Agents Involved and Severity of Acute Ocular Exposure Reported at a Poison Control Center

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Abstract

Purpose. Knowing the use categories of the products involved and on the circumstances of exposure, the aim was to identify severity factors useful in the initial management of patients in case of acute ocular exposure.

Methods. A retrospective study over a one-year period, on patients having used a poison center for eye exposure to a chemical substance.

Results.

In one year, 1582 patients were concerned. The sex ratio (M/F) was 0.8. The mean age was 28.5 ± 20.3 years. Among children, those under 4 years represented the most significant age category (n= 277; 50.1%). Exposure to chemicals were mild (n= 1342, 84.8%). Adults over 65 years appeared to be more likely to have more severe ocular damage (OR: 4.75; [2.26; 9.98]). Unintentional exposures were the most frequent (n= 1548; 97.8%). Ocular exposure primarily occurred at home (n= 937; 59.2%) then at work (n= 396; 25%), but with a higher risk of severe injury (OR: 2.93 [2.16; 3.97]). Cleaning products accounted for 31.2% of exposure cases (n= 457).Exposure to disinfectants appears to be a risk factor in more severe injuries (OR: 1.48 [1.002; 2.19] p = 0.0472). PH and severity of injuries were not statistically associated.

Conclusions. Our study showed the very wide variety in products involved in ocular exposures. Taking into account severity found, specific attention should be made by clinician on some of them like extreme ages, working exposure, and products like disinfectant and not only acid vs. base.

1. Introduction

The exposure of the ocular surface to toxic products, particularly irritants, is potentially a risk factor of serious ophthalmological complications, such as corneal scarring, corneal opacity, or permanent vision lost [1, 2].

Despite this fact, there are only a few large studies available from emergency services and without systematic study of recording, such as a register of cases seen in emergency rooms, it is difficult to have a clear idea of the epidemiology of ocular chemical exposure. In the 2016 annual report by the American Association of Poison Centers (AAPC), ocular exposure represented 4.22% of cases reported at poison control centers [3]. In the United States, chemical burns represent 1.5% of ophthalmological emergencies and 7 to 18% of eye trauma cases [4]. In France, in 2013, the ocular route represented 6.0% of exposure routes registered by the network of French poison control centers [5, 6]. Regarding the characteristics of the materials involved, very little data is available. In that respect, in a 1993 study of 102 Indian patients, acids and bases were responsible for 83.5% of cases [7], although in a recent American study of 143,985 patients published in 2016, acids and bases were only found in 11.8% of cases [8]. In fact, other categories of products exist which are rarely taken into account, but which are frequently associated in formulations (phenols, peroxides, surfactants, etc.).

The aim of this study is to describe one year assistance provided by a poison control center, a recommended structure for the management of chemical eye burns by detailing the categories of use of the products, and to identify risk factors for serious injury following exposure of the ocular surface to toxic products.

2. Materials and methods

A descriptive retrospective study on the poison control center (PCC) managing the regions of North-West France was carried out over a period of one year, between May 1, 2016 and April 31, 2017. The PCC fulfills the role of providing urgent toxicological advice to poisoned patients in the North-Western quarter of France: the regions of Normandie, Bretagne, Centre-Val de Loire and Pays de la Loire (12 million inhabitants, 20% of the French population).

2.1. Source of data

The included cases have been defined as patients having used the PCC during the period for exposure to a chemical substance via ocular route. The data collected and analyzed came from the BNCI (*base national des cas d'intoxication,* the French national database of intoxication cases) from the SICAP (*system d'information commun des CAP,* the French poison control center system for shared information). This database is approved by the CNIL (*Commission nationale Informatique et Libertés*, the French Data Protection Authority) (authorization n°747735). Personal data regarding the patients was anonymized prior to the data analysis. For each case, the information analyzed was the date and time of exposure, the age and sex of the person exposed, the agent of exposure and its composition, the symptoms, the circumstances, the place of exposure, the severity and the progression of each case.

Cases of exposure to a foreign body or physical agents (radiation) were removed from the study.

The agents involved were derived from the BNPC (*base nationale des produits et compositions,* the French national database of products and compositions) who compile combined or unmixed substances and classify them in usage category. In the interest of simplification and clarity, the usage categories have been designated by letters. The key is provided in Table 1.

The severity is assessed according to the Poisoning Severity Score (PSS): low, PSS1 (minor symptoms such as irritation, conjunctival hyperemia, lacrimation, conjunctival damage, minor

palpebral edema); moderate, PSS2 (pronounced or prolonged signs, such as intense irritation, punctate keratitis); high, PSS3 (severe symptoms such as significant ulceration or even corneal perforation, corneal scarring) [9].

2.2. Statistical analysis

The data has been presented in a descriptive manner, as well as the variables associated with the severity such as a PSS score of two or more with simple logistic regression models for crude odds ratios (OR). Statistical Analysis Software was used (Version 9.4, SAS Institute Inc., Cary, NC, USA).

3. Results:

In the period between May 2016 and April 2017, Grand Ouest PCC provided toxicological advice for 32,497 exposed patients, including all routes of exposure. Among them, 1582 patients (4.9%) had been exposed to a chemical product exclusively through the ocular route.

3.1. Description of the sample group

3.1.1. Groups by age and sex

The sex ratio (M/F) was 0.8 (704 men, 878 women). The average age was 28.5 ± 20.3 years; the median age was 27 years. The distribution of age and sex is shown in Table 2.

Among children, those between 0 and 4 years represented the most significant age category (277; 50.1% of those between 0 and 18 years). The sex ratio (M/F) in this age category is 1.3. The exposure agents most frequently found in the cases of children between 0 and 4 years correspond to products in category A (123/277; 44.4%). Products for cleaning textiles represented 48.7% of cases in this usage category. In particular, the average age of those exposed to a hydrosoluble liquid laundry detergent capsule was 7.4 ± 10.7 years, compared to 25.3 ± 17.2 years for other types of liquid detergent ($p < 0.001$). Next to laundry detergents,

surface degreasers were involved in 9.4% (26/277 cases) of exposure. Other usage categories found in cases of exposure of young children were cosmetic products (category D; 44/277; 15.8%) such as nail care products (15 cases) or perfume (19 cases), pharmaceutical products (category C; 38/277; 13.7%), mainly antiseptics or disinfectants for cutaneous use (23 cases).

In adults (962; 60.8%), products from category A were still the most commonly involved (277/962; 28.8%), mainly surface degreasers (56 cases) and dishwashing detergents (43 cases), as well as disinfectant products (category B; 123/962; 12.8%), mainly bleach (46 cases), disinfectants for milking and farming equipment (34 cases) and surface disinfectants (29 cases).

Those over 65 years old represented 5.3% of patients (85 cases). The products found largely belonged to the category of human medicinal products (16/85; 18.8%), mainly being medicinal products for dermatological use. Household bleach was also frequently involved (11/85; 14.1%).

3.1.2. Places of exposure

The distribution of places of exposure is shown in Table 2. Ocular exposure primarily took place in the home (937; 59.2%). Category A products were the most frequently involved in cases of exposure (295/937; 31.5%), mainly via textile care products (109/937; 11.6%) and cleaning products (78/937; 8.3%), followed by medicinal products belonging to class C (142/937; 15.2%).

Ocular exposures that took place in the workplace accounted for 25% of cases (396 cases). These mainly happened in a factory or a warehouse (61/396; 15.5%) or on a farm (54/396; 13.7%). Again, class A products were the most frequently involved (94/396; 23.7%), mainly in the form of cleaning products (45 cases). Another two categories were each responsible for more than 15% of workplace exposure cases: category G (64/396; 16.2%, mainly food

preparation surface disinfectants) and category B (62/396; 15.7% of cases, mainly caused by disinfectants for milking and farming equipment).

Educational institutions were the place of exposure in 5.8% of cases (91 cases). Other locations where exposure took place (care facilities, enclosed public places, community day care or leisure centers, and prison facilities) account for less than 50 cases each.

3.1.3. Circumstances of exposure

The distribution of circumstances of exposure is shown in Table 2. In 97.8% of cases (1548 cases), ocular exposures registered in the study were unintentionally caused. Occupational injuries were the most numerous (515/1548; 33.3%). The distribution of agents responsible for occupational exposures can be superimposed over the distribution for workplace exposures. Thus, categories A (141/515; 27.4% of professional cases), B (184/515; 16.3%) and G (72/515; 14.0%) are the most frequent.

Cases of non-occupational exposure (1033 cases) were mainly daily life injuries in the broad sense (331/1033; 32.0% of unintentional cases), failing to perceive risk (276/1548; 17.8%), a DIY, household or gardening injuries (306/1548; 26.7%), or a therapeutic error (118/1548; 11.4%).

When the exposure was unintentional, it took place with category A products (309/1033; 29.9% of unintentional cases), category C products (151/1033; 14.6%) such as medicinal products for cutaneous use, and category D products (117/1033; 11.3%) such as insect repellents and essential oils.

Products from categories E and H in exposure cases linked to DIY (69/306, 22.5% of cases linked to DIY) mainly involved anti-moss and lichen products (20 cases), glues (mostly cyanoacrylates, 19 cases) and paints and stains (mainly xyloprotectors, 18 cases).

Lastly, therapeutic error occurred in 33.0% of cases (39/118) with erroneous application of chlorhexidine to the eye. In children, exposure to category C was twice as likely by

therapeutic error as by failing to perceive risk (15 vs. 32; 19.0% vs. 40.5% of exposure to this category of agents in minors)

Exposure was intentional in 34 cases (2.1%) and mainly involved the substance being thrown into another individual's eyes (20 cases). Among these cases, 9 corresponded to the use of tear gas.

3.2. Exposure agents

In total, 1151 different agents were involved in ocular exposures. They are divided as follows: mixtures (1093 agents; 95.0%), individual substances (44 agents; 4.0%), plants and animals (14 agents; 1.3%). The principal order of usage categories is described in Table 2. Products of category A alone accounted for 31.2% of exposure cases (457 cases). Among them, cleaning products were represented mainly by surface cleaners/degreasers (94/452; 20.8%) and household or professional dishwashing detergents (53/457; 11.6%). Textile care products (114/457; 24.9%) were mostly represented by liquid laundry detergents (102; 89.7% of cases of exposure to any type of laundry detergents).

Category B products were present in 10.2% of exposure cases (161 cases). They represented by three subcategories: household bleach (67/161; 41.6%), surface disinfectants (39/161; 24.2%) and disinfectants for milking and farming equipment (36/161; 22.3%).

Category C products were involved in 156 exposure cases (9.7%), principally antiseptics and disinfectants (62/156; 39.7%), ophthalmological medicinal products (16/156; 10.3%) and ear medicinal products (9/156; 5.8%). Products from categories D and F represented 210 cases (13.3%). The most common were: lice repellent products (37/210; 17.6%); nail care products (36/210; 17.1%); perfumes and colognes (25/210; 11.9%); essential oils (21/210; 10.0%, mainly peppermint essential oil).

Products belonging to category E as well as category I represented 9.8% of cases (155 cases). These were mainly glues and associated products (43/155; 27.7%), paints, varnishes and

stains (39/155; 25.2%), as well as anti-moss and lichen products (38/155; 24.5%). Animals and plants were involved in 37 exposure cases (2.3%). One single case involved exposure to toad venom toxins. In the case of plants, 80.6% of cases involved the genus *Euphorbia.*

The other usage categories are described in Table 3.

Making the traditional distinction of acids vs. bases, the patients were distributed in the following way: 11.7% (185/1582) exposed to an acid, 24.7% (393/1582) exposed to a base, 12.3% (195/1582) a neutral product and lastly 16.9% (268/1582) to a product to which the concept of pH does not apply (solvent etc.).

3.3. Severity of exposures

Ocular exposure to chemical products mostly caused low intensity symptoms according to the PSS: 19 cases (1.2%) of no severity (PSS 0), 1323 cases (83.6%) of low severity (PSS 1), 226 cases (14.3%) of moderate severity (PSS 2), and 11 cases (0.7%) of high severity (PSS 3) were identified. In 3 cases, the severity was not determinable due to a lack of sufficient clinical information in the patient's file.

There was a statistically significant association between the age and the severity of ocular damage, as shown in Table 2. Adults, particularly those over 65 years appeared to be more likely to present with more severe ocular damage (OR: 4.75; $p<0.0001$).

Occupational exposure was associated with a higher risk of severe ocular injury (OR: 2.34; $p<0.0001$), as well as workplace exposure (OR: 2.93; $p<0.0001$).

Comparing ocular exposure to category A agents, exposure to disinfectants, broadly speaking, appeared to be a risk factor in more severe injuries (OR: 1.48; $p = 0.0472$). Cases of moderate to high severity (PSS 2/3) represented 22.9% of cases (55/295) of exposure in all circumstances taken together, 30.0% of cases of occupational exposure (39/169 cases). Disinfectants for milking or farming were involved in 71.4% of cases of exposure (15/21

cases) In the case of household bleach, 8 out of 11 cases of PSS 2/3 severity (17.7% of household bleach cases) involved a "concentrated" product (above 9.6% active chlorine).

Whatever the circumstances, exposure to medicinal products, hygiene and personal care products was significantly less severe than exposure to category A agents (OR: 0.43; p = 0.0001).

Cases ranked as a severity of PSS 2/3 accounted for 21.2% of exposures (33/155) to agents in the E and I categories. In the category of glues and sealing products, the proportion of PSS 2/3 cases reaches 25.5% (11/46 cases) and 28.9% for products for removing moss from facades. In almost all cases (34 cases out of 38), these products had a quaternary ammonium base in varying concentrations.

No significant connection between pH and the severity of injuries has been revealed.

Among the most severe injuries (PSS 3), we found a clear prevalence of men at 75%. Among the 12 people exposed, 2 were children under 5 years old who were both exposed to liquid detergent pods, although one did not have the eye rinsed immediately. The others were exposed to disinfectants and products for industrial use. Three of the people exposed presented a limbic ischemia that was discovered in an ophthalmological appointment, two needed an amniotic membrane graft and four presented sequela in the cornea.

4. Discussion

This study made it possible to describe one year of assistance provided by a multiregional structure and to identify the severity risk factors of exposing the ocular surface to toxic products. Our study is also the first to take interest in the usage categories of the products involved in ocular exposures beyond the traditional dichotomy of acid vs. base, which does not fully reflect the diversity of agents. This analysis is made possible by the organized categorization of mixtures, the confidential compositions of which are available to poison centers.

Our study showed the very wide variety in products involved in ocular exposures. This included more than one thousand products over one year of collecting data. Many of them met the definition of the European Biocidal Products Regulation, such as disinfectants (class B) preservatives (class G) or pest control products (class H). In a retrospective study of domestic ocular damage published in 2001 focusing on patients admitted to injuries and emergency, the products involved were spread across the following categories: alkalines (26.5% of patients), cleaning products, organic solvents, physical hygiene products, products for contact lenses and disinfectants [10]. Alkaline products were also involved in almost a quarter of exposures listed in our study, which is twice as high as for acids, as has already been shown by a British study led in 1987 [11]. We did not find any connection between the severity of the injuries and the pH of agents, which may encourage ophthalmologists and emergency doctors to look past this traditional paradigm. The category of disinfectants that appears to be the greatest cause of ocular damage, according to our results, is a good illustration of this: it contains both alkaline products and oxidants (chlorine-based agents, aldehydes, quaternary ammonium, etc.).

Furthermore, it is reasonable to think that as a result of dilutions and mixtures, the pH indicated in the composition of mixtures or on the safety data sheets provided to poison centers, and that in the solution which comes into contact with the ocular surface, will be different. Therefore, the severity of the injuries depends not only on the concentration of the product, but also the quantity and duration of exposure [12]. This means that knowledge of the pH is not a relevant piece of information for the immediate treatment of patients or the evaluation of prognosis and does not replace an exhaustive description of the patient' symptoms and, above all, the circumstances of exposure.

Therefore, thanks to this study, we have shown that splashes on the ocular surface in professional environments and, subsequently, in the workplace are frequent and associated

with more severe ocular injuries. This is what was found by epidemiological studies in various countries, as well as more frequent exposure among adults in the employed population. On the other hand, contrary to what was found in the literature, we found a majority of men only in cases of considerable severity (PSS 3) [8, 13]. In a recent Spanish study, chemical burns represented 12.7% of ocular damage at the workplace and 11.9% of keratoconjunctivitis cases [14]. Under these professional circumstances, we observed that products for cleaning, maintenance, scouring and descaling are more frequent in a professional environment. This is fully consistent with the results from Quesada et al. [14], which found that the service and construction sectors were the most affected (62.1% and 20.9% of cases, respectively). This is in accordance with the fact that products for an almost exclusively professional usage are also causes of average or severe damage: 1 case in 5 for the materials and products for using and treating construction materials (glues and solvents, moss and lichen removal), 22.5% of cases for surface disinfectants (22.5% of PSS 2 cases), even almost three quarters (71.4%) of cases of exposure to disinfectants for milking equipment and also the involvement of a concentrated product in 72.7% of cases of average exposure to household bleach.

Workers are usually subject to safety policies based on training about the risk of chemicals, establishing a standardized protocol for treating burns and even wearing personal protective equipment. It has already been shown that this type of equipment remains underused and its use must be promoted more strongly [15].

Children from 0 to 4 years old represented only half of cases of exposure among children under 18 years old. It is the exploratory behavior of children who are becoming more and more mobile that is given as the cause for the frequency of exposures. Although young children understand the distinction between good and bad behavior, they have no capacity to understand the consequences [16]. Therefore, it is the lack of risk perception that was the

main case of ocular exposure in this age group. The prevalence of young boys is customary in cases of poisoning and is not specific to ocular exposures [3, 17]. The causes of exposure most frequently encountered by young children from 0 to 4 years old corresponded to products found at home (fabric cleaners, home maintenance products, cosmetic and hygiene products). For several years, there has been a real concern regarding the severity of ocular exposures to water-soluble laundry detergent pods, which is confirmed by a number of studies on the subject [18–20]. The bright colors and rounded and smooth appearance of the detergent pods are especially attractive. In addition, in our study, these causes represented almost half of exposures to cleaning products.

In our study, we observed that in the case of ocular exposures to medications, children were, in particular, victims of error in treatments, in that they received dangerous products as eye drops. These medical exposures perfectly illustrate the difficulty posed by pharmaceutical packaging that is too similar. In the same size and shape, with small labels that are hard to read, it can be difficult to distinguish one bottle from another. Over 7 years, a study of an Australian poison center made it possible to identify around 1,300 cases where drops of a medication that is not intended for use in the eyes was unintentionally administered [21]. Chlorhexidine, which we found the most often in our study, was one of the ten most frequently found products in the Australian study [21]. There are specific recommendations available for this type of administration error, such as to read packaging carefully, store ophthalmological medications separately and throw away products at the end of treatments [21].

In more general terms, as shown by a case-control study in Great Britain [22], failing to put medications and household products away immediately after use in a locked cabinet and out of reach increases the risk of poisoning among children aged 0 to 4 years old. The authors

believe that effective prevention on the subject would make it possible to significantly reduce these exposures among children [22].

The main limitations of this study are caused by its retrospective nature, on the one hand, and the fact that patients were contacted only by phone, on the other hand. There is also missing data, especially on points that are not essential to the patient's medical treatment. A prospective study on ocular damage in a professional environment must be conducted to identify the exact determining factors exposures, as well as more specific identification of risk factors.

5. Conflicts of interest

The authors have no conflicts of interest to declare.

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Table 1. Main order of usage categories and corresponding code.

Usage categories (main order)	Code
Products for cleaning, maintenance, scouring and descaling	A
Disinfectants (excluding medical equipment)	B
Pharmaceutical products	C
Cosmetics, personal hygiene products	D
Materials and products for construction	E
Personal care products	F
Food contact products	G
Phytopharmaceutical products	H
Products for treating construction materials	I
Fuels, flammables, solvents, lubricants	J
Sport and leisure products	K
Food and diet products	L
Stimulants (excluding drugs and medications)	M
Medical materials, accessories	N
Non-food additives	O
Weapon/self-defense item	P
School and office supplies	Q
Air conditioning, cooling and heating products	R
Reagents, laboratory dyes, developing products	S
Cell/accumulator/battery electrolyte	T
Fire prevention products (extinguisher)	U
Printing and copying products	V
Water treatment products (excluding pools)	W
Products for animals (e.g. litter)	X

Table 2. Description of the sample group, circumstances and usage categories of products involved in the ocular exposures in total, and according to severity.

	PSS 0/1		PSS 2/3		Total	OR [95%CI]	*p*
	N	%	N	%			
Age							
0-4 years old	255	92.39	21	7.61	276	1.36 [0.68 ; 2.73]	0.3901
5-18 years old	231	94.29	14	5.71	245	Reference	N/A
18-65 years old	778	80.96	183	19.04	961	3.88 [2.21 ; 6.81]	< 0.0001
Over 65 years old	66	77.65	19	22.35	85	4.75 [2.26 ; 9.98]	< 0.0001
Usage categories							
Categories K, P, Q, R, T, U	56	96.55	2	3.45	58	0.18 [0.04 ; 0.75]	0.0182
Category A	379	83.3	76	16.7	455	Reference	N/A
Categories B, G, W	185	77.08	55	22.92	240	1.48 [1.00 ; 2.19]	0.0472
Categories C, D, F, L, M, N	396	92.09	34	7.91	430	0.43 [0.28 ; 0.66]	0.0001
Categories E, I, O, S	135	77.14	40	22.86	175	1.48 [0.96 ; 2.27]	0.0754
Categories H, X	42	79.25	11	20.75	53	1.31 [0.64 ; 2.65]	0.4598
Categories J, V	45	90	5	10	50	0.55 [0.21 ; 1.44]	0.2262
Sex							
Female	738	84.25	138	15.75	876	Reference	N/A
Male	604	85.92	99	14.08	703	0.88 [0.66 ; 1.16]	0.3558
Place of exposure							
Home	834	89.1	102	10.9	936	Reference	N/A
Educational institute	84	92.31	7	7.69	91	0.68 [0.31 ; 1.51]	0.3461
Hospital stay, care, accommodation	38	80.85	9	19.15	47	1.94 [0.91 ; 4.12]	0.0863
Work	290	73.6	104	26.4	394	2.93 [2.16 ; 3.97]	< 0.0001
Other location	89	86.41	14	13.59	103	1.29 [0.71 ; 2.34]	0.4109
Circumstances							
Everyday life	260	88.14	35	11.86	295	Reference	N/A
DIY, housework, gardening	265	86.6	41	13.4	306	1.15 [0.71 ; 1.86]	0.5718
Error in the perception of risk	252	91.3	24	8.7	276	0.71 [0.41 ; 1.22]	0.2155
Work	390	76.02	123	23.98	513	2.34 [1.56 ; 3.52]	< 0.0001
Other	175	92.59	14	7.41	189	0.59 [0.31 ; 1.14]	0.116

A, Products for cleaning, maintenance, scouring and descaling; B, Disinfectants (excluding medical equipment); C, Pharmaceutical products; D, Cosmetics, personal hygiene products; E, Materials and products for construction; F, Personal care products; G, Food contact products; H, Phytopharmaceutical products; I, Products for treating construction materials; J, Fuels, flammables, solvents, lubricants; K, Sport and leisure products; L, Food and diet products; M, Stimulants (excluding drugs and medications); N, Medical materials, accessories; O, Non-food additives; P, Weapon/self-defense item; Q, School and office supplies; R, Air conditioning, cooling and heating products; S, Reagents, laboratory dyes, developing products; T, Cell/accumulator/battery electrolyte; U, Fire prevention products (extinguisher); V, Printing and copying products; W, Water treatment products

(excluding pools); X, Products for animals (e.g. litter). PSS, Poisoning Severity Score; OR, odds ratio; 95%CI, 95% Confidence Interval; DIY, do it yourself.

Table 3. Organized order of the usage of products involved in the ocular exposures.

	Order of usage	PSS 0/1		PSS 2/3		Total	
		N	%[a]	N	%[a]	N	%[b]
A	**Products for cleaning, maintenance, scouring and descaling**	**379**	**82.9**	**76**	**16.6**	**457**	**28.9**
	Cleaning	128	81.0	29	18.4	158	10.0
	Product for cleaning fabrics	94	82.5	20	17.5	114	7.2
	Corrosive agent	52	80.0	13	20.0	65	4.1
	Deodorizer/odorizer	36	97.3	1	2.7	37	2.3
	Descaling agent	28	82.4	5	14.7	34	2.1
	Vehicle maintenance product	15	83.3	3	16.7	18	1.1
	Product for septic tank/pipes	13	81.3	3	18.8	16	1.0
	Product for pool maintenance	10	83.3	2	16.7	12	0.8
	Products for treating leathers and skins	2	100.0			2	0.1
	Polishing/waxing product	1	100.0			1	0.1
B	**Disinfectants (excluding medical equipment)**	**124**	**77.0**	**37**	**23.0**	**161**	**10.2**
	Household bleach	56	83.6	11	16.4	67	4.2
	Floor, wall, surface disinfectant	32	82.1	7	17.9	39	2.5
	Disinfectant for milking and livestock farming equipment	21	58.3	15	41.7	36	2.3
	Air disinfectant	5	83.3	1	16.7	6	0.4
	Sanitary disinfectant (WC, bathroom)	6	100.0			6	0.4
	Disinfectant for babies' bottles/dishes	3	75.0	1	25.0	4	0.3
	Disinfectant for products for domestic animals			1	100.0	1	0.1
C	**Pharmaceutical products**	**156**	**91.2**	**14**	**8.2**	**171**	**10.8**
	Human medications	139	90.3	14	9.1	154	9.7
	Veterinary medications	14	100.0	0	0.0	14	0.9
	Phytotherapy	2	100.0	0	0.0	2	0.1
D	**Cosmetics, personal hygiene products**	**118**	**95.9**	**5**	**4.1**	**123**	**7.8**
	Nail care/varnish	37	100.0		0.0	37	2.3
	Perfume/eau de toilette/cologne	25	100.0		0.0	25	1.6
	Skin cleanser	18	94.7	1	5.3	19	1.2
	Hair product	12	85.7	2	14.3	14	0.9
	Deodorant/antiperspirant	6	100.0		0.0	6	0.4
	Bath and shower product	5	100.0		0.0	5	0.3
	Sun screen	5	100.0		0.0	5	0.3
	Skincare	2	50.0	2	50.0	4	0.3
	Shaving product	2	100.0			2	0.1
	Dental and oral hygiene	2	100.0			2	0.1
	Face and/or body mask/exfoliation/peel	2	100.0			2	0.1
	Make-up product	1	100.0			1	0.1
	Cosmetic product for babies	1	100.0			1	0.1
E	**Materials and products for construction**	**87**	**81.3**	**20**	**18.7**	**107**	**6.8**
	Glue/adhesive/sealant and associated products	32	74.4	11	25.6	43	2.7
	Paint/varnish/enamel/wood stain and associated products	36	92.3	3	7.7	39	2.5
	Materials (including construction)	14	70.0	6	30.0	20	1.3
	Rubber and plastic and associated products	5	100.0			5	0.3
F	**Personal care products**	**77**	**88.5**	**10**	**11.5**	**87**	**5.5**

	Order of usage	PSS 0/1		PSS 2/3		Total	
	Insect repellent for humans applied to skin	20	95.2	1	4.8	21	1.3
	Essential oil (personal care)	25	92.6	2	7.4	27	1.7
	Hand sanitizer	16	88.9	2	11.1	18	1.1
	Hygiene products for glasses/contact lenses	6	66.7	3	33.3	9	0.6
	Cryotherapy and heat therapy	4	100.0			4	0.3
	Massage cream/gel/oil (excluding medication)	4	100.0			4	0.3
	ENT and eye hygiene without medicine	2	66.7	1	33.3	3	0.2
	Dental hygiene equipment			1	100.0	1	0.1
G	**Food contact products**	**59**	**78.7**	**16**	**21.3**	**75**	**4.7**
	Disinfectant for food preparation surfaces (excluding dishes)	35	81.4	8	18.6	43	2.7
	Cleaner for food preparation surfaces (excluding dishes)	24	77.4	7	22.6	31	2.0
H	**Phytopharmaceutical products**	**42**	**82.4**	**9**	**17.6**	**51**	**3.2**
	Pesticides for plants	21	75.0	7	25.0	28	1.8
	Pesticides for animals	13	92.9	1	7.1	14	0.9
	Surface repellent (excluding human/animal skin)	4	100.0			4	0.3
	Fertilizer/soil enhancement	3	100.0			3	0.2
	Additive for phytosanitary products			1	100.0	1	0.1
	Tar/sealing putty	1	100.0			1	0.1
I	**Products for treating construction materials**	**34**	**70.8**	**14**	**29.2**	**48**	**3.0**
	Moss/lichen removal/fungicidal wash in masonry for construction materials	26	68.4	12	31.6	38	2.4
	Anti-rust/rust removal product	5	83.3	1	16.7	6	0.4
	Product for protecting/treating masonry for construction materials (wall, terrace, roof)	2	100.0			2	0.1
	Soldering and brazing product	1	100.0			1	0.1
	Oxidant			1	100.0	1	0.1
J	**Fuels, flammables, solvents, lubricants**	**41**	**91.1**	**4**	**8.9**	**45**	**2.8**
	Solvent	18	85.7	3	14.3	21	1.3
	Fuel for combustion engine	12	92.3	1	7.7	13	0.8
	Lubricant/unmolding agent	7	100.0			7	0.4
	Heating and lamp fuel	4	100.0			4	0.3
K	**Sport and leisure products**	**21**	**95.5**	**1**	**4.5**	**22**	**1.4**
	Toy/gadget	19	95.0	1	5.0	20	1.3
	Creative/decorative leisure product	2	100.0			2	0.1
L	**Food and diet products**	**19**	**90.5**	**2**	**9.5**	**21**	**1.3**
	Food/drink	18	94.7	1	5.3	19	1.2
	Food supplement	1	100.0			1	0.1
	Food additive			1	100.0	1	0.1
M	**Stimulants (excluding drugs and medications)**	**15**	**100.0**			**15**	**0.9**
	Electric cigarette	13	100.0			13	0.8
	Tobacco	1	100.0			1	0.1
	Aphrodisiacs (poppers)	1	100.0			1	0.1
N	**Medical materials, accessories**	**11**	**78.6**	**3**	**21.4**	**14**	**0.9**
	Medical disinfectant/sterilizing material	8	88.9	1	11.1	9	0.6
	Medical care equipment	3	60.0	2	40.0	5	0.3
O	**Non-food additives**	**8**	**61.5**	**5**	**38.5**	**13**	**0.8**
	Additive for rubber and plastic	3	50.0	3	50.0	6	0.4
	Non-food preservative	2	100.0			2	0.1
	Perfuming preparation	1	100.0			1	0.1

		PSS 0/1		PSS 2/3		Total	
	Dye and pigment	1	100.0			1	0.1
	Non-food texturing agent			1	100.0	1	0.1
P	**Weapon/self-defense item**	**10**	**100.0**			**10**	**0.6**
Q	**School and office supplies**	**9**	**100.0**			**9**	**0.6**
	Paper glue for school/office	4	100.0			4	0.3
	Correction fluid	2	100.0			2	0.1
	Ink (office material)	2	100.0			2	0.1
	Felt-tip pen	1	100.0			1	0.1
R	**Air conditioning, cooling and heating products**	**7**	**87.5**	**1**	**12.5**	**8**	**0.5**
	Additive for heat transfer circuit	3	75.0	1	25.0	4	0.3
	Refrigerant fluid	1	100.0			1	0.1
	Heat transfer	2	100.0			2	0.1
S	**Reagents, laboratory dyes, developing products**	**6**	**85.7**	**1**	**14.3**	**7**	**0.4**
T	**Cell/accumulator/battery electrolyte**	**4**	**100.0**			**4**	**0.3**
U	**Fire prevention products (extinguisher)**	**5**	**100.0**			**5**	**0.3**
V	**Printing and copying products**	**4**	**80.0**	**1**	**20.0**	**5**	**0.3**
	Printing ink (offset, etc.)	1	50.0	1	50.0	2	0.1
	Printing and copying product, excluding ink (acid mordant, etc.)	2	100.0			2	0.1
	Ink for printing cartridge (inkjet)	1	100.0			1	0.1
W	**Water treatment products (excluding pools)**	**2**	**50.0**	**2**	**50.0**	**4**	**0.3**
	Disinfectant for drinking water	2	66.7	1	33.3	3	0.2
	pH adjuster/regulator (excluding pools)			1	100.0	1	0.1
X	**Products for animals (e.g. litter)**			**2**	**100.0**	**2**	**0.1**
	TOTAL	1238	84.6	223	15.2	1464	92.5

[a] Calculated based on the total numbers in the usage category; [b] Calculated based on the total numbers in the study.