



**The risk of HIV infection from tattooing and body piercing: a
review of the literature
28/03/2018**



**The risk of transmission of Human Immunodeficiency Virus from tattooing
and body piercing: a review of the literature**

1.0 Introduction

Tattooing can be described as the production of a permanent design on the human body through the introduction of external pigments and/or dyes into the dermis using needles or other sharp instruments, whilst body piercing is defined as “the perforation of the skin and underlying tissues in order to create a tunnel in the skin through which jewellery may be inserted”¹⁻³. The evidence base indicates that these practices have grown in popularity in recent years but the prevalence of tattoos and body piercings varies widely between reported studies. A 2012 online cross-sectional survey in the United States (US) demonstrated a tattoo prevalence of 21% in those aged 18 years and above whilst a study undertaken in Germany in 2005 revealed a tattoo prevalence of 8.5% in individuals aged between 14 – 93 years^{4,5}. A report published by the European Union in 2015 estimated tattoo prevalence across Europe at 12% and that up to 24% of individuals living in the US are tattooed⁶. With regard to the prevalence of body piercings, cross-sectional studies in the UK, Australia and Germany found prevalence rates of 10%, 8% and 6.5% respectively^{5,7,8}.

The increasing practice of tattooing and body piercing has raised concerns amongst healthcare professionals and policy-makers alike, who recognise the potential risk of transmission of bloodborne viruses through such practices⁹. While there remains no enacted legislation pertaining to tattoo premises in Ireland, the Department of Health is currently engaged in drafting tattooing and body piercing infection control guidelines for practitioners⁶. A review of the literature to examine the risk of transmission of Human Immunodeficiency Virus (HIV) from tattooing and body piercing as a prelude to this work is necessary in the first instance.

2.0 Methodology

A review of the peer-reviewed and grey literature was undertaken to identify the available research evidence pertaining to the risk of transmission of HIV through tattooing and body piercing, with a particular focus on identifying specific risk factors that may increase the risk of transmission of infection.

A similar methodology to that used in reviewing the evidence to inform the National Hepatitis C Screening Guidelines was adopted in this instance¹⁰. The PICOS framework was used to guide the search strategy:

- Population: people who have a tattoo or body piercing;
- Intervention: not applicable;
- Comparison: not applicable;
- Outcome: incidence of HIV/prevalence of HIV;
- Study design: experimental or observational studies, case studies, case reports published between 1 January 1980 and 31 December 2017.

A comprehensive search of the international literature was performed using Medline, Embase, ClinicalKey, PubMed, CINAHL and Cochrane Library electronic databases. A search of the grey literature was undertaken using the Google and Google Scholar websites. A separate search strategy was created to examine the risk of transmission of HIV infection through tattoo application and through body piercing. The search strategies were constructed using free text searches and also MeSH terms and were designed to examine the risk of transmission of HIV infection through tattoo application and body piercing (see Tables 1 and 2 for a description of the search terms used in the Medline search). Ancestor referencing was also undertaken in an effort to identify further suitable articles.

Table 1. Search terms used in Medline search to identify the risk of HIV transmission via tattooing

Search #	Query	Limiters/expanders	Results
S1	HIV OR human immunodeficiency virus OR HIV-1 OR HIV-2 OR HIV 1 OR HIV 2	Search modes-Boolean/Phrase	337,222
S2	(MM "HIV+") OR (MM "HIV Infections+") OR (MM "HIV-2") OR (MM "HIV-1") OR (MM "HIV Seroprevalence")	Search modes-Boolean/Phrase	252,741
S3	risk factor*	Search modes-Boolean/Phrase	959,041
S4	(MM "Risk Factors") OR (MM "Risk Assessment+") OR (MM "Risk Management+") OR (MM "Risk Taking+") OR (MM "Risk Reduction behaviour+")	Search modes-Boolean/Phrase	64,375
S5	S1 OR S2	Search modes-Boolean/Phrase	368,361
S6	S3 OR S4	Search modes-Boolean/Phrase	959,041
S7	Transmission or transmit OR mode of transmission OR acquisition OR acquire* OR transmit*	Search modes-Boolean/Phrase	996,717
S8	(MM "Disease Transmission Infectious+")	Search modes-Boolean/Phrase	35,126
S9	S7 OR S8	Search modes-Boolean/Phrase	1,004,181
S10	tattoo* OR body art OR body ornament*	Search modes-Boolean/Phrase	5,033
S11	(MM "Body Modification, Non-Therapeutic+")	Search modes-Boolean/Phrase	7,606
S12	(MM "Tattooing")	Search modes-Boolean/Phrase	2,491
S13	S10 OR S11 OR S12	Search modes-Boolean/Phrase	10,106
S14	S5 AND S13	Search modes-Boolean/Phrase	1,339
S15	S6 AND S14	Search modes-Boolean/Phrase	313
S16	S9 AND S15	Search modes-Boolean/Phrase	218
S17	S9 AND S15	Limiters – Date of Publication: 19800101-20171231; Human Search modes –Boolean/Phrase	201
S18	S9 AND S15	Limiters – Date of Publication: 19800101-20171231; Human; English Language Search modes –Boolean/Phrase	189

Table 2. Search terms used in Medline search to identify the risk of HIV transmission via body piercing

Search #	Query	Limiters/expanders	Results
S1	HIV OR human immunodeficiency virus OR HIV-1 OR HIV-2 OR HIV 1 OR HIV 2	Search modes-Boolean/Phrase	337,222
S2	(MM "HIV+") OR (MM "HIV Infections+") OR (MM "HIV-2") OR (MM "HIV-1") OR (MM "HIV Seroprevalence")	Search modes-Boolean/Phrase	252,741
S3	risk factor*	Search modes-Boolean/Phrase	959,041
S4	(MM "Risk Factors") OR (MM "Risk Assessment+") OR (MM "Risk Management+") OR (MM "Risk Taking+") OR (MM "Risk Reduction behaviour+")	Search modes-Boolean/Phrase	64,375
S5	S1 OR S2	Search modes-Boolean/Phrase	368,361
S6	S3 OR S4	Search modes-Boolean/Phrase	959,041
S7	Transmission or transmit OR mode of transmission OR acquisition OR acquire* OR transmit*	Search modes-Boolean/Phrase	996,717
S8	(MM "Disease Transmission Infectious+")	Search modes-Boolean/Phrase	35,126
S9	S7 OR S8	Search modes-Boolean/Phrase	1,004,181
S10	Body pierc*	Search modes-Boolean/Phrase	781
S11	(MM "Body Modification, Non-Therapeutic+")	Search modes-Boolean/Phrase	7,606
S12	(MM "Body piercing")	Search modes-Boolean/Phrase	463
S13	S10 OR S11 OR S12	Search modes-Boolean/Phrase	7,882
S14	S5 AND S13	Search modes-Boolean/Phrase	1,148
S15	S6 AND S14	Search modes-Boolean/Phrase	204
S16	S9 AND S15	Search modes-Boolean/Phrase	154
S17	S9 AND S15	Limiters – Date of Publication: 19800101-20180131; Human Search modes – Boolean/Phrase	149
S18	S9 AND S15	Limiters – Date of Publication: 19800101-20171231; Human; English Language Search modes – Boolean/Phrase	144

The inclusion criteria were as follows:

- Low endemicity country (defined as population prevalence of HIV <1%);
- Reports on prevalence/incidence in those with tattoos or body piercings accounting for other risk factors;
- HIV status based on blood or salivary tests as opposed to self-reporting of infection; and
- From 1980.

The exclusion criteria were as follows:

- High endemicity country (defined as population prevalence of HIV >1%);
- Articles for which access to the full text could not be obtained and where the abstract contained insufficient information;
- Studies only examining HIV without reference to tattooing or body piercing; and

- Studies published in a language other than English.

Articles were critically appraised using the tools provided by the Critical Appraisal Skills Programme (CASP) and the STROBE checklist for cross-sectional studies^{11,12}. The quality of the evidence was categorised in a similar fashion to that used in the National Hepatitis C Screening Guidelines (Table 3)¹⁰.

Table 3. Categorisation of evidence¹⁰

Level of evidence	Type of evidence	Rationale
High	Consistent evidence from well performed randomised, controlled trials, meta-analyses, or overwhelming evidence of some other form	Further research is unlikely to change our confidence in the estimate of benefit and risk.
Moderate	Evidence from randomised, controlled trials with important limitations (inconsistent results, methodological flaws, indirect or imprecise), or very strong evidence of some other research design	Further research (if performed) is likely to have an impact on our confidence in the estimate of benefit and risk and may change the estimate.
Low	Evidence from observational studies, consensus opinion of experts, case studies, or from randomised, controlled trials with serious flaws, or standard care	Any estimate of effect is uncertain

3.0 Results

3.1 Risk of transmission of HIV infection from tattooing: search results

The above search yielded a total of 338 articles, of which the titles and abstracts were scanned for suitability. A total of eleven papers were deemed suitable for inclusion in the review following the application of the inclusion and exclusion criteria (Figure 1). The papers included consisted of six cross-sectional studies, three case reports, one case-control study and one media statement based on a case report (Table 4).

Of the eleven papers included in this review, two related to the Australian population, two to the Brazilian population, three to the population of the United States of America, two to the Iranian population, and one each to the Indian and Irish populations. Six of the included studies derived their study populations from the prison setting, whilst five derived their populations from the community.

3.2 The risk of HIV transmission via tattooing

The Centers of Disease Control (CDC) undertook both a matched and unmatched case-control study amongst male prisoners in Georgia in 2005¹³. The study aimed to identify demographic characteristics and behavioural risk factors associated with HIV seroconversion in prison. While the unmatched study didn't demonstrate a significant association between HIV seroconversion and

tattoos after multivariate logistic regression analysis, the matched study (matched for location, sentence length and time already served) did show a significant association between HIV seroconversion in prison and receiving a tattoo in prison on multivariate logistic regression analysis (adjusted OR 13.7, 95% CI 1.5-390.6). A cross-sectional study based in 27 prisons across Iran by Navadeh *et al.* was consistent with this finding showing a significant association between HIV infection and history of tattoo acquisition (adjusted OR 2.1, 95% CI 1.1-4.2)¹⁴. Similarly, Seyed Alinaghi *et al.* found a significant association between HIV infection and tattoos after multivariate logistic regression analysis amongst male prisoners at one Iranian prison (adjusted OR 1.84, 95% CI 1.05-3.24)¹⁵. An Australian case report concluded that a cosmetic tattoo applied by a mobile beauty therapist in Vietnam three years previously was the only identifiable risk factor in a HIV-positive case which was discovered on an antenatal screen¹⁶. Similarly, a case report published in India in 2017 identified tattooing as the most likely mode of transmission of HIV infection and this finding was in keeping with an American case report by Doll *et al.* who reported shared use of a tattoo gun that had not been appropriately sterilised as a potential route of transmission of HIV infection amongst prison inmates^{17,18}. A media report released by Western Australia Health, indicated that tattoo application in Bali in one HIV-positive case was the most likely vehicle of transmission of the HIV infection¹⁹.

In contrast, a cross-sectional study of individuals within Irish prisons which was published in 2014 demonstrated a significant association between HIV infection and acquiring a tattoo whilst in prison but this association was no longer significant on multivariate logistic regression²⁰. Similarly, a cross-sectional study of female prisoners in New York State in 1991 found a significant association between HIV infection and tattooing on univariate analysis but this was no longer significant on multivariate analysis²¹. A further two Brazilian-based cross-sectional studies didn't demonstrate a significant association between tattoos and HIV infection^{22,23}. While Nishioka *et al.* didn't demonstrate a significant association between HIV infection and either the number of tattoos acquired or tattoo application by a non-professional tattoo artist, they did find a significant association between tattoo application by a non-professional practitioner and testing positive for at least one of five transfusion-transmitted diseases (HIV, HBV, HCV, Chagas' disease, syphilis) on multiple logistic regression (OR 3.25, 95% CI 1.39-7.59)^{22,23}.

3.3 Risk of transmission of HIV infection from body piercing: search results

The search yielded a total of 236 articles, of which the titles and abstracts were scanned for suitability. A total of one paper was deemed suitable for inclusion in the review following the

application of the inclusion and exclusion criteria (Figure 2). The paper included was a case report relating to one individual who tested positive for HIV against a backdrop of multiple body piercing events across the United States and Amsterdam during the period of seroconversion²⁴. The case report concluded that the transmission of HIV infection through the use of HIV-contaminated needles was a possibility in this instance (Table 5).

Fig 1. PRISMA flow diagram of review of literature on risk of HIV transmission through tattooing

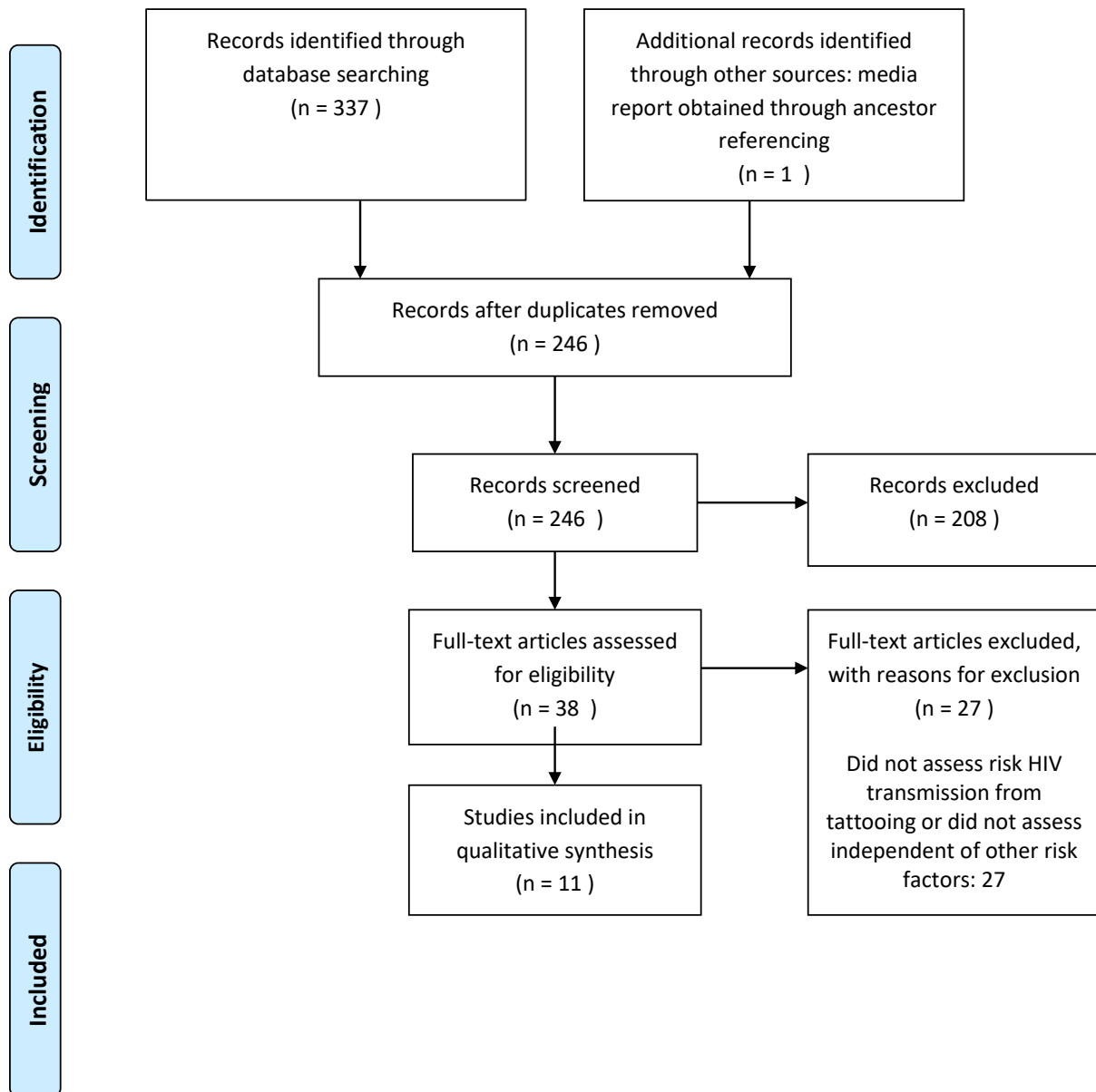
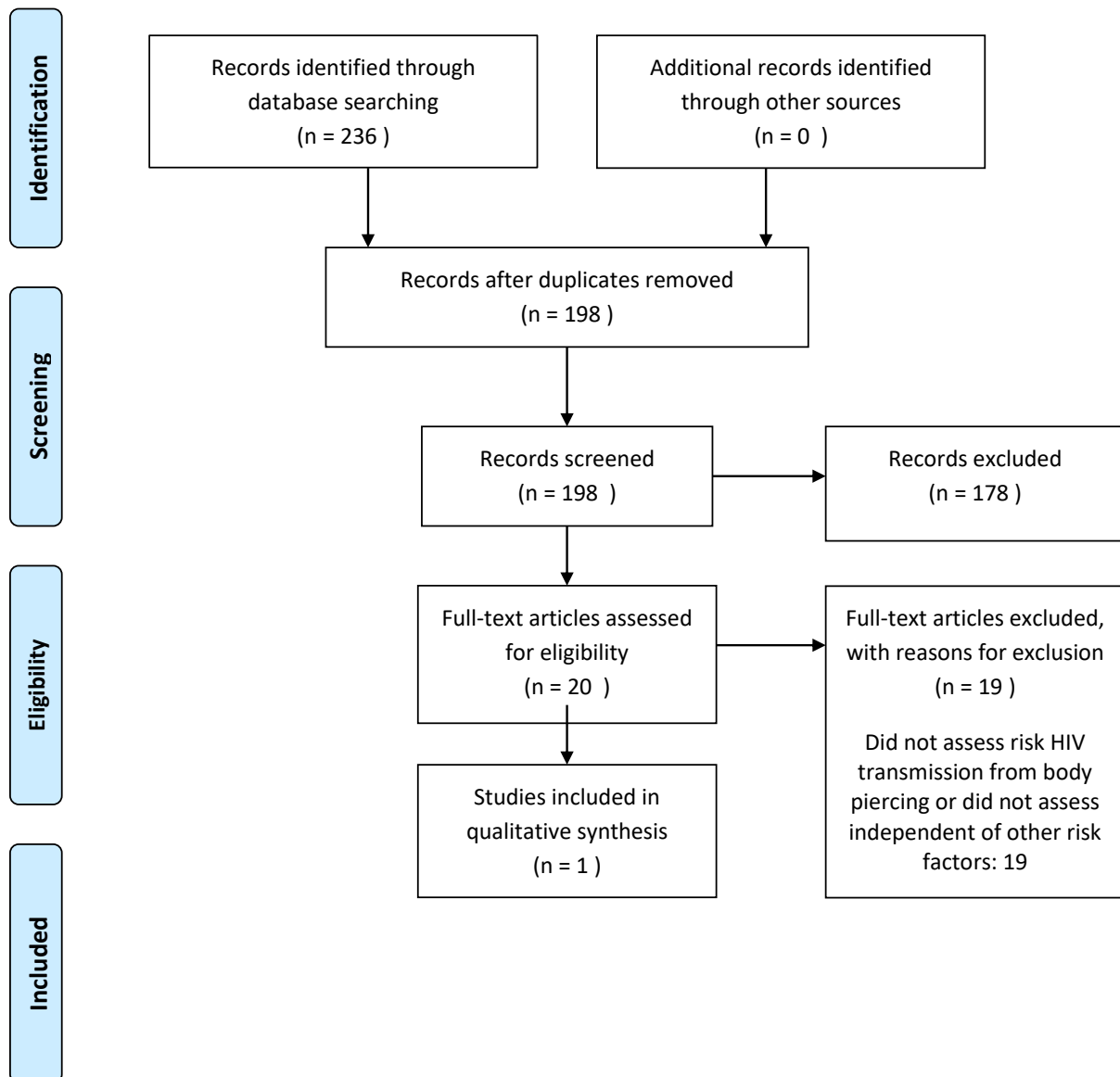


Fig 2. PRISMA flow diagram of review of literature on risk of HIV transmission through body piercing



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Table 4. The risk of HIV infection from tattooing: characteristics of studies included in review

Author	Sample size	Study design	Country	Sample derived from	Salient findings	Comments	Quality
Garland <i>et al.</i> (2006) ¹⁶	1	Case report	Australia	Community	<ul style="list-style-type: none"> HIV positive result yielded from antenatal screening. Only potential risk identified was a cosmetic tattoo applied by a mobile beauty therapist in Vietnam three years previously 	<ul style="list-style-type: none"> Recall bias, social desirability bias 	Low
Western Australia Health (2011) ¹⁹	1	Media statement on case report	Australia	Community	<ul style="list-style-type: none"> HIV positive case. Investigation concluded that tattoo application in Bali was most likely vehicle of infection 	<ul style="list-style-type: none"> Media statement only – no further information available 	Low
Nishioka <i>et al.</i> (2003) ²³	345 individuals: 280 of whom were matched for age, gender and clinical complaint of the tattooed individual; 42 tattooed individuals without a suitable match; 23 individuals without tattoos without suitable match	Cross-sectional matched study	Brazil	Hospital population: admissions, outpatient clinic attendees, blood donors	<ul style="list-style-type: none"> Study aimed to assess whether having a tattoo was associated with having positive serological tests for HIV, HCV, HBV, syphilis and Chagas' disease Interview regarding: presence of tattoos, their number, design and conditions in which they were applied. Blood test for anti-HIV Univariate analysis showed an association between HIV infection and having a tattoo (OR 29.65, 95% CI 3.99-220.57) which was no longer significant after multiple logistic regression analysis 	<ul style="list-style-type: none"> Efforts made to minimise bias: matching of participants, direct visualisation of tattoo, blood test OR on multivariate analysis 6.46 (95% CI 0.72-58.22). ?large CI secondary to small sample size: only 29 participants tested positive for HIV 	Low
Centers for Disease Control and Prevention (2006) ¹³	68 cases enrolled in matched and unmatched case control studies (91% response rate). 65 unmatched	2 studies: matched and unmatched case control studies	USA	Prison	<ul style="list-style-type: none"> Aim of study was to identify demographic characteristics and behavioural risk factors associated with HIV seroconversion in prison Anonymised questionnaire. Blood sample taken for anti-HIV on entry into study Unmatched study: <ul style="list-style-type: none"> Multivariate analysis did not find a significant association between HIV 	<ul style="list-style-type: none"> Selection bias – volunteers sought to participate ?generalisability of findings Recall bias Social desirability bias 	Moderate

	controls participated (response rate 87%) and 70 matched controls (response rate 79%) participated				<p>seroconversion and tattoos</p> <ul style="list-style-type: none"> Matched study (matched for location, sentence length and time already served): <ul style="list-style-type: none"> Multivariate logistic regression analysis showed an association between HIV seroconversion in prison and receiving a tattoo in prison (adjusted OR 13.7, 95% CI 1.5-390.6) 		
Sankaranantham M. (2017) ¹⁷	1	Case report	India	Community	<ul style="list-style-type: none"> 26 year old HIV positive male with no past history of engaging in sexual activities, intravenous drug use or blood transfusion Tattoo application was identified as most likely mode of transmission of HIV infection 	<ul style="list-style-type: none"> Recall bias, social desirability bias No information on how many tattoos or environment in which tattoo application was performed 	Low
Doll DC (1998) ¹⁸	2	Case report	USA	Prison	<ul style="list-style-type: none"> 2 cases of HIV infection most likely acquired by tattoo application in prison using unsterilized needles that had been used to tattoo other prison inmates 	<ul style="list-style-type: none"> Abstract only 	Low
Navadeh <i>et al.</i> (2013) ¹⁴	5,530	Cross-sectional study	Iran	Prison	<ul style="list-style-type: none"> Aimed to estimate prevalence of HIV and related risk behaviours among prisoners in Iran Structured interview with prison officer and blood test for anti-HIV 1 and anti-HIV-2 Statistically significant association between HIV prevalence and history of tattoo application observed (adjusted OR 2.1, 95% CI 1.1-4.2) 	<ul style="list-style-type: none"> Recall bias, social desirability bias No information on where tattoo application(s) occurred 	Low
Drummond <i>et al.</i> (2014) ²⁰	824	Cross-sectional study	Ireland	Prison	<ul style="list-style-type: none"> Study objectives included estimating the prevalence of BBVs amongst the prison population and to identify associated risk behaviours Self-administered questionnaire and saliva sample for anti HIV Univariate analysis demonstrated a significant association between HIV infection and acquiring a tattoo whilst in prison. This association was no longer 	<ul style="list-style-type: none"> Recall bias, social desirability bias Of all participants, only 15 were HIV positive: small numbers in some categories 	Low

					significant on multivariate analysis.		
Nishioka <i>et al.</i> (2002) ²²	182	Cross-sectional study	Brazil	Tattooed individuals within a hospital population: admissions, outpatient clinic attendees, blood donors	<ul style="list-style-type: none"> Aimed to assess the odds of testing positive for HBV, HCV, HIV, Chagas' disease and syphilis according to tattoo number and type, tattoo design and environment in which tattoos were applied Questionnaire and serological test for anti-HIV Multiple logistic regression didn't demonstrate a strong association between number of tattoos acquired and HIV or having the tattoo applied by a non-professional tattoo artist and HIV infection Multiple logistic regression did show an association between having a tattoo applied by a non-professional and testing positive for one of the above five transfusion-transmitted diseases (OR3.25, 95% CI 1.39-7.59). This analysis also demonstrated a significant association between having three or more tattoos and testing positive for at least one of the five transfusion-transmitted diseases 	<ul style="list-style-type: none"> Efforts made to minimise bias: matching of participants, direct visualisation of tattoo, blood test ?generalisability 	Low
Seyed Alinaghi S <i>et al.</i> (2017) ¹⁵	2,680/6900 offered screening based on assessment of risk factors	Cross-sectional study	Iran	Prisoners	<ul style="list-style-type: none"> Study aimed to evaluate the prevalence of HIV and associated risk factors among male prisoners in one Iranian prison between 2013-2014 All individuals admitted to prison were counselled re: HIV and their risk behaviours for the disease were assessed using a staff-administered questionnaire. Individuals with risk behaviours were offered HIV blood testing (positive rapid test confirmed by HIV ELISA and Western blot) HIV infection was independently associated with tattooing at multivariate logistic regression (adjusted OR 1.84, 95% CI 1.05-3.24) 	<ul style="list-style-type: none"> Significant potential for selection bias, social desirability bias in this study 	Low
Smith PF <i>et al.</i>	480/520	Cross-	New York	Prisoners	<ul style="list-style-type: none"> Study sought to identify the prevalence of, 	<ul style="list-style-type: none"> Secondary data 	Low

(1991) ²¹	women	sectional study			<p>and risk factors for HIV infection among women entering the prison system in New York State</p> <ul style="list-style-type: none"> • Secondary anonymised data was collected from the routine prison records and blood samples taken for HIV-1 were also anonymised • A HIV seropositive test was significantly associated with the presence of tattoo(s) on univariate analysis but this was no longer significant after multivariate analysis 	<ul style="list-style-type: none"> • Group excluded from study had higher proportion of risk factors (race, residence, IVDU): potential for underestimation 	
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Table 5. The risk of HIV infection from body piercing: characteristics of studies included in review

Author	Sample size	Study design	Country	Sample derived from	Salient findings	Comments	Quality
Pugatch <i>et al.</i> (1998) ²⁴	1	Case report	USA	Community	<ul style="list-style-type: none"> Male who reported multiple body piercing events in New York, Boston and Amsterdam during the documented period of seroconversion. No other high risk behaviours during period of seroconversion identified. The case report concluded that transmission of the HIV infection through the use of HIV-contaminated needles was considered a possibility in this instance 	<ul style="list-style-type: none"> Recall bias, social desirability bias 	Low

4.0 Discussion

The aim of this literature review was to examine the literature pertaining to the risk of transmission of HIV infection from tattooing and body piercing. While the available literature indicates tattooing as a possible vehicle for transmission of HIV infection, particularly in non-professional environments such as prison, the inherent quality, quantity and heterogeneity of the findings within the evidence base don't allow for firm conclusions to be drawn in response to the research question. There was insufficient evidence to support or refute body piercing as a potential vehicle of transmission of HIV infection.

There was a number of limitations of this review. It is important to be cognisant of the dearth of high quality evidence available to answer the research question in this instance. Most of the evidence included in this review was observational in nature which does not confirm causation. Furthermore, the nature of this evidence introduces the potential for bias and confounding. This limitation is likely secondary to the ethical and methodological difficulties inherent in undertaking interventional studies to further explore this area. It's likely that the varying study methodologies also contributed to the heterogeneity of findings. However, the potential for transmission of HIV infection via tattooing and body piercing is widely acknowledged within the literature^{1,2,13,22,23}. The risk of transmission of HIV infection from a single needlestick injury from a needle contaminated with blood from a HIV-positive source is estimated at between 0.1% to 0.36%²⁵. While tattooing in most instances does not involve the use of hollow bore needles, tattooing is a process involving multiple needlestick injuries to the dermal layer of the skin, and body piercing involves skin and tissue penetration on at least one occasion, and it is therefore biologically plausible that HIV infection could be transmitted through the use of unsterile tattooing or body piercing equipment. This conclusion is consistent with other studies which demonstrate a risk of transmission of other bloodborne viruses from tattooing, but similar findings are not demonstrated for body piercing²⁶⁻²⁸. Further research is required in this area.

A further limitation was the exclusion criteria applied to this search which may have limited the scope of the literature reviewed. An explicit search criterion applied was that articles included had to be published in the English language. Furthermore, where full texts were not available, the papers were excluded from the review. It is also worth noting that studies originating from countries where HIV infection is endemic were excluded from this review. Background prevalence of HIV infection varies widely between countries and this decision was taken in an effort to draw conclusions from the literature that were generalisable to the Irish setting. Nonetheless, all of the above factors must be acknowledged as potential sources of bias in this review.

5.0 Implications for public health

In Ireland, tattooing and body piercing are not systematically collected as risk factors on the enhanced surveillance form for HIV. Therefore, it remains unknown whether tattooing or body piercing were implicated in the transmission of any incident HIV infections in people living in Ireland in the past.

The evidence base indicates that tattooing may play a role in the acquisition of some cases of HIV, although further research is needed in this area. There is insufficient evidence to comment on the risk of HIV transmission via body piercing at present. In the absence of high quality evidence, standard precautions should apply and the need for education, regulation and guidance for tattoo artists and body piercers has been recognised^{1,9,26}.

6.0 Conclusion

This review examined the risk of HIV transmission from tattooing and body piercing. While it appears that tattooing may be a risk factor for HIV transmission, particularly in non-professional settings, the conclusions that can be drawn from this review are limited by the lack of availability of high quality evidence. Significant heterogeneity exists within the evidence base: one matched case-control study, two cross-sectional studies and four case reports published during the time period 1998-2017 indicated a risk of HIV transmission from tattooing whilst four cross-sectional studies undertaken during the time period 1991-2014 didn't identify a significant association between HIV transmission and tattooing.

Of the five observational studies included in this review that derived their population from the prison setting, three studies demonstrated a significant association between HIV infection and tattoos on multivariate analysis whilst two studies didn't. A further two community-based cross-sectional studies didn't identify a significant association between HIV infection and tattoos. Of the four case reports which indicated tattooing as a potential route of transmission of HIV infection, two described tattoo acquisition in prison and two described tattoo acquisition in low-middle income countries. Further examination of risk factors including the identification of high-risk populations and the settings in which tattoos are acquired, is an area requiring further study.

This review included one U.S.-community-based case report which concluded that body piercing was a potential vehicle for transmission of HIV infection. It is clear that further research is needed in this area.

Tattooing and body piercing practices have risen in popularity in recent years and the potential risk of transmission of bloodborne viruses from such practices is widely acknowledged within the literature, making this a noteworthy public health issue. The need for robust infection control practices has been recognised and while there remains no enacted legislation pertaining to tattoo premises in Ireland, the tattoo and body piercing infection control guidelines will act as a necessary resource for tattoo artists and body piercing practitioners in Ireland.

7.0 References

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