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## I. Abstract

Currently, 12% of the whole European population has one or more tattoos which correspond to more than 60 million people in the European Union.

A review of the medical literature on health hazards due to tattooing and permanent make-up (PMU) practices shows an increase report of adverse health effects of an infectious and non-infectious nature. Despite this fact the review shows a limited perception on the health risks of tattooing both among the health care professionals and the general public. It can be concluded that not only tattoo artists and the public but also the health care professionals should be targeted in the development of communicational and preventive strategies in order to increase the safety of tattoo practices and to guarantee informed choices.

## II. Resumen

Actualmente, el 12 % de la población europea presenta uno o más tatuajes, lo que corresponde a 60 millones de personas en la Unión Europea.

Una revisión de la literatura médica sobre peligros para la salud debido a las prácticas de tatuaje y maquillaje permanente (PMU) muestra un aumento de los efectos adversos de salud de carácter infeccioso y no infeccioso. A pesar de ello, las revisiones muestran una percepción limitada de los riesgos del tatuaje tanto entre los profesionales de la salud como entre el público en general. Se puede concluir que las estrategias preventivas de educación deben dirigirse no sólo a los tatuadores y al público en general, sino también los profesionales de la salud con el fin de aumentar la seguridad de la práctica del tatuaje y garantizar una decisión informada.

### III. Introduction and aims

According to the *Medical Dictionary for the Health Professions and Nursing*, tattoo is a “deliberate decorative implanting or injecting of indelible pigments into the skin or the tinctorial effect of accidental implantation”.<sup>1</sup> There are different types of tattoos. They can be classified according to the practitioner (amateur or professional) as “home” tattoos or registered and trained professional tattoo. Depending on the purpose they can be defined as: cosmetic tattoos (including the ones also known as PMU or permanent make-up) and iatrogenic or medical tattoos, which are mainly carried out by physicians for diagnosis or therapeutic purposes (such as in nipple reconstruction). Finally, considering the cause, we can encounter traumatic tattoos that may be provoked by accidents and explosions, where exogenous elements enter the human skin and color it in an indelible way<sup>2</sup>.

Currently, 12% of the whole European population has one or more tattoos which correspond to more than 60 million people in the European Union<sup>2</sup>.

The influence of age on the tattoo prevalence is remarkable. The prevalence in the young generations is around 20-30% in Europe and in some cases it can reach almost the double (Finland, France and Italy) or more (Germany and Netherlands) and it may increase in the general population if the trend continues<sup>2</sup>. The tattoo prevalence significantly decreases for people over fifty and it is usually lower than 10%, with just few exceptions<sup>2</sup>.

Moreover, gender influence is varying: while in the past women represented a minority of the tattooed population, nowadays this is not always the case. According to recent studies, women represent the majority of the tattooed population in Denmark, Italy and the United States<sup>2-7</sup>

This recent popularity among Westerners of tattooing and body art in general among has also come along with a blooming interest –academic and popular- in its history and its artistic, social and cultural dimensions.<sup>8-10</sup>

Throughout human history, tattoos have served as rites of passage, religious symbols, decorations for bravery, marks of status, protection, pledges of love, but also as punishment, marks of outcasts and slaves. Their appearance varies according to the different places of the world, and has different meanings depending on the historical, cultural and social context. However, the meanings and uses of ancient tattoo practices share some commonalities with contemporary tattoo customs.<sup>9</sup>

The earliest tattooed bodies date to 6000 BCE from the Chinchorro culture of South America. In Europe, the oldest and well-studied is the mummified ‘Iceman’, discovered in the Ötztal Alps on the Italy–Austria border in 1991, dated 5300 BCE. The mummified body is covered in 57 tattoos including lines scored in groups on his lower back and ankles, a cross behind his right knee and two rings circling his left wrist. Anthropologist Lars Krutak speculates that the tattoos may have a connection with medicine since 80% of the tattoos on his body overlap with Chinese acupuncture points.<sup>11-13</sup> Other

evidence of early tattoos can be found in Ancient Egypt, in Western Alaska (apparently used as medicine by the indigenous Yupik peoples of St. Lawrence Island) and among the indigenous people of North and South America, Africa, and throughout the Pacific region.<sup>9,10</sup>

Some researchers had speculated the possible reasons why people tattooed themselves in early human history, and how tattoos may have functioned in relationship of health and embodiment<sup>12</sup>. In addition to having spiritual and symbolic purposes, tattoos may have served in easing pain, promoting health, and curing illness.<sup>10</sup> Besides, the painful stimulation is associated with a release of endorphins in the body, generating positive emotions in addition to an anesthetizing effect.<sup>9</sup>

As to what concerns western society, some researchers assign colonialism and the seafaring culture as giving rise to the birth of the modern Western tattoo. As a matter of fact, in the late 1700s, Captain James Cook was responsible for bringing the Tahitian word 'ta-tu' or 'tatau' (to strike or mark) since he encountered tattooing while exploring the islands of the South Pacific. It seems that he introduced the then exotic practice to European society, carrying new meanings.<sup>14</sup>

In Europe and the United States, in fact, for most of the eighteenth and nineteenth centuries, tattooing was associated with marginalized populations; such as and circus workers, criminals, sailors, gang members, and the economically underprivileged<sup>10</sup>.

Nonetheless, there is evidence to suggest a short-lived tattoo fad within the circles of the cultural elite in Europe and the United States during the 1880s, because some members of polite society got tattoos as symbols of exoticism and distinction. In Italy, for example, the Savoia royal family is tattooed with the Savoia knot design since beginning of the 19th century.

The ambiguous connotation of the tattoo at the end of the 19<sup>th</sup> century caused by the coexistence in both social classes' extremes (the elite and the marginalized) seems to fade away with the embracement of the tattoo culture by the politicized middle class.

In fact during the mid-1960s tattooing starts to signal changes in esthetics, population, and discourse. Major social changes and counterculture (the feminist, social justice, and antiwar movements) led to increase interest in tattoos within a climate of protest. In the 1980s the punk and gay movement adopts tattooing as a protest against the conservative middle class norms of society.<sup>8,10</sup>

Nowadays, it seems that tattoo in western society has gradually become a mainstream consumption practice that can be found among people from all social classes<sup>10,15</sup>. In the most comprehensive study to date on the reasons of getting tattooed, Wohlrab and colleagues found ten motivational categories that ranged from 1-beauty, art and fashion; 2-individuality; 3-personal narrative; 4-physical endurance; 5-group affiliations and commitment, 6-resistance; 7-spirituality and cultural tradition; 8-addiction; 9-sexual motivation; and 9- no specific reason<sup>9</sup>.

Most of the anthropological and sociological research agree in understanding the increase popularity of tattoos in Western societies as a mass consumer phenomenon,

comparable to other consumption practices where people seek to beautify their bodies according to current fashion norms<sup>8-10,16-20</sup>.

It is interesting to note that this sociological change in the spectrum of tattooed people has evolved in parallel with an increase preoccupation with the regulation of its practice as shows a recent report (2016) of the European Commission on the safety of tattoo/PMU products and practices in order to protect the consumers' health<sup>2</sup>.

The aim of this essay is to explore risk perception and awareness of the adverse health effects of tattooing among the European general public and health professionals as reported in the medical literature available.

#### IV. Material and methods

A systematic revision has been carried out using as a the main source of information original and review articles found through Pubmed and the final report of the European Commission (2016) on the safety of tattoo/PMU <sup>2</sup> and references from relevant articles.

Google Scholar has also been used as a search engine, especially when researching over the cultural aspects of tattoos and it's link with consuming fashion.

Search terms used were: Tattoo/Tattooing; Body modification/ Body art; Health risk/Risk-taking; in combination with Body piercing; Awareness; Behavior; Motivations; Adolescent; Students; Adult; Young Adult; Age Factors; Attitudes; Health Knowledge; Risk Factors; Sex Factors; Psychology; Prevalence; Sensation seeking.

Once the abstracts of the articles have been read, they were filtered according to the publication date and place of the field research in order to focus on the phenomena of tattoos in the 21<sup>st</sup> century and in western society, specifically in Europe.

Primarily the articles were classified according to the three matters taken into consideration: motivations for getting a tattoo; risk perception and adverse health effects in medical literature.

We then focused on the awareness of health related risks of both general public and medical personnel comparing it to the actual adverse health effects due to tattooing practices as reported in the medical literature.

The original TFG plan included in-depth interviews with tattooed people and tattooists. In agreement with the TFG supervisor and due to practical reasons we decided not to follow this research path. However, a small sample of tattooed individuals has been interviewed and photographed using the methodology of ethnographic field-based research. There was a dual aim. Primary, of a formative nature, to acquire first-hand knowledge of the possibilities of the ethnographic methodology applied to health. Second, with the aim to use the material for the poster presentation. The field work has been conducted under the ethical guidelines for the

Social Sciences and Humanities endorsed by the European Commission as recommended by the University of Cantabria.

## V. Results and discussion

A review of the medical literature on health hazards due to tattooing and PMU practices shows an increase report of those both of an infectious and non-infectious nature. However, we must bear in mind the potential bias of the information gathered. On the one hand tattoo recipients are usually keener, especially for minor health complaints, to return to their tattooist rather than to seek medical advice. On the other hand, the long-term effects that include non-specific reactions are difficult to report and can pass undetected. As a matter of fact, and because there are no systematic data gathering of the tattooed population, the actual extent and prevalence of tattoo adverse health effects as reported in the medical literature is currently non-conclusive and with a large predominance of those of a dermatological nature.<sup>2,8,21</sup>

However, and acknowledging these limitations, the findings of the review done for this essay and those of the 2016 *JRC Science for policy report on safety of tattoos and PMU* for the European Commission, the main health problems related to tattooing practices reported in the medical literature are the following:

1. Some very common acute local effects that occur in the form of an acute aseptic inflammation provoked by the needle trauma are: pain, swelling, redness, lymphadenopathy, bleeding and blistering. They usually disappear after a few days, unless the lesion gets infected. Also itching and other systemic symptoms such as headache, dizziness, fever, and vomiting have been described.
2. Infectious diseases, mainly of bacterial (sometimes virus), may occur within several days when minimal hygiene conditions (tattoo premises, tools and inks) are not fully met. The true incidence of such cutaneous bacterial infections remains unknown, although estimations calculate that approximately 1 and 5% of all tattoo-recipients. Very rarely infections further widespread, although it is important to remember that infective endocarditis with fatal septicaemia should be prevented in patients with prior valve heart disease with an antibiotic umbrella before any tattoo application.
3. Although it is a very controversial issue, blood borne viral transmission, such as hepatitis virus B and C, is theoretically possible during a tattooing procedure, especially in unhygienic settings like prisons. The two main systematic reviews on the topic assert that tattooing is associated with hepatitis C. It has to be considered, however, that any pathogenic contamination could be virtually eradicated if strict hygienic measures are duly applied by tattoo practitioners. This may be due to the fact that ink is manufactured without standardization or quality control. Besides, the water that is added to the ink either in production or by the tattooist diluting the ink may be common source of microbial

contamination. For example, the authorities in Italy found, in both new ink and ink that was already in use, contamination up to 86% of the samples studied<sup>8</sup>.

4. Tattoo complications due to ink ingredient. The colorants of the tattoo's ink (that compose the major ingredient of the ink) are not specifically produced for such purposes and do not undergo any risk assessment procedure that takes into account their intra-dermis injection and long term permanence in the human body. The organic pigments undergo degradation with formation of primary aromatic amines that could cause complications, such as hypersensitivity, called also "allergic" reactions, including photosensitivity, with unpredictable onset and duration, and nonspecific clinical appearance. They may occur either:
  - A) Immediately (acute contact eczema by reaction to inks' ingredients, to latex proteins contained in tattooist's gloves, or to aftercare topical ointments), affecting mostly the red parts of the tattoos, and exceptionally it can provoke a general flush and cardiovascular collapse; or
  - B) After a long latency (months, years and even decades) in the case of chronic dermatosis and rare underlying auto-immune pathologies, such as systemic sarcoidosis, "revealed" (rather than triggered) in predisposed patients. Such reactions, sometimes exacerbated by sun exposure, are not predictable, and patch tests usually used for detecting allergies are mostly inconclusive for detecting the culprit substance (with frequent false negative results).In addition, latent cutaneous herpes lesions might be reactivated by tattooing procedures. Furthermore, those suffering from diabetes raise their risks of complicated tattoo outcome.
5. Long term sequels to allergic reactions embrace post-inflammatory dyschromic changes and hypertrophic/keloid scars.
6. Finally, tattoos may interfere with PET scan and Magnetic Resonance Imaging, causing in rare cases burning complaints. These image tests should be avoided in patients with cardiac, blood or autoimmune pathologies.

Skin cancer as a complication in connection with tattoos is a debated issue. Some researchers suggest that the risk of tattoo-induced tumors cannot be totally excluded, due to the carcinogenic properties of many inks' impurities, and of degradation products of ink ingredients. The main hypothesis is that dark tattoos, due to absorption of sunlight, may function as a physical sun filter in the skin itself, where the tattoo pigment absorbs the light, which then cannot be reflected back to the epidermis and cause the development of cancer. However, other scholars<sup>8</sup> have a different points of view on this matter: in their understanding, reported cases of skin cancer in tattooed individuals are primarily induced by the UVB radiation in sunlight and not by chemical carcinogens.

Finally, another explanation for the apparent lack of neoplastic effect of the potentially carcinogenic substances on the development of cancer in connection with tattoos may be that contamination substances of the polyaromatic hydrocarbon (PAH) and free primary aromatic amine (PAA), are eliminated quickly (over a period of a few days or weeks) and do not, therefore, have a long-lasting or chronic impact on mitotic cells.

Because tattoo pigments are very robust and not easily soluble, and for this reason are permanent in the tissue, any hypothetical segregation of PAA over time from azo colorants in pigments in the tissue may easily be so small and insignificant that they do not comprise a risk of cancer<sup>8</sup>.

There are no reports of cancer occurring in the regional lymph nodes, even though, as first pass organs, they are frequently exposed to tattoo pigment. Neither are there any reports of cancer of the inner organs related to tattoos.<sup>8</sup>

However, the lack of reports on the connection between tattoos and skin cancer does not in itself preclude that there may be a connection between tattooing and other cancers, but considering that many millions of people over decades and centuries have been tattooed with ink and colors that contain potentially cancer-causing substances, especially PAH in soot and black pigment,— based on current knowledge there is no clinical evidence of significant risk of cancer caused by tattoo pigment and tattoos.

In any case, there is agreement in the literature that prevention by avoiding tattoo in skin areas containing moles or pigmentary changes, since they could delay or complicate the diagnostic of potential malignant growth, could be a safe strategy.

If the revision of the international medical literature reveals a professional concern both on the potential infectious and non-infectious health problems caused by tattooing practices, the view of the general public is narrower focusing on the hygienic and infectious aspects of it. This could lead to negative consequences by conditioning an ill-informed choice.

Few studies have been carried out in Europe (six in Italy and one in Denmark) about the public awareness of health risks involved in tattoo and PMU practices.

The studies show certain methodological limitations. The characteristics of the population investigated, only students in the Italian surveys and the small sample size in the Danish case, make it difficult to extrapolate conclusions about risk perception of tattooing among the general European public. This difficulty grows even bigger since the questionnaires of the investigations included tattoo and body piercings. However, some general conclusions can be gathered.

The Italian surveys comprise different investigations that took place among young adults (13-22 years of age) of university and secondary schools of both the north and the south of the Italian peninsula between 2010 and 2013.

As to what regards the north of the country, S. Majori et al study the perception of associated risk for infections in various high schools of Veneto and show that a high rate of students perceive a generic risk of infection but that there is a substantial ignorance about the risk of transmitted diseases through body art.<sup>22</sup> A total of 2843 students participated in the study by filling out a questionnaire. As regard to infections, most part of interviewed subjects (81.6%) thought that it is possible to get an infection. Although, when specific notices were asked about HIV, viral Hepatitis and skin infections only about 50% of them – more often females – appeared truly aware of the risk.



Another study on awareness of health risks associated with body art among secondary school pupils in Veneto region has been carried out by Cegolon et al. in order to inform health educational programs. The researchers confirmed that there is a lack of the medical literature dealing with the awareness of this increasing phenomenon of body art.<sup>23</sup> For this reason the study investigates a sizable sample of Italian secondary schools (age 14 through 22). The results based on 4277 adolescents are useful to understand where specifically medical prevention could have an important role. The majority of the respondents of Cegolon et al. 's study had a reasonable knowledge of related infectious diseases and hygienic norms to be applied in body modifications, considered it important to refer to a certified body art practitioner and would refer to a healthcare professional in case of complications. However, male students with tattoos were found to be less aware of the risks of the blood-borne infectious diseases potentially transmittable by body art tools. Moreover, differences in awareness/education on the safest ways of practicing body art to avoid unwanted complications were also found across some geographical areas. Interviewees residing in the provinces of Rovigo and Vicenza (areas more rural) had a lower perception of body art risks.<sup>23</sup>

In the South of the Italy (in Apulia region), a similar study on risk perception done by Quaranta et al<sup>24</sup> among university students shows that 78.3% believe it risky to undergo body art (tattoo or body piercing), 12.3% consider it not risky to undergo these practices and 9.4% don't know if it is risky or not.<sup>24</sup> In particular, with regard to infectious diseases, AIDS is indicated as possible infection by 60.3% of the whole sample included in the analysis, hepatitis C by 38.2%, tetanus by 34.3% and hepatitis B by 33.7%. Furthermore, 28.1% of the 1.598 freshmen were not aware that there are also non-infectious complications (allergies, scars, bleeding, etc.)

Also Gallé et al.<sup>18</sup> focus on this matter in Naples (South of Italy) by researching in a multidisciplinary way in order to introduce regional guidelines and educate body art workers and their customers about possible health risks and needed safety practices. Their investigation focused on identification of the best population to target for further health information campaigns and hypothesized that adolescents would meet that criterion: two samples included 9322 high school students and 3610 university undergraduates. Approximately 79% of high school students and 87% of undergraduates knew about the possible transmission of infectious diseases through body art practices; some 3.5% of the former and 15% of the latter identified hepatitis B and C viruses and HIV among the transmittable agents. Among adolescents, 46% associated non-infectious risks with piercing and tattooing; at the university level, the number was 59%. However, only 2% of high school students and 3% of university students considered the development of allergies, bleeding and cysts as potentially associated risks.<sup>18</sup>

On the other hand, in the US, other scholars such as Schorzman et al, investigate body art and awareness of health related problems between college students aged 17 to 20 years and those aged 21 to 25 years, between men and women and between those who had body piercing and those who had not. They conclude that there are no statistical differences regarding age, sex, or race/ethnicity.<sup>25</sup>

Likewise, in a convenience sample of 225 participants, aged 12-21 years, recruited from an urban adolescent clinic in the US, Gold found that neither race, gender or age had a significant effect on the awareness of health risks.<sup>26</sup>

Houghton instead, found that the highest level of awareness was among the group at greatest risk, boys with tattoos, suggesting that some males may be attracted to tattoos because of their known risks.<sup>27</sup>

In summary, there is a visible discrepancy among the results of the above studies regarding the awareness of risk done in the US and the European ones. The reason of the divergence of these findings seems to be unclear, although an insufficient statistical power in the studies carried out by Gold, Schorzman, and Houghton could explain this in view of the small numbers involved.

However, there is a common point shared by all the studies under scrutiny: the urge of implementing health prevention programs, in order to increase the awareness on the risk of body art among the potential consumers of these types of body intervention.

According to the 2016 *JRC Science for policy report on safety of tattoos and PMU* for the European Commission the risk perception of the general public is based on the information obtained informally through the tattooist themselves, relatives, friends, mass media or the internet. It is interesting to note that, concerning risk communication, not only tattoo artists and public but also health care professionals were targeted in the development of communicational and preventive strategies.<sup>2</sup>

In fact, a review of the medical literature on health care professionals and their perception on the health risks of body art, proved a widespread disinterest or ignorance despite some calls to incorporate this awareness in their continued professional education<sup>27,28</sup>. The lack of awareness is even more telling when noting that in medical literature (mostly pediatric) tattoos are only considered of health interest as markers of risk taking behavior<sup>10,22</sup>.

Communicational programs for health care professionals seem no more aware than the specialized literature. In the web site of the semFYC (Spanish society of family and community medicine), we can find a guide so that physicians can advise patients willing to get a tattoo<sup>29</sup>. Besides from giving tips on what is recommendable to tattoo one's self (neither names nor catalog designs), from the sanitary point of view, it recommends to:

- apply during 1-2 weeks an antibiotic cream every day
- do not expose to sun directly
- apply hydrating lotion

We can see how health risks aren't mentioned whatsoever.<sup>29</sup>

## VI. Conclusions

Currently, 12% of the whole European population has one or more tattoos which correspond to more than 60 million people in the European Union.

Most of the anthropological and sociological research agrees in understanding the increase popularity of tattoos in Western societies as a mass consumer phenomenon, comparable to other consumption practices where people seek to beautify their bodies according to current fashion norms.

A review of the medical literature on health hazards due to tattooing and PMU practices shows an increase report of adverse health effects of an infectious and non-infectious nature. It should be noted that since there are no systematic data gathering of the tattooed population, the actual extent and prevalence of tattoo adverse health effects as reported in the medical literature is currently non-conclusive and with a large predominance of those of a dermatological nature

Few studies have been carried out in Europe (six in Italy and one in Denmark) about the public awareness of health risks involved in tattoo and PMU practices.

The studies show certain methodological limitations that make it difficult to extrapolate conclusions about risk perception of tattooing among the general European public although they all pointed out that concerns were focused just on the hygienic and infectious aspects of it. This could lead to negative consequences by conditioning an ill-informed choice.

Despite the increase report of adverse health effects linked to tattoo application and removal in the professional literature the perception of health care professionals on the health risks of body art, proved a widespread disinterest or ignorance despite some calls to incorporate this awareness in their continued professional education

This conclusion is in accord to the findings of the 2016 *JRC Science for policy report on safety of tattoos and PMU* for the European Commission that recommend that not only tattoo artists and the public but also health care professionals should be targeted in the development of communicational and preventive strategies.

## VII. Acknowledgments

I would like to acknowledge all the people that helped and contributed in carrying out this paper.

Firstly, I would like to express my sincere gratitude to my advisor Fernando Salmón, who accepted me in spite of the distance, for the continuous support of my study and related research, for his extreme patience, motivation, and knowledge. His guidance helped me learn during the whole research and writing of this paper. I could not have imagined having a better advisor and mentor for my TFG.

Besides my advisor, I would like to thank Roberto Martín, Marta Herrero and the rest of the library staff for their enormous help in providing the articles and material needed in the research.

My sincere thanks also go to my friends María, Santiago and Leyre who supported me in the final process.

Last but not the least; I would like to thank my parents and family.

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