

INVISIBLE RISKS: LAY PUBLIC PERCEPTION AND AWARENESS OF TATTOO-RELATED INFECTION RISKS

NEVIDITEĽNÉ RIZIKÁ: LAICKÉ VNÍMANIE A POVEDOMIE O INFEKČNÝCH RIZIKÁCH SPOJENÝCH S TETOVANÍM

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ABSTRACT

Background: The study focuses on analysing public attitudes and levels of awareness regarding the risk of blood-borne infections that may arise because of tattooing. The aim was to identify the respondents' level of knowledge about possible health risks, particularly blood-borne infections such as hepatitis B, hepatitis C, and HIV/AIDS.

Methods: The study was conducted using a self-designed questionnaire that had undergone pilot testing. The research sample consisted of N = 415 respondents (79.8 % women; 20.2 % men) with a mean age of 27.1 ± 9.5 years from various regions of the Slovak Republic. Data were collected via online distribution through e-mail addresses, social media, and cooperation with professional tattoo artists. Statistical analysis was performed using descriptive and inferential statistics (significance level $p < 0.05$).

Results: The results revealed statistically significant differences in the perception of tattoo-related risks between tattooed (N = 348) and non-tattooed respondents (N = 67) ($p < 0.00001$), as well as between genders, with 92.4% of women versus 77.4 % of men reporting awareness of health risks ($p = 0.000062$). Education level was also significantly associated with tattoo status ($p = 0.000629$). All respondents prioritized studio hygiene standards such as skin disinfection, the use of sterile instruments, and the use of gloves.

Conclusion: The findings indicate the need for more targeted public education regarding hygiene standards and the potential risks associated with tattooing. The study also highlights the importance of regulating tattoo services and raising awareness of safe practices in this area.

Key words: Tattooing, Blood-borne diseases, Hygiene risks, Public health, Lay public perception and awareness.

ABSTRAKT

Východiská: Štúdiá sa zameriava na analýzu postojov a úroveň povedomia laickej verejnosti v súvislosti s rizikom prenosu krvných infekcií, ktoré môžu vzniknúť v dôsledku tetovania. Cieľom bolo identifikovať mieru informovanosti respondentov o možných zdravotných rizikách, najmä o infekciách prenášaných krvou, ako sú hepatitída B, hepatitída C a AIDS.

Metódy: Štúdiá bola realizovaná pomocou dotazníka vlastnej konštrukcie, ktorý prešiel pilotným testovaním. Výskumnú vzorku tvorilo N = 415 respondentov (79,8 % žien; 20,2 % mužov) s priemerným vekom 27,1 ± 9,5 roka z rôznych regiónov

Slovenskej republiky. Zber dát prebiehal prostredníctvom online distribúcie (e-mail adresy, sociálne siete, spolupráca s profesionálnymi tatérmi). Štatistická analýza dát bola vykonaná s využitím deskriptívnej a inferenčnej štatistiky (hladina významnosti $p < 0,05$).

Výsledky: Výsledky ukázali štatisticky významné rozdiely vo vnímaní rizík spojených s tetovaním medzi tetovanými (N = 348) a netetovanými (N = 67) respondentmi ($p < 0,00001$), ako aj medzi pohlaviami, keď zdravotné riziko uviedlo 92,4 % žien oproti 77,4 % mužov ($p = 0,000062$). Preukázala sa aj súvislosť medzi vzdelaním a výskytom tetovania ($p = 0,000629$). Za najdôležitejšie hygienické štandardy v tetovacích salónoch respondenti, bez ohľadu na prítomnosť tetovania, považovali dezinfekciu kože pred zákrokom, používanie jednorazových a sterilných nástrojov a nosenie rukavíc personálom.

Záver: Zistenia naznačujú potrebu cielenejšej edukácie verejnosti o hygienických štandardoch a potenciálnych rizikách spojených s tetovaním. Štúdiá zároveň upozorňuje na dôležitosť regulácie tetovacích služieb a zvyšovania povedomia o bezpečných praktikách v tejto oblasti.

Kľúčové slová: Tetovanie, Krvou prenosné ochorenia, Hygienické riziká, Verejné zdravie, Vnímanie a povedomie laickej verejnosti.

INTRODUCTION

Tattooing, which has become increasingly popular across different age and social groups, involves the insertion of pigment into the skin dermis using needles. It serves aesthetic, symbolic, and cultural purposes. As its popularity continues to grow, the demand for tattoo services is increasing, thereby underscoring the importance of safety and hygiene standards. Tattooing is associated with various risks, particularly blood-borne infections such as hepatitis B, hepatitis C, and HIV/AIDS. These infections represent a significant public health concern, with serious consequences for both individuals and society. Tattooing constitutes a potential route factor for the transmission of viral infections, especially when tools are reused or inadequately

sterilized. For this reason, strict adherence to hygiene and technical standards in tattoo studios is essential [1]. The rising popularity of tattooing highlights the need to strengthen public awareness of associated infection risks, as inadequate risk perception may lead to the underestimation of these hazards, and consequently, to the selection of unsafe facilities. Systematic monitoring of public awareness of tattoo-related infections represents a key component of public health protection.

This study examined the attitudes and knowledge of the lay public regarding the risk of blood-borne infection associated with tattooing. The aim was to quantify differences in awareness between demographic groups, with a particular focus on age and educational attainment, and to identify the key factors determining the perception of this health risk. The findings may contribute to the more effective development of educational strategies, increased awareness of safe tattooing practices, and the implementation of measures aimed at protecting public health, including the integration of artificial intelligence tools. Artificial intelligence can facilitate the identification and analysis of data not originally collected for epidemiological purposes, such as information derived from social media, electronic health records, or other digital sources [2].

MATERIAL AND METHODS

In this cross-sectional descriptive study, a self-constructed questionnaire was employed for data collection. The content validity of the instrument was established through an analysis of relevant scholarly literature on tattooing, hygiene-related risks, and hematogenous infections. Subsequently, the research instrument underwent pilot testing. The questionnaire was designed to assess respondents' attitudes and levels of knowledge, as well as to examine their association with the perceived risk of blood-borne infection transmission related to tattooing. The study was conducted among respondents from various regions of the Slovak Republic. The questionnaire included basic demographic variables (age, gender, educational attainment, and place of permanent residence), information regarding personal experience with tattooing, knowledge and attitudes toward health risks (with particular emphasis on blood-borne pathogens), and criteria for selecting a tattoo studio.

The instrument consisted of open-ended, closed, and semi-closed questions, while attitudinal items were measured using a Likert scale. Data collection was carried out between September and October 2024 via the online platform Google Forms. Of the 419 returned questionnaires, four were excluded due to incompleteness or errors, resulting in a final sample of 415 fully completed questionnaires (100 %). A purposive sampling strategy was applied. The questionnaire was disseminated through social media, tattoo artist profiles, and email communication with publicly listed studios it was also shared directly by tattoo artists to reach individuals with tattoos. Prior to participation, all respondents were informed about the purpose of the study and provided informed consent.

Statistical analysis was conducted using the Social Science Statistics software. Data analysis involved descriptive and inferential statistics. The chi-square test and the Mann-Whitney test were used to analyse relationships between variables. The level of statistical significance was set at $p < 0.05$.

RESULTS

The demographic structure of the sample revealed clear differences between tattooed and non-tattooed respondents in Table 1. Overall, more than half of the participants were employed (55.20 %), while students also constituted a substantial proportion (37.60 %).

The largest age group comprised respondents aged 20 – 24 years (41.90 %), followed by those aged 25 – 29 years (17.30 %) and 15 – 19 years (14.00 %). Other age categories were less represented, with respondents over 50 years of age constituting the smallest proportion (4.10 %). The mean age of the sample was 27.1 years (SD = 9.5), and the median age was 23 years.

The distribution of age at first tattooing was observed in the 15 – 19 age group, accounting for 62.60 % (N = 260) of all tattooed respondents. This was followed by the 20 – 24 age group (19.50 %; N = 81) and the 25 – 29 age group (7.50 %; N = 31). The mean age at first tattooing was 20.2 years (SD = 5.9). None of the respondents had their first tattoo after the age of 50.

Analysis of factors influencing the selection of a tattoo studio or artist indicated that the most important criterion was the professional experience of

Table 1 Demographic Data and Tattoo Prevalence (n = 415)

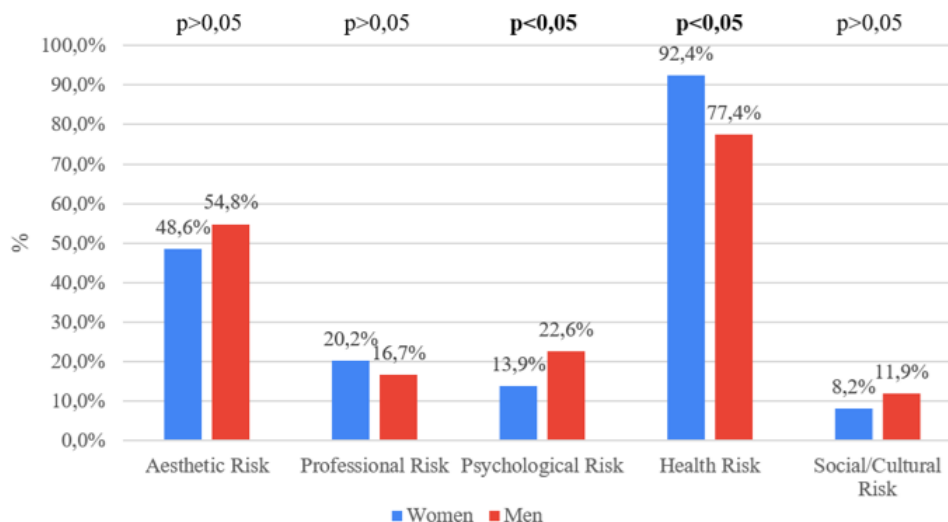
Category		Tattooed (%)	Non-Tattooed (%)	Total (Abs.)	Total (Relat. %)
Gender	Women	275 (66.30 %)	56 (13.50 %)	331	79.80 %
	Men	73 (17.60 %)	11 (2.70 %)	84	20.20 %
Residence	Urban	229 (55.20 %)	44 (10.60 %)	273	61.80 %
	Rural	119 (28.70 %)	23 (5.50 %)	142	34.20 %
Education	None	1 (0.20 %)	0 (0.00 %)	1	0.20 %
	Primary	14 (3.40 %)	5 (1.20 %)	19	4.60 %
	Secondary	227 (54.70 %)	27 (6.50 %)	254	61.20 %
	Higher	106 (25.50 %)	35 (8.40 %)	141	34.00 %
Economic Activity	Student	124 (29.90 %)	32 (7.70 %)	156	37.60 %
	Unemployed	5 (1.20 %)	3 (0.70 %)	8	1.90 %
	Maternity/ Parental Leave	19 (4.60 %)	1 (0.20 %)	20	4.80 %
	Employed	199 (48.00 %)	30 (7.20 %)	229	55.20 %
	Retired	1 (0.20 %)	1 (0.20 %)	2	0.50 %

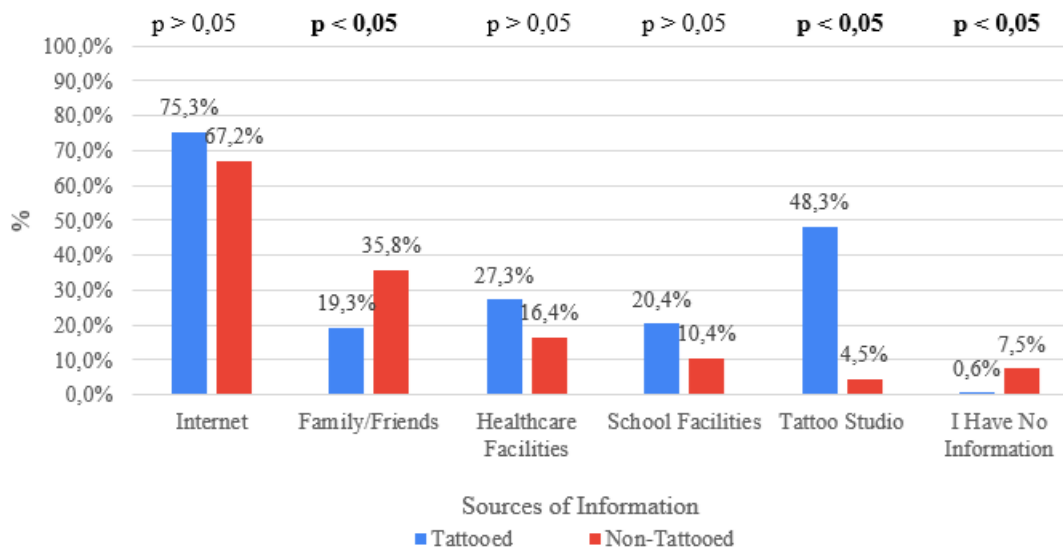
the tattoo artist (74.10 %), followed by personal recommendations from acquaintances (62.40 %) and the content of artist's portfolio (57.80 %). Less influential factors included service price (40.80%) and the perceived trustworthiness based on preliminary communication (39.90 %). The location of the studio (21.80 %) was clearly considered the least relevant criterion.

The analysis of gender differences in the perception of health risks (Graph 1) demonstrated a statistically significant association. Women significantly more often considered health risks to be important (92.40 %) compared to men (77.40 %; $p < 0.001$). Conversely, men reported a significantly higher perception of psychological risks (22.60 %) than women (13.90 %; $p = 0.049$). No statistically significant

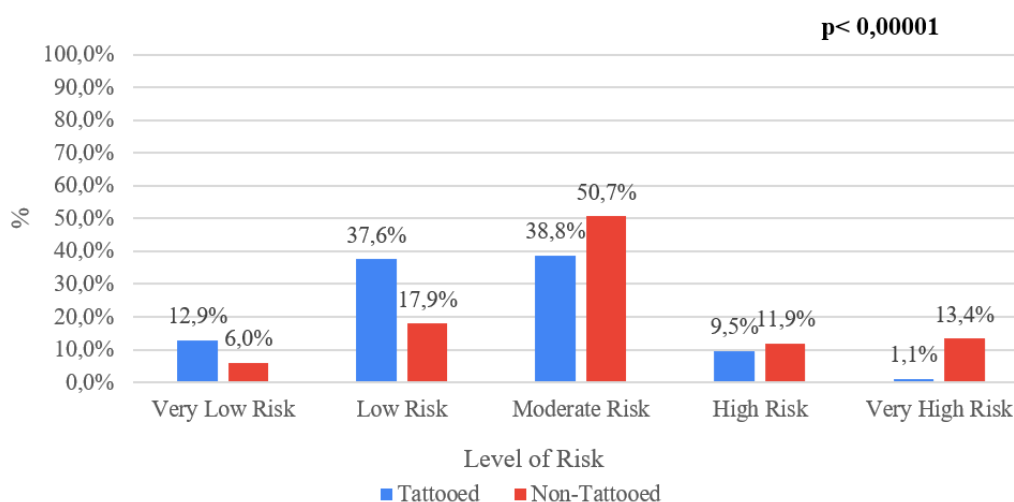
gender differences were identified in the perception of aesthetic, professional, and socio-cultural risks.

Knowledge of tattooing-associated blood-borne infections was comparable between tattooed and non-tattooed respondents. HIV/AIDS was the most frequently identified infection (75.60% tattooed respondents and 71.60 % non-tattooed respondents), followed by hepatitis B (tattooed: 43.70 %; non-tattooed: 41.80 %) and hepatitis C (tattooed: 40.50 %; non-tattooed: 35.80 %). Awareness of vector-borne and other infections was lower (15.8 % vs. 13.4 %), while 13.2 % of tattooed and 16.4 % of non-tattooed respondents reported no knowledge no associated infections. Overall, no statistically significant differences in awareness were observed between the groups ($p > 0.05$).

**Graph 1** Analysis of Differences in the Perception of Health Risks Based on Genders (n = 415)



Graph 2 Analysis of Respondents' Sources of Information About Tattoo-Related Risks (respondents could select more than one option; n = 415)



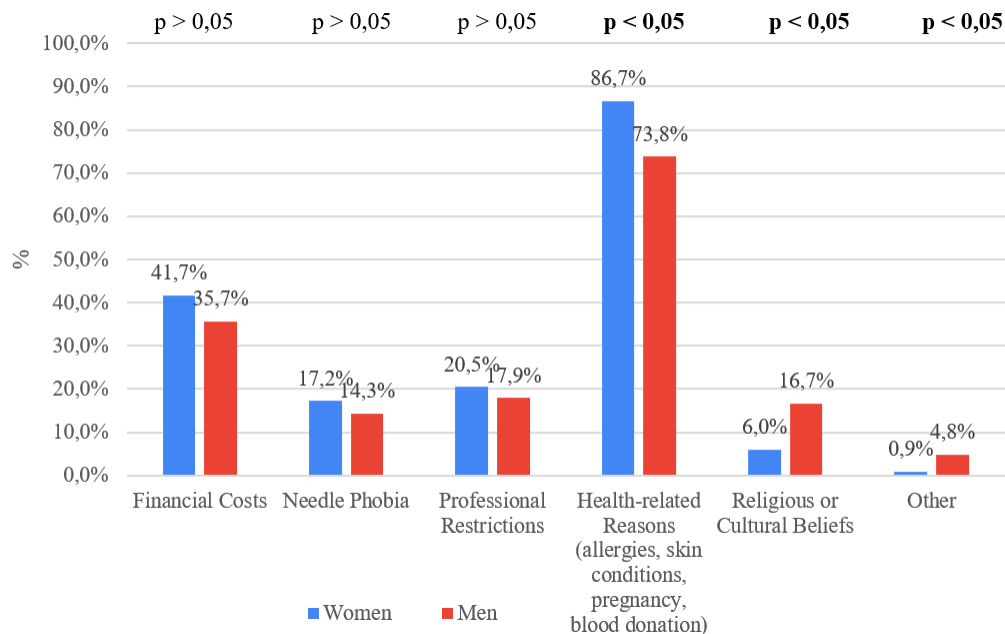
Graph 3 Analysis of Perceived Risk Associated with Tattooing Among Respondents (n = 415)

Graph 2 presents the sources of information regarding tattoo-related risks. Among tattooed respondents, the predominant source was the internet (75.30 %), followed by information obtained directly from tattoo studios (48.30 %). In the non-tattooed group, the internet was likewise the most frequently reported source. Statistically significant differences between the groups were identified for information obtained from family and friends ($p = 0.003$), information received in tattoo studios ($p < 0.001$), and reporting the absence of information ("I have no information") ($p < 0.001$).

The subjective perception of the overall health risk associated with tattooing is shown in Graph 3. Among

tattooed respondents, low (37.60 %) and medium (38.80 %) levels of perceived risk predominated, very low risk was reported by 12.90% and high risk by only 9.50%. In contrast, non-tattooed respondents more frequently perceived higher level of risk, most commonly reporting medium (50.70 %), high (11.90 %), and very high risk (13.40 %). The difference in risk perception between tattooed and non-tattooed respondents was statistically significant ($p < 0.001$).

Graph 4 illustrates the barriers reported as reasons for not obtaining a tattoo or not seeking an additional tattoo. Health-related contraindications (for example allergies, skin diseases, pregnancy, and blood dona-



Graph 4 Analysis of Reasons for the Absence of tattooing by Gender (respondents could select more than one option; n = 415)

tion restrictions), represented the principal barrier and were significantly more frequently reported by women, than by men (73.80 %; $p < 0.05$). In contrast, religious or cultural beliefs were significantly more often reported by men (16.70 %) than by women (6.0 %; $p < 0.05$). A statistically significant gender difference was also identified in the category “other reasons” ($p < 0.05$).

DISCUSSION

This study analysed public awareness and attitudes toward tattooing. The high proportion of young respondents in the sample (mean age: 27 years) reflects the relevance of this topic to this demographic group, which perceives tattooing as a popular form of aesthetic and symbolic self-expression [3]. This finding is consistent with European trends indicating a higher prevalence of tattooing among younger individuals and women [4, 5].

The prevalence of tattooing in our sample (83.90 %) was higher than that reported in international population-based studies, which may be attributed to the age structure of the respondents and the use of an online purposive sampling method. The mean age at first tattoo was 20.2 years, with the majority (62.60 %) receiving their first tattoo between the ages of 15 and 19. Similarly, the authors of the study [6] reported that 15.40 % of partici-

pants had obtained a tattoo before the age of 17, underscoring the relevance of the issue of tattooing among minors. Study [7] emphasises the need for parental or legal guardian consent and identity verification for underage clients. However, in our sample, 55.10 % of respondents reported that the tattoo artist had not required such consent, and 8.90 % of minors indicated that the authenticity of the consent had not been even verified. This finding suggests insufficient adherence to legislative requirements in practice.

Our results further demonstrated a significantly higher proportion of tattooed individuals in urban areas (55.2 %) compared to rural areas (28.7 %). This pattern is supported by study [8], which attributes the higher prevalence of tattooing in urban settings to cultural and social factors, including greater availability of tattoo studios and higher levels of acceptance of diversity. A statistically significant difference in educational attainment was identified between tattooed and non-tattooed respondents. Tattooed individuals most frequently had secondary education (65.2 %), whereas higher education predominated among non-tattooed respondents (52.2 %). According to the study [9], higher educational attainment is associated with a lower likelihood of being tattooed, while tattooing is more common among individuals with vocational or lower levels of education.

Our findings indicated a predominance of positive reactions to tattoos, followed by neutral reactions, while negative reactions were the least frequent. With respect to gender, positive reactions were more commonly reported by women (44.30 %) than by men (12.70 %). The results also indicate that prejudices toward tattooed individuals persist, particularly among older age groups and certain professional categories, in which tattoos are perceived more negatively. In contrast, younger respondents expressed more open and accepting attitudes, which is consistent with the findings of the study [10].

The selection of a tattoo studio represents a key factor in ensuring both the safety and quality of the tattooing procedure. In our study, most respondents (74.10 %) considered the professional competence and certification of the tattoo artist to be the primary criterion, followed by personal recommendations from acquaintances (62.40 %) and portfolio quality (57.80 %). Factors such as price, location, and perceived trustworthiness based on communication were less influential. This consumer profile, oriented toward safety and quality, is in line with the conclusions of the study [11], which emphasises that certified and professional studios are essential for maintaining hygiene standards and professional competence. Regarding hygiene practices, tattooed respondents prioritized skin disinfection before tattooing (81.90 %), wearing gloves (81.70 %), and the use of sterile needles (81.40 %), while studio cleanliness (79.00 %) and surface disinfection after each client (77.30 %) were also highly rated. Non-tattooed respondents evaluated these measures even more critically, particularly sterile instruments (95.50 %) and skin disinfection (94.00 %), indicating stronger preventive concerns.

Higher education attainment is associated with better perception of hygiene standards, which enhancing safety and infection prevention [12]. Overall, our results highlight the critical role of hygiene awareness and appropriate artist selection and support the need for systematic educational campaigns aimed at preventing complications.

Perceptions of tattoo-related health risks differed according to personal experience. Most tattooed respondents (76.40 %) rated the risk as low or moderate, whereas non-tattooed individuals expressed greater concern. This finding suggests that personal experience with tattooing may reduce perceived risk, with implications for public education.

Risk perception plays a crucial role in individual decision-making. Insufficient awareness or the use of non-certified services may increase the likelihood of complications, particularly blood-borne infections. Our study found that women perceived significantly greater health risks (92.40 %) than men (77.40 %), which may be related to higher health awareness [13]. Regarding aesthetic risks, men placed greater emphasis on the permanence and appearance of the tattoo (54.80 %) than women (48.60 %), suggesting gender differences in aesthetic considerations and perceptions of long-term implications. Women also reported professional risks more frequently (20.20 % vs. 16.70 %), potentially reflecting greater concern about workplace discrimination [14]. Overall, non-tattooed respondents rated all risk categories as more important than tattooed individuals. This more critical perception may represent a psychological barrier to obtaining a tattoo.

Public risk perception demonstrated a discrepancy with clinically relevant risks associated with tattooing. Although HIV/AIDS, was most frequently mentioned as the primary health risk by both groups (tattooed: 75.60 %; non-tattooed: 71.60 %), awareness of hepatitis B (tattooed: 43.70 %; non-tattooed: 41.80 %) and hepatitis C (40.50 % and 35.80 %), which are more directly relevant in this content, was substantially lower. A notable proportion of respondents (13.2 % vs. 16.4 %) reported of associated blood-borne infections, indicating significant gaps in public health awareness. These findings partially correspond with studies [8, 15, 16], which reported high awareness of HIV/AIDS but lower awareness of hepatitis B and C.

Complications associated with tattooing include bleeding, scarring, bruising, local infections, and allergic reactions [17]. In our sample, complications were reported by 6.90 % of respondents who had followed recommended aftercare instructions, while 90.20 % reported no complications. The study [11] notes that complications may occur even when hygiene standards are observed, primarily due to contaminated inks, up to 10 % of which may contain bacteria.

The findings of this research suggest that awareness levels and attitudes toward tattooing are influenced by individual characteristics, including age, gender, education, and socio-cultural environment. Despite increasing public interest, access to reliable

information remains limited, and many individuals rely on unverified sources, which may contribute to distorted perceptions of risk.

LIMITATION

The main limitation of the study is the disproportionate representation of tattooed respondents (83.90 %) compared with non-tattooed individuals, which results from purposive sampling focused on a group exposed to risks associated with tattooing. Consequently, the findings primarily reflect the level of awareness and attitudes of this specific group and may not be fully generalizable to the non-tattooed population.

Differences in sample composition, data collection methods, and research objectives compared with previous studies may influence the interpretation of the results. These factors limit direct comparability and may account for discrepancies in the observed patterns and conclusions. Although the study provides valuable insights into the knowledge and attitudes of tattooed individuals, caution is warranted when extrapolating the findings to the broader population or to other sociocultural contexts.

The strengths of the study include the targeted selection of respondents, which enables an in-depth examination of the knowledge and attitudes of a group exposed to risks associated with tattooing. The study provides important insights into tattooed individuals' perceptions of risks and preventive measures, which is relevant for health education and the development of interventions targeting this specific population. The findings, therefore, offer a valuable basis for professional practice and further research in the fields of public health and safe tattooing.

CONCLUSION

Blood-borne infections represent a significant public health concern affecting both individuals and society, with the increasing popularity of tattooing posing a potential risk factor in their transmission. The findings emphasize the necessity for strict control of tattooing services, adherence to hygiene and legislative standards, and targeted education on health risks and prevention, particularly among young people. The approach to the issue of tattooing should be multidisciplinary, combining healthcare, sociological, psychological, and educational strategies, including the implementation of

artificial intelligence systems. Educational efforts should involve not only healthcare workers but also public health professionals, media, and education specialists, thereby supporting safe and informed decision-making among individuals.

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