Hepatitis C Screening Guideline Development Group
Background to recommendation 12: People with tattoos or body piercings

The purpose of this document is to provide the background information to the formulation of recommendations by the Guideline Development Group (GDG).

Not all evidence in this document is presented in the National Clinical Guideline.

The National Clinical Guideline is available from: http://health.gov.ie/national-patient-safetyoffice/ncec/national-clinical-guidelines/

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Contents

History of development of the recommendation

Date	Process	Outcome
02/06/2015	Recommendations from quality appraised national and international guidelines reviewed	Agreed to augment recommendations from existing guidelines with further literature
29/12/2016	GDG subgroup meeting to undertake considered judgement process	Formulation of recommendation
24/01/2017	Review of subgroup recommendation by GDG	Recommendation accepted
25/04/2017	Consultation feedback reviewed by GDG	No changes to recommendation
June – July 2017	Editing	Recommendation reworded in final editing process

Considered judgement process

The considered judgment form completed by the GDG subgroup in formulating the recommendations is presented below. Please note the final wording of the recommendation may have changed after review of the GDG, after the consultation process, or during the editing process.

Date: 20 December 2016
Attendees: MB, AOC, LM, US, SD, ER, LT

Table 1: Considered judgement form

1. What is the question being addressed? Present PICO if relevant
Q2. Who should be offered screening for Hepatitis C? b. Should the following specified groups be offered screening? xiii. **Recipients of Tattoos and Body Piercings**
2. What evidence is being considered to address this question and why? (This section will explain the approach taken to address this question and what GDG members are being asked to consider)
Relevant guidelines – quality appraised (Section 3) Primary research literature – critically appraised (section 3 and 4 and attached tables)
3. What is the body of evidence? Source of evidence: (tick all that apply) ✓ Guidelines ✓ Primary literature Other □ ; specify: _____
Current Guidelines that address tattooing and body piercing **WHO, 2016** The guidelines consider that those specific populations at the highest risk of HCV infection should be prioritised for screening. The guidelines recognise a small but increased risk of HCV transmission via contaminated equipment including during cosmetic procedures such as tattooing and body piercing. However, persons who have had tattoos and body piercing, although recognised as a higher-risk group, are not included in the 16 priority populations identified in the guidelines. (*WHO 2017 Guidelines on hepatitis B and C testing (1))* **WHO, 2016** Persons who have had tattoos, body piercing or scarification procedures done where infection control practices are substandard should be offered screening for HCV. *(World Health Organization, Guidelines for the screening, care and treatment of persons with hepatitis C infection (2)).* HIQA Quality Score of 148 **SIGN, 2013** People who have had tattoos or body piercings in circumstances where infection control procedure is, or is suspected to be, suboptimal should be offered HCV testing. *(Scottish Intercollegiate Guidelines Network, Management of Hepatitis C A National Clinical Guideline (3)).* HIQA Quality Score of 127.7

CDC, 1998 Routine hepatitis C virus (HCV) testing is of uncertain need for persons with a history of tattooing or body piercing.
(Centers for Disease Control and Prevention, Recommendations for Prevention and Control of Hepatitis C Virus (HCV) Infection and HCV-Related Chronic Disease (4)). HIQA Quality Score of 98

Current guidelines that address tattooing only

AASLD, 2016 Persons getting a tattoo in an unregulated setting should be offered screening for HCV.
(*American Association for the Study of Liver Diseases, Recommendations for Testing, Managing, and Treating Hepatitis C* (5)). HIQA Quality Score of 134.5

US Preventive Services Taskforce, 2013 Recipients of an unregulated tattoo are considered persons at high risk of hepatitis C infection.
(United States Preventive Services Taskforce, Screening for Hepatitis C Virus Infection in Adults (6)). HIQA Quality Score of 117

IUSTI/WHO Euro, 2010 Tattoo recipients should be considered for HCV testing.
(The International Union Against Sexually Transmitted Infections/WHO Europe, European Guideline for the Management of Hepatitis B and C Virus Infections (7)). HIQA Quality Score of 66.3

BASHH, 2015 Tattoo recipients should be screened for HCV.
(British Association for Sexual Health and HIV, United Kingdom National Guideline on the Management of the Viral Hepatitides A, B & C 2015 (8)). HIQA Quality Score of 97

Literature review on the risk of HCV infection associated with tattooing

Jafari et al 2010 (9) A large, global systematic review and meta-analysis in 2010 determined a strong association between HCV infection and tattooing. The pooled OR for all studies was 2.74 (95% CI 2.38 - 3.15). The OR for tattoos carried out in non-professionals parlours or by 'friends' was 2.8 (95% 1.29-6.08). The OR for tattoos done in professional parlours was lower and non-significant (OR 1.28, 95%CI 0.68-2.39). Subgroup analysis by study population type found the strongest association in samples derived from non-IDUs (OR 5.74; 95%CI 1.98-16.66), blood donors (OR 3.73, 95%CI 2.46-5.67) and hospital samples (OR 3.2; 95%CI 1.95-4.0). Subgroup analysis by country found that studies from Australia (OR 5.90; 95%CI 2.62-13.3), Iran (OR 5.61; 95%CI 2.31-13.62) and Canada (OR 5.15; 95%CI 2.65-9.98) had the strongest association.

Mitrovic et al 2015 (10) **(Serbia)** A case-control study amongst blood donors determined tattooing was associated with anti-HCV positivity. Multiple logistic regression analysis calculated an odds ratio of 8.8 (95%CI 2.02 - 38.53, p=0.004). However, the study is limited by the small sample size and low response rate among cases.

Alvarez et al 2014 (11) (USA) A cross-sectional study from a prison population in New York City found an odds ratio of 2.9 (95%CI 1.9 - 4.5) on logistic regression for HCV infection among inmates who reported any tattoos. It should be noted that HCV status was recorded from the medical notes and was not laboratory confirmed. The setting where the tattoo was performed (i.e. in prison or elsewhere) was not examined.

Urbanus et al 2011 (12) (Netherlands) An observational study from the Netherlands determined that people with multiple tattoos were not at increased risk of HCV infection. From a cohort (n = 434) of tattoo artists, body piercers, and people with multiple tattoos and/or body piercings, one participant was HCV positive. This participant had multiple risk factors including numerous tattoos.

Vickery et al 2009 (13) **(Australia)** A retrospective cohort study from a hospital endoscopy population found an OR of HCV infection (anti-HCV positive) of 3.73 (95%CI 2.32-5.99) in persons who had ever been tattooed. An adjusted analysis of the odds of HCV infection according to date of tattooing found an OR of 3.28 (95%CI 1.11-9.67) in patients tattooed before 1980, an OR of 5.92 (95%CI 1.46-24.06) in patients tattooed between 1980 and 1990, and an OR of 0.37 (95%CI 0.15-1.02) for patients tattooed after 1990.

Goldman et al 2009 (14) **(Canada)** A case-control study from a population of blood donors in 2006 compared risk factors for HCV infection in cases with matched controls. Logistic regression analysis yielded an OR of 3.47 (95%CI 1.49 - 8.07) for HCV and tattooing. Having received a tattoo more than 10 years ago was significantly associated with HCV infection (OR 5.43, 95%CI 1.82 - 16.2) while receiving a tattoo within the last 10 years was non-significant (OR 2.35, 95%CI 0.77 - 7.22).

Coelho et al 2009 (15) **(Brazil)** A retrospective cohort study in a prison setting determined a marginal statistical association between HCV infection and tattooing (p=0.07). After multiple logistic regression analysis, having a tattoo was identified as an independent predictor for HCV infection with an OR=3.2 (95%CI 1.05 – 10.0, p=0.04). The setting where the tattoo was performed (i.e. in prison or elsewhere) was not examined.

Literature review on the risk of HCV infection associated with body piercing

Alvarez et al 2014 (11) (USA) A cross-sectional study based in a New York City prison population found on multivariate analysis that the odds of HCV in any inmate with body piercings was 1.2 (95%CI 0.8 - 1.8). HCV status was not confirmed by laboratory testing.

Azevedo et al 2012 (16) **(Brazil)** Azevedo et al undertook a study of 97 former soccer players. No association was found between HCV infection and piercings. The type of piercing (i.e. ear / body / either / both) was not described.

Wiegand et al 2013 (17) **(Germany)** An abstract was reviewed of a cross-sectional study of GP patients (n = 11,845). Piercing occurred more frequently in patients who were anti-HCV positive (p<0.001). Multivariate analysis was not carried out / presented. 'Drug abuse' was recorded as a risk factor for 40% of anti-HCV positive patients. The type of piercing (i.e. ear / body / either / both) was not defined. No detail was available in the abstract on many of the study characteristics e.g. inclusion and exclusion criteria, response rate, etc.

Urbanus et al 2011(12) (Netherlands) An observational study from the Netherlands determined people with multiple tattoos and body piercings were not at increased risk of HCV. From a cohort (n = 434) of tattoo artists, body piercers, and people with multiple tattoos and/or body piercings, only one participant with multiple risk factors was HCV positive. The case is documented as having multiple tattoos but there is no clear documentation of whether or not they had any piercings.

Goldman et al 2009 (14) (Canada) A Canadian case-control study in 2009 determined on both univariate and multivariate analysis that neither ear piercing nor body piercing were risk factors for HCV.

King et al 2009 (18) **(France)** Utilising the 2004 national hepatitis C antibody seroprevalence survey (14,416 participants) risk factors for antibodies to HCV were examined. No association was found between HCV infection and body piercing (OR 1.4; 95% CI 0.7-2.8).

Vickery et al 2009 (13) (Australia) A retrospective cohort study from a hospital endoscopy population, with an anti-HCV prevalence of 4.7%, examined the risks of HCV infection (anti-HCV positive) associated with ear and body piercing as separate variables. Univariate analysis found an OR of HCV infection in individuals who had ever had body piercing of 2.98 (95%CI 1.30-6.86). Univariate analysis of the association between ear piercing and HCV infection was not significant (OR 1.36; 95%CI 0.85-2.20). On multivariate analysis the odds of HCV infection associated with body piercing was no longer significant.

Hwang et al 2006 (19) **(USA)** A cross-sectional seroprevalence study of university students in the United States determined there was no relationship between HCV prevalence and body piercings, the number of body piercings, the setting where piercings were performed, or the type of disinfection method used.

Alvarado-Esquivel et al 2005 (20) **(Mexico)** Alvarado-Esquivel et al carried out a study of inmates in a correctional facility. The anti-HCV prevalence was 10% amongst study participants. Univariate analysis of the risk of HCV infection associated with ear piercing was examined and found to be significant (OR 3.26; 95%CI 1.08-9.87). No multivariate analysis was carried out. Only ear piercing was examined as a risk factor and the setting where the piercing was carried out (i.e. in prison or elsewhere) was not examined.

Thaikruea et al 2004 (21) **(Thailand)** A matched case-control study amongst a cohort of blood donors, with an anti-HCV prevalence of 1.3%, examined the risk factors for HCV infection. Body piercing and ear piercing were considered as a single variable. Non-IDU participants were analysed separately. The OR for ear/body piercing on univariate analysis was 2.42 (95%CI 1.20-4.89). However the odds were no longer statistically significant on multivariate analysis.

Roy et al 2001 (22) (Canada) A Canadian cross-sectional study of Montreal street youths found no relationship between body piercings and HCV in this high risk population (anti-HCV prevalence 12.6%).

Murphy et al 2000 (23) **(USA)** A case-control study from a cohort of blood donors was undertaken. The risk of HCV infection associated with having ears or other body parts pierced was examined. The unadjusted OR for HCV infection in those with pierced ears or body parts was 4.6 (95%CI 3.2-6.6). When adjusted for IDU the OR decreased to 2.7 (95%CI 1.7-4.2). On multivariate analysis the OR further decreased to 2.0 (95% CI: 1.1-3.7). Low and differential response rates between cases and controls may have introduced bias.

Balasekaran et al 1999 (24) **(USA)** Participants were recruited for a matched case-control study (58 cases, 58 controls) from patients attending hospital gastroenterology clinics. Patients with a history of IDU were excluded. No statistically significant association was found between ear piercing and HCV infection. The ethnicity of 54% of the study population was Hispanic, African-American or Native American. No detail was provided on how the HCV status of controls was determined.

Neal et al 1994 (25) **(United Kingdom)** A case-control study amongst a cohort of blood donors examined the relative risks for HCV infection. On univariate analysis the RR for individuals with ear piercing was 3.7 (95%CI 1.9 - 7.4). However, after the exclusion of all donors with a history of injecting drug use, the relative risk of HCV infection in participants with ear piercing was non-significant (RR 1.5 95%CI 0.7 - 2.9).

***Note**: A systematic review and meta-analysis by Yang et al (26) (2015) was retrieved but is not included*

here. The results of the meta-analysis presented in the paper by Yang et al raised concerns and the individual studies included in the review were retrieved. 29 studies were included in Yang's review. 27 of these full text articles were critically appraised, of which 16 were excluded. Several inappropriate study inclusions were noted e.g. studies of unacceptably poor quality, studies relating to HBV, or studies in high endemic countries. Eleven studies were deemed appropriate for consideration by this guideline development subgroup and are considered above. The full text of two articles could not be reviewed - neither the abstract nor full text could be accessed for one article and only an abstract could be retrieved for the 2nd article which contained insufficient detail for inclusion.

4. What is the quality of the evidence? To be considered if primary literature was reviewed.

4.1. How reliable are the studies in the body of evidence?

If there is insufficient evidence to answer the key question go to section 11. Comment here on any issues concerning the quantity of evidence available on this topic and its methodological quality.

Tattooing

Seven guidelines, one systematic review and meta-analysis, and 6 additional primary research studies were included which addressed the question. Therefore the quantity of evidence is sufficient. The quality of the primary research was variable. However, the findings are consistent (Section 4.2).

Body Piercing

Three guidelines and 14 primary research studies were included which addressed the question. Therefore the quantity of evidence is sufficient. The quality of the primary research was variable. However, the findings are consistent (Section 4.2).

4.2. Are the studies consistent in their conclusions – comment on the degree of consistency within the available evidence. Highlight specific outcomes if appropriate. If there are conflicting results highlight how the group formed a judgement as to the overall direction of the evidence

Tattooing

The systematic review and meta-analysis and the additional primary research appraised were consistent in finding an association between HCV infection and tattooing.

Two studies specifically looked at the time period when the tattoo was acquired and found that the association between tattooing and HCV infection was only present in individuals who were tattooed pre 1995 (14)) and pre 1990 (13).

The systematic review and meta-analysis (9) found that the OR for tattoos carried out in non-professionals parlours or by 'friends' was 2.8 (95%CI 1.29-6.08). Whereas the OR for tattoos done in professional parlours was lower and non-significant (OR 1.28, 95%CI 0.68-2.39).

Body piercing

14 studies were included that addressed the question and were of sufficient quality.

Three studies examined the risk associated with ear piercing. One looked at the risk of body piercing (specifically excluding ear piercing). Two considered ear and body piercing separately. The remainder either didn't define piercing or didn't distinguish between ear and body piercing.

Only one study examined the setting in which piercing was done. No detail is provided but the authors reported that no significant association was found.

6 studies found an association. However

- The findings in Neal et al (25)were no longer significant when adjusted for IDU
- The findings in Thaikruea et al (21)were no longer significant on multivariate analysis
- Vickery et al (13) found an association with body piercing and not ear piercing on univariate analysis. The association with body piercing was no longer significant on multivariate analysis
- Alvarado-Esquivel et al's study (20) on prison inmates did not carry out multivariate analysis
- Wiegand et al (17) (abstract only) did not carry out multivariate analysis

Only one study (Murphy et al (23)) determined an association between piercing and HCV infection on univariate and multivariate / adjusted analysis. This study was carried out between 1994 and 1995 when there may have been less awareness of the necessary hygiene practices during piercing procedures to reduce the risk of blood borne virus transmission.

4.3. Generalisability – are the patients in the studies similar to our target population for this guideline? is it reasonable to generalise

Tattooing

The systematic review included studies from 30 different countries and included a subgroup analysis that investigated the effect of the country where the study was conducted, with further analysis by study population risk (9).

The primary literature reviewed included:

- Two studies carried out on blood donor cohorts (10, 14).
- One study which assessed risk amongst tattoo artists, piercers, and people with multiple tattoos and/or piercings (12).
- One study from a cohort of hospital endoscopy patients (13).
- Two studies on prison inmates (neither considered the setting where a tattoo was performed) (11, 15)

Body piercing

Nine of the included studies were carried out in low risk populations. Two were carried out in correctional facilities (11, 20), one was carried out amongst disadvantaged street youths (22) and two were carried out amongst hospital patient cohorts (13, 24).

4.4. Applicability - Is the evidence applicable to Ireland? Is the intervention/ action implementable in Ireland?

Tattooing

Yes

Body piercing

Yes

4.5. Are there concerns about publication bias? Comment here on concerns about all studies coming from the same research group, funded by industry etc

Tattooing

Jafari et al acknowledged in their systematic review and meta-analysis that some publication bias may be present (9). However, they considered that it would not influence the overall results.

Body piercing

Most studies published found no association between body/ear piercing and HCV infection suggesting a low risk of publication bias.

5. Additional information for consideration

5.1. Additional literature if applicable e.g. Irish literature

5.2. Relevant national policy

National HCV Strategy Ireland, 2011 (27) (*HIQA quality score 98*)
The National HCV Strategy does not make any recommendation on screening for people with tattoos or body piercing.

At present in Ireland there is no regulation of the tattoo or body piercing industry. Department of Health guidance on infection prevention and control in relation to tattooing and body piercing is in development and due to be published shortly.

5.3. Epidemiology in Ireland if available and applicable

Long et al carried out a cross-sectional study in 1999 of prisoners entering the Irish prison system (prisoners committed within the previous 48 hours) (28). The study found that tattooing in prison was the only independent risk factor identified for the presence of hepatitis C antibodies in respondents who had never injected drugs.

Drummond et al carried out a cross-sectional study in 2011 targeting a random sample of all inmates (sentenced and remand) in prison in the Republic of Ireland (29). The study found that both the presence of tattoos and tattoos acquired in prison were significantly associated with hepatitis C on univariate analysis $p<0.001$. However on multivariate analysis only having had a tattoo done in prison remained significant OR 2.6 (1.4-5.1).

In a study of HCV screening in the antenatal population in Dublin tattooing was significantly associated with anti-HCV status on multiple regression ($p<0.05$) (30).

There is no available data on the prevalence of tattoos or body piercing in the general population in Ireland.

Tattooing or body piercing was cited as the most likely risk factor for 38 of >4,200 notifications of hepatitis C in Ireland between 2011 and 2015. Of the 28 cases where country of infection was stated, 21 were outside Ireland

6. Potential impact of recommendation

6.1. Benefit versus harm

What factors influence the balance between benefit versus harm? Take into account the likelihood of doing harm or good. Do the desirable effects outweigh the undesirable effects?

Benefits:

- Linkage to care and treatment will result in improved quality of life for detected cases.
- The offer of screening also provides an opportunity to raise awareness and educate on hepatitis C.
- Promotion and further normalisation of testing may improve uptake and reduce stigma around hepatitis C.
- Detection and treatment of undiagnosed cases will reduce the risk of transmission to others.

Harms:

- False positives. The rate of false positive screening results depends on the population being

screened. In high risk populations false positive rates are acceptable. However, in low risk populations the positive predictive value of the screening test decreases and may not be acceptable. False-positive test results incur costs and can also cause psychological harm. Confirmatory testing reduces the false-positive rate but increases the cost.

- Detection of cases who may not yet be eligible for treatment may lead to frustration and anxiety.
- Detected cases may suffer from stigmatisation.
- Opportunity cost. Diversion of resource from other risk groups where greater support is needed for testing and linkage to care.
- Tattooing is common in Ireland and the recommendation may result in anxiety for those who are at very low risk as their tattoo may have been done with good adherence to infection prevention and control.

6.2. What are the likely resource implications and how large are the resource requirements? Consider cost effectiveness, financial, human and other resource implications

A large number of people are likely to have tattoos. Including tattooing as one of the risk factors for antenatal screening will increase the cohort eligible for screening in the antenatal population.

6.3. Acceptability – Is the intervention/ option acceptable to key stakeholders?

The proportion of those with tattoos coming forward for screening is likely to be low.
Given the large numbers of people with tattoos and the low HCV risk for most, healthcare providers may consider the screening of all those with tattoos to be unacceptable.

6.4. Feasibility - Is the intervention/action implementable in the Irish context?

If the recommendation for screening of those with a tattoo is to be based on a risk assessment, tattoo recipients may not be able to self-assess whether infection prevention and control measures were adequate. This also cannot be done retrospectively by a third party except for some situations such as the prison setting, where it will be very likely that infection prevention and control would not have been adequate.

The proportion that would be eligible for screening is unknown but likely to be large.

6.5. What would be the impact on health equity?

The principle of proportionate universalism should underpin the recommendations and their implementation in order to have a positive impact on health equity.

Recommending HCV screening for all those who have had a tattoo would likely divert resources to a low risk population and away from other higher risk population groups.

7. What is the value judgement? How certain is the relative importance of the desirable and undesirable outcomes? Are the desirable effects larger relative to undesirable

Recent advances in treatment options for hepatitis C make treatment more acceptable and more successful. Treatment with the new DAAs which are now available results in cure in the majority of patients with shorter duration of treatment and less side effects than previous treatments. However at present the cost of these treatments is high.

Screening enables early detection, referral for assessment and treatment where indicated. Without screening cases may go undetected for a considerable length of time due to the asymptomatic nature of HCV infection. Individuals often do not present until symptomatic, which is usually indicative of severe liver damage. Early treatment and cure will confer personal, social, and economic benefits. Early treatment and cure will also reduce the risk of transmission to others. A treatment programme exists in Ireland allowing detected cases access treatment.

There is a clear risk of transmission from tattooing, although the risk is likely to now be low in Ireland in professional practices that adhere to infection prevention and control measures. However, the tattoo industry is not regulated in Ireland to assure standards are being met, thus a recommendation based selectively on the setting where a tattoo was received cannot be made.

The evidence of HCV infection risk from body piercing does not support a recommendation to screen all recipients of body piercing.

8. Final Recommendations

□ Strong recommendation
√ Conditional/ weak recommendation

Text:

Screening should be considered for all those with a tattoo. Those most at risk of having acquired hepatitis C through tattooing are those who received tattoos a long time ago, in non-professional settings, or in other circumstances where infection control was poor.

There is insufficient evidence to support screening of recipients of body piercings (including ear piercings).

9. Justification

Those most at risk of having acquired hepatitis C through tattooing are those who received tattoos a long time ago, in non-professional settings, or in other circumstances where infection control was poor. However there is no regulation of the industry in Ireland. It is not considered appropriate to ask recipients of tattoos to adequately self-assess whether or not infection prevention and control practices were adequate. For these reasons, offering HCV screening to all recipients of tattoos is recommended.

10. Implementation considerations

Given the large numbers of people likely to have had a tattoo, this recommendation could be implemented on an opportunistic basis for the time-being, i.e. to be considered when the person presents for other healthcare.

Infection prevention and control guidance for tattooists should be issued. Guidance for the general public on what infection prevention standard should be expected should also be issues.

11. Recommendations for research

List any aspects of the question that have not been answered and should therefore be highlighted as an area in need of further research.

Prevalence of tattoos is the Irish population. Prevalence of HCV in those with tattoos amongst pregnant women

Review by GDG

Date: 24/01/2017

It was discussed that in terms of antenatal screening this will likely lead to a significant proportion of women being eligible for screening.
It was suggested that this could be an area for research. With the new maternity IT system it could be evaluated by determining the proportion of cases detected in antenatal women with tattoos compared to other risk factors. If the yield is very low the recommendation may be reviewed. Research into the risk of HCV from tattooing within the antenatal population would also be a proxy for the risk in the general population. This research would also give a prevalence estimate for tattoos in Ireland.
The recommendation was accepted as proposed.

Phrasing of recommendation amended.

Consultation feedback and review by GDG

Please see *Report of the consultation process* for feedback received.

No material change to recommendation.

Final recommendation

Recommendation 12

12.1. Screening for HCV should be considered for all those with a tattoo. Those most at risk of having acquired HCV through tattooing are those who received tattoos a number of decades ago, in nonprofessional settings, in prison, in high prevalence countries, or in other circumstances where infection control was poor.

12.2. There is insufficient evidence to support screening of recipients of body piercings (including ear piercings).

Quality/level of evidence: low; good consistency between existing high quality guidelines on screening of those with tattoos
Strength of recommendation: conditional/weak

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Appendices

Evidence search and results

International and national guidelines

HCV guidelines identified, reviewed, and quality appraised as described in the National Clinical Guideline.

Grey literature

Nil used.

Primary literature

The GDG determined that to formulate a recommendation further information was required on the risk of HCV transmission through tattooing and body piercing.

PICO

Population: people who have had a tattoo or body piercing
Intervention: n/a
Comparison: n/a
Outcome: incidence of HCV/ prevalence of HCV

Search strategy

Sources:

- Medline
- Embase

See table 2 for search terms used in Medline search

Study type/ limits: experimental or observational studies, case studies, case reports; published between 1 January 1990 and 30 June 2015

Inclusion criteria:

- Low endemicity country
- Reports on prevalence/ incidence in those with tattoos or body piercing accounting for other risk factors
- HCV status based on blood/ saliva rather than self report
- From 1990

Exclusion criteria:

- High endemicity country

Table 2: Search terms used in Pubmed/Medline search

#	Query	Limiters/Expanders	Results
S1	hepatitis C or HCV or hepacivirus or hep C or hepC	Search modes - Boolean/Phrase	74,953
S2	(MM "Hepatitis C+")	Search modes - Boolean/Phrase	41,127
S3	(MM "Hepacivirus")	Search modes - Boolean/Phrase	17,165
S4	risk factor*	Search modes - Boolean/Phrase	793,591
S5	(MH "Risk Factors")	Search modes - Boolean/Phrase	594,724
S6	S1 OR S2 OR S3	Search modes - Boolean/Phrase	74,953
S7	S4 OR S5	Search modes - Boolean/Phrase	793,591
S8	transmission or transmit or mode of transmission or acquisition or acquire* or transmit*	Search modes - Boolean/Phrase	863,409
S9	(MM "Disease Transmission, Infectious+")	Search modes - Boolean/Phrase	29,862
S10	S8 OR S9	Search modes - Boolean/Phrase	870,117
S11	tattoo* or body art or body ornament*	Search modes - Boolean/Phrase	4,340
S12	(MM "Body Modification, Non-Therapeutic")	Search modes - Boolean/Phrase	81
S13	(MM "Tattooing")	Search modes - Boolean/Phrase	2,160
S14	S11 OR S12 OR S13	Search modes - Boolean/Phrase	4,408
S15	S6 AND S14	Search modes - Boolean/Phrase	404
S16	S7 AND S15	Search modes - Boolean/Phrase	288
S17	S10 AND S16	Search modes - Boolean/Phrase	197
S18	S10 AND S16	Limiters - Date of Publication: 19900101-20151231 Search modes - Boolean/Phrase	197
S19	S10 AND S16	Limiters - Date of Publication: 19900101-20151231; Human Search modes - Boolean/Phrase	183

Search results

Figure 1: PRISMA flow diagram of review of literature on risk of HCV transmission through tattooing

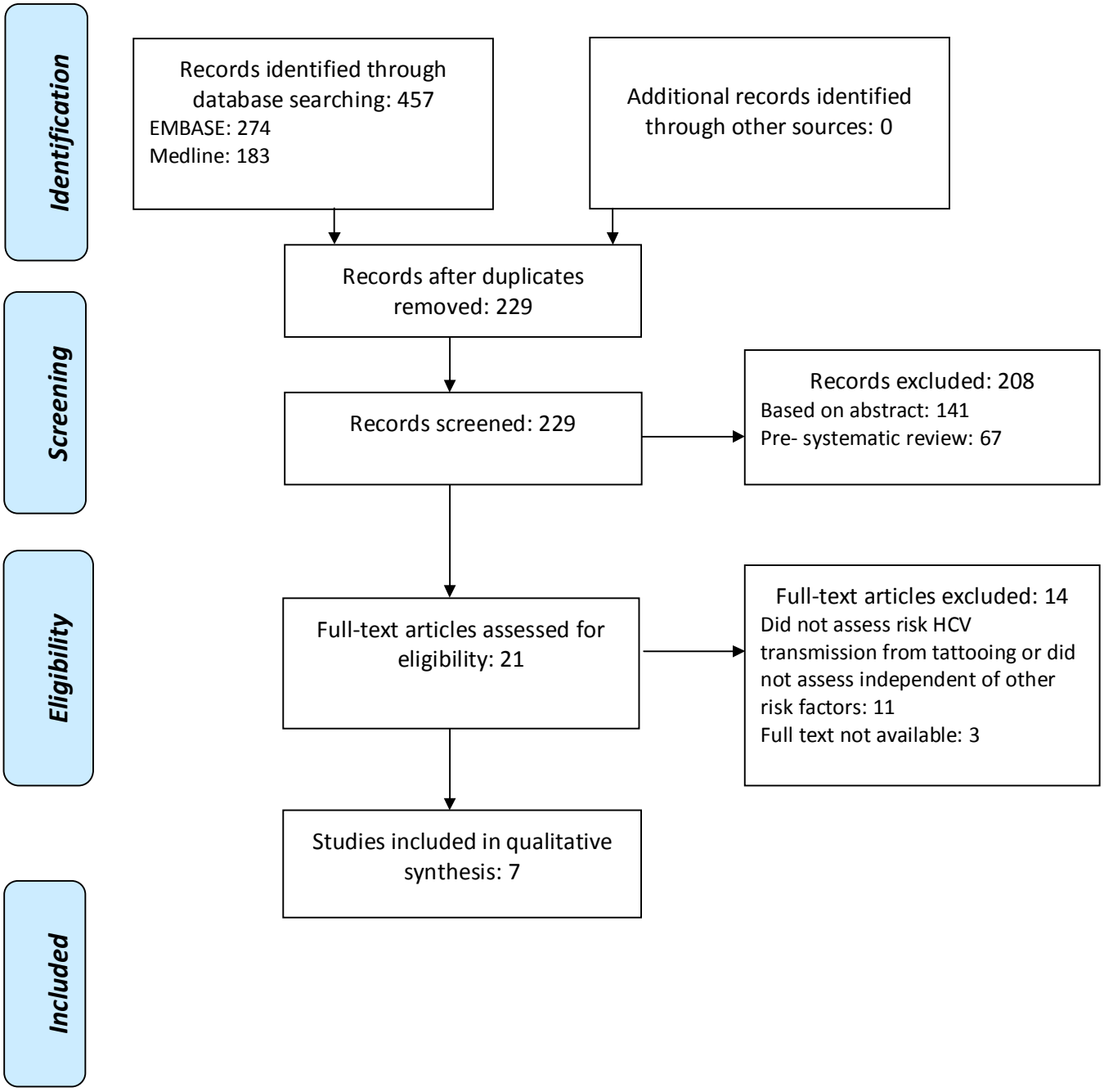

Figure 2: PRISMA flow diagram of review of literature on risk of HCV transmission through body piercing