SYSTEMATIC REVIEW

Tattooing and Risk of Hepatitis B: A Systematic Review and Meta-analysis

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ABSTRACT

Objective: The objective of this systematic review and meta-analysis is to assess the association between tattooing and the risk of transmission of hepatitis B virus.

Methods: A systematic search of MEDLINE, EMBASE, PubMed, Database of Abstracts of Reviews of Effects, ACP Journal Club and BIOSIS Previews was performed up to March 2011.

Results: Forty-two observational studies were included in this systematic review, of which 31 were included in the meta-analysis. Pooled odds ratios (95% confidence intervals) of the association of tattooing and hepatitis B infection was 1.48 (1.30-1.68) when all studies were included in the analysis. Subgroup analysis shows the strongest association between tattooing and risk of hepatitis B among populations involved in high-risk behaviours (OR=1.64, 95% CI: 1.32-2.03).

Conclusion: Findings of the current systematic review and meta-analysis indicate that tattooing is associated with hepatitis B transmission in all subgroups. A population health approach that emphasizes universal hepatitis B immunization, education of young adults who are more likely to get tattoos, and education of prison inmates (who have the highest background rate of hepatitis B infection), along with enforcement of guidelines and safer tattooing practices in prison, are fundamental in prevention of transmission of hepatitis B.

Key words: Tattooing; hepatitis B; hepatitis; infections

La traduction du résumé se trouve à la fin de l'article.

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Tattooing and body arts have become more prevalent in recent years, their popularity increasing among young adults. A population-based study revealed that one third of people younger than 30 years old in the United States have at least one tattoo.[1] Canadian data indicate that around 8% of high school students have at least one tattoo[2,3] and that 21% of those who did not have a tattoo were eager to have one. Tattooing requires injection of pigments into the dermal layer of skin by repeated puncture of the skin. Such close contact of the tattoo instruments with blood and bodily fluids may cause transmission of viral and bacterial infections if the instruments are used on more than one person without being sterilized.

In North America, most cases of hepatitis B infection occur via blood or sexual contact.[4] Acute hepatitis B infection causes chronic infection in 6-10% of adolescents and adults; chronic infection can lead to liver cirrhosis and to cancer.[5] Thus, cases of hepatitis B infection due to tattooing have important clinical and public health implications. Results from epidemiologic studies regarding the risk of hepatitis among tattooed individuals are conflicting;[3,6] therefore, we conducted a review of the current literature in order to quantify, in a systematic fashion and by using appropriate meta-analytical techniques, the risk of transmission of hepatitis B infection.

METHODS

Search strategy

MEDLINE (1966-March 2011), EMBASE (1980-March 2011), Database of Abstracts of Reviews of Effects (1991-March 2011), and ACP Journal Club (1991-March 2011), International Pharmaceutical Index (1970-March 2011), BIOSIS Previews (1969-March 2011) and Web of Science (1961-March 2011) were searched to identify the relevant studies and abstracts. The initial search strategy was developed from the MeSH subject headings "hepatitis" and "tattoo" in MEDLINE. We reviewed the titles for their relevance to this study, and then examined subject headings and abstracts. We searched the proceedings and conference abstracts through the databases PapersFirst (1993) and ProceedingsFirst (1993) up to March 2011. Authors' names and year of publication from key papers were entered into the cited reference search in the Web of Science. References of the retrieved studies and review articles were screened for any potentially missed articles. We also hand searched the reference lists of retrieved studies as well as journals related to "hepatitis", "hepatology", "transfusion", "blood", "infection", "epidemiology", "gastroenterology", and abstracts and books related to hepatitis. We did not have any language restrictions. Details of the search strategy are available upon request from the authors.

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Conflict of Interest: None to declare.

Selection criteria

Observational studies that assessed the association between tattooing and hepatitis B were included if they clearly defined: 1) hepatitis B as either primary or secondary outcome based on serology test, and 2) tattoos as either primary or secondary exposure; and presented relative risks or odds ratios (ORs) and their corresponding 95% confidence intervals (95% CI) or provided sufficient data to compute these parameters. If a study was published in different phases or data were duplicated in more than one publication, we only included the most recent. Two authors (SJ and SB) scanned the titles of abstracts identified through our search strategy and excluded articles that did not meet the selection criteria, such as those on basic sciences, review articles, letters to editor, and commentaries.

Data extraction

We created a spreadsheet and recorded study characteristics, including authors' names, publication year, country of study, study design, sample size, study population, mean age and/or range, gender of participants, type of risk factors or confounders adjusted for, outcome of interest (hepatitis B), and the adjusted OR and 95% CI. Included articles were reviewed in full by two independent reviewers (SJ and SB). All discrepancies were resolved after reviewing the source papers and further discussion among two reviewers. Studies were included only after full consensus was achieved. For studies that provided several levels of exposure, each exposure was categorized and analyzed in the designated subgroup.

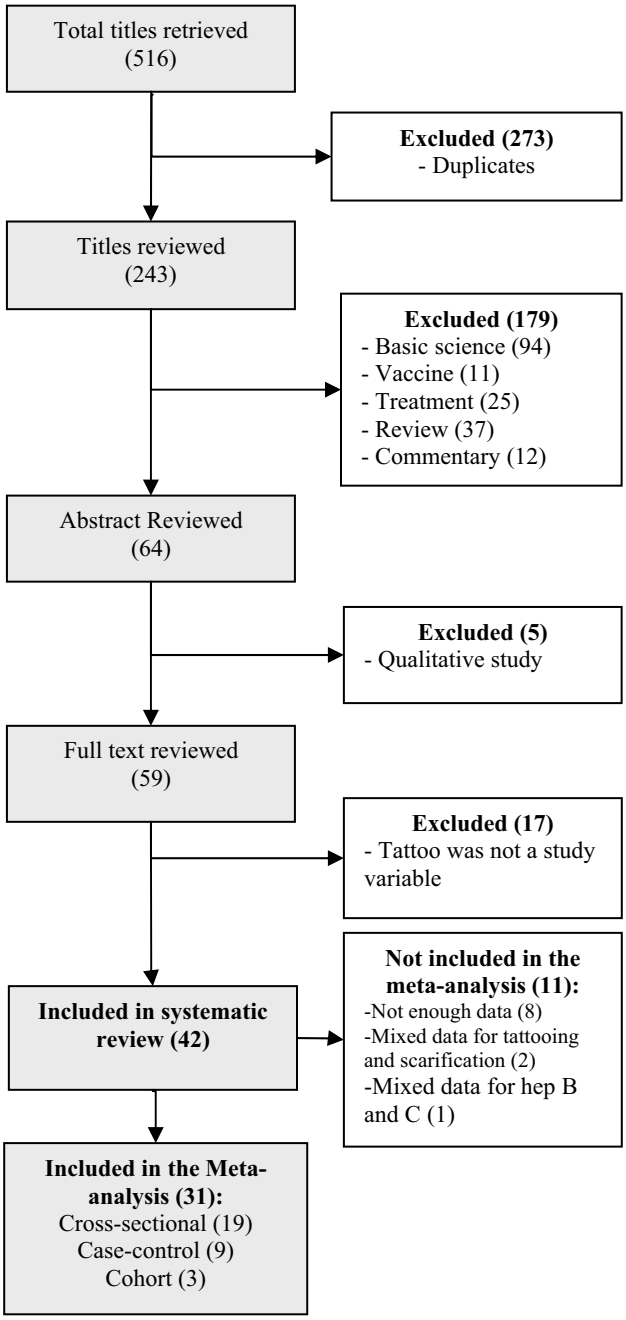
Statistical analysis

We pooled the OR and 95% CI of all studies to calculate the overall risk. If a study provided more than one OR, we used the OR that was representative of all participants to calculate the overall pooled OR and 95% CI of all studies included in the meta-analysis. If the overall OR (95% CI) for all participants was not provided in a study, we calculated the pooled OR of that study and then used it for the purpose of calculation of overall OR (95% CI) of our meta-analysis. We performed several subgroup analyses to investigate the association between tattooing and risk of hepatitis B among different populations. We conducted subgroup analyses based on the study population and study design (case control, cohort, and cross-sectional). We grouped the studies on tattoos and hepatitis B into four main groups: 1) community sample (e.g., blood donors, students, and pregnant women), 2) hospital samples, 3) prisoners and 4) high-risk populations (street youth, persons with HIV, people who use drugs, those whose tattoos were done with reused tattoo needles, and those tattooed in non-professional tattoo parlours). Because only three studies in our review [W5,W18,W31]* were reporting samples derived from blood donors, we did not create a subgroup for this group; however, those studies are included in the pooled analysis. We calculated pooled OR (95% CI) from one study [W9] that provided data on both tattoos performed in non-professional parlours and tattoos done with reused needles, and used it in the subgroup of high-risk subjects.

For all analyses, we weighted the study-specific adjusted log ORs by the inverse of their variances. A random effects model was used to estimate the pooled adjusted OR. Statistical heterogeneity between studies was evaluated with Higgins I^2 statistic.[7] Sensitivity analysis was carried out to assess the influence of individual studies and then repeating the analysis by excluding the studies with the largest weights.

* See Table 1 for a list of the 31 studies (W1 through W31).

Figure 1. Selection of studies for inclusion in the systematic review and meta-analysis



RESULTS

Figure 1 shows the results of our search strategy and step-by-step inclusion and exclusion of the retrieved papers. We identified a total of 516 citations related to risk factors of hepatitis. After excluding 273 duplicates, 243 titles were reviewed, of which 64 were selected for abstract review; of these, 59 studies were selected for full-text review. The review process resulted in 31 studies (19 cross-sectional, 9 case-control, 3 cohort), with a total of 665,169 participants from 19 countries, being included in the meta-analysis. All studies identified were in English. Characteristics of the 31 studies included in the meta-analysis are presented in Table 1.

We found a statistically significant association (pooled OR=1.48, 95% CI: 1.30-1.68; I^2=47%) between tattooing and risk of trans-

Table 1. Characteristics of Studies Included in Both Systematic Review and Meta-analysis

Study ID	Author	Year	Location	Sample Size (case/control)	Study Design	Sample Derived From	Age, Range, Mean (SD)	Gender	OR/ RR	95% CI	Adjustment
W1	Anda	1985	USA	619	CS*	Prison	Mean (24.8-28.2)	M	0.53	0.31-0.92	IVDU; IVDU and previous imprisonment; prior hepatitis or jaundice; race; age
W2	Auamnoy	2003	Thailand	92 (46/46)	CC†	Hospital	22.88 ± 1.41	M/F	15.9	1.97-128.16	No
W3	Babudieri	2005	Italy	973	CS	Prison	30-44 (36.9)	M/F	1.14	0.89-1.47	Age; gender; area of origin; exposure category; unprotected sex; transfusions; imprisonment
W4	Butler	2007	Australia	612	CS	Prison	All ages	M/F	1.66	1.01-2.74	No
W5	Christensen	2000	Denmark	325	CO‡	Prison	All ages	M	1.00	0.30-2.90	Age, times in prison, duration of IDU, sexual risk index, IDU in prison
W6	Christensen	2001	Denmark	10,862	CS	Blood donors	Median=48	M/F	2.89	1.51-5.50	No
W7	Coppola	2007	Italy	3579	CS	Healthy subjects	33.19 (12.18)	M/F	1.85	1.18-2.90	No
W8	Hull	1985	USA	455	CS	Prison	18-71	M	1.30	0.40-2.60	No
W9	Hwang	2006	USA	7960	CS	Students; all	>18; median age: 21.62	M/F	0.96	0.73-1.25	No
	Hwang	2006	USA	7960	CS	1-2 tattoo(s)	Not reported	M/F	0.99	0.74-1.32	No
	Hwang	2006	USA	7960	CS	>3 tattoos	Not reported	M/F	0.87	0.50-1.50	No
	Hwang	2006	USA	7960	CS	Professional tattoo parlour	Not reported	M/F	0.93	0.70-1.23	No
	Hwang	2006	USA	7960	CS	Non-professional tattoo parlour	Not reported	M/F	1.24	0.69-2.23	No
	Hwang	2006	USA	7960	CS	New or autoclaved needle	Not reported	M/F	0.87	0.65-1.18	No
	Hwang	2006	USA	7960	CS	Reused needle	Not reported	M/F	1.91	1.11-3.30	No
W10	Hymas	1989	Sudan	851	CS	Community	1-89 (24.6)	M/F	1.58	1.04-2.39	No
W11	Khan	2005	USA	1124	CS	Prison	18-72	M	1.46	1.04-2.06	Age, race, history of IDU/STI, lifetime number of female partners, incarcerated more than 14 years, tattoo during incarceration
W12	Ko	1990	Taiwan	90/180	CC	Healthy adults	Not reported	M	8.10	1.90-34.8	No
W13	Lai	2007	Taiwan	286	CS	Prison	Not reported		0.66	0.32-1.39	No
W14	Liao	2006	Taiwan	298	CS	Prison	Not reported		1.49	0.78-2.84	No
W15	Luksamijarulkul	2008	Thailand	354	CS	Public cleaners	39.5 (7.7)	M/F	1.17	0.69-1.99	No
W16	Mariano	2004	Italy	2964/7221	CC	IVDU & blood transfusion	15-55	M/F	1.70	1.00-3.10	Sex, age, education, geographical area, surgical intervention, dental therapy, number of sexual partners, households or sexual partners of HBsAg/HCV chronic carrier
W17	Mele	1995	Italy	5241 (363/4879)	CC	Community	Not reported	M/F	2.12	1.10-4.09	Age, sex, education level, geographic area, surgical interventions, dental therapy, sexual exposure
W18	Nishioka	2003	Brazil	345	CS	Blood donors	18-62	M/F	1.90	0.94-3.83	Syphilis, Chagas' disease, HIV infection, at least one marker for HBV, HCV, or HIV
W19	Nurgalieva	2007	Kazakhstan	290	CS	Community	10-65	M/F	1.26	0.51-3.12	No
W20	Pallas	1999	Spain	1215	CS	Prison	30.6 (9.9)	M/F	1.70	0.80-3.5	Age, sex, educational level, number of sexual partners
W21	Pereira	2006	Brazil	1025	CS	HIV patients	17-77	M/F	1.60	1.10-2.40	Age, gender, number of sexual partners
W22	Phoon	1988	Singapore	6328	CS	Hospital	35-65	M	1.16	0.75-1.79	Age
W23	Pourahmad	2007	Iran	1431 (497/934)	CC	Prison	25-60	M	1.85	1.00-3.43	No
W24	Roy	1999	Canada	437	CO	Street youth	19.5	M/F	1.60	0.60-4.20	Age, IDU, number of sexual partners, body piercing
W25	Sali	2005	Iran	(500/434)	CC	Hospital	37.6 (15.1)	M/F	1.40	0.85-2.29	No
W26	Samuel	2001	USA	2898	CO	IDU, tattooed in prison	>15	M/F	2.30	1.40-3.8	Age, study site, race, share injection equipment, use of heroin, years of injection
	Samuel	2001	USA	2898	CO	IDU, tattooed in community	>17	M/F	1.60	1.10-2.50	No
W27	Sebastian	1992	Brunei	(187/187)	CC	Hospital	20-70	M	2.01	1.05-3.95	Matched case-control
W28	Shi	2007	Taiwan	(476/1421)	CC	Military	All 20 years old	M	1.37	0.98-1.93	No
W29	Tawk	2005	Australia	2120	CS	Hospital	52.3	M/F	1.33	0.88-2.02	No
W30	Vahid	2005	Iran	454/428	CC	Blood donors	HBsAg+ 36.69 (0.82); HBsAg- 30.88 (0.80)	M/F	4.60	1.50-13.9	No
W31	Wada	1999	Japan	95	CS	Hospital	24.4 (6.1)	M/F	1.60	0.00-24.00	No
	Wada	1999	Japan	95	CS	Hospital	24.4 (6.1)	M/F	1.40	0.37-4.99	No

*CS = Cross-sectional; †CC = Case-control; ‡CO = Cohort; M = Male; F = Female

mission of hepatitis B infection. In subgroup analysis, we found the strongest association between tattooing and risk of hepatitis B for samples derived from high-risk groups (OR=1.64, 95% CI: 1.32-2.03; I^2=0%), followed by community samples (OR=1.47, 95% CI: 1.12-1.92; I^2=58%), hospital samples (OR=1.45, 95% CI: 1.07-1.97; I^2=30%), and prison samples (OR=1.30, 95% CI: 1.01-1.66; I^2=56%). Figure 2 shows the results of our meta-analysis for association between tattooing and risk of hepatitis B for four main subgroups of samples derived from community, hospital, prison inmates, and high-risk groups.

We conducted a subgroup analysis to investigate the effect of the study design on the association of tattooing and the risk of hepatitis B. The association between tattooing and risk of hepatitis B was the strongest among case-control studies (OR=1.97, 95% CI: 1.45-2.69; I^2=46%), followed by cohort (OR=2.01, 95% CI: 1.52-2.67; I^2=0%) and cross-sectional (OR=1.34, 95% CI: 1.16-1.54; I^2=43%) studies. We also conducted sensitivity analysis to review the effect of three studies with wide confidence intervals [W2,W12,W31] on overall pooled OR (95% CI). The analysis was conducted multiple times; first, all three studies were removed from the analysis, and then one study at a time was removed. We did not find a significant difference in OR (95% CI) when all three studies were removed from the analysis (OR=1.44, 95% CI: 1.20-2.08; I^2=38%). We also found no significant difference between the pooled pre-sensitivity effect size (OR=1.48, 95% CI: 1.30-1.68; I^2=47%) and post-sensitivity effect size after removing any of these studies (OR=1.46, 95% CI: 1.29-1.65; I^2=41%) [W2], (OR=1.45, 95% CI: 1.29-1.64; I^2=41%) [W12], (OR=1.48, 95% CI: 1.30-1.68; I^2=46%) [W31] from the analysis.

In studies of tattooing and hepatitis B, a moderate heterogeneity was detected (I^2=47%) in this review. Using Jackknife method,[8] six studies [W1,W2,W3,W10,W12,W13] were identified to be the source of heterogeneity. Removing these studies from the analysis resulted in elimination of the heterogeneity from pooled and subgroup analysis. However, pre- and post-sensitivity overall pooled OR (95% CI) (pre-sensitivity OR=1.48, 95% CI: 1.30-1.68, I^2=47%; post-sensitivity OR=1.58, 95% CI: 1.44-1.74, I^2=0%), and pre-/post-sensitivity OR (95% CI) in community samples (pre-sensitivity OR=1.47, 95% CI: 1.12-1.92, I^2=58%; post-sensitivity OR=1.51, 95% CI: 1.25-1.84, I^2=0%) and prisoners (pre-sensitivity OR=1.30, 95% CI: 1.01-1.66, I^2=56%; post-sensitivity OR=1.62, 95% CI: 1.33-1.96, I^2=0%) increased, whereas for hospital samples (pre-sensitivity OR=1.45, 95% CI: 1.07-1.97, I^2=16%; post-sensitivity OR=1.35, 95% CI: 1.07-1.72, I^2=0%), these diminished. Differences in the study populations, time and place that the studies were conducted and the study methodology would potentially contribute to the heterogeneity in this study. To further examine the effect of adjustment done in some studies, we removed studies with non-adjusted OR from all subgroups. We did not find any significant change in pooled OR (95% CI) (pre-sensitivity OR=1.48, 95% CI: 1.30-1.68, I^2=47%; post-sensitivity OR=1.48, 95% CI: 1.24-1.77, I^2=30%). We did not conduct such a sensitivity for subgroups because exclusion of studies with unadjusted OR resulted in a small number of studies in each subgroup.

DISCUSSION

Results of our systematic review indicate an increased risk of hepatitis B infection among those who receive tattoos. The risk is persistent among all population subgroups. Not surprisingly, the strongest association is observed among samples from the high-risk populations: injection drug users, sex workers, street youth, HIV patients, those whose tattoos were done with reused tattoo needles, and those tattooed in non-professional tattoo parlours.

A major strength of our review is the large number of studies and the multinational nature of the study sample. We found an association between tattooing and hepatitis B in all subgroups and across all study designs. Our findings are consistent with the literature which documents an association between tattooing and risk of transmission of other infections (including HIV,[9] leprosy,[10] tetanus,[9] and Methicillin Resistant Staphylococcus Aureus[11]) and with a systematic review of hepatitis C.[12] Several studies have indicated a dose–response relationship between tattooing and the risk of transmission of hepatitis C.[13-15] In fact, the risk of transmission of hepatitis C infection increases with the increase in the surface area covered by a tattoo as well as the number of tattoos received by an individual. Taking into account that the infectivity and inocula differ between HBV and HCV and considering that such dose–response associations between tattooing and risk of transmission of hepatitis B were not reported in the included studies, this topic requires further study.

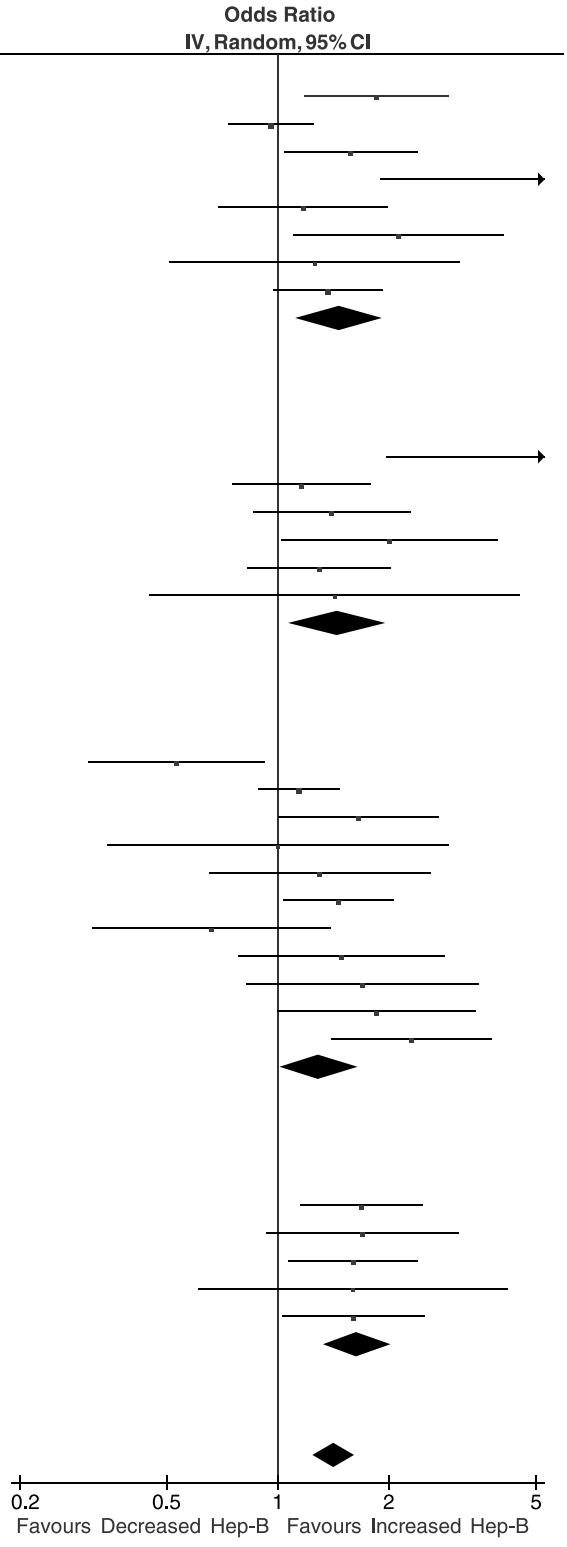
The risk from tattooing may depend on the background prevalence of hepatitis B infection and immunization uptake in the subgroups of a population. Tattooing among prisoners is an area of concern due to the high prevalence of hepatitis B infection among incarcerated individuals; the background rates of hepatitis B infection are 10 to 20 times higher among prisoners[16-18] than among the general public. Reusing and sharing tattoo needles are reported to be common practice among almost 45% of prisoners.[19] However, our results indicate that the association between tattooing and the risk of transmission of hepatitis B among prisoners is minimally lower compared with other subgroups. This may be because of variations in study design and sampling method among included studies or immunization programs within correctional facilities. The results of this study support the recommendations of experts,[19] advocating the need for prison programs that provide safer tattooing practices to inmates. Such programs may also prevent the transmission of other blood-borne infections among the prison population.

Given that hepatitis can spread through percutaneous or mucous membrane exposure to blood,[20] needlestick injury,[21] and tattooing using unsterile equipment,[22] several measures can be implemented to prevent the transmission of hepatitis B among tattoo recipients. Educational programs for tattoo parlour owners and tattoo artists which reinforce the guidelines and emphasize the importance of appropriate infection control measures should be implemented. These measures include the use of single-use sterile tattoo needles, proper functioning of autoclaves, use of appropriate disinfectants and keeping records of sterilization techniques. Regular and unscheduled inspection of tattoo parlours conducted by health protection units of the local health authorities may improve adherence to the current guidelines. Insufficient follow-up can cause public panic and has resulted in lawsuits against health authorities and business owners in Canada and the United States in recent years.[23]

Tattoo parlours should be required to keep records of their clients and to report any adverse event related to tattooing to local health authorities.[12,22] Tattoo recipients should be provided with written

Figure 2. Forest plot of meta-analysis of tattooing and risk of transmission of hepatitis B

Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Random, 95% CI
1.4.1 Tattoo and Hepatitis-B, Community sample				
Coppola, 2007	0.615	0.23	4.2%	1.85 [1.18, 2.90]
Hwang, 2006	-0.04	0.136	6.4%	0.96 [0.74, 1.25]
Hymas, 1989	0.455	0.213	4.5%	1.58 [1.04, 2.39]
Ko, 1990	2.092	0.741	0.7%	8.10 [1.90, 34.62]
Luksamijarulkul, 2008	0.157	0.27	3.5%	1.17 [0.69, 1.99]
Mele, 1995	0.7514	0.335	2.6%	2.12 [1.10, 4.09]
Nurgalieva, 2007	0.2311	0.462	1.6%	1.26 [0.51, 3.12]
Shi, 2007	0.3148	0.174	5.4%	1.37 [0.97, 1.93]
Subtotal (95% CI)			**29.0%**	**1.47 [1.12, 1.92]**
Heterogeneity: Tau² = 0.08; Chi² = 16.55, df = 7 (P = 0.02); I² = 58%				
Test for overall effect: Z = 2.77 (P = 0.006)				
1.4.3 Tattoo and Hepatitis-B, Hospital samples				
Auamnoy, 2003	2.7663	1.0648	0.4%	15.90 [1.97, 128.16]
Phoon, 1988	0.1484	0.22	4.4%	1.16 [0.75, 1.79]
Sali, 2005	0.3365	0.25	3.8%	1.40 [0.86, 2.29]
Sebastian, 1992	0.6981	0.345	2.5%	2.01 [1.02, 3.95]
Tawk, 2005	0.2582	0.228	4.2%	1.29 [0.83, 2.02]
Wada, 1999	0.355	0.59	1.1%	1.43 [0.45, 4.53]
Subtotal (95% CI)			**16.4%**	**1.45 [1.07, 1.97]**
Heterogeneity: Tau² = 0.04; Chi² = 7.16, df = 5 (P = 0.21); I² = 30%				
Test for overall effect: Z = 2.38 (P = 0.02)				
1.4.4 Tattoo and Hepatitis-B, Prisoners				
Anda, 1985	-0.6349	0.28	3.3%	0.53 [0.31, 0.92]
Babudieri, 2005	0.13	0.13	6.6%	1.14 [0.88, 1.47]
Butler, 2004-b	0.505	0.256	3.7%	1.66 [1.00, 2.74]
Christensen, 2001	0.001	0.543	1.2%	1.00 [0.35, 2.90]
Hull, 1985	0.2624	0.353	2.4%	1.30 [0.65, 2.60]
Khan, 2005	0.3784	0.175	5.4%	1.46 [1.04, 2.06]
Lai, 2007	-0.4155	0.379	2.2%	0.66 [0.31, 1.39]
Liao, 2006(2)	0.3988	0.329	2.7%	1.49 [0.78, 2.84]
Pallas, 1999	0.528	0.37	2.3%	1.70 [0.82, 3.50]
Pourahmad, 2007	0.6152	0.315	2.9%	1.85 [1.00, 3.43]
Samuel, 2001	0.8329	0.256	3.7%	2.30 [1.39, 3.80]
Subtotal (95% CI)			**36.4%**	**1.30 [1.01, 1.66]**
Heterogeneity: Tau² = 0.09; Chi² = 22.96, df = 10 (P = 0.01); I² = 56%				
Test for overall effect: Z = 2.07 (P = 0.04)				
1.4.5 Tattoo and Hepatitis-B, Highr risk group and IDUs				
Hwang, 2006	0.523	0.195	4.9%	1.69 [1.15, 2.47]
Mariano, 2004	0.5306	0.307	3.0%	1.70 [0.93, 3.10]
Pereira, 2006	0.47	0.206	4.7%	1.60 [1.07, 2.40]
Roy, 1999	0.47	0.492	1.4%	1.60 [0.61, 4.20]
Samuel, 2001	0.473	0.227	4.2%	1.60 [1.03, 2.50]
Subtotal (95% CI)			**18.3%**	**1.64 [1.32, 2.03]**
Heterogeneity: Tau² = 0.00; Chi² = 0.06, df = 4 (P = 1.00); I² = 0%				
Test for overall effect: Z = 4.54 (P < 0.00001)				
Total (95% CI)			**100.0%**	**1.42 [1.25, 1.61]**
Heterogeneity: Tau² = 0.05; Chi² = 50.42, df = 29 (P = 0.008); I² = 42%				
Test for overall effect: Z = 5.45 (P < 0.00001)				
Test for subgroup differences: Chi² = 2.04, df = 3 (P = 0.56), I² = 0%				



handouts informing them about the risks related to tattooing and the signs and symptoms of common infections that can be transmitted through tattooing. Last, tattoo artists and clients should be aware of the availability of an effective vaccine for the prevention of hepatitis B infection.

Many countries have introduced a universal infant and/or adolescent hepatitis B immunization program; therefore those who undergo tattooing at a young age are now likely to be immunized. In Canada, all unimmunized individuals who are at increased risk of hepatitis B infection (i.e., IDU, persons with high-risk sexual behaviour) are recommended to receive hepatitis B vaccine. However, this strategy has several limitations. Risk factors cannot be identified for about 25% of acute hepatitis B infections,[24] and there is poor compliance with the hepatitis B vaccine schedule in risk

groups.[25] Therefore, it is important to ensure that individuals have been fully immunized – including those who move between jurisdictions which may have different immunization schedules – and to concentrate on immunization of high-risk and prison populations.

Over time, there has been a shift in the demographics of the people who acquire tattoos. Tattoos are no longer popular just among people with high-risk behaviour, but are becoming common among younger adults with a more conservative lifestyle. This increased prevalence of tattooing warrants the need for prevention programs that target young adults.[26]

Our study is subject to several limitations due to the observational nature of the studies included in the review. Information on the past history of tattooing may not reflect the current population risk of hepatitis infection. Second, recall bias and social desirability bias may affect the validity of the information collected in observational studies. Finally, it is important to note that background prevalence of hepatitis B infection and hepatitis B vaccinations vary in different settings and countries. We did not have specific geographic data on the transmission of hepatitis B. Further studies to determine the pre-tattoo hepatitis B serostatus and the prevalence of other high-risk behaviours are needed to fully assess the association between tattooing and hepatitis B transmission.

The results of this systematic review are consistent with an increase in all population groups in the risk of contracting hepatitis B through tattooing. Immunization of susceptible individuals with hepatitis B vaccine, unscheduled inspection and enforcement of infection control guidelines in tattoo parlours, and provision of safe tattoo programs to inmates can play an important role in the interruption of transmission.

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RÉSUMÉ

Objectif : Nous avons procédé à un examen systématique et à une méta-analyse afin d'évaluer l'association entre le tatouage et le risque de transmission du virus de l'hépatite B.

Méthode : Recherche systématique dans les bases de données MEDLINE, EMBASE, PubMed, DARE (*Database of Abstracts of Reviews of Effects*), ACP Journal Club et BIOSIS Previews jusqu'en mars 2011.

Résultats : Quarante-deux études observationnelles étaient comprises dans l'examen systématique, dont 31 ont été incluses dans la méta-analyse. Le rapport de cotes combiné (intervalles de confiance de 95 %) de l'association entre le tatouage et l'infection à VHB était de 1,48 (1,30-1,68) lorsque toutes les études étaient comprises dans l'analyse. L'analyse par sous-groupe montre la plus forte association entre le tatouage et le risque d'hépatite B dans les populations s'adonnant à des comportements à risque (RC=1,64, IC de 95 % : 1,32-2,03).

Conclusion : Les résultats de l'examen systématique et de la méta-analyse montrent que le tatouage est associé à la transmission de l'hépatite B dans tous les sous-groupes. Une approche axée sur la santé des populations, qui met l'accent sur la vaccination universelle contre l'hépatite B, la sensibilisation des jeunes adultes, plus susceptibles de se faire tatouer, et la sensibilisation des détenus (qui présentent le plus haut taux naturel d'infection à VHB), ainsi que l'application des lignes directrices et des pratiques de tatouage à moindre risque en prison, sont fondamentales pour prévenir la transmission de l'hépatite B.

Mots clés : tatouage; hépatite B; hépatite; infections