What are the causes of accidental poisoning in children, and how can they be prevented?

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Accidental poisoning in young children is common and, for the most part, preventable. Although cases are usually benign, some can be serious or even fatal.
Between 2014 and 2020, the top three causes of poisoning were cleaning and maintenance products, medicines for human use and carbon monoxide. Others, however, are also a concern, such as cannabis poisoning or ingestion of button batteries. Preventing accidents by raising awareness among relatives or carers, wherever the child may be, is a priority. First and foremost, it is essential to keep small objects and hazardous products out of the reach of children.

Following a request from the Directorate General for Health and the Directorate General for Competition, Consumer Affairs and Fraud Control, ANSES analysed various health databases in order to describe accidental poisonings occurring in children under the age of 15 between 2014 and 2020.

With the help of *Santé Publique France* and experts from an ANSES working group, national data from French poison control centres (PCCs) and on emergency department admissions (OSCOUR® network[1]), hospital admissions (PMSI[2]) and mortality (CépiDc[3]) were studied to obtain an overview of accidental paediatric poisoning cases in France.

The full study report also includes the results of the permanent survey on everyday accidents (EPAC), conducted by Santé Publique France, which confirmed the results obtained from the other data sources and described the trends over time in certain types of poisoning.

These sources complement each other (see box), in particular when describing poisoning cases according to their severity – whether the child stayed at home, was taken to the emergency department, hospitalised or even died – but also when documenting the agents involved and the circumstances. It should be noted that the same patient may have been counted in several sources without being identified: the counts from different databases should not therefore be added together.

By comparing the results for each source, accidental paediatric poisonings can be classified according to two criteria: frequency and severity (Table I). Cleaning products (mainly household products), medicines for human use and carbon monoxide made up the top three most common and most serious causes of poisoning.

[1] OSCOUR®: OSCOUR®: Organisation of coordinated emergency surveillance, led by *Santé Publique France*.
[2] PMSI: French Programme for the Medicalisation of Information Systems.
[3] CépiDc: Epidemiology Centre on Medical Causes of Death.

Box – Information provided by each of the health data sources for the multi-source study of accidental paediatric poisoning cases

POISON CONTROL CENTRES – PCCS	EMERGENCY DEPARTMENT VISITS – OSCOUR®	HOSPITALISATIONS – PMSI	DEATHS – CÉPIDC
N=143,144, 2014–2020 **<15 years** (**<6 years**: 87%) Around 20,500 cases/year Calls made by individuals or healthcare professionals	**N=63,406**, 2014–2020 **<6 years** Around 9100 cases/year Source for nearly all (94%) emergency department visits	**N=22,785**, 2014–2019 **<6 years** Around 3,800 cases/year Source for all hospital admissions	**N=23**, 2014–2017 **<15 years** Around 6 cases/year Source for all deaths
Most often mild poisonings, calls made by the child's relatives or carers. Generally required monitoring at home.	Children brought to the emergency department spontaneously by relatives or carers, or on the advice of a healthcare professional. Severity indicator when the emergency department visit was followed by hospitalisation.	Poisonings requiring hospitalisation (severity indicator).	Precise causes of death not always available in the certificate: some poisonings may not have been identified as such.
Also more serious cases of poisoning, calls made by a healthcare professional for advice on how to treat the child.	Agent not always detailed.	Another severity indicator if admitted to intensive care.	
Detailed description of the agent responsible for the poisoning, all severity levels combined.	Difficulty distinguishing between accidental and intentional poisoning. Analysis limited to poisonings in children under 6 years of age, all accidental.	Agent not always detailed.	
		Difficulty distinguishing between accidental and intentional poisoning. Analysis limited to poisonings in children under 6 years of age, all accidental.	

Table I – Categories of products or agents causing the most common and/or most serious accidental paediatric poisonings

(multi-source study, 2014 to 2020)

CATEGORIES OF PRODUCTS OR AGENTS	MOST COMMON POISONINGS	MOST SERIOUS POISONINGS
Cleaning, maintenance, stripping and descaling products, including: - Detergent pods - Drain unblockers	Yes, but increasingly rare No	Yes Yes
Medicines, including: - Neurological - Dermatological - Respiratory - Cardiovascular	Yes Yes Yes No	Yes No No Yes
Carbon monoxide	Yes	Yes
Animals, including: - Snakes - Arthropods (insects)	No Yes	Yes No
Drugs, including: - Cannabis	No, but increasingly common	Yes
Foreign bodies, including: - Button batteries	No	Yes
Plants	Yes	No
Cosmetics	Yes	No

Categories causing poisonings that are uncommon and mild are not shown.

CLEANING AND MAINTENANCE PRODUCTS: BEWARE OF LIQUID DETERGENT PODS AND DRAIN UNBLOCKERS

During the period 2014–2020, cleaning and maintenance products were the leading cause of accidental poisonings in children under 15 years of age recorded by PCCs (29%, Figure 1). Nearly half of these cases (45%) were due to textile treatment products (liquid or powder detergents, fabric softeners, stain removers, etc.), followed by surface cleaning products (32%). While water-soluble detergent pods accounted for more than two-thirds (69%) of poisonings by textile treatment products, these paediatric accidents nevertheless fell by half between 2014 and 2020 following the introduction of mandatory European prevention measures in 2015: product packaged in an opaque box with reinforced closure, prevention pictograms, bittering agent in the film enclosing the pod, reduced solubility of the film, increased resistance to pressure, etc.

Cleaning and maintenance products were responsible for almost a quarter of the serious poisonings recorded by PCCs (22%, 88 cases – Figure 2). Textile treatment products accounted for more than a third of serious cases (30 out of 88, i.e. 37%), mainly due to liquid detergent pods (23 cases), which were responsible for respiratory distress in the event of choking or serious corneal damage following splashes in the eyes. They were followed by drain unblockers (15 serious cases out of 88, or 20%), which caused corrosive digestive lesions in the event of accidental ingestion by the child.

Figure 1 – Most common accidental poisonings recorded by PCCs in children under 15 years of age. Categories of agents accounting for at least 2% of these poisonings.
(Source SICAP, 2014–2020)

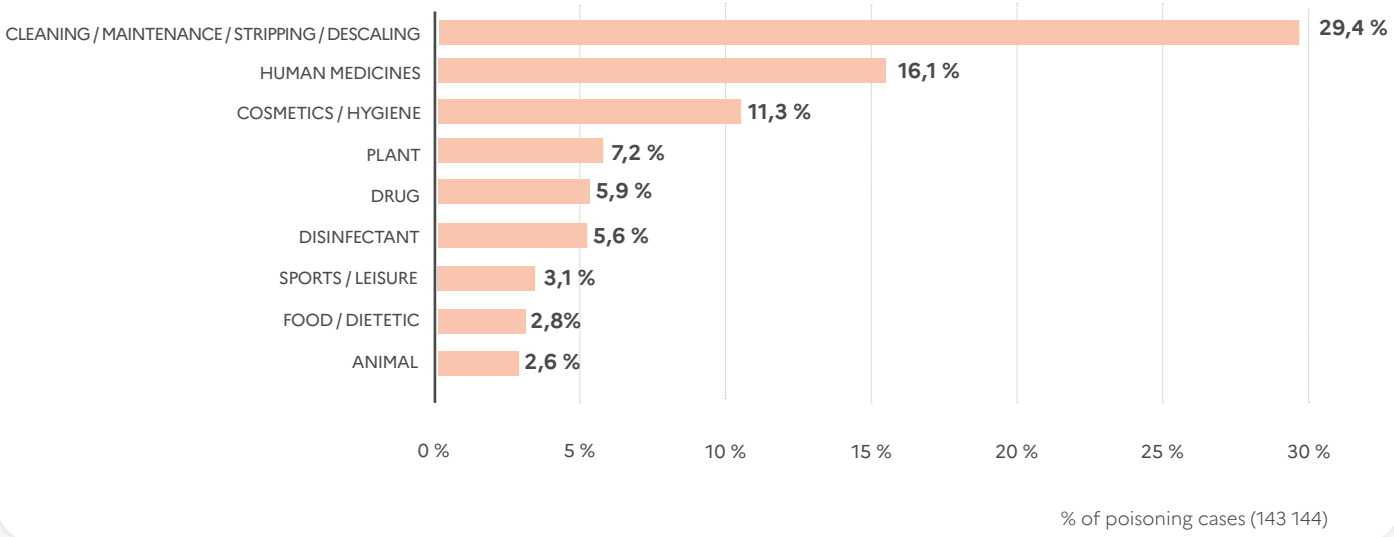
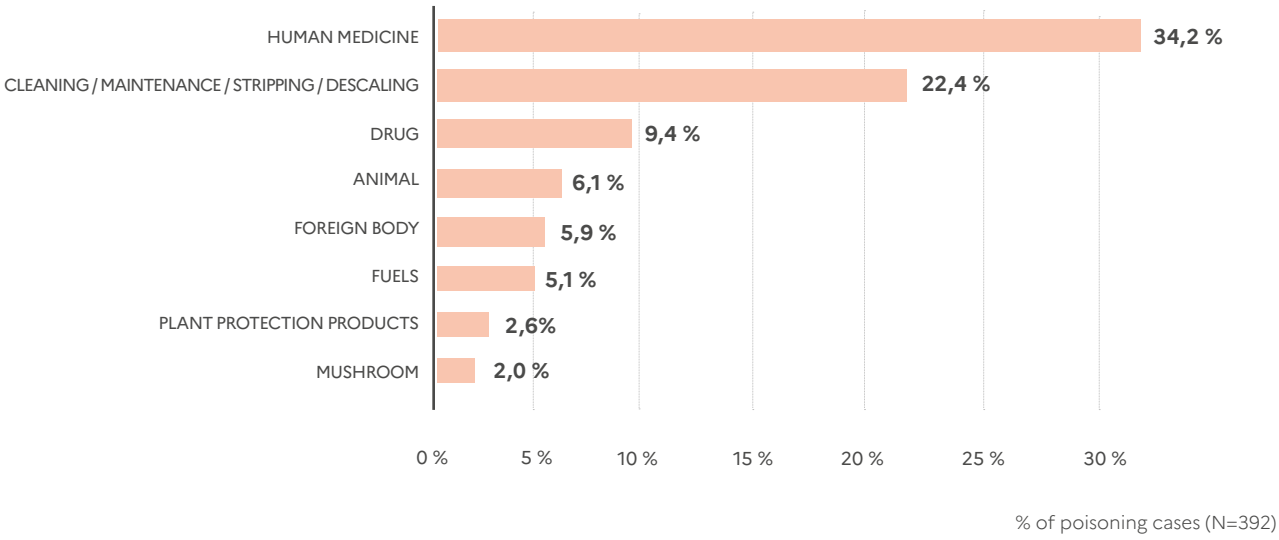


Figure 2 – Most common serious accidental poisonings recorded by PCCs in children under 15 years of age. Categories of agents accounting for at least 2% of all these poisonings.

(Source SICAP, 2014–2020)



The agents in the other databases were not coded as precisely as in the PCC data. However, in children under 6 years of age, poisoning by corrosive substances (descalers, unblockers, etc.) accounted for 5% of emergency department visits (Table II), 6% of hospital admissions (Table III) and 2% of intensive care admissions (Table IV).

Table II – Most common poisonings in children under 6 years of age treated in emergency departments. Categories of toxic substances accounting for at least 4% of these emergency department visits.

(Source : OSCOUR®, 2014-2020)

TOXIC SUBSTANCE CATEGORIES	NUMBER (TOTAL N=63,406)	PERCENTAGE
Toxic effect of venom from other arthropods	19211	30,3
Poisoning by medicines, biological substances, other and unspecified substances	5697	9,0
Toxic effect of a substance, unspecified	4393	6,9
Toxic effect of a corrosive substance, unspecified	2995	4,7
Toxic effect of carbon monoxide	2625	4,1

Table III – Most common hospital admissions for poisoning in children under 6 years of age. Categories of toxic substances accounting for at least 2% of these hospital admissions.

(Source: PMSI, 2014–2019)

TOXIC SUBSTANCE CATEGORIES	NUMBER (TOTAL N=22,785)	PERCENTAGE
Toxic effect of carbon monoxide	2472	10,8
Non-opioid, antipyretic and antirheumatic analgesics	2365	10,4
Of which 4-aminophenol derivatives (paracetamol)	*1340*	*5,9*
Benzodiazepine poisoning	2161	9,5
Poisoning by medicines, biological substances or other substances	2070	9,1
Cannabis poisoning (derivatives)	1671	7,3
Toxic effect of a corrosive substance, unspecified	1326	5,8
Psycholeptics, antipsychotics, psychostimulants	775	3,4
Antiepileptics	563	2,5
Soaps (household, etc.) and detergents	515	2,3
Beta-blockers, not classified elsewhere	499	2,2

Table IV – Most common admissions to intensive care in children under 6 years of age. Categories of toxic substances accounting for at least 2% of these admissions.

(Source SICAP, 2014–2020)

TOXIC SUBSTANCE CATEGORIES	NUMBER (TOTAL N=559)	PERCENTAGE
Cannabis poisoning (derivatives)	130	23,3
Toxic effect of carbon monoxide	116	20,6
Benzodiazepine poisoning	42	7,5
Psycholeptics, antipsychotics, psychostimulants	32	5,7
Poisoning by medicines, biological substances or other substances	24	4,3
Other opioids	19	3,4
Antiepileptics	14	2,5
Antidepressants	14	2,5
Methadone	14	2,5
Toxic effect of a corrosive substance, unspecified	13	2,3
Calcium channel blockers	12	2,1
Non-opioid, antipyretic and antirheumatic analgesics	11	2,0
Snake venom	11	2,0

SERIOUS POISONINGS FROM MEDICINES WITH NEUROLOGICAL OR CARDIAC ACTION

Medicines for human use were the second leading cause of accidental poisoning in children under 15 years of age (16%, Figure 1) and the leading cause of serious cases (34%, Figure 2) in the PCC database. Poisoning due to a treatment error by relatives or carers was more common in children under one year of age than in children aged one to five years (23% and 4% respectively), as the children in the latter group more often accessed the medicinal product on their own. All severity levels combined, medicinal products for the nervous system such as analgesics, anxiolytics and antipsychotics were most often implicated (30% of drug poisonings), followed by dermatological (antiseptics, disinfectants – 19%) and respiratory treatments (antihistamines – 12%). While nervous system medicines, mainly opioid analgesics, dominated serious drug poisoning cases (57%), they were followed by cardiovascular system medicines (21%), mainly beta-blockers, calcium channel blockers and treatments for high blood pressure.

The PMSI data showed that non-opioid analgesics, which include ibuprofen, aspirin and paracetamol, were responsible for 10% of hospital admissions for paediatric poisoning in children under six years of age, followed by benzodiazepines for almost 10% (they were respectively the second and third causes after carbon monoxide, Table III).

In terms of serious poisoning, benzodiazepines accounted for 7.5% of intensive care admissions for poisoning in children under six, followed by psycholeptics, antipsychotics and psychostimulants (antidepressants, anxiolytics, etc.) responsible for 6%. Calcium channel blockers accounted for 2% of these hospital admissions (Table IV).

Accidental medication poisoning was involved in six of the 10 deaths of children under 15 years of age recorded by PCCs between 2014 and 2020. In addition, of the 23 deaths of children under 15 recorded by the CépiDc between 2014 and 2017, seven (30%) were due to medication (the second leading cause of death), although there were no details of the product responsible.

CARBON MONOXIDE: A DOMESTIC GAS THAT CAUSES FREQUENT AND SERIOUS POISONINGS, ESPECIALLY IN VERY YOUNG CHILDREN

Carbon monoxide, a colourless, odourless, non-irritant toxic gas, is known to be responsible for multiple poisonings, often involving families and most commonly occurring during the winter (see the article on the subject in this issue).

Between 2014 and 2020, carbon monoxide poisoning accounted for 4% of emergency department visits for children under six years of age (fifth cause, Table II). It was also the leading cause of hospitalisation (11%, Table III) and the second leading cause of admission to intensive care (21%, Table IV) for poisoning in children under six.

Children under one year of age were particularly affected, accounting for 12% of emergency department visits (second leading cause) and 33% of intensive care admissions for poisoning in this age group (leading cause).

Inhalation of gas or smoke, including carbon monoxide and smoke from fires, was the leading cause of death in the under-15s among the deaths recorded by the CépiDc (9 out of 23 deaths, 39%). In addition, one of the 10 deaths recorded by PCCs was due to inhalation of carbon monoxide and smoke from a fire.

CONTACT WITH ANIMALS: FREQUENT INSECT BITES AND SERIOUS SNAKE BITES

While contact with animals of all species accounted for just under 3% of poisonings in children under 15 years of age recorded by PCCs (Figure 1), contact with the venom of arthropods (stinging caterpillars, wasps, bees, hornets, etc.) was the main cause of emergency department visits for children under six between 2014 and 2020 (30%, Table II). Animals were the fourth most common source of serious cases recorded by PCCs (6%, Figure 2). This primarily involved another class of animal, since 20 of the 24 serious cases recorded were due to snake bites (83%). Moreover, viper bites were responsible for 2% of intensive care admissions for accidental poisoning in children under six years of age (Table IV).
No paediatric deaths were reported as a result of contact with animals.

CANNABIS AND BUTTON BATTERIES: VERY SERIOUS POISONINGS

Cannabis poisoning accounted for 7% of hospital admissions for poisoning in children under six years of age (Table III), but 23% – the leading cause – of admissions to intensive care for poisoning in this same age group (Table IV). These cases increased in frequency over the study period, particularly in children under one year of age (from 9% of hospital admissions for poisoning in 2014 to 16% in 2020), but also in severity: the percentage of intensive care admissions following emergency department visits for cannabis poisoning in children under six doubled between 2014 and 2020 (from 5% to 11%). Narcotics were the third leading cause of serious

poisoning in children under 15 years of age in the PCC data (9%, Figure 2). Moreover, 33 of the 37 serious cases associated with narcotics were due to cannabis.

Although foreign bodies accounted for only 1% of the poisonings recorded by PCCs, they were responsible for 6% of serious cases (23 cases – Figure 2). Nineteen children swallowed button batteries[4], one of whom eventually died from perforation of the oesophagus and aorta. Another child ingested a water bead[5], leading to digestive complications and death. In both cases, ingestion of the foreign body had gone unnoticed at the time of the accident, delaying medical treatment.

COSMETICS AND PLANTS: FREQUENT BUT GENERALLY NOT VERY SERIOUS POISONINGS

Cosmetics and personal hygiene products – nail care products and nail varnish, skin cleansers, bath and shower products, etc. – were the third leading cause of accidental paediatric poisonings between 2014 and 2020 (11%, Figure 1), but represented barely 1% of serious cases.

Poisoning due to plants, for example as a result of ingestion or mucocutaneous contact, accounted for 7% of poisonings recorded by PCCs (Figure 1) but fewer than 1% of serious cases. Wild plants caused more serious cases than house plants.
None of these categories were listed as common reasons for visits to the emergency department in the OSCOUR® data, or for hospitalisation in the PMSI data.

WHAT RECOMMENDATIONS SHOULD BE GIVEN TO THE CHILD'S PARENTS AND CARERS?

The frequency and severity of accidental paediatric poisonings, in all their diversity, are grounds for continuing and even stepping up communication to the general public, especially young parents and childcare professionals, in order to avoid complacency about certain risks and reduce the number of accidents.

In the first few years of life, poisoning mainly occurs when children are beginning to stand up and reach for products they can access on their own and that are not intended for them: cleaning products in the kitchen or bathroom, medicines in the bathroom or bedroom, small objects in the living room (button batteries in remote controls), but also drugs and narcotics. They then tend to put these products in their mouths. Decanting a household product by pouring it into a food container such as a water, soda or fruit juice bottle exposes children to the risk of accidental ingestion.

An article in this issue is devoted to this problem.

Toddlers are particularly vulnerable to overdose, or administration of medicines that are not intended for them, both of which can lead to serious poisoning.
Preventing these situations involves first and foremost keeping small objects or hazardous products out of the reach of children even when they are not at home, storing prescription medicines — whether for a child or other family members — out of sight, and being sure to correctly use any heating appliances that could emit carbon monoxide.

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FIND OUT MORE:

NOTE:

Because everyday accidents can very often be avoided by taking appropriate preventive action, the Ministry of Health has made the prevention of everyday accidents in children under 15 years of age one of the priorities of the 2018-2022 national health strategy. In this regard, the serious game *«Zéro accident: un jeu d'enfant !»* («Zero accidents: it's child's play») https://www.cesim-sante.fr/innovation-developpement/serious-game-realite-virtuelle/serious-game-zero-accident-un-jeu-denfant-aventure-preventive-securiser-maison-3d/ was developed by CESIM-Santé, a scientific interest group set up by the University of Western Brittany and Brest university hospital, with financial support from the Directorate General for Health.

[4] Beware of button batteries! A potential hazard for young children. Vigil'Anses 7, February 2019. https://vigilanses.anses.fr/sites/default/files/Vigil%27Anses-N7_Fevrier2019VF_0.pdf
[5] Beads made from super-absorbent polymers, used as decorative items, plant supports or toys. Water beads: keep them out of the reach of children. Vigil'Anses 11, July 2020. https://vigilanses.anses.fr/sites/default/files/VigilAnsesN11_Juillet2020_3.pdf