

The tattooed population in Italy: a national survey on demography, characteristics and perception of health risks

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Abstract

Background. In recent years, Italy has seen a constant upward trend in the practice of tattooing. The Italian National Health Institute has conducted a national survey to determine the prevalence of tattooed people in Italy and to study related features of the phenomenon.

Aim. Establish the prevalence and characteristics of the tattooed population and evaluate awareness of the risks associated with tattoos, which can contribute to consumer health protection.

Methods. Computer-assisted telephone interviews and computer-assisted web interviews were completed by a sample of the general population; 7608 people aged between 12 and 75+.

Results. The prevalence of tattooed people was 12.8% of the general population in Italy (95% CI: 12.05%-13.55%), equivalent to an estimated 6 900 000 tattooed individuals. Tattoos were more prevalent among women, at 13.8%, while tattooed men accounted for 11.8%. The vast majority of tattooed subjects had decorative tattoos of small dimensions, with a higher prevalence of monochromatic tattoos. Only a minority of tattooed participants reported having cosmetic tattoos (3.0%) or medical tattoos (0.5%). According to the data, 3.3% of tattooed subjects claimed complications or reactions; of these, only 21.3% consulted a dermatologist/general practitioner; more than half (51.3%) did not consult anyone. In general, only 58.2% of the sample were aware of health risks. The Italian survey showed that 36.7% of all tattoos had been performed in the last five years prior to the interview.

Conclusions. The estimated prevalence of tattoos in Italy is in agreement with the statistics of the European Union. The prevalence in the age group 35-44 years is almost double that of the Italian population and it is higher in women than in men. Tattooing is relevant to public health. The high number of tattooed Italians, the potential long-term effects on health and the reported complications call for the awareness of health authorities. Appropriate intervention should ensure safer tattooing by reinforcing the training of tattooists, by improving surveillance and by providing information to raise public awareness of the risks and contraindications of tattooing.

Key words

- tattooing
- risk
- survey and questionnaires
- safety
- health

BACKGROUND

In recent years, the number of tattooed individuals has increased significantly worldwide. It has been estimated that approximately 24% of the US population

has at least one tattoo [1], while, in Europe, there are about 60 million people (around 12%) who have been tattooed [2].

In Italy, no nationwide data on the prevalence of tat-

tooded individuals in the general population was available. As tattoo practice may potentially have some health implications, obtaining an estimation of the real prevalence of the tattooed population was the main reason why the Italian National Health Institute (Istituto Superiore di Sanità, ISS) has conducted this nationwide study. Equally important was gathering information so as to allow policy-makers, health authorities, stakeholders and professionals to ensure adequate protection at all levels of tattoo practice and to prepare information campaigns on health risks. During the last few years, only some prevalence studies involving segments of the Italian population have been published, mostly covering young groups and students. However the results of these studies were scattered and limited territorially, and were anyway unable to provide a precise estimation of the phenomenon at national level [3-5].

In Italy, there is no specific legislation covering tattoo safety [6]. The Italian legislative framework is fundamentally based on the Italian Ministry of Health Orders no. 2.9/156 dated 05/02/1998, no. 2.8/633 dated 16/07/1998 and on Decree no. 206 of 6th September 2005: "Codice del Consumo", which is the Italian transposition of Directive 2001/95/EC and guarantees the safety of all products found on the Italian market.

The Orders of the Italian Ministry of Health of 1998 "Guidelines for the implementation of procedures for tattooing and piercing in safe conditions" prescribe the measures that should be applied in tattoo practice. In particular, the guidelines cover the basic rules of hygiene and environmental control to address the risks of infections caused by blood-borne pathogens, skin infections and toxic effects due to substances found in tattoo inks.

It is forbidden for professional tattooists to execute tattoos on clients under the age of eighteen without the consent of the minor's parents or guardians.

Another gap in information regards the compliance of tattooists and tattoo parlours with the prescriptions of the above mentioned laws and the other requirements laid down.

The increasingly widespread of tattooing has given rise to increasing concerns about the possible health risks posed by microbiological contamination, the presence of hazardous chemicals in inks or the procedures themselves when not performed by trained professionals under appropriate hygiene conditions and in suitable facilities [2]. A recent internet survey of 3411 tattooed respondents from German-speaking countries showed that 67.5% of the sample had experienced an immediate adverse reaction to the procedure; 8% reported still having a reaction 4 weeks after having the tattoo and 6% reported a persistent ongoing reaction consisting of oedema, permanent elevation of the skin, and pruritus [7].

Tattooing could be considered as a form of minor surgery performed without anesthesia [8].

Modern professional tattooing involves the repeated injection of ink into the derma, typically using a powered instrument that pierces the skin at a speed of between 50 and 3000 times a minute [9]. Intact skin has a protective function, acting as an anatomical barrier against potential pathogens and harmful agents. The

lesion provoked by the needle, introducing ink, alters the skin's function and creates subcutaneous access to microorganisms, which involves a risk of complications.

A tattoo complication is a very complex issue, as is the classification of such events. Høgsberg, *et al.* define complaints as being any unusual condition, sensation or visual reaction in the tattooed skin which differs from normal skin, and define complications as more serious adverse reactions associated to tattoos [10].

Adverse tattoo reactions may start early, right after the tattoo procedure, or occur later on, even months and years afterwards. Understanding the nature and prevalence of tattoo reactions is important, as they can be quite distressing: a Danish study in a dedicated 'tattoo clinic' surveyed patients with tattoo reactions lasting for > 3 months, and found that patients reported troublesome persistent symptoms, such as itching, pain, soreness, and stinging, that had a significant impact on the quality of life, affecting daily and leisure activities [11].

In general, the classification includes infectious, non-infectious, acute, and chronic complications [12]. The acute reaction is a needle trauma driven by the traumatic release of histamine provoked by the thousands of needle pricks performed down to the mid-dermal level [8].

In the context of tattoo and permanent make-up (PMU) applications, Wenzel *et al.* reported there are 3 potential origins of infections. Firstly, pathogens may proliferate for various reasons: the tattoo ink itself can be contaminated starting at manufacture, or once the bottle has been opened and used without respecting the standard rules of asepsis. Secondly, contamination could occur in the case of poor hygienic conditions at the time of the tattoo, or the inappropriate use of tattoo equipment, such as using the same needle or ink cap for successive clients without proper sterilisation. Residential bacteria can enter the skin in the case of inadequate disinfection of the skin area to be tattooed. Thirdly, during the healing process of the injured tissue after tattooing, patients often notice pruritus and burning, with the risk of superinfecting the tattooed skin area by scratching and therefore inoculating microorganisms. The wound may be subject to infection if hygiene recommendations are not followed by the tattooed individual [13].

Cutaneous infections usually develop within days to weeks after the procedure and may include: pyogenic infections (staphylococcus, streptococcus, *Pseudomonas aeruginosa*, etc.), but also atypical bacteria (commensal mycobacteria, tuberculosis, leprosy, etc.), viral infections (*Molluscum contagiosum*, *verruca vulgaris*, herpes, etc.), and also fungal and parasitic infections [14, 15].

In registered parlours, by implementing standard hygiene guidelines, professional tattoo artists have succeeded in reducing the rate of contamination by pathogens, especially in the PMU sector. On the other hand, backyard tattooing still constitutes a remarkable source of risk.

Acute aseptic inflammation takes place already while the tattoo is being performed or removed, immediately

followed by a wound healing process. Skin bacterial infection may occur after some days, while for allergic reactions, it can be delayed for weeks, or even years and decades for chronic dermatosis and immune reactions [15].

Clinical infection may depend on the spontaneous resistance of the person tattooed, the amount of inoculum, the bacterial strand, the degree of traumatization of the skin and the quality of care, disinfection, sterility and aftercare [8].

Rare bacterial infections related to tattooing include – among others – folliculitis, impetigo, ecthyma and even septicaemia [14].

Viral infections have been observed due to transmission of the virus during the process of tattooing.

Cutaneous infections caused by human papillomavirus (HPV) include common, plantar and juvenile warts. There are also reports on the appearance of *Molluscum contagiosum* caused by *Poxviridae* and of Herpes simplex virus (HSV) infection in tattooed areas [13].

Hepatitis viruses (HBV and HCV), which are responsible for severe systemic diseases, can be transmitted *via* tattooing. Recent data, collected by the Italian Surveillance System (SEIEVA-ISS) in the period 2010-2014, showed a strong association between placing tattooing and acute B- or C-hepatitis [2].

In contrast to hepatitis virus, which can easily infect a person, direct transmission of the HIV virus needs extensive and prolonged bodily fluid contact, hence AIDS contamination through tattoo application remains theoretical, and has been indeed documented only once in the whole medical literature in 1988 [16].

Hypersensitivity is cited in the medical literature as the most common reaction to tattoos and PMU inks, in particular the classical lichenoid reaction to red pigments [15].

Other reported collateral effects include neurologic pain in the upper limbs, papulo-nodular skin elevation from pigment overload, soft tissue lymph oedema, skin pigmentation around the tattooed area and in the regional lymph nodes [17]. Most granulomatous reactions are foreign body encapsulation forms, appearing like papulo-nodular skin deposits of black pigment and they are not considered as allergic reactions and are classified as inflammatory non-infectious. Several studies have reported isomorphic Koebner response after tattooing in patients with active susceptible disease, e.g. psoriasis, lichen planus and vitiligo [2].

Light sensitivity may affect about 20% of tattooed individuals mainly on parts exposed to the sun, such as the face and hands [18].

Regarding the concerns relating to tumours, it is worth mentioning the JRC final Report: “It is unclear whether tattoo inks may induce tumours, be they local or general. On the other hand, many substances contained in tattoo inks, such as Polycyclic Aromatic Hydrocarbons (PAHs) in black pigments or Primary Aromatic Amines (PAAs) and their degradation products, sometimes with increased solubility properties, are classified as mutagenic, genotoxic and carcinogenic. A direct correlation between tattoos and tumours is challenging to establish and a straightforward causal-

ity between tattooing and cancer formation has not been demonstrated. Hence, most authors consider the growth of cutaneous tumours within tattooed areas as purely incidental” [2, 19, 20].

With the increase in the popularity of tattooing, there has also been a rise in the number of people regretting their decision to have a tattoo. A recent review found that up to 50% of their tattooed population regretted their tattoos [21]. There has been, therefore, a consequent increase in requests for removal. There are various methods for removing a tattoo: surgical excision methods or dermatome shaving, salabrasion, chemical removal, and so forth. However, such procedures risk scarring and dyspigmentation. In general, laser removal is preferred routinely and is more effective for ordinary tattoos. On the other hand, the risk is that residues or degradation products (as a result of induced thermophotolysis) released in the skin, can lead to unforeseen immune reactions. Further secondary effects, especially after laser removal, are pigmentary disruptions, grouped in areas of hypopigmentation and hyperpigmentation, and paradoxical darkening. Moreover, in some cases, complete removal by laser is never achieved, e.g. particularly for multicoloured tattoos [2, 21].

MATERIALS AND METHODS

To estimate the tattooed population in Italy and to evaluate any potential correlations between tattoos and geography, level of education and occupation, a questionnaire was developed and administered using an integrated methodology Computer-Assisted Telephone Interview (CATI) and Computer-Assisted Web Interview (CAWI). The reference population was represented by individuals over 12 years of age, resident in Italy.

The sampling on the Italian population was carried out by adopting a stratified sampling design for proportional allocation shares, structured on the basis of the variables to be estimated and for which the distribution was known through official sources (ISTAT). In particular, the sample was built on the following variables:

- geographic area (northwest, northeast, central, south, islands);
- dimension of the city (0-10 000 inhabitants, 10 001-30 000 inhabitants, 30 001-100 000 inhabitants, over 100 000 inhabitants);
- gender (male, female);
- age classes (12-17 years, 18-24 years, 25-34 years, 35-44 years, 45-54 years, over 54 years).

Regarding the interviews conducted *via* CATI, the “full dual” system was used, selecting subjects from landline telephone listings and from the mobile phone registers. Out of the 12 437 people who answered, 5535 accepted to be interviewed (44.5% response rate).

To perform the interviews *via* CAWI, 5208 e-mails were sent. Of these e-mails, 2023 recipients agreed to be interviewed (38.8% response rate). This survey also included an additional random sample comprising about 50 minors interviewed “face to face”. The need for this additional sample of minors was justified by the legal requirement to carry out interviews only in their parents’ presence.

The interviews were concluded by January 2015. The

fieldwork was carried out by IPR Marketing, an agency operating in the field of social statistics and market research.

The distribution of interviews between different methods of administration (CATI and CAWI) was determined on the basis of the most recently available data regarding the penetration and use of internet among the Italian population (Audiweb).

Since one of the aims was not only to estimate the number of tattooed people in the total population, but also to carry out in-depth analysis of certain targets, the size of the overall sample was not fixed in advance, but was increased gradually until 1000 tattooed individuals had been included, in order to have a subsample that was statistically significant for subsequent analysis. This subsample included ex-tattooed individuals, which means people who had had a tattoo but had removed it.

In total, 7608 subjects, constituting the sample, completed the questionnaire. The sample of the population consisted specifically of 3946 females (51.9%) and 3662 men (48.1%), proportionally selected to be representative of the Italian resident population aged 12 and over (the Italian reference population over 11 years of age was 54 053 162 units – source ISTAT, data 2014). Of these, the 1000 tattooed subjects enrolled represent a segment of analysis.

The data was weighted through appropriate coefficients to allow carry-over to the universe not only for the variable on which the sample was built (gender, age, dimension of the city, geographic area) but also for “title of study” and “professional condition”. The potentially highest margin of sampling error on the estimated prevalence at a confidence level of 95% is equal to $\pm 1.124\%$.

Before the survey, a validation test regarding the questionnaire was performed through the administration of a pilot survey to about a hundred people *via* CATI and a hundred people *via* CAWI. The dropout rate of individuals abandoning at initial interview led us to reduce the extent of the questionnaire.

The administered questionnaire consisted of 43 closed questions asking:

- place of residence, age, gender, level of education and occupation;
- if the interviewed have/had a tattoo and when she/he did the first time;
- number of tattoos, their size and prevalent colours, the body area involved and motivation for having the tattoo or for removing it;
- information regarding adverse events;

- awareness of the contraindications and risks of tattoos;
- information on the hygienic conditions of tattoo parlours and on how tattoos are performed.

The first group of questions concerned: nationality, sex, age, number of tattoos, age of the first and last tattoo. Questions then addressed the hygienic conditions during the execution of the tattoo, its characteristics, the ink colours used (monochrome/polychrome tattoos), and the degree of customer satisfaction with the tattoo. Questions were also asked about whether the tattoos were carried out by professionals in authorized centres or outside, by non-professional tattooists.

In order to simplify the interview, questions concerning tattoo characteristics referred only to the most recent one. Furthermore, certain questions were related to knowledge of risks and contraindications, and mild complaints or medical complications that arose after the execution of the tattoo. We submitted to the subjects interviewed some questions with a list of 6 answers (3 correct and 3 incorrect – type yes/no) to assess their knowledge of risks and contraindications and to understand their level of information.

Non-tattooed individuals responded only to a part of the survey and in particular to questions about:

- perception of the risks and possible contraindications associated with the practice of tattooing and the relevant sources of information;
- sociodemographic variables.

RESULTS

The prevalence of tattooed people was 12.8% of the general population in Italy (95% CI: 12.05%-13.55%), equivalent to an estimated 6 900 000 (CI: 6 499 000-7 310 000) tattooed individuals (*Table 1*). If one also considers the ex-tattooed, which means those who had removed their tattoos, then the total tattooed population prevalence rises to 13.2%.

Tattooing is more frequent among women, with a prevalence of 13.8% for women and 11.7% for men. Women accounted for 55.9% of tattooed subjects in the subsample (*Table 2*).

As regards age groups in our study, the greatest number of tattooed subjects were found to be between 35 and 44 years of age, which represents 23.9% of the sample (*Table 2*), almost double the estimated prevalence of tattooed people in the general population (12.8%). The average age at the first tattoo was 25.1 years, basically the same for males and females.

Table 1

The “structure” of the sample and the estimated prevalence of tattooed people in the general population in Italy > 12 years of age

	No. cases	%	95% CI	No. of people: estimate	Lower bound	Upper bound
Tattooed people	972	12.8	(12.02-13.52)	6 904 000	6 499 000	7 310 000
Ex-tattooed people	35	0.5	(0.31-0.61)	250 000	168 000	332 000
Not tattooed people	6601	86.7	(86.0-87.53)	46 899 000	46 487 000	47 311 000
Total	7608	100.0		54 053 000		

CI: confidence interval.

Table 2
Demographic characteristics of tattooed people in the sample (n = 7608)

Categories	Characteristics	No. of tattooed people	% of tattooed people	% of tattooed people in the sample	95% CI
Sex	Female	543	55.9	13.8	(12.7-14.8)
	Male	429	44.1	11.7	(10.7-12.7)
	Total	972	100	/	
Age	12-17 years	37	3.8	7.7	(5.3-10.1)
	18-24 years	133	13.7	22.1	(18.8-25.4)
	25-34 years	224	23.0	22.7	(20.1-25.3)
	35-44 years	313	32.2	23.9	(21.6-26.2)
	45-54 years	200	20.6	15.0	(13.1-16.9)
	Over 54	65	6.6	2.2	(1.7-2.8)
	Total	972	100	/	

CI: confidence interval.

The percentage of young people tattooed, between 12 and 17 years of age, amounted to 7.7%.

Ninety-eight point one percent of tattooed people (954/972) were of Italian nationality. With regard to the geographical area of residence, it was noted that 29.0% (282/972) of the tattooed subjects lived in the Northwest Regions of Italy, 16.7% (162/972) in the Northeast Regions, 23.6% (229/972) in the Southern Regions, 21% (204/972) in the central Regions and 9.7% (94/972) in the Islands.

The prevalence of tattooed people by geographical area of residence and other characteristics was as follows (Table 3).

Overall, 45.7% (444/972) of the subjects lived in Northern Italy, where there were 788 authorized tattoo parlours out of 2055 working throughout the national territory, in 2015. The number of authorized tattoo parlours has increased to 4103, in December 2017 [6, 22]. In our subsample of tattooed individuals, 61% (590/967) were married or lived together with a partner, 14.9% (144/967) were engaged and 24.1% (233/967) were single. Regarding educational qualifications, 55.4% (539/972) of the tattooed population had a high school diploma, 30.8% (299/972) had a university degree/master's degree and 13.8% (134/972) held some other qualification (elementary school certificate/secondary school /none).

Regarding professional status, the greatest percentage was "employed worker" at 47.6% (462/970), followed by "self-employed" at 15.5% (150/970), while 14% (136/970) were studying. "Unemployed" or "job-seeker" accounted for 10.3% (100/970), "housewife" was 9.8% (95/970), and "pensioner" was 2.8% (27/970).

The popularity of tattooing has increased considerably since the 1990s. In our study, we evaluated the distribution of the overall number of tattoos in the Italian population over the period 1960-2014 (Figure 1). The graph shows that 36.7% of all tattoos were performed in the last five years considered, with a peak of 10.8% in 2013.

According to our findings, the main motivations for having a tattoo changed with age and over time. Our

tattooed subjects were asked for what reasons they made the decision to have a tattoo (for this question they – including the ex-tattooed – were allowed to give multiple responses): 32.3% (326/1007) answered "Because it is beautiful to get tattooed" and because, in general, they "like tattoos", 27.6% (277/1007) said "to remember a date, or an event", 15.2% (153/1007) said "as a lucky charm", 8.9% (90/1007) replied "because it is fashionable, trendy". The motivations relating to transgression or a sense of belonging, for example, to a group, were in the minority as only 4% (41/1007) of the subjects showed a will to "transgress" or to "be more transgressive". Only 6% (60/1007) did it out of a sense of belonging to a group or to an ideal, while 3.6% (36/1007) claimed "spiritual reasons".

Among the motivations, it is worth noting that a minority of tattooed subjects, 3.0% (30/1007), claimed cosmetic reasons (permanent make-up) and 0.5% (5/1007) had medical tattoos, used to deal with certain consequences of a number of pathological conditions, e.g. reconstruction of the nipple-areola complex after mastectomy. No specific reason for having a tattoo was the response of 5.8% (58/1007). In order to evaluate whether the choice of getting a tattoo could be associated with some specific factors, behaviours or lifestyles, the binomial logistic regression was performed.

This analysis showed a moderate association between getting a tattoo and having other tattooed family members in the family nucleus ($B = 1.167$ – sig. 0.000). It can be argued that a decision to get tattooed is positively influenced by the presence of other tattooed people in the family. The regression analysis also showed:

- a modest association between the decision to get tattooed and having experienced sexual intercourse before the age of 18 ($B = 0.720$ - sig. 0.000);
- a weak association with other factors such as use of drug ($B = 0.595$ - sig. 0.000) or habitual use of alcohol ($B = 0.251$ - sig. 0.008).

The areas of the body generally tattooed were different for men and women. Men preferred to get tattooed on the arms (54.0%), shoulders (29.1%) and on the legs (12.6%) while women preferred the arms

Table 3

Distribution of the sample population (tattooed and non tattooed) by geographical area of residence, nationality, civil status, educational qualification and professional status

		No. of tattooed people	% of tattooed people	Proportion in the total population (%)	Prevalence (%)	95% CI	No. of non-tattooed people	% of non-tattooed people
Geographical area	Northwest	282	29.0	3.7	13.9	(12.4-15.4)	1750	26.4
	Northeast	162	16.7	2.1	11.2	(9.6-12.8)	1287	19.4
	Central area	204	21.0	2.7	13.8	(12.0-15.6)	1274	19.2
	Southern	230	23.6	3.0	12.8	(11.2-14.3)	1573	23.7
	Islands	94	9.7	1.3	11.1	(9.0-13.2)	752	11.3
	Total	972	100.0	12.8			6636	100.0
Nationality	Italian	954	98.1	12.6	12.7	(12-13.5)	6537	98.5
	Foreigners	18	1.9	0.2	15.4	(8.8-21.9)	99	1.5
	Total	972	100.0	12.8			6636	100.0
Civil Status*	Married/cohabitant	590	61.0	7.8	12.7	(11.8-13.7)	4038	61.3
	Engaged (non-cohabiting)	144	14.9	1.9	26.6	(22.8-30.3)	397	6.0
	Single, divorced, widow/er	233	24.1	3.1	9.7	(8.6-10.9)	2159	32.7
	Total	967*	100.0	12.8			6594*	100.0
Educational qualification*	Elementary school certificate/secondary school/ none	134	13.8	1.8	6.2	(5.2-7.2)	2041	30.8
	High school diploma	539	55.4	7.1	15.3	(14.1-16.5)	2986	45.0
	University degree/master's degree	299	30.8	3.9	15.7	(14.1-17.3)	1603	24.2
	Total	972	100.0	12.8			6630*	100.0
Professional status*	Employed worker	462	47.6	6.1	19.0	(17.5-20.6)	1964	29.7
	Self-employed	150	15.5	2.0	17.9	(15.2-20.4)	689	10.4
	Unemployed / jobseeker	100	10.3	1.3	16.7	(13.7-19.6)	500	7.6
	Housewife	95	9.8	1.2	13.1	(10.6-15.5)	632	9.5
	Student	136	14.0	1.8	13.3	(11.2-15.4)	887	13.4
	Pensioner	27	2.8	0.4	1.4	(0.9-1.9)	1940	29.3
	Other	0	-	-	-	-	8	0.1
	Total	970*	100.0	12.8			6620*	100.0

* Due to the missing data, the number of cases is not always equal to 972 for tattooed people and 6636 for non-tattooed people. CI: Confidence Interval.

(33.4%), shoulders (28.3 %), back (22.3 %), legs and ankles (23.1%), showing more homogeneity overall in the choice.

The survey also evaluated some characteristics of the tattoos themselves: the number of tattoos, the size and the prevalent colours. The categories identified were associated with gender.

The majority of subjects (66.2%) had only one tattoo, while a minority (2.5%) had more than five tattoos. The average number of tattoos *per* individual was 1.7 (Table 4).

As shown in Table 4, 41.4% (412/997) of tattooed subjects declared they had tattoos of small dimensions, which means an area inferior or equal to 0.5% of the body surface area (1% of the body surface area is equivalent to the size of the palm of the hand, fingers included) [10]. Overall, 71.6% of the subjects of both sexes said they had tattoos that covered an area 1% or less of the body surface area. The average size was 0.7%. There were no women with tattoo size greater than 10% of the total body surface.

In general, black (70.6%), blue (16.0%), red (15.9%)

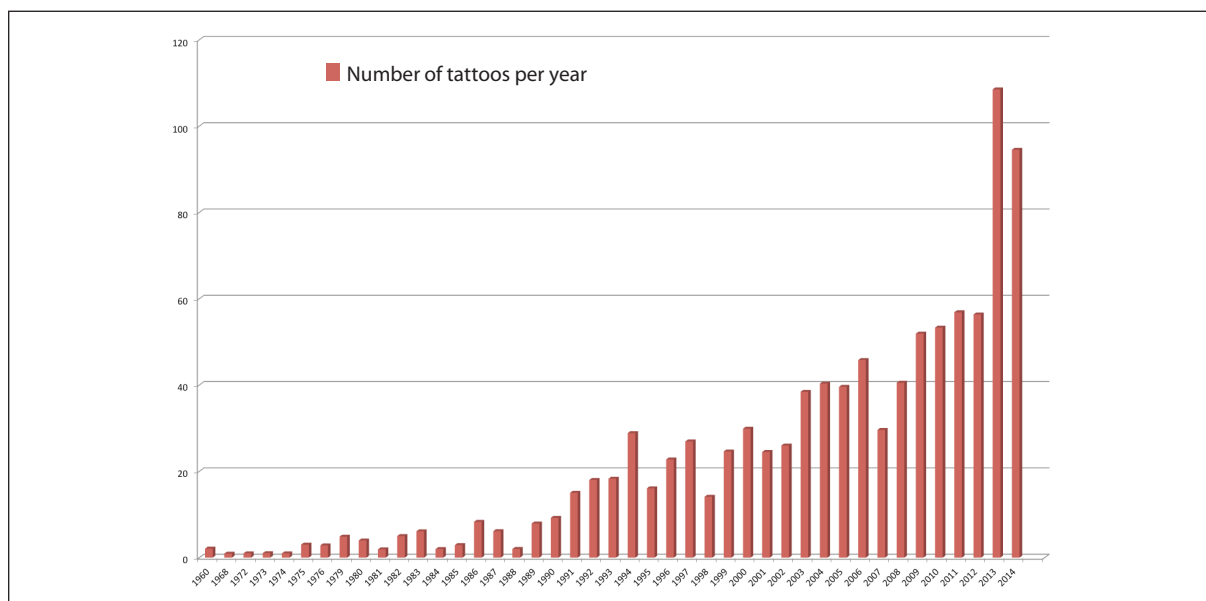


Figure 1
Growth trend of tattoos 1960-2014.

Table 4
Characteristics of tattoos

Type of characteristics	Female		Male		Total		χ^2 -test	P value
Number of tattoos	Cases	%	Cases	%	Cases	%		
1	361	63.9	306	69.2	667	66.2		
2	106	18.8	59	13.4	166	16.5		
3	63	11.2	37	8.4	100	10.0	12.045	0.017
4-5	25	4.4	24	5.4	49	4.8		
>5	9	1.6	16	3.6	25	2.5		
Size								
≤ 0.5%	259	46.6	153	34.8	412	41.4		
> 0.5% ≤ 1%	156	28.0	145	32.9	301	30.2		
> 1% ≤ 2%	78	14.1	69	15.6	147	14.8		
> 2% ≤ 4%	53	9.6	46	10.4	99	10.0	27.774	0.000
> 4% ≤ 6%	7	1.3	19	4.3	26	2.6		
> 6% ≤ 10%	2	0.4	3	0.7	5	0.5		
> 10%	0	0.0	6	1.4	6	0.6		
Colours								
Black	402	71.3	308	69.8	710	70.6		
Blue	90	15.9	72	16.3	161	16.0		
Red	88	15.6	72	16.2	160	15.9		
Yellow	59	10.5	28	6.4	88	8.7		
Green	48	8.5	24	5.4	72	7.2		
White	31	5.4	29	6.5	59	5.9	16.722	0.081
Orange	23	4.1	27	6.1	50	5.0		
Grey	25	4.4	14	3.1	39	3.9		
Brown	15	2.7	10	2.2	25	2.5		
Other colours	12	2.1	3	0.7	15	1.5		

and yellow (8.7%) were the most frequently used colours (Table 4).

Monochromatic tattoos predominate at 67.3%, both for men (68.8%) and women (66.1%), compared with polychromatic tattoos accounting for 32.7% (men 31.2%, women 33.9%). Of the monochromatic tattoos, black was the colour most used (81.8%). Of those with a polychromatic tattoo, black (47.6%) and red (46.2%) were the two most common colours, followed by blue (28.5%) and yellow (26.0%). A greater preference for monochromatic tattoos, or for tattoos with a limited number of colours, was found among men compared with women, who were more inclined to greater colour variety. Of the female subjects, 14.0% had tattoos with three or more colours, greater than the 9.1% found amongst the males.

This study revealed that 13.4% of tattooed subjects had had tattoos outside authorized centres, possibly exposing themselves to significant risk. In detail, for 76.1% (761/1000) of tattooed subjects, the most recent tattoo had been carried out in authorized parlour, and for 9.1% (91/1000) in a beauty salon, while 1.3% of the people interviewed (13/1000) said that they had had the tattoo during conventions. A further 8.9% (89/1000) said that their tattoo had been done by a non-professional tattooist and 4.4% (44/1000) said they had done it at home, alone or with friends. In the South and in the Northwest regions, we found the greatest percentages of people who had turned to unauthorized parlours. In particular, 13.2% of tattooed individuals in the Northwest and 10.8% of those in the South had gone to a non-professional tattooist. In addition, 7.3% of people tattooed in the South and 5.9% of those in the Northwest had done it at home, alone or with friends.

Participants were also asked questions in order to understand whether tattooists had complied with the safety standards and hygiene procedures required. With regard to following health and hygiene standards (workstation sanitisation, use of gloves, mask and gown, use of disposable materials) 85.9% of responses stated that the workstation was clean, 85.5% that the tattoo artist wore all the equipment (gloves, gowns, etc.), 86.7% that disposable materials (covers, containers, etc.) were used, as well as sterile needles and pigments. The lack of any hygiene precautions ranged between 13.3% and 14.5%, according to the geographical area considered.

In addition, 91.4% of tattooed subjects received the necessary instructions for tattoo care and hygiene up to the stage of complete healing. It was found, however, that only 50.8% of the subjects had signed an informed consent form; 22.4% responded that they did not remember whether they signed and 26.8% of our subjects did not sign an informed consent form. Of these, the subjects who had had their tattoos in an authorized centre without signing the form accounted for 22.2% and in a beauty salon, 24.0%.

Participants were also asked how they got information about the health risks and side effects of tattooing. Multiple responses were given. The main sources of information were: on the Internet (46.1%), books or magazines (38.0%), and friends/relatives/other tattooed people (28%). Only 13.0% consulted healthcare profes-

sionals or general practitioners and 10.4% asked for information from a tattooist.

To appraise awareness of the risks and contraindications associated to the tattooing practice, some questions were provided to the participants with 6 responses for each one (3 correct and 3 incorrect).

In general, 58.1% of the interviewed were informed or reasonably informed on the risks (4-6 answers out of 6 were correct). The information level of health risks among tattooed people was higher (65.5%) compared with non-tattooed people (57.0%). Among the correct responses provided in the questionnaire (not including all complications/side effects associated with tattooing), the most frequent and perceived risks regarded allergic reactions (79.2%), hepatitis (68.8%) and herpes (37.4%).

Regarding the awareness of contraindications, only 41.7% of respondents were adequately informed (4-6 answers out of 6 were correct). In this case, non-tattooed respondents were more informed about contraindications (42.2%), compared with those who had a tattoo (38.5%). Overall, only 25.4% responded that diabetes constitutes a contraindication to tattooing.

Participants were also asked about complications observed after tattooing; only 3.3% of our tattooed subjects declared they had had complications and/or mild complaints associated with the tattoo, but the figure is likely to be underestimated. Of the more frequent reactions/complications, there was pain (39.3%), swelling, blisters, granuloma (27.7%), dermatitis, eczema, itching (26.7%), skin thickening (24.4%), allergic reactions (17.5%), and also pus, bleeding, dizziness, headache, scabs and fever. The reactions were self-reported and not evaluated clinically.

As regards tattoo colours, 5.8% of tattooed respondents reported complications and/or reactions involving tattoos with more than one colour and particularly those where yellow and red had been used (6.6%) or where three or more colours (8.3%) had been applied. Complications decreased to 2% for monochrome tattoos.

Tattoos in the lower part of the trunk (abdomen, groin, buttocks, etc.) were those at higher risk of reporting complications (10.3%). The majority of the complications (90.7%) were restricted to the area of the tattoo.

However, only 12.1% of those in our study who had complications asked for a consultancy with a dermatology, someone else consulted their general practitioner (9.2%) and others referred back directly to the tattooist (27.4%), while the majority (51.3%) did not consult any of these professionals.

Among tattooed people, it was found that 92.2% were content with their latest tattoo. Of these, 44.4% were very satisfied (446/1003). No significant difference was found between those who had a monochromatic tattoo compared to those with a polychromatic tattoo.

It is worth noting the absolute satisfaction in the age group 12-17 years, where no one claimed to be "unsatisfied".

However, in our subsample of tattooed people, 17.2% of the subjects were thinking about getting their tattoo removed and of these, 4.3% had actually removed it

(43/1007). To remove their tattoos, 49.2% (21/43) had gone to a dermatologist and 18.6% (8/43) to a plastic surgeon, but a relative high percentage, 32.2% (14/43), had had their tattoo removed in a tattoo parlour. In the interview, they were also asked how satisfied they were with the removal: 55.6% of them were satisfied (24/43), 30.7% were partially satisfied (13/43) and 13.7% (6/43) claimed to be unsatisfied.

Individual reasons for removal (multiple responses) included: loss of meaning (51.3%), bored seeing it/did not like it anymore (39.3%), the colour faded (15.9%), motivations related to job (11.4%), health reasons (11.4%).

DISCUSSION AND CONCLUSIONS

The results of the survey show that the prevalence of tattooed Italians (12.8%) is in line with the average prevalence of tattooed in the European population (12%) [2]. The prevalence in the age group 35-44 years is almost double that of the Italian population, with tattoos being more common in women than in men. Women accounted for 55.9% of tattooed subjects and the figure is in agreement with a survey conducted in Germany, where women made up 58.9% of the tattooed subjects interviewed [7].

The percentage of tattooed adolescents (7.7%) is remarkable, if we consider the obstacle of getting the consent form signed by a parent and that, in Sicily, tattooing cannot be done for minors under 18 years of age [23]. This figure shows a slight increase on the data published in 2011 by Eurispes-Telefono Azzurro, which reported that teenagers with at least one tattoo were 7.5% in 2011, an increase from 6.5% of the previous year. The regression analysis showed a weak association between getting a tattoo and specific behaviour or lifestyle, such as habitual use of alcohol or drug. "We are observing a tendency of the diffusion of these practices, accompanied by a social acceptance of the phenomenon, considered as typical of very young people" [24].

From the data collected, it was found that over 1/3 of all tattoos have been carried out in the last five years considered; this is likely to be overestimated, as the sharp increase in the number of tattoos per year, shown in *Figure 1*, is partly due to the study design, based on cross-sectional data collected at only one point in time, in 2015. Furthermore, this could also be biased by the participant's recall. However, owing to the lack of official data, it was the only way to estimate the number of tattoos per year, albeit with potential bias. Nevertheless, it is sufficient to appraise the long-term trend, which clearly shows a remarkable increase in tattoo practice in recent years. The significant increase in the number of tattoo parlours, during the considered period, confirms that the phenomenon, which started at the beginning of the '90s and has become more evident in the last decade, is in rapid and constant development in Italy. Regarding the sources of information concerning the health risks of tattooing, it is noteworthy that only 13.0% of the sample consulted a reliable source, such as a healthcare professional or a general practitioner, while the majority got information through internet (46.1%), where the quality of information is variable.

It could be of importance to observe that less than 14% of the whole population of tattooed subjects had tattoos greater than 2% of the body surface area, while 71.6% reported having tattoos \leq 1% of the body surface area. This is to say that most tattoos are of small dimensions and that this might explain the low level of complications observed, if we consider the quantity of ink introduced into the skin; according to Engel, *et al.* [25], the quantity of ink injected during the execution of a tattoo is equal to 2.5 mg/cm². Thus, the low percentage of complications and mild complaints (3.3%) could be explained by the low number of tattoos per person, their small size and the predominance of monochromatic tattoos.

Furthermore, a methodological bias should be considered; that reactions were self-reported and not clinically ascertained.

Other factors may have had an influence on the figure:

- the low percentage of those who consulted a practitioner;
- the questionnaire referring to the most recent tattoo;
- lack of education on recognising post tattooing health effects.

In addition, in Italy, there are no systems in place for reporting tattooing complications and it might be worth considering an additional survey to explore this further, involving clinicians and health professionals.

Recently, a strong correlation has been found between the colour of the ink used and reactions and/or complications in tattooed subjects. Of these adverse events, allergic reactions from red tattoos are amongst the most common [26]. That is why one of the objects of the survey was to acquire information on the tattoo colours employed. We found that the complications and/or reactions involving tattoos where red and yellow were predominant accounted for 6.6%, double the percentage of the complications/reactions in the overall sample (3.3%).

There is a consideration that, for a constantly growing number of people, tattooing means exposure to a mixture of chemicals that have not been characterised or properly researched and that there may be possible long-term negative effects on health [21]. This makes the phenomenon a matter of great interest to the Italian health authorities. With so many people tattooed, almost seven million, even rare occurrences could become many by number. In this situation, the advice of doctors to individuals wishing to have a new tattoo become especially important in the prevention of tattoo complications [8].

This survey also investigated whether and to what extent compliance with the measures prescribed in the "Guidelines for the implementation of procedures for tattooing and piercing in safe conditions", and the current regional law requirements were met by tattoo professionals [6]. Italian tattooists are required to be at least 18 years of age and to be in possession of a certificate of participation in a regional training course for tattoo artists. Tattoo parlours should comply with the minimum requirements for structures and instruments laid down by regional and municipal laws and regulations.

The survey reveals that 13.4% of tattooed subjects had had their tattoo done outside authorized centres by non-professional tattooists and this can constitute a remarkable source of risk, especially when one considers that the figure may be underestimated, as there appeared to be a lower tendency of the subjects to admit to having had a tattoo in an unauthorized centre during the telephone interviews, compared with the answers given by CAWI (Web), or without the interviewer as an intermediary.

In addition, clients must sign an informed consent form, after being told by the tattooist of the health risks associated with tattooing. It was found that 26.8% of the subjects did not sign an informed consent form. The level of knowledge regarding risks appears inadequate.

The work of the various committees and expert groups at European level takes on ever-increasing importance, both from the technical and political point of view. In order to be effective, whatever decisions are made by such bodies, they should be accompanied by regulations and/or a common set of rules on the safety of tattoos, hopefully adopted throughout the EU.

Certainly, there is a need for strict controls on the ingredients and the other components of tattoo inks. However, regulation cannot be confined to this, because it would not tackle the need for health protection at all levels of tattoo practice. In fact, consideration must also be given to the infectious and microbiological risks, as well as those involved in the application of the tattoo itself [2].

In particular, the following aspects must be considered:

- correct labelling, sterility of the inks and needles;
- qualification and training of tattoo artists through standardized courses;
- respect of correct hygiene standards and correct disinfection of workstations and instrument;

REFERENCES

1. Laumann AE, Derick AJ. Tattoos and body piercings in the United States: a national data set. *J Am Acad Dermatol.* 2006;55:413-21. DOI: 10.1016/j.jaad.2006.03.026
2. Piccinini P, Pakalin S, Contor L, Bianchi I, Senaldi C. Safety of tattoos and permanent make-up. Final Report. Publications Office of the European Union; 2016. DOI: 10.2788/011817
3. Boncompagni G, Lazzeri G, Martiello MA, Incandela L, Santori R, Spinelli GM, Senatore R, Gentili G, Giacchi M, Pozzi T. Related risks of tattooing and body piercing: prevalence study in a convenience sample. *J Prev Med Hyg.* 2005;46:153-8.
4. Cegolon L, Miatto E, Bortolotto M, Benetton M, Mazzoleni F, Mastrangelo G, VAHP Working Group. Body piercing and tattoo: awareness of health related risks among 4277 Italian secondary school adolescents. *BMC Public Health.* 2010;10:73-81.
5. Gallè F, Quaranta A, Napoli C, Di Onofrio V, Alfano V, Montagna MT, Liguori G. Body art and health risks: young adults' knowledge in two regions of southern Italy. *Ann Ig.* 2012;24:535-42. DOI: 10.1186/1471-2458-11-625
6. Renzoni A, Pirrera A, Novello F, Diamante MS, Guarino C. Implementation of European Council resolution ResAP(2008)1 in Italy. National and regional regulation of tattoo practices: diversity and challenges. *Curr Probl Dermatol.* 2015;48:201-5. DOI: 10.1159/000369228
7. Klügl I, Hiller KA, Landthaler M, Bäuml W. Incidence of health problems associated with tattooed skin: A nation-wide survey in German-speaking countries. *Dermatology.* 2010;221:43-50. DOI: 10.1159/000292627
8. Serup J. Individual risk and prevention of complications: Doctors' advice to persons wishing a new tattoo. *Curr Probl Dermatol.* 2017;52:18-29. DOI: 10.1159/000450775
9. Simunovic C, Shinohara MM. Complications of decorative tattoos: Recognition and management. *Am J Clin Dermatol.* 2014;15:525-36. DOI: 10.1007/s40257-014-0100-x
10. Høgsberg T, Hutton Carlsen K, Serup J. High prevalence of minor symptoms in tattoos among a young population tattooed with carbon black and organic pigments. *J Eur Acad Dermatol Venereol.* 2013;27:846-52. DOI: 10.1111/j.1468-3083.2012.04590.x
11. Hutton Carlsen K, Serup J. Patients with tattoo reactions

- the taking of a customer medical history to exclude certain types of pathologies that constitute contraindications for tattoos.

It is necessary to improve consumer awareness, through specific information campaigns on the risks and contraindications, among the public, especially for the young generations. Before tattooing, particular attention should be given to the importance of obtaining adequate information before signing an informed consent form.

It would also be desirable to have legislation that provides:

- harmonized supervision of the European market with sampling and analytical screening of inks, so as to contrast counterfeit products;
- an authorization process with audit at the parlours in compliance, hopefully, with European standards regarding hygiene and procedures to be followed;
- a register of certified tattoo artists to combat the phenomenon of unauthorised tattooists;
- the introduction of a system to report complications and side effects due to tattoos.

The regulatory path should also overcome the fragmentation of existing, varied legislation. It would be important for Italian and other European citizens to be equally protected, regardless of the Italian region or the European country in which they choose to have a tattoo.

Conflict of interest statement

There are no potential conflicts of interest or any financial or personal relationships with other people or organizations that could inappropriately bias conduct and findings of this study.

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- have reduced quality of life and suffer from itch. *Skin Res Technol.* 2015;21:101-7. DOI: 10.1111/srt.12164
12. Serup J, Sepehri M, Hutton Carlsen K. Classification of tattoo complications in a hospital material of 493 adverse events. *Dermatology* 2016;232:668-78. DOI: 10.1159/000452148
 13. Wenzel SM, Rittmann I, Landthaler M, Bäuml W. Adverse reactions after tattooing: Review of the literature and comparison to results of a survey 2013. *Dermatology.* 2013;226(2):138-47. DOI: 10.1159/000346943
 14. Kluger, N. Cutaneous complications related to permanent decorative tattooing. *Expert Rev Clin Immunol.* 2010;6(3):363-71.
 15. Brady BG, Gold H, Leger EA, Leger MC. Self-reported adverse tattoo reactions: a New York City Central Park study. *Contact Dermatitis.* 2015;73(2):91-9. DOI: 10.1111/cod.12425
 16. Kluger N. Acute complications of tattooing presenting in the ED. *Am J Emerg Med.* 2012;30(9):2055-63. DOI: 10.1016/j.ajem.2012.06.014
 17. Serup, J, Hutton Carlsen K, Sepehri M. Tattoo complaints and complications: diagnosis and clinical spectrum, in tattooed skin and health. *Curr Probl Dermatol.* 2015;48-60. DOI:10.1159/000369645
 18. Hutton Carlsen K, Serup J. Chronic tattoo reactions cause reduced quality of life equaling cumbersome skin diseases. *Curr Probl Dermatol.* 2015;71-5. DOI: 10.1159/000369644
 19. Kluger N, Koljonen V. Tattoos, inks, and cancer. *Lancet Oncol.* 2012;13(4):e161-8. DOI: 10.1016/S1470-2045(11)70340-0
 20. Sweeney SA, Hicks LD, Ranallo N, Snyder N 4th, Soldano AC. Perforating granulomatous dermatitis reaction to exogenous tattoo pigment: a case report and review of the literature. *Am J Dermatopathol.* 2013;35(7):754-6. DOI: 10.1097/DAD.0b013e318209f117
 21. Laux P, Tralau T, Tentschert J, Blume A, Dahouk SA, Bäuml W, et al. A medical-toxicological view of tattooing. *Lancet.* 2016;387(10016):395-402. DOI: 10.1016/S0140-6736(15)60215-X.
 22. Unioncamere-Infocamere: Registro delle Imprese 2014.
 23. Italia. Decreto 31 luglio 2003. Linee guida in materia di tatuaggi e piercing. *Gazzetta Ufficiale della Regione Siciliana n. 35 del 08/08/2003.*
 24. Istituto di Studi Politici Economici e Sociali. Indagine conoscitiva sulla condizione dell'infanzia e dell'adolescenza in Italia. Roma: EURISPES; 2011.
 25. Engel E, Santarelli F, Vasold R, Maisch T, Ulrich H, Prantl L, König B, Landthaler M, Bäuml W. Modern tattoos cause high concentrations of hazardous pigments in skin. *Contact Dermatitis.* 2008;58:228-33. DOI: 10.1111/j.1600-0536.2007.01301.x
 26. Serup J. Seamless prevention of adverse events from tattooing: integrated strategy emphasising the customer-tattooist interaction. *Curr Probl Dermatol.* 2015;48:236-47. DOI: 10.1159/000370017