

Physical and Geographical
Injecting Sites Among
Injecting Drug Users

Shane Darke, Joanne Ross
& Sharlene Kaye

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INJECTING DRUG USERS**

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EXECUTIVE SUMMARY

A sample of 200 injecting drug users were interviewed about their physical injection sites (body parts) and the geographical locations in which they injected. The use of multiple physical injection sites was common. The mean number of injection sites that had been used by subjects was 3.1, and 2.0 sites had been used in the previous six months. Sixteen percent of subjects had injected in five or more sites. Almost all (99%) had injected in the cubital fossa (crook of the arm). The next most popular site was the forearm (71%). Other sites included the hand (53%), foot (19%), leg (18%), neck (10%) and groin (6%). There was a clear progression in sites used, from the cubital fossa at initial injection to the use of sites such as the groin after 10 years of injecting. Compared to the initial injection, the most recent injection was significantly more likely to be in a site other than the cubital fossa (27% v 6%).

Females had used significantly more injection sites than males. There were significant correlations between the number of injection sites ever used and: length of injecting career, number of injection related problems experienced, number of drug classes ever used and number of drug classes ever injected. Linear multiple regressions revealed that a greater number of injection-related problems and a greater number of drug classes ever injected were independently associated with the use of more injection sites.

Nearly all subjects (96%) had injected in a public place, and 89% had done so in the preceding six months. Large proportions had injected in all locations studied, including cars (90%), public toilets (81%), the street (80%) and trains (55%). Injecting in public places also occurred frequently. Twenty seven percent had injected often in the street over the preceding six months, 22% had injected often in cars and 17% had injected often in public toilets. Overall, 53% of subjects had injected often in at least one public location during the preceding six months.

Frequent injectors in public places were more likely to be male, and to have overdosed in the preceding six months. They had injected significantly more drug

classes in the preceding six months, had injected in more physical injecting sites in that period and had more current injection-related problems. Logistic regressions indicated that, after controlling for the effects of other variables, being male and having a greater number of injection-related problems were independently associated with frequent public injections.

1.0 INTRODUCTION

A great deal of research has been conducted in recent years on the injecting risk-taking behaviours of injecting drug users (IDU). However, this research has focussed almost exclusively upon the risk of blood borne transmission of HIV and hepatitis through the sharing of injecting equipment. It has long been recognised, however, that the act of injecting *per se*, however, carries health risks¹⁻⁵. Frequent injections may, for example, cause vascular damage, irrespective of "safe" injecting practices. Damage to a favourite injection site may, in course, lead to the use of other, potentially more dangerous injection sites.

To the knowledge of the authors, only one study to date has examined the prevalence of injection sites among IDU⁶. This British study reported widespread use of a variety of sites. While almost all of these British IDU had injected in their arms (99%), significant proportions had injected in legs (42%), feet (38%), groin (24%) and necks (14%). Injection sites were distinguished by their age of first use, with a mean age of 20 years for injection in the arm and 28 years for injection in the groin and neck, suggesting a career in which the more obvious injection sites are used up. While injecting in any site carries risks, the risk of injecting in sites such as the groin and neck is substantially greater than in sites such as the cubital fossa (crook of the arm). It is difficult for the person to see what they are doing in such sites, increasing the risk damaging the vein or hitting an artery. As the veins in sites such as these are substantially larger, any damage to them may result in serious circulatory problems and an increased risk of life threatening infections such as endocarditis.

There are also clear health implications regarding the types of drugs injected into injection sites. The injection of oral preparations such as benzodiazepines and methadone syrup is common among IDU in Australia and elsewhere⁷⁻¹¹, and has serious health consequences. The injection of temazepam has been associated with amputations and death¹¹⁻¹³. The injection of methadone syrup, common in Sydney⁸, has been associated with fistulas, abscesses/infections in injection sites and venous thrombosis^{8,14}.

An issue related to the physical injection site practices of IDU concerns the geographical location of such injections. A recent British study reported a higher rate of overdose among those IDU who injected in public places such as streets, parks and toilets¹⁵. Street injectors also injected more frequently and had more vascular problems than other IDU. In New South Wales between 1992 and 1996, a quarter of heroin overdose deaths occurred in public places¹⁶. During this period, in the region of Sydney with the largest street-based heroin market, 70% of deaths occurred in public places¹⁷. The risk of overdose in public places may reflect a more dependent, risky individual. Alternatively, factors such as more rapid injecting so as to avoid detection, with a consequently larger bolus effect, may be implicated. The geographical injecting practices of IDU in Australia, and associated harms, are currently unknown.

Given the paucity of data on the physical and geographical injecting practices of IDU, the current study examined these behaviours. The study aimed to provide a more complete picture of the injecting practices of IDU and associated harms, beyond those associated with the sharing of injecting equipment.

1.1 Study Aims

The study aimed to examine the physical and geographical injecting sites of a sample of Sydney injecting drug users. Specifically, the aims of the study were as follows:

1. To document the physical injection site histories of IDU, and associated factors and harms;
2. To document the geographical injection site histories of IDU, and associated factors and harms.

2.0 METHOD

2.1 Procedure

All respondents were volunteers who were paid A\$20 for their participation in the study. Recruitment took place from February to September of 1999, by means of

advertisements placed in treatment agencies, rock magazines, needle exchanges and by word of mouth.

Respondents contacted the researchers, either by telephone or in person, and were screened for eligibility to be interviewed for the study. To be eligible for the study respondents must have injected a drug at least six times in the preceding six months or be in treatment for drug dependence.

All respondents were guaranteed, both at the time of screening and interview, that any information they provided would be kept strictly confidential and anonymous. Respondents were administered a structured interview that took between 30 and 45 minutes to complete. All interviews were conducted by one of the research team.

2.2 *Structured Interview*

2.2.1 Demographic characteristics

Demographic details obtained included: gender, age, suburb of residence, level of high school and tertiary education, employment status, drug treatment history and prison record.

2.2.2 Drug use history

In order to gain an indication of drug use history, respondents were asked which drug classes they had ever used, which ones they had ever injected, and which ones they had injected in the last 6 months. An estimation of how many days they had used each of the drug classes during the 6 months preceding interview was also sought. Further questions were asked about the first drug ever injected and their age when they first injected. Heroin dependence was measured by the Severity of Dependence Scale (SDS)¹⁸.

2.2.3 Risk behaviours

The needle risk component of the Opiate Treatment Index (OTI)¹⁹ was used in assessing injecting behaviours in the month preceding interview that placed respondents at risk of either contracting or transmitting blood borne viruses.

Those subjects who had ever used heroin were asked how many times they had overdosed, how long since they had last overdosed and whether they had ever been administered naloxone.

2.2.4 Injection-related health

The Health Scale of the OTI was administered to gain an indication of the respondent's injection-related problems. Questions were also asked about lifetime history of injection-related problems.

2.2.5 Physical injection sites

A detailed section on physical injection sites was constructed. Questions included: first and most recent injection sites, lifetime and recent use of injection sites, age at first injection in each site, drugs injected into each site, and perceived danger of individual injection sites.

2.2.6 Geographical injection sites

Questions on geographical injection sites included first and most recent injection sites, lifetime and recent injection sites and frequency of injecting in individual sites.

2.3 *Statistical Analyses*

T-tests were used for continuous data. Where distributions were highly skewed, medians were reported. For dichotomous categorical variables, Odds Ratios (OR) and 95% Confidence Intervals (95% CI) were reported. In order to determine factors associated with multiple physical injection sites, simultaneous multiple regressions were conducted. Logistic regressions were performed to determine factors associated with injecting in public places. All analyses were conducted using SPSS for Windows (version 6.1.4)²⁰.

3.0 RESULTS

3.1 *Sample Characteristics*

The sample consisted of 200 IDU, recruited from all areas of Sydney. The mean age of subjects was 28.4 years (SD 7.5, range 15-52), with 61% being male (Table 1).

The mean years of formal school education was 9.9 (SD 1.6, range 5-12). Twenty nine percent of subjects had completed a trade or technical course, and 4% had completed a university course. The majority of subjects (92%) were currently unemployed, with 4% in full-time employment.

Forty percent of subjects were currently enrolled in a drug treatment programme, with 25% of subjects currently enrolled in drug free residential programmes (median enrolment= 2 mths, range 1-8 mths) , and 16% in methadone maintenance (21 mths, range 1-144 mths). The mean methadone dose of those enrolled in methadone maintenance was 62.5 mg (SD 43.2, range 15-250).

Forty seven percent of subjects reported a history of imprisonment, with males being significantly more likely than females to report such a history (57% v 30%, OR 3.22, 95% CI 1.76-5.89).

Table 1: Demographic characteristics

Variable	Males (N=122)	Females (N=78)	Total (N=200)
Age (mean yrs)	28.9	27.6	28.4
School education (mean yrs)	9.7	10.1	9.9
<i>Tertiary education:</i> None Trade/technical University	62 34 3	77 19 4	68 29 4
<i>Employment (%)</i> : Unemployed Full time Part time Student	92 3 5 0	92 4 1 3	92 4 4 1
<i>Drug treatment (%)</i> : Not in treatment Drug free Methadone	 60 25 16	 59 25 15	 60 25 16
Prison record (%)	57	30	47

3.2 *Drug Use History*

The mean age of first injection was 18.2 yrs (SD 4.3, range 11-46). Heroin was the drug first injected by 51% of subjects, with 43% having first injected amphetamines, and 3% cocaine.

The sample engaged in a wide variety of polydrug use (Table 2). The mean number of drug classes ever used was 8.9 (SD 1.9, range 2-11), with 5.8 (SD 2.1, range 1-10) classes having been used in the preceding six months. A mean of 3.7 (SD 1.4, range 1-6) classes had ever been injected, with 2.3 (SD 1.2, range 0-5) classes having been injected in the preceding six months.

The most commonly used drug classes over the preceding six months were tobacco (99%), heroin (96%), cannabis (80%), benzodiazepines (64%), alcohol (59%), cocaine (50%), and amphetamines (46%).

The mean SDS score for heroin dependence among those who had used heroin in the preceding six months (96% of subjects) was 9.8 (SD 3.6, range 0-15).

Table 2: Drug use history

Class	Ever used	Drug Ever Injected	Used 1st 6 mths	Injected 1st 6 mths	Days used 1st 6 mths*
Heroin	99	99	96	96	131
Other opiates	71	58	38	23	12
Amphetamines	90	82	46	45	5
Cocaine	85	75	50	43	5
Hallucinogens	77	23	19	6	2
Benzodiazepines	87	35	64	18	21
Antidepressants	39	0	20	0	42
Alcohol	94		59		8
Cannabis	97		80		72
Inhalants	49		6		3
Tobacco	99		99		180
Mean no. drug classes	8.9	3.7	5.8	2.3	N/A

* Median number of days used in the last 6 months by those who had used the drug class in that period

3.3 Risk taking behaviours

The majority (60%) of the sample had injected on a daily basis over the preceding month (Table 3). The overwhelming majority (88%) of subjects not enrolled in drug treatment had injected on a daily basis during the previous month.

Thirteen percent of subjects reported having injected with a borrowed used syringe in the preceding month, with females significantly more likely to have done so (20% v 9%, OR 2.60 95% CI 1.14-5.96). Twenty three percent of subjects reported having passed on their used injecting equipment during the preceding month, with no difference in the proportions of males and females reporting having done so.

Over a half (55%) of subjects who had ever used heroin reported having experienced an overdose, 35% in the preceding year. The median number of overdoses experienced was 2 (range 1-40). Thirty six percent reported having been administered the opioid antagonist naloxone, 23% in the preceding year. There were no gender differences in the prevalence of overdose.

Table 3: Risk taking behaviours

Variable	Males (N=122) %	Females (N=78) %	Total (N=200) %
<i>Frequency of injection (%) (last month):</i>			
No injections	21	24	23
Once a week or less	4	4	4
More than once a week	12	19	15
Daily	63	53	60
Borrowed used needle (%) (last month)	9	20	13
Lent used needle (%) (last month)	20	28	23
<i>Heroin overdose (%)</i> ∗:			
Ever	57	53	55
Last year	37	32	35
Administered naloxone (ever)	37	35	36
Naloxone in last year	25	19	23

* N= 199 (excludes subject who had never used heroin)

3.4 Injection-related problems

Nearly all subjects reported having experienced injection-related problems (97%), and 91% had experienced injection-related problems in the preceding six months (Table 4). Subjects reported a mean of 2.9 (SD 1.3, range 0-6) problems in their lifetime, and 2.3 (SD 1.3, range 0-6) in the preceding six months. The most common reported problems, both lifetime and recent, were prominent scarring/bruising, lumps/swelling and difficulty injecting (vascular scarring). It should be noted that significantly more females reported having had difficulty in injecting, both in their lifetime (80% v 49%, OR 4.00 95% CI 2.08-7.70) and in the preceding six months (67% v 38%, OR 3.30 95% CI 1.82-6.00).

Females reported significantly more lifetime (3.2 v 2.7, $t_{198}=2.6$, $p<.01$) and recent injection-related problems (2.6 v 2.0, $t_{198}=2.9$, $p<.005$). There was no difference between those in treatment and other subjects in the number of lifetime injection-related problems (2.9 v 2.9). Subjects not currently in treatment, however, reported significantly more recent injection-related problems (2.4 v 2.0, $t_{198}=2.6$, $p<.05$).

Table 4: History of injection-related problems

Problem	Ever %	Six months %
Prominent scarring/bruising	88	84
Lumps/swelling	86	64
Difficulty injecting	61	49
Hit artery	21	10
Abscesses/infections from injecting	19	9
Thrombosis	12	9
Septicaemia	3	1
Any problem (%)	97	91
Mean no. problems	2.9	2.3

3.5 Physical injection sites

3.5.1 Initial and most recent injection sites

Almost all subjects (94%) reported their initial injection as being in the cubital fossa (crook of the arm) (Table 5). At the most recent injection significantly more subjects injected in a site other than the cubital fossa compared to the initial injection, primarily in the forearm and hand (27% v 6%, OR 5.79 95% CI 2.99-11.23). The

one case who had injected in an "other" site on the last occasion injected in the penis.

Table 5: Sites of initial and most recent injection

	Initial injection %	Most recent injection %
Arm (cubital fossa)	94	73
Arm (forearm)	5	12
Arm (upper)	1	2
Hand	0	6
Fingers	0	1
Leg	0	1
Foot	0	1
Toes	0	0
Groin	1	3
Neck	0	1
Other:	0	1

Subjects were asked who injected them the first time they had an injection (Table 6). Two thirds (63%) responded that they were injected by a friend, with almost equal proportions reporting that they injected themselves or that a sexual partner injected them. There were notable gender differences. While 21% of males injected themselves on the first occasion, only 10% of females did so (OR 2.37 95% CI

1.01-5.55). Females, however, were significantly more likely to have been first injected by a sexual partner (28% v 7%, OR 4.93 95% CI 2.13-11.42).

Table 6: Person who administered initial injection

Person	Males (N=122) %	Females (N=78) %	Total (N=200) %
Friend	67	56	63
Self	21	10	17
Partner	7	28	16
Relative	4	5	5

3.5.2 History of physical injection sites

The prevalence of injection site use is presented in Table 7. Almost all IDU (99%) had injected in the cubital fossa, 86% in the preceding six months. The next most popular injection site was the forearm (71%), which had been used by 48% of subjects in the preceding six months. A half (53%) of the sample had injected in the hand, 26% in the preceding six months. Approximately a fifth of IDU reported having injected in the foot (19%) and/or leg (18%). Classified under "other" injection sites were small proportions who had injected in the clavicle, shoulder, penis and breasts.

The mean number of injection sites that had been used by subjects was 3.1 (SD 1.8, range 1-11), and 2.0 (SD 1.4, range 0-7) sites had been used in the previous six months. Sixteen percent of subjects had injected in five or more sites in their injecting careers.

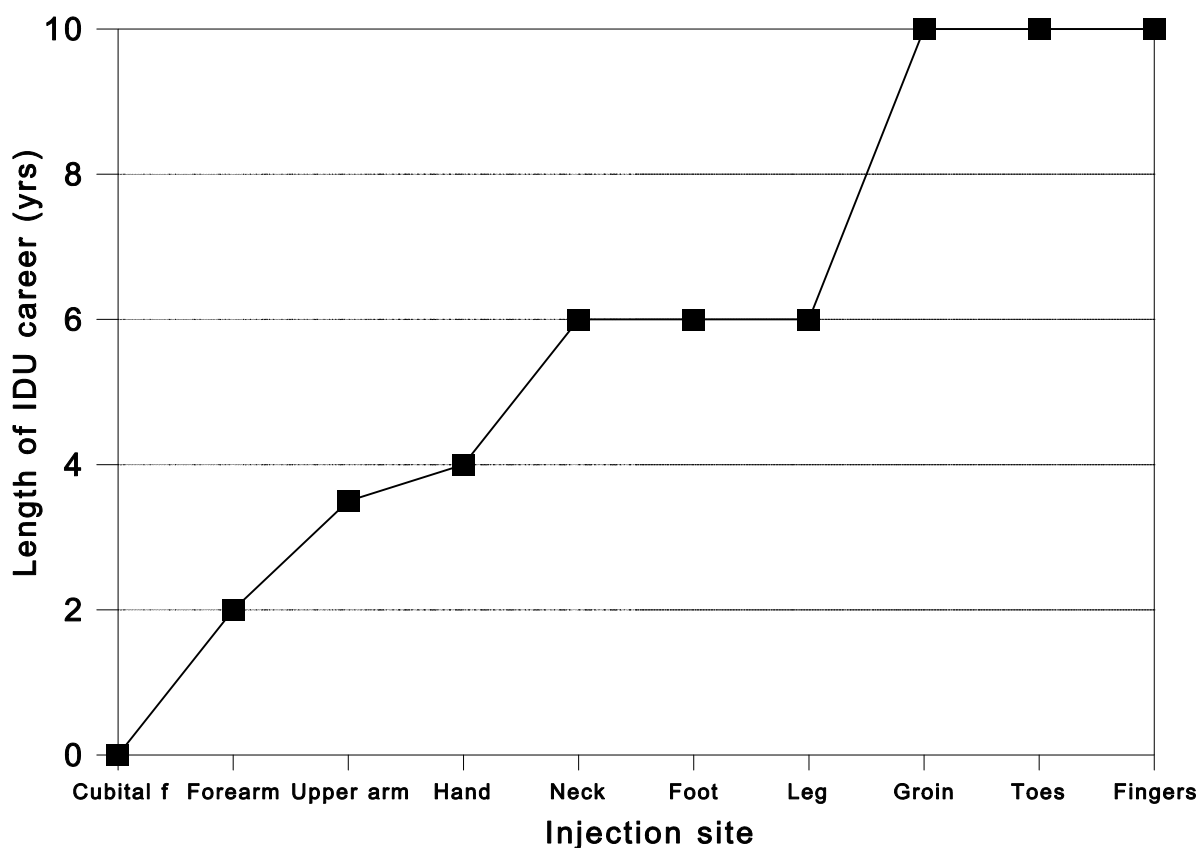
Subjects were asked how they obtained a vein for injecting. The most common methods described were: use a tourniquet (52%), do not need to do anything (31%) and pump/clench hand (14%). Females were more likely than males to report using a tourniquet (65% v 43%, OR 2.46 95% CI 1.37-4.43), while males were more likely to report having to do nothing (37% v 22%, OR 2.10 95% CI 1.09-4.02).

Table 7: History of physical injection sites

	Ever %	Last six months %	Age first injected in site (mdn)
Arm (cubital fossa)	99	86	17
Arm (forearm)	71	48	20
Hand	53	26	21
Arm (upper)	20	12	21
Foot	19	8	22.5
Leg	18	8	24
Neck	10	4	22
Groin	6	4	26
Fingers	6	3	27.5
Toes	3	1	27
Other:	4	3	26
Mean no. sites	3.1	2.0	N/A

The number of years from initial injection until individual injection sites were first employed are shown in Figure 1. There was a marked progression in the use of different sites. On average, the forearm was first used as an injection site two years after the initiation of injecting, the upper arm after 3.5 years and the hand after four years. The neck, foot and leg all first occurred after six years of injecting. Injection in the groin, toes and fingers occurred, on average, after a decade of injecting.

Figure 1: Median number of years from initial injection until first use of injection sites



Drug classes that had been injected into physical injection sites are presented in Table 8. The upper arm is not included, as this was originally coded as an "other" site, prior to analysis showing its popularity. There was widespread injection of a wide variety of drug classes into various physical sites. As expected, the three most commonly injected drugs (heroin, amphetamines, cocaine) had the highest prevalence of injection into all physical sites. The potential for drug specific harm in individual injection sites is illustrated by the injection of methadone syrup and benzodiazepines. While, like all drug classes measured, these oral preparations had been predominantly injected into the cubital fossa, both had been injected into a wide variety of sites, including the groin, toes and neck.

Table 8: Drugs injected in physical injection sites

	Arm (cubital) %	Arm (forearm) %	Hand %	Foot %	Leg %	Neck %	Groin %	Fingers %	Toes %	Other %
Heroin	98	65	46	15	14	9	5	5	1	22
Amphetamines	77	30	15	6	5	1	2	1	2	10
Cocaine	70	24	12	4	4	2	2	1	1	9
Methadone	44	12	4	2	2	1	2	1	1	3
Benzodiazepines	31	9	5	4	2	0	1	1	1	3
Hallucinogens	21	2	0	0	0	1	0	0	0	1

3.5.3 Risk perceptions of physical injection sites

Subjects were asked to rate the degree of danger involved in injecting into individual injection sites (Table 9). As in Table 8, the upper arm was not included as it had been originally coded as an "other" site. The cubital fossa was considered the least dangerous place to inject, with 77% stating it was either not very dangerous or not dangerous at all. The sites perceived to be the most dangerous were the groin and neck, with 91% and 93% respectively believing it to be dangerous. While injecting in the neck was considered the most dangerous activity, it was not the site least often employed for injection. More subjects had injected in the neck than in the groin, fingers and toes. It is worthy of note that all but one of the subjects who had injected in the neck believed it to be dangerous.

Table 9: Risk perceptions of physical injection sites

	Very dangerous %	Quite dangerous %	Not very dangerous %	Not dangerous at all %
Cubital fossa	10	18	48	29
Forearm	11	30	41	20
Leg	28	39	25	9
Hand	33	41	20	7
Foot	41	34	15	4
Fingers	47	36	13	5
Toes	48	34	15	4
Groin	69	22	7	3
Neck	78	15	4	2

3.5.4 Factors associated with multiple physical injection sites

Females had used significantly more injection sites than males (3.4 v 2.9, $t_{198}=1.98$, $p<.05$). There were significant correlations between the number of injection sites ever used and: length of injecting career ($r=0.18$, $p<.01$), number of injection-related problems experienced ($r=0.48$, $p<.001$), number of drug classes ever used ($r=0.36$, $p<.001$) and number of drug classes ever injected ($r=0.43$, $p<.001$). There was no significant difference between the number of sites ever used by those currently in treatment and those not in treatment (3.3 v 2.9). There were also no significant correlations between number of injecting sites and age ($r=0.07$) or years of secondary education ($r=-0.09$).

In order to determine independent predictors of multiple injection sites, linear multiple regressions were conducted. Variables entered into the initial model were: sex, length of injecting career, years of education, treatment status, number of injection related problems experienced, number of drug classes ever used and number of drug classes ever injected. Length of injecting career and age were co-linear ($r=0.82$). As such, only length of injecting career was entered into the model.

The final regression model is presented in Table 10. After controlling for the effects of other variables, a greater number of injection-related problems and a greater number of drug classes ever injected were significantly associated with the use of a larger number of injection sites. The model was significant ($f=43.4$, $p<.001$) and accounted for 31% of the variance.

Table 10: Linear regression predicting number of injection sites ever used

Variable	Beta	SE	t-value	P
Number of injection-related problems	0.55	0.09	5.9	<.001
Number of drug classes injected	0.37	0.08	4.5	<.001

3.6 Geographical injection sites

3.6.1 Initial and most recent geographical injection sites

The locations of initial and most recent injections are shown in Table 11. The majority of subjects (77%) injected in a home environment on the initial injecting occasion. The category "other public place" included a variety of locations, including car parks, beaches and building sites. There were clear differences between the initial and most recent injections in the likelihood of injecting in a public place. Subjects were significantly more likely to have injected in a public place on the most recent injecting occasion than on the initial injecting occasion (OR 3.00 95% CI 1.96-4.61).

Table 11: Geographical location of initial and most recent injection

	Initial injection %	Most recent injection %
Home	35	40
Friends place	42	9
Street	5	15
Public toilet	3	9
Pub/club	1	2
Car	5	8
Train	1	2
Other public place	10	17

3.6.2 History of injection in geographical sites

Subjects had injected in a wide variety of locations, both in home environments and in public places (Table 12). The most common locations in which injections had occurred, both ever and in the preceding six months, were the person's own home, a friend's home and a car. Eighty percent of subjects had injected in the street, with 61% having done so in the preceding six months. Over a half (55%) had injected in a train, and a third (34%) had done so in the preceding six months. Nearly all subjects (96%) had injected in a public place, and 89% had done so in the preceding six months.

Table 12: History of injection in geographical sites

	Ever %	Six months %
Home	99	92
Friends place	95	79
Car	90	68
Public toilet	81	58
Street	80	61
Pub/club	70	39
Train	55	34
Other public location	75	59
Any public location	96	89

3.6.3 Frequency of use of geographical injection sites

Subjects were asked how frequently they had injected in specific geographical locations over the preceding six months (Table 13). Seventy one percent reported having injected often in their own home. However, injecting in public places was also common and frequent. Twenty seven percent reported having injected often in the street over the preceding six months, 22% had injected often in cars and 17% had injected often in public toilets. Overall, 53% of subjects reported having injected often in at least one public location during the preceding six months.

Table 13: Frequency of use of geographical injection sites in preceding six months

	Often %	Sometimes %	Rarely %	Never %
Home	71	11	11	8
Street	27	14	20	36
Car	22	23	24	31
Friends place	20	35	26	20
Public toilet	17	19	24	37
Pub/club	8	11	21	56
Train	7	11	17	61
Other public place	19	18	22	34

3.6.4 Factors associated with injections in public locations

In order to examine which factors were associated with injecting in public places, those subjects who reported having often injected in public places in the preceding six months were compared with the remainder of the sample. Frequent injectors in public places were more likely to be male (60% v 41%, OR 2.14 95% CI 1.20-3.02) and to have overdosed in the preceding six months (31% v 19%, OR 1.96 95% CI 1.02-3.79). They had also injected significantly more drug classes in the preceding six months (2.5 v 2.1, $t_{198}=2.2$, $p<.05$), were more likely to have injected in more physical injecting sites in that period (2.3 v 1.7, $t_{198}=2.9$, $p<.01$) and had more current injection-related problems (2.5 v 2.0, $t_{198}=2.9$, $p<.01$). There were no significant differences between the groups in length of injecting career, education, needle sharing, number of drug classes used in the preceding six months or SDS scores.

In order to determine independent predictors of frequent public injecting, logistic regressions were conducted. Variables entered into the initial model were: sex, length of injecting career, years of education, treatment status, number of injection

related problems experienced in the preceding six months, number of drug classes used in the preceding six months, number of drug classes injected in the preceding six months, experience of overdose in the preceding six months, recent borrowing of used needles, SDS score, and number of physical injection sites used in the preceding six months.

The final regression model is presented in Table 14. After controlling for the effects of other variables, being male and a greater number of injection-related problems were independently associated with frequent public injections.

Table 14 Logistic regression predicting frequent public injections

Variable	OR	95% CI
Sex	2.86	2.24-3.48
Number of injection-related problems (preceding 6 mths)	1.53	1.27-1.79

4.0 DISCUSSION

4.1 *Major Findings of the Study*

The study showed widespread use of multiple injection sites. Subjects had used an average of three injection sites in their careers, and two in the previous six months. Significant proportions of IDU had injected in sites such as the hand, foot, leg and neck. A wide variety of substances, including oral preparations, had been injected into various sites.

The study revealed a clear career progression in the use of injection sites, from the near universal use of the cubital fossa for the initial injection, to the use of less common sites such as the groin and fingers after a decade of injecting. There was an association between the number of injection sites used, and experiencing a greater number of injection-related problems.

The second major finding of the study was the widespread and frequent use of public injecting locations. Nearly all subjects had injected in a public place, and 89% had done so in the preceding six months. Injections in locations such as streets, cars and public toilets were all common. The frequent use of public locations for injections was associated with a greater number of injection-related problems.

4.2 *Prevalence of use of physical injection sites*

As was the case in the British study⁶, the current study revealed widespread use of almost all body sites for injection. The common public perception, reinforced by media images, of injections taking place in the cubital fossa, represents a small component of the injecting behaviours of IDU. Significant proportions of subjects had injected in sites such as the hand, foot and leg. One in ten subjects had injected in the neck. Several subjects had injected in unexpected sites, such as below the clavicle. One in six subjects had injected in five or more different sites. Interestingly, no subject reported injecting in the eye, which is a common lay belief of the behaviour of IDU.

There were noticeable differences in the prevalence of use of sites between the Australian IDU and those reported in the British study. Equal proportions in both

samples had injected in the arm (although the British study did not distinguish separate parts of the arm). However, larger proportions of British IDU had injected in the hand (71% v 53%), foot (38% v 19%), leg (42% v 18%) and groin (24% v 6%). While the British study was less precise in measuring body parts, e.g. not distinguishing between hands/fingers and foot/toes, aggregating the components indicated that the discrepancies were not attributable to the use of different categories. It is unclear whether this reflects cultural differences, or the impact of the use of particular drugs. For instance, the injection of the benzodiazepine temazepam, strongly associated with serious vascular health effects, is more common in the UK than in Australia^{7,8,11}. The differences could also not be attributed to major differences in the characteristics of the samples, as their demographics and drug use careers samples were almost identical.

Subjects typically began their injecting career by injecting in the cubital fossa. This injection was most commonly given by a friend, although significant gender differences existed. Consistent with studies that have found that female IDU are much more likely to have an IDU partner than males²¹, the odds of a female being first injected by a partner were five times those of males. Conversely, males were more likely to have injected themselves.

The progression of injection sites is illustrated by the comparison of initial and most recent injection sites. While the first injection was almost exclusively in the cubital fossa, a quarter of subjects injected in some other location on the most recent occasion. There appeared to be a marked injecting site "career" among these IDU. The initial progression from the cubital fossa was to other parts of the arm: the forearm (two years after initiation) and upper arm (3.5 years). The use of the hand, having been practised by a half of subjects, occurred on average four years after initial injection. Those who had injected in the neck/foot/leg did so after six years of injecting. The final progression to the use of the groin and the extremities (toes/fingers) occurred a decade after the initiation of injecting.

The reasons for such progressions, in all probability, relate to injection-related problems experienced in often used sites. This view is supported by the finding that the use of more injection sites was independently associated with a greater number of injection-related health problems. Large numbers of the sample reported both lifetime and current injecting-related health problems. Thus, prominent scarring, lumps and swelling and difficulty injecting were all reported by large proportions of the sample. The results indicate that most subjects continue to use earlier injection sites, such as the cubital fossa, but add other sites to their repertoire. Regular vascular damage would thus be occurring in a wide variety of sites.

A wide range of drug types had been injected into body sites. Heroin was the drug that had the highest prevalence of injection in all sites, with the exception of the toes. Amphetamines and cocaine had also been injected by substantial proportions into a variety of sites. Of particular health interest was the fact that the two oral preparations, benzodiazepines and methadone syrup, had been injected by some subjects into sites such as the hand, groin, fingers and toes. As noted in the introduction to this report, the injection of these substances has been associated with amputations, fistulas, abscesses/infections in injection sites, venous thrombosis and death^{10-13,16}. The fact that such substances have been injected into sites such as the fingers and groin is cause for concern. While users may be aware that injecting into such sites is risky, it is doubtful that they are aware of the added risks posed by injecting oral preparations into such sites.

4.3 Risk perceptions of use of physical injection sites

The IDU in this sample held a benign view of the risks of injecting in the arm. The majority of subjects believed that this practice was either not very dangerous, or was not dangerous at all. This view was prevalent, despite the large number of injection-related problems that were reported by the sample, and the fact that subjects were moving on to other injection sites presumably, at least in part, due to the negative effects of reported injections in the arm.

There was a strong belief that injecting in sites other than the arm was dangerous, particularly the neck and groin. While these sites were less commonly used than the arm, the perception of risk did not correspond with the prevalence of their use. Thus, while injecting in the neck was viewed as the most dangerous activity, more of the sample had injected in this site than in perceived less dangerous sites such as the groin, fingers and toes. A perception of danger is clearly not sufficient to discourage an activity. The fact that all but one of the neck injectors recognised neck injecting as dangerous illustrates this point. Given that injecting in any site carries risks, this may not be surprising.

4.4 *Injection-related problems*

Consistent with previous research²², nearly all subjects reported both lifetime and current injection-related problems. As noted above, prominent scarring, lumps and swelling and difficulty injecting were the three most commonly reported problems. The data clearly show that the risks associated with injecting are significant, independent of practices such as needle sharing.

Females reported significantly more lifetime and current injection-related health problems than males. This may reflect generally smaller veins in females compared to males. Females would appear to be at a higher risk for health problems that arise directly from the act of injecting than their male colleagues. In relation to this issue, it is worth noting that males were significantly more likely to report having to do nothing to find a vein for injection.

As would be expected, those not currently in treatment had more current problems than those in treatment. Treatment has been shown to be protective against overdose and blood borne viruses¹⁷. The reduction of the rate of injections associated with drug treatment would also appear to reduce the incidence of health problems arising directly from injecting.

4.5 *Factors and harms associated with the use of multiple injection sites*

Females reported using significantly more injection sites than males. Given the greater number of injection-related health problems that females reported, and more specifically the greater difficulty they reported in relation to injecting, it is feasible that females may be prompted to use more sites due to a higher likelihood of vascular damage.

As would be expected, there was an association between length of injecting career and the number of injecting sites ever used. Thus, as the vascular health in a particular site degenerates, the need to find alternative sites becomes important.

The final regression model indicated that a greater number of injection-related health problems and the injection of more drug classes were both independent predictors of the number of injection sites used. Thus, after taking into account the effects of other variables, these two variables predicted multiple injection site use. The fact that there is a strong and independent relationship between health problems and multiple injection site use is of importance. While, as argued above, health problems may be a factor in causing a move to other sites, the use of such sites as the groin is likely to cause further significant damage. The clinical picture of someone presenting with a range of injecting sites is likely to include a range of vascular problems.

Similarly, the more different drug classes injected, the more sites used. The injection of a wide variety of drug types may be a marker for the more entrenched drug user.

4.6 *Prevalence of use of geographic injection sites*

The current study indicated widespread and frequent use of public locations as injection sites. Nearly all subjects had injected in a public location, and nearly all had done so in the preceding six months. Injecting in a street was common: 80% had done so, and 61% had done so in the preceding six months. Such common use of public locations presents public health implications for the disposal of the needles used by these IDU, many of which would presumably be left at the injection scene.

The most common place to inject, other than in a home, was in a car. This is of concern, as it can be assumed that many who do so will drive after intoxication. Toxicological data from intoxicated drivers from whom blood samples were taken by police after being stopped for dangerous driving is illustrative of this point²³. Morphine, the metabolite of heroin, was detected in 31% of those in whom drugs were detected. Clearly the association between driving and heroin use is cause for concern. It should be noted that 4% of fatal heroin overdoses that occurred in NSW between 1992 and 1996 were located in cars¹⁶.

Surprisingly, over a half of the sample had injected in a train, and a third had done so in the preceding six months. One of the likely reasons for this is that many people are travelling by train to obtain drugs, and inject on the train soon after. The major drug markets in Sydney are on train lines. The largest heroin market is located in Cabramatta, in outer south western Sydney, to which IDU travel from all areas of Sydney and beyond to obtain heroin. Consistent with the wide geographic appeal to IDU of this market is the fact that over a half of heroin overdose deaths that occur in this area are of IDU that reside outside south western Sydney altogether¹⁷.

While public injecting was common, the initial injecting was likely to occur in a home environment. Three quarters of subjects had their initial injection in either their own home or that of an acquaintance (in some cases a dealer). However, when the most recent injection was examined, only a half had done so in a home environment.

Injecting in public locations was not only prevalent, but occurred frequently. A half of the sample had injected frequently in at least one public location in the preceding six months. A quarter of the sample reported having often injected in the street in the preceding six months. The concerns raised above about injecting in cars is further emphasised by the fact that 22% of the sample reported often injecting in cars in the preceding six months.

4.7 *Factors and harms associated with frequent public injecting*

While common in both sexes, males were significantly more likely to report frequent injections in public locations (60% v 41%). There were clear harms associated with public injecting. Frequent street injectors were more likely to have experienced a heroin overdose in the preceding six months, and to have more current injection-related problems. In terms of drug use, public injectors had injected more drug classes and used more injection sites in the preceding six months. The overall picture is of a riskier sub-group of IDU.

The logistic regression indicated that, after taking into account other variables, being male and having a greater number of injection-related problems were independently associated with frequent public injections.

The results of this study are consistent with those reported by Klee and Morris¹⁵ among British IDU. Klee also reported that street injectors were more likely to be male, to have overdosed and have more vascular problems than other IDU. Thus, the patterns of harm associated with public injecting were almost identical in two geographically remote locations.

While public injectors may be characterised as a risky IDU sub-group, the circumstances of injecting in public locations provide clues as to why more harms attach to such behaviours. An injection in a public location, with the accompanying risk of detection, would be performed in a hurried manner. Users would have to locate a vein and inject as quickly as possible, there being no time for "best practice" injecting. Health problems would thus be expected, both from the rapid nature of the process, and the risk of infection from the environment. The rapid nature of the injection might also increase the risk of an overdose, as a larger bolus effect may be experienced.

4.8 Summary and conclusions

The current study demonstrates that where a person injects is important, both in terms of body sites and geographical locations. The importance of location is illustrated by the findings that poorer vascular health was associated both with

multiple bodily injection sites, and with frequent public injecting. The risks of such behaviours were demonstrated by the large proportion of IDU with injection-related problems. The study found multiple site injecting to be common among IDU, particularly among females, with a clear career progression to the use of more dangerous sites. Similarly, the use of public locations for injecting, particularly by males, was almost universal.

The current study illustrates the importance of examining needle use behaviours beyond those related to the spread of blood borne viruses. By focusing upon needle *sharing*, the extent of needle-related problems is greatly underestimated. This study has shown this to be true both for the physical and geographical locations of injections. If the harms associated with injecting are to be further addressed, attention needs to be given to *where* IDU inject.

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