Patterns and Characteristics of Ambulance Attendance at Heroin Overdose at a Local-Area Level in Melbourne, Australia: Implications for Service Provision

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ABSTRACT *The monitoring of heroin use and related harms is undertaken in Australia with a view to inform policy responses. Some surveillance data on heroin-related harms is well suited to inform the planning and delivery of heroin-related services, such as needle and syringe provision. This article examines local-area variation in the characteristics of nonfatal heroin overdoses attended by ambulances in Melbourne over the period June 1998 to October 2000 to inform the delivery of services to the heroin-using population in Melbourne. Five so-called hot spot local government areas were considered in relation to the remainder of the Melbourne metropolitan area. Significant local-area variations in the characteristics of nonfatal heroin overdoses were evident over the study period, including the number of heroin overdoses, the age and sex of the people attended, the time of the attendance, the likelihood of hospitalization, and the likelihood of police coattendance. The implications of the findings are discussed in terms of service provision (e.g., opening hours) within the five hot spot local government areas, and it is argued that the analyses undertaken could easily be applied to other jurisdictions for which comparable data are available.*

KEYWORDS *Heroin use, Need, Nonfatal heroin overdose, Service planning.*

INTRODUCTION

Information on the patterns of heroin use and harm at a local-area level is important for the delivery of services to heroin users. The monitoring of patterns and trends in heroin use and related harms is undertaken through a variety of mechanisms in Australia. For example, the Illicit Drug Reporting System (IDRS) collects data on an annual basis from a variety of sources to describe trends in heroin use and harm. This information is used to inform illicit drug policy and planning in Australia.^{1,2} Australian state, however, is the smallest geographical unit for IDRS data presentation and analysis. Therefore, these data are not well suited to the documentation of local-area variation in heroin use and related harms.

Heroin overdose is a key heroin-related harm that is experienced by a large section of the heroin-using population.^{3,4} The prevalence of heroin overdose has been documented in various jurisdictions of Australia through a variety of informa-

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tion sources, including coronial records,^{5,6} national mortality statistics on opioid overdose,^{7,8} and ambulance service records.⁹⁻¹¹ While mortality data have been important in documenting changes in heroin-related harm over time in Australia (and, by inference, the changes in the prevalence of heroin use),¹² mortality rates at a local-area level are too low to be useful for local-area level analysis. However, nonfatal heroin overdoses occur frequently among people who use the drug,^{4,13,14} meaning that systems for monitoring nonfatal heroin overdose can be useful for determining variation at the local-area level in heroin-related harms.

In Melbourne, evidence suggests that nonfatal heroin overdose is treated largely through ambulance attendance.^{10,15} Ambulance service records are a rich source of data on trends in nonfatal heroin overdose that allow the development and use of definitions of heroin overdose based on biological markers of heroin involvement.¹⁰ Records of ambulance service attendance at nonfatal heroin overdose in Melbourne have been collected since 1997,¹⁰ with consistent and reliable data available from June 1998.¹⁵ The use of naloxone in the treatment for heroin overdose by ambulance paramedics from Metropolitan Ambulance Service (MAS) means that an objective criterion (e.g., an increase in respiration rate following its administration) can be used in the definition of heroin overdose, thereby avoiding some of the problems evident in defining *heroin overdose*.¹⁶

Previous research has shown that data on nonfatal heroin overdose are well suited for the purposes of monitoring heroin overdose at a local community level.¹⁰ This is particularly the case in areas of Melbourne with identified street-based heroin markets.¹⁰ In the absence of reliable direct measures of the prevalence of drug use, indirect measures of drug use and related harms can be used to identify potential variations in the need for drug-related services.¹⁷ To the extent that data on nonfatal heroin overdose represent a proxy indicator of heroin market activity, they are important in the provision of heroin-related services at a local community level.

In this article, we describe recent trends in the prevalence of nonfatal heroin overdose attended by ambulance in Melbourne. We also examine the variation in the characteristics of these attendances in selected key locations in metropolitan Melbourne to demonstrate their utility in service development, planning, and delivery.

METHODS

Setting and Data Source

Melbourne is the capital city of Victoria, a state in the southeast of Australia, and has a population of approximately 3.5 million. In November 1997, a computerized database of ambulance service records for attendance at heroin overdose events in greater Melbourne was established,¹⁰ with other drug-related events included from June 1998. This database is a compilation of attendance characteristics extracted from patient care records (PCRs) completed by ambulance paramedics at the attendance scene. Data from the period June 1998 until October 2000 were extracted for use in this article. However, as a result of a labor dispute involving ambulance paramedics in June 1999, data from this period have been excluded from the analysis. Local government area (LGA) is the key local-area administrative unit in Melbourne. The geographic boundaries of LGAs in Melbourne, determined administratively by the Victorian State government, are detailed for the Greater Melbourne metropolitan area in Fig. 1. LGAs in Melbourne generally consist of one or more

FIGURE 1. Greater Melbourne metropolitan area with five hotspot LGAs highlighted (relevant suburbs).

suburbs. Figure 1 also shows the location of the five so-called heroin hot spots in Melbourne, LGAs characterized by the existence of street-based heroin markets within one or more constituent suburbs or high levels of heroin-related harms. These LGAs (hereafter referred to as hot spot LGAs) include the cities of Greater Dandenong, Maribyrnong, Melbourne (covering the central business district), Port Phillip, and Yarra. While some of these areas are adjacent (see Fig. 1), the street-based drug markets are contained entirely within the administrative boundaries of the LGAs.

Case Selection

While there is some difficulty in defining heroin overdose,^{16,18} the clinical practice guidelines for treatment of narcotic overdose by the MAS (initial ventilation with 100% oxygen and the subsequent administration of naloxone) permit the use of a positive response to naloxone administration as a marker for opioid involvement.^{10,19} Additional attendances for which there was evidence of heroin involvement (e.g., stated by person attended or other persons at the scene)¹⁵ were not included for analysis in this article.

In this article, an increase in heroin user respiration rate following the administration of naloxone has been taken as a marker of heroin involvement termed *heroin overdose*. Cases for which there was evidence of the involvement of other opioids (as stated by the heroin user or other persons or additional evidence such as prescription opioid packaging) were excluded from this analysis. Ambulance attendance at events that demonstrated these characteristics is referred to as attendance at nonfatal heroin overdoses.

Outcome Measures

A number of variables have been extracted from the database to examine local-area variation in nonfatal heroin overdose characteristics. These include day, time, and

location of the attendance; known age (available for 76% of cases) and sex of the person attended; police coattendance; and the subsequent outcome of hospitalization (measured here as whether the person was transported to, and received at, a hospital).¹⁹

Data Analysis

Variation in the patterns and characteristics of nonfatal heroin overdoses occurring in the five heroin hot spot LGAs was determined using the rest of the Greater Melbourne metropolitan area as a baseline. Loess curves of best fit, calculated using S-Plus 2000, were used to present time trends evident in the heroin overdoses attended over the time included in the study. Odds ratios (and 95% confidence intervals [CIs]) of the differences between areas on the other major characteristics of attendances were computed using logistic regression implemented in Stata V7.

RESULTS

There was a total of 8,441 nonfatal heroin overdoses in the Greater Melbourne metropolitan area over the study period of June 1998 to October 2000. Figure 2 shows the monthly totals of these overdoses, along with trend lines of best fit, broken down into the five hot spot LGAs along with the remainder of the Greater Melbourne metropolitan area. Inspection of Fig. 2 reveals that the number of overdoses increased in most of the areas (the exception being the city of Port Phillip) until early 1999. Thereafter, increases were evident only in the cities of Greater Dandenong, Maribyrnong, and Melbourne until around December 1999, with decreases evident in these areas after this time. There were dramatic decreases evident in the city of Yarra and the remainder of the Greater Melbourne metropolitan area from early to mid-1999.

FIGURE 2. Monthly totals of nonfatal heroin overdoses attended by ambulance in hotspot LGAs and the remainder of the Greater Melbourne metropolitan area, June 1998–October 2000.

Demographic Characteristics of Nonfatal Heroin Overdose Victims

The age and sex distributions of heroin overdoses in each region in the five hot spot LGAs along with the remainder of the Greater Melbourne metropolitan area are shown in Fig 3. The bars represent the proportions of overdoses in each age and sex category; within each region, the proportions sum to 100%. Ages are grouped from the youngest (younger than 16 years) at the bottom of each pyramid to the oldest (older than 50 years) at the top; males are represented on the left of each panel and females on the right.

The pyramids show that the majority of people who experienced nonfatal heroin overdose were male. Among males, nonfatal heroin overdoses occurred most frequently in the group 21–25 years old, except in the city of Port Phillip, where the modal category was the males 26–30 years old. Among females, however, the youngest age group, 16–20 years, was the predominant age group in all regions, except again in Port Phillip, where the nonfatal overdoses were most frequent in the group aged 21–25 years old.

Time of Day and Day of Week of Attendances

Figures 4 and 5 show the distributions of nonfatal heroin overdoses across different times of the day (Fig. 3) and days of the week (Fig. 4) for the five hot spot LGAs along with the remainder of the Greater Melbourne metropolitan area. Inspection of Fig. 3 reveals that, in all areas, nonfatal heroin overdoses tended to occur most frequently in the afternoon through the early evening. Nevertheless, there were im-

FIGURE 3. Age and sex distributions of nonfatal heroin overdose victims in hotspot LGAs and the remainder of the Greater Melbourne metropolitan area, June 1998–October 2000.

FIGURE 4. Circadian distributions of nonfatal heroin overdose attendances in hotspot LGAs and the remainder of the Greater Melbourne metropolitan area, June 1998–October 2000.

portant differences between the heroin hot spot areas, with the occurrence of non-fatal overdose in the city of Port Phillip more evenly distributed across different times of the day than the other areas (indeed, the distribution in the city of Port Phillip was bimodal, with a second peak evident toward midnight). Further, few, if any, nonfatal overdoses occurred in the early hours of the morning in the cities of Greater Dandenong, Maribyrnong, and Yarra, with no overdoses evident in the city of Maribyrnong between the hours of 3 and 5 AM.

Figure 5 shows that the occurrence of nonfatal heroin overdose peaked in all areas on Wednesday, Thursday, or Friday. Importantly, the data show that the number of overdoses occurring in all areas was low on the weekend (Saturday and Sunday), with numbers remaining low on Mondays in all areas.

Location of Attendance

Figure 6 shows that the likelihood with which nonfatal heroin overdoses were attended in private (e.g., private residences), as opposed to public (e.g., public toilets, alleyways, parks), spaces was lower in the five hot spot LGAs compared to the remainder of the Greater Melbourne metropolitan area. However, there was a gradient in the likelihood of attendance in private spaces across the hot spot LGAs, with the likelihood lowest in the city of Melbourne, followed in turn by the cities of Maribyrnong, Greater Dandenong, Yarra, and Port Phillip.

Hospitalization

Over the study period, there were 1,483 (18%) nonfatal heroin overdoses that resulted in hospitalization. Figure 7 shows the likelihood of hospitalization of non-

FIGURE 5. Distributions of nonfatal heroin overdose attendances in hotspot LGAs and the remainder of the Greater Melbourne metropolitan area across weekdays, June 1998–October 2000.

fatal heroin overdose victims in the five hot spot LGAs, with the remainder of the Greater Melbourne metropolitan area serving as the baseline. The likelihood of hospitalization outcomes for nonfatal heroin overdose victims attended in the city of Melbourne was similar to that for the remainder of the Greater Melbourne metropolitan area. However, attendances in the city of Port Phillip were more likely, and attendances in the cities of Greater Dandenong, Maribyrnong, and Yarra were less

FIGURE 6. Likelihood of occurrence of nonfatal heroin overdose attendances in private spaces in hotspot LGAs (remainder of the Greater Melbourne metropolitan area as baseline), June 1998–October 2000.

FIGURE 7. Likelihood of hospitalization of nonfatal heroin overdose victims in hotspot LGAs (remainder of the Greater Melbourne metropolitan area as baseline), June 1998–October 2000.

likely, to result in hospitalization than in the remainder of the Greater Melbourne metropolitan area.

Police Coattendance

Police were in coattendance at 1,111 (13%) of nonfatal heroin overdoses over the study period. Figure 8 shows the likelihood of police coattendance at nonfatal heroin overdoses in the five hot spot LGAs, with the remainder of the Greater Melbourne metropolitan area serving as the baseline. While the likelihood of police coattendance at nonfatal heroin overdoses attended in the cities of Yarra and Port Phillip was similar to that for the remainder of the Greater Melbourne metropolitan area, police coattendance was more likely to occur in the cities of Greater Dandenong, Maribyrnong, and Melbourne than the remainder of the Greater Melbourne metropolitan area.

FIGURE 8. Likelihood of police coattendance at nonfatal heroin overdose attendances in hotspot LGAs (remainder of the Greater Melbourne metropolitan area as baseline), June 1998–October 2000.

DISCUSSION

In Melbourne, the operation of harm reduction services (e.g., needle and syringe programs) has been determined largely through a consideration of available resources. However, to best meet the needs of heroin users, we would argue that the provision of these services should be matched to evidence around heroin market activity (including surveillance of any dynamic shifts that may take place over time). To the extent that nonfatal heroin overdose rates serve as a proxy indicator of heroin market activity, the local-area variation in the characteristics of nonfatal heroin overdose has important implications for service provision. In this article, we have shown that the patterns and characteristics of nonfatal heroin overdose vary substantially across different areas of Melbourne.

The overall number of attendances in the hot spot LGAs suggests that heroin market activity in Greater Melbourne is concentrated most highly in the city of Melbourne. This finding suggests that the provision of services related directly to heroin use (e.g., needle and syringe provision) or harm (e.g., Mobile Overdose Response Services¹⁵) should be most highly concentrated in this LGA. This also suggests that the policy of targeting hot spot LGAs for service provision is appropriate as these are the areas in which the key heroin-related harm of overdose appears to be most concentrated. Similarly, information on nonfatal heroin overdose occurrence in public spaces suggests that programs oriented toward heroin use in public spaces (e.g., street-based outreach services, Mobile Overdose Response Services) should be directed toward the hot spot LGAs. Further, the data suggest the highest service need is in the hot spot LGAs, with highest rates of attendance in public spaces, such as the cities of Melbourne, Greater Dandenong, and Maribyrnong. Nevertheless, it is important to note that these types of services are oriented toward heroin use in public spaces, suggesting that strategies for heroin overdose prevention in private locations need to be provided through mechanisms that ensure coverage throughout the greater Melbourne metropolitan area.

The local-area variation in age and gender has implications for the provision of services targeted toward specific age and gender groups. For example, Victoria's Youth Substance Abuse Service (YSAS) provides outreach services for drug users under the age of 25 years. Within the hot spot LGAs, it would appear that the proportion of young people accessing heroin markets is highest in the cities of Melbourne, Maribyrnong, and Greater Dandenong. This suggests that age-specific services should be oriented toward servicing these areas to best meet the needs of this age group. Similarly, the city of Port Phillip showed the largest bias toward females (consistent with reports of street-based sex work being concentrated in this LGA), which suggests that the delivery of services oriented toward female heroin users should be prioritized in this area.

While nonfatal heroin overdose occurrence in all areas tended to peak in most areas between the afternoon to early evening period, there was substantial variation in time of occurrence between the hot spot LGAs. The city of Port Phillip stands out as having a relatively flat distribution of overdoses across different times of the day, suggesting the need for services across the entire day. Conversely, the absence of nonfatal heroin overdose occurrence in the early hours of the morning in the cities of Maribyrnong and Greater Dandenong suggests that service provision during these times may be superfluous to client need. All areas showed peaks in overdose occurrence from the middle to the end of the working week. This finding

suggests that the provision of services across the Greater Melbourne metropolitan area should be oriented toward these days rather than the weekend.

The outcomes in relation to hospitalization have implications for service provision. The greater likelihood of hospitalization in the city of Port Phillip suggests the need for the integration of overdose-related services (e.g., Mobile Overdose Response Services) with local hospitals. Conversely, the decreased likelihood of hospitalization in the cities of Greater Dandenong, Maribyrnong, and Yarra suggests that such services need to be able to respond at the site of ambulance attendance.

Police coattendance at nonfatal heroin overdoses has been cited as a major deterrent for heroin users in calling ambulances to attend these overdoses.⁴ A harm minimization response to these concerns from Victoria Police has seen the incorporation of provisions designed to minimize the likelihood not only of coattendance, but also of drug law enforcement when coattendance does occur, in police operating procedures (known as standing orders).²⁰ These standing orders have been widely publicized in Victoria.²¹ While police did not attend the majority of nonfatal heroin overdoses in this study, there were substantial variations in rates of coattendance between areas, with likelihood greatest in the cities of Melbourne, Greater Dandenong, and Maribyrnong, in spite of the policy application on coattendance across the greater Melbourne metropolitan area. This finding may reflect problems with the coattendance policy implementation when the policy was merely incorporated into police standing orders on the basis of a top-down directive from the chief commissioner of police, an indication that there was little or no ownership of the policy at a local command level. Indeed, recent work highlights the importance of involving participants at the local-area level to ensure change in police practice is fully institutionalized.²² However, it should be noted that current data coding does not allow for the determination of the reasons for police coattendance at nonfatal heroin overdose events. This means that these coattendances may reflect situations for which police patrols may have actually reported the nonfatal heroin overdose. Nevertheless, this information needs to be provided to local-area law enforcement personnel to ensure accountability in relation to compliance with Victoria Police policies on harm minimization. To this end, the data may also be useful in targeting the specific local-area commands of the Victoria Police for training in police procedures and attendance policies at heroin overdose events.

Limitations

The data presented in this article represent a secondary analysis of ambulance service records that are completed for purposes other than the research detailed here. As with any administrative data set, there are limitations associated with the data presented, including potential bias that may confound the interpretation of the results as presented. While the use of the criterion of a positive response to naloxone means that a relatively standardized definition of nonfatal heroin overdose has been applied, it is possible that there may be some differences in the likelihood that ambulance paramedics will administer naloxone on attendance at nonfatal heroin overdose events. However, as the MAS clinical guidelines apply across the greater Melbourne metropolitan area, we are confident that there is unlikely to be any local-area variation in the treatment provided at the scene for the acute event of nonfatal heroin overdose.

There may also be local-area differences in the likelihood of people calling ambulances for the treatment of nonfatal heroin overdose, especially given the

differences in police attendance found in this study. While it is not possible to determine this extent from the available data, it is reassuring that the area with the greatest number of attendances (the Melbourne LGA) also reflected the highest rate of police attendance. This finding suggests that the potential disincentive provided by police attendance did not have a significant impact on the likelihood by which ambulances were called to nonfatal heroin overdose events.

Finally, it is possible that the variation in hospitalization rates may reflect differences in practice between regions. For example, more experienced paramedics may be more confident in managing nonfatal heroin overdose at the scene of attendance alone, or paramedics may be aware that hospitalization is unlikely to produce any significant benefits for the individuals involved. While these practice differences may exist, the differing hospitalization rates between the Melbourne and Yarra LGAs, where paramedics will generally attend from one central ambulance branch, suggests that the differences between LGAs are unlikely to result from differences in the practices of ambulance paramedics in Melbourne.

SUMMARY

Information at the local-area level on drug use and harm has important implications for service provision. In the area of alcohol services, for example, there is a considerable history of the development at the local-area level of indicators of alcohol use and harm to inform service planning and delivery.^{17,23–25} In Victoria, this work suggests that the need for services is higher in rural, rather than metropolitan, populations.¹⁷ Equivalent data sets are not available in relation to heroin use and harm. In this article, however, we demonstrated that the use of information on a key heroin-related harm as a proxy for local-area variation in characteristics of local heroin markets has implications for service delivery at a local-area level. The data used in this study suggest that the current focus on so-called heroin hot spots in terms of the provision of services, such as needle and syringe programs, and overdose response in Melbourne is appropriate. In addition, the data highlight the importance of the development of strategies and services that are appropriately tailored to the characteristics of local-area drug markets. While we believe that this is the first local-area analysis of the characteristics of ambulance attendances at non-fatal heroin overdose events, similar data are available in many jurisdictions.^{9,26–28} This means that the analyses for Melbourne detailed in this paper could easily be undertaken in many other jurisdictions to determine local-area variations in the characteristics of heroin markets. These analyses can then be used to inform the provision of services to best meet the needs of heroin users in these other jurisdictions.

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REFERENCES

1. Darke S, Topp L, Kaye S, Hall W. Heroin use in New South Wales, Australia, 1996–2000: 5 year monitoring of trends in price, purity, availability and use from the Illicit Drug Reporting System (IDRS). *Addiction*. 2002;97:179–186.
2. Hando J, Darke S, O'Brien S, Maher L, Hall W. The development of an early warning system to detect trends in illicit drug use in Australia—the Illicit Drug Reporting System. *Addiction Res*. 1998;6:97–113.
3. Rumbold G, Fry C. *Victorian Drug Trends 1998: Findings From the Melbourne Trial of the Illicit Drug Reporting System (IDRS)*. Sydney, Australia: National Drug and Alcohol Research Centre; 1999. NDARC Technical Report 73.
4. Darke S, Ross J, Hall W. Overdose among heroin users in Sydney, Australia. I: prevalence and correlates of nonfatal overdose. *Addiction*. 1996;91:405–411.
5. Gerostamoulos J, Staikos V, Drummer OH. Heroin deaths in Victoria: a review of cases for 1997 and 1998. *Drug Alcohol Depend*. 2001;61:123–127.
6. Darke S, Ross J, Sunjic S, Zador D. *Heroin-Related Deaths in New South Wales 1992–1996*. Sydney, Australia: National Drug and Alcohol Research Centre; 1999. NDARC Technical Report 68.
7. Degenhardt L. *Opioid Overdose Deaths in Australia*. Sydney, Australia: National Drug and Alcohol Research Centre; 2001.
8. Hall W, Darke S. *Trends in Opiate Overdose Deaths in Australia 1979–1995*. Sydney, Australia: National Drug and Alcohol Research Centre; 1997. NDARC Technical Report 49.
9. Degenhardt L, Hall W, Adelstein B-A. *Ambulance Calls to Suspected Drug Overdoses: Analysis of New South Wales Patterns July 1997 to June 1999*. Sydney, Australia: National Drug and Alcohol Research Centre; 2000. NDARC Technical Report 94.
10. Dietze PM, Cvetkovski S, Rumbold GR, Miller P. Ambulance attendance at heroin overdose in Melbourne: the establishment of a database of ambulance service records. *Drug Alcohol Rev*. 2000;19:27–33.
11. Bammer G, Ostini R, Sengoz A. Using ambulance service records to examine nonfatal heroin overdoses. *Aust J Public Health*. 1995;19:316–317.
12. Hall WD, Ross JE, Lynskey MT, Law MG, Degenhardt LJ. How many dependent heroin users are there in Australia? *Med J Aust*. 2000;173:528–531.
13. Fry C, Miller P. *Victorian Drug Trends 2001: Findings from the Illicit Drug Reporting System (IDRS)*. Sydney, Australia: National Drug and Alcohol Research Centre; 2002. NDARC Technical Report 129.
14. Gossop M, Griffiths P, Powis B, Williamson S, Strang J. Frequency of non-fatal heroin overdose: survey of heroin users recruited in a non-clinical setting. *BMJ*. 1996;313:402.
15. Dietze P, Fry C, Rumbold G, Gerostamoulos J. The context, management and prevention of heroin overdose in Victoria, Australia: the promise of a diverse approach. *Addiction Res Theory*. 2001;9:437–458.
16. Darke S, Zador D. Fatal heroin “overdose”: a review. *Addiction*. 1996;91:1765–1772.
17. Dietze P, Rumbold G, Cvetkovski S, Hanlin K, Laslett A-M, Jonas H. Using population-based data on alcohol consumption and related harms to estimate the relative need for alcohol services in Victoria, Australia. *Eval Program Plann*. 2000;23:429–436.
18. Fitzgerald J, Hamilton M, Dietze P. Walking overdoses: a re-appraisal of non-fatal illicit drug overdoses. *Addiction Res*. 2000;8:327–355.
19. Dietze P, Cantwell C, Burgess S. Bystander resuscitation attempts at heroin overdose: does it improve outcomes? *Drug Alcohol Depend*. 2002;67:213–218.
20. Victoria Police. Police attendance at incidents of drug overdose. Chief Commissioner's instructions. *The Gazette*. February 1999:8.
21. Dietze PM, Fry CF, Rumbold GR, Gerostamoulos J. The context, management and prevention of heroin overdose in Victoria: the promise of a diverse approach. *Addiction Res Theory*. 2001;9:437–458.
22. Midford R, Acres J, Lenton S, Loxley W, Boots K. Cops, drugs and the community:

- establishing consultative harm reduction structures in two Western Australian locations. *Int J Drug Policy*. 2002;13:181–188.
23. Crook GM, Oei TPS. A review of systematic and quantifiable methods of estimating the needs of a community for alcohol treatment services. *J Subst Abuse Treat*. 1998;15:357–365.
 24. Rush B. A systems approach to estimating the required capacity of alcohol treatment services. *Br J Addict*. 1990;85:49–59.
 25. Dewitt DJ, Rush BR. Assessing the need for substance abuse services: a critical review of needs assessment models. *Eval Program Plann*. 1996;19:41–64.
 26. Seidler D, Schmeiser-Rieder A, Schlarp O, Laggner AN. Heroin and opiate emergencies in Vienna: analysis at the municipal ambulance service. *J Clin Epidemiol*. 2000;53:734–741.
 27. Seidler D, Woisetschlaeger C, Schmeiser-Rieder A, Hirschl MM, Kaff A, Laggner AN. Prehospital opiate emergencies in Vienna. *Am J Emerg Med*. 1996;14:436–439.
 28. Schulz-Schaeffer W, Peters T, Pueschel K. Drug abuse emergencies in Hamburg 1990/91. *Forensic Sci Int*. 1993;62:167–171.