

REPORT ON THE NATIONAL AUDIT
OF COMMUNITY NEEDLE AND
SYRINGE DISPOSAL FACILITIES

Literature Review

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Literature Review

Introduction

There is a lack of pertinent literature both from Australia and internationally on the topic of community needle and syringe disposal issues. The bulk of the literature deals with the use of Needle and Syringe Programs (NSP), in preventing spread of bloodborne pathogens between Injecting Drug Users (IDU), as well as the advantages/successes of NSP.

Needles²¹ and syringes (N&S), pose a hazard due to the potential to cause penetrating injuries. Many N&S contain pharmaceutical substances, and there is an equal risk that these substances can also be “injected” into a person through an accident. However, with discarded N&S from an IDU, this risk is virtually negligible as the substance is usually fully expended from the syringe (personal communication 2005).

There are several Australian media articles in relation to N&S being found in community areas and the resulting publicity is often emotive. The following reported quote by National Hepatitis Chairman Professor Bob Batey in response to the statement that in the 12 months ending June 2003, almost 1.7 million needles and syringes were issued through the Needle and Syringe Program in Northern New South Wales alone – “so that could mean, yes, there are significant thousands, if not millions of syringes lying around having been disposed of inappropriately”. This was on a website providing information on a NBN news special on “The Needlestick Scourge” (NBN 2004).

Several Australian and international authors made mention of the community reactions to discarded N&S and/or the presence of a NSP to increase the actual numbers of N&S discarded. The data from studies (mostly international), does demonstrate that there is not any increase in discarded N&S following the introduction of a NSP – in fact reductions have been recorded. While this is so, some studies did indicate that access to appropriate disposal facilities needs to be improved so that discards do not happen. However, if the wider community perceives that the risk is greater than it actually is, it does not mean that their opinion should be ignored. The perceived risk must be managed as well.

²¹ Needles are also referred to as Sharps within the literature.

Only one firm conclusion can be drawn from the literature, that there is no conclusive evidence to state with a high degree of certainty as to the presence or the absence of risk(s) to the public, the environment and waste workers in managing and disposal of discarded N&S in public areas. However, based on what information is available and extrapolating data/information from related studies, the risk to the community of bloodborne infections from discarded N&S is extremely low.

In an extensive review of the Australian and international literature on NSPs, Ksobiech (2004a), it was concluded that there were a number of weaknesses in studies reported by authors into NSPs. A number of recommendations were made in regards to NSP studies to improve their outcomes, not just justifying their existence. One difficulty being faced is the lack of consistency in approaches so as to be able to compare data and a broad range of variables.

NSP programs have been well documented to reduce transmission of bloodborne pathogens between IDU. Stancliff (2003), states that NSPs have been extremely effective in preventing disease. In addition, limited studies have also indicated lowering blood titers of HIV, HBV and HCV in syringes used by IDU. Therefore it can be reasonably concluded that NSP programs are also reducing risks to the community from infection post-needlestick injury.

The following provides an overview of the literature review in respect to the scope of the Australian Department of Health and Ageing "National Audit of Community Needle and Syringe Disposal Facilities".

Methodology

The literature review was conducted in the following manner:

- (a) A search of Deakin University's library journal databases was conducted for journal articles. The searches were restricted to refereed journal articles as the database possessed that limiting capability.
- (b) A review of publications held in the Deakin University library for references on community needle and syringe disposal issues.
- (c) Personal communication was made to various personnel who have demonstrated expertise/experience in community needle and syringe disposal issues to ascertain their understanding of the latest literature on this topic.

The literature searches and interviews were conducted with the express purpose of determining:

1. Current and best-practice disposal of N&S.
2. Community concerns in relation to discarded N&S in public areas.

3. Issues and barriers for disposal of N&S.
4. Hazards associated with disposal of N&S.

Notes: The literature review initially focussed on refereed articles published post 2000 and of studies/data relevant to developed countries (so that extrapolations could be made to Australian conditions). However, given the dearth of publications, those from earlier dates were also referred if they provided the only relevant information (ie., there were no later studies/publications).

It should also be noted that several articles reviewed provided an overview analysis of existing literature – as most of these were published in peer review journals, the conclusions contained within were accepted.

Several publications referred to the term “sharp”, rather than N&S. When this has been done, the original term is used. NSP was also referred to as needle exchange programs, in these instances the term NSP has been used.

Current Needle and Syringe Waste Disposal Practices

Current Practices

Based on discussions with NSP coordinators, there are a variety of practices employed and/or recommended for the disposal of N&S. These variations in practice have resulted largely from a lack of clarity of State and Territory legislative requirements for the management of N&S deposited at a NSP or community sharps container for disposal. While legislative requirements for management of similar wastes from a healthcare centre are quite clear, most jurisdictions have elected to “administratively” exempt NSP services from these requirements – in essence this is not documented so may not provide the relief necessary should an adverse incident occur. Miller (2001), also makes comment on the unpredictable manner in which many of the “waste laws” are enforced in Australia.

However, each jurisdiction and local government has legislation that could be used to prosecute a NSP under broad “pollution”, “litter”, “public health” and “nuisance” provisions. Again it is unclear as to how and when these provisions could be used.

Essentially, used N&S deposited at a NSP or into a sharps container located in public areas are disposed of in accord with requirements imposed on healthcare facilities. That is, use of a waste contractor to transport the sharps containers to a treatment facility. In some jurisdictions, landfilling of untreated clinical waste is allowed and the N&S may be disposed of via this process.

While IDU are generally encouraged to return used N&S when obtaining new supplies, this is not an absolute requirement. Given that that NSP program was established on the principles of “harm minimisation” for the spread of bloodborne pathogens, not supplying new equipment should used N&S not be returned would compromise these initial aims of the NSP program.

As a consequence, used N&S from IDU in many States are often disposed of in domestic waste/recycling systems. In some jurisdictions such as Western Australia, this is actively promoted. Others allow it but do not promote it, with the remaining jurisdictions generally providing some guidance as to how it is to occur. Olowokure (2003), reports that disposal of N&S into domestic waste streams has the potential to:

- Create concern in the community over this waste in domestic waste containers
- Containers used are often punctured during landfill compacting processes
- Containers with N&S are placed into the recycling stream posing risks to recycling contractor staff (eg., at material recovery facilities)

Best Practice

Best practice management of needles and syringes is predicated on the hazards associated with these waste products. It must be noted that the hazards exist to human health (with those at risk ranging from IDU, NSP staff, waste management staff and the wider community), generally via exposure to needles. In addition, there could be environmental hazards (eg., from the content of syringes), but this is probably quite minimal. It should also be noted that in risk management, perceived risks should be just as actively managed as identified risks.

Therefore, management of N&S needs to be based on all risks (as identified further on within this literature review).

It is also essential that in evaluating waste disposal methodologies, full costings of all aspects of the various methods be conducted. This includes costs of providing training to staff (Drain 2003). Some current disposal strategies rely on “in kind” support from NSP sites, particularly those located within healthcare facilities and so the costs associated with waste management are not understood. Given the recommendations of several Australian and international authors in regards to development of community N&S disposal systems, it is not only the costs of the service that needs to be determined, but also the savings resulting from the protocols implemented post-needlestick injury to a member of the community (Drain 2003, Law 2003, Ekwueme 2002, Macalino 1998, Gold 1997).

Best practice management of N&S requires (ANZCWMIG 2004):

- Containerisation of the N&S at source (ie., where the N&S becomes a waste product);
- Use of containers that meet relevant Australian Standards (ie., colour coded, signed and strength);
- Use of containers that are sufficiently sized for the expected waste volumes;
- Containers are secured to prevent removal as well as access to contents;
- Regular replacement of containers at locations;
- No manual emptying of contents;
- Managed in accord with the philosophy specified by State and Territory government agencies for N&S generated within healthcare facilities;
- Disposal of container contents via a recognised treatment process (eg., those that are approved by State and Territory environmental agencies for N&S generated within healthcare facilities);
- No landfilling of untreated N&S;
- No disposal of N&S into domestic waste/recycling streams (ie., due to risk of needlestick injuries to waste contractor staff).

One of the issues highlighted by Kermode (2003), is what is defined as “safe” and “unsafe” disposal and hence what is best practice. Some jurisdictions advocate the disposal of N&S via rigid containers and these then placed into the domestic waste stream. However, this advice does not necessarily factor in trends in waste management that has seen a growth of sorting facilities whereby the N&S poses risks to staff manning these facilities. Clearly all approaches and advice in regards to N&S disposal should only occur following extensive consultation between all stakeholders.

In addition, Kelsall (2002) discusses the concept of “safe disposal” as perceived by Australian IDU and what could be construed as altruistic attempts to prevent reuse of the N&S by other IDU. Surveys of IDU have clearly demonstrated that there is a clear intent by the vast majority to ensure safe disposal of used N&S – what is of concern is that there are different concepts of what is safe. It must also be noted that good intents can be undermined by the fear of Police enforcement activity.

Community Concerns in Respect to Needle and Syringe Disposal

According to Thompson (2003), while there can be significant quantities and types of litter discarded in public areas, it is the fear of a needlestick injury from a discarded N&S that causes significant concern. This fear is heightened when the N&S is observed in areas such as playgrounds and schools.

Other factors reported by Kermode (2003), in regards to community concerns over community-acquired needlestick injuries include:

- Inconvenience.
- Anxiety and distress for the affected person and family.
- Costs associated with follow up procedures.

In addition, as reported by Gontasezewski (2003), discarded N&S can come from other sources than IDU such as; pet owners, people with Diabetes and those on home based medications. To a member of the community that has read about the issue of disease transmission, it is logical to assume however, that any injecting equipment is a N&S and that it comes from an IDU.

A survey undertaken of various stakeholders including the general community demonstrated some concern with the establishment of N&S collection boxes to be located in public areas in East Baltimore USA. Following implementation of these boxes, a survey was then re-conducted. This second survey showed greater community support for the boxes as concerns (eg. condoning drug use, loitering), were not realised. In addition, counts of discarded needles reduced in the project areas as compared to control areas (ie., those without boxes installed (Riley 1998).

Research undertaken internationally has demonstrated that there is not an increase of discarded N&S in the community from the establishment of NSPs (MacGowan 1998).

An additional study conducted in America concluded that there was an actual decrease of discarded needles based on an analysis of needles, drug vials and bottles measured prior to the opening of the NSP and during a two year period after. Based on the geographical area studied, there was no difference in the number of discarded needles by distance from the NSP (Doherty 2000). This study was a follow up study of an original one that compared results after two months of the opening of the NSP and arrived at similar conclusions (Doherty 1997).

A review of needle return studies (using predominantly international data), by Ksobiech (2004b), has concluded that concern over the increased availability of contaminated needles in NSP communities appears unfounded. That is the siting of a NSP does not lead to increases in discarded N&S in the locale.

Kermode (2003), indicates that community concern is inter alia based on a perception that all discarded N&S in the community arises from IDU. However, the true source of these discarded N&S is rarely known. This article also indicates that perceptions associated with discarded N&S and needlestick injuries, and NSP activities threaten the viability of the NSP program(s).

In Kermode's (2003) article, an example of a community driven closure of an NSP resulted from a child receiving a needlestick injury (the source of the N&S was not able to be determined). Based on the studies reported by Kermode (2003), it is the discarded N&S that are more of a concern than the NSP program. This article provides some demonstration of the fragility of community concerns over NSP programs and the absolute need to ensure all N&S are effectively managed to avoid needlestick injuries.

In other factors relating to the communities concerns over NSP (and hence concern over discarded N&S), the following was found:

- No increase in crime in the areas neighbouring an NSP following its establishment (Strathdee 2004).

Issues and Barriers Associated with Needle and Syringe Disposal

The following summarises the key issues.

Needlestick Injuries

Macalino (1998), cites a study conducted in England and Wales that showed the following breakdown (by location), of needlestick injuries (based on 958 injuries over a 4 year period):

- Streets – 16%
- Contact with rubbish – 12%
- Parks – 6%
- Beach – 4%

Russell (2002), reports that in Melbourne, Australia the following breakdown by location:

- 30% – public park
- 18% – street
- 6% – beach
- 5% – carpark

This article also indicated that waste workers (outside healthcare workers), were most prone to needlestick injuries. However, there was no distinction made as to the source of the N&S as to whether from IDU or other sources.

Kelsall (2002) provided an estimate of approximately 50 needlestick injuries occurring in the community every month in Australia, with no reported seroconversion or infection.

An interesting comparison is provided by Philipp (1993), who analysed those people having Hepatitis B Immune Globulin as a prophylaxis against Hepatitis B infection. In the analysis, of those receiving a needlestick injury and having this treatment (and completing survey forms), 51% of accidental exposures occurred in the community and 45% in hospitals. Of the locations, the following was reported for community exposures:

- 53% – accidents (not defined)
- 16% – street
- 12% – contact with rubbish
- 4% – beach

Needle and Syringe Return & Disposal

By marking needles, a study measured the return rate of needles distributed by a NSP in the USA (Guydish 1991). Approximately 50% were returned within a two week period and 61% returned during the study period. This study also found that return rates were higher for stationary NSP than for mobile/roving sites (Guydish 1991). Another study reported in 1992 (Kelsall 2002), demonstrated a reduction in discarded needles from 5.14 needles/month to 1.9 after 20 months following the opening of an NSP in Portland USA.

Wood (2004a), found similar results in Canada, with a mean daily average of discarded needles declining from 11.5 to 5.4. This study also factored a range of variables such as weather and Police presence in the area of the NSP. Of interest was that disposal into public sharps containers rose after opening of the NSP.

A study undertaken of the literature on NSP return rate data was conducted (Ksobiech 2004b). The conclusions reached from the analysis of the literature were:

- NSP are relatively effective as a disposal site for used needles.
- Average worldwide return rate was 90%, with the range from 15-112%.

- A study reported in this article showed a 41% return rate for Australia (no date was provided as to when this specific study was conducted). Gontasezewski (2003), indicates a return rate in Western Australia of >95%. PSA (2002), reports a return rate of 99% in Tasmania (additional data reported 2,800 syringes distributed for every report of discarded N&S equipment in 1997/98). In Brisbane, approximately 0.1% of injecting equipment distributed was discarded (equating to 871 pieces).
- Data on return rates clearly indicate that studies conducted on larger numbers of needles distributed have a higher percentage rate of needles returned. The above Australian percentage was based on a distribution of 6,306 needles (which was relatively small compared to other studies).
- Given that there were some reported return rates in excess of 100%, needles are obviously being obtained elsewhere, but returned to NSP. Therefore, it could be concluded that data on return rates could effectively be lower due to “imported” needles being included in return data.
- Data indicating that a percentage of needles are not returned to NSP does not indicate that they are discarded. Use of public area sharps containers and disposal into domestic waste/recycling streams are other methods of disposing of used needles.

In 2001, Miller reported on a study conducted in Geelong, Victoria on N&S provision and disposal. This author concluded that while discarded N&S are a significant community concern, “the vast majority of needles and syringes are not discarded”. The study showed that while there were a variety of methods used to dispose of used N&S, only approximately 0.38% of the N&S dispensed were collected by council staff (from community reports of them being discarded). While this number is still of a community concern, it does show that the majority of IDU do not discard used N&S into public areas.

A study by the Australian Injecting and Illicit Drug Users League (AIVL)(undated), showed that in a self reporting survey, IDU indicated that they felt that they safely dispose of used N&S 97.3% of the time (it was not clearly defined as what is determined as “safe” – however, discarding into public places was not considered as safe). In this report, many respondents indicated that they had to dispose of used N&S into full bins, thus requiring them to manually push waste into the container, and 57.7% reported that disposal container availability was not sufficient.

School of Public Health, University of California (undated) concluded that NSP in the United States have not been shown to increase the total number of discarded N&S and can be expected to result in fewer discarded N&S. In addition this report cited:

- In Toronto Canada, the numbers of discarded N&S collected since the opening of the NSP has decreased.
- This latter study is important as it actually answers criticism that opening of a NSP may reduce discarded N&S in the vicinity, by demonstrating that they are actually discarded elsewhere. This conclusion is supported by other authors (Ksobiech 2004b, Doherty 2000, Riley 1998, MacGowan 1998).
- In Amsterdam, increased reports of discarded N&S following the opening of a NSP, is thought to be attributed to increased awareness of needle-borne infections.

However, an article reviewing the impact of the closure of a NSP in Connecticut, America (Broadhead 1999), showed that the volume of discarded used N&S in the community did not rise.

NSP provide a forum whereby issues including safe disposal of N&S can be discussed (as well as providing the actual venue for such safe disposal (Stancliff 2003). In this article it is concluded also that IDU are more inclined to adopt safe N&S disposal if the actual obtaining of new N&S is conducted legally (eg. at a NSP or even able to be purchased from pharmacies). Latkin (2005), looked at the role of needle sellers in Maryland USA, and concluded that this sector is more likely to disseminate used N&S, so all IDU need to be educated as to safe disposal so as to prevent the used N&S being available to others.

Kermode (2003), cites several studies whereby it has been assumed that following self-reporting surveys, IDU indicate that they do dispose of N&S safely (this is for those N&S not returned to a NSP). However, as the disposal methods include; burying, burning, flushing down toilets and placement in drains and garbage bins – many of these would not be considered “safe” by others.

The City of Melbourne (MCC 2004), reports that the numbers of discarded N&S was reduced following the implementation of the council’s “Syringe Management Plan 2001-2003”. This plan provided a coordinated framework inter alia for providing public disposal boxes for N&S.

The Northern Territory report (2002), indicated that of approximately 500,000 N&S distributed in 2000, there were 132 reports of discarded N&S across the whole Northern Territory. This represents 0.003% of those distributed. As other authors have indicated, the origin of these N&S cannot be accurately determined.

The study conducted for AIVL by Kelsall (2002), provided a broad range of reasons as to why IDU do not dispose of N&S appropriately – these conclusions were based on a literature review by the authors. They include:

- Fear of Police action based on having N&S found on them. Data quoted ranged from 16%-30% of IDU stating Police “fear” as a barrier to safe disposal.
- Not wanting to go to a pharmacy for new N&S (and thus returning used N&S).
- NSP not open at needed times.
- Fear of disclosure of being an IDU to friends/family.
- Other reasons included; access to services, stigma attached to accessing NSP, being “stoned”, apathy, inexperience and lack of knowledge as to safe disposal.

The NSW Health Department (2004), has estimated of the 28 million N&S distributed annually in NSW (through National Diabetes Services Scheme and from NSP), approximately 20 million may end up in the domestic waste stream, with a very small number (not provided), ending up as what would be termed discarded.

Australian and international authors have provided comment on the harm minimisation aspects of the NSP programs implemented. There is a consistent finding that through these programs the number of N&S being discarded has declined and that the probability of disease transmission has also declined. What may have occurred though is a greater community awareness of the issues facing management of IDU and as a consequence, all discarded N&S (and other equipment), is linked in the community’s mind to IDU activity.

Police Activity

Wood (2004b), investigated the impact of Police “crackdown” on IDU in a specific area of Vancouver. This study concluded that this Police enforcement activity significantly increased unsafe N&S disposal (particularly in areas not necessarily sites for discarding of N&S), from 784 to 1,253 in a three month period. In addition there was a reduction of N&S being disposed of at NSP within the crackdown area – with reductions in the use of public sharp containers within the area as well (from a monthly average of 865 to 502 used syringes deposited into these containers). Wood (2004), also found that the proportion of N&S distributed and not returned to the NSP increased from 4.0% in the three months prior to the Police activity to 8.1% in the three months following.

Kermode (2003), also cites several studies (mainly international ones), that indicate that fear of Police harassment is a major barrier to safe disposal of N&S. Macalino (1998), indicates that while many IDU choose a disposal method for used N&S that will perceivably reduce harm to others in the community, fear of either arrest for possession of N&S or that this possession will identify them as an IDU leads to N&S being discarded.

Based on the conclusions reached by these authors and commented on by others reviewing their work, Police activity clearly has a negative influence on safe disposal of N&S – leading to increased instances of discarding into public areas.

Legislation

Legislative impacts on both safe disposal of N&S as well as prevention of disease are based on two types of laws. Laws that prohibit the possession of drug equipment as well as prescription laws that prohibit the obtaining of N&S without specific approval encourage N&S reuse and discarding in public areas (MCC 2004, School of Public Health, University of California (undated), Springer 1999).

Having different waste legislative requirements as well as lack of clarity in regards to obligations by the different participants in a NSP program compounds the problem of creating safe uniform avenues of needles disposal (Macalino 1998). Turnberg (2002), based on a study in America, supports this previous conclusion and indicates that “A national effort is needed to achieve consistent community syringe collection and disposal laws and guidelines for all states”. This is a view supported within Australia by the many consultations conducted.

Hazards Associated with Needle and Syringe Disposal

The following summarises the key issues.

Bloodborne Pathogens

While there is some argument over exact timeframes and circumstances (eg. ambient versus laboratory conditions), the main bloodborne pathogens that the community is at risk of, in regards to discarded N&S (Hepatitis B virus (HBV), Hepatitis C virus (HCV), and human immunodeficiency virus (HIV)), can survive outside the human body for several weeks (Thompson 2003). Survival is influenced by the following factors:

- Virus titer
- Volume of blood
- Sunlight
- Humidity

Ekwueme (2002), indicates that incorrect disposal of N&S can transmit disease to the community (HBV and HIV being the two main bloodborne pathogens of

concern). HCV is also of concern. While, there are other bloodborne pathogens that may be transmitted human to human from N&S, the probability of these is much lower than for HIV, HBV, HCV. These include (Simonsen 1999, Collins 1997):

- Hepatitis D
- Malaria
- Haemorrhagic fever viruses (eg., Ebola and Lassa)
- Tetanus
- Syphilis
- In addition, abscesses and even septicaemia can result from a needlestick injury (PSA 2002)

The Californian Integrated Waste Management Board states that there are four main modes of transmission of infection (Californian 1994):

- Direct transmission
- Airborne transmission
- Vehicle borne transmission (eg., from punctures or touching a contaminated item)
- Vector borne transmission

The potential for all or any of these modes must also be considered when conducting studies into the risks of discarded N&S. However as many authors have indicated, such studies are extraordinarily complex to prove any such links.

For infection to occur the following is required (DHA 2004):

1. a source of infecting micro-organisms or other infectious agent (at a sufficient level to cause infection);
2. a susceptible host; and
3. a path or transmission for infectious agent to the susceptible host.

The DHA Guidelines clearly state that those who have physical contact with, or potential exposure to blood and body fluids are definitely at risk of contracting an infection.

Thompson (2003) further indicates that other factors in relation to risk of infection are:

- The prevalence of a bloodborne pathogen with the IDU discarding the N&S
- The type of injury sustained
- The viability of the pathogen outside the human body

- How recently has the N&S been used
- The level of immunity of the person injured
- The use of post-exposure prophylaxis

It is the 2nd point that is relevant for needlestick injuries within the community as many of these involve the needle “sticking” into semi-permeable materials such as the soles of shoes, whereby the needle could not puncture the skin.

The following table by Thompson (2003) (modified), summarises the prevalence amongst IDU, major modes of transmission within Australia, potential virus survival and published cases of community transmission:

Pathogen	Prevalence amongst IDU	Major modes of transmission within Australia	Potential virus survival at room temperature	Published cases of community transmission
HBV	1-2%	Sexual contact, IDU	Up to 8 months (no decline in sensitivity)	One
HCV	50-60%	IDU	Up to 8 months (9 fold decline in sensitivity)	Nil
HIV	1%	Male homosexual contact	Up to 30 days, but generally 1-2 days	Nil

Gontasezewski (2003), estimates that in Australia, 4.4% of IDU have HIV infections and 65% infected with HCV. Given the longer estimated survival time for HCV, this bloodborne pathogen is probably more of concern in regards to transmission to the community from discarded N&S.

It is suggested that the survival rates for viruses outside the human body does not reflect reality due to the studies determining these times based on laboratory conditions and higher than expected blood volumes and/or virus titers. However, there are studies reporting similar survival times for a range of temperatures. Thus, while the risk of seroconversion following a needlestick injury is unlikely to be zero, the potential for virus transmission of HBV and HCV from a recently discarded N&S is the most likely hazard.

Given the lack of literature on transmission of bloodborne pathogens to the community from discarded N&S in public areas, it is difficult to accurately portray the probability and/or demonstrate the potential risks. However, extrapolation from studies that bear some relevance can be used to provide (as best can be determined), best/worst case scenarios and probabilities of seroconversion.

Thompson (2003), states that there have been no published cases of bloodborne virus transmission following community needlestick injury. However, Kermode (2003), states that there has been one documented case of probable bloodborne virus transmission due to a needlestick injury – that of HBV. This occurred in Spain, with a 4 year old boy presented with a history of needlestick injury involving a needle from a neighbour known to be HBV and HIV infected. Other conclusions made in Kermode's paper include:

- No other case of community-acquired transmission of a bloodborne virus has been reported either in Australia or elsewhere.
- A study of 50 community-acquired needlestick injuries (59% occurring in public places), revealed no seroconversion to bloodborne viruses.
- A study in Italy reported no seroconversion to HIV with 408 people following accidental needlestick injury (despite a high percentage of HIV amongst IDU or >50%).

PSA (2002), reports that a study conducted in Madrid showed that for 249 children that suffered a needlestick injury from discarded N&S during the period 1988-95, no seroconversion to HIV occurred.

Studies undertaken by Ekwueme (2002), demonstrate the following probability of infections attributed to discarded N&S (used by patients undergoing immunisation), to the community from improper disposal as:

- 0.000003% for HBV
- 0.000001% for HIV.

Gontasezewski (2003), estimates the risks for contracting the following due to a community needlestick injury as:

- 0.000007% for HCV
- 0.0000002% for HIV

According to the World Health Organization (WHO 1999), there was between 500-7,300 waste workers (outside hospitals), injured by sharps of which, annually, 1-15 contracted Hepatitis B. Kermode (2003), also discusses one known and reported seroconversion to HBV following a needlestick injury in the community. The Communicable Diseases Network Guidelines (DHA 2004), clearly state that those who have physical contact with, or potential exposure to blood and body fluids are definitely at risk of contracting an infection.

A recent study conducted in Australia (Tooher 2005), that reviewed literature relating to waste workers exposure to, seroconversion and/or presence of antibodies to HAV, HBV and Tetanus concluded that there may not be any greater risk to solid

waste workers as compared to other waste workers that would be more at risk (eg., sewage waste workers). The authors also concluded that more studies are necessary to arrive at firm conclusions.

To gauge what could be considered “worst case” scenario for seroconversion following a needlestick injury, data on such conversions was determined for healthcare personnel and IDU. These two groups have been determined as most at risk due to the potential of the needlestick injury occurring with fresh blood and higher titers of the virus within the blood.

The following table provides data on seroconversion post-needlestick injury in the healthcare setting:

Bloodborne Virus	PSA (2002)	CDC (2001)	Heimer (1998)	Collins (1997)
HBV	19-30%	6-30%	20-30%	3-35%
HCV	3-10%	0.4-1.8%	2-3%	1-2.8%
HIV	0.3%	0.25-0.4%	0.3-0.7%	0.12-0.4%

While this data shows similar relative percentages, it does illustrate the differences in interpretation of data to arrive at the rates of seroconversion. Thus it can be inferred that each author would also state different (though similar), risk factors for seroconversion following a needlestick injury.

It could be argued that IDU to IDU transmission of bloodborne pathogens is in effect a needlestick injury (though an elective rather than accidental one). Based on this premise, data from the Victorian Department of Human Services illustrate the following. In 2002, 1.7% of those diagnosed with HIV were classified as injecting drug users, 58% with Hepatitis B and 73.4% with Hepatitis C (DHS 2003). This data indicates that IDU to IDU transmission of bloodborne viruses is high and that this group does pose a risk to members of the community from discarded N&S. The level of risk, based on the lack of evidence of seroconversion of the community to these bloodborne pathogens, may be deemed to be extremely low.

It must be noted that it is when the syringe is accompanied by an uncapped needle that the risk for infection becomes more probable. This could arise from an accidental encounter (eg. the needle not noticed on the ground), or from a needlestick injury (eg. by picking the needle up to dispose of it or attempting to recap the needle).

In the United Kingdom, a study (Nyiri 2004), found that following laboratory testing of 106 syringes found at four parks in South London. The subsequent testing found that evidence of:

- HBV in 4.7% of syringes
- HCV in 4.7% of syringes

This does demonstrate that there is some risk associated with discarded used N&S. The authors of this study also pointed out that it was not only park users who were at risk, but park rangers who are required to clean up these discarded used N&S.

However, while seroconversion to HIV and HCV has occurred through exposure of fluids onto the skin it is extremely unlikely that this route is of concern to the community from discarded N&S. Russell (2002), reported on studies conducted in Melbourne, Australia that found of 50 cases of a community acquired needlestick injury, there were no seroconversions to HIV, HBV or HCV. These results were also supported in a Canadian study (Slinger 2000) and an Irish study (Nourse 1997). An additional study in New South Wales, Australia, (O'Leary 2003), demonstrated no seroconversions from a community acquired needlestick injury.

Of interest was that, while not conclusive, the article by O'Leary (2003), indicated that the profile of those people most at risk of a community acquired needlestick injury were male and employed as cleaners or police officers.

While extrapolating data from studies undertaken in regards to risks associated with inappropriate disposal of sharps from healthcare facilities, Olowokure (2003), reports that while there are reports of needlestick injury in the community, the risk of infection is lower than that of healthcare facilities. Macalino (1998), supports this due to blood not being "fresh" and in lower volumes in the syringe (than for healthcare facilities).

To put into context, a risk based study conducted (Environment Agency 2002), in the United Kingdom states that the estimated infections resulting from needlestick injuries within the healthcare sector over a 20 year period are (it must be noted that this is probably the highest risk sector in regards to numbers of needlestick injuries and seroconversions):

- HIV – one individual
- Hepatitis B – 32 individuals
- Hepatitis C – 21 individuals

MacGowan (1998), found that generally there were reductions in HIV DNA in discarded syringes following introductions of NSP. Similar results relating to seroconversion rates for HBV and HCV were also found. It is believed that the use of NSP reduces IDU to IDU transmission, thus reducing the spread of bloodborne pathogens. This is supported by research conducted in Australia that also examined overseas data that determined there was a decline in bloodborne virus spread within the IDU community as a result of NSP programs (DHA 2002). This information would then logically be extrapolated to assume that the risk of IDU to community transmission would also be reduced in regards to risk if there are reductions in bloodborne pathogens in blood remaining in N&S. However this conclusion needs to factor in risky sexual behaviours of IDU, which may be becoming an increasing source of the spread of HIV (Ksobiech 2004a).

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