Drug-Related Death Cases in Hong Kong

Commissioned by Action Committee Against Narcotics (ACAN)

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April 2001

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Acknowledgements

This project was only possible because of the constant support and encouragement of Mr. Andrew Chan, the Coroner, and, Dr. David Clark, the Acting Government Chemist. We must specifically thank Mr. Andrew Chan for allowing us to have access to the drug-related death cases investigated by the Coroner during 1994-1998. We must also thank Dr. Clark for allowing us to have access to the data-base of the Forensic Toxicology Section of the Government Laboratory.

We would also like to thank the following individuals for their assistance in our work and for working closely with us during the past two years:

1. The clerical staff of the Coroner's Office for retrieving the case files for us.
2. The staff of the Forensic Toxicology Section and Controlled Drugs Section of the Government Laboratory for providing us with the information essential to this project.
3. Our project assistant (Ms. Theresa F.P. Leung), medical postgraduates (Dr. Ye Zhang and Dr. Hailu Zhao) and pharmacy postgraduate (Mr. Wilson Y.S. Leung) of the Division of Clinical Pharmacology, Department of Medicine and Therapeutics, the Chinese University of Hong Kong for their help with reviewing the case files as well as the entry and tabulation of data.
4. Mr. Albert Y.K. Cheung at the Centre For Clinical Trials & Epidemiological Research, the Chinese University of Hong Kong for his help in the tabulation and analysis of the data.

This project initially received funding for one year from an Action Committee Against Narcotics (ACAN) Research Sub-Committee Grant and then was supported by the members and research funds of the Division of Clinical Pharmacology, Department of Medicine and Therapeutics, The Chinese University of Hong Kong.

Summary of Major Findings

In this project, we have reviewed hospitalised cases of poisoning (whether drug abuse or parasuicidal attempt) and drug abuse related medical illnesses, Coroner cases (whether drug abuse related death or suicide) and the data-base of the Forensic Toxicology Section of the Government Laboratory. Our data provide a picture of the drug-related deaths during the period 1994-1998 (Section 1 to Section 5) and a quantitative basis for reference regarding the formulation of education and publicity programmes to increase the awareness of the community to the dangers of drug abuse. Based on our experience from this project and the potential sources of data, a feasible way to monitor the problem of drug abuse and drug abuse related deaths in Hong Kong is given in Section 6.

A. Medical Admissions to the Prince of Wales Hospital, 1995-1998

A.1 Acute Poisonings due to Drug Abuse

A.1.1 Between 1995 and 1996-1997, there was a dramatic increase (162-192%) in the number of admissions (from 26 to 68-72) per year. In 1998, the number of admissions decreased to 31, but this was still higher than the 1995 level.

A.1.2 The incidence of poisoning due to drug abuse adjusted for the changing size of the catchment population of the Prince of Wales Hospital was also calculated. Between 1995 and 1996-1997, the increasing incidence of poisoning was even more obvious (from 0.26 to 0.63-1.24 per 100,000, a 142-377% increase). In 1998, the incidence of poisoning decreased to 0.49 per 100,000, but this was still 88% higher than the 1995 level.

A.1.3 There was an obvious male predominance (male:female ratio of 4.7 to one) and the subjects were relatively young (median age 25-36 years).

A.1.4 Heroin was the most commonly involved drug, accounting for 42.1-57.7% (overall 50.2%) of cases. The increased incidence of poisoning due to drug abuse seen during 1996-1997 was largely due to the increased number of admissions with heroin toxicity.

A.1.5 Benzodiazepines and alcohol accounted for 10.5-19.4% (overall 14.9%) and 10.3-19.2% (overall 11.9%) of cases, respectively.

A.1.6 Of the 201 cases of poisonings due to drug abuse, one patient died from the acute toxicity of heroin. The overall in-hospital mortality was therefore 0.5%.

A.2 Admissions due to drug abuse related health problems

A.2.1 During 1995-1998, there were 22 hospital admissions due to acute illnesses related to drug abuse other than poisoning.

A.2.2 The male:female ratio among these subjects was 21:1. Their age was 20-67 years (median 38 years).

A.2.3 The main drugs of abuse included heroin (n=14) and alcohol (n=4).

A.2.4 Among the heroin abusers, the main reasons for admissions included deep vein thrombosis (n=4), infective endocarditis (n=4) and other infections (n=2).

A.3 Admissions due to self-poisonings

A.3.1 During 1995-1998, there were 1,117 cases of medicinal poisonings (ICD 960-977) and 192 cases of non-medicinal poisonings (ICD 980-989). Emotional upset and social crisis were the main reasons for the self-poisonings.

A.3.2 The annual incidence of medicinal poisonings decreased between 1995 and 1996 (3.05 to 2.77 per 100,000, 9.2%), but then increased markedly in 1997 (to 4.62, 51.5%) and 1998 (to 3.70, 21.3%). The incidence of non-medicinal poisonings fluctuated between 1995 and 1998 (0.48-0.65 per 100,000). The annual incidence of medicinal poisonings was 4.8-7.7 times that of non-medicinal poisonings.

A.3.3 Females accounted for 72.7% of all medicinal poisonings and 66.1% of non-medicinal poisonings.

A.3.3 The overall median age of subjects with medicinal poisonings was 27 years in males and 28 years in females. The proportion of males and females aged <21 years was 18-22% and 40-58%, respectively.

A.3.4 The overall median age of subjects with non-medicinal poisonings was 30 years for the males and 29 years for the females. The proportion of males and females aged <21 years was 0-24% and 11-19%, respectively.

A.3.5 Three drug classes accounted for the great majority of medicinal poisonings – analgesics, sedatives/hypnotics and psychotropic drugs. During 1995-1998, the importance of analgesics had declined (43.7% of admissions in 1995 and 37.8% in 1998). Sedatives/hypnotics were increasingly important (35.8% of cases in 1995 and 45.7% in 1998). Other psychotropic drugs accounted for 7.0-10.9% of cases.

A.3.6 Among subjects with non-medicinal poisonings, other substances including household products accounted for 63.3-96.8% of cases.

A.3.7 There were 4 deaths as a result of medicinal (benzodiazepine/amitriptyline) or non-medicinal (paraquat, carbon monoxide and "Dettol") poisonings. The overall in-hospital mortality for medicinal and non-medicinal poisonings was 0.09% and 1.6%, respectively.

B. Drug Abuse Related Deaths, 1994-1998

B.1. A total of 1,003 cases of drug abuse related deaths were reviewed. Between 1994-1995 and 1996, there was a large increase in the number of cases (from 142 to 240, 69%). This rising trend continued in 1997 (n=258). The number of deaths then decreased slightly in 1998 (n=223).

B.2 Most (46.5-58.5%) of the deaths occurred in Kowloon. The New Territories and Hong Kong Island accounted for 27.9-41.5% and 12.0-18.3% of cases, respectively.

B.3 The incidence of drug abuse related deaths was higher in Kowloon (3.50-7.35 per 100,000) than in Hong Kong Island (1.30-2.80 per 100,000) and the New Territories (1.69-2.47 per 100,000).

B.4 Between 1995 and 1996-1997, the incidence of drug abuse related deaths approximately doubled in Hong Kong Island (1.30 to 2.80 and 2.41 per 100,000) and Kowloon (3.50 to 6.53 and 7.53 per 100,000). In the New Territories, the incidence remained almost unchanged during 1995-1998 (2.23-2.47 per 100,000).

B.5 The number of deaths in the whole of Hong Kong varied greatly from 9 to 32 per month. Several peaks were seen during 1994 (16 deaths in March), 1995 (15-22 deaths in January and March), 1996 (24-31 deaths in February, March, July, October and December), 1997 (24-27 deaths in February, April, July and October) and 1998 (25-32 deaths in March and November).

B.6 Among the subjects who died from drug abuse, males accounted for 83.9-93.7% of the cases (overall 89.2%). The median age of all subjects was between 29 and 39 years. Chinese accounted for 95.3% of cases.

B.7 Overall, a single agent was responsible for the deaths in 65.2% of cases in Hong Kong Island, 71.5% of cases in Kowloon and 76.3% of cases in the New

Territories. Two agents were involved in 27.1% of cases in Hong Kong Island, 21.5% of cases in Kowloon and 19.6% of cases in the New Territories.

B.8 Heroin was the most important aetiological agent throughout 1994-1998, accounting for 88.0-94.1% of deaths each year (overall 90.6%). The figures for other drugs and substances of abuse were as follows: alcohol 1.3-5.6% (overall 2.9%), amphetamines 0-2.2% (overall 1.2%), benzodiazepines 0.4-2.1% (overall 1.1%), cough medicine (dextromethorphan) 0-2.8% (overall 0.7%), organic solvents (sniffing of volatile substances) 0-0.4% (overall 0.3%) and cocaine 0-0.7% (overall 0.1%).

B.9 Around 55.7-74.6% of the subjects who died from drug abuse each year were single.

B.10 Excluding the students, retired persons and the prostitutes, 66.1-76.9% of the subjects were unemployed.

B.11 Overall, 32.4% of subjects had primary school education levels or below and 61.9% of subjects had secondary school education levels or below.

B.12 The great majority of subjects lived in public housing estates (58.9%) or private housing (12.6%).

B.13 30.3% of subjects were allegedly receiving public assistance and 12.4% of subjects had financial problems.

B.14 70.3% of subjects were apparently otherwise healthy. The remaining subjects had some active or chronic medical illness (21.3%), a minor or major mental illness with or without medical illness (5.8%) or physical disability with or without medical illness (2.6%).

B.15 Among the 877 subjects who died from heroin abuse during 1994-1998, the great majority of subjects either abused only heroin (68.3-83.3% annually, 76.5%

overall) or heroin plus other agents (15.8-31.0% annually, 22.7% overall). These other agents were usually benzodiazepines.

B.16 During 1994-1998, the overall rate of prior participation in residential rehabilitation programmes was higher among subjects in Kowloon (92.9%) than in Hong Kong (81.0%) and the New Territories (84.2%).

C. Deaths Due to Heroin Abuse, 1994-1998

C.1 Between 1994-1995 and 1996-1997, there was a large increase in the number of deaths due to heroin (from 130 and 125 to 223 and 232 cases per year). The number of deaths then decreased slightly to 198 in 1998.

C.2 Kowloon accounted for 44.0-58.2% of the deaths. The New Territories and Hong Kong Island accounted for 28.0-45.6% and 10.4-16.9% of cases, respectively.

C.3 In Hong Kong Island, deaths due to heroin abuse occurred more commonly in Aberdeen (0.8-8.5%), Chai Wan (1.7-3.8%) and Wan Chai (0-3.2%).

C.4 In Kowloon, deaths occurred more commonly in Cheung Sha Wan (2.4-6.3%), Kwun Tong (3.1-6.7%), Mong Kok (3.1-5.1%), Sau Mau Ping (5.4-8.6%), Sham Shui Po (3.4-6.2%), Shek Kip Mei (2.3-6.5%), Wong Tai Sin (3.6-8.6%) and Yau Ma Tei (5.1-10.4%).

C.5 In the New Territories, deaths occurred more commonly in Lei Muk Shui (1.0-7.2%), Tsuen Wan (3.9-8.0%), Tuen Mun (1.5-6.4%) and Yuen Long (2.6-3.8%).

C.6 After adjustment for the differences in population size, the incidence of heroin-related deaths was still higher in Kowloon (2.92-6.57 per 100,000) than in Hong Kong Island (1.00-2.58 per 100,000) and the New Territories (1.58-2.30 per 100,000).

C.7 Between 1995 and 1996-1997, the incidence of heroin-related deaths doubled in Hong Kong Island (1.00 to 2.58 and 2.2 per 100,000) and Kowloon (2.92 to 6.07 and 6.57 per 100,000). In the New Territories, the incidence of heroin-related deaths remained almost unchanged during 1995-1998 (2.07-2.30 per 100,000).

C.8 The number of deaths in the whole of Hong Kong varied greatly from 4 to 31 per month. Several peaks were seen during 1994 (15 deaths in March), 1995 (13-19 deaths in January and March), 1996 (22-31 cases in February, March, July, October and December), 1997 (22-31 cases in February, April, July and October) and 1998 (21-29 deaths in March and November).

C.9 Males accounted for 86.4-93.4% of the deaths seen each year (overall 90.3%).

C.10 In 1994, subjects aged 25-29 years were most commonly involved. In 1995 and 1998, subjects aged 35-39 years were most commonly involved. In 1996 and 1997, subjects aged 40-44 years were most commonly involved.

C.11 Overall, subjects who died from heroin abuse were most commonly between the ages of 20-24 and 50-54 years. They together accounted for 81.5-90.1% of cases seen each year (overall 86.3%). Subjects between the ages of 25-29 and 45-49 years accounted for 64.6-72.7% of cases (overall 69.5%).

C.12 The youngest subject who died from heroin abuse was a 14-year-old girl. The proportion of subjects aged <21 years had increased from 5.4% in 1994 to 7.2% in 1995 and 8.5% in 1996, but then decreased to 3.9% in 1997 and 2.0% in 1998.

C.13 Overall, Chinese accounted for 95.9% of cases. Other Asians accounted for 2.2% of cases. Europeans accounted for 1.7% of cases.

C.14 Most (54.1-74.4%) of the subjects who died from heroin abuse were single.

C.15 Among the subjects who died from heroin abuse, 30.0% had run away or had been expelled from their families. Many subjects had no known relatives (8.7%) or

their wives/children were in the Mainland China (3.7%). Others (7.6%) either had no parental care or came from single parent families.

C.16 Most subjects (65.9%) were living with their families or friends and 31.0% were living alone.

C.17 The great majority of subjects lived in public housing estates (58.5%) or private housing (11.8%). Others lived in rented rooms (6.4%), village huts (4.7%), caged flats (3.5%) or squatter dwellings (1.1%). The remaining subjects were street sleepers (6.7%) or had no fixed address (6.5%).

C.18 The proportion of subjects with an education level of primary school or below and secondary school or below was 30.0-33.3% and 64.3-70.0%, respectively.

C.19 Excluding the students, retired persons, housewives and the prostitutes, 67.6-78.8% of subjects seen each year were unemployed.

C.20 Overall, 55.8% of the subjects had no apparent financial problems. Others either received public assistance (30.8%) or had financial problems (13.4%).

C.21 70.6% of subjects were otherwise apparently healthy. Physical disability or injury with or without medical illness was seen in 2.7% of subjects. Minor or major mental illnesses with or without medical illness/physical disability were seen in 4.9% of subjects. The remaining 21.8% of subjects had active or chronic medical conditions.

C.22 Overall, 90.2% of subjects who died from heroin abuse had previously participated in rehabilitation programmes. The average number of programmes attended per subject was 2.8. Overall, 95.2% of subjects had participated in a methadone treatment programme.

C.23 Overall, 88.8% of subjects had participated in both rehabilitation programmes and methadone treatment programme and 9.8% had participated in either programmes.

Only 1.4% of subjects who died from heroin abuse had not participated in any of these programmes.

D. Determinants of the Incidence of Deaths Due to Heroin Abuse

D.1 The number of heroin abusers

The number of heroin abuse related deaths during 1994-1998 was considered in relation to the number of heroin abusers newly or previously reported to the Central Registry for Drug Abuse (CRDA). Between 1995 and 1996-1998, the number of heroin abuse related deaths had increased by 52.3-78.5%. During these periods, the total number of heroin abusers known to the CRDA had decreased by 6.5-21.2%. Hence, the mortality rate of known drug abusers increased by 84-116%.

It can be concluded that the large increase in the number of heroin related deaths seen in Hong Kong between 1996-1998 was not due to an increase in the number of known heroin abusers in the community.

D.2 The proportion of heroin abusers on methadone treatment

Participation in methadone treatment programmes and abstinence from heroin use should reduce the risk of heroin abuse related death. Between 1994 and 1995-1998, there was a progressive increase (from 17.5% to 19.4-32.5%) in the proportion of CRDA cases who received methadone treatment. There were no obvious changes in the proportion of methadone clinic cases receiving detoxification treatment (13.8 and 12.0-15.3%). Therefore, the increased number of heroin-related deaths during 1996-1998 was not due to a decrease in the number and proportion of drug abusers participating in methadone treatment programmes.

D.3 The purity of heroin

Data from the Controlled Drugs Section of the Government Laboratory indicated that in 1997 and, particularly, 1998, a greater proportion of heroin seizures was of high purity (>60-65%). When compared with the trend in the incidence of heroin abuse related deaths, the sudden increase in the large number of deaths had occurred (in 1996) even before there was any substantial increase (in 1997) in the known purity of heroin available to the drug abusers. However, the increase in purity of heroin could have partly contributed to the higher mortality from heroin abuse.

D.4 The amount of heroin injected

The amount of heroin injected may increase if its retail or "street" price falls. Data from the Hong Kong Police Force indicated that the retail prices of No. 4 heroin rose between 1994-1995 and 1996-1998. Thus street price is unlikely to have been a factor in the increase in heroin abuse related deaths.

D.5 Concomitant use of central nervous system depressant drugs

The use of other central nervous system depressant agents may increase the risk of acute respiratory depression due to heroin. In fact, benzodiazepines and alcohol were detected in the blood of a variable proportion of the heroin abuse victims during 1994-1995 (9.4 and 5.1%) and 1996-1998 (15.3 and 8.7%).

D.6 The toxicity of heroin preparations

If the increase in heroin deaths was due to higher purity heroin preparations being available and larger amounts being injected or potentiation of heroin's respiratory depressant action by other central nervous system depressants, then one might expect a reduced time interval between drug exposure and death. Interestingly, the recorded median interval between drug exposure and death did decrease in

parallel with the increase in deaths from 4 hours in 1994-1995 to 2 hours in 1996-1998.

D.7 Knowledge of the toxicity of heroin

Experienced heroin abusers would tend to learn about the acute (toxic) effects of heroin and be more careful while first time intravenous heroin drug abusers may be at a higher risk of death from acute respiratory depression. If this was a significant factor, there should be a disproportionate number of new abusers among the subjects who die from heroin abuse. Thus we made the assumption that among the subjects who died from heroin abuse during 1994-1998, those without a known history of drug abuse had only recently started using heroin. The proportion of these subjects was then compared with the proportion of newly reported heroin abusers known to the CRDA.

During 1994-1995, the proportion of heroin abusers newly reported to the CRDA was 13.1-18.5% of the total heroin abusers. However, all the subjects who died from heroin abuse during this period had a history of known previous abuse. During 1996-1998, the CRDA new heroin abusers proportion was lower at 9.2-11.7% while 0.9-1.8% of deaths related to heroin abuse involved subjects without a previous history of drug abuse. These figures suggest that, if anything, new abusers were less likely to die than established users.

E. Deaths Due to Suicide by Self-Poisoning

E.1 In comparison with drug abuse, self-poisonings with drugs or chemicals were much less important as a cause of drug-related deaths in Hong Kong. During 1994-1998, 339 subjects died from suicide by self-poisoning.

E.2 The number of deaths due to self-poisoning was almost unchanged during 1994-1997 (63-67 cases per year). However, in 1998, there was a sudden increase in the number of deaths to 81.

E.3 There were more deaths from self-poisoning in Kowloon (29.9-50.0%) and the New Territories (34.4-56.3%) than in Hong Kong Island (9.4-22.4%).

E.4 After adjustment for the differences in population size, the incidence of deaths due to self-poisoning remained generally higher in Kowloon (0.97-1.59 per 100,000) and the New Territories (0.78-1.36 per 100,000) than in Hong Kong Island (0.46-1.03 per 100,000).

E.5 In the whole of Hong Kong, the annual incidence of deaths due to suicide by self-poisoning remained very similar throughout 1994-1997 (1.02-1.10 per 100,000). The large increase in the number of deaths in 1998 represented an increased incidence of self-poisoning in the community (1.21 per 100,000) as well as an increase in population size.

E.6 During 1994-1997, 55.6-59.7% of fatal suicides were male. In 1998, there were almost equal numbers of males and females (49.5 vs 50.5%).

E.7 The median age of subjects who died from self-poisoning varied from year to year in Hong Kong Island (32-55 years), Kowloon (34-58 years) and the New Territories (41-54).

E.8 Overall, Chinese accounted for 97.1% of fatal suicides.

E.9 Overall, a single agent was responsible for 51.8% of fatal suicides in Hong Kong Island, 63.6% in Kowloon and 77.6% in the New Territories. Two agents were involved in 35.7% of fatal suicides in Hong Kong Island, 21.7% in Kowloon and 15.6% in the New Territories.

E.10 During 1994-1998, drugs or substances of abuse (e.g. benzodiazepines and alcohol) accounted for 4.9-23.4% (overall 11.8%) of fatal suicides. There were 8 deaths involving heroin.

E.11 Other drugs (therapeutic) were the most commonly involved, accounting for 30.9-41.3% of fatal suicides (overall 34.8%). The most important drug classes were analgesics (5.3-10.9%, overall 8.6%), antidepressants (9.0-14.3%, overall 12.1%) and antipsychotics (1.2-9.5%, overall 5.3%).

E.12 Household products particularly "Dettol" accounted for 1.5-10.9% of deaths (overall 6.5%).

E.13 Pesticides accounted for 9.0-25.0% of fatal suicides (overall 16.2%). Paraquat (4.7-15.6%, overall 8.3%) and organophosphates (1.5-11.1%, overall 5.3%) were the most important.

E.13 Carbon monoxide and liquefied petroleum gas accounted for 10.9-37.0% of fatal suicides (overall 21.5%). During 1994-1996, carbon monoxide accounted for 10.9-11.1% of fatal suicides, but in 1997 and 1998, it accounted for 25.4-37.0%.

E.14 The proportion of subjects being single, married or divorced/separated varied during 1994-1998 (26.6-37.7%, 44.4-59.4% and 9.4-23.5%, respectively).

E.15 Excluding the students, retired persons and the housewives, the unemployment rate among subjects who died from self-poisoning was 37.5-60.0%. There was a sudden increase in the number and proportion of deaths involving housewives between 1994-1997 (9-11 cases per year, 13.4-17.2%) and 1998 (21 deaths, 25.9% of cases).

E.16 The proportion of subjects having education levels of primary or below, secondary or below or university was 15.2%, 63.3% and 21.5%, respectively.

E.17 The great majority of subjects lived in public housing estates (48.8%) or private housing (32.9%).

E.18 Apparently, 75.3% of subjects had no financial problems. The remaining subjects either had financial problems (18.5%) or received public assistance (6.2%).

E.19 Apparently, 36.8% of subjects were otherwise healthy. Others had some active or chronic medical conditions (25.7%), minor or major mental illnesses with or without medical illnesses/physical disability (35.9%) or physical disability with or without medical illnesses (1.5%).

E.20 Only 7.5% of subjects were previously known to abuse drugs and then heroin was most commonly involved.

E.21 The reasons for committing suicide included health problems (25.7%), psychiatric problems (17.8%), financial problems (13.4%) and relationship problems with friends or family members (21.6%).

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1 Introduction

Drug abuse has long been a problem in Hong Kong.[1] One of the hazards is death especially with heroin that remains the predominant drug of abuse. As toxicologists, we are concerned about these deaths in predominantly young people and wanted to evaluate the factors. We hope that the information acquired will assist in the formulation of measures to reduce this unnecessary mortality.

1.1 Background to the Study

1.1.1 Poisonings as a health problem in Hong Kong

In Hong Kong, fatal poisonings (due to suicidal attempts, accidents or drug abuse) together with injuries are the leading cause of deaths in subjects under the age of 45.[2] Poisonings accounted for 5-7% of acute medical admissions and 1% of paediatric admissions to hospitals.[3,4] A substantial proportion of these poisonings is "suicidal self poisoning" incidents followed by full recovery and do not involve drug abuse as it is usually defined.

We have previously analysed the territory-wide trends in hospitalisations and mortality due to medicinal (ICD codes 960-977) and non-medicinal (ICD codes 980-989) poisonings,[5] based on the data provided by the Department of Health.[2] Rates of medicinal poisoning increased between 1980/1981 (57.3/100,000) and 1993/1994 (80.9/100,000), but declined in 1993/1994 (59.1/100,000). Rates of non-medicinal poisoning were unchanged between 1980/1981 and 1988/1989 (49-53/100,000), but then declined in 1994/1995 (22.0/100,000). From 1980/1981 to 1988/1989, fatality rates due to medicinal (0.73-1.31/100,000) and non-medicinal (0.98-1.70/100,000) poisonings were similar. However, from 1989/1990, there was an obvious increase in the rates of fatal

medicinal poisoning (1.94-2.80/100,000), although the rates for non-medicinal poisoning remained much the same (0.80-1.38/100,000). Many of these deaths were related to drug abuse.

1.1.2 Sources of information for studying drug abuse situation and trends

The close monitoring of the drug abuse situation in Hong Kong and related trends assists the formulation of policies to combat drug abuse and appraise their effectiveness. There are several sources of information that are indicative of the extent of the problem and the pattern of drug abuse in Hong Kong (Figure 1). Some of these data sources will be briefly mentioned here.

1. The Central Registry of Drug Abuse (CRDA) was established within the Narcotics Division of the Government Secretariat.[1] The CRDA receives, processes, analyses and reports data on illicit drug abuse in Hong Kong. Reports on known or suspected drug abusers are submitted to the CRDA by means of a CRDA record sheet by a wide network of reporting agencies, including law enforcement and treatment agencies and welfare organisations in Hong Kong.

2. The main function of the Controlled Drugs Section (CDS) of the Government Laboratory is offer a comprehensive analytical service to law-enforcement agencies in the analysis of substances controlled under the Dangerous Drugs Ordinance, the Pharmacy and Poisons Ordinance, the Antibiotics Ordinance and the Control of Chemicals Regulations.

Material submitted to the CDS for examination ranges from abused drugs seized from drug addicts to pharmaceutical products seized from unauthorised sellers and illegal clinics, as well as that from the sites of illicit drug manufacture.

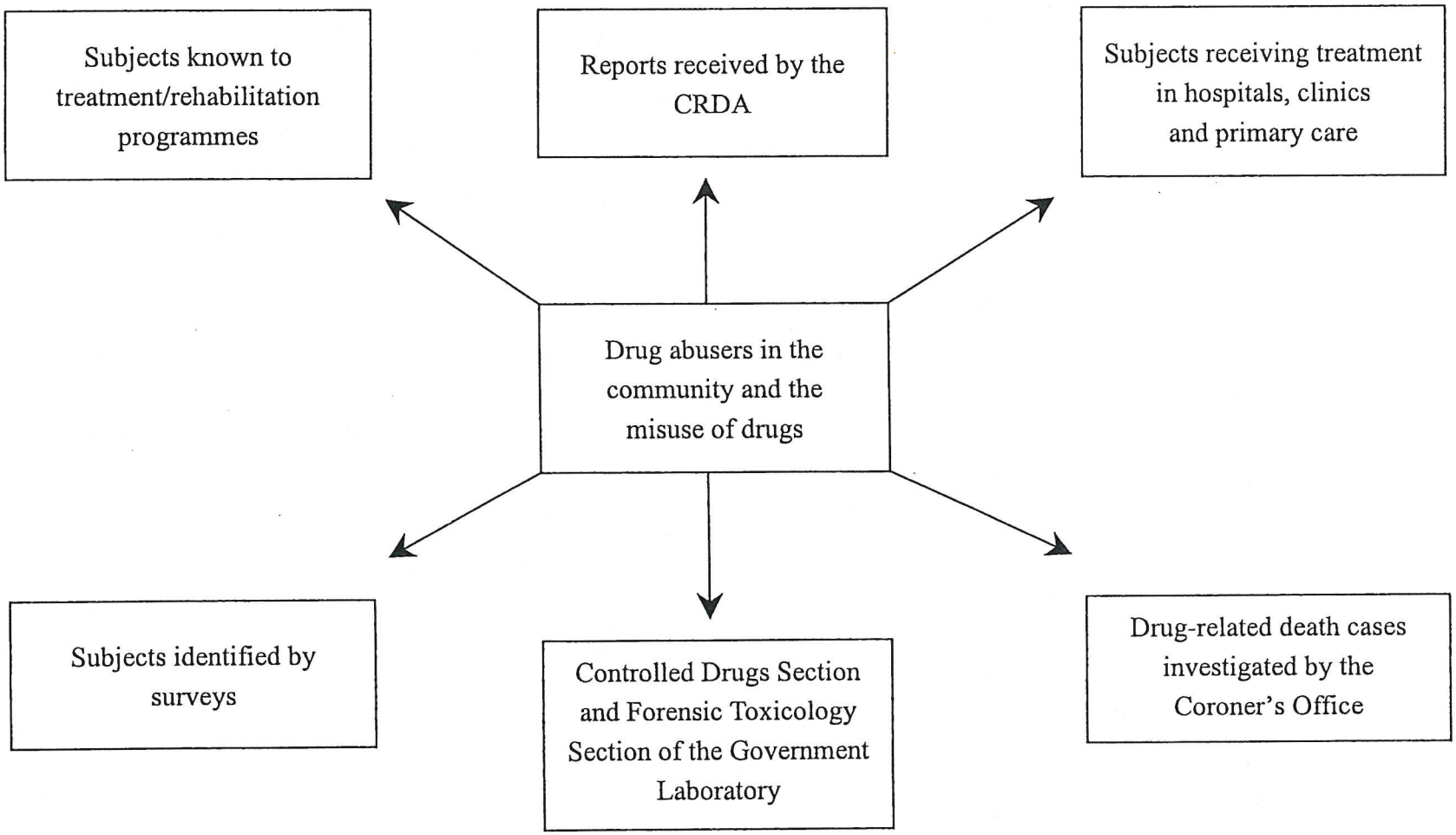

Figure 1. Data sources indicative of the problem and pattern of drug abuse.

3. Since 10% of intentional poisonings admitted to our general medical wards in the Prince of Wales Hospital (PWH) (which, until 1997, served approximately 20% of the population in Hong Kong) are related to drug or alcohol abuse, hospital-based studies may provide additional information on drug abuse.[6]

1.1.3 Deaths related to drug abuse

Very little is known about the incidence and pattern of fatal drug abuse in Hong Kong. Deaths under such circumstances are particularly tragic because these involve mostly young people and help should have been readily available from various treatment and rehabilitation programmes.

All deaths related to drugs (whether suicides, drug abuse or accidents) occurring either in the community or hospitals must be reported to the Coroner. Toxicological analysis of body fluids and drugs/items found at the scene of crimes will be referred to the Forensic Toxicology Section of the Government Laboratory. Thus these should be the most comprehensive sources of information about drug-related death cases in Hong Kong.

1.2 Rationale of the Study and Potential Application of Results

Our reviews of the Coroner cases, Forensic Toxicology Section data-base and hospitalised cases of poisonings (whether drug abuse, suicidal attempts or accidental) have enabled us to identify and study in detail drug-related deaths in the community and a large general teaching hospital in Hong Kong.

The research findings provide a better portrait of the drug-related death cases and a quantitative basis for reference in the formulation of relevant preventive education and

publicity programmes to increase the awareness of the community (including health care professionals) to the dangers of drug abuse.

It is important to formulate the best, feasible way of monitoring drug-related deaths in Hong Kong. We will later in this report suggest how the toxicology and clinical information from the computerised data-base of the Forensic Toxicology Section of the Government Laboratory as well as the information from the Coroner's Office and the public hospitals may be used for this purpose.

1.3 Initial Objectives of our Project

1. *To provide an overview of drug-related deaths and a trend analysis of these cases in Hong Kong.*
2. *To analyse the characteristics of the cases, which include the type of drugs involved, reasons for taking the drugs, where such drugs are obtained, and whether they are undergoing any drug treatment programmes.*
3. *To assess as far as possible whether the deaths were caused by unexpected increase in purity of heroin, suicidal attempts, lack of understanding of the properties of drugs, or otherwise.*
4. *To determine the best, feasible way of monitoring drug-related deaths in Hong Kong, using the toxicology/clinical data from the computerised data-base of the Forensic Toxicology Section, Government Laboratory and information that may be available from the Coroner's Office and the public hospitals.*

1.4 **Study Period** – January 1994-December 1998

Based on the figures from the CRDA,[1] an upward trend in the number of reported persons involved in drug abuse has been noted since 1992. Apparently, the trend reversed in transiently 1995 but then continued until 1998 and beyond. Heroin remained the predominant drug of abuse. Our study covering the period 1994-1998 indicates whether; (a) there has been a simultaneous decrease in the number of fatal cases; (b) there were any changes in the fatality rate from heroin abuse.

1.5 Study Subjects and Settings

1.5.1 Subjects hospitalised because of drug abuse and other poisonings (See Section 2)

Patients who were hospitalised in the medical unit of the PWH because of medicinal or non-medicinal poisonings were reviewed. Some of these patients were under the care of TYKC and JAJHC, who are consultant physicians and clinical pharmacologists in the PWH. The Chief-of-Service of the Department of Medicine and Therapeutics kindly allowed the investigators to review these cases.

1.5.2 Subjects who died of drug abuse or suicides involving drugs or chemicals (See Section 3, Section 4 and Section 5)

Patients who died of poisoning with drugs or substances of abuse (particularly opiates) in the whole of Hong Kong were identified from the registries of Coroner cases in the Coroner's Office.

The toxicological data for these Coroner cases were also retrieved from the computerised data-base in the Forensic Toxicology Section. This data-base contains the

analytical toxicology results from the death cases referred by the Forensic Pathologist and the Clinical Pathologist.

In view of the importance of heroin as an aetiological agent, subjects who died from heroin abuse were studied in even greater detail (See Section 4).

Both the Coroner and the Government Chemist had kindly given us permission and assistance to review all drug-related death cases that came under their attention.

1.5.3 Confidentiality of subject information

As always, all the data from the cases were kept in the strictest confidence. The assistants involved in this project were closely supervised by the investigators for this purpose.

1.6 Outline Plan

To utilise fully our expertise and facilitate the review of cases and analysis of results, the investigators and the assistants worked closely as a team but there was some distribution of responsibility for certain parts of the project.

TYKC was responsible for the review of the hospitalised cases, conversion of data from the Coroner cases and Forensic Toxicology data-base into the appropriate formats, the analysis and interpretation of all data and the writing up of the report. DTWC was responsible for the review of the Coroner cases and Forensic Toxicology data-base. JAJHC was responsible for interpretation of all data and the writing up of the report.

The hospitalised cases were reviewed first. The relative importance of drug abuse and suicidal attempts causing poisonings and the agents responsible were then obvious. The Forensic Toxicology data-base was reviewed next, the findings from which would

guide our review of the Coroner cases. The investigators and assistants in this project frequently met and discussed the review of the Coroner cases and coding of the data.

1.7 The Layout of this Report

Because of the vast amount of data involved and the differences in the nature of drug exposures, the types of aetiological agents and subject characteristics, data from the hospitalised cases (Section 2) and death cases due to drug abuse (Section 3 and Section 4) or suicides by self-poisonings (Section 5) are presented separately.

Among the Coroner cases, only death cases that were related to drug abuse or suicides with drugs or chemicals were included. Deaths due to idiosyncratic reactions to drugs or homicides involving drugs or chemicals were excluded.

Wherever possible, yearly data from Hong Kong Island, Kowloon and the New Territories are presented separately so as to highlight any regional differences in the incidence and patterns of drug-related deaths in Hong Kong.

A general profile about drug abuse related deaths (heroin and non-heroin cases) is first presented in Section 3. The incidence and characteristics of heroin-related deaths are described in much greater detail in Section 4.

In Section 6, some feasible ways of monitoring drug-related deaths in Hong Kong are discussed.

2 Hospitalisations Due to Drug Abuse and Other Poisonings

The PWH is a general teaching hospital for over one million people in the New Territories East region. Until 1997, it received patients from Shatin, Tai Po, the North District and neighbouring districts. With the opening of other district hospitals in the region since 1997, most patients in Tai Po and the North District would have been admitted to these other hospitals.

The main objective of this part of the study was to determine the incidence and pattern of drug abuse and related problems as seen in the hospital setting. Findings in these subjects were compared with those presenting after self-poisonings with drugs and chemicals. The relative importance of different agents and related toxicity should enable us to highlight the dangers from certain drugs (e.g. the opiates).

2.1 Study Methodology

At the PWH, a computerised medical record system was introduced within our Medical Unit to facilitate the storage and retrieval of clinical information about patients.[7] The demographic data, main diagnoses with International Classification of Diseases (ICD) codes and discharge summaries of patients are typed in and stored in a computer.

To identify all medical patients admitted with drug abuse, drug abuse related health problems or poisonings, a search of our computerised medical record data-base was performed. These patients would most likely to have one or more of these ICD codes - 960-977 (medicinal poisonings), 980-989 (non-medicinal poisonings), 291 (alcoholic psychosis), 292 (drug psychosis), 303 (alcohol dependence syndrome), 304 (drug dependence) or 305 (non-dependent abuse of drugs).

The discharge summaries and, if necessary, the case notes of these patients were reviewed. Data relevant to this study was noted. We originally planned to study all patients admitted during 1994-1998, but the computerised medical record system at the PWH was in full operation only in 1995. Only a few cases from 1994 could be identified. Hence, only subjects admitted during 1995-1998 formed the basis of this part of our study. In this way, the annual incidence of drug-related admissions could be estimated more accurately. In this project, cases of unintentional poisonings and adverse reactions to drugs or herbal medicines were excluded.

Due to the differences in the nature of drug exposure and other health effects, the data will be presented separately as follows: acute poisonings as a result of drug/substance abuse (Sub-Section 2.2), drug abuse related health problems (Sub-Section 2.3) and self-poisonings as a result of emotional upset and social crisis (Sub-Section 2.4). Subjects could have been admitted with acute non-fatal poisoning on more than one occasion. Unless stated otherwise, the data presented here and throughout this report refers to the number of cases rather than patients.

To ascertain whether there was a genuine increase in the incidence of drug abuse, drug abuse related health problems or self-poisonings, the number of hospital admissions due to these problems was also considered in relation to the changing population size in the New Territories East region.

2.2 Poisonings Due to Drugs of Abuse

2.2.1 Incidence of poisonings due to drugs of abuse

During the 4-year period from 1995-1998, there were at least 201 hospital admissions due to poisonings by drugs of abuse (Table 1). These admissions involved 162 males (four were admitted twice) and 35 females. Only one patient died

Table 1. The incidence of poisonings due to drugs of abuse.

	1995	1996	1997	1998
Number of hospital admissions	26	68§	76	31
Population in Shatin, Tai Po and the North District*	990,100	1,081,300	-	-
Population in Shatin†	-	-	614,600	627,600
Incidence (per 100,000 population) ‡	0.26	0.63	1.24	0.49

Catchment population of the Prince of Wales Hospital based on the mid-year population estimates in *1995/1996 and †1997/1998, Census & Statistics Department.

‡The exact incidence might vary very slightly because subjects living outside the catchment areas were admitted to the PWH or subjects living in the catchment areas were admitted to other hospitals instead.

§Including 1 death from heroin overdose.

Compared to 1995, there was a dramatic increase in the annual number of admissions during 1996 (162%) and 1997 (192%) (Table 1). The number of admissions then decreased rapidly in 1998, but was still significantly higher than the 1995 level (31 vs 26).

2.2.2 Incidence of poisonings adjusted for changes in population size

Before it can be concluded that drug abuse was an increasingly important cause of poisonings and hospital admissions in the New Territories East, the effects of any changes in the population size (and composition) should be considered. This is necessary because of the population movements in Hong Kong and the opening of district general hospitals for Tai Po and the North District in 1997.

The crude incidence of poisonings due to drug abuse in relation to population size in Shatin, Tai Po and the North District (in 1995 and 1996) or Shatin (in 1997 and 1998) was calculated (Table 1). It then became obvious that the incidence (per 100,000 population) of poisonings had increased dramatically between 1995 and 1996 (142%), 1997 (377%) and 1998 (88%) after adjustment for the change in population size.

2.2.3 Sex and age distributions of these subjects and aetiological agents

The sex and age distributions of these subjects in relation to the types of drugs abused are shown in Table 2 and Table 3, respectively.

There was an obvious male predominance among subjects admitted because of poisonings due to drugs of abuse (Table 2). The overall male:female ratio was 4.7 to one. These subjects were relatively young, as reflected each year by the median age (25-36 years) and proportion of subjects aged <21 years (13-26%) (Table 3).

Table 2. Aetiological agents and sex distributions of 201 subjects hospitalised because of poisonings by drugs of abuse.

Agents	Number of subjects (male:female ratio)			
	1995	1996	1997	1998
Heroin	15 (13:2)	38 (34*:4)	33 (31:2)	16 (15:1)
Morphine	0	0	1 (1:0)	0
Physeptone/methadone	0	0	3 (2:1)	0
Cannabis	0	2 (1:1)	2 (1:1)	1 (0:1)
Amphetamines	1 (0:1)	4 (4:0)	3 (2:1)	3 (2:1)
Benzodiazepines	3 (2:1)	13(9:4)	8 (7:1)	6 (6:0)
Cough medicine	1 (1:0)	3 (1:2)	6 (5:1)	1 (1:0)
Organic solvents	1 (1:0)	0	1 (1:0)	0
Alcohol	5 (4:1)	7 (6:1)	8 (6:2)	4 (2:2)
Unknown	0	1 (0:1)	11 (8:3)	0
Total	26 (21:5)	68 (55:13)	76 (64:12)	31 (26:5)

*Including 1 death.

Table 3. Aetiological agents and age distributions of 201 subjects hospitalised because of poisonings by drugs of abuse.*

Agents	Medians (ranges) of age (years) / % of subjects aged <21 years			
	1995	1996	1997	1998
Heroin	18 (18-50) / 20	32 (17-80)‡ / 8	30 (17-66) / 21	42 (15-61) / 6
Morphine	-	-	19 / †	-
Physeptone/methadone	-	-	32 (24-41) / †	-
Cannabis	-	(17-17) / †	(16-21) / †	21 / 0
Amphetamines	26 / †	21 (19-21) / †	25 (23-25) / †	24 (19-29) / †
Benzodiazepines	26 (16-26) / †	26 (15-46) / 31	23 (17-46) / 38	25 (28-40) / 33
Cough medicine	15 / †	20 (19-34) / †	21 (17-25) / 50	26 / †
Organic solvents	16 / †	-	16 / †	-
Alcohol	28 (15-58) / 20	35 (17-50) / 29	45 (17-73) / 13	37 (35-67) / †
Unknown	-	16 / †	28 (16-54) / 27	-
Total	28 (15-58) / 23	29 (15-80) / 24	25 (16-73) / 26	36 (15-67) / 13

*Refer to Table 2 for the number of subjects in each group.

†The % was not calculated because the number of subjects was less than 5.

‡Including 1 death.

2.2.4 Aetiological agents

Based on the history and clinical features, the drugs and substances of abuse causing poisoning could be determined in 190 cases (Table2 and Table 3). Heroin was the drug most commonly involved, accounting for 42.1-57.7% (overall 50.2%) of admissions (Table 1). The increased incidence of poisoning related to drugs of abuse during 1996 and 1997 was largely due to the increased number of admissions with heroin toxicity. In fact, during 1996 and 1997, the number of admissions due to acute heroin toxicity was more than double that for 1995 (38 and 33 vs 15 admissions).

Benzodiazepines and alcohol were also commonly involved, accounting for 10.5-19.4% (overall 14.9%) and 10.3-19.2% (overall 11.9%) of these hospital admissions, respectively. All these patients made uneventful recoveries.

2.2.5 Other drugs abused by these subjects

Twenty-two subjects (10.9%) in this survey had also abused other agents on the day of admission. Among the heroin abusers, 16 had also taken benzodiazepines (n=11), amphetamines (n=3), alcohol (n=2) or analgesics (n=1).

Among the benzodiazepine abusers, four had also taken heroin (n=2) or cough medicines (n=2). Among the amphetamine abusers, one had also taken cannabis, cocaine and heroin. Among the 12 subjects in whom the exact aetiological agents were not known, one had also taken alcohol.

2.2.6 In-hospital mortality

Of the 201 cases of poisonings due to drugs of abuse, a 40-year-old man died from the acute toxic effects of heroin overdose. The overall in-hospital mortality was therefore 0.5%.

2.3 Admissions Due to Drug Abuse Related Health Problems

During 1995-1998, there were 22 hospital admissions due to problems related to drug abuse other than acute poisonings. There were two admissions in 1995, six admissions in 1996 and 1997 and eight admissions in 1998.

These admissions involved 20 males (a 48-year-old man was admitted twice in 1996) and one female. Their ages ranged from 20 to 67 years (median 38 years). Only one subject was below the age of 21 years. Thirteen subjects (59%) were below the age of 41 years.

The main drugs of abuse were heroin (n=14), alcohol (n=4), benzodiazepines (n=2) and unspecified (n=2). One of two subjects in the latter group actually abused multiple agents. Two of the heroin abusers also abused benzodiazepines or alcohol.

Among the heroin abusers, the main reasons for the hospital admission were deep vein thrombosis (n=4), infective endocarditis (n=4), other bacterial infections (n=2), pulmonary embolism (n=1), acute pulmonary oedema (n=1), drug withdrawal reactions (n=1) and mental illness (n=1).

Among the chronic drinkers, the main reasons for hospital admissions were withdrawal reactions (n=2), hypokalaemia (n=1) and minor haematemesis (n=1).

The two subjects who predominantly abused benzodiazepines were admitted with a withdrawal reaction and bacterial infection, respectively.

One subject who abused multiple drugs presented with vague complaints. The remaining subject presented with vomiting after taking some "soft" drugs.

There were no deaths among these 22 cases during the period of hospitalisation.

2.4 Admissions Due to Self-Poisonings

During 1995-1998, there were altogether 1,117 cases of medicinal poisoning (ICD 960-977) and 192 cases of non-medicinal poisoning (ICD 980-989) (Table 4). Drugs were therefore involved far more often than chemicals and other substances in the self-poisonings in the New Territories East (85.3% vs 14.7%). Emotional upset and social crisis were the main reasons for self-poisoning. There were four deaths.

2.4.1 Incidence of self-poisoning due to drugs or chemicals

Annual admissions due to medicinal poisoning were static between 1995 and 1996 (around 300 per year). With the onset of patients in Tai Po and neighbouring areas being admitted to the Tai Po Nethersole Hospital, a slight fall in the number of admissions was seen during 1997 (to 284) (Table 4). The reduction in the number of admissions that was seen between 1997 and 1998 (from 284 to 232) probably reflected a decreased incidence of self-poisoning in the region.

Annual admissions due to non-medicinal poisoning were also static between 1995 and 1996 (around 60 per year). However, during 1997 and 1998, there was a significant fall in the number of admissions to 40 and 30, respectively.

2.4.2 Incidence of self-poisoning adjusted for changes in population size

The crude incidence of medicinal and non-medicinal poisonings in relation to population size in Shatin, Tai Po and the North District (in 1995 and 1996) or Shatin (in 1997 and 1998) is shown in Table 4.

The incidence of medicinal poisoning decreased between 1995 and 1996 (3.05 to 2.77 per 100,000, or a 9.2% reduction), but then increased in 1997 (to 4.62, or a 51.5% increase) and 1998 (to 3.70, or 21.3% increase).

Table 4. The incidence of self-poisoning with drugs (medicinal poisoning) or chemicals (non-medicinal poisoning).

		1995	1996	1997	1998
Medicinal poisoning	Number of hospital admissions	302	299§	284	232
(ICD 960-977)	Population in Shatin, Tai Po and the North District*	990,100	1,081,300	-	-
	Population in Shatin†	-	-	614,600	627,600
	Incidence (per 100,000 population)‡	3.05	2.77	4.62	3.70
Non-medicinal poisoning	Number of hospital admissions	63	59§	40	30
(ICD 980-989)	Population in Shatin, Tai Po and the North District*	990,100	1,081,300	-	-
	Population in Shatin†	-	-	614,600	627,600
	Incidence (per 100,000 population)‡	0.64	0.55	0.65	0.48

Catchment population of the Prince of Wales Hospital based on the mid-year population estimates in *1995/1996 and †1997/1998, Census & Statistics Department.

‡The exact incidence might vary very slightly because subjects living outside the catchment areas were admitted to the PWH or subjects living in the catchment areas were admitted to other hospitals instead.

Including §1 and 2 deaths.

The incidence of non-medicinal poisoning fluctuated considerably between 1995 and 1998 (0.48-0.65 per 100,000) (Table 4).

The annual incidence of medicinal poisoning was between 4.8 and 7.7 times that of non-medicinal poisoning (Table 4).

2.4.3 Sex and age distributions of subjects with self-poisoning

The sex and age distributions of subjects with medicinal or non-medicinal poisoning are summarised in Table 5. Females accounted for 72.7% of all medicinal poisoning and 66.1% of all non-medicinal poisoning.

Subjects with self-poisoning were relatively young. The overall median age for medicinal poisoning was 27 years in males and 28 years in females; the figures for non-medicinal poisoning were 30 and 29 years. Among subjects with medicinal poisoning, the proportions of males and females aged <21 years were 18-22 and 40-58%, respectively (Table 5). Among subjects with non-medicinal poisoning, the proportion of males and females aged <21 years were 0-24 and 11-19%, respectively.

2.4.4 Agents involved in self-poisoning

The agents involved in medicinal and non-medicinal poisonings are shown in Table 5 and Table 6.

Three drug classes accounted for the great majority of medicinal poisonings in this survey - analgesics, sedatives/hypnotics (mainly benzodiazepines) and other psychotropic drugs. This might reflect the wider availability of these drugs in the community and the higher risk of parasuicides among subjects treated with sedatives/hypnotics and other psychotropic drugs.

Table 5. Sex and age distributions of 1,309 subjects admitted with medicinal or non-medicinal poisoning.

			1995	1996	1997	1998
Medicinal poisoning (ICD 960-977)	Males	Number of subjects	83	86*	69	66*
		Age (years)	27 (17-88)	28 (15-77)	26 (14-81)	25 (15-73)
		% < 21 years old	18	22	22	21
	Females	Number of subjects	219	213	215	166
		Age (years)	28 (14-83)	28 (14-78)	28 (14-78)	29 (14-82)
		% < 21 years old	44	58	47	40
Non-medicinal poisoning (ICD 980-989)	Males	Number of subjects	25	12*	16	12
		Age (years)	28 (16-59)	30 (18-54)	31 (16-70)	33 (22-63)
		% < 21 years old	24	17	19	0
	Females	Number of subjects	38	47	24	18*
		Age (years)	29 (15-86)	25 (15-73)	38 (14-86)	43 (15-83)
		% < 21 years old	11	19	13	11

*Including 1 death.

Table 6. Aetiological agents in 1,117 cases of medicinal poisoning.

Agents	1995	1996	1997	1998
Antibiotics	5	1	0	1
Other anti-infectives	3	0	0	0
Hormones and synthetic substitutes	0	0	0	0
Blood constituents	0	0	2	0
Analgesics, antipyretics and antirheumatics	132	111	112	88
Anticonvulsants and anti-Parkinsonism drugs	3	4	4	0
Sedatives and hypnotics*†	108	130	110	106
CNS depressants	0	0	1	1
Other psychotropic drugs*	21	22†	31	18
CNS stimulants	0	1	0	0
Autonomic nervous system drugs	0	1	0	0
Cardiovascular drugs	3	4	2	5
Gastrointestinal drugs	2	3	4	3
Drugs affecting smooth/skeletal muscles and respiratory system	7	3	3	1
Drugs affecting skin and mucous membrane, ophthalmological, dental drugs	3	5	3	3
Other and unspecified drugs	15	14	12	6
Total	302	299	284	232

*Different from the ICD classification. †Mainly benzodiazepines. ‡Including 1 death from benzodiazepine/amitriptyline overdose.

Table 7. Aetiological agents in 192 cases of non-medicinal poisoning.

Agents*	1995	1996	1997	1998
Alcohol	1	0	2	2
Petroleum products	0	0	0	1
Solvents other than petroleum products	0	2	3	1
Corrosive aromatics, acids and caustic alkalis	0	0	1	0
Carbon monoxide	0	4	0	5†
Gases, fumes or vapours except carbon monoxide	1	0	0	2
Other substances	61	53†	34	19†
Total	63	59	40	30

*Same as the ICD classification. †Including 1 death.

During the study period, the importance of analgesics declined (132 cases and 43.7% of admissions in 1995, 88 cases and 37.9% of admissions in 1998).

During 1995-1998, sedatives/hypnotics appeared to be increasingly important (108 cases and 35.8% of admissions in 1995, 106 cases and 45.7% of admissions in 1998). The dominance of sedatives/hypnotics was most obvious in 1996 (130 cases and 43.5% of admissions).

Other psychotropic drugs remained the third most important agents, accounting for 7.0-10.9% of admissions.

Among subjects with non-medicinal poisoning, other substances including household products (ICD 989) accounted for the great majority of cases (63.3-96.8%).

2.4.5 Repeated attempts and in-hospital mortality

Repeated attempts of self-poisonings with drugs or chemicals were uncommon among the subjects in this survey. A 41-year-old woman presented twice in 1995 after self-poisoning with hypnotics. A 26-year-old lady was admitted twice in 1998 after self-poisoning with analgesics.

There were four deaths as a result of medicinal (n=1) or non-medicinal (n=3) poisoning. In 1996, a 72-year-old man died from a mixed overdose of amitriptyline and a benzodiazepine. A 20-year-old man died from paraquat poisoning. In 1998, a 32-year-old man died from carbon monoxide poisoning. An 82-year-old woman probably died from "Dettol" (a household disinfectant) poisoning.

The overall in-hospital mortality for medicinal and non-medicinal poisonings was therefore 0.09% and 1.6%, respectively.

3 Drug Abuse Related Deaths

All death cases investigated by the Coroner each year are listed in the registries for Hong Kong Island, Kowloon and the New Territories. The entry of a case in one of the registries corresponds to where the death occurred. For each entry in the "book", core information about a case is available, including the name, sex and age of the deceased, the Coroner's verdict and cause of death (ICD and E-cause codes). Based on such information, all drug-related death cases could be identified.

With the help of the clerical staff of the Coroner's Office, these case files were retrieved. The review of each case file took an experienced health care professional (required in view of the complexity of the terminology and the large number of reports from the parties concerned) at least 25-30 minutes. Drug abuse related cases are presented in this Section. Deaths related to heroin abuse are presented in greater detail in Section 4. Deaths related to suicides by self-poisonings are presented in Section 5.

Using the Laboratory Reference and Laboratory Number of individual cases, it was possible, after some difficulties, to merge the data from the Coroner's Office with the forensic toxicology data from the Government Laboratory data-base.

3.1 Study Methodology

In view of the large number of case files to be reviewed and the complexity of each case, the investigators and their assistants first discussed the best ways to review the case files, extract the relevant information and code the data. A specially designed data sheet (hard copy) and computer spreadsheet (Microsoft Excel) were used. To facilitate the sorting and analysis of data, relevant information for each case was coded.

Once the review of cases and entry of data were completed, the investigators reviewed the data several times and discussed any "unusual" cases.

3.1.1 Information collected for each case

The information collected for each case included the following: the age, sex, ethnicity, marital status, employment status and education level of the deceased, type of accommodation, history of drug addiction and drug abuse, history of participation in rehabilitation and treatment programmes, and past medical health.

Also based on the information from the Forensic Toxicology data-base of the Government Laboratory, the drugs (drug combinations) responsible for the deaths were determined. For subjects who died of heroin abuse, the purity of heroin seized from the scene (also available from the Forensic Toxicology data-base) was noted.

If such information was recorded, any description of the source of drugs and evidence of the deceased's understanding of the properties of the drugs was also noted.

3.1.2 Reason for exposure to the drug – drug abuse or suicides

Based on the Coroner's verdict, the E-cause and other information from the case file (history of drug abuse, the nature of the drugs or agents responsible for the death and suicidal note), the reason for exposure to the drugs could be estimated.

3.1.3 Drug or drug combinations responsible for the death

Based on the Coroner's verdict, the circumstances under which the death had had occurred and the Forensic Toxicology findings, the drug or drug combinations responsible for the death were determined by the investigators. When multiple drugs

were involved, the one most likely to be predominantly responsible for the fatality based on its toxicity and quantity was chosen.

3.1.4 District of occurrence of the death vs district of residence

Throughout this report, we have used the district of the occurrence of the death instead of the district of residence. Obviously, it is far more important to know where the drug abuse deaths occurred in Hong Kong and, presumably, where drugs of abuse were more readily available and drug abuse occurred most often. Moreover, some subjects did not have a fixed address. Furthermore, some subjects did not stay at their stated address for much of the time during the day.

3.2 Incidence of Drug Abuse Related Deaths

We had reviewed a total of 1,003 cases of drug abuse related deaths. The case files of 12 other subjects were still not available as of January 2001. These 12 cases had to be excluded because the nature of drug exposure was not known and other information essential for this study was not available. Also excluded were the few cases in whom the reason for exposure (accidental or deliberate) to the agents was unknown.

The annual and monthly as well as the regional occurrences of drug abuse related deaths were determined.

3.2.1 Annual incidence of drug abuse related deaths

The numbers of subjects who died from drug abuse in Hong Kong Island, Kowloon and the New Territories during 1994-1998 are shown in Figure 2.

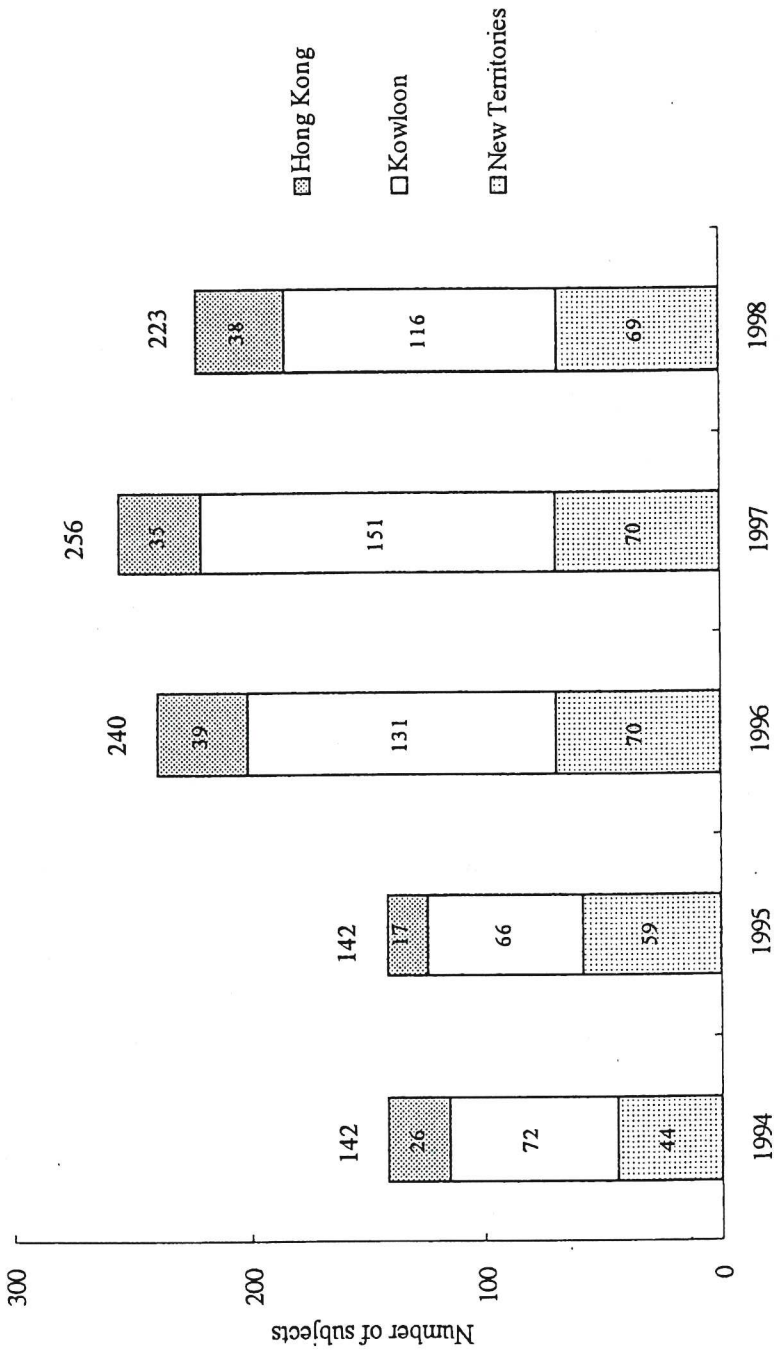

Figure 2. Deaths due to drug abuse.

There was a large increase (69%) in the number of deaths between 1995 (n=142) and 1996 (n=240). This rising trend in the number of drug abuse related deaths continued in 1997 (n=258). The number of deaths then decreased slightly in 1998 (n=223).

Most of the drug abuse related deaths (46.5-58.5%) in Hong Kong occurred in Kowloon. The New Territories and Hong Kong Island accounted for 27.9-41.5% and 12.0-18.3%, respectively.

3.2.2 Annual incidence in relation to population size

To find out if the regional variations in the incidence of heroin-related deaths were related to the differences in population size between Hong Kong Island, Kowloon and the New Territories, the incidence per 100,000 general population was also calculated (Table 8).

After adjustment for the differences in the population size, it became even more obvious that the incidence of drug abuse related deaths was always higher in Kowloon (3.50-7.35 per 100,000) than in Hong Kong Island (1.30-2.80 per 100,000) or the New Territories (1.69-2.47 per 100,000).

It is also obvious from Table 8 that drug abuse related deaths had become and remained more common now (1995-1998) than previously (1994).

Between 1995 and 1996-1997, the incidence of drug abuse related deaths has approximately doubled in Hong Kong Island (1.30 to 2.80 and 2.41 per 100,000) and Kowloon (3.50 to 6.53 and 7.35 per 100,000).

In the New Territories, the incidence of drug abuse related deaths remained almost unchanged during 1995-1998 (2.23-2.47 per 100,000).

Table 8. The incidence (per 100,000 population) of deaths due to drug abuse.

		1994	1995	1996	1997	1998
Hong Kong Island	Number of deaths	26	17	39	35	38
	Population*	1,296,800	1,304,100	1,393,200	1,450,900	1,477,900
	Incidence	2.05	1.30	2.80	2.41	2.57
Kowloon	Number of deaths	72	66	131	151	116
	Population*	1,892,000	1,883,300	2,009,100	2,054,400	2,101,700
	Incidence	3.81	3.50	6.53	7.35	5.52
New Territories	Number of deaths	44	59	70	70	69
	Population*	2,600,400	2,639,300	2,831,400	2,978,000	3,090,500
	Incidence	1.69	2.24	2.47	2.35	2.23
Total	Number of deaths	142	142	240	256	223
	Population*	5,789,200	5,826,700	6,233,700	6,483,300	6,670,100
	Incidence	2.45	2.44	3.85	3.95	3.34

*Mid-year population estimates, Census & Statistics Department.

3.2.3 Monthly incidence of drug abuse related deaths

The monthly incidence of deaths due to drug abuse in Hong Kong Island, Kowloon and the New Territories is shown in Figure 3. Such information may help indicate if drug abuse related deaths were more common during certain periods of the year, for example, long holidays. Appropriate preventive measures can then be contemplated.

The number of deaths in the whole of Hong Kong varied greatly from 9 to 32 each month. There was an obvious increase in the monthly number of deaths between 1994-1995 and 1996-1998. This was particularly noticeable in Kowloon.

The number of drug abuse related deaths in Hong Kong Island varied from 0 to 8 per month. The number death cases in Kowloon and the New Territories also varied greatly from 2 to 17 and from 1 to 11, respectively.

Several peaks in the monthly number of drug abuse related deaths were seen over the whole of Hong Kong. In 1994, the monthly average was 11.8, but in March, there were 16 deaths. In 1995, the monthly average was 11.8, but in January and March, there were 15 and 22 deaths. In 1996, the monthly average was 20.0, but in February, March, July, October and December, there were 28, 25, 24, 26 and 31 cases. In 1997, the monthly average was 21.3, but in February, April, July and October, there were 27, 24, 26 and 27 deaths. In 1998, the monthly average was 18.6, but in March and November, there were 32 and 25 deaths. These peaks were predominantly due to fluctuations in the number of heroin-related deaths (see Sub-Section 4.1.2).

Hence, there were more peaks in the monthly number of drug abuse related deaths in 1996 and 1997 than in 1994, 1995 and 1998.

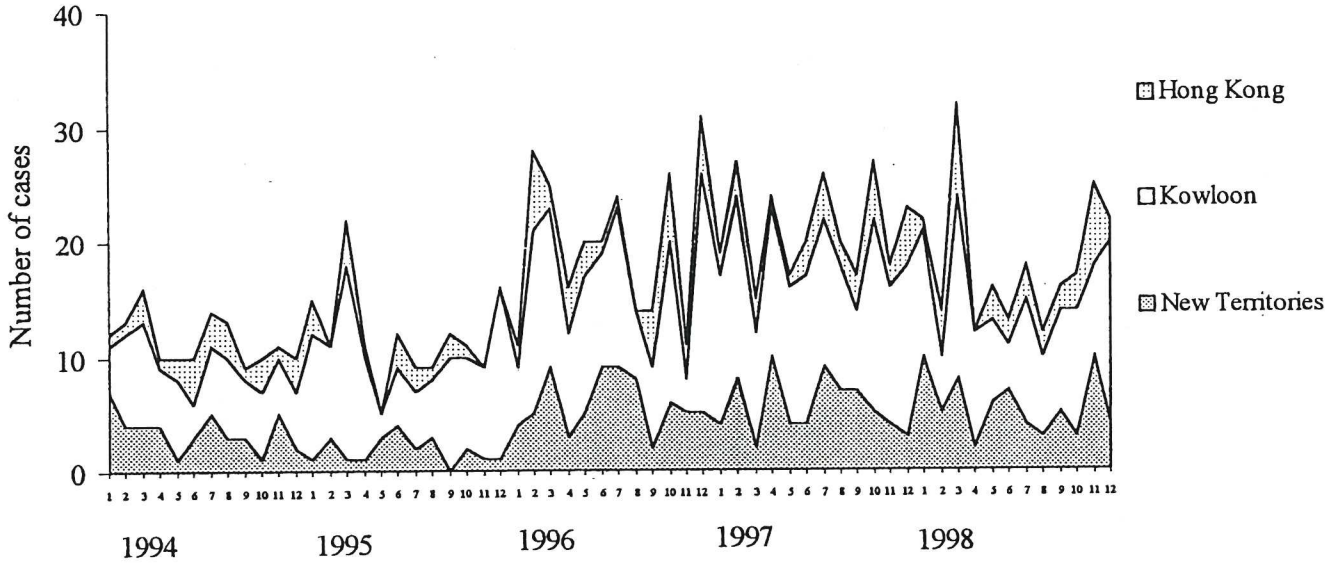

Figure 3. Monthly incidence of deaths due to drug abuse.

3.3 Subject Characteristics

3.3.1 Sex and age distributions

The sex and age distributions of subjects who died from drug abuse in Hong Kong Island, Kowloon and the New Territories between 1994 and 1998 are shown in Table 9, Table 10, Figure 4, Figure 5 and Figure 6.

Among subjects who died from drug abuse, a male predominance was seen throughout 1994-1998 (Table 9). Males accounted for 83.9-93.7% of the deaths each year (overall 89.2%).

The age distributions of subjects who died from drug abuse are shown in Table 10, Figure 4, Figure 5 and Figure 6. The median age of subjects was always between 29 and 39 years. Subjects aged <21 years were involved less often than before and this was particularly obvious in Hong Kong Island and Kowloon. In Hong Kong Island, Kowloon and the New Territories, subjects aged 20-49 years were involved most often during 1994-1998.

It is also obvious from Figure 4, Figure 5 and Figure 6 that there were no clear changes in the age distributions of subjects who died from drug abuse during 1994-1998.

3.3.2 Ethnicity

During 1994-1998, Chinese accounted for 88.4% of the cases in Hong Kong Island, 96.3% of the cases in Kowloon and 97.1% of the cases in the New Territories.

Overall, Chinese accounted for 95.3% of the cases in the whole of Hong Kong. Other Asians and Europeans accounted for 2.2% and 1.5% of cases, respectively.

Table 9. Sex distributions of 1,003 subjects who died from drug abuse.

		1994	1995	1996	1997	1998	Total
Males	Hong Kong Island	23	13	37	29	37	139
	Kowloon	59	53	118	137	109	476
	New Territories	40	54	61	63	63	281
	Total	122	120	216	229	209	896
Females	Hong Kong Island	3	4	2	6	1	16
	Kowloon	13	13	13	14	7	60
	New Territories	4	5	9	7	6	31
	Total	20	22	24	27	14	107
Total		142	142	240	256	223	1,003

Table 10. Age distributions of 1,003 subjects who died from drug abuse.

		1994	1995	1996	1997	1998
Hong Kong Island	Number of subjects	26	17	39	35	38
	Medians (ranges)	29 (14-61)	39 (17-67)	37 (20-76)	34 (20-71)	39 (22-71)
	% <21 years old	11.5	17.7	2.6	2.9	0
Kowloon	Number of subjects	72	66	131	151	116
	Medians (ranges)	38 (17-76)	35 (17-59)	37 (17-76)	39 (18-70)*	40 (19-71)†
	% <21 years old	2.8	6.1	6.9	2.7	1.7
New Territories	Number of subjects	44	59	70	70	69
	Medians (ranges)	33 (19-79)	37 (16-68)	33 (14-91)	31 (16-76)	38 (17-79)
	% <21 years old	9.1	8.5	14.3	5.7	7.3
Total	Number of subjects	142	142	240	256	223
	Medians (ranges)	35 (14-79)	36 (16-68)	37 (14-91)	37 (16-76)*	39 (17-79)†
	% <21 years old	6.3	8.5	8.3	3.5	3.1

Excluding *4 subjects (estimated age 30-50, 40-50, 40-60, 50-70 and 50-80 years).
Excluding †1 subject (estimated age 30-60 years).

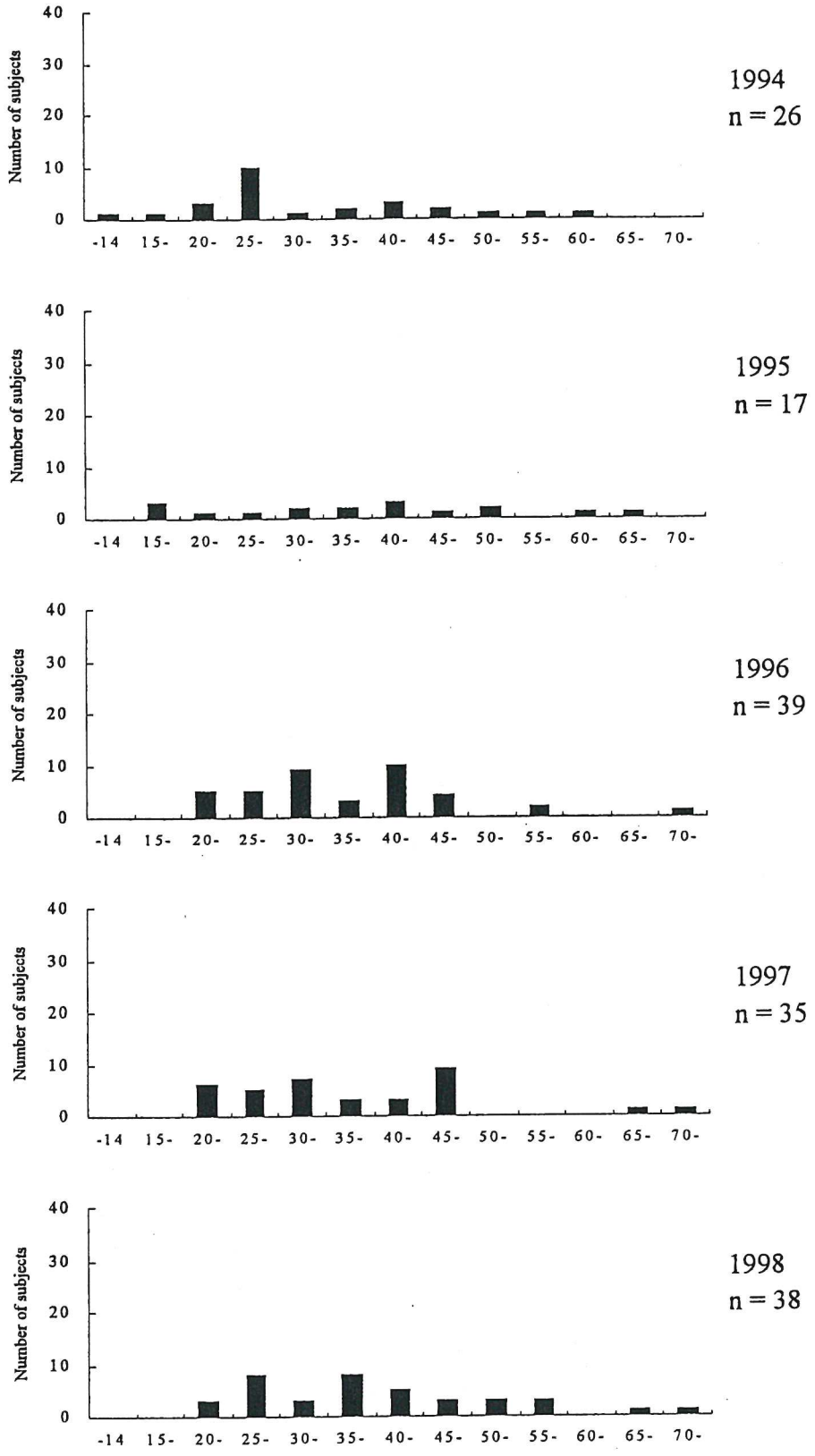

Figure 4. Age distributions of 155 subjects who died from drug abuse in Hong Kong Island.

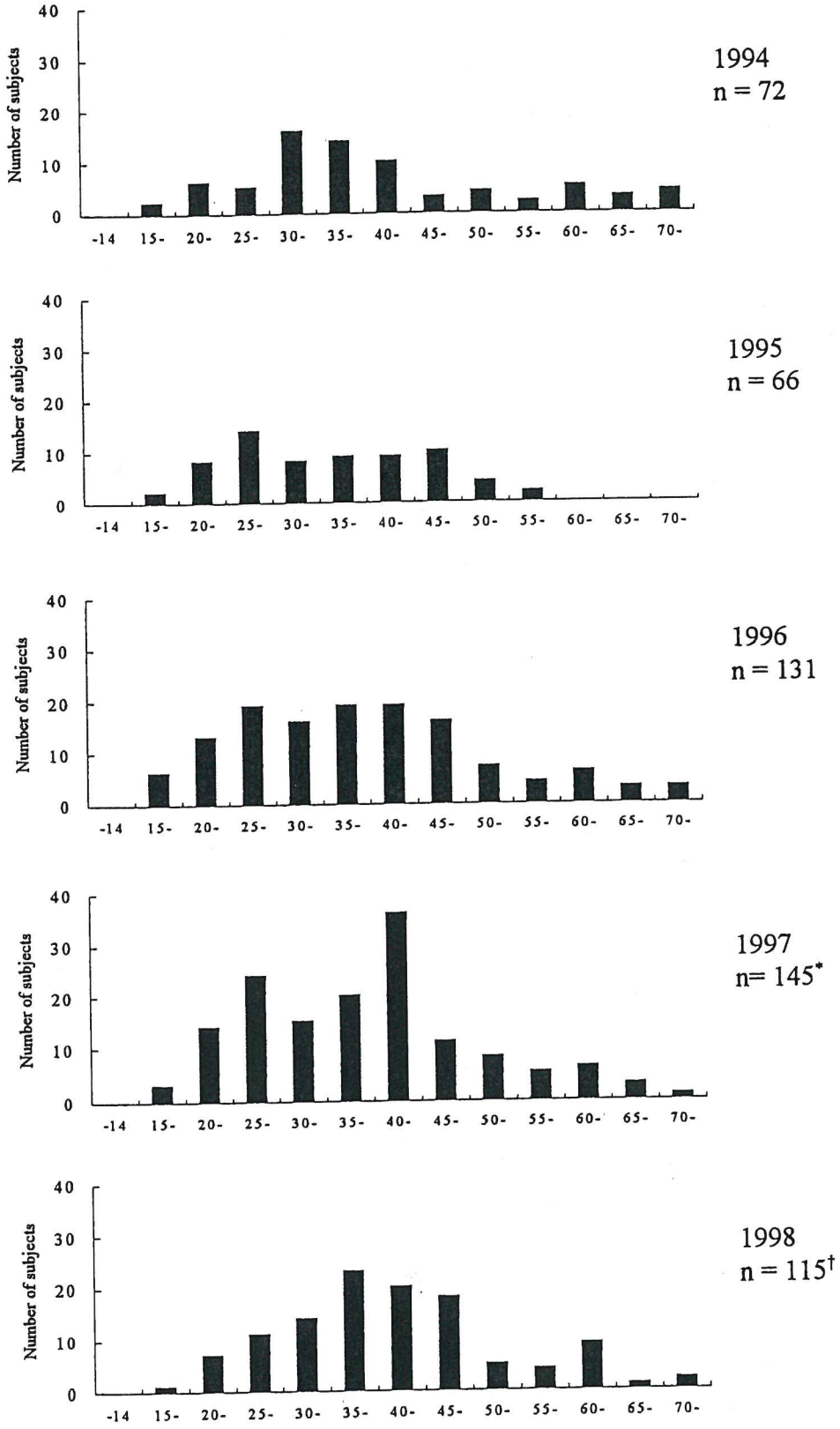

Figure 5. Age distributions of 529 subjects who died from drug abuse in Kowloon.
(Excluding *5 and †1 subjects of uncertain age.)

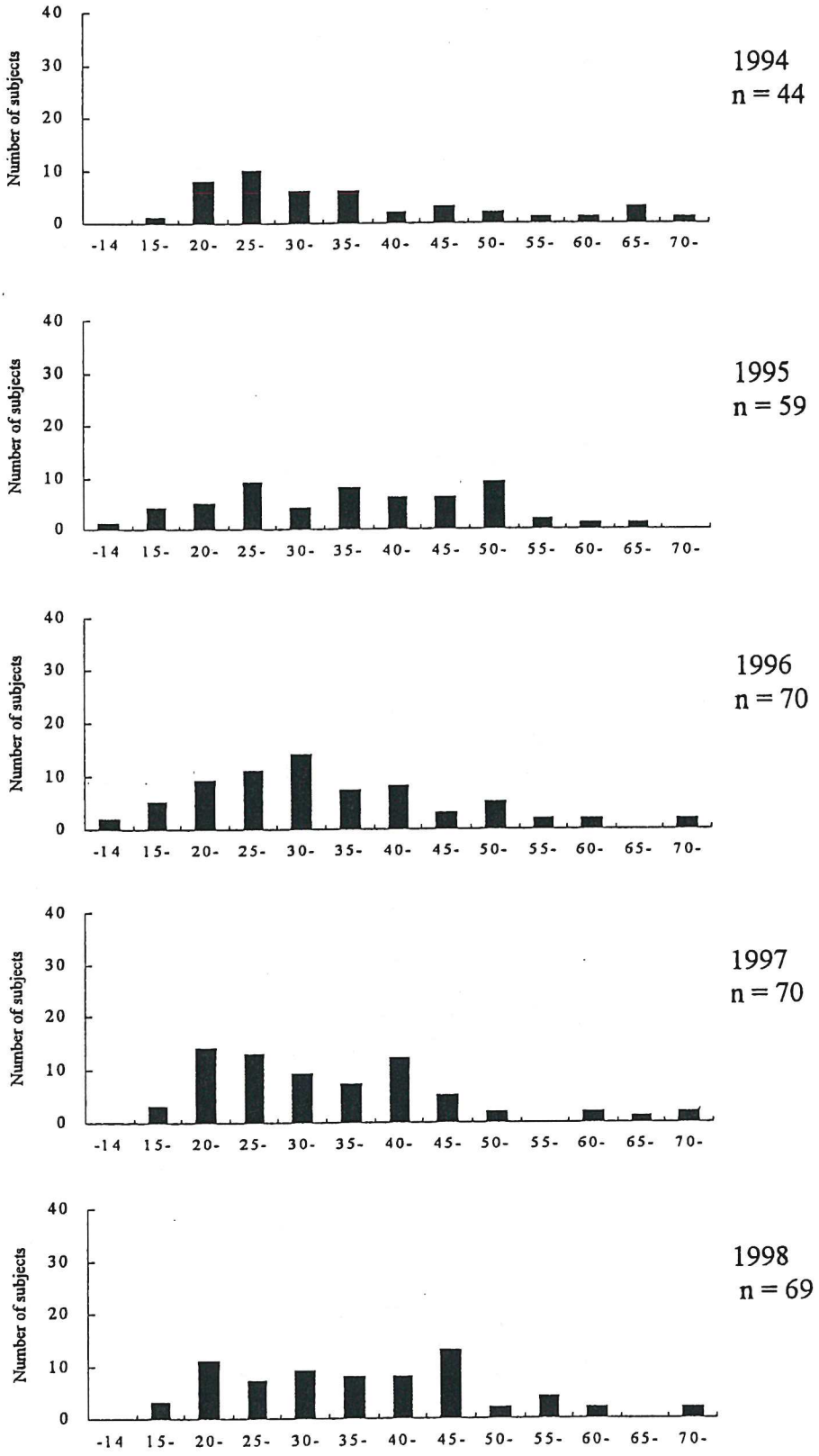

Figure 6. Age distributions of 312 subjects who died from drug abuse in the New Territories.

3.4 Drugs of Abuse Causing Deaths

3.4.1 Single or multiple agents responsible for the deaths

Drug abusers often used several drugs (Sub-Section 2.2.5). The adulterants (contaminants) could have contributed to the toxicity of some drugs (e.g. heroin). It will therefore be of great interest to find out how often multiple agents were involved among subjects who died from drug abuse.

Based on the case history and the Forensic Toxicology findings, the proportions of patients who died from single or multiple agents during 1994-1998 are shown in Figure 7. Such information was available in 991 (98.8%) subjects.

Overall, a single agent was responsible for the deaths in 65.2% of cases in Hong Kong Island, 71.5% of cases in Kowloon and 76.8% of cases in the New Territories. Two agents were involved in 27.1% of cases in Hong Kong Island, 21.5% of cases in Kowloon and 19.6% of cases in the New Territories. In other words, subjects from Hong Kong were more likely to have taken drug combinations.

Such information was not available in 3 subjects in 1996, 5 subjects in 1997 and 4 subjects in 1998. However, the 3 males in 1996 (aged 29-56 years) were known to abuse heroin only. The 3 males in 1997 (aged 26-70 years) and 2 females (aged 25 years) were known to abuse heroin (n=4) or heroin with amphetamines (n=1). The 4 males in 1998 (aged 33-59 years) were known to abuse heroin with benzodiazepines (n=2) or heroin only (n=2). Deaths in these subjects possibly occurred after exposure to drugs of abuse. Confirmation of the diagnosis by Forensic Toxicology analysis was not done because, for example, the bodies were already decomposing. Drugs might not be detected in the blood or body fluids or the results could not be ascertained reliably if samples were submitted for analysis long after death.

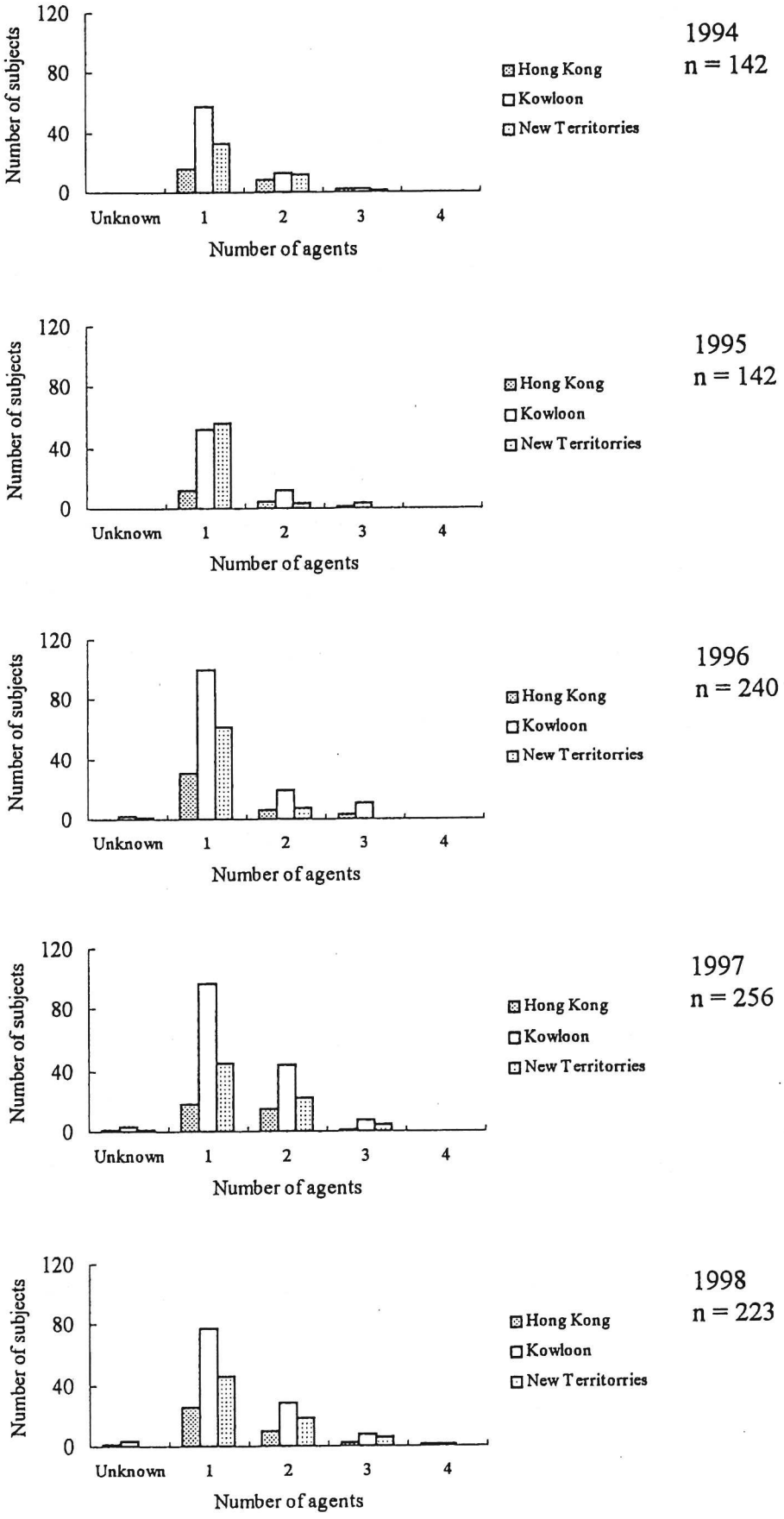

Figure 7. The number of agents contributing to the deaths of 1,003 drug abusers.

In order not to underestimate the size of the problem of drug abuse and heroin abuse in Hong Kong, these 12 cases were also included in this part of the analysis.

The types of agents and the frequency of use of multiple agents can also be appreciated from the findings presented in Sub-Section 3.4.3.

3.4.2 The main agents responsible for the deaths of drug abusers

The main agents responsible for the deaths of drug abusers of all ages in the whole of Hong Kong are shown in Table 11.

Heroin was the most important aetiological agent throughout 1994-1998 and accounted for 88.0-94.1% of deaths each year. Overall, heroin accounted for 90.6% of deaths. [If the 12 other subjects in whom confirmation of diagnosis by Forensic Toxicology analysis was not possible were included (see Sub-Section 3.4.1), heroin would have accounted for 91.8% of cases.] Other narcotics accounted for 0-2.1% (overall 1.4%).

The figures for other drugs and substances of abuse were as follows: alcohol 1.3-5.6% (overall 2.9%), amphetamines 0-2.2% (overall 1.2%), benzodiazepines 0.4-2.1% (overall 1.1%), cough medicine (dextromethorphan) 0-2.8% (overall 0.7%), organic solvents (sniffing of volatile substances) 0-0.4% (overall 0.3%) and cocaine 0-0.7% (overall 0.1%).

Five other subjects died as a result of poisonings by drugs (promethazine plus codeine 1, cyclizine plus dipipanone 1, "dologesic" 1 and dothiepin 1) or methanol in contaminated alcohol (n=1). There was evidence of misuse of drugs or alcohol, but there was no evidence of suicidal attempts. For examples, the 2 subjects who died of antihistamine poisoning also had other agents of drugs detected in their blood – codeine and dipipanone (organic solvent).

Table 11. The main agents responsible for the deaths of 1,003 drug abusers of all ages.

Agents	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Heroin	130	91.5	125	88.0	223	92.9	232	90.6	199	89.2
Opium	-	-	-	-	-	-	-	-	1	0.4
Methadone	3	2.1	2	1.4	-	-	2	0.8	2	0.9
Other opiates	1	0.7	1	0.7	-	-	1	0.4	1	0.4
Amphetamines	-	-	-	-	4	1.7	3	1.2	5	2.2
Cocaine	1	0.7	-	-	-	-	-	-	-	-
Benzodiazepines	3	2.1	1	0.7	4	1.7	2	0.8	1	0.4
Antidepressants†	-	-	-	-	1	0.4	-	-	-	-
Cough medicine*	1	0.7	4	2.8	1	0.4	1	0.4	-	-
Organic solvents	-	-	-	-	1	0.4	1	0.4	1	0.4
Alcohol	3	2.1	8	5.6	3	1.3	7	2.7	8	3.6
Analgesics†	-	-	-	-	-	-	-	-	1	0.4
Antihistamines†	-	-	1	0.7	-	-	1	0.4	-	-
Methanol†	-	-	-	-	-	-	1	0.4	-	-
Unascertained	-	-	-	-	3‡	1.3	2‡	0.8	3‡	1.3
No drugs detected	-	-	-	-	-	-	2‡	0.8	1‡	0.4
No toxicology analysis	-	-	-	-	-	-	1‡	0.4	-	-
Total	142	100.0	142	100.0	240	100.0	256	100.0	223	100.0

*Dextromethorphan. †Misuse of drugs or substances (see text). ‡These 12 subjects were known to abuse heroin (see Sub-Section 3.4.1).

The main agents responsible for the deaths of drug abusers aged under 21 and aged 21 or over are shown in Table 12 and Table 13. During 1994-1998, subjects aged below 21 accounted for 3.1-8.4% of cases (overall 5.7%). In particular, subjects aged below 21 were involved less frequently since 1997-1998 (3.1-3.5%). Heroin was the most important aetiological agent in this age group, accounting for 52 cases (91.2%).

During 1994-1998, subjects aged 21 or above accounted for 91.5-96.9% of drug abuse related death cases (overall 94.6.). During 1997-1998, there was a relative as well as an absolute increase in the number of subjects aged 21 or above (Table 13). Heroin was also the most important agent in this age group, accounting for 857 cases (90.6%).

3.4.3 The main and other agents responsible for the deaths of drug abusers

The main and other agents responsible for the deaths of 991 drug abusers are shown in Table 14. The 12 subjects without Forensic Toxicology data were now excluded in this further analysis. The relative importance of agents other than the main ones (Table 11) is indicated.

During 1994-1998, heroin remained the most important agent, accounting for 89.4-94.1% of cases (overall 92.1%). Other narcotics accounted for 2.8-7.0 of cases (overall 4.9%).

The figures for other agents of abuse were as follows: benzodiazepines 9.2-17.9% (overall 14.7%), alcohol 5.9-14.7% (overall 10.1%), amphetamines 0-5.0% (overall 2.3%), cough medicine 0-2.8% (overall 0.7%), cocaine 0-1.4% (overall 0.4%) and organic solvents 0-0.7% (overall 0.4%).

Table 12. The main agents responsible for the deaths of 57 drug abusers aged under 21.

Agents	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Heroin	8	5.6	9	6.3	20	8.3	9	3.5	6	2.7
Opium	-	-	-	-	-	-	-	-	-	-
Methadone	-	-	1	0.7	-	-	-	-	-	-
Other opiates	-	-	-	-	-	-	-	-	-	-
Amphetamines	-	-	-	-	-	-	-	-	-	-
Cocaine	-	-	-	-	-	-	-	-	-	-
Benzodiazepines	-	-	-	-	-	-	-	-	-	-
Antidepressants†	-	-	-	-	-	-	-	-	-	-
Cough medicine*	1	0.7	2	1.4	-	-	-	-	-	-
Organic solvents	-	-	-	-	-	-	-	-	-	-
Alcohol	-	-	-	-	-	-	-	-	-	-
Analgesics†	-	-	-	-	-	-	-	-	1	0.4
Antihistamines†	-	-	-	-	-	-	-	-	-	-
Methanol†	-	-	-	-	-	-	-	-	-	-
Unascertained	-	-	-	-	-	-	-	-	-	-
No drugs detected	-	-	-	-	-	-	-	-	-	-
No toxicology analysis	-	-	-	-	-	-	-	-	-	-
Total‡	9	6.3	12	8.4	20	8.3	9	3.5	7	3.1

*Dextromethorphan. †Misuse of drugs or substances (see text). In relation to the number subjects of all ages in that year.‡

Table 13. The main agents responsible for the deaths of 946 drug abusers aged 21 or over.

Agents	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Heroin	122	85.9	116	81.7	203	84.6	223	87.1	193	86.5
Opium	-	-	-	-	-	-	-	-	1	0.4
Methadone	3	2.1	1	0.7	-	-	2	0.8	2	0.9
Other opiates	1	0.7	1	0.7	-	-	1	0.4	1	0.4
Amphetamines	-	-	-	-	4	1.7	3	1.2	5	2.2
Cocaine	1	0.7	-	-	-	-	-	-	-	-
Benzodiazepines	3	2.1	1	0.7	4	1.7	2	0.8	1	0.4
Antidepressants†	-	-	-	-	1	0.4	-	-	-	-
Cough medicine*	-	-	2	1.4	1	0.4	1	0.4	-	-
Organic solvents	-	-	-	-	1	0.4	1	0.4	1	0.4
Alcohol	3	2.1	8	5.6	3	1.3	7	2.7	8	3.6
Analgesics†	-	-	-	-	-	-	-	-	-	-
Antihistamines†	-	-	1	0.7	-	-	1	0.4	-	-
Methanol†	-	-	-	-	-	-	1	0.4	-	-
Unascertained	-	-	-	-	3‡	1.3	2‡	0.8	3‡	1.3
No drugs detected	-	-	-	-	-	-	2‡	0.8	1‡	0.4
No toxicology analysis	-	-	-	-	-	-	1‡	0.4	-	-
Total‡§	133	93.7	130	91.5	220	91.7	247	96.5	216	96.9

*Dextromethorphan. †Misuse of drugs or substances (see text). ‡These 12 subjects were known to abuse heroin (see Sub-Section 3.4.1).
§In relation to the number of subjects of all ages in that year.

Table 14. The main and other agents responsible for the deaths of 991 drug abusers.*

Agents	1994 (n=142)		1995 (n=142)		1996 (n=237)		1997 (n=251)		1998 (n=219)	
	Number	%	Number	%	Number	%	Number	%	Number	%
Heroin	130	91.5	127	89.4	223	94.1	233	92.8	200	91.3
Opium	-	-	-	-	-	-	-	-	1	0.5
Methadone	8	5.6	2	1.4	6	2.7	12	4.8	10	4.6
Other opiates	2	1.4	2	1.4	1	0.4	3	1.2	2	0.9
Amphetamines	-	-	1	0.7	7	3.0	4	1.6	11	5.0
Cocaine	1	0.7	-	-	-	-	-	-	3	1.4
Benzodiazepines	20	14.1	13	9.2	30	12.7	45	17.9	38	17.4
Antidepressants	1	0.7	1	0.7	3	1.3	3	1.2	3	1.4
Antipsychotics	-	-	-	-	1	0.4	5	2.0	2	0.9
Zopiclone	4	2.8	1	0.7	3	1.3	3	1.2	1	0.5
Other CNS drugs	-	-	-	-	1	0.4	2	0.8	2	0.9
Respiratory drugs	-	-	1	0.7	-	-	1	0.4	1	0.5
Cough medicine	1	0.7	4	2.8	1	0.4	1	0.4	-	-
Organic solvents	-	-	1	0.7	1	0.4	1	0.4	1	0.5
Alcohol	12	8.5	12	8.5	14	5.9	37	14.7	25	11.4
Analgesics	1	0.7	-	-	-	-	-	-	2	0.9
Barbiturates	1	0.7	-	-	3	1.3	2	0.8	1	0.5
Antihistamines	3	2.1	3	2.1	1	0.4	3	1.2	4	1.8
Methanol	-	-	-	-	-	-	1	0.4	-	-
Total†	184	129.6	168	118.3	295	124.5	356	141.8	307	140.2

*Excluding 12 subjects without toxicology data. †>100% because some subjects were exposed to more than one agent.

Hence, during 1994-1998, benzodiazepines and alcohol remained commonly involved. As already mentioned, benzodiazepines were also abused by some heroin abusers. Cocaine and organic solvents were occasionally involved.

As can be seen in Table 14, there were trends for an increased use of amphetamines during 1994-1998. The use of cough medicine appeared to be less common.

Other prescription drugs (e.g. analgesics and psychotropic drugs) were also detected, possibly because of the use of several agents for drug abuse and treatment of underlying medical and mental illnesses and the contamination of the abused drugs.

3.5 Social Background and Financial Status of Subjects

3.5.1 Marital status

Data about the marital status was available in 976 (97.3%) subjects. The proportion of subjects being single, married or divorced/separated respectively varied between 1994 (59.2%, 22.5% and 11.3%), 1995 (74.6%, 16.2% and 9.2%), 1996 (66.7%, 20.4% and 12.9%), 1997 (66.5%, 23.6% and 9.9%) and 1998 (55.7%, 24.8% and 19.5%). These figures indicated that around 56-75% of subjects who died from drug abuse were single.

Overall, the proportion of subjects being single, married or divorced/separated was similar in Hong Kong Island (69.1%, 18.1% and 12.8%), Kowloon (66.0%, 20.7% and 13.3%) and the New Territories (61.5%, 26.4% and 12.0%).

3.5.2 Employment status

During 1994-1998, 15 of the subjects who died from drug abuse had retired and four other subjects were students. Twelve other subjects worked as prostitutes.

Six subjects were business owners and 267 other subjects were casual workers or had a full-time job. There were 666 unemployed subjects, who made up 69.8% of the subjects in whom the employment status was known (excluding the students, subjects who had retired and the prostitutes).

Among subjects who died from drug abuse (excluding the students, subjects who had retired and the prostitutes), the unemployment rates varied slightly between 1994 (66.1%), 1995 (76.9%), 1996 (69.4%), 1997 (73.0%) and 1998 (70.5%).

The overall unemployment rates were similar in Hong Kong Island (69.8%), Kowloon (70.0%) and the New Territories (65.9%).

3.5.3 Education levels

Information about the education levels was available in 278 (27.7%) subjects. During 1994-1998, the proportion of subjects having education levels of primary school or below, secondary school or below or university was similar between Hong Kong Island (33.3%, 64.4% and 2.2%) and Kowloon (36.9%, 59.2% and 3.8%). In the New Territories, the corresponding figures were slightly different (29.0% and 71.0%).

Overall, 32.4% of subjects had education levels of primary school or below and 61.9% of subjects had education levels of secondary school or below.

3.5.4 Types of residence

Information about the types of residence was available in 985 (98.2%) subjects. The great majority of subjects lived in public housing estates (58.9%) or private properties (12.6%). Other subjects lived in rented rooms (6.0%), village huts

(4.6%), caged flats (3.6%) or squatters (1.2%). The remaining subjects were street sleepers (6.7%) or had no fixed address (6.5%).

3.5.5 Financial status

Crude information about the financial status was available in 715 (71.3%) subjects. Apparently, 57.2% of subjects had no financial problems. The remaining subjects either received public assistance (30.3%) or had financial problems (12.4%).

Overall, the proportion of subjects who had financial problems or received public assistance was higher in the New Territories (55.3%) than in Hong Kong Island (44.6%) and Kowloon (42.1%).

3.6 Health Status of Subjects and History of Drug Abuse

3.6.1 Health status

Information about the health status of the drug abusers was available in 978 (97.5%) subjects. Apparently, 70.3% of subjects were otherwise healthy. The remaining subjects had some active or chronic medical conditions (21.3%), minor or major mental illnesses with or without medical diseases (5.8%) or physical disability with or without medical illnesses (2.6%).

3.6.2 History of drug abuse

Subjects who died from drug abuse often also abused other agents. The drugs or drug combinations that had been abused by the subjects who died from misuse of heroin and other major classes of agents are shown in Table 15, Table 16, Table 17, Table 18, Table 19, Table 20, Table 21, Table 22 and Table 23. The subjects were conveniently grouped according to the main agent causing their deaths.

Table 15. Drugs or drug combinations previously abused by 877 subjects who died from heroin abuse.

Agents	1994	1995	1996	1997	1998
Heroin only	84	103	185	173	126
Heroin with other drugs					
Alcohol	-	-	-	-	1
Amphetamines	-	-	2	1	2
Amphetamines/cannabis	-	-	1	1	1
Benzodiazepines	31	15	23	36	46
Benzodiazepines/amphetamines	1	-	-	-	4
Benzodiazepines/cannabis	1	-	-	-	-
Benzodiazepines/cannabis/ cough medicine	-	-	-	-	2
Benzodiazepines/cough medicine	1	-	-	1	-
Benzodiazepines/"soft" drugs	-	-	1	-	-
Cannabis	1	1	4	1	-
Cough medicine	-	-	-	2	-
Methadone	-	-	-	1	-
"Soft" drugs	2	3	3	2	2
"Soft" drugs/cocaine	-	1	-	-	-
"Soft" drugs/cough medicine	-	-	-	1	-
"Soft" drugs/cough medicine/ thinner	-	1	-	-	-
Thinner	-	-	1	2	-
Others					
Amphetamines/cannabis	-	-	-	-	1
Amphetamines/cough medicine	-	-	-	-	1
Benzodiazepines	-	-	-	-	1
Benzodiazepines/cannabis/ cough medicine	1	-	2	-	-
Cannabis	1	-	-	-	-
Total	123	124	222	221	187

Table 16. Drugs or drug combinations previously abused by 13 subjects who died from abuse of codeine, methadone, propoxyphene or opium.

Agents	1994	1995	1996	1997	1998
Heroin only	2	1	-	2	-
Heroin with other drugs					
Benzodiazepines	-	-	-	-	2
Cough medicine	1	-	-	-	-
"Soft" drugs	1	1	-	-	-
Others					
Cannabis/"soft" drugs/ cough medicine	-	1	-	-	-
Cough medicine	-	-	-	1	-
Opium	-	-	-	-	1
Total	4	3	-	3	3

Table 17. Drugs or drug combinations previously abused by 2 subjects who died from abuse of antihistamines.

Agents	1994	1995	1996	1997	1998
Cough medicine	-	1	-	-	-
"Soft" drugs	-	-	-	1	-
Total	-	1	-	1	-

Table 18. Drugs or drug combinations previously abused by 11 subjects who died from abuse of amphetamines.

Agents	1994	1995	1996	1997	1998
Amphetamines only	-	-	-	-	1
Amphetamines/cannabis	-	-	2	-	2
Heroin	-	-	-	1	1
Heroin/benzodiazepines	-	-	1	-	-
Heroin/"soft" drugs	-	-	-	-	2
"Soft" drugs/ cough medicine	-	-	1	-	-
Total	-	-	4	1	6

Table 19. Drugs or drug combinations previously abused by 11 subjects who died from abuse of benzodiazepines.

Agents	1994	1995	1996	1997	1998
Benzodiazepines only	-	-	1	-	-
Benzodiazepines/heroin	3	-	3	-	1
Heroin	-	-	-	2	-
Heroin/"soft" drugs	-	1	-	-	-
Total	3	1	4	2	1

Table 20. Drugs or drug combinations previously abused by 6 subjects who died from abuse of dextromethorphan.

Agents	1994	1995	1996	1997	1998
Benzodiazepines/cannabis	-	-	-	1	-
Benzodiazepines/cannabis/ cough medicine	-	1	-	-	-
Cough medicine	1	1	-	-	-
"Soft" drugs	-	-	1	-	-
"Soft" drugs/cough medicine	-	1	-	-	-
Total	1	3	1	1	-

Table 21. Drugs or drug combinations previously abused by 9 subjects who died from abuse of alcohol.

Agents	1994	1995	1996	1997	1998
Alcohol	3	-	-	-	2
Heroin	-	1	-	-	1
Cannabis/"soft" drugs	-	1	-	-	-
"Soft" drugs	-	-	1	-	-
Total	3	2	1	-	3

Table 22. Drugs or drug combinations previously abused by 3 subjects who died from abuse of propane or toulene.

Agents	1994	1995	1996	1997	1998
Heroin	-	-	-	-	1
Heroin/thinner			1		
Heroin/cannabis/thinner	-	-	-	1	-
Total	-	-	1	1	1

Table 23. Drugs previously abused by the subject who died from abuse of cocaine.

Agents	1994	1995	1996	1997	1998
"Soft" drugs	1	-	-	-	-
Total	1	-	-	-	-

In many cases, the agents that were abused could not be verified except that they appeared to be psychotropic agents. These were referred to as "soft" drugs in the Tables. Information was missing in some cases. Hence, the yearly and overall totals might not add up to the total number of subjects who died from drug abuse.

Among the 877 subjects who died from heroin abuse (Table 15), most subjects either abused heroin only (68.3-83.3% annually, 76.5% overall) or heroin plus other drugs/substances of abuse (15.8-31.0% annually, 22.7% overall). Among the subjects who abused heroin with other drugs, benzodiazepines alone (84.8%) or together with other agents (1.3%) were used most often. It should be noted that 7 subjects who died from heroin toxicity had no known previous abuse of heroin.

Among the 13 subjects who died from abuse of non-heroin narcotics (Table 16), 11 were previously known to abuse heroin (n=5), heroin plus other drugs (n=5) or opium (n=1). Only 2 subjects did not have a history of opiate abuse.

Among the subjects who died from abuse of antihistamines (Table 17), amphetamines (Table 18), benzodiazepines (Table 19), cough medicine (Table 20), alcohol (Table 21), organic solvents (Table 22) and cocaine (Table 23), the types of drugs abused, as indicated in the Coroner's Records, did not always correlate with the agent(s) we considered responsible for their deaths.

3.7 Participation in rehabilitation programmes

Many subjects who died from drug abuse had been known to be participating in rehabilitation programmes, such as those offered by the Hei Ling Chau Addiction Treatment Centre, Shek Kwu Chau Addiction Treatment Centre and Chi Ma Wan Drug Addiction Treatment Centre. Such information was available in 678 subjects (Table 24).

Table 24. Participation rates in rehabilitation programmes among 678 individuals who died from drug abuse.

		1994	1995	1996	1997	1998	Total
Hong Kong Island	Yes	16	5	26	21	17	85
	No	5	0	6	5	4	20
	Rate (%)	76.2	100.0	81.3	80.8	81.0	81.0
Kowloon	Yes	28	38	77	93	90	326
	No	2	3	17	2	1	25
	Rate (%)	93.3	92.7	81.9	97.9	98.9	92.9
New Territories	Yes	17	36	46	44	44	187
	No	4	9	11	3	8	35
	Rate (%)	81.0	80.0	80.7	93.6	84.6	84.2
Total	Yes	61	79	149	158	151	598
	No	11	12	34	10	13	80
	Rate (%)	84.7	86.8	81.4	94.0	92.1	88.2

During 1994-1998, the overall rate of participation in rehabilitation programmes was higher among subjects in Kowloon (92.9%) than in Hong Kong Island (81.0%) and the New Territories (84.2%).

In the whole of Hong Kong, the participation rate among the subjects who died from drug abuse was higher in 1997 (94.0%) and 1998 (92.1%) than in 1994 (84.7%), 1995 (86.8%) and 1996 (81.4%).

Previous participation in rehabilitation programmes and methadone treatment programmes by the heroin abusers who died will be described in greater detail in Sub-Section 4.7.

4 Deaths Due to Heroin Abuse

In this Section, the incidence and epidemiological features of deaths due to heroin abuse in the whole of Hong Kong during 1994-1998 will be presented in detail. In assessing the factors possibly contributing to the changing incidence, any unexpected increase in the purity of heroin available to the drug addicts and their knowledge of heroin toxicity will be determined as far as possible.

4.1 Incidence of Deaths Due to Heroin Abuse

4.1.1 Annual incidence of deaths due to heroin abuse

The annual incidence of deaths due to heroin abuse in Hong Kong Island, Kowloon and the New Territories is shown in Figure 8. There was a large increase (78%) in the number of deaths between 1995 (n=125) and 1996 (n=223). This increased number was sustained in 1997 (n=232). The number of deaths due to heroin abuse then decreased slightly in 1998 (n=198).

Most of the heroin-related deaths (44.0-58.2%) in Hong Kong occurred in Kowloon. The New Territories and Hong Kong Island accounted for 28.0-45.6% and 10.4-16.9% of deaths, respectively.

To find out if this regional variation in the incidence of heroin-related deaths was possibly related to the differences in population size and if the changing incidence of heroin-related deaths was related to changing population size, the incidence per 100,000 general population was calculated (Table 25).

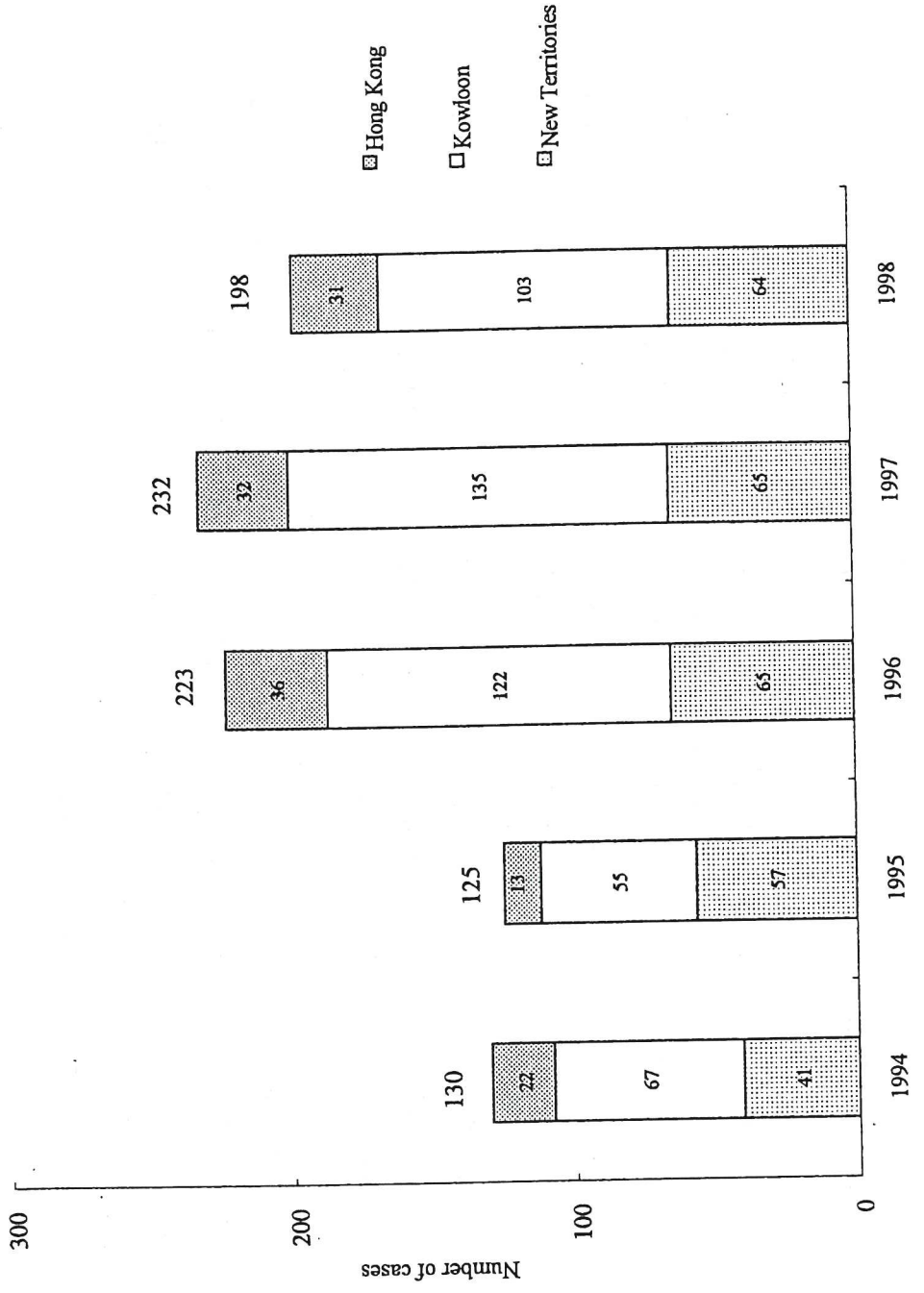

Figure 8. Deaths due to heroin abuse.

Table 25. The incidence (per 100,000 population) of deaths due to heroin abuse.

		1994	1995	1996	1997	1998
Hong Kong Island	Number of deaths	22	13	36	32	31
	Population*	1,296,800	1,304,100	1,393,200	1,450,900	1,477,900
	Incidence	1.70	1.00	2.58	2.21	2.10
Kowloon	Number of deaths	67	55	122	135	103
	Population*	1,892,000	1,883,300	2,009,100	2,054,400	2,101,700
	Incidence	3.54	2.92	6.07	6.57	4.90
New Territories	Number of deaths	41	57	65	65	64
	Population*	2,600,400	2,639,300	2,831,400	2,978,000	3,090,500
	Incidence	1.58	2.16	2.30	2.18	2.07
Total	Number of deaths	130	125	223	232	198
	Population*	5,789,200	5,826,700	6,233,700	6,483,300	6,670,100
	Incidence	2.25	2.15	3.58	3.58	2.97

*Mid-year population estimates, Census & Statistics Department.

After adjustment for the population size, it became obvious that the incidence of heroin-related deaths was always higher in Kowloon (2.92-6.57 per 100,000) than in Hong Kong Island (1.00-2.58 per 100,000) or the New Territories (1.58-2.30 per 100,000).

Between 1995 and 1996-1997, the incidence of heroin-related deaths had doubled in Hong Kong Island (1.00 to 2.58 and 2.21 per 100,000) and Kowloon (2.92 to 6.07 and 6.57 per 100,000).

In the New Territories, the incidence of heroin-related deaths almost remained unchanged during 1995-1999 (2.07-2.30 per 100,000).

4.1.2 Monthly incidence of deaths due to heroin abuse

The monthly incidence of deaths due to heroin abuse in Hong Kong Island, Kowloon and the New Territories is shown in Figure 9. The number of deaths in the whole of Hong Kong varied greatly from 4 to 31 each month. Since 1996, there had been a significant increase in the monthly number of deaths, most noticeably in Kowloon.

Several peaks in the monthly number of heroin-related deaths were seen in the whole of Hong Kong. In 1994, the monthly average was 10.8, but in March, there were 15 deaths. In 1995, the monthly average was 10.4, but in January and March, there were 13 and 19 deaths. In 1996, the monthly average was 18.6, but in February, March, July, October and December, there were 23, 25, 23, 22 and 31 cases. In 1997, the monthly average was 19.3, but in February, April, July and October, there were 23, 22, 24 and 31 deaths, respectively. In 1998, the monthly average was 16.5, but in March and November, there were 29 and 21 deaths, respectively.

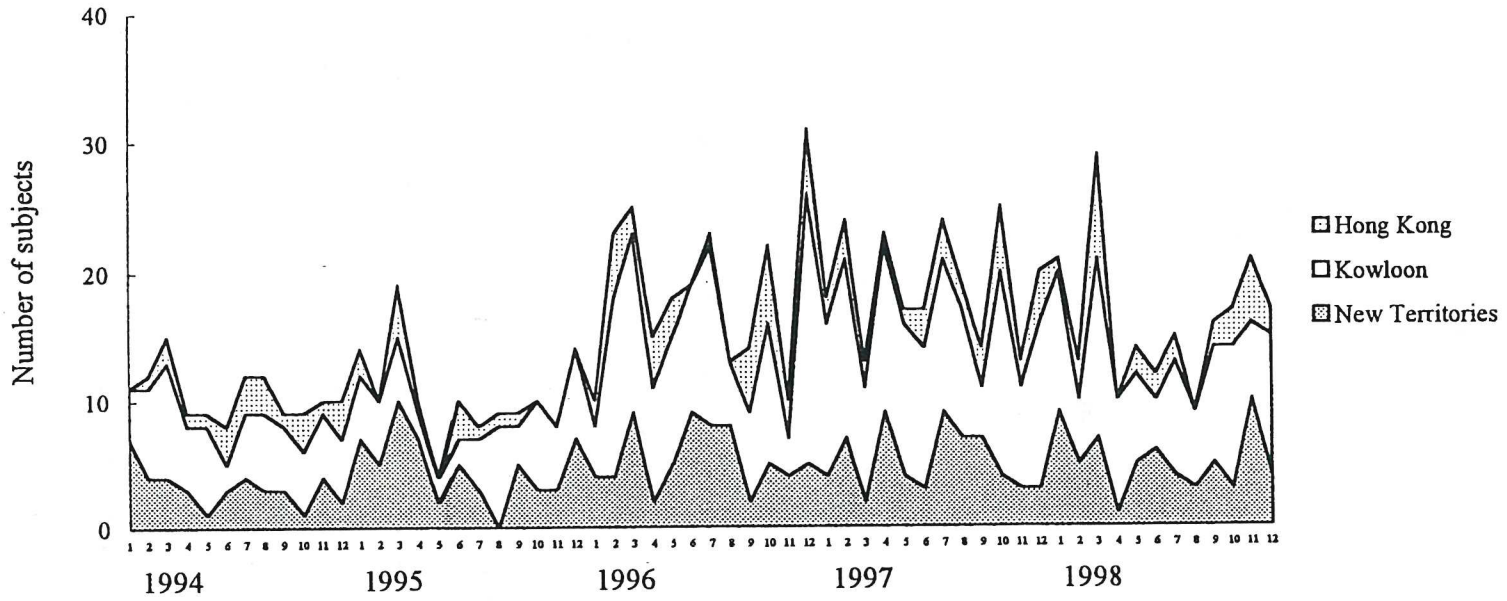

Figure 9. Monthly incidence of deaths due to heroin abuse.

4.2 Occurrence of Deaths in Different Districts of Hong Kong

The occurrence of heroin abuse related deaths in Hong Kong Island, Kowloon and the New Territories during 1994-1998 is shown in Tables 26, Table 27 and Table 28. The districts referred to are the areas served by different police stations instead of the boundaries defined by the District Boards.

In Hong Kong Island, deaths occurred more commonly in Aberdeen (0.8-8.5%), Chai Wan (1.7-3.8%) and Wan Chai (0-3.2%).

In Kowloon, deaths occurred more commonly in Cheung Sha Wan (2.4-6.3%), Kwun Tong (3.1-6.7%), Mong Kok (3.1-5.1%), Sau Mau Ping (5.4-8.6%), Sham Shui Po (3.4-6.2%), Shek Kip Mei (2.3-6.5%), Wong Tai Sin (3.6-8.6%) and Yau Ma Tei (5.1-10.4%).

In the New Territories, deaths occurred more commonly in Lei Muk Shui (1.0-7.2%), Tsuen Wan (3.9-8.0%), Tuen Mun (1.5-6.4%) and Yuen Long (2.6-3.8%).

4.3 Sex and Age Distributions and Sex and Age Specific Incidence

Subjects particularly at risk and the incidence of death from heroin abuse were also examined in relation to the general population and the heroin abuser population.

4.3.1 Sex and age distributions

The sex and age distributions of subjects who died from drug abuse in Hong Kong Island, Kowloon and the New Territories between 1994 and 1998 are shown in Figure 10 and Table 29.

Among subjects who died from heroin abuse, a male predominance was seen throughout 1994-1998. Males accounted for 86.4-93.4% of the deaths seen each year (overall 90.3%).

Table 26. Occurrence of heroin abuse related deaths in Hong Kong Island.

Districts*	1994		1995		1996		1997		1998	
	Number	%*	Number	%*	Number	%*	Number	%*	Number	%*
Aberdeen	11	8.5	1	0.8	13	5.8	10	4.3	7	3.5
Cheung Chau	1	0.8	1	0.8	1	0.4	1	0.4	1	0.5
Central	-	-	-	-	1	0.4	-	-	-	-
Chai Wan	5	3.8	3	2.9	7	3.1	4	1.7	4	2.0
Happy Valley	-	-	-	-	1	0.4	1	0.4	3	1.5
Lamma Island	-	-	-	-	1	0.4	-	-	-	-
North Point	-	-	2	1.6	1	0.4	1	0.4	1	0.5
Shau Kei Wan	-	-	1	0.8	-	-	5	2.2	7	3.5
Wan Chai	-	-	4	3.2	5	2.2	7	3.0	4	2.0
Waterfront	-	-			-	-	-	-	1	0.5
Western	4	3.1	1	0.8	6	2.7	3	1.3	3	1.5
Total	22	16.9	13	10.9	36	16.1	32	13.8	31	15.7

*Expressed as % of the totals for 1994 (n=130), 1995 (n=125), 1996 (n=223), 1997 (n=232) and 1998 (n=198).

Table 27. Occurrence of heroin abuse related deaths in Kowloon.

Districts	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Cheung Sha Wan	6	4.6	3	2.4	14	6.3	10	4.3	5	2.5
Homantin	1	0.8	-		3	1.3	1	0.4	-	-
Hunghom	3	2.3	1	0.8	1	0.4	3	1.3	2	1.0
Kowloon City	5	3.8	-	-	5	2.2	-	-	2	1.0
Kung Tong	4	3.1	5	4.0	15	6.7	13	5.6	8	4.0
Mongkok	4	3.1	6	4.8	12	5.4	8	3.4	10	5.1
Ngau Tau Kok	4	3.1	-	-	5	2.2	7	3.0	4	2.0
Sai Kung	-	-	-	-	-	-	1	0.4	-	-
Sau Mau Ping	7	5.4	9	7.2	13	5.8	20	8.6	14	7.1
Sham Shui Po	8	6.2	6	4.8	10	4.5	8	3.4	10	5.1
Shek Kip Mei	3	2.3	6	4.8	7	3.1	15	6.5	12	6.1
Tseung Kwan O	-	-	-	-	1	0.4	1	0.4	1	0.5
Tsim Sha Tsui	2	1.5	-	-	3	1.3	5	2.2	5	2.5
Tsz Wan Shan	-	-	-	-	8	3.6	5	2.2	8	4.0
Wong Tai Sin	11	8.5	6	4.8	8	3.6	20	8.6	12	6.1
Yau Ma Tei	9	6.9	13	10.4	17	7.6	18	7.8	10	5.1
Total	67	51.5	55	44.0	122	54.7	135	58.2	103	52.0

*Expressed as % of the totals for 1994 (n=130), 1995 (n=125), 1996 (n=223), 1997 (n=232) and 1998 (n=198).

Table 28. Occurrence of heroin abuse related deaths in the New Territories.

Districts	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Castle Peak	3	2.3	2	1.6	1	0.4	3	1.3	1	0.5
Kwai Ching	11	8.5	9	7.2	7	3.1	3	1.3	5	2.5
Lau Fu Shan	1	0.8	1	0.8	1	0.4	1	0.4	1	0.5
Lei Muk Shu	5	3.8	9	7.2	3	1.3	5	2.2	2	1.0
Lok Ma Chau	-	-	1	0.8	-	-	1	0.4	-	-
Ma On Shan	-	-	-	-	1	0.4	1	0.4	2	1.0
Pat Heung	-	-	1	0.8	4	1.8	2	0.9	3	1.5
Shatin	1	0.8	-	-	2	0.9	2	0.9	2	1.0
Sheng Shui	1	0.8	5	4.0	4	1.8	5	2.2	5	2.5
Siu Lei Yuen	-	-	1	0.8	1	0.4	2	0.9	2	1.0
Ta Kwu Leng	1	0.8	-	-	-	-	-	-	-	-
Tai Hing	3	2.3	1	0.8	2	0.9	4	1.7	10	5.1
Tai Po	1	0.8	-	-	3	1.3	6	2.6	6	3.0
Tin Shui Wai	-	-	-	-	3	1.3	2	0.9	3	1.5
Tin Sum	-	-	3	2.4	2	0.9	3	1.3	3	1.5
Tsing Yi	-	-	2	1.6	4	1.8	4	1.7	-	-
Tsuen Wan	5	3.8	10	8.0	12	5.4	9	3.9	9	4.5
Tuen Mun	4	3.1	8	6.4	4	1.8	6	2.6	3	1.5
Yuen Long	5	3.8	4	3.2	11	4.9	6	2.6	7	3.5
Total	41	31.5	57	45.6	65	29.1	65	28.0	64	32.3

*Expressed as % of the totals for 1994 (n=130), 1995 (n=125), 1996 (n=223), 1997 (n=232) and 1998 (n=198).

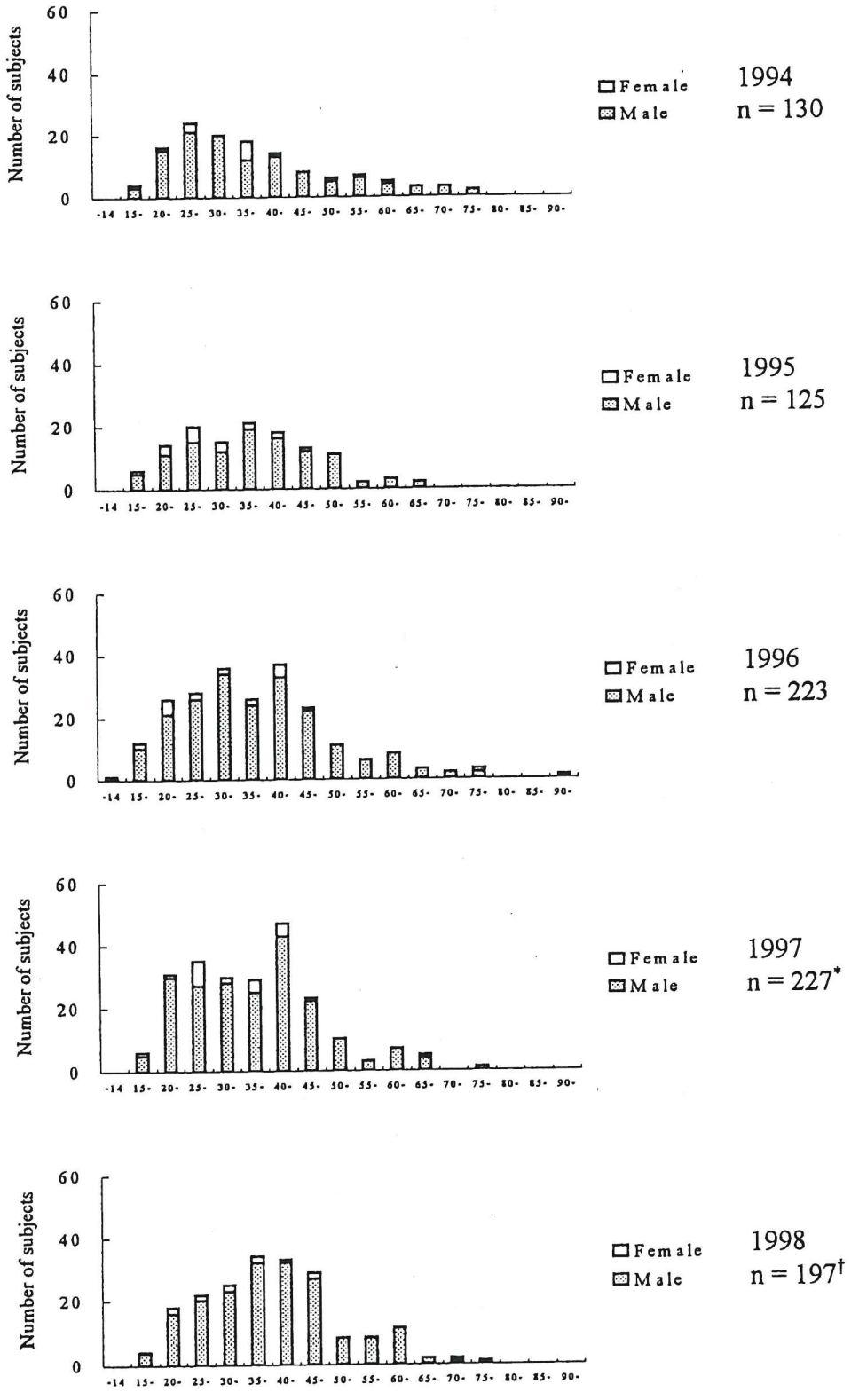

Figure 10. Sex and age distributions of 902 subjects who died from heroin abuse. (Excluding *5 and †1 subjects of uncertain age.)

Table 29. Sex and age distributions of 908 subjects who died from heroin abuse.

Age Group	1994			1995			1996			1997			1998		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
< 15	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
15 – 19	3	1	4	5	1	6	10	2	12	5	1	6	4	-	4
20 – 24	15	1	16	11	3	14	21	5	26	30	1	31	16	2	18
25 – 29	21	3	24	15	5	20	26	2	28	27	8	35	20	2	22
30 – 34	20	-	20	12	3	15	34	2	36	28	2	30	23	2	25
35 – 39	12	6	18	19	2	21	24	2	26	25	4	29	32	2	34
40 – 44	13	1	14	16	2	18	33	4	37	43	4	47	32	1	33
45 – 49	8	-	8	12	1	13	22	1	23	22	1	23	27	2	29
50 – 54	5	1	6	11	-	11	11	-	11	10	-	10	8	-	8
55 – 59	6	1	7	2	-	2	6	-	6	3	-	3	8	-	8
60 – 64	4	1	5	3	-	3	8	-	8	7	-	7	11	-	11
65 – 69	3	-	3	2	-	2	3	-	3	4	1	5	2	-	2
70 – 74	3	-	3	-	-	-	2	-	2	-	-	-	1	1	2
75 – 79	2	-	2	-	-	-	2	1	3	1	-	1	1	-	1
90 – 94	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-
< 21	*7*	*1*	*8*	*7*	*2*	*9*	*15*	*5*	*20*	*8*	*1*	*9*	*6*	-	*6*
21 or over	*108*	*14*	*122*	*101*	*15*	*116*	*188*	*15*	*203*	*201*	*22*	*223*	*179*	*13*	*192*
Total	115	15	130	108	17	125	203	20	223	209*	23†	232*†	185	13‡	198‡

Including *4 males (est. age 30-50, 40-50, 40-60 and 50-70 y) and †1 female (est. age 50-80 y); Including ‡1 female (est. age 30-60 y).

As can be seen in Figure 10, the age distributions of subjects who died from heroin abuse were skewed towards the younger age groups. In 1994, subjects aged 25-29 years were most commonly involved. In 1995 and 1998, subjects aged 35-39 years were most commonly involved. In 1996 and 1997, subjects aged 40-44 years were most commonly involved.

Overall, subjects who died from heroin abuse were predominantly aged between 20-54 years accounting for 81.5-90.1% of the cases seen each year (average 86.3%). Subjects between the age of 25-49 years accounted for 64.6-72.7% of the cases (average 69.5%).

During this 5-year period, the youngest subject who died from heroin abuse was a 14-year-old girl. The proportion of subjects aged <21 years increased from 6.2% in 1994 to 7.2% in 1995 and 9.0% in 1996, but then decreased to 3.9% in 1997 and 3.0% in 1998 (Table 29).

4.3.2 Sex and age specific incidence

The sex and age specific incidence of heroin-related deaths among males and females of all ages is shown in Table 30. The incidence was calculated by dividing the number of deaths by the number of subjects in that age group in the general population. The incidence was expressed per 100,000 population. The number of males and females in each age group of the general population was based on the mid-year figures provided by the Census & Statistics Department.

The highest incidence of deaths due to heroin abuse among subjects of all ages was seen in 1996 (3.97 per 100,000) and 1997 (3.75 per 100,000). These figures were almost twice those of 1994 and 1995 (2.18 and 2.16 per 100,000). The number of heroin-related deaths then decreased in 1998 (2.95 per 100,000).

Table 30. Sex and age specific incidence (per 100,000 population) of heroin-related deaths.

Age Groups	1994			1995			1996			1997			1998		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
10 – 14	-	-	-	-	-	-	-	0.48	0.23	-	-	-	-	-	-
15 – 19	1.43	0.52	0.99	2.29	0.49	1.42	4.56	0.97	2.83	2.22	0.47	1.37	1.77	-	0.91
20 – 24	6.44	0.41	3.36	4.90	1.33	3.11	9.14	2.16	5.63	12.84	0.42	6.60	6.83	0.82	3.77
25 – 29	7.80	1.04	4.30	5.97	1.74	3.71	10.46	0.70	5.25	10.83	2.89	6.65	7.82	0.71	4.09
30 – 34	6.07	-	3.02	3.84	0.88	2.27	10.98	0.58	5.50	9.05	0.59	4.63	7.45	0.59	3.86
35 – 39	3.77	1.99	2.91	5.99	0.63	3.30	7.26	0.60	3.92	7.22	1.16	4.20	8.87	0.56	4.72
40 – 44	5.00	0.43	2.84	6.19	0.81	3.55	12.13	1.51	6.89	14.52	1.41	8.11	9.95	0.33	5.26
45 – 49	4.05	-	2.21	5.65	0.54	3.26	9.50	0.48	5.24	8.74	0.44	4.80	10.16	0.83	5.71
50 – 54	3.74	0.96	2.52	8.25	-	4.57	7.66	-	4.22	6.09	-	3.35	4.24	-	2.32
55 – 59	4.28	0.86	2.72	1.45	-	0.78	4.37	-	2.36	2.05	-	1.17	5.73	-	3.16
60 – 64	3.10	0.86	2.03	2.27	-	1.18	5.92	-	3.09	5.01	-	2.64	7.78	-	4.12
65 – 69	2.86	-	1.43	1.83	-	0.90	2.64	-	1.31	3.31	0.83	2.07	1.61	-	0.81
70 – 74	4.21	-	1.95	-	-	-	2.48	-	1.15	-	-	-	1.09	0.98	1.03
75 – 79	4.46	-	1.92	-	-	-	3.92	1.52	2.56	1.82	-	0.80	1.73	-	0.76
< 21	*0.80*	*0.12*	*0.47*	*0.80*	*0.24*	*0.53*	*1.67*	*0.60*	*1.15*	*0.89*	*0.12*	*0.52*	*0.67*	-	*0.35*
21 or over	*4.99*	*0.64*	*2.81*	*4.58*	*0.67*	*2.60*	*7.99*	*0.63*	*4.28*	*8.46*	*0.90*	*4.62*	*7.47*	*0.52*	*3.90*
Total	3.76	0.52	2.18	3.69	0.60	2.16	7.00*	0.74	3.97*	6.66	0.75	3.75	5.49	0.36	2.95

*Excluding a 91-year-old male because the number of subjects in this age group in the general population is not known.

During 1994-1998, the incidence of heroin-related deaths was much higher among males of all ages than females (3.69-7.00 vs 0.36-0.75 per 100,000).

Between 1994-1995 and 1996-1997, heroin-related deaths among males were more common especially in subjects aged 20-49 years.

Heroin-related deaths were most common (incidence >7.5 per 100,000) among males aged 25-29 years (7.90 per 100,000) in 1994, males aged 50-54 years (8.25 per 100,000) in 1995, males aged 20-34 years (9.14-10.98 per 100,000) and 40-54 years (7.66-12.13 per 100,000) in 1996, males aged 20-34 years (9.05-12.84 per 100,000) and 40-49 years (8.74-14.52 per 100,000) in 1997 and males aged 25-29 (7.82 per 100,000), 35-49 years (8.87-10.16 per 100,000) and 60-64 years (7.78 per 100,000) in 1998.

4.4 Subject Characteristics

Much of this information has been presented in Sub-Section 3.5 together with that of other drug abusers. Only information for the whole of Hong Kong is presented here.

4.4.1 Ethnicity

The great majority of the subjects who died from heroin abuse were Chinese. They accounted for 97.7% of cases in 1994, 97.6% of cases in 1995, 97.3% of cases in 1996, 94.8% of cases in 1997 and 92.9% of cases in 1998 (overall 95.8%). Overall, other Asians accounted for 2.2% of cases. Europeans accounted for 1.7% of cases.

4.4.2 Marital status

Data about marital status was available in 875 (96.4%) subjects. The proportion of subjects being single, married or divorced/separated was very similar in 1994 (65.8%, 22.5% and 11.7%), 1996 (67.7%, 20.2% and 12.1%) and 1997 (68.0%, 21.6% and 10.4%). The figures were slightly different in 1995 (74.4%, 16.8% and 8.8%) and 1998 (54.1%, 25.4% and 20.5%).

It can therefore be concluded that most (54-74%) of the subjects who died from heroin abuse were single.

4.4.3 Family background

Information in this regard was available in 884 (97.4%) subjects. Overall, the family background was unremarkable in 36.8% of cases.

About 30.0% of subjects run away from or had been expelled from their families. Others had no relatives (8.7%) or their wives/children were in Mainland China (3.7%). Others (7.6%) either had no parents or came from single parent families.

4.5 Social Background, Family Support and Financial Status

Much of this information has been presented in Sub-Section 3.5 together with that of other drug abusers.

4.5.1 Family and social support at home

Such information was available in 867 (95.5%) subjects. Most of the subjects (65.9%) were living with their families or friends and 31.0% were living alone. The remaining 3.1% of subjects were institutionalised

4.5.2 Types of residence

Information about the types of residence was available in 892 (98.2%) subjects. The great majority of subjects lived in public housing estates (58.5%) or private properties (11.8%). Other subjects lived in rented rooms (6.4%), village huts (4.7%), caged flats (3.5%) or squatters (1.1%). The remaining subjects were street sleepers (6.7%) or had no fixed address (6.5%).

4.5.3 Education levels

Information about education level was available in 232 (25.6%) subjects. The proportion of subjects having an education level of primary school standard or below or secondary school standard or below was very similar in 1994 (30.0% and 70.0%), 1995 (32.1% and 64.3%), 1996 (30.2% and 67.9%), 1997 (33.3% and 66.7%) and 1998 (32.4% and 66.2%). Only 1.4-3.6% of subjects in 1995, 1996 and 1998 had an education level of university standard.

In brief, among the subjects who died from heroin abuse, approximately one-third had education levels of primary school or below and two-thirds had education levels of secondary school or below.

4.5.4 Employment status

Information about the employment status and the social class was available in 884 (97.4%) of subjects who died from heroin abuse during 1994-1998. Three subjects were students and five subjects were housewives. Eleven subjects had retired. There were 618 unemployed subjects. Eleven subjects worked as prostitutes.

Six subjects were business owners. Fifty-three subjects were casual workers. One hundred and eighty subjects (20.4%) were working as construction/decoration

workers (5.5%), transport workers/drivers (3.8%), restaurant workers (2.4%), factory workers (1.6%), cleaners (1.1%), managers/administrators (0.8%), restaurant workers (0.8%), sales (0.8%), restaurant workers (0.8%), public relation workers (0.6%), office worker (0.1%), professional (0.1%) or other workers (3.2%).

In this survey, unemployed subjects accounted for 69.9% of the cases. The % was even higher (72.4%) if the students, housewives, retired persons and prostitutes were excluded.

The proportion of subjects being unemployed, before and after the exclusion of the students, housewives, retired persons and prostitutes, was 63.6% and 67.6%. The corresponding figures from 1995 (74.4% and 78.8%), 1996 (69.1% and 71.3%), 1997 (72.6% and 74.5%) and 1998 (68.8% and 69.8%) were slightly higher.

4.5.5 Financial status

Crude information about the financial status was available in 643 (70.8%) subjects. Apparently, 55.8% of subjects had no financial problems. The remaining subjects either received public assistance (30.8%) or had financial problems (13.4%).

Overall, the proportion of subjects who had financial problems or received public assistance varied considerably between 1994 (10.8% and 19.4%), 1995 (15.8% and 28.9%), 1996 (15.9% and 20.6%), 1997 (14.7% and 22.8%) and 1998 (5.6% and 50.6%).

4.6 Health Status of Subjects and History of Drug Abuse

4.6.1 Health status

Information about the health conditions of the drug abusers was available in 884 (97.4%) subjects. Apparently, 70.6% of subjects were otherwise healthy.

Physical disability or injury with or without medical illnesses was seen in 2.7% of subjects. Minor or major psychiatric illnesses with or without medical illnesses or physical disability were seen in 4.9% of subjects. The remaining 21.8% of subjects had active or chronic medical conditions.

4.6.2 History of drug abuse

The great majority of subjects who died from heroin abuse during 1994-1998 either abused heroin only (68.3-83.3% annually, 76.5% overall) or heroin plus other agents (15.8-31.0% annually, 22.7% overall) (see Table 15). In the latter situation, benzodiazepines were used most often as the other drug of abuse.

4.7 Participation in Rehabilitation/Treatment Programmes

4.7.1 Rehabilitation programmes

Among the subjects who died from heroin abuse, information about previous participation in rehabilitation programmes was available in 630 (69.4%). These residential programmes were mostly offered by the Hei Ling Chau Addiction Treatment Centre, Shek Kwu Chau Addiction Treatment Centre and Chi Ma Wan Drug Addiction Treatment Centre.

The proportion of subjects participating in these rehabilitation programmes was as follows: 58/64 (90.6%) in 1994, 76/84 (90.5%) in 1995, 143/171 (83.6%) in 1996, 152/160 (95.0%) in 1997 and 139/151 (92.1%). The overall participation rate among these subjects during 1994-1998 was 90.2%.

Among the subjects who died from heroin abuse, the number of residential rehabilitation programmes each had participated in was known for only 192 (21.1%). The mean number of programmes attended per subject was 3.2 in 1994, 3.0 in 1995,

2.7 in 1996, 1.8 in 1997 and 4.1 in 1998. The overall average of the number of programmes attended per subject was 2.8 during 1994-1998. Most of these subjects had attended 1 (26.6%), 2 (26.6%) or 3 (22.4%) programmes. Two subjects in 1994 and 1998 had attended 20 programmes.

4.7.2 Methadone treatment programmes

Among subjects who died from heroin abuse, 883 (97.2%) were previously known to be drug abusers and information about whether or not they had previously participated in a methadone treatment programme was available for 392 (43.2%). The great majority (95.2%) of these 392 subjects had been treated with methadone before the fatal drug abuse episode (Table 31).

4.7.3 Rehabilitation programmes and methadone treatment programmes

Among the known drug abusers who died from heroin abuse, information about their participation in both residential rehabilitation programmes and methadone treatment programmes was available for 285 (Table 32). Overall, 88.8% of subjects had participated in both residential rehabilitation programmes and methadone treatment programmes and 9.8% of subjects had participated in one or other type of programme. Only 1.4% of subjects had not participated in any programme.

Table 31. Participation rates in methadone treatment programmes among 392 known drug abusers who died from heroin abuse.

		1994	1995	1996	1997	1998	Total
Hong Kong Island	Yes	8	2	14	16	21	61
	No	0	0	0	5	0	5
	Rate (%)	100.0	100.0	100.0	76.2	100.0	92.4
Kowloon	Yes	15	14	44	65	49	187
	No	0	0	0	0	0	0
	Rate (%)	100.0	100.0	100.0	100.0	100.0	100.0
New Territories	Yes	12	25	28	26	34	125
	No	1	0	0	12	1	14
	Rate (%)	92.3	100.0	100.0	68.4	97.1	89.9
Total	Yes	35	41	86	107	104	373
	No	1	0	0	17	1	19
	Rate (%)	97.2	100.0	100.0	86.3	99.0	95.2

Table 32. Participation rates (%) in rehabilitation/methadone treatment programmes among 285 known drug abusers who died from heroin abuse.

	1994	1995	1996	1997	1998	Total
Rehabilitation programmes only	1 (6.3)	0	0	11 (12.0)	0	12 (4.2)
Methadone treatment only	2 (12.5)	1 (3.8)	8 (11.3)	1 (1.1)	4 (5.0)	16 (5.6)
Both	13 (81.3)	25 (96.2)	63 (88.7)	76 (82.6)	76 (95.0)	253 (88.8)
None	0	0	0	4 (4.3)	0	4 (1.4)
Total	16 (100.0)	26 (100.0)	71 (100.0)	92 (100.0)	80 (100.0)	285 (100.0)

4.8 Determinants of the Incidence of Deaths Due to Heroin Abuse

We have considered several factors that could possibly determine the number of heroin abuse related deaths in Hong Kong during 1994-1998.

4.8.1 The number of heroin abusers

The large increase in the number of heroin abuse related deaths seen between 1994-1995 and 1996-1998 might or might not be related to an increased use of heroin by the drug abusers in the community. Hence, the annual number of heroin abuse related deaths during these periods was considered in relation to the number of heroin abusers newly and previously reported to the CRDA (Table 33).

Between 1995 and 1996-1998, the number of heroin abuse related deaths had increased by 52.3-78.5%. During these periods, the total number of heroin abusers known to the CRDA had decreased by 6.5-21.2% and the mortality rate among known drug abusers increased by 84-116% (Table 33).

Based on this information, it can be concluded that the large increase in the number of heroin abuse related deaths seen in Hong Kong during 1996-1998 was not be due to an increase in the number of known heroin abusers in the community.

4.8.2 The proportion of heroin abusers on methadone treatment

If the number and proportion of heroin abusers receiving methadone treatment decreased and the number and proportion of drug addicts abusing heroin "actively" had increased, there might be an increased number of heroin related deaths. Conversely, abstinence from heroin among heroin abusers should result in a decreased number of deaths.

Table 33. Number of heroin abuse related deaths in relation to the changes in the number of newly and previously reported abusers.

	1994	1995	1996	1997	1998
Number of heroin abuse related deaths	130	125	223	232	198
% change compared with 1994	-	-3.8	71.5	78.5	52.3
Number of newly reported heroin abusers*	3,192	2,092	1,887	1,476	1,248
% change compared with 1994	-	-34.5	-40.9	-53.8	-60.9
Number of previously reported heroin abusers*	14,033	13,921	14,219	12,808	12,320
% change compared with 1994	-	-0.8	1.3	-8.7	-12.2
Total number of known heroin abuser*	17,225	16,013	16,106	14,284	13,568
% change compared with 1994	-	-7.0	-6.5	-17.1	-21.2
Mortality rate among known heroin abusers (%)	0.75	0.78	1.38	1.62	1.46
% change compared with 1994	-	4	84	116	95

*Data from the CRDA.

Hence, the number of heroin abuse related deaths was considered in relation to the number of heroin abusers known to the CRDA, the number of heroin abusers known to the methadone treatment clinics and the average daily attendance at these clinics (Table 34). The average daily attendance at these clinics in relation to the total number of known heroin abusers provided an estimate of the proportion of heroin abusers abstaining from drug abuse.

Between 1994 and 1995-1998, there was a progressive increase (from 17.5% to 19.4-32.5%) in the proportion of CRDA cases who received methadone treatment (Table 34). During this period, there were no obvious changes in the proportion of methadone clinic cases receiving detoxification treatment (13.8 and 12.0-15.3%). Therefore, the large increase in the number of heroin abuse related deaths between 1994-1995 and 1996-1998 was not due to any increases in the number and proportion of drug addicts who abused heroin actively or any decreases in the number and proportion of drug addicts abstaining from drug abuse.

4.8.3 The purity of heroin

The risk of death from acute respiratory depression rises if there is an increase in the purity of heroin used for intravenous abuse. [Also see Sub-Section 4.8.6 about the possible relationship between heroin purity and the time interval between drug exposure and death.] The purity of heroin available to the drug addicts in the community may vary with time. Although a drug addict may be injecting himself with the usual amount of heroin powder, any unexpected increase in the purity of heroin may result in an unintentionally high dose and death. Hence, any possible relationship between the purity of heroin available in the community and the number of heroin abuse related deaths, was examined.

Table 34. Number of heroin abuse related deaths in relation to the changes in the number of heroin abusers known to the CRDA and the methadone treatment clinics.

	1994	1995	1996	1997	1998
Number of heroin abuse related deaths	130	125	223	232	198
% change compared with 1994	-	-3.8	71.5	78.5	52.3
Number of heroin abuser known to the CRDA	17,225	16,013	16,106	14,284	13,568
% change compared with 1994	-	-7.0	-6.5	-17.1	-21.2
Number of heroin abusers known to methadone clinics*	10,401	10,006	10,394	9,756	9,590
% change compared with 1994	-	-3.8	-0.1	-6.2	-7.8
Average daily attendance at methadone clinics*	6,401	7,002	7,157	6,914	6,691
% change compared with 1994	-	9.4	11.8	8.0	4.5
Rate of attendance among CRDA cases (%)†	37.2	43.7	44.4	48.4	49.3
% change compared with 1994	-	17.5	19.4	30.1	32.5
Rate of attendance among methadone clinic cases (%)‡	61.5	70.0	68.9	70.9	69.8
% change compared with 1994	-	13.8	12.0	15.3	13.5

*Data from the Department of Health.
Average daily attendance at methadone clinics divided by the total number of †CRDA and‡methadone clinic cases.

Data from the Controlled Drugs Section

We are most grateful to the Controlled Drugs Section of the Government Laboratory for providing us with the information about the purity of heroin seized by the Hong Kong Police Force and other law-enforcement agencies. Data for 1994-1998 are summarised here and in Figure 11 and Figure 12.

Two main groups of heroin – unadulterated (high purity) and adulterated (low purity) heroin were involved. The unadulterated heroin normally had purity of >70% while the low purity heroin ranged mainly from 10% to 70%.

The purity of heroin seized in 1995 continued to drop as only 8% of the items as compared with 40% in 1994 were in the range if 30-45%. In addition, there were 1,616 cases in 1995 as compared with 402 cases in 1994 where the concentration of heroin was <10%.

The purity distribution of heroin items seized in 1995 and 1996 was mainly between 5-10% and 20-25% (Figure 11). However, in 1997 and, particularly, 1998, there were far more items of much higher purity (>60-65%) (Figure 12).

When compared to the trend in the incidence of heroin abuse related deaths in the whole of Hong Kong (Figure 8), it is then obvious that the sudden increase in the large number of deaths occurred (in 1996) even before there was any major known increase (in 1997) in the purity of heroin available to the drug abusers (Figure 12). However, since the heroin abuse related deaths remained common (in 1997 and 1998) when the heroin in the community remained of high purity (in 1997 and 1998), the increase in purity of heroin could have, at least in part, contributed to the higher mortality from heroin abuse during 1997-1998.

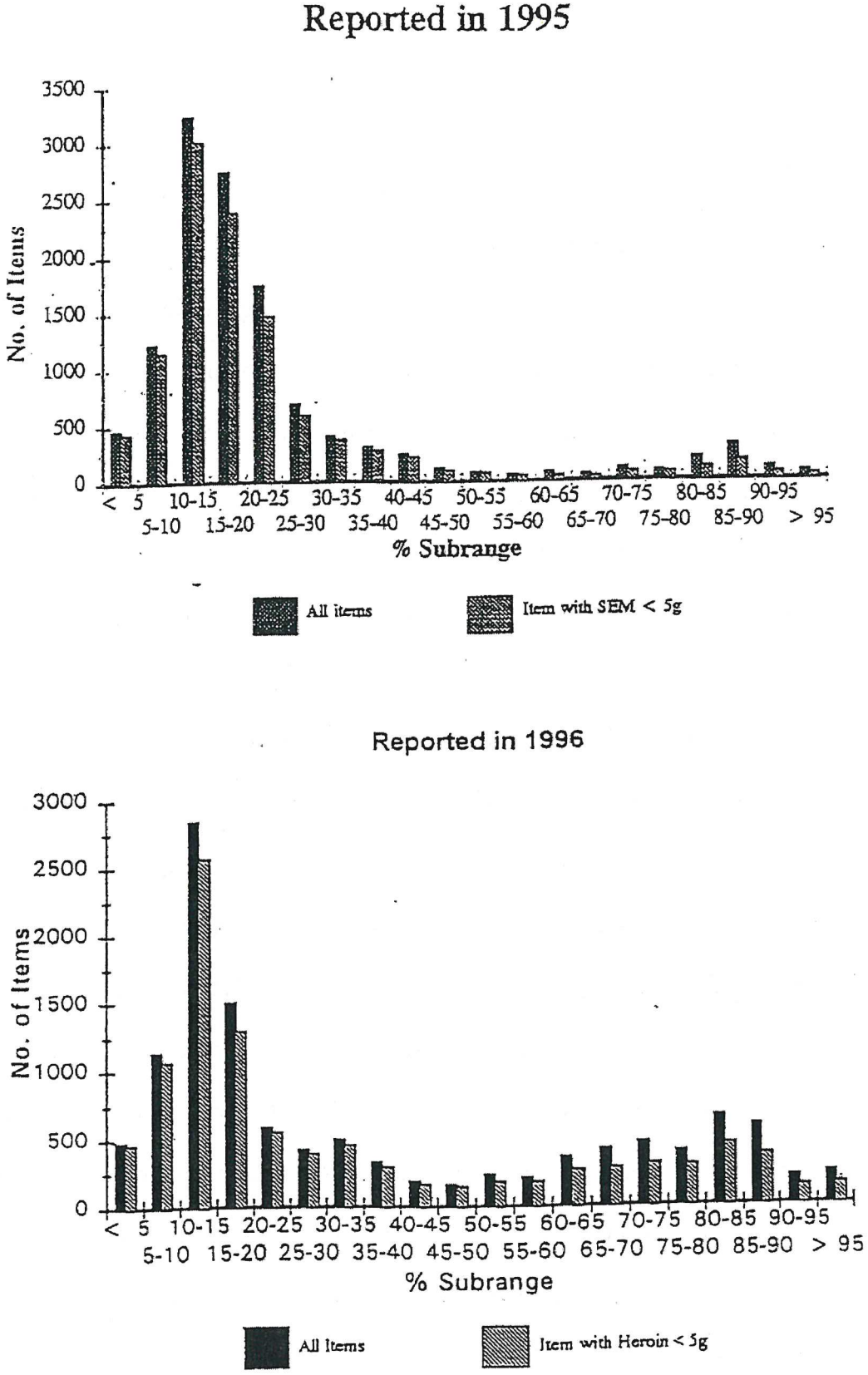

Figure 11. Purity distribution of heroin items in 1995 and 1996.
(Data from the Controlled Drugs Section, Government Laboratory.)

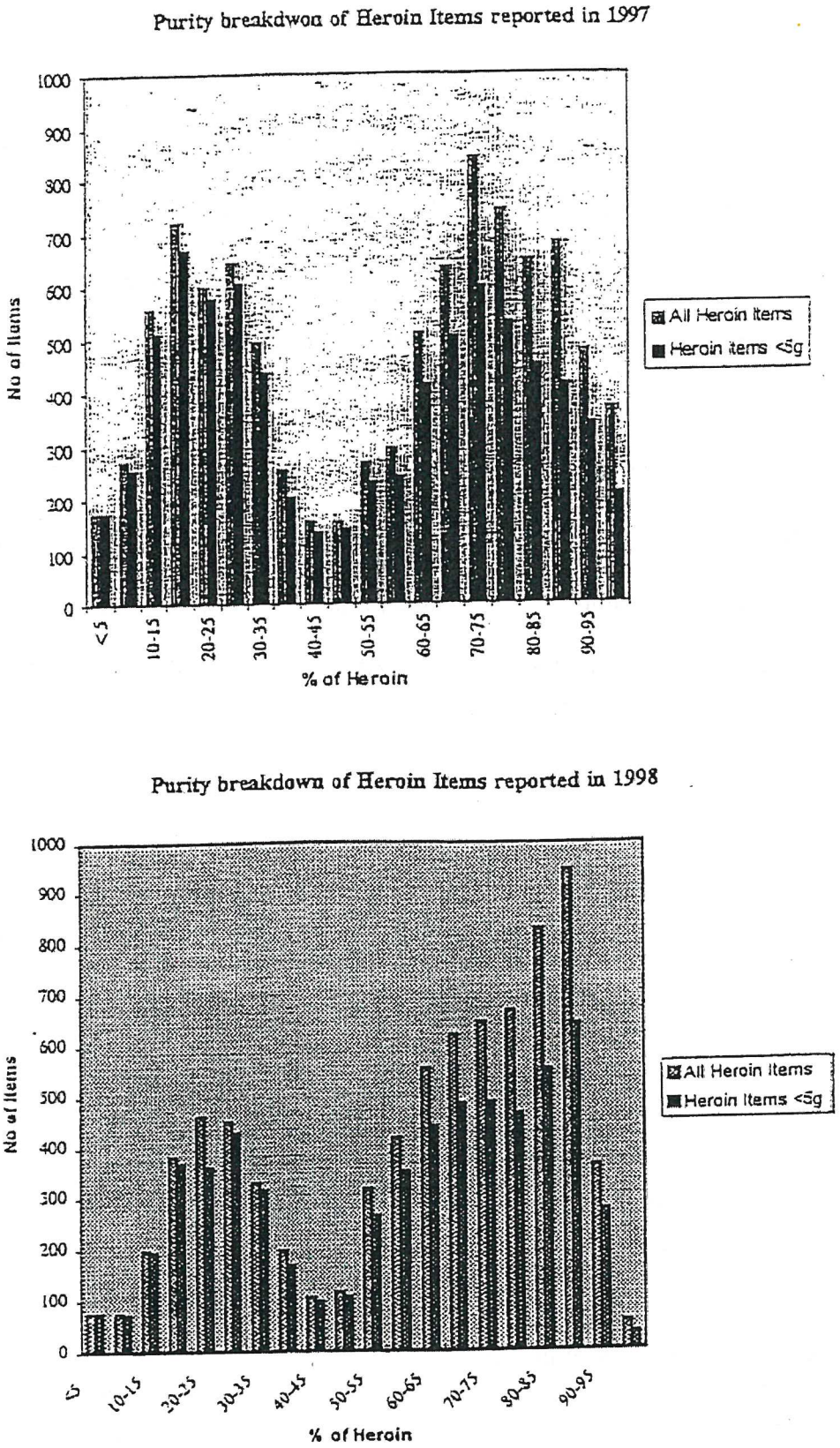

Figure 12. Purity distribution of heroin items in 1997 and 1998.
(Data from the Controlled Drugs Section, Government Laboratory.)

Data from heroin samples seized at the scenes of heroin abuse related deaths

If an unexpected increase in the purity of heroin used by the drug abusers was the most important reason for the large increase in the number of deaths during 1996-1998, heroin samples seized at the scene of the deaths should be of higher purity during 1996-1998 than in 1994. Hence, heroin samples obtained at the scenes of the death of 33 heroin abusers in 1994, 1996 and 1998 were studied (Table 33). Heroin samples were not available from heroin abuse related death cases in 1995 and 1997. The heroin samples seized in 1996 and 1998 appeared to be of higher purity than those in 1994. In fact, none of the samples in 1994 but 35% of the samples in 1996 and 65% of the samples in 1997 had purity of >60%. The increased availability of high purity heroin could have contributed to some of the deaths in 1996 and 1997.

Table 35. Subject characteristics and purity distribution of heroin samples seized at the scene of the death of 33 heroin abusers.

	1994	1996	1998
Subject characteristics			
Male:female ratio	9:1	12:2	9:0
Age (median and ranges) (years)	37 (22-56)	32 (19-44)	47 (37-62)
Distribution of purity of heroin			
<10%	-	7%	-
10-40%	80%	50%	22%
40-60%	20%	7%	22%
60-90%	-	21%	56%
>90%	-	14%	-

However, since deaths had occurred in some subjects after injection of very low purity heroin of <10%. Some other factors such as adulterants could also be important (see Sub-Section 4.8.5).

4.8.4 The amount of heroin injected

Apart from the purity of heroin (Sub-Section 4.8.3), the amount injected and the toxicity (due to, for example, the adulterants, Sub-Section 4.8.5) of the preparation could also determine the risk of death from acute respiratory depression and other causes. The amount of heroin injected could be higher if the heroin available to the drug abusers in the community was cheaper. Hence, the number of heroin abuse related deaths was considered in relation to the wholesale and retail prices of No. 4 heroin during 1994-1998 (Table 36).

Table 36. Wholesale and retail prices of No. 4 heroin.

	1994	1995	1996	1997	1998
Wholesale (HK$ per g)					
Range	80-200	164-250	171-289	120-250	
Average		-	-	162	149
Retail (HK$ per g)					
Range	270-460	307-463	335-474	376-463	
Average	348	363	409	419	427

Data from the Hong Kong Police Force.

These figures indicated that the retail prices of No. 4 heroin increased between 1994-1995 and 1996-1998 (Table 36). Therefore, price changes did not appear responsible for the heroin abusers possibly injecting themselves with greater amounts of heroin (see Sub-Section 4.5.5 about their financial status).

4.8.5 Concomitant use of other drugs and adulterants in heroin preparations

Heroin is often adulterated ('diluted') with one or more diluents, the most common of which are caffeine, paracetamol, chlorpheniramine, theophylline, antipyrine, and carbetapentane (Annual Reports of the Controlled Drugs Section, the Government Laboratory). Heroin abusers often also abused other drugs, especially benzodiazepines (Sub-Section 3.6.2). Addicts frequently abused midazolam together with low purity heroin in order to make up for any loss of effect of the latter (Annual Reports of the Controlled Drugs Section). To assess the importance of adulterants in heroin and the concomitant use of other drugs, the proportion of heroin abusers having other agents detected in their blood during 1994-1998 was studied (Table 37).

Table 37. Incidence of other agents detected in the blood of 908 subjects who died from heroin abuse.

	1994	1995	1996	1997	1998
Proportion	33/130	16/125	53/223	100/232	80/198
%	25.4	12.8	23.8	43.1	40.4

Between 1994-1995 and 1996-1998, there was a significant increase in the proportion of heroin abusers having other agents detected in their blood (49/255 vs 193/653 or 19.2 vs 35.7%, p=0.001). The types of agents involved are summarised in Table 38. Since these were mostly agents of abuse, the heroin abusers must have used other drugs concurrently. Benzodiazepines (especially midazolam) and alcohol were used most often, especially during 1996-1998.

Table 38. Other agents detected in the blood of 282 subjects who died from heroin abuse.

Agents	1994	1995	1996	1997	1998
Midazolam	13	8	17	39	26
Other benzodiazepines	2	1	7	2	9
Alcohol	9	4	11	30	16
Methadone	5	0	5	10	8
Other opiates	1	0	1	1	1
Amphetamines	0	1	3	1	6
Cocaine	0	0	0	0	3
Tricyclics/antipsychotics	0	0	3	8	5
Other hypnotics/sedatives	3	0	4	4	0
Other therapeutic drugs	2	1	2	5	6
Organic solvent	0	1	0	0	0
Total	35	16	53	100	80

Other agents were also detected, possibly reflecting the underlying psychiatric illnesses of heroin abusers (e.g. depression and psychosis) and the contamination of some heroin preparations by antihistamines and other drugs.

Among heroin abusers, the concomitant use of other central nervous system depressant agents such as benzodiazepines and alcohol would have increased the risk of acute respiratory depression due to heroin (see Sub-Section 4.8.6). The increased concurrent use of these agents (during 1996-1998) seemed to coincide with the increased number of heroin abuse related deaths (during 1996-1998), suggesting that this could be one factor influencing the annual mortality rate among heroin abusers. However, since benzodiazepines and alcohol were detected only in a small proportion of the fatal cases of heroin abuse during 1994-1995 (9.4 and 5.1%) and 1996-1998 (15.3 and 8.7%), the increased number of heroin abuse related deaths during 1996-1998 must be due to other factors.

4.8.6 The toxicity of heroin preparations

If the heroin preparations available to the drug abusers during 1996-1998 were of increased purity (Sub-Section 4.8.3), the amount of heroin injected was larger (Sub-Section 4.8.4) and benzodiazepines, alcohol and other central nervous system depressants were increasingly used, the time intervals recorded between drug exposure (heroin with or without other agents) and death may be shorter than that seen in 1994-1995. Therefore, we have determined if the time interval between drug exposure and death was different among the heroin abusers who died during 1994-1995 and 1996-1998 (Table 39). We were able to make such an estimate in 400 subjects.

Table 39. Estimated time interval between drug exposure and death in 400 heroin abusers.

	1994	1995	1996	1997	1998
Number of subjects	41	74	115	96	74
Estimated time interval (hours)					
Ranges	0.2 - 240.0	1.0 – 192.0	1.0 – 240.0	0.5 – 120.0	0.2 – 120
Medians	2.0	5.0	2.0	2.0	2.0
Means ± SD	9.9 ± 37.3	10.0 ± 22.8	9.5 ± 28.5	6.1 ± 14.9	8.1 ± 19.9

Among 285 subjects in 1996-1998, the median time interval was 2 hours; among 115 subjects in 1994-1995, the median time interval was 4 hours in 1994-1995; p=0.000 by Mann-Whitney Test.

The estimated time interval between drug exposure and death varied a lot among subjects, as indicated by the ranges (0.2-240.0 hours) and the SD (2.3-3.8 times of the means) (Table 39). The time interval between drug exposure and death was skewed, as indicated by a median of 2 hours in 1994 and 1996-1998 and 5 hours in 1995. Deaths had occurred within 10 minutes of drug exposure among some heroin abusers in 1994 and 1998.

Between 1994-1995 and 1996-1998, there were large increases in the number of deaths due to heroin abuse (from 125-130 to 198-232, see Sub-Section 4.1). The purity of heroin available to the drug abusers in the community increased slightly in 1996 but significantly in 1997 and 1998 (Sub-Section 4.8.3). The median interval between drug exposure and death decreased significantly from 4 hours in 1994-1995 to 2 hours in 1996-1998.

In other words, deaths from heroin abuse occurred much quicker after drug exposure in 1996-1998 than in 1994-1995. Possible explanations for this observation included the availability of more purified heroin (Sub-Section 4.8.3) and the increased use of central nervous system depressant agents (Sub-Section 4.8.5).

However, between 1994 and 1995 and between 1995 and 1996, the small decrease and increase in the purity of heroin (Sub-Section 4.8.3) could not explain the large increase (from 2 to 5 hours) and decrease (from 5 to 2 hours), respectively, in the median intervals between drug exposure and death. The large increase in the purity of heroin between 1994-1995 and 1997-1998 could explain the large decrease (from 4 to 2 hours) in the median time interval between drug exposure and death. Hence, the correlation between the annual mortality due to heroin abuse and the median interval between drug exposure and death was poor between 1994 and 1995 and between 1996 and 1997-1998. Some of the discrepancies in results could be in

part related to the difficulties and inaccuracies in estimating the time interval between drug exposure and death.

4.8.7 Knowledge of the toxicity of heroin

Only an interview, questionnaire or similar survey could have reliably assessed the subjects' knowledge of heroin toxicity. Such information was obviously not available retrospectively in the records of the deceased individuals studied.

Previously reported heroin abusers would most probably have learned about the acute (toxic) effects of heroin from their own experience and conversations with other abusers during methadone and other treatment programmes. In theory, the drug abusers who expose themselves to heroin for the first time (e.g. out of curiosity) might be at a higher risk of death from acute respiratory depression. These "newcomers" might have little understanding about the properties and toxicity of heroin. On the other hand, they may be more careful than experienced users who have become care free and careless. If the former were the case, there should be a disproportionately higher number of new abusers among the subjects who died from heroin abuse.

Among the subjects who died of heroin abuse during 1994-1998, we assumed that those without a history of previous drug abuse were more likely to have been exposed to heroin only recently (if not for the first time). The proportion of these subjects as compared with the proportion of newly reported heroin abusers known to the CRDA are shown in Table 40.

Table 40. Subjects who died from heroin abuse and heroin abusers in the CRDA in relation to the history of drug abuse.

	1994	1995	1996	1997	1998
Subjects who died from heroin abuse					
Not known to be a drug abuser	0	0	2	3	4
Known to be a drug abuser	125	125	221	223	189
Total	125	125	223	226	223
% of total without a history of drug abuse	0	0	0.9	1.3	1.8
Heroin abusers in the CRDA*					
Newly reported	3.192	2,092	1,887	1,476	1,248
Previously reported	14,033	13,921	14,219	12,808	12,320
Total	17,225	16,013	16,106	14,284	13,568
% of total being newly reported	18.5	13.1	11.7	10.3	9.2

*Data from the CRDA.

During 1994-1995, all subjects who died from heroin abuse were previously known to abuse drugs. During 1996-1998, subjects without a previous history of drug abuse only accounted for 0.9-1.8% of deaths related to heroin abuse. During 1994-1995, the proportion of heroin abusers being newly reported to the CRDA was 13.1-18.5%. The corresponding figure for 1996-1998 was 9.2-11.7%.

Hence, there was no evidence from this analysis that subjects who had begun abusing heroin recently were at a higher risk of death from acute heroin toxicity. Despite these subjects presumably having less knowledge of the dangers of heroin.

4.8.8 Other factors

The underlying medical illnesses of some heroin abusers could have altered their response to heroin and resulted in greater toxicity.

5 Deaths Due to Suicide by Self-Poisoning

In this survey, only cases of suicide using drugs or chemicals as the only or predominant of cause of death were included. Deaths caused by other means of self-harm such as hanging were not included.

5.1 Study Methodology

During the review of case files (see Sub-Section 3.1), information particularly relevant to subjects who committed suicide was also noted. This included the reason for committing suicide and any history of previous suicidal attempts. Whether the deceased had a history of drug abuse was also recorded since drug abusers with psychiatric illnesses may be at a higher risk of self-harm.

Based on the Coroner's verdict, the case history and the Forensic Toxicology findings, the drug or drug combinations responsible for the deaths were determined by the investigators. When multiple agents were involved, the most important one was identified.

5.2 Incidence of Deaths Due to Suicide by Self-poisoning

In comparison with drug abuse (see Section 3), self-poisoning with drugs or chemicals was much less important as a cause of drug-related deaths in Hong Kong. During 1994-1995, only 339 subjects died from suicide by self-poisoning.

5.2.1 Annual incidence

The number of deaths due to suicide by self-poisoning in Hong Kong Island, Kowloon and the New Territories during 1994-1998 is shown in Figure 13.

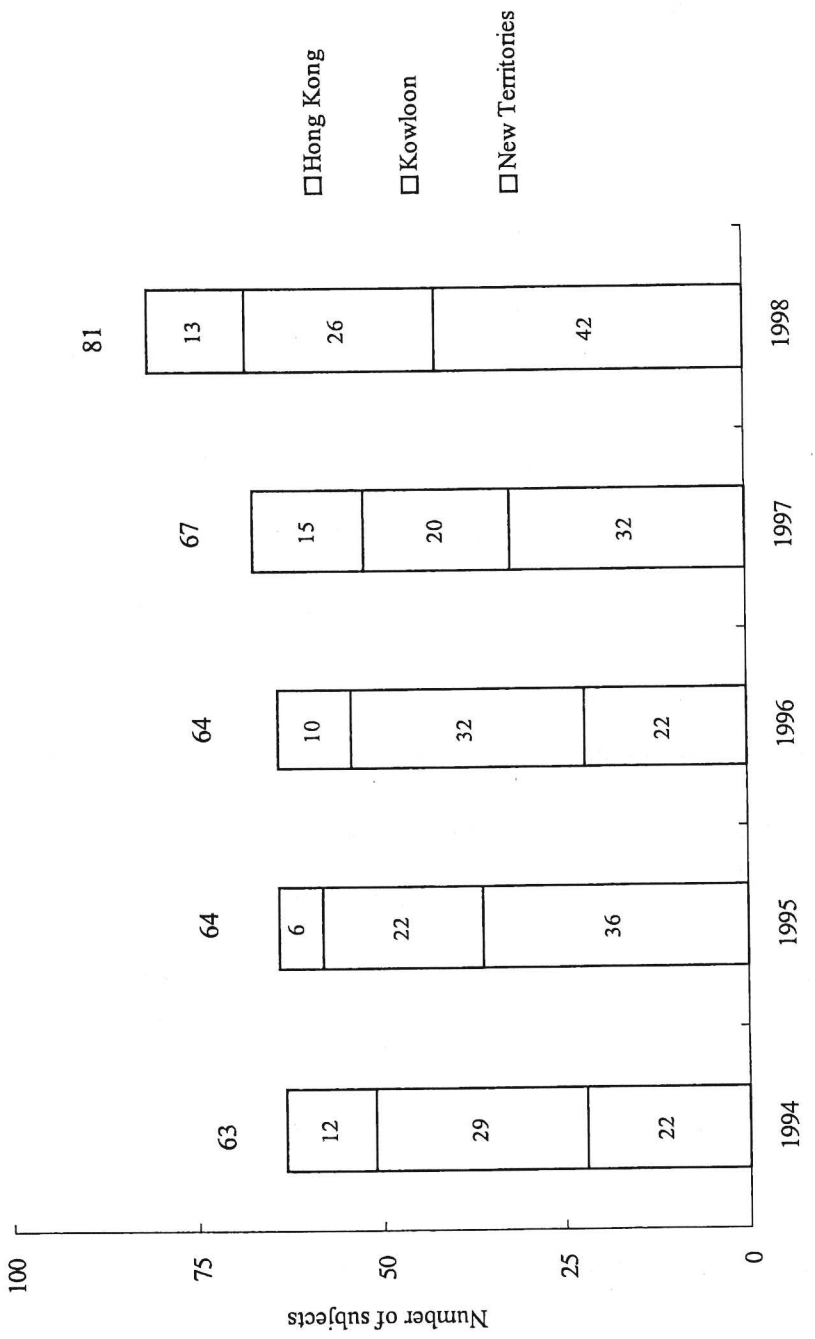

Figure 13. Deaths due to suicide by self-poisoning.

In the whole of Hong Kong, the number of deaths due to self-poisoning was almost unchanged during 1994-1997, with 63-67 deaths per year during 1994-1997. However, in 1998, there was a sudden increase in the number of deaths to 81.

Most of the deaths due to suicide by self-poisoning occurred in Kowloon (29.9-50.0%) and the New Territories (34.4-56.3%). Hong Kong Island accounted for 9.4-22.4% of cases.

5.2.2 Annual incidence in relation to population size

To find out if the regional variations in the incidence of deaths due to self-poisoning was in part related to the differences in population size between Hong Kong Island, Kowloon and the New Territories, the incidence per 100,000 general population was also calculated (Table 41).

After adjustment for the differences in population size, the incidence of deaths due to self-poisoning remained generally higher in Kowloon (0.97-1.59 per 100,000) and the New Territories (0.78-1.36 per 100,000) than in Hong Kong Island (0.46-1.03 per 100,000). There was no consistent trend for an increase or decrease in the number of deaths due to self-poisoning in different parts of Hong Kong.

In the whole of Hong Kong, the annual incidence of deaths due to suicide by self-poisoning was very similar between 1994 (1.08 per 100,000), 1995 (1.10 per 100,000), 1996 (1.02 per 100,000) and 1997 (1.03 per 100,000). The large increase in the number of deaths in 1998 (Figure 13) represented an increased incidence of self-poisoning in the community (1.21 per 100,000) as well as an increase in population size.

Table 41. The incidence (per 100,000 population) of deaths due to suicide by self-poisoning with drugs or chemicals.

		1994	1995	1996	1997	1998
Hong Kong Island	Number of deaths	12	6	10	15	13
	Population*	1,296,800	1,304,100	1,393,200	1,450,900	1,477,900
	Incidence	0.93	0.46	0.72	1.03	0.88
Kowloon	Number of deaths	29	22	32	20	26
	Population*	1,892,000	1,883,300	2,009,100	2,054,400	2,101,700
	Incidence	1.53	1.17	1.59	0.97	1.24
New Territories	Number of deaths	22	36	22	32	42
	Population*	2,600,400	2,639,300	2,831,400	2,978,000	3,090,500
	Incidence	0.85	1.36	0.78	1.07	1.36
Total	Number of deaths	63	64	64	67	81
	Population*	5,789,200	5,826,700	6,233,700	6,483,300	6,670,100
	Incidence	1.09	1.10	1.03	1.03	1.21

*Mid-year population estimates, Census & Statistics Department.

5.3 Subject Characteristics

5.3.1 Sex and age distributions

The sex and age distributions of subjects who died from self-poisoning in Hong Kong Island, Kowloon and the New Territories between 1994 and 1998 are shown in Table 42, Table 43, Figure 14, Figure 15 and Figure 16.

As can be seen in Table 42, males slightly outnumbered females throughout 1994-1997. During this period, males accounted for 55.6-59.7% of cases each year. In 1998, however, there were an almost equal proportion of males and females (49.5% vs 50.5%). During 1994-1998, males accounted for 55.5% of cases overall. In marked contrast, there was an obvious female predominance among subjects presenting to the PWH with parasuicide by self-poisoning (Sub-Section 2.4.3).

During 1994-1998, the medians and distributions of age of subjects who died from suicide by self-poisoning varied considerably across regions and from year to year (Table 43, Figure 14, Figure 15 and Figure 16). In general, subjects who died from self-poisoning were older than subjects who presented to the PWH with parasuicide (Sub-Section 2.4.3).

In Hong Kong Island, the number of subjects was too small to allow a conclusion to be drawn (Figure 14). In Kowloon, subjects aged ≥70 years were most commonly involved in 1996, but subjects aged 30-34 years were most commonly involved in 1998 (Figure 15). In the New Territories, subjects aged ≥70 years were commonly involved (Figure 16). In 1998, subjects aged 35-39 years were most commonly involved.

Table 42. Sex distributions of 339 subjects who died from suicide by self-poisoning with drugs or chemicals.

		1994	1995	1996	1997	1998	Total
Males	Hong Kong Island	7	5	7	10	6	35
	Kowloon	17	13	16	11	13	70
	New Territories	11	19	13	19	21	83
	Total	35	37	36	40	40	188
Females	Hong Kong Island	5	1	3	5	7	21
	Kowloon	12	9	16	9	13	59
	New Territories	11	17	9	13	21	71
	Total	28	27	28	27	41	151
Total		63	64	64	67	81	339

Table 43. Age distributions of 339 subjects who died from suicide by self-poisoning with drugs or chemicals.

		1994	1995	1996	1997	1998
Hong Kong Island	Number of subjects	12	6	10	15	13
	Medians (ranges)	32 (22-78)	55 (36-73)	39 (17-61)	44 (28-83)	44 (21-79)
	% < 21 years old	0	0	10	0	0
Kowloon	Number of subjects	29	22	32	20	26
	Medians (ranges)	43 (14-92)	39 (16-78)	58 (19-87)	40 (24-85)	34 (16-81)
	% <21 years old	6.9	4.5	3.1	0	3.8
New Territories	Number of subjects	22	36	22	32	42
	Medians (ranges)	54 (24-84)	50 (25-94)	41 (20-82)	45 (14-94)	42 (22-85)
	% <21 years old	0	0	4.5	3.1	0
Total	Number of subjects	63	64	64	67	81
	Medians (ranges)	42 (14-92)	47 (16-94)	46 (17-87)	44 (14-94)	38 (16-85)
	% <21 years old	3.1	1.6	4.7	1.5	1.2

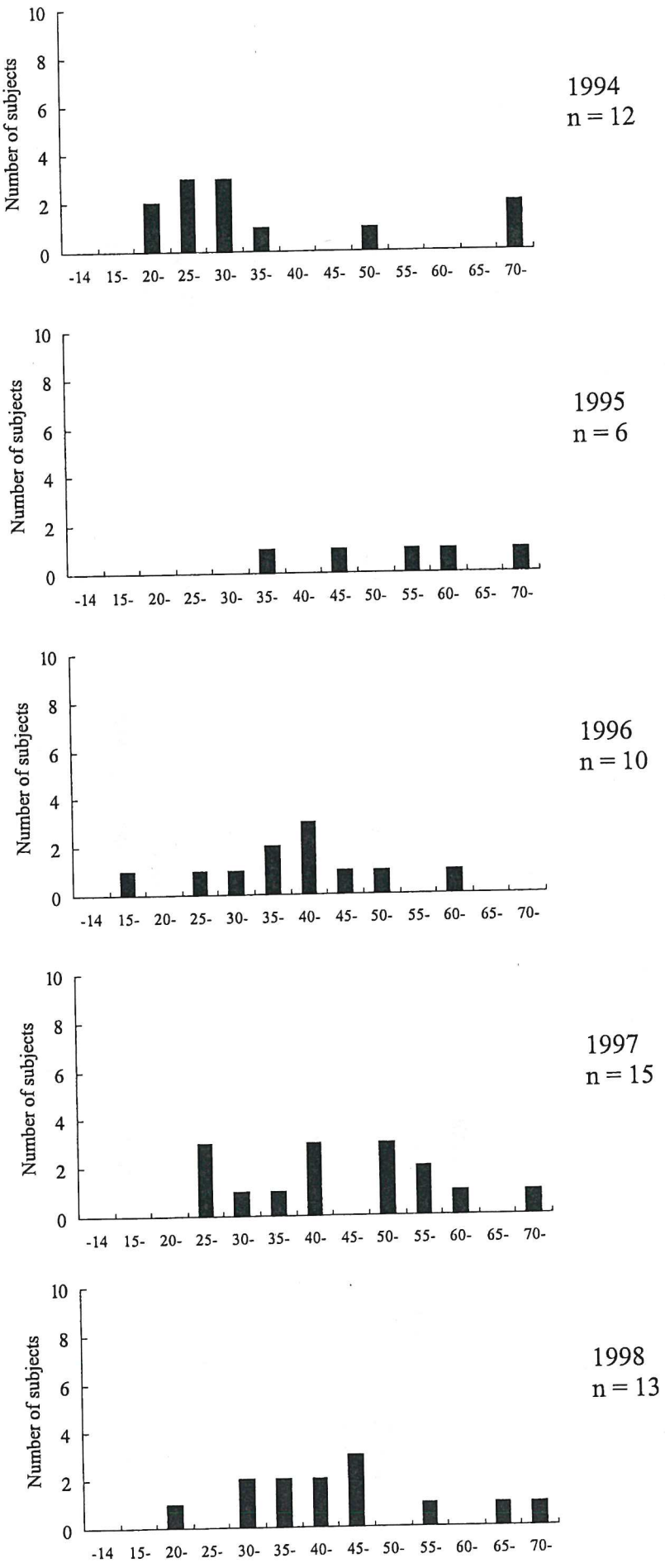

Figure 14. Age distributions of 56 subjects who died from suicide by self-poisoning in Hong Kong Island.

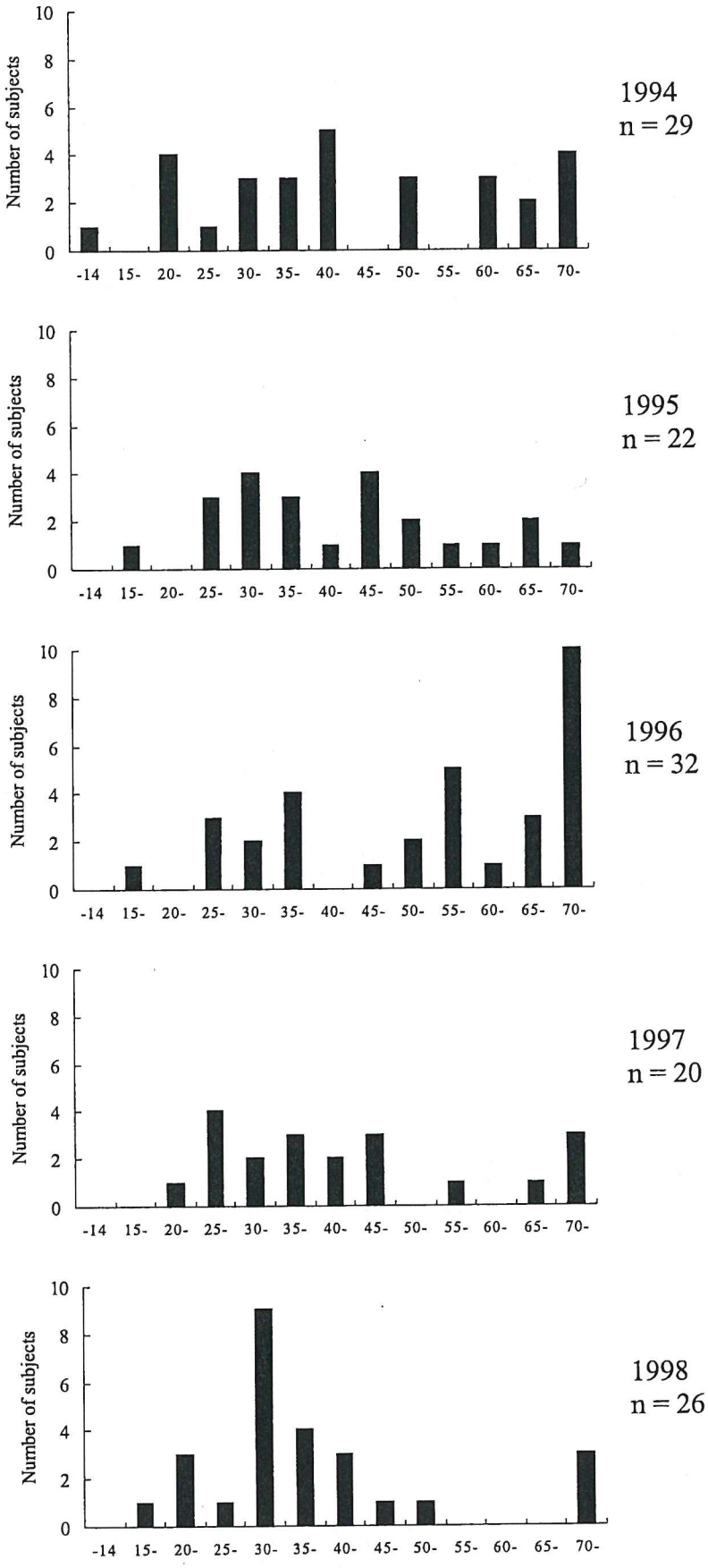

Figure 15. Age distributions of 129 subjects who died from suicide by self-poisoning in Kowloon.

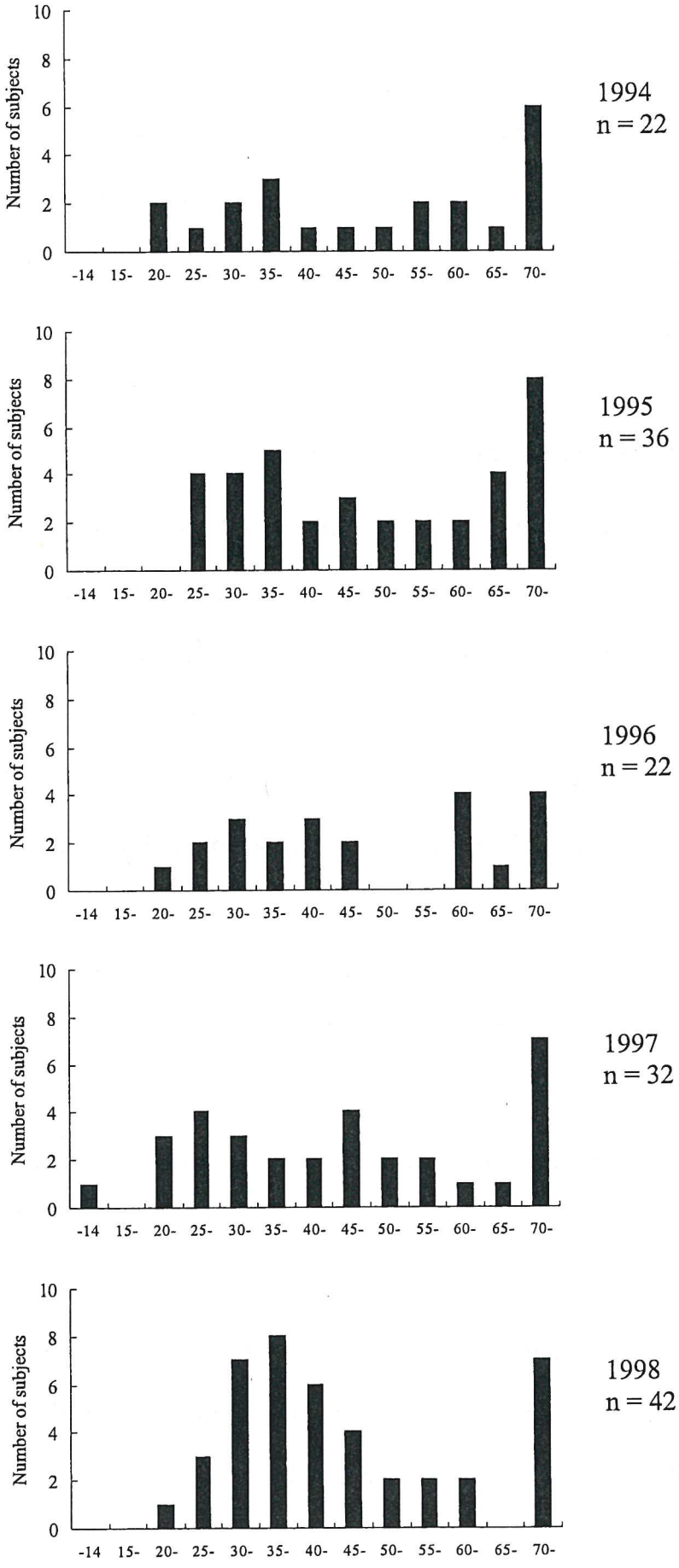

Figure 16. Age distributions of 154 subjects who died from suicide by self-poisoning in the New Territories.

5.3.2 Ethnicity

During 1994-1998, Chinese accounted for 92.9% of the cases of suicide by self-poisoning in Hong Kong Island, 96.1% of the cases in Kowloon and 99.4% of the cases in the New Territories. Overall, Chinese accounted for 97.1% of the cases in the whole of Hong Kong.

5.4 Drugs and Chemicals Causing Deaths

5.4.1 Single or multiple agents responsible for the deaths

In subjects with self-poisoning, several agents were often involved. Based on the case history and the Forensic Toxicology findings, the proportions of patients who died from single or multiple agents during 1994-1998 are shown in Figure 17.

Overall, a single agent was responsible for the deaths in 51.8% of cases in Hong Kong Island, 63.6% of cases in Kowloon and 77.6% of cases in the New Territories. Two agents were involved in 35.7% of cases in Hong Kong Island, 21.7% of cases in Kowloon and 15.6% of cases in the New Territories. In other words, the fatal cases from Hong Kong and Kowloon were more likely to involve a mixed drug overdose.

In 2 fatal cases in 1997 and 4 in 1998 no drugs were detected or no toxicology measurements were performed or the relevant data was unobtainable due to the degree of decomposition or measurements being performed too long after the drug exposure. In these subjects, a note indicating their intention to commit suicide had been left or the underlying reasons were otherwise known. In 1997, 2 males (aged 57-85 years) committed suicide by taking solid or liquid substances (E-cause E-950 and E-950.9).

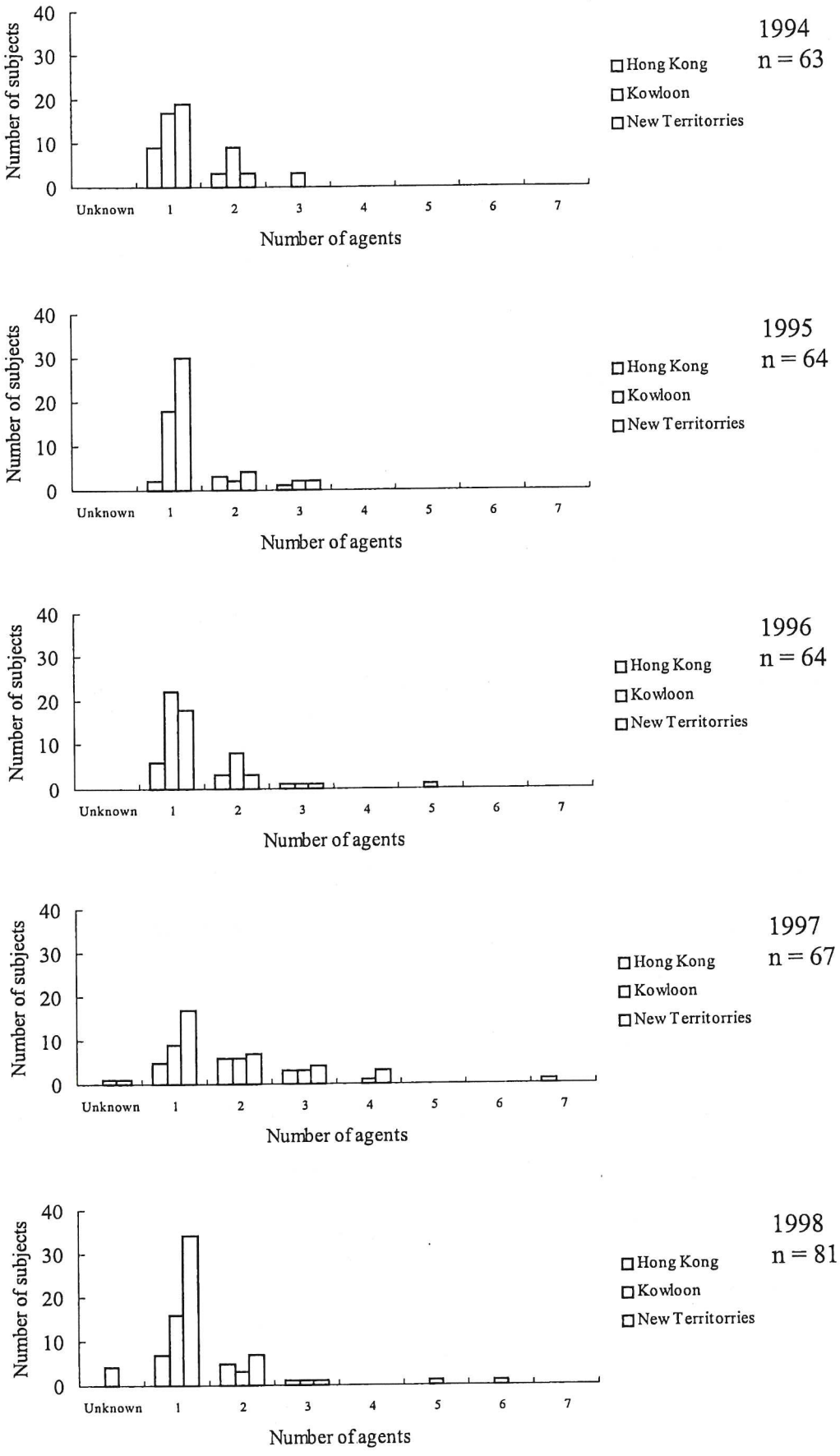

Figure 17. The number of agents contributing to the deaths of 339 individuals by self-poisoning.

In 1998, 3 males (aged 30-40 years) and 1 female (aged 37 years) committed suicide by exposing themselves to gases or vapours (E-952), tranquillisers (E-853.8) or solid or liquid substances (E-950 and E-950.5).

In order not to underestimate the size of the problem of fatal self-poisonings in Hong Kong, these 6 cases were included in this part of the analysis.

The types of agents and the frequency of mixed poisonings are shown in Sub-Section 5.4.3.

5.4.2 The main agents responsible for the deaths from self-poisoning

The main agents responsible for the deaths of 333 subjects from self-poisoning are shown in Table 44, Table 45, Table 46, Table 47, Table 48 and Table 49. Because of the vast amount of data involved, the subjects are grouped according to the nature of the agents involved, namely, drugs or substances of abuse (including benzodiazepines), other drugs (including non-benzodiazepines hypnotics and sedatives), household products, pesticides, gases and other chemicals. The 2 subjects from 1997 and 4 subjects from 1998 in whom Forensic Toxicology data were not available are not included here.

During 1994-1998, drugs or substances of abuse accounted for 4.9-23.4% (overall 11.8%) of subjects who died from suicides by self-poisoning (Table 44).

During 1994-1998, other drugs (therapeutic) were always the most commonly involved, accounting for 30.9-41.3% of cases (overall 34.8%) (Table 45). The most important drug classes were analgesics (5.3-10.9%, overall 8.6%), antidepressants (9.0-14.3%, overall 12.1%) and antipsychotics (1.2-9.5%, overall 5.3%).

Household products particularly "Dettol" (a household disinfectant containing chloroxylenol) accounted for 1.5-10.9% of cases (overall 6.5%) (Table 46).

Table 44. The main agents (drugs or substances of abuse) responsible for the deaths of 40 in-patients from self-poisoning.

	1994		1995		1996		1997		1998	
Agents	Number	%	Number	%	Number	%	Number	%	Number	%
Heroin	1	1.6	2	3.1	2	3.1	2	3.0	1	1.2
Other opiates*	-	-	3	4.7	4	6.3	1	1.5	1	1.2
Benzodiazepines	3	4.8	2	3.1	6	9.4	2	3.0	1	1.2
Cough medicine	-	-	-	-	-	-	1	1,5	-	-
Organic solvents	-	-	-	-	-	-	4	6.0	1	1.2
Alcohol	-	-	-	-	3	4.7	-	-	-	-
Total	4	6.3	7	10.9	15	23.4	10	14.9	4	4.9

n = 63 in 1994, n= 64 in 1995 and 1996, n = 67 in 1997 and n = 81 in 1998.
*Codeine, dihydrocodeine, dipanone and propoxyphene.

Table 45. The main agents (other drugs) responsible for the deaths of 118 subjects from self-poisoning.

Agents	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Analgesics*	5	7.9	4	6.3	7	10.9	6	9.0	7	8.6
Antihistamines	1	1.6	1	1.6	-	-	1	1.5	2	2.5
Lithium†	-	-	-	-	1	1.6	-	-	-	-
Tricyclics†	9	14.3	6	9.4	6	9.4	5	7.5	13	16.0
Tricyclic related†	-	-	-	-	-	-	1	1.5	-	-
Chlorpromazine‡	3	4.8	4	6.3	1	1.6	2	3.0	-	-
Clozapine‡	-	-	-	-	1	1.6	-	-	-	-
Haloperidol‡	-	-	1	1.6	1	1.6	-	-	1	1.2
Thioridazine‡	1	1.6	1	1.6	-	-	2	3.0	-	-
Non-benzodiaz hypnotics	-	-	1	1.6	1	1.6	2	3.0	1	1.2
Barbiturates	1	1.6	1	1.6	1	1.6	1	1.5	1	1.2
Other CNS drugs	3	4.8	1	1.6	-	-	1	1.5	-	-
Cardiac drugs	1	1.6	1	1.6	1	1.6	4	6.0	-	-
Respiratory drugs	1	1.6	-	-	-	-	1	1.5	-	-
Chloroquine	1	1.6	-	-	-	-	-	-	-	-
Total	26	41.3	21	32.8	20	31.3	26	38.3	25	30.9

n = 63 in 1994, n =64 in 1995 and 1996, n = 67 in 1997, n = 81 in 1998. †Antidepressants, ‡antipsychotics.
*Including "Dologesec" causing 3 deaths in 1994, 1 death in 1995, 5 deaths in 1996, 6 deaths in 1997 and 6 deaths in 1998.

Table 46. The main agents (household products) responsible for the deaths of 22 subjects from self-poisoning.

Agents	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Cleaning agent	1	1.6	-	-	-	-	-	-	-	-
Detergent	-	-	3	4.7	1	1.6	1	1.5	2	2.5
"Dettol"	3	4.8	3	4.7	6	9.4	-	-	2	2.5
Total	4	6.3	6	9.4	7	10.9	1	1.5	4	4.9

n = 63 in 1994, n = 64 in 1995 and 1996, n = 67 in 1997 and n = 81 in 1998.

Table 47. The main agents (pesticides) responsible for the deaths of 55 subjects from self-poisoning.

Agents	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Organophosphates	7	11.1	4	6.3	3	4.7	1	1.5	3	3.7
Carbamates	2	3.2	-	-	-	-	1	1.5	1	1.2
Endosulfan	-	-	1	1.6	2	3.1	-	-	-	-
Sulfotep	-	-	1	1.6	-	-	-	-	-	-
Paraquat	4	6.3	10	15.6	3	4.7	4	6.0	7	8.6
Unspecified	-	-	-	-	1	1.6	-	-	-	-
Total	13	20.6	16	25.0	9	14.1	6	9.0	11	13.6

n = 63 in 1994, n = 64 in 1995 and 1996, n = 67 in 1997 and n = 81 in 1998.

Table 48. The main agents (gases) responsible for the deaths of 73 subjects from self-poisoning.

Agents	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Carbon monoxide	7	11.1	7	10.9	7	10.9	17	25.4	30	37.0
Liquefied petroleum gas	4	6.3	1	1.6	-	-	-	-	-	-
Total	11	17.5	8	12.5	7	10.9	17	25.4	30	37.0

n = 63 in 1994, n = 64 in 1995 and 1996, n = 67 in 1997 and n = 81 in 1998.

Table 49. The main agents (other chemicals) responsible for the deaths of 25 subjects from self-poisoning.

Agents	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Acetone	-	-	-	-	-	-	1	1.5	-	-
Carbon tetrachloride	-	-	-	-	-	-	1	1.5	-	-
Cyanide	2	3.2	4	6.3	2	3.1	2	3.0	2	2.5
Potassium permanganate	1	1.6	-	-	-	-	-	-	-	-
Corrosives	2	3.2	2	3.1	4	6.3	1	1.5	1	1.2
Total	5	7.9	6	9.4	6	9.4	5	7.5	3	3.7

n = 63 in 1994, n= 64 in 1995 and 1996, n = 67 in 1997 and n = 81 in 1998.

Pesticides accounted for 9.0-25.0% of cases (overall 16.2%) (Table 47). Of these, paraquat (4.7-15.6%, overall 8.3%) and organophosphates (1.5-11.1%, overall 5.3%) were the most important.

Carbon monoxide and liquefied petroleum gas accounted for 10.9-37.0% of fatalities (overall 21.5%) (Table 48). In particular, carbon monoxide was an increasingly important cause of fatal self-poisoning. During 1994-1996, carbon monoxide accounted for 10.9-11.1% of cases, but by 1997 and 1998, it accounted for 25.4-37.0% of cases.

Corrosives, cyanide and other chemicals accounted for 3.7-9.4% of cases (overall 7.4%) (Table 49).

5.4.3 The main and other agents in subjects with fatal self-poisoning

The main and other agents responsible for the deaths of 333 subjects from suicide by self-poisoning are shown in Table 50, Table 51, Table 52, Table 53, Table 54 and Table 55. The 2 subjects from 1997 and 4 subjects from 1998 in whom Forensic Toxicology data were not available are not included here. The relative importance of mixed overdoses compared to single agent poisoning (Sub-Section 5.4.2) can be seen.

During 1994-1998, drugs or substances of abuse were involved in 25.9-61.2% (overall 36.9%) of subjects who died from self-poisonings (Table 50). The two most important agents were benzodiazepines (11.9-15.9%, overall 13.3%) and alcohol (3.1-19.4%, overall 8.6%).

Table 50. The main and other agents (drugs or substances of abuse) responsible for the deaths of subjects from self-poisoning.

Agents	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Heroin	2	3.2	3	4.7	2	3.1	2	3.0	1	1.2
Methadone	-	-	-	-	-	-	1	1.5	-	-
Other opiates	-	-	3	4.7	4	6.3	1	1.5	2	2.5
Amphetamines	-	-	-	-	-	-	2	3.0	-	-
Benzodiazepines	10	15.9	8	12.5	9	14.1	8	11.9	10	12.3
Cough medicine	-	-	1	1.6	-	-	1	1.5	-	-
Organic solvents	1	1.6	-	-	1	1.6	4	6.0	1	1.2
Alcohol	4	6.3	2	3.1	6	9.4	13	19.4	4	4.9
Total*	19	30.2	19	29.7	25	39.1	41	61.2	21	25.9

n = 63 in 1994, n = 64 in 1995 and 1996, n = 67 in 1997, n = 81 in 1998.
*Some subjects were exposed to more than one agent.

Table 51. The main and other agents (other drugs) responsible for the deaths of subjects from self-poisoning.

Agents	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Analgesics	6	9.5	5	7.8	9	14.1	12	17.9	8	11.9
Antihistamines	2	3.2	1	1.6	1	1.6	6	9.0	5	6.2
Citalopram*	-	-	-	-	-	-	-	-	1	1.2
Lithium*	-	-	-	-	1	1.6	-	-	-	-
Tricyclics*	9	14.3	14	21.9	10	15.6	7	10.4	15	18.5
Tricyclic related*	1	1.6	-	-	1	1.6	4	6.0	-	-
Chlorpromazine†	5	7.9	4	6.3	3	4.7	4	6.0	2	2.5
Clozapine†	-	-	-	-	1	1.6	-	-	-	-
Haloperidol†	-	-	1	1.6	1	1.6	-	-	1	1.2
Prochlorperazine†	-	-	-	-	-	-	1	1.5	-	-
Thioridazine†	1	1.6	1	1.6	-	-	2	3.0	-	-
Non-benzodia hypnotics	1	1.6	1	1.6	1	1.6	8	11.9	2	2.5
Barbiturates	1	1.6	1	1.6	2	3.1	1	1.5	1	1.2
Other CNS drugs	3	4.8	2	3.1	-	-	2	3.0	1	1.2
Cardiac drugs	1	1.6	1	1.6	1	1.6	4	6.0	1	1.2
Respiratory drugs	1	1.6	-	-	-	-	3	4.5	1	1.2
Chloroquine	1	1.6	-	-	-	-	-	-	-	-
Metoclopramide	-	-	-	-	1	1.6	-	-	-	-
Total‡	30	47.6	29	45.3	29	45.3	45	67.2	35	43.2

n = 63 in 1994, n = 64 in 1995 and 1996, n = 67 in 1997, n = 81 in 1998. *Antidepressants, †antipsychotics.
‡Some subjects were exposed to more than one agent.

Table 52. The main and other agents (household products) responsible for the deaths of subjects from self-poisoning.

Agents	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Cleaning agent	1	1.6	-	-	-	-	-	-	-	-
Detergent	-	-	3	4.7	1	1.6	1	1.5	2	2.5
"Dettol"	4	6.3	3	4.7	6	9.4	-	-	2	2.5
Total*	5	7.9	6	9.4	7	10.9	1	1.5	4	4.9

n = 63 in 1994, n = 64 in 1995 and 1996, n = 67 in 1997, n = 81 in 1998.
*Some subjects were exposed to more than one agent.

Table 53. The main and other agents (pesticides) responsible for the deaths of subjects from self-poisoning.

Agents	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Organophosphates	7	11.1	4	6.3	4	6.3	1	1.5	3	3.7
Carbamates	2	3.2	-	-	-	-	-	-	2	2.5
Pyrethrins	-	-	-	-	-	-	2	3.0	1	1.2
Endosulfan	-	-	1	1.6	2	3.1	-	-	-	-
Sulfotep	-	-	1	1.6	-	-	-	-	-	-
Bromodialone	1	1.6	-	-	-	-	-	-	-	-
Paraquat	4	6.3	10	15.6	3	4.7	4	6.0	7	8.6
Unspecified	-	-	-	-	1	1.6	-	-	-	-
Total	14	22.2	16	25.0	10	15.6	7	10.4	13	16.0

n = 63 in 1994, n = 64 in 1995 and 1996, n = 67 in 1997, n = 81 in 1998.
*Some subjects were exposed to more than one agent.

Table 54. The main and other agents (gases) responsible for the deaths of subjects from self-poisoning.

Agents	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Carbon monoxide	7	11.1	7	10.9	8	12.5	17	25.4	30	37.0
Liquefied petroleum gas	4	6.3	1	1.6	1	1.6	1	1.5	-	-
Total*	11	17.5	8	12.5	9	14.1	18	26.9	30	37.0

n = 63 in 1994, n = 64 in 1995 and 1996, n = 67 in 1997, n = 81 in 1998.
*Some subjects were exposed to more than one agent.

Table 55. The main and other agents (other chemicals) responsible for the deaths of subjects from self-poisoning.

Agents	1994		1995		1996		1997		1998	
	Number	%	Number	%	Number	%	Number	%	Number	%
Acetone/isopropyl alcohol	-	-	-		1	1.6	1	1.5	-	-
Carbon tetrachloride	-	-	-		-	-	1	1.5	-	-
Cyanide	2	3.2	4	6.3	2	3.1	2	3.0	2	2.5
Ethyl acetate	-	-	-	-	-	-	1	1.5	-	-
Potassium permanganate	1	1.6	-	-	-	-	-	-	-	-
Corrosives	2	3.2	2	3.1	5	7.8	1	1.5	1	1.2
Total*	5	7.9	6	9.4	8	12.5	6	9.0	3	3.7

n = 63 in 1994, n = 64 in 1995 and 1996, n = 67 in 1997, n = 81 in 1998.
*Some subjects were exposed to more than one agent.

As can be seen in Table 51, other drugs (therapeutic) were always the most commonly involved in subjects with self-poisoning, accounting for 43.2-67.2% of the cases (overall 49.6%). The most important drug classes were analgesics (7.8-17.9%, overall 11.8%), antidepressants (15.9-21.9%, overall 18.6%) and antipsychotics (3.7-9.5%, overall 8.0%).

Household products particularly "Dettol" (a household disinfectant containing chloroxylenol) were involved in 1.5-10.9% of cases (overall 6.5%) (Table 52).

Pesticides were involved in 10.4-25.0% of cases (overall 17.7%) (Table 53). Of these, paraquat (4.7-15.6%, overall 8.3%) and organophosphates (1.5-11.1%, overall 5.6%) were the most important.

Carbon monoxide and liquefied petroleum gas were involved in 12.5-37.0% of cases (overall, 22.4%) (Table 54). As already mentioned, there was a steady increase in fatalities involving carbon monoxide particularly during 1997-1998.

Other chemicals accounted for 3.7-12.5% of fatal cases (overall 8.3%) (Table 55).

5.5 Social Background, Family Support and Financial Status

5.5.1 Marital status

Data about the marital status was available in 335 (98.8%) subjects who died from suicide by self-poisoning. The proportion of subjects who were single, married or divorced/separated, respectively, varied between 1994 (37.7%, 50.8% and 11.5%), 1995 (26.6%, 59.4% and 14.1%), 1996 (26.6%, 64.1% and 9.4%), 1997 (30.8%, 49.2% and 20.0%) and 1998 (32.1%, 44.4% and 23.5%).

5.5.2 Employment status and occupations

Information about employment status and occupation was available for 335 (98.8%) subjects. During 1994-1998, 55 of the subjects who died from suicide by self-poisoning had retired and 3 were students. Sixty (17.9%) other subjects were housewives. Sixteen subjects were business owners. Ninety-seven (29.0%) subjects did not have a job.

The remaining 104 (31.2%) subjects were employed. Fifty subjects worked as an administrator/manager (n=7), a professional (n=4), a factory worker (n=15), an office worker (n=13), a restaurant worker (n=8), a cleaner (n=1) or a casual worker (n=2). Fifty-four subjects worked in the following sectors: retail (n=11), transport (n=10), public relations (n=2), construction/decoration (n=7) or others (n=24).

Among the subjects who died from self-poisoning (excluding students, subjects who had retired and the housewives), the unemployment rats varied considerably between 1994 (37.5%), 1995 (43.9%), 1996 (60.0%), 1997 (44.4%) and 1998 (37.8%).

Among the 335 subjects in whom the employment status was known, there was a sudden increase in the number and proportion of deaths involving the housewives between 1994-1997 (9-11 deaths per year, 13.4-17.2% of cases) and 1998 (21 deaths, 25.9% of cases).

5.5.3 Education levels

Information about education levels was available in 79 subjects. The proportion of subjects having an education level of primary school standard or below, secondary school standard or below or university standard was 15.2%, 63.3% and 21.5%, respectively.

5.5.4 Family and social support

Information about their family and social support was available in 324 (95.6%) subjects. Of these 324 subjects, 257 (79.3%) lived with their families or friends and 55 (17.0%) lived alone. The remaining 12 (3.7%) subjects were institutionalised.

5.5.5 Types of residence

Data about the types of residence was available for 334 (98.5%) subjects. The great majority of subjects lived in public housing estates (48.8%) or private properties (32.9%). Other subjects lived in village huts (14.1%) or rented rooms (3.6%). Two (0.6%) subjects were street sleepers.

5.5.6 Financial status

Crude information about financial status was available for 308 (90.9%) subjects. 75.3% of subjects appeared to have no financial problems. The remaining subjects either had financial problems (18.5%) or received public assistance (6.2%).

5.6 Health Status of Subjects and History of Drug Abuse

5.6.1 Health status

Information about their health status was available for 334 (98.5%) of the fatal suicide victims. 36.8% appeared to be previously healthy. The remaining subjects had a record of some active or chronic medical conditions (25.7%), minor or major mental illnesses with or without medical illness or physical disability (35.9%) or physical disability with or without medical illness (1.5%).

5.6.2 History of drug abuse

Information regarding a past history of drug abuse was available for 333 (98.2%) subjects. Only 25 (7.5%) subjects were previously known to abuse drugs. Seventeen of these 25 subjects were known to abuse heroin without or without other drugs.

5.7 Reasons for Committing Suicides and Previous Attempts

5.7.1 Reasons for committing suicides

Among the subjects who died from self-poisoning, underlying reasons for the suicides were recorded for 269 (79.4%) subjects.

The reasons for the subjects committing suicide included health problems (25.7%), psychiatric problems (17.8%), financial problems (13.4%), relationship problems with friends or family members (21.6%), problems at work (1.5%), bereavements (1.1%) and facing prosecution (0.4%).

5.7.2 Previous attempts

Information concerning a previous history of attempted suicide was available for 285 (84.1%) subjects. About one-third (34.7%) were known to have previously attempted suicides.

5.8 Suicidal Deaths Due to Heroin Overdose

Among the 339 subjects who died from suicide by self-poisoning during 1994-1998, seven Chinese males (aged 19-50 years) and one Korean male (aged 36 years) had done so by using heroin. The reasons for self-poisoning were unknown in 3, financial problems in 2, financial and love affair problems in 2 and problems with

finance and family in 1. Six subjects (including 2 with unknown reasons for self-poisonings) had left a note indicating their intention to kill themselves. One subject had made a previous suicidal attempt. The Forensic Toxicology department confirmed the presence of morphine (heroin metabolite) in their blood (and, in many cases, other body fluids). In 3 subjects, midazolam, carbon monoxide or methadone, alcohol plus liquefied petroleum gas were also involved.

Four of these eight subjects were single. Two other subjects were married and two subjects had divorced or separated from their wives.

Six of the Chinese males were previously known to be drug abusers (heroin in 5 and heroin plus benzodiazepines in 1). Four of these six subjects had participated in rehabilitation programmes (n=3) or a methadone treatment programme (n=1).

6 Monitoring Drug-Related Deaths in Hong Kong

Based on our experience from this project and the potential sources of data in Hong Kong (Figure 1), feasible ways to monitor the problem of drug abuse and drug abuse related deaths are suggested below.

6.1 The Numbers of Drug Abusers and Patterns of Drug Abuse

As already outlined in Figure 1, the most important sources of information about the number of drug abusers and patterns of drug abuse in Hong Kong will be the CRDA and the records from the various rehabilitation/treatment programmes, clinics and hospitals. Surveys of subject groups particularly at risk of drug abuse can also be used to assess the magnitude of the problem in the community, but there is always the problem of under-reporting.

The trends in the amounts of various abused drugs seized by the law-enforcement agencies in Hong Kong may also indicate the magnitude of the problem and changes in the pattern of drug abuse. The Controlled Drugs Section of the Government Laboratory can provide such information.

Co-ordinated efforts to collect and correlate the data from various sources will provide an even better description of the problem of drug abuse in Hong Kong. For example, we have previously shown that the sales of benzodiazepines in Hong Kong can be used to monitor the use and misuse of these drugs in the community.[8] One approach is to relate findings to changes in the numbers of abusers reported to the CRDA as we did for 1990-1993, confirming the effectiveness of the Government's regulatory changes reclassifying these drugs as Dangerous Drugs in 1990-1992.

6.2 Hospitals as a Source of Information

Drugs and substances of abuse are acutely toxic and many subjects attend the public hospitals after drug exposure. Epidemiological studies of subjects requiring treatment in hospitals provide useful information about drug abuse in Hong Kong. Detailed case studies help establish the toxicity of abused drugs.

In this project, the review of the routinely collected information in our computerised data-base at the Prince of Wales Hospital revealed a rising incidence in drug abuse in Shatin and neighbouring districts during 1995-1998 (Sub-Section 2.2). It highlighted that heroin accounted for the great majority of cases attending hospital (Sub-Section 2.2).

Acute and chronic health problems directly or indirectly related to drug abuse are difficult to study. Such information cannot be routinely obtained by a voluntary reporting system. The milder problems tend to be ignored although drug abusers will usually seek in-patient hospital treatment for severe illnesses. In this project, we also made use of our computerised data-base to study the health problems related to drug abuse (Sub-Section 2.3).

The review of hospitalised cases of acute poisonings allows a comparison of subjects presenting after habitual drug abuse (Sub-Section 2.2) with parasuicidal attempts by self-poisoning (Sub-Section 2.4), particularly with regard to the relative toxicity of the agents involved.

6.3 Improving the information from HK Hospitals

Retrospective reviews of the discharge summaries of patients has inherent limitations as some data will inevitably be missing, necessitating the time consuming review of the hand written medical records. A major problem is the identification of

all the relevant cases. Some cases of drug abuse and related health problems will be missed if, the records are given ICD codes other than 960-977 (medicinal poisonings), 980-989 (non-medicinal poisonings), 291 (alcoholic psychosis), 292 (drug psychosis), 303 (alcohol dependence syndrome) 304 (drug dependence) or 305 (non-dependent abuse of drugs). For example, in this project, only a small number of subjects with drug abuse related health problems could be identified (Sub-Section 2.3), raising the possibility that some cases had been missed.

Thus it is important that details of all patients with a drug abuse history who attend hospital are recorded. Those attending medical and psychiatric units will have discharge summaries written but patients seen in other units (e.g. surgical) and those who are discharged from Accident & Emergency Departments may be missed. To avoid the under-estimation of such admissions, a simple reporting system for all HK hospitals is required for all patients admitted or attending A & E with problems directly or indirectly related to drug abuse. Only very basic data regarding patient characteristics and the drugs involved should be required so as not to discourage reporting by busy hospital personnel. More detailed data can then be collected by subsequent review of discharge summaries and case notes. Alternatively, the diagnosis codes can be slightly modified so as to facilitate the identification of such cases. The staff responsible for writing the discharge summaries or typing the ICD codes can simply indicate whether or not this is an admission directly or indirectly related to drug abuse.

Prospective studies of drug abusers presenting to hospitals provide the most comprehensive information. However, such studies are very time-consuming and are difficult to sustain for long periods of time.

Another major problem with hospital-based studies of this kind is that subjects die outside hospitals are also missed. Therefore, reviews of the Coroner's Records will continue to be the most important source of comprehensive information regarding drug-related deaths.

6.4 Drug Abuse Related Deaths

In this project, the cases that had been investigated by the Coroner have provided the most important information about drug abuse related deaths in Hong Kong. They have enabled us to define the annual and regional incidences of drug abuse related deaths during 1994-1998; the agents responsible and the subjects involved (Section 3 and Section 4).

Among subjects who were exposed to multiple agent poisoning, the concentrations of the individual agents in the blood and body fluids as recorded in the computerised database of the Forensic Toxicology Section of the Government Laboratory were particularly useful in helping us to decide which one was the most important.

Reviews of the findings in drug abuse related death cases submitted to the Forensic Toxicology Section also provide important data about the relative importance of various drugs and any changes over time. The database can also provide important information about other circumstances under which abused drugs indirectly contribute to deaths (e.g. accidents occurring while under the influence of drugs).

However, since the information about the individual cases provided in the request form for the toxicological examination is quite brief, it was necessary to review the case file for data about subject characteristics, etc. This is inefficient and it would be

preferable if more (and thus contemporaneous) information was provided at the time of the toxicology request. We suggest that a customised data sheet request form be introduced for forensic toxicology requests so as to facilitate the speedy review of drug related death data.

6.5 Co-ordinated Efforts to Monitor Drug Abuse Related Deaths

In this project, we have related the number of deaths from heron abuse to the number of heroin abusers newly and previously reported to the CRDA (Sub-Section 4.8.1). This approach helped answer whether the increased number of heroin abuse related deaths during 1996-1998 was directly related to an increased number of abusers in the community. It also indicated whether the annual mortality due to heroin abuse increased during 1996-1998 and facilitated the quantification of the relative toxicity of the different drugs of abuse. This information has highlighted that of the drugs commonly abused in Hong Kong, heroin is particularly dangerous being associated with the vast majority of fatalities.

A better way of quantifying the annual incidence (risk) of death from heroin abuse (and other drug abuse) would be to calculate the actuarial survival among known drug abusers. Similarly, the cumulative incidence of non-fatal adverse events among drug abusers could be calculated. The annual incidence of events (deaths or other major illnesses necessitating Hospital Authority hospital admissions) among a cohort of heroin abusers newly reported to the CRDA should be monitored by means of a HK Identity Card Number-based follow system. The data collection could be done either prospectively or retrospectively. Comparison with a carefully selected control group will enable us to identify subject or drug factors that may be responsible for any changes in mortality, etc. Subject factors may include non-participation in

rehabilitation or treatment programmes. Drug factors may include changes in heroin purity and the concomitant use of central nervous system depressant drugs. We have already formulated plans for such a system, if required.

6.6 Co-ordinated Efforts to Monitor Major Events Related to Drug Abuse

Similarly, drug abusers who require hospital treatment because of major illnesses directly or indirectly related to drug abuse can be easily identified from the computerised medical record system in the public hospitals. Thus, the annual incidence (risk) of major illnesses among these subjects can also be determined.

6.7 Co-ordinated Efforts to Monitor Treatment of Drug Abusers

It is important to find out the participation rates in and effectiveness of any rehabilitation or treatment programmes. From the original cohort of drug abusers, their participation in these programmes and subsequent progress can be determined. Again, by comparing with matched controls, factors associated with non-participation can be determined.

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