

**ACUTE POISONINGS: A COMPARATIVE STUDY OF HOSPITAL
ADMISSIONS VERSUS POISON CENTRE CONSULTATIONS.**

By

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Declaration

I the undersigned hereby declare that the work contained in this thesis is my own original work and has not previously in its entirety or in part been submitted at any university for a degree.

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ABSTRACT

A prospective study was conducted in 1999 to establish the incidence and nature of acute poisonings in the Cape Town / Western Cape region. This study was based on an analysis of Poison Centre queries and acute poisoning admissions to Tygerberg Hospital over a period of 1 year (1999).

Summary of findings for Hospital admissions (1010 cases):

Acute poisonings were more common in adults (83%) than in children (17%) and drug overdose was by far the most common clinical entity in adult Hospital admissions (89% of cases). Most overdoses in adults were intentional (97%). Seventy five percent of these cases were female, predominantly in the 20-40 year age group. The incidence of non-drug chemical exposures in adults was relatively low (11%). In children, on the other hand, there was much less of a discrepancy between drug and non-drug chemical exposures (41% and 59% respectively). Paracetamol was the drug most commonly used in overdose in both adults and children. In adults ethanol featured in 17% of cases. Ingestion of paraffin and related volatile hydrocarbons were the most important cause of acute poisoning in children. Acute poisoning admissions due to drugs of abuse, excluding ethanol, were minimal in both age groups (1%). Toxic exposures to non-drug chemicals in the agricultural and industrial settings were low (3%). The number of exposures to biological toxins was also minimal (2%).

Summary of findings for Poison Centre inquiries (3744 consultations):

In 1999 the Tygerberg Poison Information Centre received 3744 calls, of which 2690 were related to acute human exposures to poisonous substances. The remainder of the calls (1054) was either about drug therapy, or general non-patient related toxicological matters. There were more calls regarding poisoning in adults (61%) than in children (39%). Most of the paediatric poisonings were accidental (97%), whereas in adults 55% were deliberate and 45% accidental. Forty four percent of the children and 52% of adults were female. In children, inquiries about exposures to potentially harmful non-drug household chemical products comprised 56% of poison calls, while drug overdose was 28% and exposures to biological toxins 16%. In adults 44% of inquiries were with regard to household products, 40% about drugs and 16% biological toxins.

A comparison of Hospital admissions versus Poison Centre consultations:

In order to make a valid comparison between Hospital admissions and Poison Centre consultations, acute poisoning cases originating from the same area were compared. Eight hundred and thirty four (90%) of patients admitted to Tygerberg Hospital and 592 (25%) of Poison Centre consultations originated from the same region, the Tygerberg catchment area. Several differences were noted when comparing poisoning cases reported to the Poison Centre and Hospital admissions. Six hundred and eighty eight (83%) adults and 145 (17%) children were admitted to Hospital in contrast to Poison Centre inquiries, where 322 (54%) were adults and 270 (46%) children. In adults, 99% of Hospital admissions versus 59% of Poison Centre consultations were regarded as self-inflicted. Ninety three

percent of adults admitted to Hospital were drug overdoses, whereas only 48% of adult Poison Centre consultations involved ingestion of medicines. In adult overdoses with paracetamol and other analgesics, tricyclic antidepressants, antiepileptics, theophylline and ethanol were significantly higher in Hospital admissions than in Poison Centre consultations. In contrast, exposures to pesticides e.g. pyrethroids, misuse of recreational drugs e.g. cannabis and biological toxin exposures e.g. spider bites, were significantly higher in Poison Centre consultations than in Hospital admissions.

In children, poisoning exposures to volatile hydrocarbons, especially paraffin, were significantly higher in Hospital admissions compared to Poison Centre enquiries.

As is evident from the disparity in the results above, inquiries to the Tygerberg Poison Information Centre cannot be regarded as a reflection of the true incidence of acute poisonings in the community.

Poison Information Centre statistics are distorted because of two factors:

1. **Under-reporting to the Poison Information Centre.** Healthcare providers are familiar with how to manage drugs commonly used in overdose (e.g. paracetamol) and certain household non-drug chemicals (e.g. paraffin), and often do not consult the Poison Centre for poison cases involving these substances. The number of inquiries received by the Poison Information Centre regarding these substances is, therefore, an under representation of actual incidence.

2. Over-reporting to the Poison Information Centre. The Tygerberg Poison Information Centre is well known for its expertise in biological toxins (e.g. spider and snake bites, scorpion stings, plant and mushroom ingestions, and marine toxins). Therefore, the number of inquiries received by the Centre with regard to these exposures is far higher than actual incidence of exposures.

It is clear from this study that one cannot use data derived from a poison centre alone as an indicator of true incidence of poisoning in the community. A more accurate estimate of incidence of acute poisoning could be obtained by including data from hospital admissions, as well as those from primary health care facilities.

Another prominent finding in this study was the high incidence of self-inflicted drug overdose in adult females, with paracetamol being the drug of choice. Poison prevention should therefore not be limited to children. Adult prevention programs need urgent attention.

OPSOMMING

'n Prospektiewe studie om die insidensie en aard van akute vergiftigings in die Wes-Kaap vas te stel, is gedurende 1999 in Tygerberg Hospitaal uitgevoer. Die studie is gebaseer op 'n analise van oproepe wat deur die Tygerbergse Vergifinligtingsentrum ontvang is en pasiënte wat gedurende dieselfde tydperk met 'n diagnose van akute vergiftiging by die Hospitaal toegelaat is.

Opsomming van Hospitaal toelatings (1010 gevalle):

Toelatings van akute vergiftigings was meer algemeen by volwassenes (83%) as by kinders (17%). Die meeste hospitaal toelatings (83%) by volwassenes is a.g.v. geneesmiddeloordoseing. By 97% van volwassenes was gifstowwe doelbewus ingeneem, met vroue in die meerderheid (75%). Die insidensie van vergiftigings met nie-geneesmiddel verwante gifstowwe by volwassenes was laag (11%). By kinders was daar egter 'n meer eweredige verspreiding tussen geneesmiddel (41%) en nie-geneesmiddel verwante (59%) gifstowwe. By beide volwassenes en kinders, was parasetamol die middel wat by die meeste oordoserings betrokke was. Alkohol was by 17% van vergiftigings by volwassenes betrokke. Paraffien en verwante vlugtige substansie was die belangrikste gifstowwe betrokke by akute vergiftigings by kinders. Akute vergiftigings as gevolg van die gebruik van dwelmiddels was laag in alle ouderdomsgroepe (1%). Vergiftigings in die landbou en industriële sektore was laag (3%). Dit was ook die geval ten opsigte van blootstelling aan biologiese toksienes (2%).

Opsomming van Tygerberg Vergifinligtingsentrum konsultasies (3744 gevalle):

Gedurende 1999 het die Tygerberg Vergifinligtingsentrum 3744 oproepe ontvang waarvan 2690 as gevolg van akute vergiftigings was. Die ander 1054 oproepe het gehandel oor geneesmiddel terapie of algemene, nie-pasiënt verwante navrae.

Daar is aangetoon dat oproepe ten opsigte van akute vergiftigings by volwassenes meer algemeen was as by kinders (61% en 39% respektiewelik). By kinders was die meeste vergiftigings per ongeluk (97%), terwyl by volwassenes die meeste doelbewus (55%) was. By kinders was 44% van die vroulike geslag teenoor 52% by volwassenes. By kinders was nie-geneesmiddel gifstowwe by 56% van akute vergiftigings betrokke en geneesmiddels by 44%. By volwassenes was dit 60% en 40%, respektiewelik.

'n Vergelyking ten opsigte van Hospitaal toelatings en Vergifsentrum konsultasies:

Om 'n geldige vergelyking tussen Hospitaal toelatings en Vergifinligtingsentrum konsultasies te maak is gevalle van akute vergiftigings afkomstig uit dieselfde geografiese gebied, vergelyk. Toelatings tot Tygerberg Hospitaal 834 (90%) en 592 (25%) oproepe wat deur die Tygerbergse Vergifsentrum ontvang is, kom uit dieselfde opvangsgebied, naamlik die Tygerbergse substruktuur. Verskeie verskille tussen die twee instansies ten opsigte van die tipe vergiftigings is aangetoon. Volwassenes 688 (83%) en 145 (17%) kinders is met 'n diagnose van akute vergiftiging by Tygerberg Hospitaal toegelaat in teenstelling met die Inligtingsentrum konsultasies waar 322 (54%) volwassenes en 270 (46%) kinders

by betrokke was. By volwassenes was 99% van die toelatings die gevolg van doelbewuste vergiftiging (paraselfmoord), terwyl dit 59% van die Inligtingsentrum se navrae was. Drie en negentig persent van die volwassenes was in die Hospital toegelaat met geneesmiddel oordosering. Heelwat minder geneesmiddel oordosering (48%) was deur die Inligtingsentrum hanteer. Parasetamol en ander analgetika, trisikliese antidepressante, anti-epilepsie middels, alkohol en teofillien oordoserings by volwassenes was beduidend hoër by Hospitaal toelatings as by Vergiftingsentrum konsultasies. Akute vergiftiging deur paraffien en verwante vlugtige substansie by kinders was beduidend hoër by Hospitaal toelatings as wat gevind is by Inligtingsentrum navrae. Navrae ten opsigte van pestisied vergiftiging, gebruik van dwelmmiddels en blootstelling aan biologiese toksiene was beduidend hoër as by Hospitaal toelatings.

Hierdie duidelike kontrasterende data dui daarop dat die tipe navrae wat deur die Tygerberg Vergifinligtingsentrum hanteer word nie noodwendig 'n weerspieëling van die ware insidensie van akute vergiftiging in die gemeenskap is nie. Daar is 2 hoofredes hiervoor.

- 1. Onderrapportering by die Inligtingsentrum.** Gesondheidverskaffers (dokters, verpleegsters, aptekers ens.) is vertrouwd met die behandeling van sekere algemene vergiftigings soos byvoorbeeld parasetamol oordosering en paraffien inname. Hulle ag dit derhalwe onnodig om die Sentrum hieroor te konsulteer. Dit lei dus tot onderrapportering.

2. Oorrapportering by die Inligtingsentrum. Die Tygerbergse

Vergifinligtingsentrum is bekend vir sy vakkundigheid ten opsigte van blootstelling aan biologiese toksiene (spinnkopbyte, slangbyte, skerpioensteke, plante-en sampioen vergiftigings, ens). Dit is om hierdie rede dat vergiftigings deur biologiese agense, geraporteer aan die Sentrum, 'n hoër syfer verteenwoordig as wat die werklike insidensie ten opsigte van dié vergiftigings is.

Hierdie studie toon dat vergifinligtingsentrum data nie noodwendig 'n indikator van die ware insidensie van akute vergiftigings in die gemeenskap is nie. Dit is dus belangrik dat hospitaaltoelatingsdata asook data van primêre gesondheidsklinieke ingesluit word om sodoende 'n beter beeld te verkry van die ware insidensie van akute vergiftigings.

'n Opmerklike bevinding tydens die studie was die hoë insidensie van doelbewuste geneesmiddel oordosering by volwasse vroue, met veral parasetamol as die middel van keuse. Programme wat fokus op die voorkoming van akute vergiftigings in volwassenes het dringende aandag nodig.

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LIST OF FIGURES

	Page
Figure 1: Map of the Cape Peninsula, South Africa, depicting the exact location of the Tygerberg catchment area	6
Figure 2: The Tygerberg catchment area	7
Figure 3: Referral sources of acutely poisoned patients	10
Figure 4: Symptoms and signs of the adult patient on admission	11
Figure 5: Age distribution of adult exposures to drug versus non-drug chemicals (excluding ethanol)	12
Figure 6: Drugs involved in acute poison exposures in adults (N=1321)	12
Figures 7&8: Non-drug chemical exposures in adults (N=247)	13
Figure 9: Symptoms and signs of the paediatric patient on admission	14
Figure 10: Significant differences ($p < 0.05$) when comparing adult and paediatric poisoning cases	16
Figure 11: Breakdown of all consultations processed by the Tygerberg Poison Information Centre	18
Figure 12: Origin of calls received by the Tygerberg Poison Information Centre	19
Figure 13: The Interlocutors (callers)	20
Figure 14: Age distribution of poisoned patients: Tygerberg Poison Information Centre	20
Figure 15: Gender distribution (%) in adults versus children	21
Figure 16: Accidental and intentional poisoning (%) in adults versus children	22

Figure 17: The distribution of non-drug chemicals to drugs (%) in adults versus children	22
Figure 18: Drugs involved in acute poisonings: Tygerberg Poison Information Centre: Children versus adults	25
Figure 19: Pesticides involved in acute poisonings	26
Figure 20: Volatile hydrocarbons involved in acute poisonings	27
Figure 21: Irritants and corrosives involved in acute poisonings	27
Figure 22: Miscellaneous non-drug chemicals involved in acute poisonings	28
Figure 23: Biological agents (plants and animals) involved in poisoning exposures: Adults versus children	28
Figure 24: Female to male ratio in acute poisonings: Hospital admissions versus Poison Centre consultations	30
Figure 25: Intentional versus Accidental poisonings in the Adult group (Tygerberg catchment area)	30
Figure 26: Intentional versus Accidental poisoning in Children (Tygerberg catchment area)	31
Figure 27: Comparison of age distribution in Hospital admissions versus Poison Centre consultations (Tygerberg catchment area)	32
Figure 28: Drugs involved in acute poisonings in adults. Hospital admissions versus Poison Centre consultations (Tygerberg catchment area)	34
Figure 29: Age distribution of patients exposed to paracetamol (Tygerberg catchment area)	35
Figure 30: Gender distribution of adults exposed to paracetamol (Tygerberg catchment area)	35

Figure 31: Non-drug chemicals involved in acute poisonings in adults. Hospital admissions versus Poison Centre consultations	36
Figure 32: Drugs in acute poisonings in children. Hospital admissions versus Poison Centre consultations	37
Figure 33: Non-drug chemicals involved in acute poisonings in children. Hospital admissions versus Poison Centre consultations (Tygerberg catchment area)	38
Figure 34: Age distribution of patients exposed to paraffin (Tygerberg catchment area)	39
Figure 35: Gender distribution of children exposed to paraffin (Tygerberg catchment area)	39

LIST OF TABLES

	Page
Table 1: Age distribution of the 1010 acute poisoning cases admitted to Tygerberg Hospital in 1999	8
Table 2: Tygerberg Hospital admissions regarding acute poisonings, 1999: Details of 1010 cases	9
Table 3: Breakdown of agents involved in acute poisonings in children (Tygerberg Hospital)	14
Table 4: Agents responsible for fatal poisonings in the different age groups (Tygerberg Hospital)	17
Table 5: Tygerberg Poison Information Centre consultations regarding acute poisonings, 1999: Details of 2690 cases	18
Table 6: Drugs versus non-drug chemical consultations (Tygerberg Poison Information Centre)	23
Table 7: Agents responsible for fatalities (Tygerberg Poison Information Centre)	24
Table 8: Deaths recorded in Hospital admissions and Poison Centre consultations: Tygerberg catchment area	33
Table 9: Breakdown of major categories: Queries regarding non-drug exposures in children	58

CONTENTS

	Page
i) DECLARATION	i
ii) ABSTRACT	ii
iii) OPSOMMING	vi
iv) ACKNOWLEDGEMENTS	x
v) LIST OF FIGURES	xi
vi) LIST OF TABLES	xiv
vii) TABLE OF CONTENTS	xv
1. INTRODUCTION AND AIM OF THE STUDY	1
2. METHODS	3
2.1 Tygerberg Hospital admissions	3
2.2 Tygerberg Poison Information Centre consultations / queries	4
2.3 Tygerberg Catchment area	5
3. RESULTS	8
3.1 Acute poisonings and exposures to poisonous substances:	
Tygerberg Hospital admissions.	8
3.1.1 Adults	10
3.1.2 Children	13
3.1.3 Comparison of adult and paediatric poisonings	16

3.2	Acute poisonings and exposures to poisonous substances:	
	Tygerberg Poison Information Centre consultations.	18
3.2.1	Analysis of acute poisoning consultations (N=2690)	20
3.2.1.1	Differences between adult and paediatric poisonings	21
3.3	Results in respect of acute poisoning cases from the Tygerberg catchment area, comprising both Hospital admissions and Poison Information Centre consultations: A comparison.	29
3.3.1	Adults	34
3.3.2	Children	37
4.	DISCUSSION	40
4.1	Tygerberg Hospital admissions	43
4.1.1	Children	43
4.1.2	Adults	46
4.1.3	Elderly	49
4.1.4	Adults fatalities	50
4.1.5	Treatment of the poisoned patient	51
4.1.6	The toxicology laboratory	52
4.2	Poison Information Centre consultations	53
4.2.1	Children	56
4.2.1.1	Non-drug chemical exposures in children	58
4.2.1.2	Childhood fatalities	63

4.2.2	Adults	64
4.2.2.1	Non-drug chemical exposures in adults	65
4.2.2.2	Drug overdose in adults	68
4.2.2.3	Adult fatalities	68
4.3	Hospital admissions versus Poison Center consultations from the Tygerberg catchment area	70
5.	CONCLUSIONS AND RECOMMENDATIONS	76
6.	REFERENCES	84

1. INTRODUCTION AND AIM OF THE STUDY

The true extent of acute poisonings in southern Africa is not known. The available statistics are not accurate for a variety of reasons, one of the reasons being that only certain acute poisonings are notifiable.^{1,2} These include food poisoning, lead poisoning and poisoning from any agricultural or stock remedy registered in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies.^{1,2} Hence, it is difficult to obtain reliable epidemiological data. A review of the literature, revealed that most published articles on the incidence of poisoning are based on poison center statistics.³⁻³⁹ In the USA, where poison information services are well known and integrated into the emergencies services, up to 80% of calls come from the lay public.³ For poison information centres such as these, it is possible to make a fair estimation of the general occurrence of exposures to poisonous substances and actual acute poisonings. Most requests for information to the Tygerberg Poison Information Centre, on the other hand, come from health care professionals, so that most of the enquiries have already undergone a screening process. Therefore, statistics derived from an analysis of enquiries and consultations processed by the Tygerberg Poison Information Centre (and probably most other poison centers in the country), are not necessarily a reflection (or barometer) of the true incidence of acute poisonings. Information derived from actual hospital admissions will probably provide more meaningful statistics on poisonings than data collected by poison centers. To test this hypothesis a comparative study was conducted, and data on acute poisonings that required hospital admissions were compared to poison exposure consultations processed by a poison information centre.

This prospective study was conducted at Tygerberg Hospital, where data on actual admissions due to acute poisonings, was collected. A second prospective study was conducted during the same period at the Tygerberg Poison Information Centre on consultations processed by the Centre.

2. METHODS

2.1 Tygerberg Hospital admissions

During 1999 a medical doctor and a clinical pharmacist gathered data, on a daily basis, regarding patients who were admitted to the medical emergency units and intensive care units of Tygerberg Hospital, due to acute poisonings. Tygerberg Hospital is a large teaching institution affiliated with Stellenbosch Medical School. It is located in the northern suburbs of Cape Town, South Africa. Poisoned patients were admitted to both the adult and paediatric medical emergency units. Severely poisoned patients with life threatening symptoms were admitted directly to specific Intensive / High Care Units. All patients were personally interviewed, where possible, and physically examined. In children a family member was interviewed if available. Additional information was obtained from the attending physician, ward sisters and the laboratory. Other pertinent details were collected from the medical records. Each patient's details were recorded on a standard data collection sheet, designed specifically for this study. Microsoft Excel format was used as a database. Data was entered using controlled vocabulary lists of terms and classification systems. The study variables included: age and gender of the patient, agents involved, route of exposure, deliberate or accidental poisoning, clinical status on arrival, treatment and length of stay in hospital. Identification of the poison was based on information from the patients themselves, friends or relatives as well as from the containers of alleged poisons where indicated. Samples of body fluids and actual poisons were sent to the toxicology laboratory for identification / verification.

2.2 Tygerberg Poison Information Centre consultations / queries

The Tygerberg Poison Information Centre forms an integral part of Tygerberg Hospital. It is located in the Department of Pharmacology, Faculty of Health Sciences, University of Stellenbosch. The Centre provides toxicology information to all areas in South Africa. For over 20 years this Poison Centre has provided a valuable 24-hour, free service, 365 days a year. Toxicity assessments and poisoning treatment recommendations are provided to health care workers and the lay public.

For the purposes of this study, the institutions / areas that were serviced by the Poison Centre included Tygerberg Hospital, the Tygerberg catchment area (outside Tygerberg Hospital), the greater Cape Town region, other parts of the Cape Province, other provinces and Namibia.

Most consultations were handled by telephone, either by a pharmacist or medical doctor. When handling a request the following information is established: name and telephone number of the caller (in the event of the call being cut off, or if a follow-up call is indicated), age, sex and weight of the victim (to help assess the potential severity of the exposure), a description of the victim's presenting symptoms and signs, details of any pre-existing illness, name, use and composition of the suspected poisonous substance (if available), a realistic estimation of the quantity, the time elapsed since exposure, and the route of exposure, treatment the patient had received and whether he had responded, as well as information on special investigations and their results. All consultations

and associated information were logged. Data compilation and analysis was performed with Excel spreadsheets.

2.3 Tygerberg catchment area

In order to be able to make a valid comparison between Hospital admissions and Poison Centre consultations, cases originating from the same immediate geographical region, the Tygerberg catchment area (Figures 1 and 2) were identified and classified. The Hospital recorded data was matched with the Poison Centre data from 1999 in order to determine similarities and differences in the two sources of data. Statistical analysis was done by calculating the 95% confidence interval for the expected ratio e.g. men to woman. P values < 0.05 were considered statistically significant.

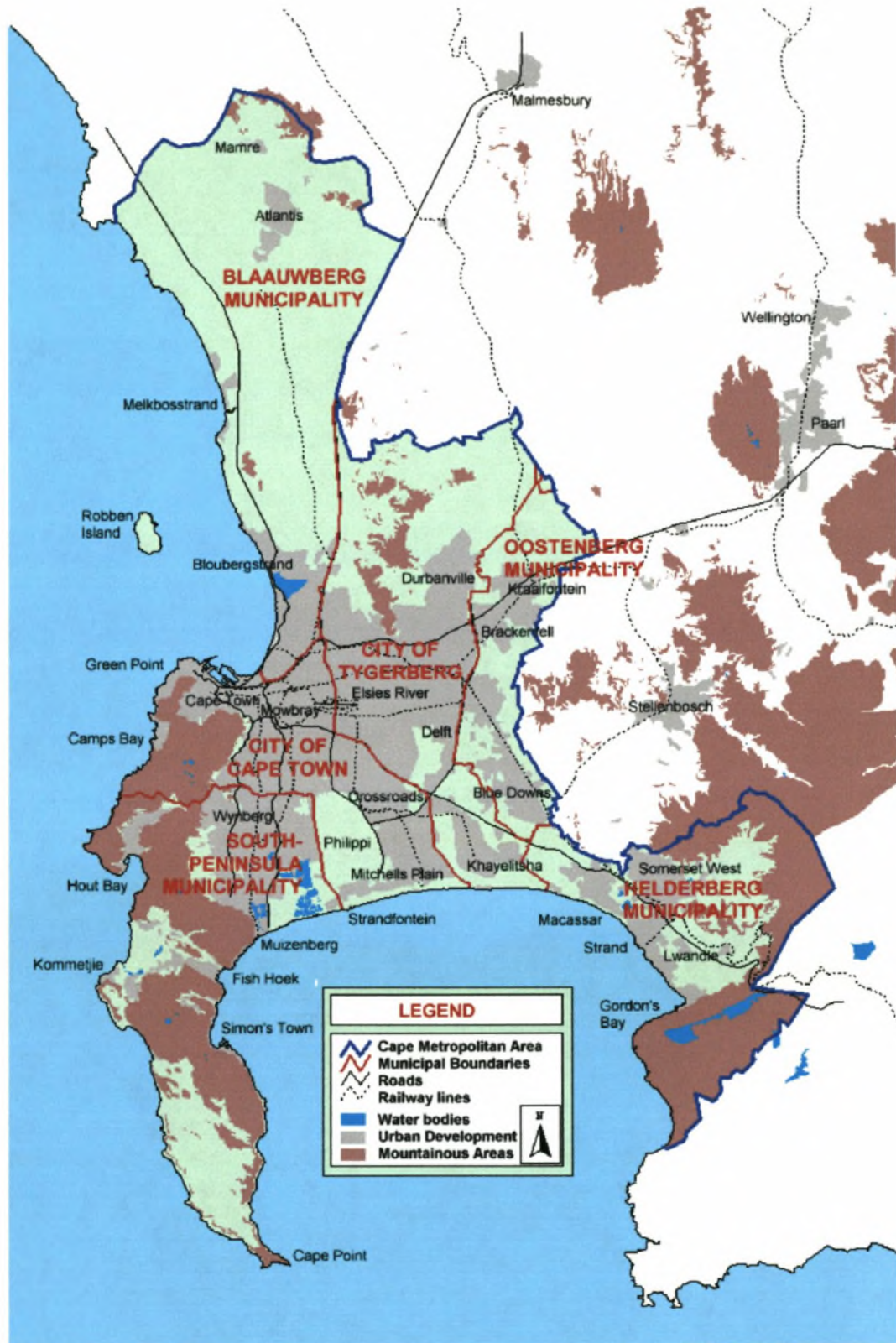


Figure 1: Map of the Cape Peninsula, South Africa, depicting the exact location of the Tygerberg catchment area.

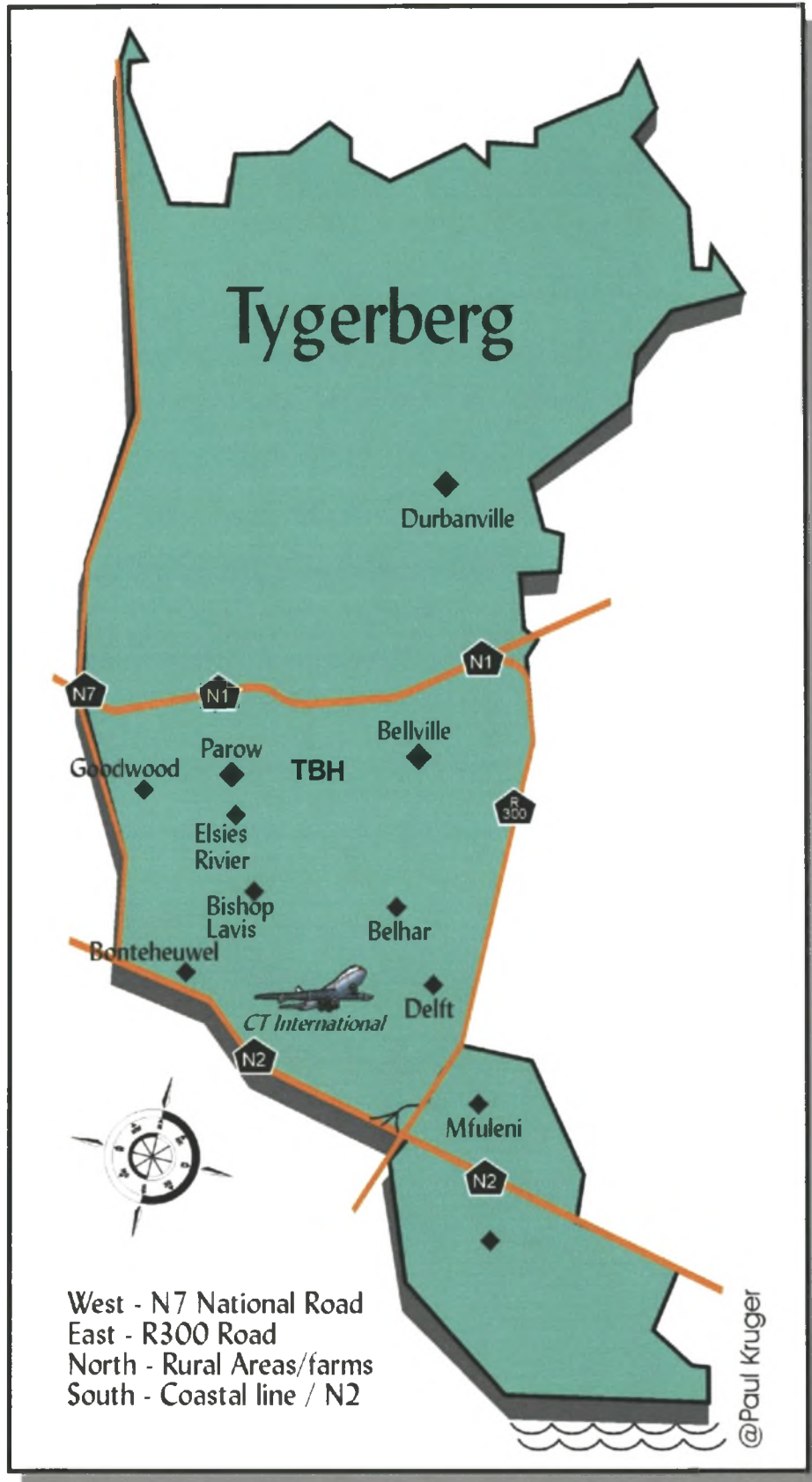


Figure 2: The Tygerberg catchment area. TBH = Tygerberg Hospital

3. RESULTS

3.1 Acute poisonings and exposures to poisonous substances: Hospital admissions.

Between January 1 and December 31, 1999, a total of 11 723 patients, comprising 2930 children (0 to 13 years) and 8793 adults (14+ years) were admitted to the medical emergency units of Tygerberg Hospital. From the total of 11 723 patients, 1010 were admitted for acute poisoning (9%). Eight hundred and thirty six (83%) of the 1010 cases were adults and one hundred and seventy four (17%) children.

Table 1 depicts the age distribution of the acute poisoning cases.

Age distribution		
Years	N	%
0 to 4	131	13
5 to 13	43	4
14 to 19	229	22
20 to 44	544	54
45 to 59	47	5
60+	16	2

Table 1: Age distribution of the 1010 acute poisoning cases admitted to Tygerberg Hospital in 1999.

Table 2 depicts a detailed overview of data collected. Agents more frequently involved in poisonings are presented as separate entities, e.g. Rattex (a pesticide) and paracetamol (an analgesic).

Of the total of 1010 patients, 834 were from the Tygerberg catchment area and 175 from other regions. Most patients were referred from day hospitals, clinics or by health care workers (60%). 40 percent came directly from home ('self' in figure 3).

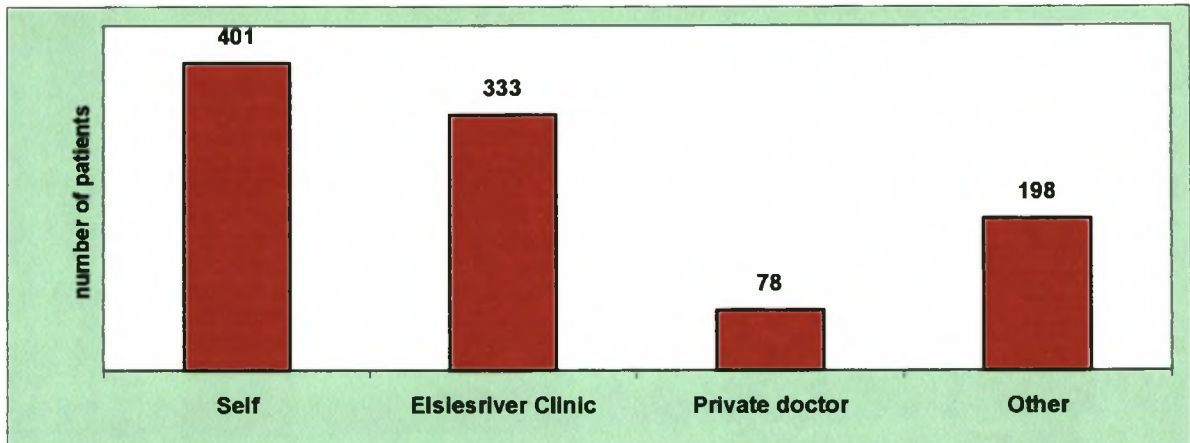


Figure 3: Referral sources of acutely poisoned patients

3.1.1 Adults

Of the 836 adults with acute poisoning, 622 (75%) were female. Eight hundred and twelve were intentional poisonings while only 24 (3%) cases were considered accidental. Of the 812 intentional poisonings, 614 (76%) were female. Forty six patients (6%) had a history of repeated suicide attempts, 89 (11%) were being treated for depression at the time of overdose and 19 (2%) were pregnant.

Emergency laboratory drug screenings were performed in 667 (80%) cases. Four hundred and ninety six (74%) of these poisoning cases were confirmed by laboratory tests and in 171 cases (26%) the toxicology screen was negative.

Of the 836 adults, 276 (33%) presented to medical emergencies with no symptoms and signs of poisoning. Symptoms and signs of the adult patient are depicted in figure 4.

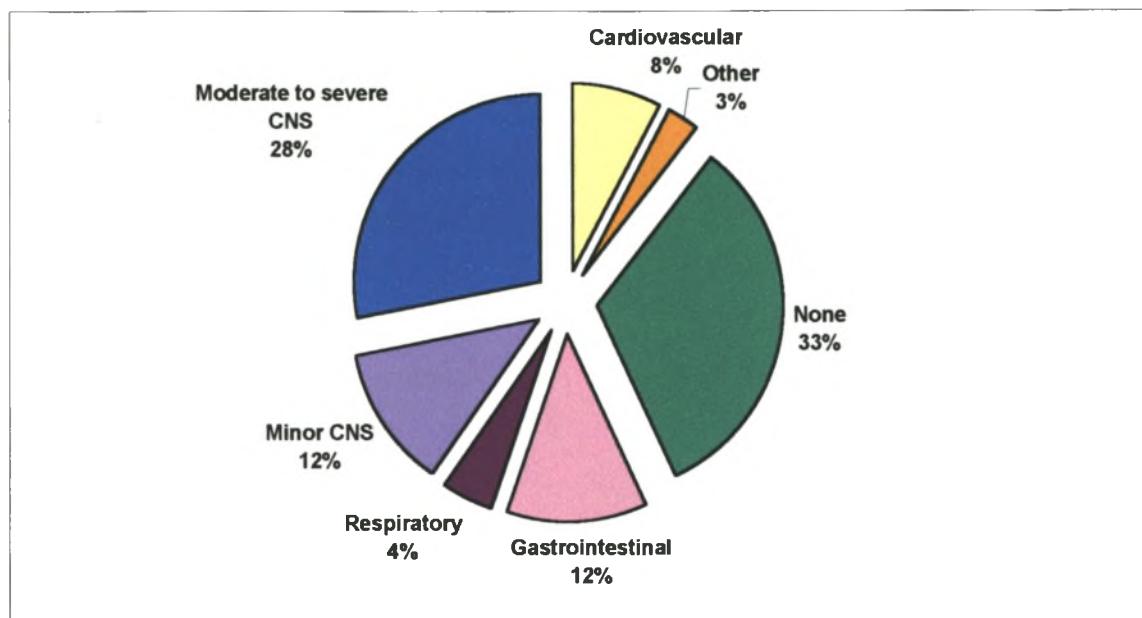


Figure 4: Symptoms and signs of the adult patient on admission.

Minor central nervous system (CNS) symptoms and signs included drowsiness and disorientation. Moderate to severe central nervous system (CNS) symptoms and signs included anxiety, headaches, tremors, agitation, aggressive behaviour, ataxia, delirium, stupor and coma. Gastrointestinal (GI) symptoms and signs included nausea, vomiting, diarrhoea, epigastric cramps, etc. Cardiovascular (CVS) symptoms and signs included palpitations, tachycardia, bradycardia, high or low blood pressure, etc. Respiratory symptoms and signs included cough, shortness of breath, difficulty in breathing, hyperventilation, etc.

Five hundred and twenty four (63%) adults were discharged within 24 hours, while 146 (17%) were admitted to high care facilities.

Three hundred and sixty nine (44%) adults were exposed to a single agent and 467 (56%) adults to more than one agent. Figure 5 illustrates the age distribution of adults exposed to drug versus non-drug chemicals (excluding ethanol).

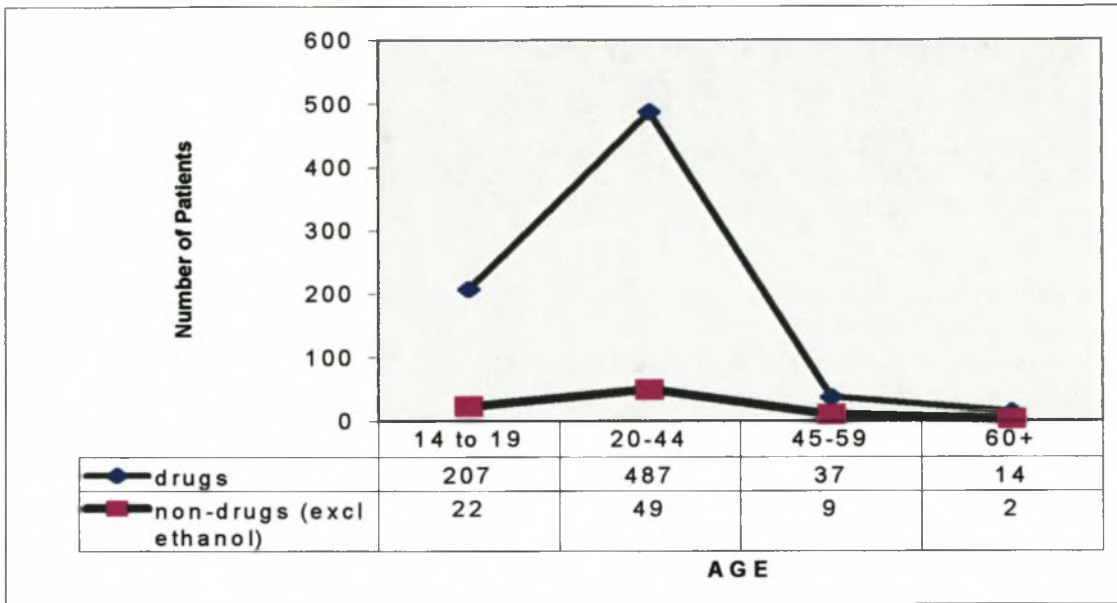


Figure 5: Age distribution of adult exposures to drug versus non-drug chemicals (excluding ethanol).

Drugs were involved in 745 acute adult poisonings (figure 6). A large percentage of patients took more than one drug (a mean of 1.8 drugs per case).

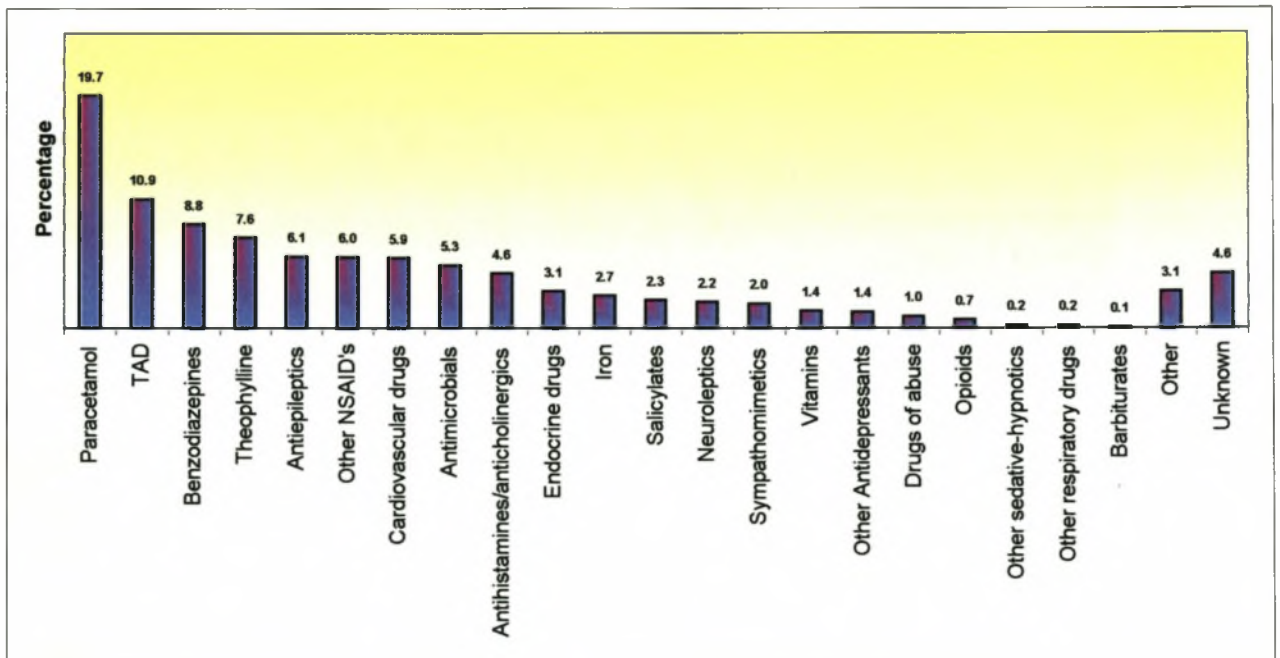
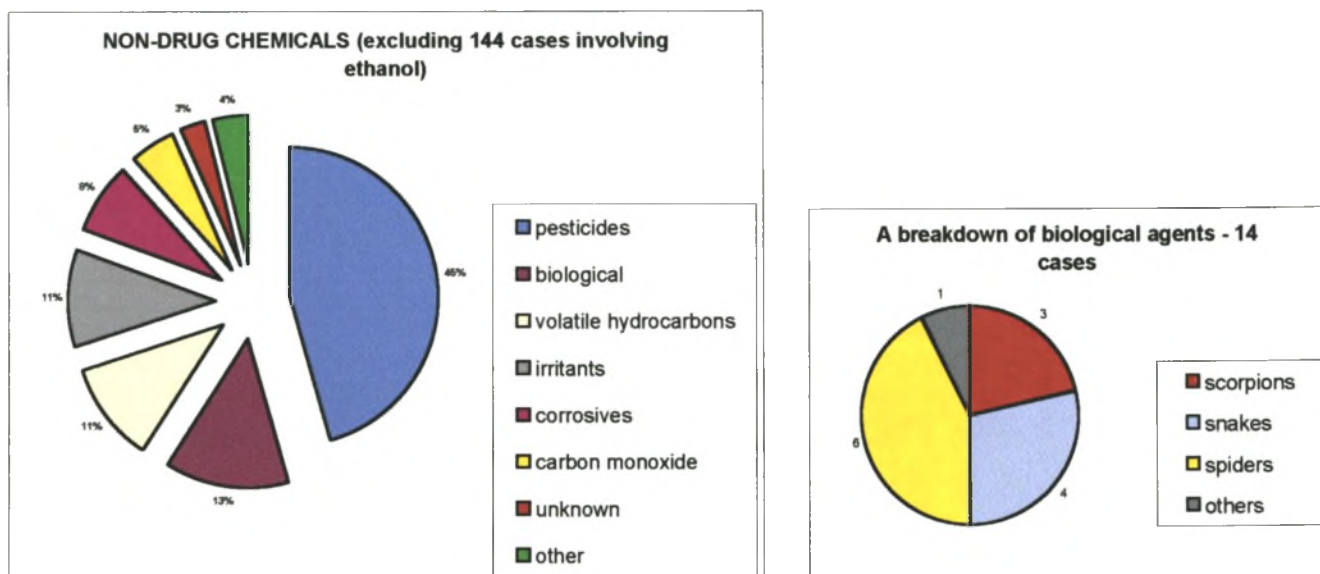


Figure 6: Drugs involved in acute poison exposures in adults (N=1321).
 Note that more than one (1) drug may have been involved in a single case.

Alcohol was involved in 144 cases (17%), mostly in combination with other agents (126 of the 144 cases). Non-drug chemicals were classified as household (210 cases), agricultural (0 cases), industrial (0 cases) and biological (14 cases). Figures 7 and 8 depict the different non-drug chemicals involved in adult poisonings.



Figures 7 and 8: Non-drug chemical exposures in adults (N=247).

Note that more than one (1) agent may have been involved in a single case.

3.1.2 Children

One hundred and seventy four acutely poisoned children were admitted to Tygerberg Hospital in 1999, of which 163 (93%) cases were accidental poisonings. One-hundred and thirty-one (75%) of the patients were between the ages of 0 to 4 and forty-three (25%) between the ages of 5 to 13. There was an insignificant difference in number between the gender groups: 88 male and 86 female. As illustrated in Figure 9, 40% of children exposed to poisonous substances presented with no symptoms and signs.

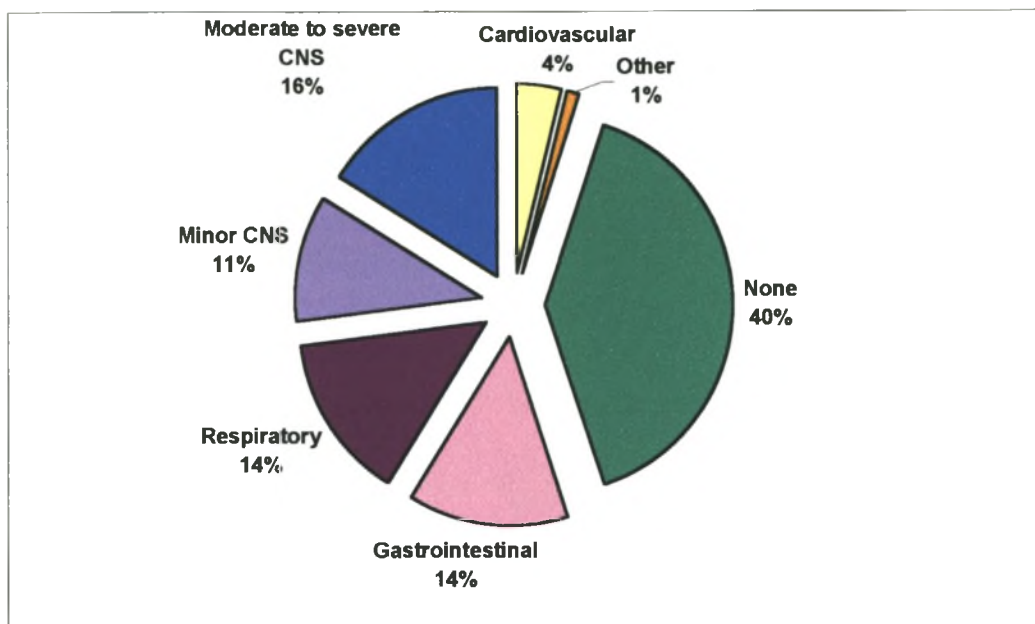


Figure 9: Symptoms and signs of the paediatric patient on admission.

Minor central nervous system (CNS) symptoms and signs included drowsiness and disorientation. Moderate to severe central nervous system (CNS) symptoms and signs included anxiety, headaches, tremors, agitation, aggressive behaviour, ataxia, delirium, stupor and coma. Gastrointestinal (GI) symptoms and signs included nausea, vomiting, diarrhoea, epigastric cramps, etc. Cardiovascular (CVS) symptoms and signs included palpitations, tachycardia, bradycardia, high or low blood pressure, etc. Respiratory symptoms and signs included cough, shortness of breath, difficulty in breathing, hyperventilation, etc.

One-hundred and fifty-nine (92%) of the children were exposed to a single agent only. Poisons were divided into 2 groups: Drugs, 71 cases (41%) and non-drug chemicals, 103 cases (59%). See table 3.

During the study period there were no admissions for exposure to agricultural or industrial poisons.

One-hundred and thirty-one (75%) children were discharged within 24 hours and nine (5%) were admitted to Intensive / High Care Units.

Non-Drug Chemicals (103 cases)		
Pesticides :	Rattex	4
	Other	1
Volatile Hydrocarbons :	Paraffin	42
	Turpentine	8
	Petrol/diesel	3
	Thinners	1
	Other	1
Corrosives:		11
Detergents, irritants:	Jik	9
	Other	2
Ethanol:		3
Biological:	Scorpions	3
	Mushrooms	2
Unknown non-drug chemicals:		3
Other non-drug chemicals:		7
Drugs (171 cases)		
	Paracetamol	11
	Antiepileptics	9
	Cardiovascular	9
	Benzodiazepines	8
	Antihistamines / anticholinergics	7
	Neuroleptics	5
	Salicylates	4
	Antimicrobials	4
	Sympathomimetics	3
	Drugs of abuse	3
	Vitamins	3
	Tricyclic antidepressants	2
	Iron	2
	Theophylline	1
	Unknown	14
	Other	4

Table 3: Breakdown of agents involved in acute poisonings in children. Note that more than one (1) agent may be involved in a single case (N=186).

3.1.3 Comparison of adult and paediatric poisonings: Hospital admissions

Adult and paediatric poisoning cases were compared and statistical analysis was done by calculating the 95% confidence interval for the expected parameters. When the ratio of male to female, intentional to unintentional poisonings and drug to non-drug chemical exposures were compared, all the P values were < 0.05, which is considered statistically significant. There was also a significant difference ($p < 0.05$) in the number of adult versus child poisoning cases that were admitted to Intensive / High Care facilities. A significant difference ($p < 0.05$) was also shown when comparing agents involved in poisonings such as ethanol, volatile hydrocarbons, paracetamol, benzodiazepines and tricyclic antidepressants, in the adult versus paediatric groups (figure 10).

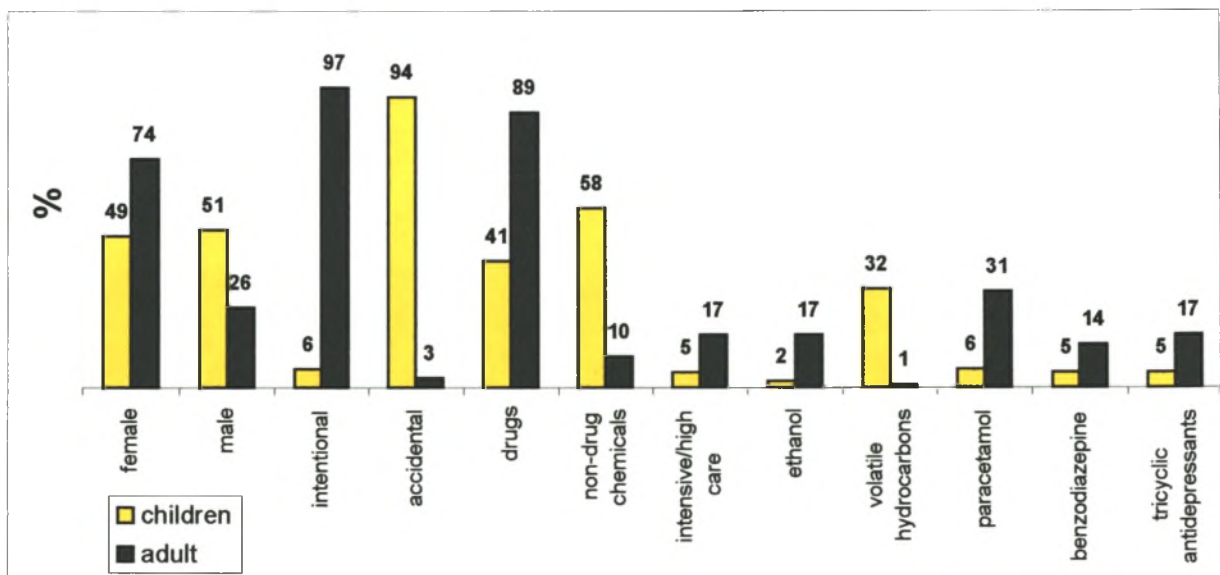


Figure 10: Significant differences ($p < 0.05$) when comparing adult and paediatric poisoning cases. Hospital admissions



Of the total of 1010 acutely poisoned patients, 12 died, of whom 10 were adults and 2 children. Of the 10 adult fatalities, 8 were suicides and 2 accidental. The 2 children fatalities were accidental. Table 4 depicts the

agents responsible for the fatalities.

0-4 years	Paraffin	Turpentine			
5-13 years	NO DEATHS				
14-19 years	Tricyclic antidepressant	Chloroquine and Olanzapine	Tricyclic antidepressant		
20-44 years	Lime sulphur	CO-inhalation	Corrosive and Rattex and Ethanol	Tricyclic antidepressant and Orphenadrine and Ethanol	Unknown
45-59 years	NO DEATHS				
60+ years	Thinners	CO-inhalation			

Table 4: Agents responsible for fatal poisonings in the different age groups.

3.2 Acute poisonings and exposures to poisonous substances: Tygerberg Poison Information Centre consultations.

Between January 1 and December 31, 1999, the Tygerberg Poison Information Centre processed a total of 3744 consultations. Of these, 3416 (91%) enquiries emanated from sources outside of Tygerberg Hospital, while only 328 (9%) calls came from within the Hospital. Eighty six percent of consultations were of a toxicological nature and the rest were drug information inquiries. A breakdown of all consultations processed by the Tygerberg Poison Information Centre is depicted in figure 11.

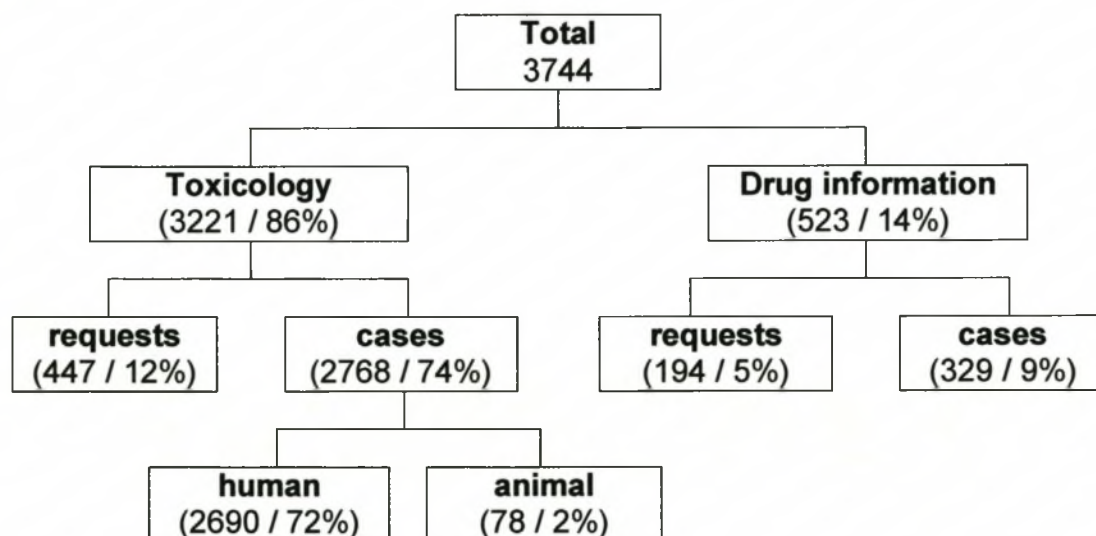


Figure 11: Breakdown of all consultations processed by the Tygerberg Poison Information Centre. (Requests = general non-patient related; cases = patient related.)

Table 5 depicts a detailed overview of data collected. This table differs slightly from the Hospital admissions (table 2) in that less clinical information was recorded by the staff on duty. It also deals with those consultations not related to poisonings (figure 11).

Table 5: T

Age in years	Gender		Regions					Exposure Route														
	Consultation totals	Female	Male	Accidental	Intentional	Tygerberg Catchment	Greater Cape Town	Cape Province	Other Provinces	Namibia	Ingestion	Inhalation	Cutaneous	Bites & stings	Ocular	Other	Decontamination AC/GL/emesis	Antidote	Intensive / High Care	Deaths	One agent	> 1 agent
0 to 4	865	388	474	852	5	228	227	264	145	7	791	10	16	33	10	11	271	43	8	4	838	2
5 to 13	188	76	113	158	29	48	42	67	31	0	126	12	8	36	4	2	44	13	5	1	180	
14 to 19	307	201	106	94	213	68	74	120	46	0	225	26	11	37	9	1	84	37	2	4	245	6
20 to 44	1117	555	563	487	617	209	302	426	178	7	759	109	57	156	21	25	286	121	35	28	952	16
44 to 59	156	69	89	106	52	36	43	53	25	2	84	30	15	24	5	2	16	14	2	5	144	13
60+	55	30	25	39	16	10	18	19	8	0	37	6	4	3	1	5	6	4	4	2	48	
sum	2690	1319	1370	1746	932	599	706	949	433	16	2022	193	111	289	50	46	707	232	56	44	2407	28

General categories: (AC) = activated charcoal (GL) = gastric lavage

Age in years	Categories				Pesticides								Volatile hydrocarbons									
	Biological (plants & animals)	Household	Agricultural	Industrial	Ethanol	Cholinesterse inhibitors	Phostoxln	Mothballs	Mosquito coils	Antipoison with Lindane	Antipoison (excluding Lindane)	Lindane (excluding antipoison)	Rattex	Paraquat	Other pesticides	Paraffin	Petrol and Diesel	Thinners	Benzene	Turpentine	Essential oils	Other volatile hydrocarbons
0 to 4	91	509	2	2	2	20	1	18	14	0	2	5	50	0	18	16	1	1	0	16	22	11
5 to 13	52	77	0	2	4	9	0	1	1	0	0	1	5	0	7	3	2	1	1	0	1	1
14 to 19	46	111	2	3	7	11	1	0	0	4	0	1	3	0	12	2	6	0	1	0	1	3
20 to 44	181	503	17	33	35	103	6	2	2	13	9	11	27	8	79	4	7	5	2	4	5	18
45 to 59	30	81	4	3	6	12	0	0	0	0	0	0	1	1	19	2	0	0	1	1	1	4
60+	2	31	0	1	2	2	0	0	0	0	0	0	0	0	3	1	0	3	0	0	2	0
sum	402	1312	25	44	56	157	8	21	17	17	11	18	86	9	138	28	16	10	5	21	32	28

Non-drug chemicals involved in acute poisonings

Table 2: Tygerberg Hospital admissions regarding acute poisonings, 1999. Details

Age in years	Gender			Regions			Exposure route			Treatment			Referral			History			Symptoms and Signs			Lab results																						
	Case totals	Female	Male	Accidental	Intentional	Tygerberg Catchment	Greater Cape Town	Cape Province	Other Provinces	Ingestion	Inhalation	Cutaneous	Bites & stings	Decontamination AC/GL/emesis	Antidote	N-acetylcysteine	Antivenom	Intensive / High Care	Deaths	One agent	> 1 agent	Drugs	Drugs + Non-drug chemicals	Non-drug chemicals	self (no referral)	Elsiesriver Day Hospital	Private doctor	Other	Pregnant	Depression	Previous suicide	Mild CNS (drowsiness)	Moderate to severe	Gastrointestinal	Respiratory	Cardiovascular	Skin	Bites & Stings	None	Time in hospital <24h	Time in hospital > 24h	Tox screen positive	Tox screen negative	Tox screen not available
0 to 4	131	60	71	131	0	106	19	6	0	130	0	0	1	28	0	0	0	9	2	125	5	48	0	83	40	42	12	36	0	0	0	13	19	21	24	6	0	0	62	99	32	6	4	121
5 to 13	43	25	18	32	11	39	4	0	0	39	0	1	2	18	0	0	0	0	0	34	9	24	0	19	21	9	4	9	0	0	7	12	6	4	1	0	2	17	33	10	3	4	36	
14 to 19	229	189	40	6	222	193	16	19	0	222	0	0	6	200	11	7	2	39	3	108	121	191	16	22	91	83	12	41	4	10	12	25	63	34	11	25	2	6	95	143	86	134	48	47
20 to 44	544	395	149	11	532	451	42	47	3	532	2	1	7	467	24	14	4	91	5	228	316	381	106	55	221	172	45	94	15	66	32	83	174	77	24	44	1	3	208	349	195	327	114	105
45 to 59	47	29	18	2	44	35	6	6	0	43	2	0	2	34	1	0	1	10	0	22	25	24	13	10	22	12	4	9	0	9	1	11	22	7	6	4	2	2	6	27	20	25	6	15
60+	16	9	7	5	11	9	1	6	0	15	1	0	0	9	1	0	0	6	2	11	5	13	1	2	5	1	1	0	2	1	1	0	2	0	2	5	11	10	3	3	3			
sum	1010	707	303	187	820	833	88	84	3	981	5	2	18	756	37	21	7	155	12	528	481	681	136	191	400	319	78	198	19	89	46	140	301	145	71	84	5	13	390	656	354	505	179	327

General categories: (AC) activated charcoal (GL) gastric lavage

Age in years	Categories			Pesticides										Volatile hydrocarbons										CO	Irritants			Corrosives			Miscellaneous non-drugs chemicals															
	Biological	Household	Agricultural	Ethanol	Cholinesterse inhibitors	Phostoxin	Mothballs	Mosquito coils	Ant-poison with Lindane	Ant-poison (excluding Lindane)	Lindane (excluding ant-poison)	Rattex	Paraquat	Other pesticides	Paraffin	Petrol and Diesel	Thinners	Benzine	Turpentine	Essential oils	Other volatile hydrocarbons	CO-inhalation	Jik	Acetone	Other detergents and irritants	Jeye's Fluid	Dettol and Savion	Potassium permanganate	Handy Andy	Other corrosives	Ethylene glycol	Cyanide	Calamine lotion	Benzy-benzoate	Surgical spirits	Methylated spirits	Mercurochrome	Silica gel	Thermometer	Disc batteries	Other non-drug chemicals	Unknown non-drug chemicals				
0 to 4	3	75	0	1	0	0	0	0	0	0	0	4	0	1	38	2	1	0	7	1	0	0	9	1	1	0	1	1	0	7	0	0	1	0	0	0	3	0	0	0	0	0	0	0	1	
5 to 13	2	17	0	2	1	0	0	0	0	0	0	0	0	0	4	1	0	0	1	0	0	2	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
14 to 19	6	31	0	16	4	0	0	0	0	0	0	3	1	3	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
20 to 44	6	148	0	113	17	0	0	1	0	1	1	4	1	5	4	1	1	0	3	0	1	3	6	0	3	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	
45 to 59	2	19	0	14	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
60+	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
sum	19	294	0	147	27	0	0	1	0	1	1	11	2	9	46	4	3	0	11	1	1	7	16	1	5	2	2	1	0	14	0	0	2	0	1	2	0	3	0	0	0	3	6			

Non-drug chemicals involved in acute poisoning cases

of 1010 cases

Age in years	Paracetamol	Salicylates	Other NSAID's	Benzodiazepines	Barbiturates	Other sedative-hypnotics	Tricyclic antidepressants	Other antidepressants	Neuroleptics	Antiepileptics	Opioids	Antimicrobials	Theophylline	Other respiratory drugs	Cardiovascular drugs	Vitamins	Iron	Endocrine drugs	Anti-histamines / anti-cholinergics	Sympathomimetics	Drugs of abuse	Other drugs	Unknown drugs
0 to 4	8	2	0	5	0	0	1	0	4	6	0	2	1	0	7	1	2	0	4	2	1	3	7
5 to 13	3	2	0	3	0	0	1	0	1	3	0	2	0	0	2	2	1	0	3	1	2	1	7
14 to 19	70	7	23	19	1	11	27	1	6	28	2	22	42	3	23	5	11	18	13	9	1	16	19
20 to 44	177	21	52	87	0	12	103	16	18	45	7	47	53	0	46	14	24	19	45	17	12	23	41
45 to 59	10	3	3	6	0	1	11	1	4	6	0	1	6	0	4	0	0	3	2	1	0	2	0
60+	3	0	1	3	0	0	3	0	1	1	0	0	0	0	5	0	0	1	1	0	0	1	1
sum	271	35	79	123	1	24	146	18	34	89	9	74	102	3	87	22	38	41	68	30	16	45	75

Drugs involved in acute poisoning cases

Age in years	scorpions	snakes	spiders	mushroom	plants	other
0 to 4	1	0	0	2	0	0
5 to 13	2	0	0	0	0	0
14 to 19	1	2	2	0	0	1
20 to 44	2	1	3	0	0	0
45 to 59	0	1	1	0	0	0
60+	0	0	0	0	0	0
sum	6	4	6	2	0	1

Biological agents (plants to animals) involved in acute poisoning cases

Telephonic enquiries were received from all parts of the country. Although the majority of these came from the Western Cape, a substantial number originated in other provinces. Figure 12 depicts and includes all calls received during 1999.

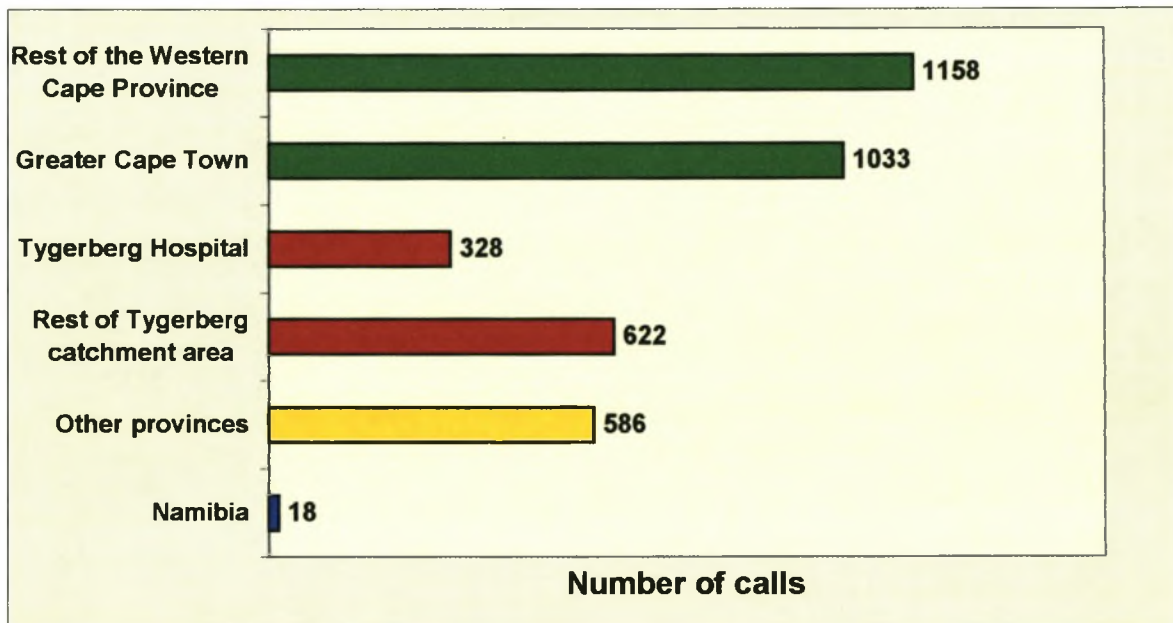


Figure 12: Origin of calls received by Tygerberg Poison Information Centre.

■ = Tygerberg catchment area; ■ + ■ = Western Cape

Of the total of 3744 consultations processed by the Poison Centre, 2583 (69%) were from health professionals and 1157 (31%) from the lay public. Of the health professional group, 2079 (80%) were from medical doctors (figure 13).

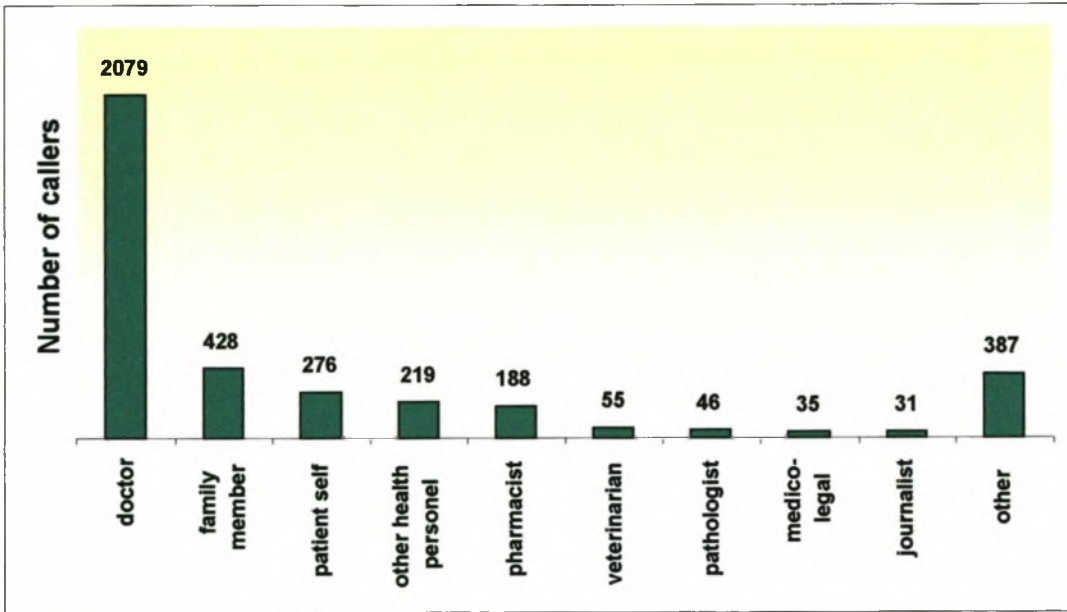


Figure 13: The Interlocutors (callers). (All consultations).

Results which follow will deal with acute human poisonings only.

3.2.1 Analysis of acute poisoning consultations (N= 2690)

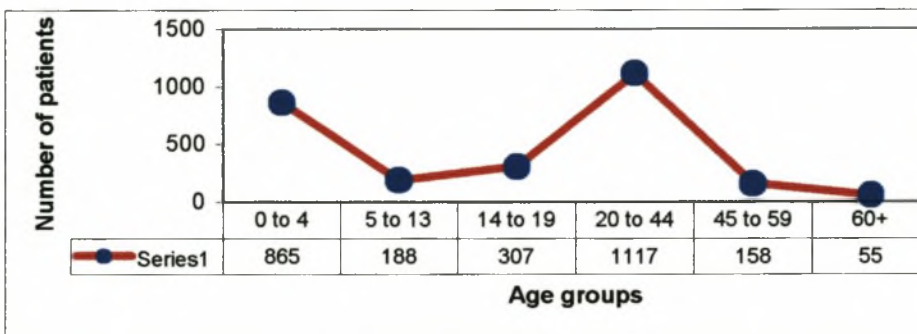


Figure 14: Age distribution of poisoned patients: Tygerberg Poison Information Centre.

Most patients (42%) fell into the 20-44 age group, while 32% were in the 0-4 age group. In most cases the route of exposure was oral (76%), followed by skin (15%), inhalation (7%) and ocular (2 %). Seventy two percent of the skin exposures were

due to bites and stings. Of the total of 2690 acute poisoning cases managed by the Poison Centre, 1796 (66%) involved non-drug chemicals and 932 (34%) drugs. In 38 of the 2690 cases, a combination of drugs and non-drugs were used. Ethanol was ingested or co-ingested in 56 cases.

3.2.1.1 Differences between adult and paediatric poisonings: Poison Centre consultations

From the total of 2690 cases, 1053 were children (39%) and 1638 adults (61%).

Forty four percent of the children and 52% of the adults were females. Most of the poisonings in children were accidental (97%), whereas in adults 55% were intentional and 45% accidental.

There was no statistical difference in the male to female ratio in adults versus children (figure 15).

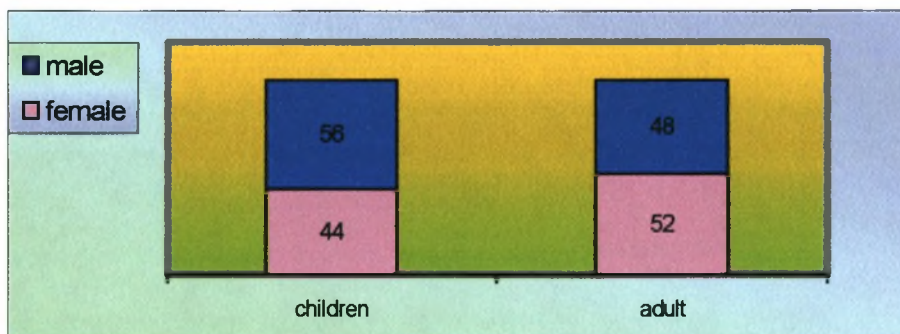


Figure 15: Gender distribution (%) in adults versus children.

There was however a statistically significant difference in the intentional to accidental ratio in the adult versus paediatric groups (figure 16).

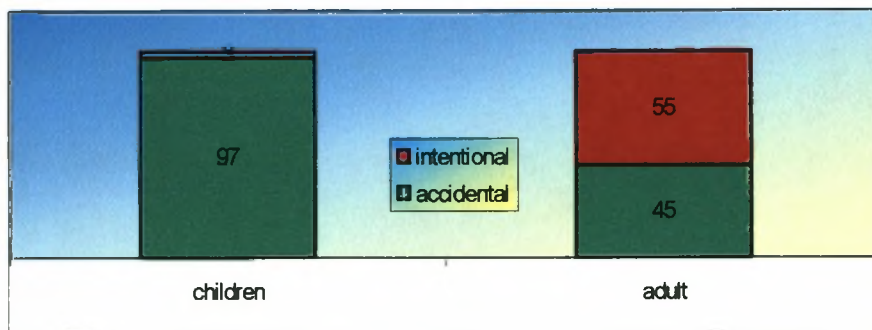


Figure 16: Accidental and intentional poisoning (%) in adults versus children.

When comparing the drug to non-drug chemical ratio in adults versus children no statistically significant difference was found (figure 17).

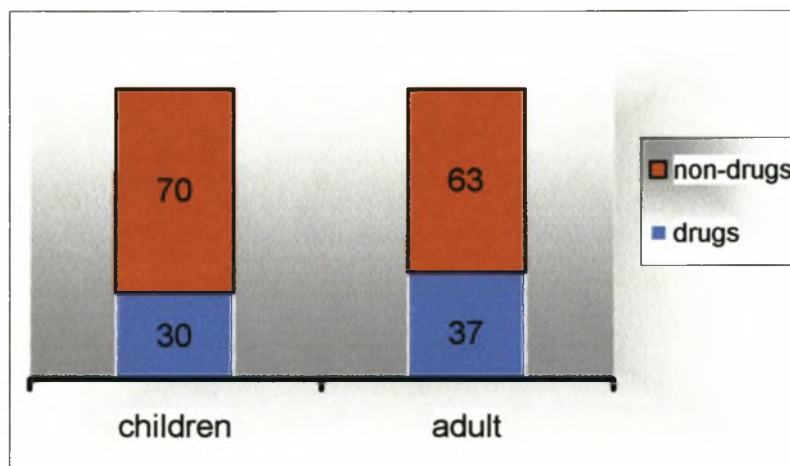


Figure 17: The distribution of non-drug chemicals to drugs (%) in adults versus children.

There were more non-drug related than drug related inquiries in both adults versus children. Details are listed in table 6.

	DRUGS N=932	NON-DRUG CHEMICALS N=1783			
		Household	Agricultural	Industrial	Biological
Children N=1053	316	586	2	4	143
Children %	30	56	0.2	0.4	14
Adults N=1638	616	726	23	40	259
Adults %	38	44	1.4	2.4	16

Table 6: Drugs versus non-drug chemical consultations.
(In some cases drugs and non-drug chemicals were taken simultaneously.)



Of a total of 2690 acute poisoning cases referred to the Poison Information Centre, 44 deaths were recorded. Of the 39 adult fatal cases, 29 were suicides and 10 accidental. The 5 children fatalities were accidental.

Most of the consults with regard to fatalities were of a medico-legal nature (84%).

Agents responsible for fatalities are listed in Table 7.

	Number	Intentional	Accidental	Benzodiazepines	NSAID'S	Tricyclic antidepressants	Antiepileptics	Cardiovascular drugs	Anticholinergics	Neuroleptics	Cocaine	Ecstasy	Opioids	Cholinesteras inhibitors	Rattex	Strychnine	Other pesticides	Paraquat	Ant poison	CO-inhalation	Volatile hydrocarbons	Corrosives	Plants	Snakes	Spiders	Other	Unknown	
0 to 4 years	4	0	4	1	1 mefenamic acid		1								1									1 cobra				
5 to 13 years	1	0	1					1																				
14 to 19 years	4	3	1			1																1 lime sulphur			1 violin		1	
20 to 44 years	28	23	5			4	1	1	3	1	1	1	3		2	1	3	1		1 chloroform		1 indian bean	1 cobra			2	1	
45 to 49 years	5	3	2					1					1				1		2									
60+ years	2	0	2		1 Diclofenac																					1		
total	44	29	15	1	2	5	2	2	1	3	1	1	2	3	1	2	1	4	1	2	1	1	1	2	1	3	2	

Table 7: Agents responsible for fatalities (Tygerberg Poison Information Centre)

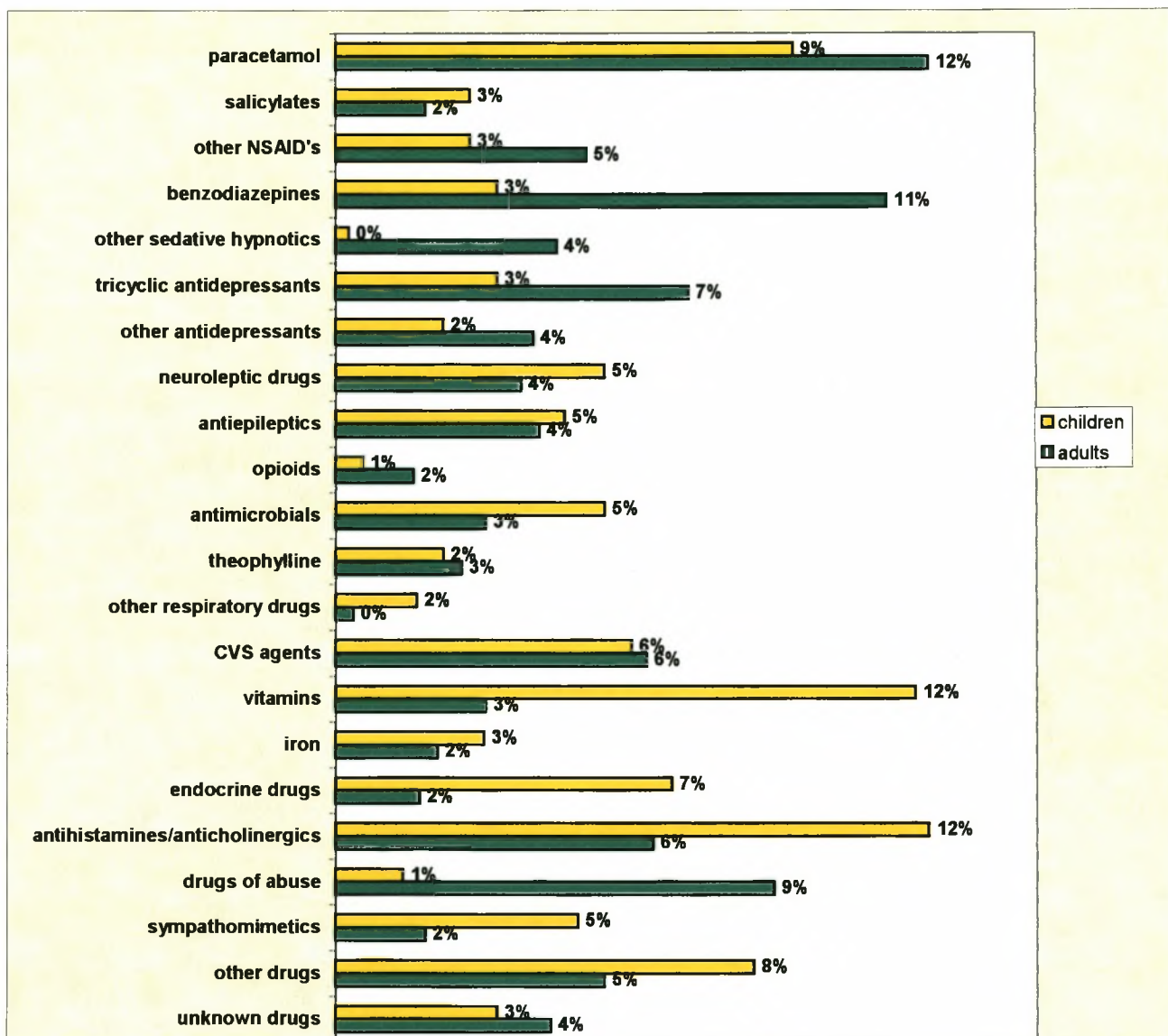


Figure 18: Drugs involved in acute poisonings: Tygerberg Poison Information Centre (Children versus adults).

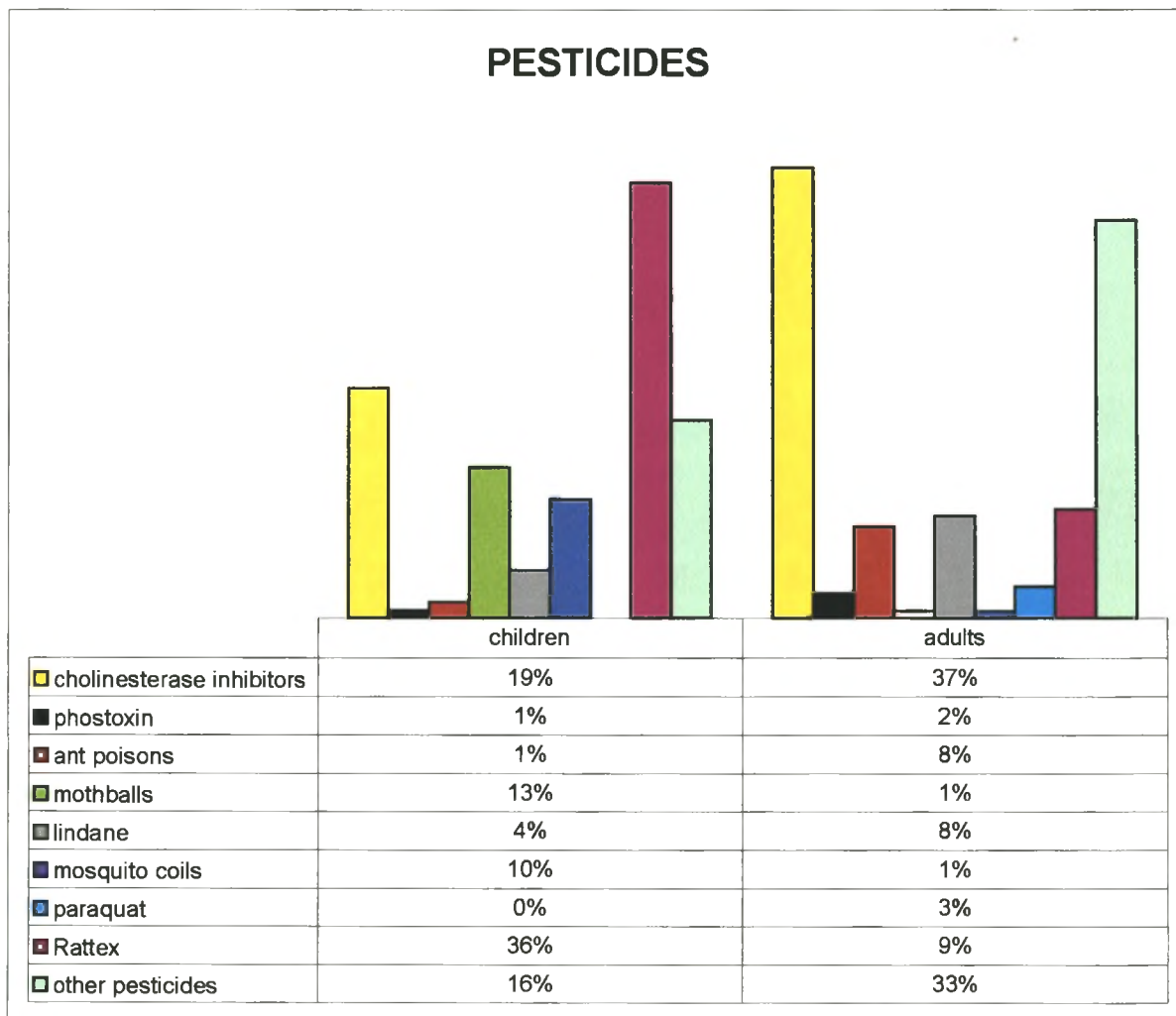


Figure 19: Pesticides involved in acute poisonings.

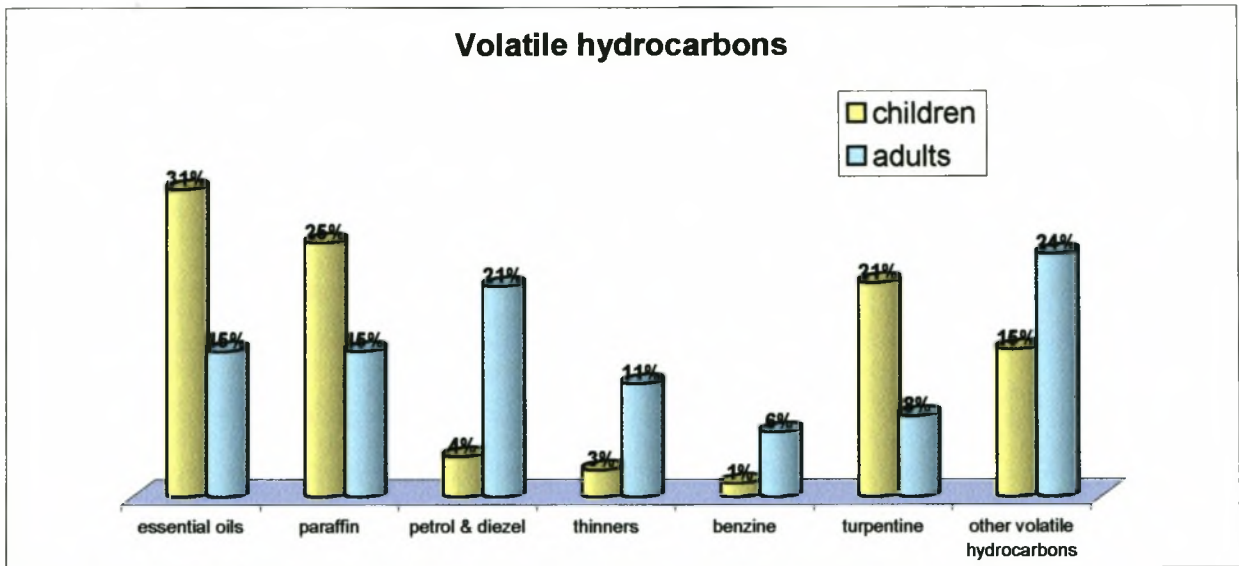


Figure 20: Volatile hydrocarbons involved in acute poisonings.

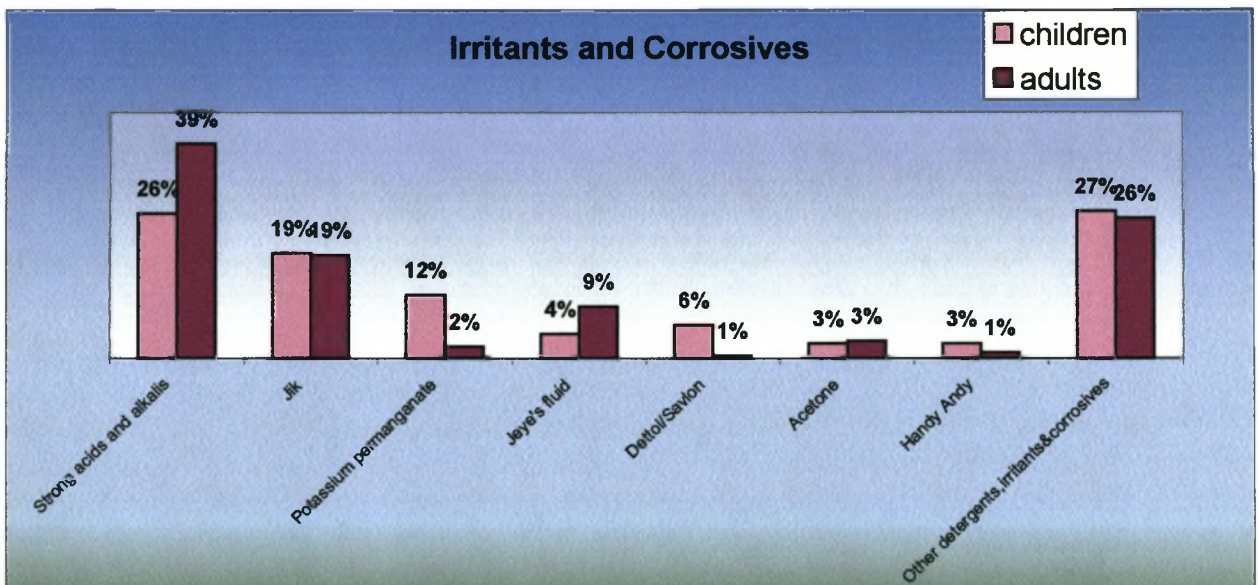


Figure 21: Irritants and corrosives involved in acute poisonings.

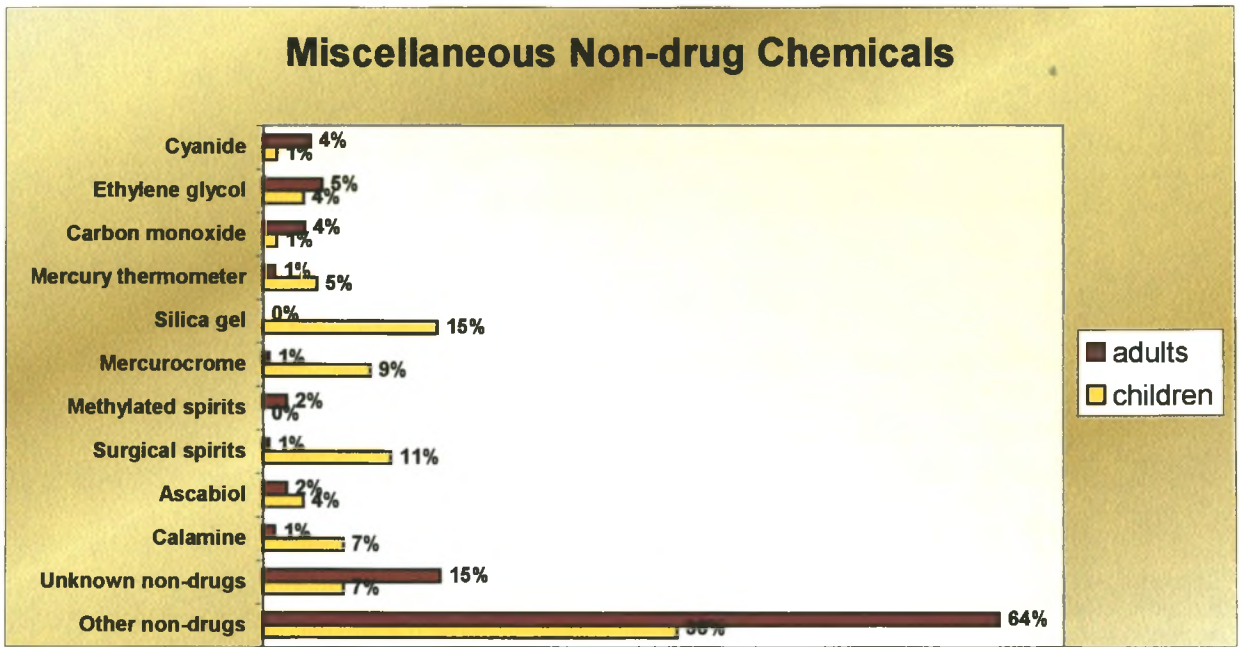


Figure 22: Miscellaneous non-drug chemicals involved in acute poisonings.

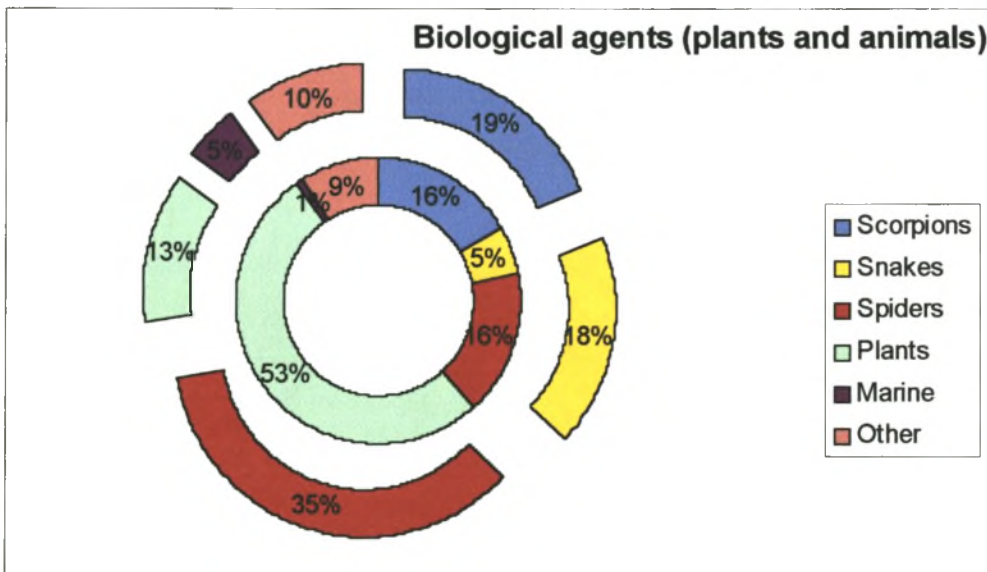


Figure 23: Biological agents (plants and animals) involved in poisoning exposures. The inner circle represents the paediatric group and the outer broken circle the adult group.

3.3 Results in respect of acute poisoning cases from the Tygerberg catchment area, comprising both Hospital admissions and Poison Information Centre consultations: A comparison.

In order to be able to make valid comparisons between Hospital admissions and Poison Centre consultations, cases originating from the same immediate geographical region (Tygerberg catchment area) were identified and classified. Approximately 90% of patients admitted to Tygerberg Hospital and 25% of Poison Centre consultations, in respect of acute poisonings, originated from the same region, the Tygerberg catchment area.

From January through December 1999, 834 acutely poisoned patients from the Tygerberg catchment area were admitted to Tygerberg Hospital, whilst the Tygerberg Poison Information Centre managed 592 consultations from the same area. The results of the above two studies were compared and statistical analysis performed by calculating the 95% confidence interval for the expected study variables. P values < 0.05 were considered statistically significant.

There was a significant difference between the ratio of men to woman in the two studies. (Depicted in Figure 24) Females accounted for 70% of acute poisoning Hospital admissions, as opposed to 51% of Poison Centre consultations.

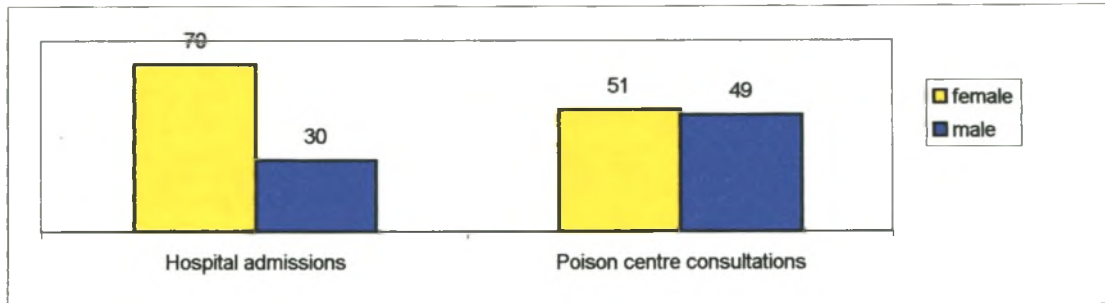


Figure 24: Female to male ratio in acute poisonings.

There was also a wide discrepancy when comparing the adult to children ratios between the two studies. Of the Tygerberg Hospital acute poisoning admissions, 688 (83%) were adults and 145 (17%) children, as compared to consultations from the Tygerberg Poison Information Centre, where 322 (54%) were adults and 270 (46%) children.

When comparing the ratio of accidental to intentional poisonings in the adult groups of the two studies, 99% of Hospital admissions and 59% of Poison Centre consultations from the Tygerberg catchment area were intentional (figure 25). The P value < 0.05 and this was considered statistically significant.

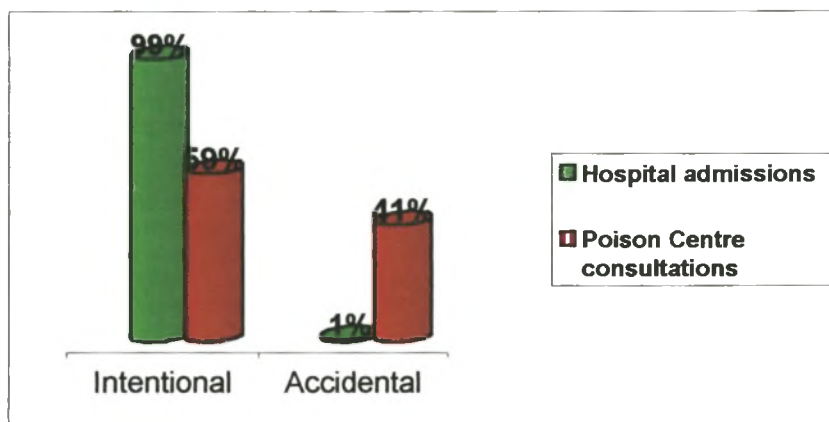


Figure 25: Intentional versus Accidental poisonings in the Adult group.

- No significant difference was found between the ratios of accidental to intentional poisoning in children. 92% of acute poisoning Hospital admissions and 96% of Poison Centre consultations in the children were accidental (as expected) (figure 26).

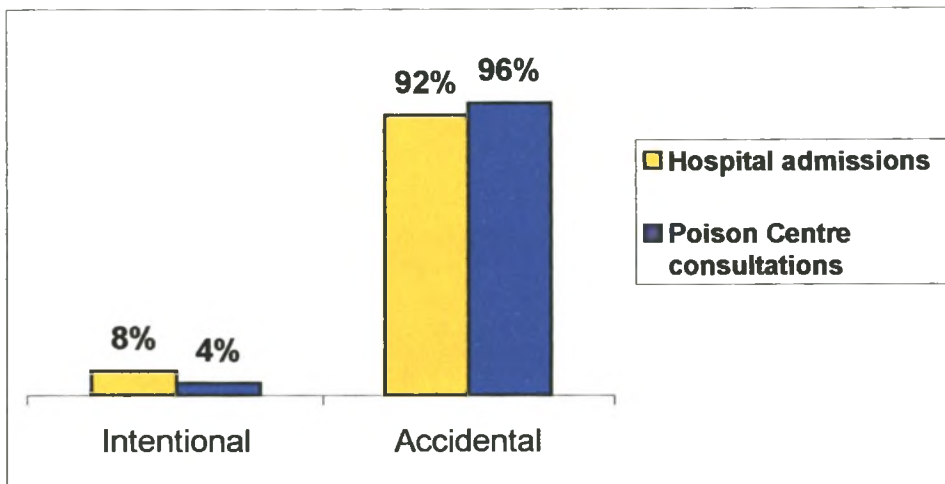


Figure 26: Intentional versus accidental poisoning in children.

- For adult female intentional poisonings, there was a significant difference between the two study groups. Seventy five percent of adult female Hospital admissions and 35% of Poison Centre consultations were intentional.

For Hospital admissions the majority of acute poisonings from the Tygerberg catchment area occurred in the 20-44 age group, while for Poison Centre consultations two peaks were noted, the 0-4 age group and the 20-44 age group (figure 27).

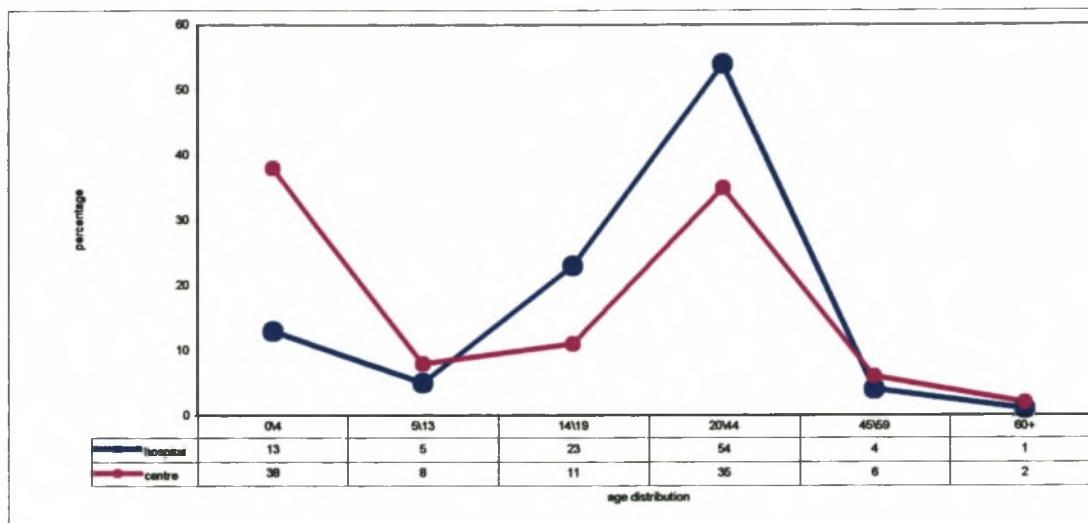


Figure 27: Comparison of age distribution in Hospital admissions versus Poison Centre consultations (Tygerberg catchment area)

Of the total of 688 acutely poisoned adults admitted to Tygerberg Hospital, 641 (93%) patients were exposed to drugs and 169 (25%) to non-drug chemicals. A substantial number of patients were exposed to a drug and non-drug chemical simultaneously. Of the total of 322 adult Poison Centre consultations, 154 (48%) ingested drugs and 175 (54%) non-drug chemicals. Of the 145 children Hospital admissions, 83 (57%) were exposed to non-drug chemicals and 62 (43%) to drugs. During the same period, the Poison Centre received 270 calls with regard to acute poisonings in children. One hundred and seventy eight (66%) of these were non-drug chemical related and 92 (34%) drug related.

Ingestion was the principal route of exposure in both Hospital admissions and Poison Centre consultations (98% and 76% respectively).

Symptoms and signs of poisoned patients reported to the Poison Centre were mostly incomplete and therefore no comparison between the two was possible.



Nine (1.1%) deaths were reported for Hospital admissions and nine (1.5%) for Poison Centre consultations (table 8).

AGENT	HOSPITAL	POISON CENTRE
Tricyclic antidepressants	3	2
Neuroleptics	1	2
Opioids	0	1
Antihistamines, anticholinergics	1	2
Corrosives	1	1
Acetylcholinesterase inhibitors	0	1
Paraffin and turpentine	2	0
CO-inhalation	1	0

Table 8: Deaths recorded in Hospital admissions and Poison Centre consultations: Tygerberg catchment area.

3.3.1 Adults

Drugs responsible for acute poisonings in adults for Hospital admissions versus Poison Centre consultations are depicted in figure 28.

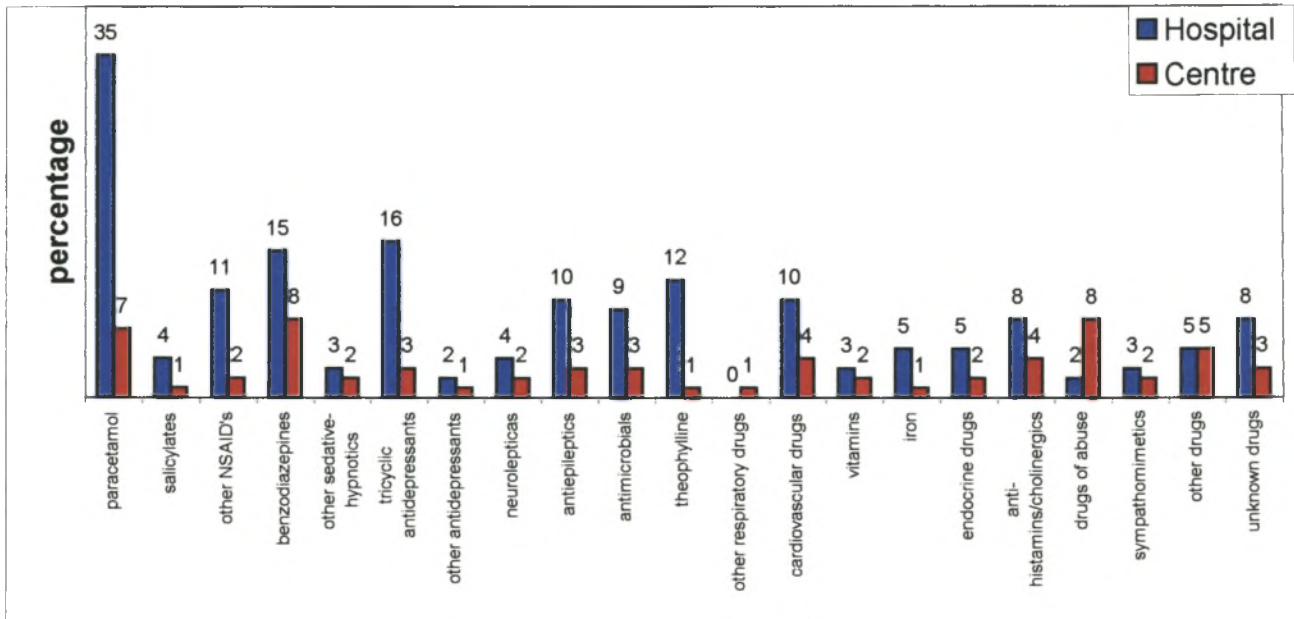


Figure 28: Drugs involved in acute poisonings in adults. Hospital admissions (641/688) versus Poison Centre consultations (154/322) (Tygerberg catchment area).

Poisoning exposures to paracetamol, other non-steroidal drugs, tricyclic antidepressants, antiepileptics, and theophylline were significantly higher in Hospital admissions than in Poison Centre consultations. Exposures to drugs of abuse, however, were significantly higher in Poison Centre consultations.

Paracetamol was the drug most commonly involved in adult Hospital admissions (figure 28). All paracetamol overdoses were intentional. Paracetamol overdose occurred predominantly in the 20-44 age group (figure 29).

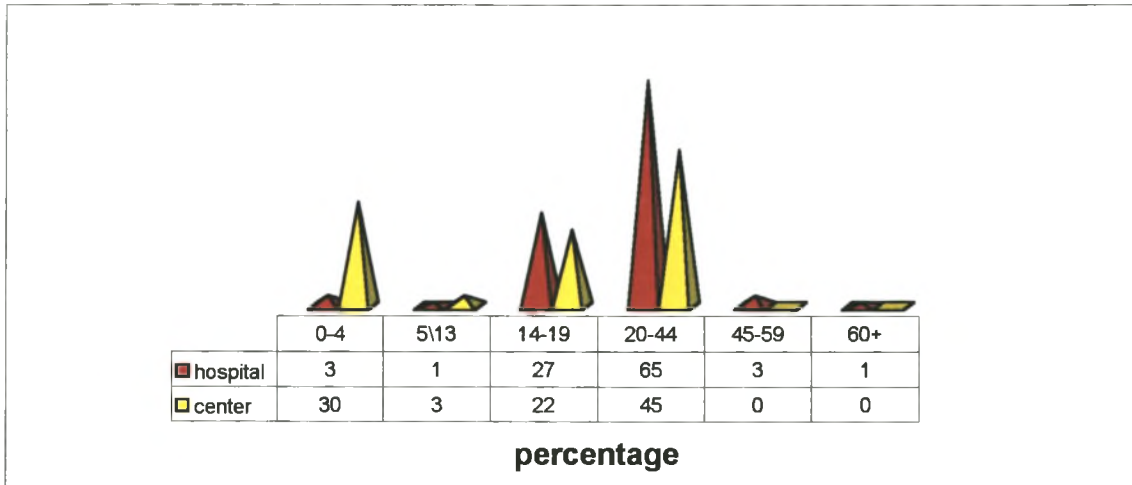


Figure 29: Age distribution of patients exposed to paracetamol (Tygerberg catchment area).

Paracetamol overdose occurred predominantly in adult females (figure 30).

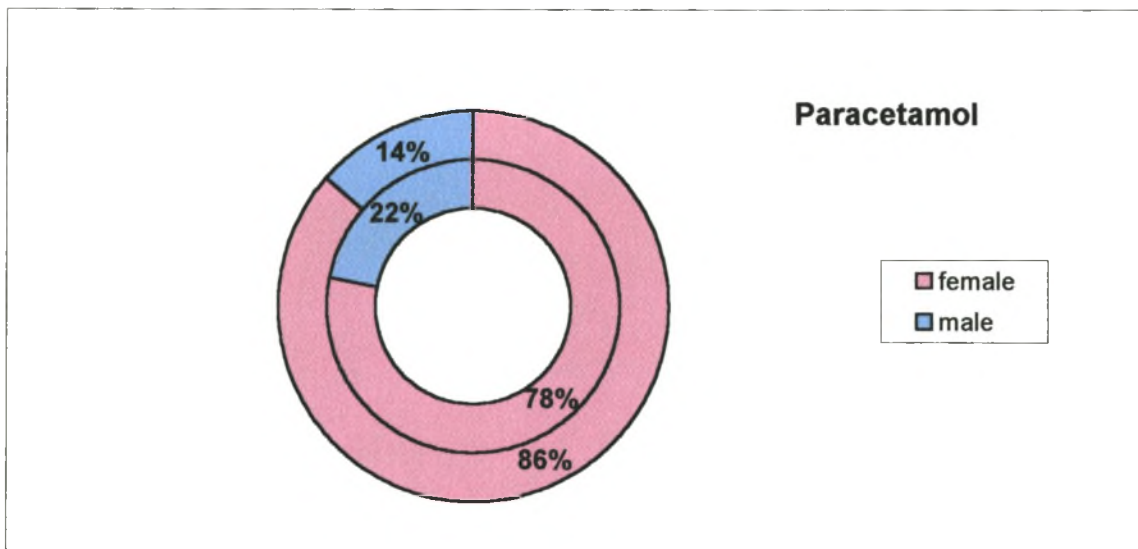


Figure 30: Gender distribution of adults exposed to paracetamol.
 Inner circle illustrates Hospital admissions, outer circle Poison Centre consultations.

Non-Drug chemicals responsible for acute poisonings in adults, Hospital admissions versus Poison Centre consultations, are depicted in figure 31.

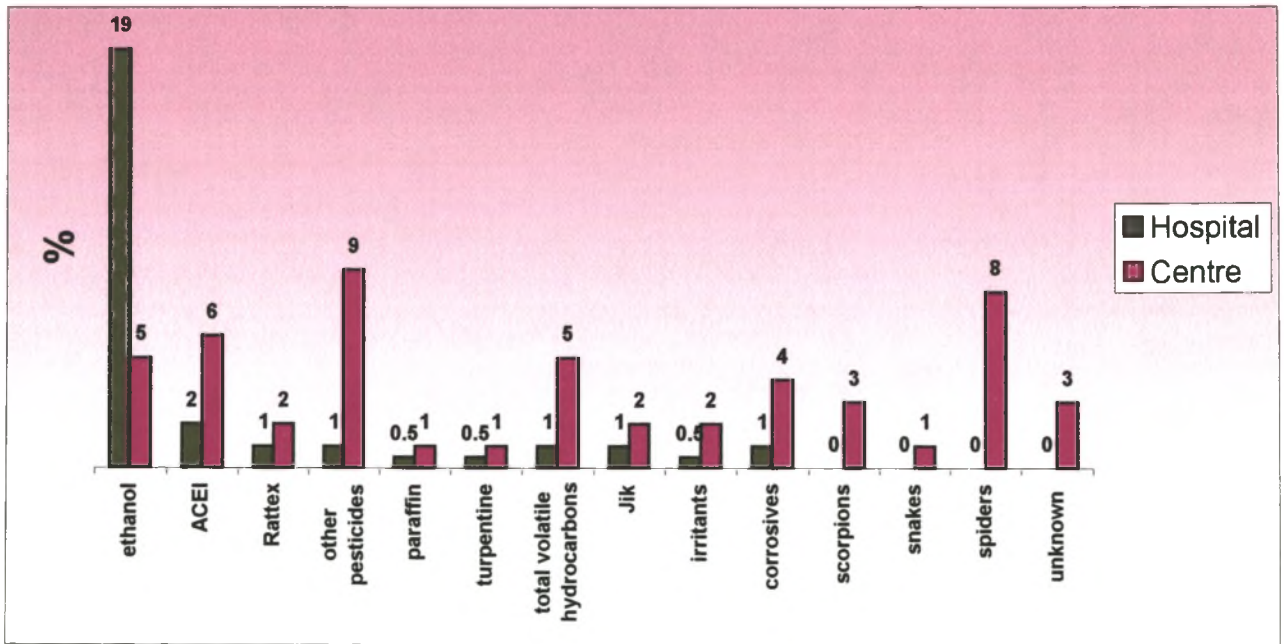


Figure 31: Non-drug chemicals involved in acute poisonings in adults. Hospital admissions (169/688) versus Poison Centre consultations (175/322). (Tygerberg Catchment area)

Poisoning exposures to pesticides were significantly higher in Poison Centre consultations compared to Hospital admissions. Poisoning exposures involving ethanol were significantly higher in Hospital admissions versus Poison Centre consultations. With regards to biological toxin exposures, 3% of consultations involved scorpion sting, 1% snake bite and 8% spider bite. No patients from the Tygerberg catchment area were admitted to Hospital with regards to biological toxin exposures.

3.3.2 Children

Drugs responsible for acute poisonings in children, Hospital admissions versus Poison Centre consultations, are depicted in figure 32.

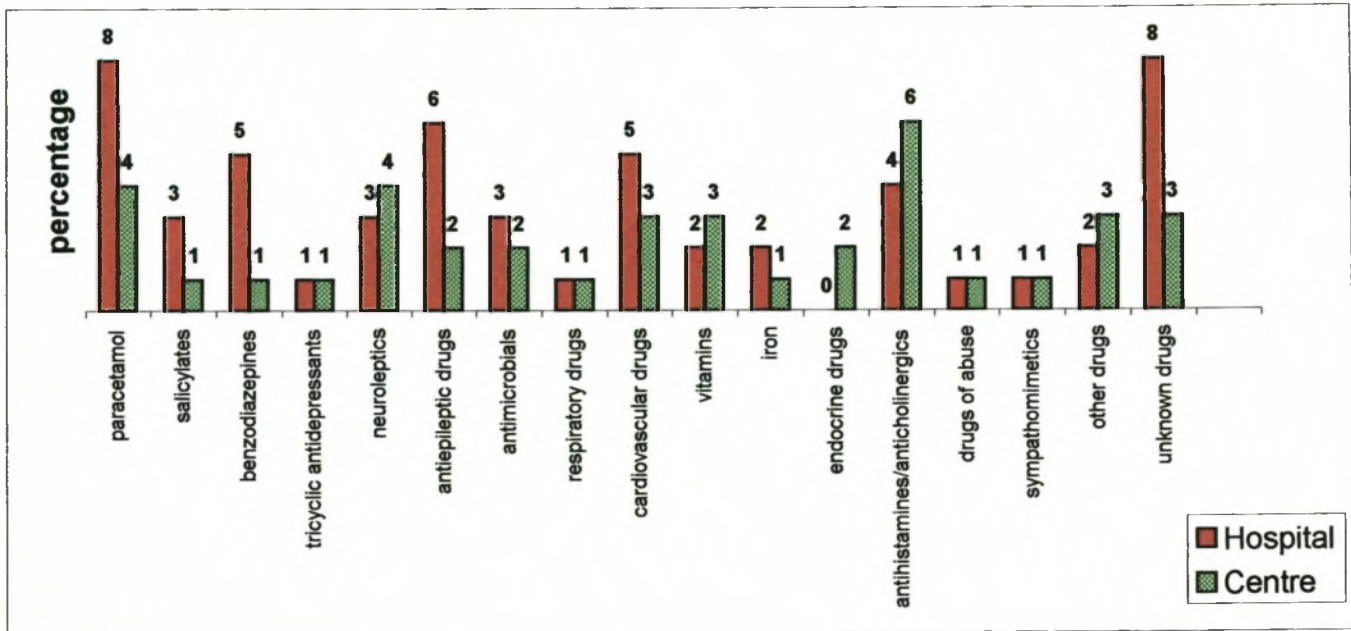


Figure 32: Drugs in acute poisonings in children. Hospital admissions (62/145) versus Poison Centre consultations (92/270). (Tygerberg catchment area)

When comparing the number of drug overdoses in children, there was no statistical significant difference between Hospital admissions versus Poison Centre consultations.

Non-drug chemicals responsible for acute poisonings in children, Hospital admissions versus Poison Centre consultations, are depicted in figure 33.

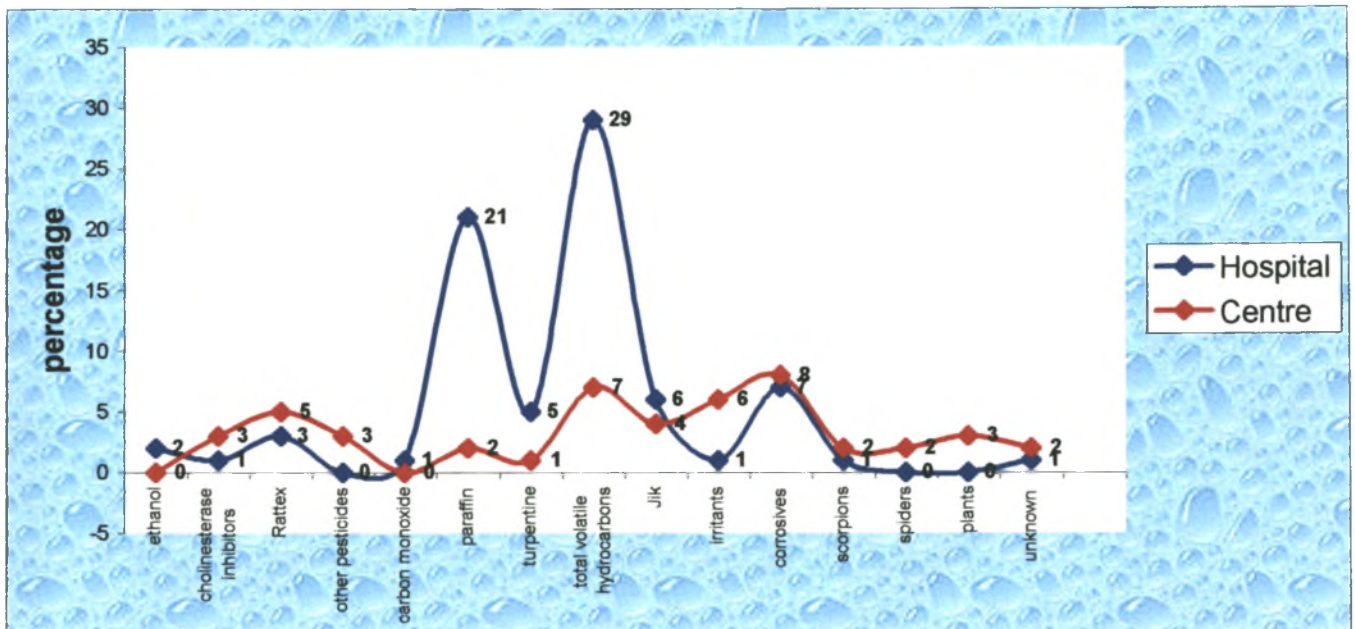


Figure 33: Non-drug chemicals involved in acute poisonings in children. Hospital admissions (83/145) versus Poison Centre consultations (178/270) (Tygerberg catchment area).

The non-drug chemicals most commonly involved in acute poisonings in children admitted to Hospital were volatile hydrocarbons, especially paraffin (figures 33&34).

Poisoning exposures to paraffin were significantly higher ($P < 0.05$) in Hospital admissions as opposed to Poison Centre consultations (figure 33). Paraffin exposures occurred predominantly in the 0-4 age group. All of these were accidental ingestions.

Paraffin poisoning in children, in both Hospital admissions and Poison Centre consultations, occurred mostly in males (figure 35).

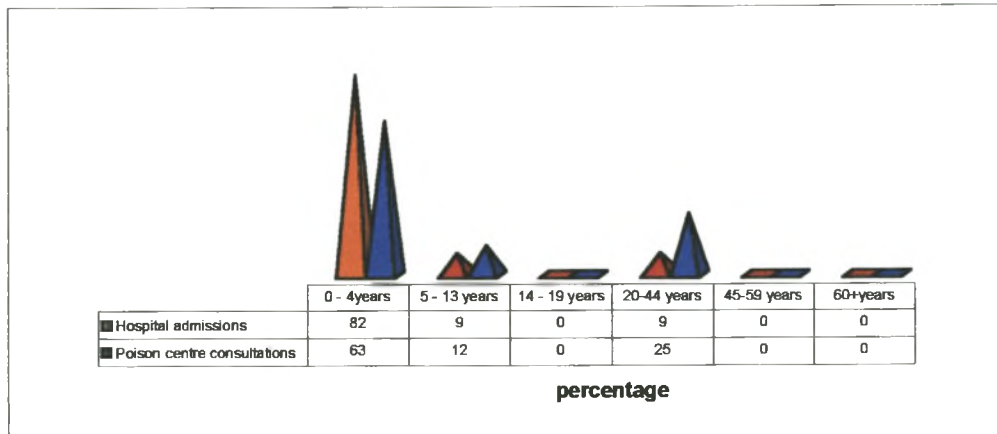


Figure 34: Age distribution of patients exposed to paraffin (Tygerberg catchment area).



Figure 35: Gender distribution of children exposed to paraffin.
Inner circle represents Hospital admissions, outer circle Poison Centre consultations.

4. DISCUSSION

Etiology: Acute poisoning is a significant public health concern and is considered to be the third most common cause of death in the home.¹⁹ Poisoning ranks among the most common reasons for acute medical hospitalisation.¹² Acute poisoning represents 3% of total injuries annually in the United States, with health care costs exceeding 8.5 billion dollars.^{40, 41}

Acute poisoning is a manifestation and result of the interplay between psychological, economic, cultural, and regional factors, illustrated by the marked inter-population differences in the nature and magnitude of this problem, particularly when contrasting the First and Third worlds.⁴² Furthermore, studies have revealed that acute poisoning is a common form of deliberate self-harm in the developing world. The mortality rate is high, due to the toxicity of the poisons, large doses and to poor medical care.²⁴ General reviews on the management of acute poisoning and toxicology textbooks tend to be based on the experience in developed countries.^{42, 43}

Poison information database: Most epidemiological research involves non-experimental, observational studies of the occurrence of illness in humans.⁹ The specific measures of illness occurrence commonly used are expressed in terms of the rate of illness occurrence (incidence), the risk of illness occurrence, or the proportion of individuals in the population who have the illness at a specific time.⁸ In toxicology, the measures are: the rate at which poisoning occur in the general population and the proportion of poisoned patients in the population.⁸ Most

regulatory toxicology is still based on *in vitro* or animal studies coupled to theoretical calculations rather than being founded in human data.⁹ It is for this reason that harmonizing data collection is essential for patient care as well as for the development of chemical risk assessment and management strategies. The IPCS INTOX project was designed to develop a computer-based poison information database.^{9,39} The aims of this project were to promote the development of poison centres and to assist such centres in the diagnosis and prevention of poisoning. That is, to resolve the scientific uncertainties outlined above and to develop evidence-based clinical toxicology.⁹ Unfortunately this IPCS INTOX project does not include poison statistics derived from emergency departments in hospitals. As is evident from the results of our 1999 study, several differences were noted when comparisons were made between the cases reported to the Poison Centre and actual Hospital admissions. Therefore, epidemiological studies that utilize statistics derived from poison centres, along with actual hospital admissions, will show a better reflection of the true incidence of acute poisonings.

Literature review on poison information centre statistics: A review of the literature revealed that many articles published on the incidence of acute poisoning are based on poison information centre statistics.³⁻³⁹ These statistics, derived from an analysis of telephone enquiries and consultations processed by poison centres, are not necessarily a reflection of the true incidence of acute poisonings for a variety of reasons:

- i) Poisoning related deaths would more than likely be underrepresented in the data.^{27, 31, 44}

- ii) Most patients, or their caregivers, prefer calling their family practitioner rather than a poison centre.²⁷
- iii) Clinicians who feel comfortable with the management of common drug overdoses or non-drug chemical poisonings may not contact a poison centre for advice on how to manage those intoxications.²⁷
- iv) Patients who are harmed by iatrogenic overdoses may go unreported.²⁷
- v) Other poison centres in the country may be contacted.²⁷
- vi) Reporting can be limited due to a lack of case definition, poor standardization of data collection and incomplete reporting.²⁷
- vii) Acutely poisoned patients without telephones cannot contact a poison centre.²⁷

Literature review on hospital admissions statistics: Numerous articles, based on actual hospital admissions for acute poisonings, were found in the literature.⁴⁷⁻⁵⁹

Despite the fact that hospital admissions are probably a more accurate reflection of the true incidence of acute poisoning, certain limitations exist. Not all cases of poisoning, or suspected poisoning, are referred to hospital.⁵⁸ Data from hospital-based surveillance of poisonings may reflect only those exposures which produce symptoms and signs sufficiently severe to warrant close medical supervision and management.²⁷

Objective of the study: Literature based on a comparison between hospital admissions due to acute poisonings and poisonings reported to poison information centres could not be found. This study is therefore unique, in that the data of these two entities were able to be compared. Not only are the Poison Information

Centre and the admission wards for acute poisonings in the same Hospital, but they also, to a large extent, service the same catchment area. This catchment area includes people from developed and developing communities.

True poisonings versus poisoning exposures: Normally one should distinguish between an exposure to a poisonous substance and a true poisoning. In a true poisoning, the substance has already caused an unfavorable or adverse effect on the body or organism, whereas an exposure to a potentially poisonous substance will not necessarily result in a poisoning. In this study it was not always possible to establish whether the case was a true poisoning or merely an exposure to a potentially poisonous substance.

4.1 Tygerberg Hospital admissions

Acute poisoning is a common medical emergency and usually requires hospital admission. Severe morbidity and mortality in hospitalised patients, however, are infrequent.⁴⁹ During 1999 a total of 11 723 patients, comprising 2930 children and 8793 adults were admitted to the medical emergency units of Tygerberg Hospital. Of the total of 11 723 patients, 1010 were admitted for acute poisoning (9%).

4.1.1 Children

This study confirmed that acute poisoning remains a notable health problem for children.⁵⁴ Of a total of 1 010 acute poisonings admitted to Tygerberg Hospital, 174 (17%) were children. The opposite was found in a retrospective study on acute poisonings in black patients from a developing community.⁴⁷ (71% of the

acutely poisoned patients were children). In another publication children accounted for as many as 80% of poisoning cases presenting to hospital.⁶⁰ As expected, acute poisonings in children were almost entirely accidental (93%) and this concurs with the literature.^{27-29, 47, 50} This study also confirmed that preschool children were poisoned far more frequently than school-aged children or adolescents. Furthermore, it was found that early childhood poisoning had no gender predominance. Similar results were obtained in other studies.^{27, 50, 52} The availability of an agent is a primary factor in accidental poisonings in children.²⁷ Impaired impulse suppression, hyperactivity, inability to discriminate safe from unsafe activities, living in a hazardous environment and inadequate parental vigilance are all possible explanations for childhood poisonings.²⁷

The literature indicates that more than 80% of all childhood poisonings take place in the child's home.^{27, 50} Accidental poisoning is a problem with toddlers (under 5 years old) with a mean age of 30 months. Deliberate poisoning however is a phenomenon that occurs in older children and usually need full psychiatric and social assessment.⁶¹

The 5 most commonly implicated agents responsible for poisoning admission to a Children's Hospital in Boston during fiscal years 1992 to 1995 were paracetamol, tricyclic antidepressants, lead, caustic alkalis and antihistamines.⁵⁴ More recent studies have shown that medications, such as benzodiazepines, iron preparations, paracetamol and anticonvulsants to be among the most common agents involved in childhood poisonings.^{27, 34, 35} Although these agents also featured prominently in the Tygerberg Hospital survey, paraffin was by far the most common agent

responsible for hospitalisation. Paraffin poisoning in South Africa, is almost exclusively a problem of early childhood⁴² and common among members of the lower socio-economic sectors of the population.³³ The highest incidence of paraffin ingestion occur in the 1 to 4 year age group. Almost 30% of all poisonings in children in this age group admitted to Tygerberg Hospital were due to paraffin ingestion. Accidental ingestion of paraffin usually occurs because it is stored in soft-drink bottles and household containers such as cups or glasses which maybe mistaken by children for water. Paraffin poisoning shows a seasonal variation with a peak incidence during summer months and a trough in winter.⁴² A possible explanation is that children are more likely to be thirsty when it is hot and drink readily accessible liquids. Similar and opposite results to our study were reported from a teaching hospital in south India: paraffin was the most common poisoning agent in children. However, in the same study plant ingestions were also frequent.⁵³ In 1999 no children were admitted to Tygerberg Hospital due to acute poisoning with plants.

Acute poisoning by household products is usually accidental and is most common among children aged 9 months to 5 years.⁶² Children over 5 years of age are less likely to ingest household products and are more likely to take medicines, plant seeds, solvents in adhesives and alcohol.^{50, 53, 62}

Of the total of 174 children admitted to Tygerberg Hospital in 1999 with acute poisonings, 76% were discharged within 24 hours, 40% had no symptoms when admitted and 11% presented with mild central nervous system symptoms only, e.g. drowsiness. 2 Children (1%), aged one and three respectively, died during

the study period. Both fatalities were due to volatile hydrocarbon ingestion (paraffin and turpentine). Another study on acute poisonings in children revealed that 6% of the children had no symptoms on admission and 27% were only drowsy.⁶³ They also reported a low mortality rate due to poisonings.⁵⁰

4.1.2 Adults

Of a total of 1 010 acute poisoning admissions, 836 (83%) were adults. Eight hundred and twelve cases (97%) were deliberate ingestions. The highest number of poisonings (54%) occurred in the 20 to 44 year old age group. Females predominated in all the age groups (74%). This is in good agreement with another study where acute poisonings in adolescents and adults were largely a problem of the female population.⁶⁶ By contrast, a prospective study of acute poisonings in a Finnish hospital revealed that poisonings appeared to be more prevalent in males than in females in the age groups 18-27 and 28-37 years. However they were more prevalent in females than in males in the age groups 38-47 and 48-57 years.⁴⁹ In 3 other studies, females predominated in all age groups, particularly in the 15 to 44 year old age group.^{64, 65}

Two hundred and seventy six (33%) adults had no symptoms on admission and 12% had only minor central nervous system symptoms, e.g. drowsiness. Sixty five percent were discharged from hospital within 24 hours. Seventeen percent of the acutely poisoned adults were admitted to the Intensive / High Care Units of Tygerberg Hospital. In the above mentioned Finnish study the clinical status of the patients on arrival was generally good and only 12% presented with serious symptoms. Only 3.5% were managed in Intensive Care Units. Almost all patients

(94%) were discharged within 24 hours.⁴⁹ Low morbidity in all the studies could be attributed to prompt treatment intervention, limited toxicity / low concentrations of the potential toxic substances involved, or the fact that no exposures had taken place.¹¹

Drugs (medications) were involved in 89% of adult admissions. One hundred and forty four cases (17%) tested positive for ethanol. Paracetamol (31%) was by far the most common agent ingested, followed by the tricyclic antidepressants (17%), the benzodiazepines (14%), theophylline (12%), antiepileptics (10%) and cardiovascular drugs (9%). Pesticide exposures were involved in 6% of adult Hospital admissions, mostly intentional or accidental (there were no occupational related exposures). Of the total of 836 patients, only 12 (1.4%) were exposed to recreational drugs (e.g. cocaine, mandrax, cannabis). There were no poisonings by traditional medicines.

The literature revealed that the barbiturates and other older non-barbiturate sedative hypnotics have become a less common cause of poisoning,⁶⁷ whilst overdose caused by agents such as the benzodiazepines and tricyclic antidepressants are now more frequent.⁶⁸ International findings in the 1980s and early 1990s showed a fall in benzodiazepine self-poisonings.⁶⁹⁻⁷² Although the benzodiazepines remain a major cause of self-poisoning worldwide, they are much safer drugs in overdose than the barbiturates whose place they have taken.⁷³ Analgesic poisoning (e.g. paracetamol) also occurs more frequently than previously recorded.^{26, 64, 74} This pattern has also been noted in Norway⁷⁵ and in central Europe.⁷⁶ In Finland, cardiovascular drugs and psychotropics are the most

common causes of poisoning.^{23, 59} In another Finnish study, aside from alcohol, the most common agents used for self-poisonings were anxiolytics, sedative-hypnotics, antidepressants and neuroleptics.⁴⁹ Alcohol consumption is a problem in Finland, with 35% of self-poisoning episodes, in a study conducted in 1992-93, involving this agent. In a UK study, as many as 62% of parasuicide patients had consumed alcohol in addition to other drugs.²⁶ In the Tygerberg Hospital admission study the role of alcohol is probably underestimated.

In South Africa, the pattern of acute poisoning in the white population mirrors that of North America and Western Europe, whereas that observed in black South Africans, is very different, with paraffin and traditional medicines accounting for the majority of hospital admissions.⁶⁰ In Sri Lanka, a developing country, agrochemicals account for nearly 60% of all poisonings,^{77, 78} while such agents account for less than 1% of hospital admissions in England and Wales.⁷⁹

Paracetamol poisoning accounts for thousands of exposures worldwide.^{31, 43, 56, 70, 80-84} Since the early 1970s, paracetamol poisoning has been the most common form of drug-induced liver disease in most countries.⁸⁰ The incidence of paracetamol poisoning continued to escalate throughout the 1980s. Recent data from the USA has failed to indicate any decline in incidence, although the mortality has fallen because of the effectiveness of antidote therapy.⁸⁰ A hospital-based study conducted in the UK revealed that paracetamol was the most commonly ingested poison in 1992-1993 (43.3% of cases).²⁶ The same study showed an increase in paracetamol self-poisoning over the years. It is now by far the most common drug taken in overdose in South Glamorgan.²⁶ This is similar to the

findings in Oxford⁷⁰ and that of a recent report from Scotland.⁵⁶ Increases have also been reported in Australia⁸² and New Zealand.⁷¹ Information regarding the ingested quantity of paracetamol is usually unreliable. The patient may have expelled an unknown number of tablets by vomiting or some individuals may attempt to conceal their overdose or understate the amount ingested. There is also a significant inter individual variability in susceptibility to liver injury.⁸¹

Because of the considerable risk of hepatotoxicity from paracetamol overdose, all acute exposures must be investigated, and this usually requires admission.⁴³ The expense of such a hospitalisation is considerable.³¹ Deliberate poisoning with paracetamol is partly due to its ubiquitous presence in the home and possibly also from the erroneous assumption that it is a relatively innocuous drug. Further research is required to supplement recent work on why patients choose paracetamol as a self poison and to identify the best way of reducing the morbidity and mortality associated with this drug.^{83, 84}

4.1.3 Elderly

As far as the older age groups (60 + years) were concerned, 9 elderly females and 7 elderly males were admitted to Tygerberg Hospital with acute poisoning. 13 of the elderly patients had taken an overdose of drugs and 3 ingested non-drug chemicals. Poisoning in the elderly has not been adequately studied.⁸⁵ The literature revealed that poisoning in the elderly differs from poison exposures in other age groups. With more serious exposures the elderly patient is less able to cope with the acute injury and less likely to recover rapidly.⁸⁵ This could be attributed to a decreased elimination resulting from relative impairment of hepatic metabolism and renal function, as well as to reduction in both lean body mass and

synthesis of albumin.⁸⁶ Elderly patients are particularly less tolerant of drugs that act on the central nervous system.

4.1.4 Adult fatalities

Of the total of 836 adults, 10 patients (1.2%) died after admission to Tygerberg Hospital. Three died of a tricyclic antidepressant overdose, 1 of a chloroquine overdose, 2 of corrosive injuries, 1 after the ingestion of a volatile hydrocarbon (thinners), 2 after the accidental inhalation of carbon monoxide and 1 after the exposure to an unknown toxic substance. Our low in-patient mortality rates tally with international rates of 1% and less.^{71, 82}

Eighty-nine (11%) poisoned adults admitted to Tygerberg Hospital had been treated for depression and forty-six (6%) had a history of repeated suicide attempts. Studies revealed a close link between depression and suicide, and therefore antidepressants are likely to be responsible for a substantial proportion of self-poisoning episodes.²⁶

Of the 10 fatalities, 8 (including 3 adolescents) committed suicide. Three of the 8 deaths were due to tricyclic antidepressant overdose. In western countries, suicide is the eighth most common cause of death and the most common method of suicide is self-poisoning.⁸⁷ Emerging data suggest that continuous treatment with antidepressant drugs offers the best hope for sustained recovery for depression. However one should bear in mind that there is also evidence to suggest that antidepressants *per se* can induce or exacerbate suicidal

tendencies.⁸⁸ Of all the drugs that are taken in lethal overdose, prescribed antidepressants are among the most common.⁸⁷⁻⁹⁰

During 1997, post mortems were performed on 3814 bodies at the Salt River mortuary, of which 157 were classified as suicides.⁹⁰ Poisoning was the chosen method of suicide in 18 cases.⁹⁰ This study further revealed that amitriptyline, topped the list of drugs being used by victims to commit suicide.

Adolescents who attempt suicide, do so most frequently by drug overdose.⁵⁰ They usually take the most readily available drug which is often an analgesic.⁸⁷ Depression, family dysfunction and a sense of hopelessness are often the underlying causes of such acts of self destruction.²⁷

4.1.5 Treatment of the poisoned patient

Treatment and emergency management of poisoned patients at Tygerberg Hospital, was mostly decontamination, symptomatic and supportive. (Supportive care entailed the maintenance of normal cardiac, circulatory, respiratory and renal functions, including normal arterial blood gas, serum electrolyte and glucose levels.)⁹¹

Gastric decontamination was performed in 75% of the poisoning cases and seemed to be almost routinely performed at Tygerberg Hospital. In the majority of cases this was unnecessary and in a few even potentially hazardous. According to the latest literature, gastric lavage should not be used routinely in the management of poisoned patients.^{91, 92} There is no evidence proving that its use

improves outcome, and it may even contribute to significant morbidity. Therefore lavage should be considered only if a patient has ingested life-threatening amounts of a poison up to 1 hour previously. Even then it is possible that drug absorption may be enhanced by its use.⁹² Although gastric lavage is the most effective means of gastric emptying, the benefits should outweigh the risks and the cost involved.⁹¹ The use of activated charcoal is now considered to be the first-line choice in preventing the absorption of many pharmaceuticals and other organic and inorganic poisons.⁹³

4.1.6 The Toxicology laboratory

The Tygerberg Toxicology Laboratory situated in the Stellenbosch University Pharmacology Department, is associated with the Tygerberg Poison Information Centre, and offers a 24-hour service. Toxicology screenings accounts for 5-10% of total analyses. Urinary drug screens are not performed routinely on patients who have taken an overdose, as they are costly and time-consuming. Patient history and physical examination guide the physician in the selection of specific toxicological tests. Emergency drug screening is considered only when anticipated results are likely to affect short-term management of a patient. Ethanol levels are not routinely requested if a patient is obviously intoxicated, only when the role of ethanol needs to be excluded in certain situations or where there is uncertainty about a diagnosis.

During 1999, a total of 667 emergency drug screens were performed by the Tygerberg Toxicology Laboratory on acutely poisoned patients admitted to Tygerberg Hospital. In 496 (74%) cases laboratory tests were positive for a

specific poison. The most important role of the toxicology laboratory is to establish that an exposure to a poisonous substance has indeed occurred.⁹⁴ Negative results are as important as positive one's, in that they inform the clinician as to which substance were not involved.⁹⁴ Of the thousands of toxic agents, laboratories are seldom able to detect more than 100 on a routine screen. A high percentage of negative toxicology screens may therefore be falsely negative. A negative outcome simply means that it is negative for those items tested and not for all possibilities.⁹⁴⁻⁹⁷

4.2 Tygerberg Poison Information Centre consultations

Poison control centres can assist in reducing patient mortality and morbidity as well as decreasing the incidence of poisoning exposures.¹⁹ An evaluation of the literature on the global cost of poisonings, and savings realized from poison centres' interventions, revealed that centres are important health care cost controls.¹³⁻²² It has been estimated that for every dollar spent on a poison centre, 4 to 9 dollars are saved in unnecessary health care costs. Poison centres contribute to financial savings by preventing unnecessary treatment of minor poisonings and by reducing sequelae in severe poisonings (e.g. liver failure after acetaminophen poisoning).²¹ Research has shown that a substantial portion of the economic costs of poisonings are associated with hospitalisations⁵⁴ and poison centres clearly prevent unnecessary hospitalisations.¹⁵

Similarly, the Tygerberg Poison Information Centre's primary purpose is to enable medical health care providers to deal with toxicological problems rationally and timeously, thereby minimizing complications, while at the same time acting as a filter system to reduce unnecessary Hospital admissions. The enquiries and consultations are mostly telephonic and are handled by a clinical pharmacist or medical doctor, during office hours. After hours and during weekends a medical doctor is responsible for all calls on the emergency number. In order for the consulting toxicologist to be effective, certain essential information is required such as the nature of the toxic agent, the degree of exposure and the time since exposure. Obtaining a thorough history is important, although sometimes difficult in cases of childhood poisoning. Initial histories are often incorrect because the interlocutor (caller) either exaggerated or underestimated the amount of poison ingested. Statements about the number of tablets or the amount of a disinfectant taken are often unreliable, since knowledge of the quantities in the containers before the incident is inaccurate or unknown.

Advice from the Tygerberg Poison Information Centre never supercedes the clinical judgement of the doctor treating the patient. The advice is intended to assist the healthcare provider in making informed decisions about the management of the patient.

From a total of 3744 consultations processed by the Tygerberg Poison Information Centre in 1999, 70% were from healthcare professionals and 30% from the lay public. The 1999 results of the Tygerberg Poison Information Centre survey were compared with another survey conducted by the same Centre in 1992.³ In the

1992 study, 86% of consultations were from sources other than Tygerberg Hospital, as opposed to 1999, when 91% were from outside Tygerberg Hospital. The 1992 study was based on an analysis of 6411 consultations of which 4808 (75%) were of a toxicological nature. The 1999 study was based on an analysis of 3744 consultations of which 3221 (86%) were of a toxicological nature. Of this total, 2690 cases were acute poisonings (the subject of the thesis). Acute poisoning cases were broken down in terms of age categories and compared with the previous study. In the 1992 study, 54% comprised of adults, 35% children under 5 years of age, 5% children between 5 and 13 years and 6% between the ages of 13 and 19 years. The 1999 findings were slightly different; 50% were adults, 32% under 5 years of age, 7% between 5 and 13 years and 11% were adolescents.

Unlike the 1999 survey, the 1992 study made no differentiation between acute poisonings in children versus acute poisonings in adults. This limitation should be born in mind when the results of the two studies are compared.

Comparisons between the two surveys with regard to major acute poisoning categories:

	<i>1992</i>	<i>1999</i>
Drugs	37%	34%
Household agents	36%	48%
Agriculture agents	4%	1%
Industrial agents	7%	2%
Biological agents	16%	15%

In 1999 more patients were poisoned by household agents (e.g. Jik, Jeye's Fluid) and fewer poisonings were due to agricultural and industrial agents. In 1992 paracetamol (14%), followed by benzodiazepines (11%), were the agents most commonly involved in acute poisonings. This is an exact duplication of the 1999 results (paracetamol 14% and benzodiazepines 11%). In 1999, 12% of the inquiries were about antidepressant overdose, whereas in 1992, only 6% were antidepressant related.

In the non-drug chemical categories, slightly fewer patients were exposed to pesticides (excluding cholinesterase inhibitors) in 1992 (21%) than in 1999 (24%). There was a decline in the number of exposures to cholinesterase inhibitors from 1992 to 1999 (18% in 1992 to 11% in 1999). A similar drop was noted when exposures to volatile hydrocarbons were analyzed (18% in 1992 to 10% in 1999).

Consultations regarding exposures to biological agents:

	1992	1999
Plants	29%	23%
Spider bites	27%	29%
Snake bites	16%	14%
Scorpion stings	13%	18%
Others	15%	16%

4.2.1 Children

Of the total of 2690 acute poisoning consultations, 1053 (39%) were children.

Eight hundred and sixty five (82%) of the children were between the ages of 0 to 4

years and 188 (18%) were in the 5 to 13 years age group. Ninety seven percent of childhood poisonings were accidental and this concurs with other similar studies.^{5, 27, 31} A male predominance (56%) was found amongst poisoned children. Similar results were obtained in another study conducted in the United States of America.⁵

In the present study, the 10 most common agents involved in acute paediatric exposures, in order of preference, were:

i) Plants	(6.2%)
ii) Rattex	(5.2%)
iii) Antihistamines and anticholinergics	(4.4%)
iv) Vitamins	(4.1%)
v) Jik (bleach)	(3.3%)
vi) Paracetamol	(3.2%)
vii) Cholinesterase inhibitors (organophosphates and carbamates)	(2.8%)
viii) Silica gel	(2.5%)
ix) Endocrine drugs (mostly oral contraceptives)	(2.4%)
x) Spider bites	(2.3%)

The results of our Poison Centre data concurred with published data from other poison centres: Ingestion of plants, analgesics, cough and cold preparations, personal care products and cleaning substances (e.g. Jik) ranked amongst the common queries received by poison centres.^{5, 27, 31, 102} Data from the American Association of Poison Control Centres Annual Reports^{5, 6, 102} revealed that pesticides e.g. rodenticides, organophosphates and carbamates, hormones (oral

contraceptives) and bites/stings (envenomation) featured frequently in accidental poisonings in children. Ingestion of silica gel, a non-toxic hygroscopic substance, was often reported to the Tygerberg Poison Information Centre. Other studies on childhood poisonings did not single out silica gel to be among the substances frequently involved in paediatric exposures.

4.2.1.1 Non-drug chemical exposures in children

Most queries to the Poison Centre concerning children, were about non-drug chemicals, 736 cases (70%). (Table 9)

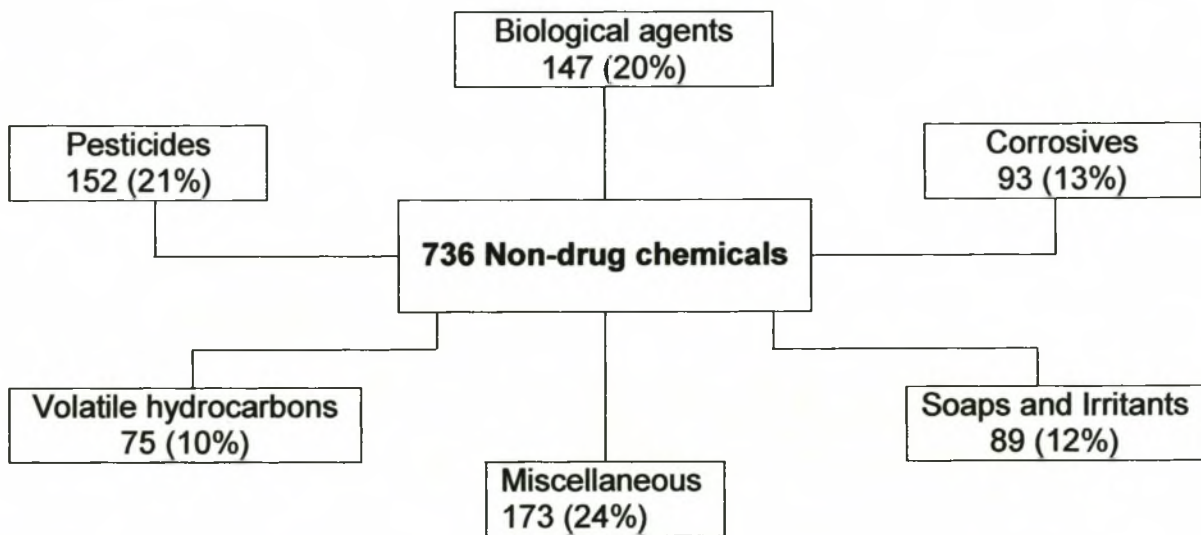


Table 9: Breakdown of major categories: Inquiries regarding non-drug exposures in children

Breakdown of pesticides (n=152):

Anticoagulant rodenticides e.g. Rattex (36 %)

Cholinesterase inhibitors e.g. organophosphates and carbamates (19%)

Naphthalene containing insect repellants (mothballs) (13%)

Mosquito coils (10%)

Others e.g. pyrethrins, ant poisons, organochlorines, etc. (22%)

Most household pesticides are available as sprays (e.g. Doom), powders, dips, animal shampoos, pet collars and foggers. Although the superwarfarins in rodenticides, as such, are supertoxic ($LD_{50} < 5 \text{ mg/kg}$),⁹⁸ rat baits contain relatively low concentrations and serious poisoning in children is therefore relatively uncommon, unless large amounts have been ingested. The majority of household and garden preparations with which children accidentally poison themselves can be purchased over-the-counter at local supermarkets and hardware stores.³

Naphthalene in mothballs is very toxic and there is a potential for serious poisoning, especially in children with G6PD deficiency.⁹⁸ G6PD deficiency is the most commonly known inherited disorder in man. The highest prevalence rates are found in tropical Africa, the Mediterranean and in Papua Guinea. Most G6PD-deficient individuals are entirely asymptomatic and develop symptoms in response to oxidative stress. Common clinical manifestations are neonatal jaundice and acute haemolytic anaemia induced by drugs and other chemicals (e.g. Naphtalene), and infection.⁹⁹ Although ingestion of mosquito mats or coils are common in children, the toxicity of the pyrethroid pesticide contained in it is relatively low and serious toxicity is uncommon.

Breakdown of soaps, detergents and other mucous membrane irritants (n=89):

Jik (39%)

Acetone (6%)

Other e.g. anionic and nonionic detergents, soaps etc. (55%)

Irritants such as soaps, detergents and bleach, featured prominently. Fortunately they have a relatively low degree of toxicity. Most of the household bleaches sold in local supermarkets contain 3.5% sodium hypochlorite solution (e.g. Jik). At this concentration, sodium hypochlorite acts as an irritant and not as a corrosive.³

Acetone irritates mucous membranes and can cause severe CNS depression if large quantities are ingested. Serious toxicity in children is rare because of the small quantities usually involved.⁶²

Breakdown of corrosives (e.g. strong alkalis and acids) (n=93):

Potassium permanganate (23%)

Dettol and Savlon (12%)

Other e.g. battery acid, sulphuric acid, oven-cleaners, Jeye's fluid, swimming pool chemicals, etc. (65%)

Recently, there has been an increase in the number of paediatric exposures to the dangerously corrosive substance, potassium permanganate. Potassium permanganate crystals are strong oxidizing agents which can cause severe burns in the mouth and pharynx. In large quantities, Dettol may cause cardiorespiratory depression, renal impairment and GI tract damage and coma.^{99, 100}

Breakdown of volatile hydrocarbons (n=75):

Essential oils (e.g. lavender, eucalyptus, camphor) (31%)

Paraffin (25%)

Turpentine (21%)

Others e.g. petrol, thinners, furniture polish, etc. (23%)

Volatile hydrocarbons are readily aspirated when ingested and can cause respiratory complications. As little as 1ml can lead to chemical pneumonitis, which occurs in 12-40% of patients.¹⁰⁶ The aliphatic-based petroleum distillates (paraffin, thinners, turpentine, petrol, diesel and benzene), have a high propensity to cause chemical pneumonitis but their inherent toxicity is low.⁹⁸

There were a relatively high number of camphor oil ingestions. This is a particularly dangerous volatile oil, in that it can cause convulsions, which in turn can lead to aspiration and its associated complications. Less than 5ml of both camphor and methyl salicylate can be fatal in a toddler.³²

Breakdown of biological agents (n=147):

Plants (44%)

Mushrooms (8%)

Spiders (16%)

Scorpions (16%)

Snakes (5%)

Others (11%) (e.g. paralytic shellfish poisoning, bee sting, rabies, etc.)

Inquiries regarding poisonings with biological agents were relatively high in this section of the study. (The reason for this will be addressed later on in the discussion.)

The inherent toxicity of most plants is low, so the ingestion of small to moderate quantities is unlikely to produce toxic effects. Serious plant poisonings are uncommon as a child eats only a few leaves or seeds at a time. Bites and stings by venomous animals on the other hand, can be potentially harmful to children and required a prompt and skilled response. Children are more susceptible to animal toxins. This is most importantly due to high dose for low body mass.

Breakdown of miscellaneous non-drug chemicals (n=173):

Silica gel (15%)

Surgical spirits (11%)

Calamine lotion (8%)

Benzyl-benzoate (5%)

Mercury thermometer (5%)

Ethylene glycol (3%)

Ethanol (3%)

Disc batteries (2%)

Carbon Monoxide (1%)

Cyanide (1%)

Others e.g. heavy metals, glue, other cleaning agents, food poisoning, etc. (46%)

Silica gel is an inert substance and is low in toxicity. Calamine is considered non-toxic when small amounts are ingested. Surgical spirits, on the other hand,

contains both methanol and salicylates in addition to ethanol (70%). Serious toxicity, however, is rare in children, owing to small amounts usually ingested.

The mercury in thermometers may accidentally be swallowed if the bulb breaks in a child's mouth. Very little mercury is likely to be absorbed after ingestion of elemental mercury from a thermometer, and mercury poisoning is almost never a risk.⁶²

Disc batteries are widely available and are frequently swallowed by young children. If a disc battery becomes lodged in the oesophagus, complications can arise and warrants prompt removal. Most batteries, however, pass into the stomach and traverse the gastrointestinal tract without difficulty, and usually do not cause adverse effects.⁶²

Ethylene glycol is a constituent of antifreeze and brake fluid. It also has a variety of other commercial applications.⁹² Ethylene glycol ingestion can cause severe poisoning, complicated by metabolic acidoses and renal failure.

4.2.1.2 Childhood fatalities

As far as childhood deaths are concerned, 5 fatalities were reported to the Tygerberg Poison Information Centre. (Rattex ingestion, cobra snakebite, and overdoses of mefenamic acid, an antiepileptic drug, and propranolol.) These results differ from other studies, where iron supplements and tricyclic antidepressants were amongst the more frequent causes of paediatric poisoning fatalities.^{5, 31, 32, 50} Non-medicinal products accounted for few deaths in the United

Kingdom, but in the United States of America petroleum distillates, pesticides and cleaning and polishing agents were significant contributory causes of death.⁵⁰

4.2.2 Adults

Of the total of 2690 poisoning inquiries processed by the Centre, 1638 (61%) were adults (over 13 years of age). Of these acute poisonings, 851 (52%) were female and 786 (48%) male. Of a total of 1638 adults, 901 cases (55%) were suicide attempts, while 737 cases (45%) were accidental exposures to poisonous substances.

Classification in order of preference of the 5 most common toxicological consultations, in major categories, in adults: Tygerberg Poison Information Centre, 1999.

- i) Pesticides (20%)
- ii) Central Nervous System drugs (18%)
- iii) Biological agents (16%)
- iv) Analgesics (10%)
- v) Corrosives (6%)

A breakdown in order of preference of the 5 agents most frequently involved in acute poisonings in adults: Tygerberg Poison Information Centre, 1999:

- i) Acetylcholinesterase inhibitors (8%)
- ii) Paracetamol (6%)
- iii) Spider bites (5.7%)
- iv) Benzodiazepines (5.6%)

- v) Drugs of abuse (4.5%)

In contrast to our findings:

The 5 agents (*in major categories*) most frequently involved in acute poisonings in adults: American Association of Poison Control Centres, 2000 report.⁶

- i) Analgesics (13.3%)
- ii) Sedatives/hypnotics/antipsychotics (9.8%)
- iii) Cleaning substances (9.5%)
- iv) Antidepressants (8%)
- v) Bites / envenomations (7.9%)

Analgesics, bites/envenomations and CNS drugs featured prominently in our study as well as in other publications.^{5,6}

4.2.2.1 Non-drug chemical exposures in adults

Breakdown of pesticides (n=330):

- Cholinesterase inhibitors e.g. organophosphates and carbamates (39%)
- Organochlorines e.g. Lindane (9%)
- Anticoagulant rodenticides e.g. Rattex (9%)
- Ant poisons e.g. arsenic containing (8%)
- Herbicides e.g. paraquat (3%)
- Aluminium phosphides e.g. phostoxin (2%)
- Other miscellaneous pesticides e.g. pyrethrums, glyphosate, strychnine etc. (30%)

Acute pesticide poisoning is an important cause of worldwide morbidity and mortality.^{24, 105} In this study very few acute pesticide poisonings occurred as a direct result of farming activities. Pesticide poisonings reported from farming areas were usually as a result of household exposures. Examples include instances where pesticides were brought into homes in unmarked containers.³

As was found in our study, the organochlorine Lindane is a common agent associated with cases of self-harm worldwide.¹¹¹ Lindane is rapidly metabolized by the body and therefore, if good supportive care is administered, the prognosis for recovery is good with only a few residual complications.²⁴ Aluminium phosphide e.g. Phostoxin, is toxic after ingestion because contact with water in the stomach liberates phosphine gas. This has recently become the most common means of self-poisoning in northern India.¹¹²

Paraquat is an extremely poisonous pesticide and any oral exposure should be considered potentially lethal.⁹⁸ Paraquat poisonings have been reported to be a serious problem in many parts of the world including Mexico,¹¹³ Malaysia¹¹⁴ and Thailand.¹¹⁵

Within the African and Asian communities, self-poisoning with household agents such as paraffin used for energy and lighting, cleaning agents such as Dettol and bleach (Jik), and strong acids such as sulphuric acid, used as drain cleaners, are fairly common.²⁴ In the present study, Jeye's Fluid was the most common corrosive ingested by adults (19 out of 101 corrosive exposures). Ingestion of this

phenolic compound can produce serious local injuries as well as systemic toxic effects such as metabolic acidosis. In other studies, self-poisoning with hydrochloric and sulphuric acid were the more commonly used corrosives.^{116, 117} Car battery acid poisoning was reported in a case series from Cape Town with 27 adults presenting to hospital over 3 years.¹¹⁸

Of a total of 92 Tygerberg Poison Centre consultations regarding exposures to irritants and detergents, 37 (40%) cases involved Jik. A Hong Kong study showed that nearly 50% of adolescents used either Dettol, detergents or shampoos for self-poisoning.²⁴ Although most household soaps, bleaches and detergents have irritant properties, it is impossible to predict whether these agents will cause cellular damage.

A breakdown of volatile hydrocarbon poisonings (n=63) in the 1999 study, showed that more inquiries regarding petrol / diesel ingestions (21% adults) were received than ingestion of any other volatile hydrocarbon (14% adults ingested paraffin). This is probably due to the fact that paraffin ingestion is common and health care workers know how to treat this type of poisoning. Petrol / diesel ingestion on the other hand, is unusual and therefore healthcare providers feel the need to contact the Poison Centre.

In our study, 262 adult consultations involved exposures to biological agents (36% spider bites, 19% scorpion stings, 18% snake bites, 13% plants and mushrooms and 14% other biological agents). The most recent annual report of the American Association of Poison Control Centres showed that envenomations in adults

occurred frequently.⁶ This is in agreement with our study. One can also speculate that the large number of inquiries with regard to bites and stings may suggest a general lack of knowledge and expertise on the part of the interlocutor. As shown in our study as well as in the literature, self-poisoning with plants in adults is uncommon.^{6, 119, 120}

4.2.2.2 Drug overdose in adults

During 1999, the Tygerberg Poison Information Centre received 616 calls with regard to drug overdose in adults. Paracetamol (16%), followed by the antidepressants (15%) and benzodiazepines (15%) were the drugs most commonly taken in overdose. This is also the finding of many reports in the literature.^{10, 24, 121-123} Drugs of abuse comprised 12% of drug inquiries. These illegal drugs are commonly taken for 'pleasure', especially by adolescents. The Tygerberg Poison Information Centre is therefore frequently contacted by concerned parents.

Compared to other studies we found poisoning with traditional medicines not to be a common occurrence in the Western Cape.^{24, 42, 124}

4.2.2.3 Adult fatalities

Of the total of 39 adult deaths reported to the Tygerberg Poison Information Centre, 29 were intentional and 10 accidental. Of the 10 accidental deaths, 3 were ostensibly due to exposures to biological agents (violin spider, cobra snake, indian bean). Four adults died by overdosing on illegal substances (1 cocaine, 1 ecstasy and 2 opioids). Two fatalities resulted from carbon monoxide inhalation

and one elderly woman died due to a medication error. Many studies in the literature have shown that deliberate self-poisoning in adults has a far higher mortality than accidental poisoning.^{103, 104} Another study has revealed that unintentional poisoning mortality was predominantly a problem of young adults and that drugs of abuse, primarily opioids and related narcotics and cocaine, was responsible for fatalities.⁴ In the UK, accidental deaths due to carbon monoxide inhalation have shown a slow but steady increase since 1975.⁵⁰

The literature reveals that fatalities due to therapeutic errors are often underreported.⁴⁴

As far as suicides are concerned, 29 deaths were recorded in the 1999 survey. CNS-acting drugs were involved in 10 of the suicides (5 tricyclic antidepressants, 3 neuroleptics, 1 antiepileptic and 1 anticholinergic drug). One patient died after the ingestion of a cardiovascular drug and 2 died after exposures to non-drug chemicals (a corrosive and a halogenated hydrocarbon). Five fatalities were due to other / unknown agents. Pesticides were the agents involved in 11 fatalities (4 paraquat, 3 organophosphates, 2 strychnine, 1 ant poison and 1 other herbicide). A recent study showed pesticides to be an important poison category used for self-harm world-wide, with a high incidence and fatality rate.^{24, 105} Agrochemical pesticides are a major public health problem throughout the developing world.¹⁰⁶⁻¹⁰⁸ Many farming households have stocks of pesticides readily available for impulsive acts. Storage facilities and knowledge of their toxicity are frequently poor.²⁴ In a publication organophosphates were responsible for the majority of deaths in most series of self-poisoning cases, particularly those from rural areas.²⁴

Paraquat is highly toxic and has been reported to be a problem in many parts of the world.^{109, 110}

4.3 Hospital admissions versus Poison Center consultations in the Tygerberg catchment area

Eight hundred and thirty four (90%) of the patients admitted to Tygerberg Hospital and 592 (25%) of the Tygerberg Poison Information Centre consultations, in respect of acute poisonings, originated from the same region, the Tygerberg catchment area. In order to make a valid comparison between Hospital admissions and Poison Centre consultations, acute poisoning cases originating from this area were compared. Several differences were noted.

- There was no significant difference between the male to female ratio in the Poison Centre study. In the Hospital-based study, however, a significant difference between the male to female ratio was found. Females predominated in the latter (70%).

Possible explanation: Acutely poisoned females will more readily go to hospital than males.

- Six hundred and eighty eight (83%) adults and 145 (17%) children were admitted to Tygerberg Hospital in 1999. These figures differ greatly from the Tygerberg Poison Information Centre survey where the adult and child consultations were found to be almost equal in number (54% and 46% respectively).

Possible explanation: The Poison Centre acts as a filter system and can prevent unnecessary Hospital admissions. Most children admitted to Hospital had already been through this filter system.

- The vast majority of acute poisonings in children, for both Hospital admissions and Poison Centre consultations, were due to accidental poisonings. This was not the case in adults. In Hospital admissions 99% of acute poisonings were deliberate, whereas in Poison Centre consultations 59% were deliberate.

Possible explanation: Accidental poisonings in adults usually involve relatively small amounts of poison. Those cases not requiring Hospital admission are often screened out by the Poison Information Centre, e.g. minor exposures to biological agents such as a non-toxic spider bite or scorpion sting.

- In adults deliberate self-poisoning by females was much higher in the Hospital-based study (75%) than in the Poison Center survey (40%).

Possible explanation: Women are more inclined to intentionally poison themselves and when they do so they usually go directly to Hospital without first contacting the Poison Centre.

- 50% of the Hospital-based poisoning cases and 14% of the Tygerberg Poison Information Centre consultations involved more than one agent.

Possible explanation: The interlocutors phoning the Poison Centre possibly only mentioned agents ingested with a high inherent toxicity and omitted all other less or non-toxic agents ingested simultaneously.

- Drugs were responsible for the majority of poisonings in the Hospital-based study (84%), while in the Poison Centre survey, drugs accounted for only (42%) of poisonings.

Possible reason: Healthcare providers tend to seek assistance from the Poison Centre more frequently in cases which are complex and unusual, e.g. corrosive injuries and organophosphate ingestions. Although drugs are readily available and commonly used in parasuicides, healthcare providers often know how to manage these overdoses and therefore do not call the Poison Centre.

- In both Hospital admissions and Poison Centre consultations, the incidence of non-drug chemical exposures in children, was higher than poisonings with drugs.

Possible explanations:

- i) Non-drug household chemicals, e.g. cleaning agents, are more readily available in the toddler's immediate environment. Unlike the household non-drug chemicals which are usually found in the kitchen, drugs are generally stored away safely.
- ii) In the lower socio-economic sectors, which are well represented in this catchment area, paraffin and rat poison are in common use. Paraffin featured prominently in the Hospital-based study and Rattex in the Poison Centre survey. Again, physicians are frequently uncertain regarding the management of a child ingesting Rattex and will be more inclined to contact the Poison Centre. The opposite applies to paraffin ingestion where

healthcare providers are comfortable with poisoning management, and often do not feel the need to consult the Poison Centre.

- In adults, paracetamol, benzodiazepines and tricyclic antidepressant overdoses featured more prominently in Hospital admissions as opposed to Poison Centre inquiries.

Possible explanation: Healthcare providers are usually familiar with treating these drug overdoses, hence they choose not to consult the Poison Centre.

- Inquiries with regard to drugs of abuse (e.g. mandrax, cocaine, opioids, cannabis) were fairly common, whereas admissions were infrequent.

Possible explanation: Concerned parents, school teachers and psychologists often contacted the Poison Centre regarding information on drug addiction or to interpret laboratory results, which included the use of illegal substances. These drugs are not frequently overdosed and therefore admissions due to acute poisoning, are fairly uncommon.

- Paracetamol is commonly used in overdose, accounting for 30% of the 834 admissions from the Tygerberg catchment area (adults and children). By contrast, only 6% of consultations to the Poison Centre involved overdose with paracetamol. An analysis of both the Hospital and Poison Centre data showed that paracetamol overdose occurred mainly in women. Thirty percent of the consultations in the 0-4 year age group were paracetamol overdose related, whereas only 3% of childhood admissions were due to paracetamol poisoning.

Possible explanation: Clinicians are often unsure about the toxic or potentially lethal dose of paracetamol in children. Therefore, the Poison Centre is often contacted on the toxic dose, the interpretation of laboratory results, or the management of the poisoned child, especially the use of the antidote, N-acetylcysteine. Consequently, more inquiries are received than actual admissions.

- Antidote treatment with N-acetylcysteine was administered in 7% of the Hospital-paracetamol-overdose cases and recommended in 27% of Poison Centre consultations. No fatalities due to paracetamol poisoning occurred during the study period in both Poison Centre consultations and Hospital admissions. A substantial proportion of paracetamol overdose patients co-ingested other drugs. This was not a finding in the analysis of the Poison Centre inquiries.

Possible explanation: The interlocutors omitted to mention other agents taken concomitantly with paracetamol because they may have felt them to be less important or toxic.

- In both children and adults, the incidence of exposures to non-drug chemicals were similar for Hospital admissions and Poison Centre consultations. However, volatile hydrocarbon exposures, especially paraffin, featured more prominently in children admitted to Hospital than inquiries received by the Poison Centre.

Possible explanation: Most healthcare professionals know how to manage paraffin ingestion. Inquiries on volatile hydrocarbons to the Poison

Information Centre tend to be about the less known agents, such as petrol and diesel, because information on these substances is not readily available.

- In adults, concomitant ingestion of drugs or non-drug chemicals was common. Ethanol was co-ingested in nearly 20% of adult admissions. In adult poisonings only 5% of queries were about ethanol abuse / overdose.

Possible explanation: Statistics regarding ethanol ingestion can be misleading. The interlocutor does not always mention that ethanol was involved in the alleged poisoning and it is often overlooked.

- In adults, inquiries regarding poisoning with acetylcholinesterase inhibitors (e.g. organophosphates) and other pesticides were higher than actual Hospital admissions.

Possible explanation: The Poison Centre act as a filter system for less serious pesticide exposures, e.g. Rattex, pyrethrums.

- Only a few acute poisoning cases due to biological agents, e.g. spider bites, snake bites and scorpion stings were admitted to Tygerberg Hospital. In contrast to this, inquiries received by the Poison Information Centre regarding biological agents, were quite common.

Possible explanation: The general lack of knowledge of professionals on this subject and the known expertise of the Tygerberg Poison Information Centre's toxicologists with regard to biological toxins.

5. CONCLUSION AND RECOMMENDATIONS

This study demonstrates quite clearly that one cannot use poison centre data alone as an indication of incidence of acute poisonings in the general population. Accurate information pertaining to the actual number of acute poisonings is virtually impossible to obtain. Therefore one must work with all available data, such as hospital admissions as well as poison centre data, and extrapolate from these to get a clearer picture. It is believed that the true incidence of acute poisoning may be much higher than statistics show.^{26, 27}

This survey confirmed that deliberate self-poisoning in adult women remains a common problem, and is placing great demands on the already overburdened hospital and psychiatric services. In this study, poisoning was mild for the majority of admissions and many Hospital admissions could have been avoided by Poison Centre intervention, thereby saving substantial costs. While patient care and positive outcomes should be the goals of therapy, the risk to benefit ratio versus cost must always be considered. The literature revealed that poisoning treatment costs could be considerably higher without poison control centres' intervention.¹⁴⁻²³

With regards to acute poisonings, the vast majority of published case series are based on retrospective studies. Data recorded prospectively, provides more accurate information than data obtained retrospectively.⁴³ Retrospective studies are dependent on medical records and this can result in the loss of relevant data which could have been obtained directly from the patient. Data from our prospective survey had certain methodological shortcomings in that not all cases

of poisonings, or suspected poisonings, were referred to Hospital. In addition, the number of cases which circumvented the Poison Centre is unknown. Another problem was the questionable accuracy regarding the description of the type and the amount of chemical ingested. Recording of the number of deaths due to poisoning, were more than likely also inaccurate. Hospital and poison centre statistics can be misleading, because many fatalities from poisonings occur outside hospital, often without poison centre intervention.⁵⁰ Available data is therefore presumed to under-represent the actual number of deaths from poisoning.

Certain observations and recommendations regarding poison prevention and poison management can be made based on the findings of this study, despite the various difficulties surrounding the collection of reliable epidemiological data on poisoning.

- Preventing poisonings is more cost effective than treating actual poisonings. Since most exposures occur in and around the home, poison prevention should primarily be directed at securing the home environment.
- While there is no substitute for adequate supervision of children, the measures listed below have been shown to reduce the incidence of poisoning:
 - a) Child-resistant packaging is effective in reducing the mortality rate by nearly 50%.⁴⁶

- b) Several authors have commented that child resistant packaging cannot completely compensate for unsafe storage.^{45, 46} Therefore, all medications, vitamins and household products should be kept in their original containers, locked up and out of sight and reach of children.
- c) Excessive childhood poisonings may be attributed to packaging which resembles food containers or to a particularly attractive package design or to the use of a scent or flavoring agent in the product.¹¹
- d) Limiting the number of tablets and improving prescribing habits are measures that can be employed to limit the amount of medications in the home.²⁷

Major differences between paediatric and adult poison exposures have been demonstrated in this study. These findings have been confirmed in a number of other similar publications.^{5, 102} Another prominent finding in our study was the high incidence of self-inflicted drug overdose in adult females, with paracetamol being the drug of choice. Much of poison prevention education, treatment and research emphasis focuses on the paediatric patient. Childhood poisonings are common and receive most of the attention. However, the incidence of significant morbidity and mortality is relatively low in children compared to that in the adult population. Given this scenario, it seems appropriate that urgent attention should be given to adult prevention programmes with emphasis on the female population.

- One of the duties of the Poison Centre is education of health care workers and the lay public. This can be accomplished with poison prevention talks,¹²⁵ epidemiological publications and poison prevention pamphlets.¹⁰

- When comparing the number of Poison Centre consultations to actual Hospital admissions, there were a greater number of Poison Centre inquiries regarding non-drug chemicals than in actual Hospital admissions. The greater number of Poison Centre inquiries may well reflect a lack of readily available information and knowledge on toxic non-drug chemicals rather than a higher incidence of exposures to these agents.
- It is important for medical and paramedical professionals (medical doctors, pharmacists, nurses, etc.) to familiarized themselves with the most frequently used antidotes and keep them in stock where possible. There is a tendency for these professionals to rely on local hospitals to stock basic decontaminants, e.g. activated charcoal and antidotes, rather than keeping them in their own practices. The opportunity for efficient and uncomplicated decontamination is all too often lost because of the inevitable delay and lack of practical preparedness. Specific antidotes,^{126, 127} which need to be administered early in the clinical course of a potentially serious poisoning, should also be readily available e.g. naloxone, atropine and flumazenil as well as certain essential rescue medications such as diazepam and adrenaline.
- Health care professionals should be aware of common poisons possessing high inherent toxicity.⁹⁷ Examples include paracetamol, theophylline, cyclopeptides in *Amanita phalloides* and paraquat. When in doubt they should

consult a poison information centre for assistance in early identification of a poison with possible high inherent toxicity.

- Education of health professionals regarding problems associated with poisoning in the elderly is essential. The elderly and their caregivers must be encouraged to consult with their local poison information centre.
- Teaching of toxicology to medical undergraduates and postgraduates should be given greater emphasis.
- The large number of toxicokinetic and pharmacokinetic consultations managed by the Tygerberg Poison Information Centre suggest a relative lack of knowledge in respect of interpretation of drug and poison levels. More attention should therefore be devoted to the training of health care professionals in clinical pharmacokinetics and toxicokinetics.
- Stricter controls should be exercised on the availability and packaging of certain hazardous agents such as organophosphates, other pesticides and household cleaning agents.
- There is a frustrating lack of information in respect of potentially toxic ingredients contained in commercially available household preparations. Labels on such products seldom provide adequate information on ingredients, and often do not contain warnings about their potential toxicity. Because of the dearth of information, poison centres are often consulted in cases of

poisonings with these agents, resulting in over reporting of non-drug chemical exposures. The Government should take more responsibility for centralizing information on all potentially toxic non-drug chemicals and make this information available to poison centres at all times.³

- Due to the significant public ignorance regarding the toxicity of household non-drug chemicals (pesticides, detergents, volatile hydrocarbons, etc.) there should be adequate warnings on labels and these preparations should not be displayed close to foodstuffs or within reach of children (as is often the case in households and supermarkets).
- Doctors and pharmacists must make patients aware of the potential danger of certain medications (e.g. paracetamol), and limit the number supplied, checking that the dosage regimen is being correctly followed. Proper disposal of unused products should be encouraged, thereby avoiding accumulation of pharmaceuticals and non-drug chemicals in the home.
- 'Over the counter drugs' such as paracetamol, aspirin, analgesic combinations, cold and influenza preparations, which are potentially toxic in overdose, should not be openly displayed in shops since this may contribute to the general misconception that these agents are safe.
- Although it is difficult to quantify, the Tygerberg Poison Information Centre prevents unnecessary health care costs through:

- 1) Providing timely first aid intervention in cases of acute poisoning, thereby reducing serious and costly sequelae and the associated lengthy hospital stay.
- 2) Acting as a filter, thereby preventing unnecessary hospital admissions.

Bearing the above in mind, it seems prudent for the South African Department of Health to invest more in this essential primary health care facility.

- Improved mental health care, particularly at the community level, must be an important part of any strategy to reduce self-harm.^{128, 129} A history of repeated attempts, psychiatric disorder and substance abuse, especially ethanol, are important indicators in assessing the risk of eventual parasuicide / suicide.
- From the results of this study as well as the literature it is clear that reducing the morbidity of paracetamol overdose is of the utmost importance. Although toxicological screenings are time consuming and expensive it is important that if there is any indication or where the history is unreliable, blood should be screened for paracetamol. If there is evidence that a patient has ingested more than 125mg/kg of paracetamol, treatment with N-Acetylcysteine should be started immediately, even before laboratory results are available.
- The lack of infrastructure and financial resources are limitations that may have a profound effect on health strategies in developing countries. It is therefore quite important that toxicology programs are realistic, appropriate, and cost-

effective. Programs should be based on local epidemiological patterns and not copy developed country models, which could be very expensive and inappropriate.⁴² Community considerations such as socioeconomic circumstances, agricultural and industrial development in the region, cultural factors and other regional factors must be taken into account. This can have a major influence on clinical advice given by the medical toxicologist.

This study confirmed that there is a significant difference when data on acute poisonings admissions to hospitals are compared to data recorded by poison information centres. Inquiries to the Tygerberg Poison Information Centre do not reflect the true incidence of poisoning in the community, but rather reflect a need for information by professionals. Therefore, an important question to be addressed for future studies, is how to compensate for both under- and over-reporting to a poison information centre. A possible approach to compensate for this shortcoming is to utilize both poison information centre data along with actual hospital admissions for acute poisoning epidemiological studies.

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