extent these control measures had a direct effect on this reduction.

Childhood poisoning

The epidemiology of child poisoning varies significantly from that of adults. Under the age of 5 years, children explore the environment around them and frequently place objects in their mouth. This results in a large number of enquiries to poisons centres but a relatively low rate of serious poisoning in children.³ Over the age of 5, the rate of poisoning falls as accidental ingestion becomes less likely, but it begins to rise again above the

Numbers of deaths related to drug poisoning by sex and underlying cause^a in England and Wales 2009–2013^b

Cause	Sex	2009	2010	2011	2012	2013
Mental and behavioural disorders due to drug use (excluding alcohol and tobacco) (F11–F16, xF18–F19)	Male	586	504	86	72	92
	Female	101	96	17	29	29
Accidental poisoning by drugs, medicaments and biological substances (X40–X44)	Male	983	899	1107	1104	1351
	Female	305	369	445	437	511
Intentional self-poisoning by drugs, medicaments and biological substances (X60–X64), and poisoning by drugs, medicaments and biological substances, undetermined intent (Y10–Y14)	Male	524	482	576	525	587
	Female	374	391	418	422	383
Assault by drugs, medicaments and biological substances (X85)	Male	5	5	3	5	2

Data from UK statistics from England and Wales.¹

^a Cause of death was defined using the International Classification of Diseases, Tenth Revision (ICD-10) codes given in the table.

^b Figures are for deaths registered in each calendar year.

Table 2

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