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Worldwide prevalence of tattoos with a focus on younger age groups: a literature review

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Abstract

Background. From 11.7% to 31.5% of the population in Western countries has tattoos. Given the potential health implications, it is important to obtain reliable estimates of the prevalence of the tattooed population.

Objective. To estimate the prevalence of tattoos in the general population and among younger age groups worldwide, and the settings in which tattoos are performed.

Methods. We conducted a literature review by searching MEDLINE, Scopus, and Web of Science for relevant articles published between January 1, 2000, and September 17, 2025. Studies were included if they reported data on the prevalence of tattoos and/or the settings in which tattooing occurred, drawn from the general population or specific age groups and students.

Results. From the 7,921 potential articles identified, 86 were included in our review. We found a global prevalence ranging from 0.18% to 63.9% (from 5.2% to 35.3% in developed countries), with a significantly increasing trend. The data revealed a higher tattoo prevalence among younger individuals. In Western countries, from 64% to 93.9% of the samples got their tattoos in authorized parlours.

Conclusions. The data demonstrate a clear increase in tattooing worldwide. This represents a matter of concern from a public health perspective, as it is likely to be accompanied by a corresponding increase in health risks and requests for tattoo removal.

Key words

- tattoo
- body art
- prevalence
- worldwide
- young

INTRODUCTION

In recent years, body art practices, most commonly tattooing and piercing, have become popular, particularly in Western countries, with 11.7% to 31.5% of the population estimated to be tattooed [1]. In parallel, the literature on this subject has grown, with adolescents being the most frequently studied population segment [2-10]. Publications about tattooed persons explore various aspects of the phenomenon, including epidemiology [1, 11-19], psychological implications [7, 12, 20, 21], associations with risky behaviours [22-24], and health consequences [25].

Tattoos involve the permanent colouration of the skin through the insertion of inks. They can be classified into five main categories: professional (created by expert tattooists), amateur (done by non-professional individuals), traumatic (unintentional tattoos caused by foreign bodies embedded in the dermis), cosmetic (primarily used for permanent makeup), and medical (performed by healthcare professionals for purposes such as nipple reconstruction, scar concealment, and as markers in radiation therapy) [26]. From a public health perspective, professional and, to a lesser extent, amateur tattoos are particularly significant. The rising global trend of individuals getting tattoos has raised concerns among health professionals regarding potential risks to both clients and tattooists. Issues such as microbiological contamination during tattooing and the presence of potentially hazardous chemicals in tattoo inks can lead to various adverse health effects. These may include infections, allergic reactions, and the development of neoplastic conditions (such as melanoma, basal cell carcinoma, and squamous cell carcinoma), along with non-neoplastic lesions (like sarcoidosis and granulomatous reactions). Other possible complications include hypertrophic scars, keloids, pain, and intense itching caused by the involvement of cutaneous nerve branches, as well as photosensitization [25].

In Italy, tattooing is not currently regulated by specific national legislation. The only national reference consists of the circulars issued by the Ministry of Health, which contain the guidelines for performing tattooing

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and piercing procedures under safe conditions [27]. The ministerial circulars provide guidance on hygiene requirements for performing tattoos safely, address the risks of transmitting infections, and the potential toxic effects of the substances used for dermal pigmentation. They also include, among the final recommendations, proper training for tattoo artists and the need to inform clients about the risk of infectious disease transmission. At the subnational level, some Italian Regions have issued specific laws to regulate the sector. For example, the Tuscany Region promulgated a regional law in 2004 [28] and the subsequent regulation detailing the specific hygienic and sanitary requirements of the parlours, the permitted equipment and materials, and training requirements for tattooists [29]; the same was done by Friuli Venezia Giulia Region [30, 31]. Analogous laws and resolutions were issued in the Veneto Region [32], in the Marche Region [33], in the Lazio Region [34, 35], and in the Lombardy Region [36].

Based on current regulations, the hygiene and public health services of the Prevention Departments within Local Health Authorities deliver hygienic-sanitary evaluations and carry out inspection activities for tattoo businesses that are properly registered. However, there remains an unquantified proportion of unauthorized or "amateur" tattooists who evade health inspections. Oversight of these tattooing activities might seem of relatively minor importance compared to other healthcare activities. For this reason, it is advisable to determine the prevalence of tattoos to measure the magnitude of the phenomenon, the population involved, and the actual impact this phenomenon could have on public health. This information can support health authorities, lawmakers, potential clients, and professionals in implementing measures to protect both the general population and tattoo workers. It is also of interest to understand whether tattoos performed outside authorized centres – potentially at greater risk of adverse effects since they are not subject to health inspections – truly represent a significant public health issue or not.

The main aim of this literature review is to assess the existing evidence on tattoo prevalence in the general population and younger age groups across various countries worldwide. The secondary objective is to present the retrieved data about the settings in which tattoos are typically performed.

METHODS

Search strategy

We employed the CoCoPop framework to develop our search query and to establish our inclusion and exclusion criteria. Our research focused on the following question: What is the prevalence of tattooed individuals (Condition) in various countries worldwide (Context), specifically within the general population and among young people or students (Population)? We conducted a search of MEDLINE, Scopus, and Web of Science to identify relevant articles published between January 1, 2000, and September 17, 2025 (the date of our last consultation). The query string used in our search among the three databases was: ((tattoo) AND (population)) OR ((tattoo) AND (epidemiology)) OR ((tattoo) AND (prevalence)). The limits applied were: full text availability (for MEDLINE), restriction to English and Italian languages (for the three databases), and exclusion from the search of books, book chapters, corrections, and retracted articles (for the three databases).

Inclusion and exclusion criteria

Studies were included if they reported data on the prevalence of tattoos and/or the settings in which tattooing occurred, drawn from the general population, specific age groups within the general population, students, or adolescents. Additionally, studies estimating the prevalence of hepatitis C virus (HCV), hepatitis B virus (HBV), and human immunodeficiency virus (HIV) infections (for which tattooing is considered a risk factor), or addressing other issues related to tattoos that encompassed information on tattoo epidemiology were also included. Conversely, the exclusion criteria were as follows: studies conducted in specific contexts, such as clinics or hospital admissions/visits, or restricted to particular population subgroups (e.g., pregnant women, inmates, blood donors, farmers, psychiatric patients, veterans); studies that did not provide sufficient information to calculate tattoo prevalence; duplicate publications; grey literature; websites; abstracts without accompanying full texts; and studies focused on traumatic, cosmetic, or medical tattooing. Critical reviews were retained for background information but were excluded as sources of original data.

Data extraction

In the first stage, all study titles and abstracts obtained from the database search were reviewed for eligibility by one of the Authors (FP). Papers that successfully passed this stage were appraised in full, and those meeting the inclusion criteria were selected for data extraction, independently of their size, by the same author. Any doubts regarding the eligibility of studies were resolved through discussion with the other Author (FV). Extracted information, reported on a spreadsheet, included citation details (authors, publication year), study period, population characteristics (country, age group), prevalence of tattooed population, and the percentage of individuals who underwent tattoos in different settings (e.g., authorized parlour, at home). References of all the included studies and relevant reviews were also screened to identify any additional eligible publications.

To validate our search, we checked if relevant publications that we were already aware of were included in the results list.

Data analysis

Measures of prevalence and the number of individuals who have received tattoos in various settings are presented as percentage values. Whenever possible, we verified the data for potential errors based on the number of tattooed individuals and the size of the population sample. We calculated prevalence estimates when they were not reported in the studies. Results were present-

ed by country and population category (all ages, young people, and students). If a paper provided age-stratified prevalence data, we extrapolated the data for younger age groups (<40 years), if available. Within each country and category, we also analysed sex-based differences in prevalence. In cases where multiple studies used the same dataset and time frame, only the most comprehensive articles were included. Additionally, if a single study reported prevalence measures for the tattooed population from different databases or populations, all relevant results were presented.

RESULTS

Initially, we identified 7,921 potential articles. After applying inclusion and exclusion criteria, and adding 12 additional references from bibliographies, we included a total of 86 articles in our review (*Figure 1*).

The selected literature consisted mainly of cross-sectional studies, often utilizing convenience sampling. These studies employed structured questionnaires, which were either self-administered (including online formats) or administered by trained interviewers.

Overall prevalence

A limited number of studies specifically aimed to estimate the absolute prevalence of tattooing in general populations across different countries [1, 11-19]. However, by combining data from these studies with figures extracted from publications regarding HCV [37-52], HBV [43-45, 50, 53-57], and HIV [58, 59] seropositivity in selected populations and other related topics (e.g., the association of tattooing and personality traits [19-21, 60-65], tobacco consumption [66], hazardous sexual behaviours [67, 68], awareness of the related risks [8, 15, 69-71], etc.), we found a global prevalence that varied widely, ranging from 0.18% [51] to 63.9% [50] (as shown in *Table 1*). In developed countries, tattoo prevalence ranged from 5.2% [54] to 35.3% [72], with a substantially increasing trend.

Age- and sex-based differences

Findings regarding sex-based differences in tattoo prevalence were inconsistent. In contrast, research consistently shows a higher tattoo prevalence among younger individuals (*Table 2*), with a peak of 45.6% among

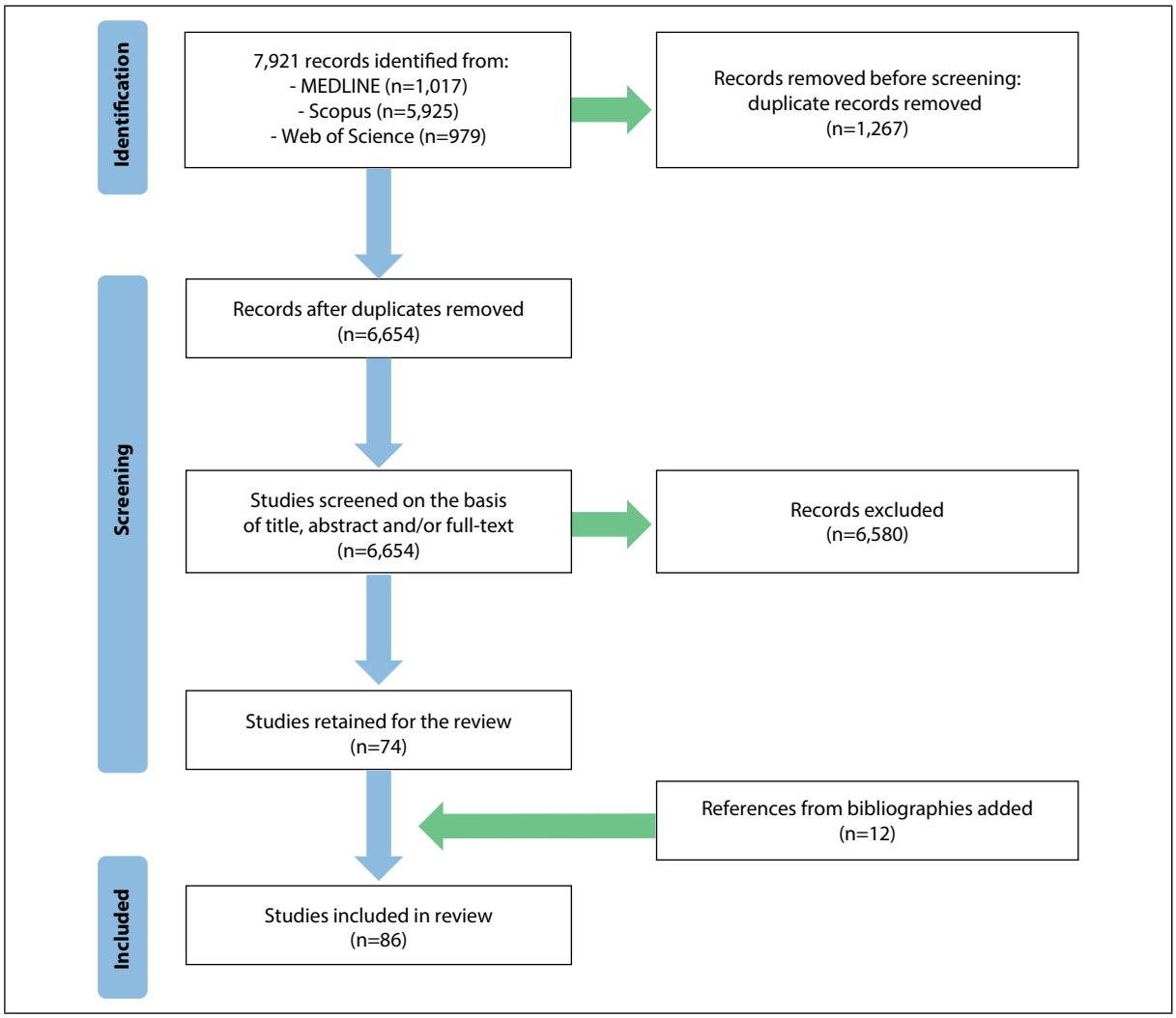

Figure 1
Flowchart of the study selection for inclusion in the literature review about the worldwide prevalence of tattoos.

Table 1
Worldwide prevalence of tattoos in general populations

Continent	Country	Study	Time	Age[§]	Sample number	Overall (%)	Men (%)	Women (%)
North America	USA	Laumann, Derick 2006 [75]	2004	18-50	500	24.0	26.0	22.0
	USA	Karagas, Wasson 2012 [13]	2008	14-69	452	-	16-18	7-29
	USA	Mortensen *et al.* 2019 [23]	2016	18-65	2,008	32.1	23.2	36.7
	USA	Morlock *et al.* 2023 [72]	2017	>18	3,033	35.3	29.4	41.1
	USA	Kluger *et al.* 2019 [1]	2018-2019	≥18	2,008	31.5	27.8	35.1
	USA (Utah)	McCarty *et al.* 2024 [19]	2020-2021	≥18	18,687	-	22	26
Europe	Denmark	Bjerre *et al.* 2018 [79]	2006	24-76	2,212	14.2	17.8	11.0
	France	Kluger *et al.* 2019 [1]	2017	≥15	5,000	16.8	14.4	19.1
	France	Kluger *et al.* 2019 [1]	2018-2019	≥18	2,048	17.8	19.5	16.2
	Italy	Renzoni *et al.* 2018 [15]	2015	≥12	7,608	12.8	11.7	13.8
	Austria and Southern Germany	Stieger *et al.* 2010 [6]	NA	≥16	440	15.2	12.4	17.8
	Austria and Southern German-speaking area of Central Europe	Swami *et al.* 2012 [62]	NA	Mean: 31.4 (SD: 13.7)	540	22.2	20.3	23.8
	Austria and Southern German-speaking area of Central Europe	Swami *et al.* 2016 [64]	NA	18-76	1,006	19.1	17.6	20.3
	Germany	Lahousen *et al.* 2019 [18]	2009	14-94	2,512	-	14.1	10.2
	Germany	Ernst *et al.* 2022 [98]	2016	14-44	1,060	32.0	-	-
	Germany	Stirn *et al.* 2006 [12]	NA	14-93	2,043	8.5	-	-
	Netherlands	Dillingh *et al.* 2020 [103]	2013	NA	5,215	9.8	-	-
	Norway	Sagoe *et al.* 2017 [14]	NA	16-91	15,654	20.8	17.9	23.8
	Romania	Gheorghe *et al.* 2013 [54]	2006-2008	18-68	12,125	5.2	-	-
	Russia	Kluger *et al.* 2019 [1]	2018-2019	≥18	2,010	11.7	15.0	8.9
	Spain (Catalonia)	Domìnguez *et al.* 2001 [37]	1996	≥5	2,142	17.2	-	-
	UK (Greater London)	Swami *et al.* 2015 [63]	2014-2015	20-58	378	25.7	-	-
South America	Southern Brazil (Porto Alegre)	Kvitko *et al.* 2013 [42]	2009	≥20	3,391	16.2	-	-
	Southern Brazil (Cássia dos Coqueiros municipality)	Melo *et al.* 2015 [45]	2011-2013	≥18	1,001	6.8	-	-
	Brazil (Amazon)*	Vasconcelos *et al.* 2024 [50]	2015	≥0	430	63.9	-	-
	Brazil	Kluger *et al.* 2019 [1]	2018-2019	≥18	2,003	22.3	20.0	24.4
	Puerto Rico (San Juan)	Pérez *et al.* 2005 [39]	2001-2002	21-64	964	12.4	-	-
Asia	Armenia	Demirchyan *et al.* 2024 [49]	2021	≥18	3,380	10.4	-	-
	Eastern China (Jiangsu province)	Huang *et al.* 2015 [51]	2011-2012	≥0	149,175	0.18	-	-
	China	Kluger *et al.* 2019 [1]	2018-2019	≥18	3,010	12.2	12.1	12.2
	Georgia	Hagan *et al.* 2019 [48]	2015	≥18	6,014	10.2	-	-
	Southern India (Andhra Pradesh)	Dandona *et al.* 2008 [58]	2004-2005	15-49	12,617	11.2	7.8	14.5
	Western Iran (Kermanshah)	Sayad *et al.* 2008 [52]	2006	15-64	1,721	10.6	-	-
	Southern Iran (Bandar Abbas)	Makiani *et al.* 2014 [43]	2012	15-45	2,000	8.4	-	-
	Western Iran (Kermanshah province)	Alavian *et al.* 2012 [57]	NA	6-65	1,979	21.3	-	-
	Southern India (area of Puducherry)	Rajalatchumi *et al.* 2025 [56]	2021-2022	≥18	5,169	4.0	-	-

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Table 1
Continued

Continent	Country	Study	Time	Age§	Sample number	Overall (%)	Men (%)	Women (%)
	Western-central India (Maharashtra state)	Bhate *et al.* 2015 [44]	NA	≥5	1,833	4.0	-	-
	South-western Iran	Moezzi *et al.* 2015 [46]	2013	≥15	3,000	10.4	-	-
	Southern Iran (Qeshim Island)	Holakouie *et al.* 2015 [59]	2013-2014	NA	1,500	4.6	-	-
	Central Iran (Qom)	Ghadir *et al.* 2012 [53]	NA	NA	3,690	4.54	-	-
	Pakistan (Balochistan province)	Ahmed *et al.* 2012 [41]	2007-2009	≥18	2,000	7.5	-	-
	Central Thailand	Wasitthankasem *et al.* 2017 [47]	2015	30-64	3,077	12.9-17.9	-	-
	Northern Vietnam (Thai Binh province)	Nguyen *et al.* 2007 [40]	2002	16-82	837	4.5	-	-
Oceania	Australia	Makkai, McAllister 2001 [11]	1998	≥14	10,340	10.1	11.9	8.5
	Australia	Tranter, Grant 2018 [99]	2009	≥18	1,525	12.6	-	-
	Australia	Heywood *et al.* 2012 [73]	2004-2005	16-64	8,656	14.5	15.4	13.6
Africa	Southwest Ethiopia	Belay *et al.* 2020 [55]	2017-2018	≥18	612	43.1	-	-

SD: standard deviation; NA: not available; §expressed in years; *sample extracted from the indigenous general population.

people aged 18 to 44 years, according to a recent a US study [72]. Out of the 86 studies reviewed, 40 focused on tattoo prevalence and related issues among younger age groups, primarily within schools, universities, and colleges (*Table 2*).

Tattooing setting

Eight publications reported data on the locations where tattoos were obtained (*Table 3*). In Western countries, the majority of the samples (64%-93.9%) received their tattoos in authorized parlours [3, 15, 73-

Table 2
Worldwide prevalence of tattoos among younger age groups and students

Continent	Country	Study	Time	Age§	Sample type	Sample number	Overall (%)	Men (%)	Women (%)
North America	Canada (Outaouais Region in Quebec)	Deschesnes *et al.* 2006 [3]	2002	12-18	High school students	2,180	7.7	5.6	9.8
	USA	Roberts, Ryan 2002 [24]	1995-1996	11-21	Adolescents from general population	5,837	4.5	4.8	4.2
	USA	Drews *et al.* 2000 [87]	1999	Mean: 19.3 (SD: 1.2)	Undergraduate college students	235	12.3	8.9	14.3
	USA	Mayers *et al.* 2002 [88]°	2001	Mean: 21.0	Undergraduate university students	446	23.8	21.6	25.9
	USA	Laumann, Derick 2006 [75]	2004	18-29	General population	140	26.0	-	-
	USA	French *et al.* 2016 [104]	2008-2009	24-32	General population	15,189	10.9	12.3	9.7
	USA	Karagas, Wasson 2012 [13]	2008	14-49	General population	-	-	18	29
	USA	Morlock *et al.* 2023 [72]	2017	18-44	General population	1,678	45.6	-	-
	USA	Kluger *et al.* 2019 [1]	2018-2019	18-24	General population	-	40.2	-	-
	USA	Kluger *et al.* 2019 [1]	2018-2019	25-34	General population	-	42.8	-	-
	USA (Colorado)	Dukes, Stein 2011 [83]	2007	13-19	High school students	1,462	18	19	17

Continues

Table 2
Continued

Continent	Country	Study	Time	Age[§]	Sample type	Sample number	Overall (%)	Men (%)	Women (%)
	USA (NY State)	Mayers, Chiffriller 2008 [4]°	2006	Mean: 21.2	Undergraduate university students	650	21.8	23.0	21.0
	USA (Utah)	McCarty *et al.* 2024 [19]	2020-2021	18-24	General population	1,575	27.4	22	32
	USA (Utah)	McCarty *et al.* 2024 [19]	2020-2021	25-29	General population	1,214	37.5	34	45
	USA (Utah)	McCarty *et al.* 2024 [19]	2020-2021	30-39	General population	2,758	33.2	31	39
	USA	Lipscomb *et al.* 2008 [90]	NA	18-62 (median: 21)	Undergraduate college students	496	19.5	16.4	23.2
	Mid-western USA	King, Vidourek 2013 [74]	NA	Mean: 21.92 (SD: 5.37)	Undergraduate college students	998	29.6	-	-
	South-western USA	Forbes 2001 [60]	NA	Male-mean: 22.5 (SD: 5.6); Female-mean: 23.8 (SD: 7.5)	Undergraduate university students	302	18.5	14.7	21.0
	South-western USA	Armstrong *et al.* 2002 [84]	NA	≥18	Undergraduate college students	514	18.9	20.9	17.5
	South-western USA	Koch *et al.* 2005 [67]	NA	Mean: 20.9 (SD: 4.5)	Undergraduate university students	450	22.2	-	-
	South-western USA	Owen *et al.* 2013 [91]	NA	NA	Undergraduate college students	595	21.0	-	-
	USA (Colorado)	Manuel, Sheehan 2007 [65]	NA	17-37 (mean: 20.0)	Undergraduate university students	210	31.9	30.4	32.3
	USA (Tennessee)	Tate, Shelton 2008 [20]	NA	Mean: 21.92 (SD: 5.37)	Undergraduate and graduate university students	1,375	26.3	27.3	25.8
Europe	Croatia	Zrno *et al.* 2015 [92]		19-30	Undergraduate university students	100	35.0	-	-
	Denmark	Bjerre *et al.* 2018 [79]	2006	24-39	General population	486	27.4	-	-
	France	Kluger *et al.* 2019 [78]Σ	2017	15-18	General population	175	10.3	12.8	6.1
	France	Kluger *et al.* 2019 [17]	2017	15-34	General population	1,592	25.3	-	-
	France	Kluger *et al.* 2019 [1]	2018-2019	18-24	General population	-	22.0	-	-
	France	Kluger *et al.* 2019 [1]	2018-2019	25-34	General population	-	30.5	-	-
	France (Brittany)	Guéguen 2012 [68]	NA	Mean: 20.84 (SD: 1.35)	Undergraduate university students	2,080	14.5	7.8	19.8
	France (Brittany)	Guéguen 2013 [66]	NA	Mean: 20-22	Undergraduate university students	2,587	12.2	10.4	14.4
	Greece (Athens)	Notara *et al.* 2022 [102]	NA	18-30	General population	629	31.3	27.6	32.5
	Italy (Padua and its province)	Bosello *et al.* 2010 [21]	2003	Mean: 16.5 (SD: 1.6)	High school students	818	4.0	-	-
	Italy (Grosseto and Scansano, Tuscany Region)	Boncompagni *et al.* 2005 [2]	2003-2004	14-20	High school students	496	4.8	3.0	6.0
	Italy (Cagliari)	Preti *et al.* 2006 [93]	2004	15-19	High school students	820	8.5	14.5	5.4

Continues

Table 2
Continued

Continent	Country	Study	Time	Age§	Sample type	Sample number	Overall (%)	Men (%)	Women (%)
	Italy (Veneto Region)	Cegolon *et al.* 2010 [94]†	2007	13-21	High school students	4,277	6.0	-	-
	Italy (Veneto Region)	Clerici, Meggiolaro 2011 [95]	2007	14-18	High school students	4,213	-	5.9-7.3	4.5-8.8
	Italy (Naples province)	Gallè *et al.* 2011 [69]	2008-2009	Mean: 16.1 (SD: 1.3)	High school students	9,322	11.3	11.7	11.0
	Italy (Naples province)	Gallè *et al.* 2011 [69]	2008-2009	Mean: 21.6 (SD: 4.1)	Undergraduate university students	3,610	24.5	-	-
	Italy (Bari)	Quaranta *et al.* 2011 [70]	2009-2010	17-58	Freshmen university students	1,598	9.6	9.1	9.8
	Italy (Veneto Region)	Majori *et al.* 2013 [8]	2009-2010	13-22	High school students	2,843	6.4	5.3-7.8	3.3-9.5
	Italy	Renzoni *et al.* 2018 [15]	2015	12-17	General population	-	7.7	-	-
	Italy	Renzoni *et al.* 2018 [15]	2015	18-24	General population	-	22.1	-	-
	Italy	Renzoni *et al.* 2018 [15]	2015	25-34	General population	-	22.7	-	-
	Italy (Palermo)	Sidoti *et al.* 2010 [5]	NA	Mean: 21.1-21.4 (SD: 3.5-4.3)	Undergraduate university students	1,200	31.8	43.5	17.6
	Italy	Gallè *et al.* 2021 [76]*	2020-2021	NA	Undergraduate university students	2,985	27.9	-	-
	Italy	Protano *et al.* 2021 [96]*	2020-2021	Mean: 23.15 (SD: 3.99)	Undergraduate university students	3,005	27.9	-	-
	Italy (L'Aquila)	Scatigna *et al.* 2022 [85]	NA	Mean: 21.5 (SD: 4.1)	Undergraduate university students	575	30.5	24.4	33.1
	Austria and Southern Germany	Stieger *et al.* 2010 [6]	NA	16-20	General population	81	0.9	-	-
	Austria and Southern Germany	Stieger *et al.* 2010 [6]	NA	21-25	General population	222	7.5	-	-
	Austria and Southern Germany	Stieger *et al.* 2010 [6]	NA	26-30	General population	109	6.4	-	-
	Austria and Southern German-speaking area of central Europe	Swami *et al.* 2012 [62]	NA	Mean: 31.4 (SD: 13.7)	General population	540	22.2	20.3	23.8
	Germany	Lahousen *et al.* 2019 [18]	2009	25-34	General population	-	-	26	25.5
	Germany	Ernst *et al.* 2022 [98]	2016	14-44 (mean: 30.47, SD: 8.41)	General population	1,060	32.0	-	-
	Germany	Stirn *et al.* 2006 [12]	NA	14-44 (mean: 31.1)	General population	864	15	-	-
	Norway	Sagoe *et al.* 2017 [14]	NA	16-19	General population	1,310	7.9	-	-
	Norway	Sagoe *et al.* 2017 [14]	NA	20-29	General population	4,358	26.2	-	-
	Norway	Sagoe *et al.* 2017 [14]	NA	30-39	General population	2,809	27.6	-	-

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Table 2
Continued

Continent	Country	Study	Time	Age[§]	Sample type	Sample number	Overall (%)	Men (%)	Women (%)
	Poland	Rogowska *et al.* 2017 [82]	2015-2016	Mean: 22±2.5	Undergraduate university students	1,199	27.0	-	-
	Russia	Kluger *et al.* 2019 [1]	2018-2019	18-24	General population	-	15.0	-	-
	Russia	Kluger *et al.* 2019 [1]	2018-2019	25-34	General population	-	19.4	-	-
	Sweden	Röhrl, Stenberg 2010 [105][#]	2000-2004	14.9-23.4	Upper secondary school children	6,095	4.8	3.0	6.0
	Sweden	Fors *et al.* 2012 [106][#]	2000-2004	14.9-23.4	Upper secondary school children	6,095	5.1	3.4	6.2
South America	Brazil	Kluger *et al.* 2019 [1]	2018-2019	18-24	General population	-	21.9	-	-
	Brazil	Kluger *et al.* 2019 [1]	2018-2019	25-34	General population	-	30.3	-	-
Asia	China	Kluger *et al.* 2019 [1]	2018-2019	18-24	General population	-	12.3	-	-
	China	Kluger *et al.* 2019 [1]	2018-2019	25-34	General population	-	20.7	-	-
	South India (Area of Puducherry)	Rajalatchumi *et al.* 2025 [56]	2021-2022	≥18	General population	5,169	4.0	-	-
	Myanmar (Mandalay Region)	Show *et al.* 2019 [71]	2015	18-24	General population	198	22.2	-	-
	Myanmar (Mandalay Region)	Show *et al.* 2019 [71]	2015	25-35	General population	203	16.7	-	-
	Central Taiwan (Taishi township)	Lee *et al.* 2004 [38]	1999	13-16	Junior high school students	1,999	1.7	-	-
	Southern Taiwan	Yen *et al.* 2012 [7]	2004	12-17	High school students	9,755	1.0	-	-
	Turkey (Istanbul)	Balci *et al.* 2015 [22]	2009-2010	Mean: 21.69 (SD: 1.55)	Undergraduate university students	1,303	4.3	-	-
	Turkey (Istanbul)	Ekinici *et al.* 2012 [61]	NA	Mean: 17.42 (SD: 0.92)	High school students	607	4.8	-	-
	Turkey (Istanbul)	Wise, Akınkoç 2022 [100]	NA	18-25	Undergraduate university students	430	32.6	-	-
Oceania	Australia	French et at. 2016 [104]	2001-2002	24-32	General population	4,279	20.4	20.8	19.9
	Australia	Heywood *et al.* 2012 [73]	2004-2005	16-19	General population	367	5.4	-	-
	Australia	Heywood *et al.* 2012 [73]	2004-2005	20-29	General population	737	22.3	-	-
	Australia	Heywood *et al.* 2012 [73]	2004-2005	30-39	General population	810	23.2	-	-
	Australia (Queensland)	Tranter, Grant 2018 [99]	2013	19-20	High school students	2,206	14.3	-	-
Africa	Tanzania (Dar es Salaam)	Chacha, Kazaura 2015 [9]	2014	Mean: 23.9 (SD: 4.5)	Undergraduate medical university students	536	7.5	6.8	8.6

SD: standard deviation; NA: not available; [§]expressed in years; [°]the same samples involved in the studies by Mayers *et al.* (2002) [88] and by Meyers and Chiffriller (2008) [4] are analysed in the Meyers and Chiffriller (2007) [89] publication (not reported in the *Table*); [Σ]the study sample was extracted from the study population analysed by Kluger *et al.* (2019) [17]; [†]the same samples involved in the study by Cegolon *et al.* (2010) [94] are analysed in the publication by Cegolon *et al.* (2010) [97] (not reported in the *Table*); *#the two studies focus on the same sample.

Table 3
Settings where tattoos are performed according to literature

Study	Authorized parlour (%)	Beauty salon/ piercing studio (%)	At home (%)	Other (%)
Balci *et al.* 2015 [22]		80.4	-	-
Deschenes *et al.* 2006 [3]	90.4	-		9.6
Gallè *et al.* 2021 [76]	93.9	0.5	4.3	1.3
Heywood *et al.* 2012 [73]	90.7	-	3.6	3.2
King, Vidourek 2013 [74]	87.6	10.7	6.7	-
Laumann, Derick 2006 [75]	64	-		26
Oinam *et al.* 2019 [10]	10.8	-	68.6	16.6
Renzoni *et al.* 2018 [15]	76.1	9.1	4.4	10.2

76], whereas a study involving Indian school students revealed that 68.6% of them were tattooed at home by friends [10].

DISCUSSION

To our knowledge, this is the first literature review that focuses exclusively on global tattoo prevalence. While one prior critical review [16] and one literature review (https://www.cieh.org/media/1982/tattoo-toolkit_part-e_-literature-review.docx) [77] have addressed prevalence as part of broader discussions on tattoo-related topics, we are not aware of any other studies that focus on where tattoos are done. Over the last 25 years, few studies have specifically addressed tattoo prevalence [1, 11-19]. Nevertheless, the literature shows a substantially increasing trend worldwide, which is expected to be accompanied by an increase in adverse reactions and tattoo removal requests as well.

Tattoo complications, removal requests, and public health concerns

The prevalence of tattoo-related complications in the general population is substantially uncertain, as they have been reported to range from 0% to 67% [4, 25, 69, 72, 75, 78, 79], with 5.6% of them requiring medical treatment [79]. While serious adverse effects are expected to be uncommon, the popularity of tattoo practices and the potential for complications to arise long after the procedure could create a considerable strain on healthcare services for many years ahead.

It has been estimated that up to 50% of tattooed persons experience regret about their tattoos [80], and some of them will attempt to erase one of their tattoos. Tattoo removal methods include surgical excision techniques (often used for small tattoos), dermatome shaving, salabrasion, and chemical removal, all of which carry the risk of scarring and dyspigmentation. Laser removal is usually preferred, but it can be painful, requires a large number of sessions, and is expensive. Additionally, it poses a risk that residues or degradation products released in the dermis as a result of the thermophotolysis process may lead to unforeseen long-term immune responses and carcinogenic effects. Further secondary effects include burns, pigmentary disruptions (hypopigmented skin areas alternated with hyperpigmented zones), and paradoxical darkening. Notably, complete removal by laser is not always accomplished, even when performed by experienced dermatologists and plastic surgeons, especially for multicoloured tattoos [16, 81].

The increase in tattoo removal requests has led to an unregulated market for such procedures, operated by beauticians, body artists, nurses, and non-specialized physicians, as well as to cheaper over-the-counter options [16].

Other matters of concern from a public health perspective are that tattoos, especially larger ones, can interfere with the performance of certain diagnostic and therapeutic procedures. Tattoos may hinder the diagnosis of various skin lesions, such as melanoma and other kinds of skin cancer. Moreover, the inks used for tattooing often contain metal filings, which can generate an electric current during magnetic resonance imaging. This reaction may cause a rise in local skin temperature, leading to discomfort, pain or even skin burns [82].

Tattoos may be performed in non-professional parlours by unlicensed personnel or even at home, possibly using low-quality and non-sterile equipment. The growth of these practices has been facilitated by the internet, which allows for easy purchase of tattoo kits and pigments and offers tutorials that claim to teach how to perform tattoos. Although studies indicate that the proportion of individuals in Western countries who receive amateur tattoos remains relatively low [3, 15, 73-76], this aspect is of relevant concern for public health and should be carefully considered due to the limited capacity to control health risks in non-professional settings. In addition, home tattooing increases the risk of low-quality tattoos, which may lead to an increased demand for tattoo removal procedures [16].

European legislation on ink safety and public health agencies' actions

The European Council adopted on February 20, 2008 the European Resolution called ResAP(2008)1 (https://search.coe.int/cm?i=09000016805d3dc4), which outlines important criteria for ensuring the safety of tattoo inks and permanent makeup (PMU). This resolution addresses several key aspects, including the labeling and composition of these products, the risks associated with substances used in tattoo inks and PMU, and the

hygienic conditions that must be upheld during tattooing and PMU procedures. It also emphasizes the obligation to inform individuals about potential health risks linked to tattoos and PMU. The resolution's annexes feature a list of banned chemical substances in tattoo ink and in PMU formulations due to their carcinogenic and mutagenic properties, along with a list specifying substances that have maximum concentration limits and information on their permissible limits. Furthermore, it requires that inks be sterile and preferably in disposable packaging.

Italy maintains an active system for surveillance and monitoring to ensure adherence to health and hygiene standards, as well as compliance with ministerial regulations and guidelines. This system operates at various levels: inspections at the local level are conducted by the Local Health Authorities (Aziende Sanitarie Locali, ASL) and Regional Environmental Protection Agencies (Agenzie Regionali per la Protezione dell'Ambiente, ARPA), which focus on performing analytical tests on substances like inks. At the national level, oversight is handled by the Carabinieri's Anti-Adulteration Units (Nuclei Antisofisticazioni e Sanità, NAS) and the Maritime, Air, and Border Health Offices (Uffici di Sanità Marittima, Aerea e di Frontiera, USMAF). The Italian National Institute of Health (Istituto Superiore di Sanità, ISS) plays a key role in coordinating the laboratory network and in conducting confirmatory analyses of analytical data.

A crucial tool in this framework is the European Union's Rapid Exchange of Information System (RAPEX), designed to address products that present serious risks to health. Through this system, Member States inform the European Commission without delay about any measures taken in response to hazardous products. RAPEX facilitates swift information sharing across Member States, detailing the product concerned and the associated risks, while outlining restrictive measures such as market withdrawal. Notifications through RAPEX are publicly accessible on specific pages of the European Union's official website (https://ec.europa.eu/safety-gate-alerts/screen/search).

In cases where tattoo products in Italy are found to contain chemical substances posing significant health risks, the Ministry of Health issues a "Consumer Alert". This alert, published on its official website (https://www.salute.gov.it/new/it/avvisi/allarmi-consumatori-e-reazioni-notifiche-di-prodotti-non-alimentari-pericolosi/), provides detailed information about the product, its potential dangers, and the actions being implemented to protect public health.

Tattoo professionals as a source of information

Research from Italy [69, 76], has highlighted that most tattooed students who had prior knowledge of health risks cited the tattoo artist as their primary source of information. This suggests that body art professionals have the potential to serve as valuable conduits for educating clients about health risks. By providing clear and essential aftercare instructions, tattooists can guide customers effectively, helping to prevent complications. Therefore, equipping tattoo artists with comprehensive health-related knowledge could significantly reduce avoidable risks associated with body art practices.

Limitations

Research has predominantly focused on specific population groups, mainly adolescents and students [2-10, 78, 83-97], often relying on convenience samples. Studies conducted within high school and university or college settings frequently face selection bias due to the voluntary nature of student participation, the disproportionate representation of individuals from higher socio-economic and cultural backgrounds, and sex imbalances (e.g., humanistic faculties often have a higher percentage of female students). As a result, these studies are not representative of the general population and tend to be geographically limited and fragmented, which makes estimating national prevalences challenging. However, the available data illustrate a clear and sustained rise in tattooing, reflecting an increase in societal acceptance of the practice. This upward trend complicates comparisons of prevalence across studies conducted in different time periods.

Although the literature from Europe and North America is relatively well-established, there is a notable scarcity of data regarding tattoo prevalence in Oceania, Africa, and South America - Brazil being a partial exception. Many studies predominantly focused on unrelated primary topics, such as addressing sociological [7, 18, 84, 85, 87, 97-102] and labour market-related issues [103, 104], or investigating blood infection rates [37-59] and allergic reactions prevalence [105, 106] within specific populations, offering only limited insights into tattoo epidemiology (e.g., differences in prevalence between males and females or among different age groups).

To compare tattoo prevalence among young people in different countries, we also extracted youth-specific data from general population studies when available. However, differences among studies in age group definitions make precise comparisons across countries difficult.

CONCLUSIONS

As tattooing practices gain popularity in the general population, a corresponding increase in associated health risks can be expected, particularly if tattoos are performed in unlicensed settings. However, as the prevalence estimates of tattoo-related adverse reactions in the general population are unreliable, their magnitude remains unknown.

Together with the number of tattooed people, practices aimed at tattoo removal are also expected to rise. As professional interventions aimed to remove tattoos are expensive, practices performed by laypersons, using cheaper and unsafe instruments bought on the internet, or even at home using do-it-yourself products, are becoming more common. This situation requires the attention of policymakers, lawmakers, and public health agencies to issue and enforce regulations governing these activities.

The collaboration between health authorities and law enforcement agencies regarding the surveillance of inks and materials used for tattooing is of utmost importance.

As body artists and their parlours appear as fundamental in preventing the avoidable health consequences of tattoos and in counselling actual and potential customers, local health authorities, such as the Prevention Departments, should play a central role in monitoring tattoo practices, ensuring compliance with hygiene standards, providing training for safe practices, and exercising regulatory oversight of parlour environments.

According to the literature, knowledge about the contraindications and health risks associated with tattooing and tattoo removal is not always satisfactory, especially among young people [10, 15, 69, 70, 82, 86, 96, 102]. As a consequence, Prevention Departments' involvement in educational programs addressing tattoo-related risks and complications, as well as in promoting public awareness campaigns at a local level, is highly recommended.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Authors' contributions

FP: data curation, writing-original draft preparation, conceptualization, methodology; FV: writing-original draft preparation, conceptualization, methodology, supervision.

Conflict of interest statement

None declared.

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