RISK FACTORS FOR LEG ULCERATION IN PEOPLE WHO INJECT DRUGS: A CROSS-SECTIONAL STUDY

RISK FACTORS FOR LEG ULCERATION IN PWID

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CONFLICT OF INTEREST

No conflict of interest has been declared by the authors.

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ABSTRACT

Aims and Objectives

The aim of this study was to assess, for the first time in a hard-to-reach population, the risk factors for leg ulceration among PWID, with the objective of making improvements to prevention and care.

Background

An estimated 4.8 million people globally inject drugs with potential for injecting related harm. Skin and vein damage associated with drug injecting is increasing. Leg ulceration is a chronic condition which in the UK has a prevalence of 15% amongst people who have injected drugs (PWID) compared to 1% in the general population. Glasgow has the highest rate of problematic drug use in Scotland with approximately 13,900 individuals, about 50% of whom are thought to inject. However, the reasons for high prevalence of leg ulceration among PWID are unknown. To support improvements in prevention and care, the dearth of evidence around risk factors for leg ulceration in PWID needs to be addressed.

Design: A cross-sectional survey of 200 current and former injectors recruited from drugs services in Glasgow, Scotland, to measure skin problems, leg ulceration and injecting habits is reported following STROBE guidelines. Logistic regression modelling examined whether demographics and injecting habits predicted leg ulceration.

Results: The likelihood of leg ulceration was increased for those who injected in the groin and the leg. Additionally, injecting in the groin and leg were associated with having a DVT.

Conclusion: The primary risk factors for leg ulceration in PWID are injecting in the groin and the legs and these are clinically linked to deep vein thrombosis. Injecting into the femoral

vein is increasingly common practice for PWID and healthcare practitioners should advise injectors of the increased risk of leg ulceration and DVT and discourage injecting into these areas.

KEY WORDS

Risk factors

Drug user

Leg Ulcer

Venous insufficiency

Venous thromboembolism

Groin or femoral injecting

Leg injecting

PWID

Skin

Nursing

INTRODUCTION

Globally, an estimated 4.8 million people inject drugs with potential for associated injecting related harm (UNODC, 2018). Mortality from drug related causes is rising across the world (EMCDDA, 2019; CDC, 2020). In Scotland in 2018, 1187 people died from drug related causes, more than any other European country (House of Commons, 2019). This public health emergency indicates a worsening problem, which requires new intervention approaches. Infections related to injecting are also rising and whilst there may be several factors at play, including ageing drug users and deteriorating health (Public Health England, 2019), research investigating implications of this rising 'epidemic' is needed and can inform global prevention efforts. Leg ulceration is a notable consequence of injection, with significant cost to individuals and society.

BACKGROUND

Leg ulceration is end–stage venous disease identified by an open wound between the ankle and the knee that can be painful, malodourous and remains unhealed for at least four weeks (SIGN, 2010). Traditionally a disease of older age, people who inject drugs (PWID) are known to suffer leg ulceration at relatively younger ages. Prevalence of leg ulceration in PWID is very high, with one study reporting 15% compared to 1% of the general population (Coull et al, 2014). Recurrence of leg ulceration is common and long-term problems and complications can lead to limb amputation. The condition causes considerable suffering to the individual, affects quality of life, and is costly and time-consuming to treat (Palfreyman et al, 2007; Guest et al, 2015). Anecdotal clinical reports suggest a rising incidence of leg ulceration amongst PWID is placing an increasing burden on nursing and healthcare delivery especially as injectors become older. Assessment and management of leg ulceration is predominantly the domain of nurses. However, the risk factors for early ulceration in PWID

are unknown and the lack of knowledge of risk factors hampers prevention and harm reduction efforts. Treatment becomes difficult to plan, potentially leading to inappropriate decisions and actions. Indeed, poor understanding may have contributed to ulceration being classified as a skin or soft tissue infection, when, in fact, it is an aspect of venous disease but not an infection and requires quite different treatment (Public Health England, Health Protection Scotland, Public Health Wales, and Public Health Agency Northern Ireland, 2019). Clear definitions of skin disease are important to determine accurately the extent of the problem, particularly when many people who work within drug-related research may not be dermatological experts. Misdiagnosing leg ulcers as an infection can lead to inappropriate treatment such as the use of antibiotics, compromising antimicrobial resistance at a population level, or prolonged unhealed ulceration without correct treatment for individuals. To support improvements in prevention and care, the dearth of evidence around risk factors for leg ulceration in PWID needs to be addressed. The aim of this study was to assess, for the first time, the risk factors for leg ulceration among PWID.

DESIGN

Our study was a cross-sectional exploratory design which involved face-to-face structured interviews with PWID conducted as part of a doctoral research project (Coull, 2016). Reporting follows the STROBE (The Strengthening the Reporting of Observational Studies in Epidemiology) Statement, guidelines for cross-sectional studies to enhance rigour and transparency (von Elm et al, 2008; Supplementary File 1).

PWID were recruited from drugs services, injecting equipment providers (IEP) and opiate substitute treatment (OST) services across the city of Glasgow, Scotland. Glasgow has the

highest rate of problematic drug use in Scotland with approximately 13,900 individuals, about 50% of whom are thought to be injecting (ISD 2011, ISD 2012).

PWID may lead chaotic and stressful lives, and are known to find keeping appointments and engaging with services difficult (Taylor and Kearney, 2005). Therefore, attending for the purpose of undertaking research can be difficult and recruitment of numbers of injectors very challenging (Syed and Beeching, 2005). Hence, opportunistic sampling was used to recruit current and former PWID to participate in the survey.

PWID were eligible for inclusion in the study if they were aged 16-44 years, could understand and speak English and had a current or previous history of injecting in their lifetime. Participants were excluded if they were visibly under the influence of alcohol and/or drugs at the time of data collection that would affect their competence to participate. One individual was excluded on this basis. The lead author approached individuals who were attending for Injecting Equipment (IEP) or Opiate Substitute Therapy (OST), who did not appear under the influence of alcohol and drugs and offered an opportunity to participate in the survey. Recruitment stopped when the target sample size of 200 participants was reached.

Data collection

Data were collected using an interviewer-administered questionnaire in a private setting. The questionnaire was designed for the study and informed by existing research with PWID (Makower et al, 1992; Pieper and Templin, 2001; Darke et al, 2001; Taylor et al, 2005; Abelson et al, 2006). It contained 14 questions derived from the ongoing Needle Exchange Surveillance Initiative (NESI) and included items on demographics, injecting history, and injecting techniques. NESI has been validated with PWID in similar settings in the West of Scotland (Health Protection Scotland and the University of the West of Scotland, 2019). The

researcher developed additional questions related to injecting habits, skin and leg wounds, venous disease, physical health, assessment and treatment. These were drawn from risk factors suggested within the literature as well as from existing leg ulcer assessment tools, and incorporated into the questionnaire (SIGN, 1998; Binswanger et al, 2000; Murphy et al, 2001; Mercure et al, 2008; Phillips et al, 2013).

Before implementation, the lead researcher (AC) conducted a pilot study of 10 individuals to test the research tools. This resulted in minor adjustments to the questionnaire. Specifically, a question on injecting technique was added and response categories were altered to improve data entry. Clear definitions of each anticipated skin problem (i.e. leg ulcer, lump, abscess, track marks, acid burns, broken skin, chronic wounds, and rashes) were provided to ensure consistency and used consistently throughout interviews to ensure reliability and validity of data gathered about skin problems (see Table 1). An 'other' category was provided in case of unexpected anomalies.

[Insert Table 1 here]

Ethical considerations

Ethical approval was granted by the Institution and research governance approval was given by the relevant NHS Board. Participants provided informed, written, consent. Remuneration in the form of a GBP £2 food voucher was given following participation.

Data analysis

Data were coded, entered into SPSS version 23.0 (IBM, Armonk, NY). Statistical analysis was conducted in three steps. First, descriptive statistics of each variable were examined and

reported as mean (standard deviation [SD]) for continuous variables and n (%) for categorical variables. Second, univariate associations between sociodemographic characteristics, injecting behaviour and clinical outcomes were conducted using Pearson's chi-square test (or Fisher's exact test, as appropriate). Third, logistic regression modelling examined the risk factors that significantly predicted leg ulceration in the sample. Statistical significance was set at $p<0.05$.

RESULTS

Sample

Three-quarters of participants were men (76.0%, n=148), and two-thirds were current injectors (64.0%, n=128) (Table 2). The age range was 21-44 years old (mean 34.6 years, SD=5.6). Participants had injected for varying lengths of time ranging from less than a year to 31 years with a mean of 10.3 years (SD=7.7). The youngest age a participant reported starting to injecting was 12 years old, and the oldest was 39 years (mean age 21.9 years, SD=5.9). The majority of participants (73.5%) were injecting before their 25th birthday.

[Insert Table 2 here]

Injecting habits

Most current injectors injected heroin (82.0%, n=105), with a smaller number (17%, n=22) injecting cocaine. Almost two-thirds (63.0%, n=81) of current injectors reported at the time of the interview they were injecting one or more times a day, with (13.0%, n=17) injecting four or more times a day. Furthermore, 47.7% (n =61) of current injectors reported injecting

four or more times in a day at least once during their life, with this increasing to 63.5% (n=46) among former injectors (Table 3).

[Insert Table 3 here]

Skin problems

Approximately two-thirds of current injectors (62.5%, n=80) and over half (55.6%, n=40) of former injectors reported a skin problem. Of those reporting a skin problem (n=120), the most commonly reported problem among current injectors was abscesses (45.3%, n=58), followed by lumps (31.3%, n=40) and track marks (31.3%, n=40), with a similar pattern among former injectors (Table 3). 'Other' skin problems identified were bruising and varicose veins, phlebitis, cellulitis, haematomas, scarring and thin skin.

Overall, 15.0% (n=30) of PWID with a skin problem reported leg ulceration; 13.3% (n=17) among current injectors and 18.1% (n=13) among former injectors (Table 3). Five PWID (16.7%) who reported a leg ulcer injected into their ulcer site. All participants who reported having a leg ulcer (n=30) had compression treatment, but only two-thirds (63.3%, n=19) reported assessment using a Doppler test.

Signs of venous disease

As end-stage venous disease, leg ulceration is likely to be preceded by one or more signs of venous disease. In this study, PWID with a leg ulcer were significantly more likely to have a history of varicose veins and skin staining (Table 4).

[Insert Table 4 here]

All but one of the participants who developed a leg ulcer had a DVT (96.5%, n=29). DVT was more frequently reported by groin injectors (94.0%, n=61) than lower leg injectors (61.5%, n=40). Injecting in the groin and lower leg were both statistically significantly associated with DVT compared with no DVT (Groin: 94.0% vs 37.0%, χ^2=57.33, <0.001; Lower leg: 61.5% vs 28.0%, χ^2=20.56, <0.001).

Risk factors for leg ulceration

In univariate analyses, age (χ2=15.509, p<0.001), but not gender, was a significant risk factor for leg ulceration. Those who injected in the groin (93.5%, n=28, p<0.001) or the lower leg (80.0%, n=24, p<0.001), had hit an artery (90%, n=27, p<0.001) or a nerve (80%, n=24, p=0.004) and those who had been injecting for ≥6 years (90%, n=27, p=0.004) were significantly more likely to have a history of leg ulceration (Table 5).

[Insert Table 5 here]

We conducted a logistic regression analysis to predict leg ulceration using age and injecting behaviours that were significant in univariate analysis. A test of the full model against a constant only model was statistically significant, indicating that the predictors reliably distinguished between those with a history of leg ulceration and those without (χ2=53.58(8), p<0.001). In a logistic regression, injecting into the groin (OR 7.162, 95% CI 1.416-36.229, p=0.017) and into the lower leg (OR 5.900, 95% CI 1.900-18,318, p=0.002) were significant predictors of leg ulceration among PWID (Table 6). Nagelkerke's R2 of 0.41 and Cox & Snell R2 of 0.24 indicated an adequate relationship between prediction and grouping.

Prediction success overall was 84.5% (90.6% for those without a history of leg ulceration and 50.0% for those with a history of leg ulceration). The Wald criterion demonstrated that injecting into the groin (B=1.969, SE=0.827) and injecting into the lower leg (B=1.775 SE=0.587) made significant contributions to the model (Table 6).

[Insert Table 6 here]

DISCUSSION

Our study found that injecting in the groin (OR 7.162, 95% CI 1.416-36.229, p=0.017) and in the lower leg (OR 5.900, 95% CI 1.900-18,318, p=0.002) increased the risk of leg ulceration. Furthermore, almost all participants who developed a leg ulcer had a DVT (96.5%, n=29). DVT was more frequently reported by groin injectors (94.0%, n=61) than lower leg injectors (61.5%, n=40). Injecting in the groin and lower leg were significantly associated with having a DVT compared with not having a DVT (Groin: 94.0% vs 37.0%, $\chi 2=57.33$, $p<0.001$; Lower leg: 61.5% vs 28.0%, $\chi 2=20.56$, $p<0.001$).

Groin injecting is an increasing health concern (Senbanjo et al, 2010; Hope et al, 2015), with a seeming lack of awareness by both nursing and service staff as well as PWID of the detrimental effects this may have on the lower limb (Coull, 2016). When combined with the previously reported high prevalence of leg ulceration in PWID compared to the general population (Coull et al, 2014; Guest et al, 2015), our study highlights the importance of raising awareness in clinical services of the increased risk of leg ulceration involved in injecting into the groin and leg. Previous work around groin injecting has considered the ethics of harm reduction in the area (Rhodes et al, 2006; Zador, 2007; Hope et al, 2015) but no paper has discussed the long-term implications of femoral injecting. Concerns have been

expressed about the narrowing of the femoral vein but the detailed implications have not been identified previously.

The increased risk of DVT reported in our study illustrates the longer-term vascular complications that are likely to result from groin and leg injection. Repeated injecting into the same vein can cause narrowing of the lumen of the vein and obstruction, which leads to slowing or sluggish blood flow resulting in an increased likelihood of clotting (Senbanjo et al, 2012). In the case of groin or femoral injecting this results in increased likelihood of DVT. Long-term chronic vascular problems can lead to amputation and devastating effects on individual lives (Pieper and Templin, 2003). These effects have not been commonly attributed to an injecting career, as many have occurred long after injecting has ceased (Pieper, 1996; EMCDDA, 2017). The lack of knowledge about the risks associated with groin injecting, and the easy accessibility of the femoral vein, means that groin injecting may continue for many years before the damage becomes overtly noticeable, profound and irreversible (Cornford et al, 2011). Injecting in the femoral vein which is closely positioned to the femoral artery and nerve, may also increase the likelihood of nerve or arterial damage in the leg further complicating potential aetiologies of ulceration (Maliphant and Scott, 2005).

It is important to note that there are other factors associated with injecting that contribute to the risk of DVT in PWID. The physical process of breaching the skin and injecting into a vein is likely to cause turbulence and trauma to the vein wall and increase risk of narrowing of the lumen which, in turn, can enhance the risk of DVT (McColl et al, 2001). That, combined with long periods of immobility when the effects of opiate injecting create somnolence, enhances the likelihood of clotting. This is not new information and the links to surface wounds where injecting had occurred is known, but the underlying damage within the

venous system is less apparent (McColl et al, 2001; Syed and Beeching, 2005). Venous signs may occur much lower in the leg from injecting sites as there is back pressure when narrowing of proximal veins occurs (Moffatt et al, 2007). Venous signs such as ankle flare, varicose veins, skin staining and changes in the shape of the lower limb are all indicators of chronic venous insufficiency or venous disease (Pieper et al, 2009). Approximately two-thirds of current injectors (62.5%, n=80) and over half (55.6%, n=40) of former injectors in our study reported a skin problem. Those with a history of leg ulceration were significantly more likely to have varicose veins ($p<0.001$) and skin staining ($p<0.001$) compared to those without a history of leg ulceration. These signs of venous disease may be early indicators to clinicians of increased leg ulcer risk.

Comparisons between our findings and existing literature are hampered for two reasons. First, there is a paucity of previous research in this area. The NESI study gathers information about injecting risk annually, which is used to assess, measure and monitor the prevalence of blood borne viruses and injecting risk behaviours among people who inject drugs (PWID) in Scotland. Sample characteristics were similar to those identified within the most recent NESI study indicating a representative sample but lacks detail on skin problems and leg ulceration (Health Protection Scotland and the University of the West of Scotland, Glasgow Caledonian University and the West of Scotland Specialist Virology Centre, 2019).

Second, there are a lack of common definitions in existing research of skin problems, including leg ulceration and there is a lack of granularity of definitions. ‘Soft tissue infection’ has become a blanket definition for many types of injecting injury, including leg ulceration. Although leg ulcers are open wounds and can be prone to infection, because they are predominantly caused by venous damage and not micro-organisms, the ulcer will heal usually

when venous return is improved by for example, using compression therapy (SIGN, 2010). Infection can occur, and should be treated concurrently to the venous damage, but if the infection alone is treated the ulcer would tend not to heal without addressing the underlying venous problem. Classifying open wounds or sores as infection can be misleading and potentially lead to an over-reporting of infections and an under-reporting of chronic leg ulceration (Public Health England, 2019).

Implications for future practice, education and research

Treatment of PWID with leg ulceration may be challenging due to misunderstandings about aetiology of these wounds in a relatively younger age group. Similarly, engagement in care may be difficult to attain due to lack of accessibility through service design issues, stigmatisation, and socio-economic factors. Our study findings highlight a need to increase the understanding of the experiences of PWID that lead them to inject in high risk areas to support improvements in treatment, care and service design. This could, for example, lead to the development and testing of education and support around harm reduction for nurses, professionals and PWID. Future research should examine the effectiveness of education and interventions to reduce leg ulceration among PWID. There is also a need to clarify definitions, to ensure that routine data collection (such as NESI) can accurately assess changing patterns of prevalence of skin and venous problems beyond skin and soft tissue infections. The definitions used here can be refined and enhanced based on the knowledge generated from this study.

SSTI generally would happen around an injecting site due to direct penetration with the needle and associated micro-organisms. Ulceration may occur both at the injecting site and

away from the injecting site. There is confusion in the literature about the definition of a SSTI and ulceration (Public Health England, 2019) and it would be advantageous to discuss SSTI infection more specifically with study participants. Definitions of skin breakdown require to be tightened in future work in order to be clear about ongoing consequences of injecting on the skin and venous system.

The originality of this paper lies in the novelty of recruiting a sample of injectors and examining risk factors for leg ulceration which has not been done before. There are complex and known challenges to recruiting PWID into research studies such as mobile populations, homelessness, suspicion of authority and disclosure of illicit practices (Lankenau et al, 2010). Additionally, definitions offered are clear and differentiate between injecting injuries and skin problems, and ulceration. The significance of this is international and applicable wherever PWID inject into the femoral vein or leg.

This is the first study to enumerate the prevalence of skin problems and, specifically, leg ulceration among PWID in Scotland. It provides vital evidence to inform efforts to decrease the long-term deleterious health impacts of injection amidst the current epidemic across the West of Scotland. Our study had a number of notable strengths. Through close collaboration with practice partners, we were able to recruit 200 PWID and reach the target sample size for statistical analysis. The research was conducted by a nurse with expertise in skin and wound care, and working within the substance misuse setting. This allowed insight into the descriptions, and jargon, provided by the participants of signs and symptoms and allowed further specific probing where necessary. This is unique.

The study method allowed current and previous injectors to provide a large amount of information in a short interview. Strenuous attempts were made to ensure rigour including standardising the definitions of skin problems, which have not previously been used in papers about skin problems in injectors.

Research strategies for drug using populations are fraught with difficulties as many drug injectors have unstable accommodation, are frequently incarcerated, and engaged in chaotic life styles which meant arranging appointments for interview or follow-up was difficult or impossible (Robinson et al, 2006). Ideally the sample of participants could have been followed up or greater numbers achieved, however the research design was based on the most practical approach to gathering the information needed.

By using interviews, acquiring accurate retrospective data is entirely dependent on the ability of participants to accurately recall activity. However, other studies appear to show that this was a reasonably reliable method of gathering data given the use of psychoactive drugs (Idler and Benyamini, 1997; Morrison et al, 1997; Pieper and Templin, 2001; Bell and Salmon, 2012). The questionnaire naturally focused on asking what was 'normal' or 'usual' for the participant in terms of injecting behaviours. However, it may not have been the 'usual' practices that caused the skin problems. It may well be that on occasions the participant was 'rattled' (drug withdrawal characterised by sweating, shaking and malaise), desperate, injected by others, or unable to remember what caused the problems, and it may be possible that these incidents could not be captured at all. Questions that appeared simple and successfully piloted became more challenging with injectors who had been using drugs over a long period.

Drug use is not a simple trajectory where people start and continue along a path. Many stop and start depending on circumstances and their use may vary according to a range of factors such as finances, employment, mental health, accessibility to drugs (Galea et al, 2003). People use a range of injecting sites on their bodies and may go back to sites, different drugs and different techniques, which they used years ago. A limitation is that the data could not be verified against medical records or other objective means (Roose et al, 2009).

The study was conducted in 2008/9 and although some years ago, the research remains current particularly as the incidence of groin injecting has increased (Hope et al, 2015). Some environmental aspects may have changed for example sterile water and filters are now available for injecting as part of IEP. In this study most people used tap water to mix their injection. However, it was not the environmental aspects that were identified as risk factors.

CONCLUSION

The prevalence of leg ulceration among PWID in this study was high and injecting in the groin and lower leg significantly increased the risk of leg ulceration. Harm reduction approaches should ensure that PWID are aware of the longer-term implications of injecting in the groin or the lower leg and that skin changes on the limb may indicate early damage. Equally, nurses and professionals working in drugs services and IEP provision should be aware of the potential for, and visible signs of, venous disease on the leg, such as skin staining and varicose veins and subsequent ulceration. Early detection of venous disease increases the chances of preventing ulceration, saving both costs and suffering.

However, we acknowledge the small number of PWID in the sample who had a history of leg ulceration meaning that results should be interpreted with caution and larger studies in PWID with leg ulceration are required. This study is the first of its kind and has established a platform for this future research by demonstrating the feasibility of data collection processes and adding clarity to categorisation of skin conditions to inform analysis and clinical utility of findings.

Relevance to clinical practice

Notwithstanding the challenges of making comparisons with previous research, our study has notable clinical implications. The findings that the prevalence of leg ulceration among PWID is high and that groin and leg injecting are important risk factors has implications for prevention and education. Harm reduction approaches should ensure that PWID are aware of the longer-term implications of injecting in the groin or the lower limb, and that skin changes on the limb may indicate early damage. Discussions could occur with groin injectors around anatomical changes associated with repeated femoral puncture and the direct correlation with DVT formation. Although it is assumed that injectors will commence venepuncture in their arms (Darke et al, 2001), in this study, four participants under the age of 24 years used the groin to inject in first.

Nurses and professionals working in drugs services and IEP provision should be aware of the potential for, and visible signs of venous disease on the leg and subsequent ulceration (Coull and Sharp, 2018). Track marks in the arms cannot be relied upon as the sole indicator of injecting habits. An awareness of venous signs that indicate harm may occur visibly on the skin surface and could form part of skin inspection during IEP transactions.

The prevalence of leg ulceration in PWID is very high and with the known rise in groin injecting and the aging injecting population, this is set to increase. Stopping groin injecting may prevent the formation of DVT, but without improvements to harm reduction approaches, cost and service delivery pressures will increase. This is because assessment and management of chronic leg ulceration is labour intensive and costly (Guest et al, 2015). In this study, all participants who reported leg ulceration received compression treatment but only approximately half had a Doppler test. An assessment of vascular status using a Doppler is usually a pre-requisite for compression therapy (SIGN, 2010). This indicates a need for practice reviews to ensure leg ulcer patients are receiving optimal care.

Almost half of the sample started injecting before the age of 20 years, however no participant was under the age of 21. Although the injecting population is known to be aging with an increasingly older population, this study demonstrated the high proportion of younger people commencing injecting with almost a fifth starting before the age of 16 years. This would suggest that young injectors were not engaging with the mainstream services that were used for recruitment to the study. Services may need to consider how to better engage younger people who may be early in their injecting careers in order to reduce harm related to injecting in the groin.

The nature and timing of the occurrence of leg ulceration reported in this study suggests that it can occur long after injecting and drug use has ceased, and therefore may present in mainstream health services rather than drugs services. This finding was also reported by Beynon, et al (2010). Traditionally physical health services and substance misuse services are distinct and separate. Our study indicates that education is required across both sectors to

create a joined-up approach to prevent, detect and treat individuals who have acquired their venous disease through injecting.

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What does this paper contribute to the wider global clinical community?

1. For the first time, risk factors for leg ulceration in people who inject drugs are identified, allowing clinicians to deliver clear and correct preventative advice.
2. For the first time, clear definitions of injecting injuries are provided that may be developed in future nursing research.
3. Nurses may now be more aware of the prevalence of femoral injecting and be able to deliver more knowledgeable and informed care.

TABLES

Table 1: Skin Problem Definitions

Skin problem	Definition
Lumps	Hard swellings without broken skin, not red or hot or particularly painful
Track marks	Scratch marks, raised red veins, raised hardened veins
Abscesses	Raised red hot painful lumps, with or without obvious pus / broken skin – possibly required lancing/ surgery or have spontaneously burst
Acid Burns	Painful, blistered or broken skin directly attributed to use of acid
Broken skin	Injecting injury that has caused a break in the skin, wounds, or scabs that have healed in less than 4 weeks
Chronic wounds	Any break in the skin (not a leg ulcer) that has been present 4 weeks or more
Rashes	Multiple red or pink spots, raised or flat that last longer than the short period following injection

Table 2: Sample socio-demographic characteristics and injecting history

	Total		Male		Female	
	n	%	n	%	n	%
Gender	200	100.0	148	74.0	52	26.0
Age (years)						
20-29	40	20.0	26	17.6	14	26.9
30-34	50	25.0	38	25.7	12	23.1
35-39	65	32.5	47	31.8	18	34.6
40-44	45	22.5	37	25.0	8	15.4
Injecting status						
Current injector	128	64.0	97	65.0	31	60.0
Former injector	72	36.0	51	35.0	21	40.0
Length of injecting career						
≤5 years	66	33.0	48	32.4	18	34.6
≥6 years	134	67.0	100	67.6	34	65.4
Age when started injecting (years)						
<16	35	17.5	28	19.0	7	13.5
16-19	57	28.5	42	28.5	15	29.0
20-24	55	27.5	38	25.5	17	32.5
25-39	53	26.5	40	27.0	13	25.0

Table 3: Injecting habits and reported skin problems

	Total (n=200)		Current injector (n=128)		Former injector (n=72)	
	n[(1)]	%	n[(1)]	%	n[(1)]	%
Drugs injected most often						
Heroin	168	84.0	105	82.0	63	87.5
Cocaine/other	32	16.0	23	18.0	9	12.5
Frequency of injection (on average)						
<1 time per day	57	28.5	47	36.7	10	13.9
1-2 times per day	72	36.0	47	36.7	25	34.7
3 times per day	35	17.5	17	13.3	18	25.0
≥4 times per day	36	18.0	17	13.0	19	26.4
Frequency of injection (at most)						
<1 time per day	36	18.0	27	21.1	9	12.5
1-2 times per day	30	15.0	24	18.7	6	8.3
3 times per day	27	13.5	16	12.5	11	15.3
≥4 times per day	107	53.5	61	47.7	46	63.9
Reported a skin problem[(2)]	120	60.0	80	62.5	40	55.6
Specified skin problem						
Leg ulcer	30	15.0	17	13.3	13	18.1
Abscesses	90	45.0	58	45.3	32	44.4
Lumps	58	29.0	40	31.3	18	25.0
Track marks	56	28.0	40	31.3	16	22.2
Acid burns	29	14.5	21	16.4	8	11.1
Chronic wound	28	14.0	17	13.3	11	15.3
Broken skin	25	12.5	15	11.7	10	13.9
Rashes/other	14	7.0	8	6.3	6	8.3

Note: (1) Where cells contained less than n≤5 the numbers were combined in line with best practice on statistical disclosure control. (2) Individuals could report more than one skin problem.

Table 4: Signs of venous disease

Signs	Total (n=200) n	%	History of leg ulceration (n=30) n	%	No history of leg ulceration (n=170) n	%	p-value
Varicose veins[1]	58	29.0	22	73.5	36	21.2	<0.001
Skin staining[2]	18	9.0	9	30.0	9	5.3	<0.001

Notes: (1) Pearson's chi-square test; (2) Fisher's exact test.

Table 5: Injecting behaviours and history of leg ulceration

Injecting behaviours	Total (n=200) n	%	History of leg ulceration (n=30) n	%	No history of leg ulceration (n=170) n	%	χ2 p-value
Always use a new needle and syringe	49	24.5	12	40.0	105	62.0	**0.026**
Does not always clean skin before injecting	97	48.5	16	53.3	81	47.6	0.566
Does not always wash hands before injecting	134	67.0	20	66.7	114	67.1	0.966
Has been injecting for ≥6 years	134	67.0	27	90.0	107	62.9	**0.004**
Has hit an artery when injecting	111	55.5	27	90.0	82	48.0	**<0.001**
Has hit a nerve when injecting	109	54.5	24	80.0	88	52.0	**0.004**
Has licked needle before injecting	183	91.5	27	90.0	156	91.8	0.749
Has popped skin or muscle	82	41.0	17	56.7	65	38.2	0.058
Injects in lower leg	117	58.5	24	80.0	54	32.0	**<0.001**
Injects in groin	78	39.0	28	93.5	83	49.0	**<0.001**

Table 6: Binary logistic regression model for risk of leg ulceration

	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)	p-value
Age			0.134
20-29	Reference	Reference	
30-34	1.625 (0.142-18.595)	0.427 (0.030-5.994)	0.528
35-39	12.735 (1.635-100.276)	2.496 (0.256-24.312)	0.431
40-44	12.618 (1.548-102.846)	2.757 (0.278-27.296)	0.386
Injecting for ≥6 years	5.299 (1.545-18.179)	0.707 (0.154-3.242)	0.656
Injects in lower leg	8.593 (3.320-22.242)	**5.900 (1.900-18.318)**	**0.002**
Injects in groin	14.675 (3.389-63.552)	**7.161 (1.416-36.229)**	**0.017**
Has hit an artery	9.659 (2.823-33.049)	3.434 (0.832-14.167)	0.088
Has hit a nerve	3.727 (1.450-9.578)	1.267 (0.402-3.994)	0.686
Constant		0.003	0.000

Always uses a new needle and syringe was not included in the final model as it did not improve fit.