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KNOWLEDGE, ATTITUDES, AND PRACTICES REGARDING ANTIMICROBIAL RESISTANCE IN DERMATOLOGICAL CARE

AUTHOR'S EXTENDED ABSTRACT

of a Thesis for the Award of the Degree of
Doctor of Philosophy (PhD)

Professional Field: 7.4 Public Health
Doctoral Program: Public Health Management

Scientific Supervisor:
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Varna, 2026

The Thesis was approved and recommended for public defence at a meeting of the Department of Social Medicine and Organization of Healthcare at the Medical University of Varna Prof. Dr. Paraskev Stoyanov.
The manuscript comprises 165 pages and includes 8 tables, 26 figures, and 2 appendices.

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The public defence of the Thesis will be held on 24 November 2026 at 10:30 a.m. (EET), via Webex and in Hall ……. at the Medical University of Varna.

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LIST OF ABBREVIATIONS

AB	Antibiotics
AMR	Antimicrobial Resistance
HAIs	Healthcare-Associated Infections
EU	European Union
IPC	Infection Prevention and Control
PPE	Personal Protective Equipment
MH	Ministry of Health
RHI	Regional Health Inspectorate
WHO	World Health Organization
CDC	Centre for Disease Control and Prevention
COVID-19	Coronavirus Disease 2019
ECDC	European Centre for Disease Prevention and Control
GEA	Global Acne Grading Scale
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency Virus

INTRODUCTION

Antimicrobial resistance (AMR) is one of the most critical global public health threats of the 21st century. By limiting the prospects for effective treatment of bacterial infections, AMR compromises the efficacy of modern medicine. Containing AMR requires a coordinated approach focused on the rational use of antimicrobial agents, effective surveillance, infection prevention and control, and the promotion of health literacy.

The relationship between AMR and skin health warrants particular attention due to the frequent use of topical and systemic antibiotics in the management of acne vulgaris. Given the condition's high prevalence, chronic nature, and need for prolonged antibiotic therapy, acne extends beyond a dermatological and aesthetic concern to become a significant public health issue. Adolescents and young adults are especially prone to self-medication, given the high disease burden, easy access to health information, and regular use of pharmaceutical and cosmetic products without consultation with a healthcare professional. Self-medication, inappropriate medication choices, suboptimal treatment duration, and the reuse of old prescriptions further increase the risk of AMR.

Infection prevention and control (IPC) in cosmetic practice constitutes another essential pillar in preventing antimicrobial resistance associated with dermatological care. Because cosmetic procedures involve close physical contact with the skin, the use of reusable instruments, and interventions that may disrupt the cutaneous barrier, they may facilitate the cross-transmission of microorganisms. To mitigate these risks, international guidelines recommend the systematic application of standard precautions, including risk assessment, rigorous hand and respiratory hygiene/cough etiquette, the appropriate use of personal protective equipment (PPE), safe injection practices and aseptic techniques, environmental cleaning and maintenance, decontamination and reprocessing of reusable

instruments, safe management of linen, and proper waste management.

In Bulgaria, there is a lack of comprehensive research examining both young people's knowledge, attitudes, and practices regarding antibiotic use for skin conditions and professional cosmetologists' knowledge, attitudes, and practices concerning infection prevention and control, and measures to contain AMR. In addition, the current regulatory framework for cosmetic establishments was developed more than three decades ago and does not adequately reflect contemporary concepts of infection prevention and control and risk management.

Against this background, the present doctoral dissertation examines the knowledge, attitudes, and practices related to AMR in the context of skin health, with particular attention to antibiotic use for skin conditions, self-medication among young people, and IPC in cosmetic practice. The findings may contribute to the development of targeted educational interventions, the improvement of professional training, the updating of the regulatory framework, and the enhancement of the safety of cosmetic services.[1]

[1] The references cited in this dissertation abstract are available from the author upon request.

AIM, OBJECTIVES, MATERIALS AND METHODS

1. Aim of the study

The principal aim of this study is to analyse two key facets of the relationship between antimicrobial resistance (AMR) and cosmetic practice:

- To assess the knowledge, attitudes, and practices (KAP) of young people with acne regarding antibiotic self-medication, thereby identifying educational gaps and raising awareness of AMR.
- To investigate the knowledge, attitudes, and professional practices of cosmetologists concerning infection control and measures to prevent AMR in dermatological care.

2. Research Objectives

To achieve this aim, the following specific objectives were established:

1. To assess the level of awareness among young people with acne regarding antimicrobial agent use and self-medication practices, as well as their attitudes toward AMR.
2. To analyse and compare patterns of antibiotic use and self-medication across demographic and attitudinal groups, stratified by sex, age, level of awareness, and attitudes toward AMR.
3. To review international and national regulatory frameworks governing infection control, cross-infection prevention, and AMR in cosmetic practice.
4. To investigate the knowledge, attitudes, and professional practices of cosmetologists with respect to infection control, the prevention of cross-infections in their professional work, and the issue of AMR.

5. To identify key trends and interrelationships linking levels of awareness and attitudes toward AMR with gaps in professional cosmetic practice.

3. Research Hypotheses

The following working hypotheses were formulated in line with the study's objectives:

Hypothesis 1: Young people with acne have an inadequate level of awareness regarding appropriate antibiotic use and the risks associated with AMR in acne treatment, which fosters self-medication practices.

Hypothesis 2: There are statistically significant differences in awareness and behaviours concerning antibiotic use and self-medication across demographic subgroups, particularly by sex and age.

Hypothesis 3: Higher levels of AMR-related knowledge among young people are associated with more responsible antimicrobial use and a lower inclination toward self-medication.

Hypothesis 4: The Bulgarian regulatory framework governing infection control in cosmetic practice and AMR prevention diverges from current international standards and recommendations.

Hypothesis 5: Cosmetologists demonstrate sound general knowledge of basic infection control principles, but gaps exist in their practical application - specifically regarding cross-infection prevention and the issue of AMR.

Hypothesis 6: There is a positive relationship between cosmetologists' level of AMR-related knowledge and attitudes and their degree of

adherence to recommended infection control practices in their professional work.

4. Materials and Methods

To achieve the aim and fulfil the research objectives, the following studies were designed and conducted:

- A systematic review of the scientific literature and official documents issued by health institutions, professional organizations, and regulatory bodies, focusing on guidelines and regulatory requirements for infection prevention and control directly related to cosmetic services, complemented by a comparative analysis of the Bulgarian regulatory framework and international regulations;
- A descriptive cross-sectional study of knowledge, attitudes, and the frequency and patterns of antibiotic self-medication for acne among young people in Bulgaria, and their awareness of AMR;
- A descriptive cross-sectional study of cosmetologists' knowledge, attitudes, and practices concerning infection control and adherence to the principles of cross-infection prevention in their professional practice, and their attitudes toward AMR;

4.1. Analysis of International and National Guidelines and Recommendations for Infection Prevention and Control in Cosmetic Salons.

A systematic review was conducted of scientific publications and official documents issued by health institutions, professional organizations, and regulatory bodies that contain guidelines or regulatory requirements for infection prevention and control directly relevant to cosmetic services. The search was conducted in English and Bulgarian using the electronic databases PubMed and Google Scholar. The following keywords and their combinations were used in the search strategy: *infection prevention*, *infection control*, *guidelines*, *regulations*, *standards*, *cosmetic services*, and *beauty services*. The

search strategy employed combinations of the terms *infection prevention & (guidelines* or *regulations* or *standards) & (cosmetic* or *beauty)*, combined with the names of European countries, the USA, Canada, Australia, New Zealand, and Bulgaria.

In addition, a targeted search was carried out on the official websites of international and national health institutions, professional organizations, and regulatory bodies to identify current guidelines, recommendations, and regulatory documents pertaining to infection prevention and control in cosmetic salons.

Recommendations issued by leading international and national institutions were reviewed and compared, including the World Health Organization (WHO) and the Centres for Disease Control and Prevention (CDC).

An additional analysis was conducted of the regulatory framework in the Republic of Bulgaria, including Ordinance No. 15 of 21 August 1987 and Ordinance No. 3 of 8 May 2013.

For each document, information was extracted on: (1) country of origin; (2) year of issuance; (3) institution responsible for developing the regulations or guidelines; (4) scope of the document, including the core IPC requirements in comparison with standard international measures; and (5) characteristics of the regulatory approach to IPC, including the degree of enforceability and the mechanisms for oversight.

The reference lists of the relevant documents were also screened to identify additional sources of information.

4.2. Study on Knowledge, Attitudes, and the Frequency and Patterns of Antibiotic Self-Medication for Skin Problems among Young People in Bulgaria.

Study Design

From September to November 2025, a descriptive cross-sectional study was conducted to assess the knowledge, attitudes, and

behaviours of young people aged 18-35 years regarding acne frequency, self-medication, and antimicrobial use.

The target population comprised young adults from Bulgaria. Participants were recruited through an online survey conducted among students from various academic programmes at the Medical University – Varna, as well as through the distribution of the questionnaire in student online communities and Viber groups. The questionnaire was also distributed through student groups at various higher education institutions across the country, including Student City – Sofia, Sofia University "St. Kliment Ohridski," Varna Free University "Chernorizets Hrabar," Paisii Hilendarski University of Plovdiv, Agricultural University – Plovdiv, Trakia University – Stara Zagora, Medical University – Pleven, University of Architecture, Civil Engineering and Geodesy – Sofia, Technical University – Sofia, New Bulgarian University, and University of Chemical Technology and Metallurgy – Sofia, as well as groups of law students at Sofia University and pedagogy students at University of Ruse "Angel Kanchev."

Participant Selection and Sampling Frame:

The sampling frame comprised all young adults aged 18 to 35 in Bulgaria.

Inclusion Criteria

Participants were eligible for inclusion if they:

- were between 18 and 35 years of age at the time of completing the survey;
- provided informed consent for participation electronically, prior to completing the questionnaire.

Exclusion Criteria

Participants were excluded if they:

- were under 18 or over 35 years of age;

- did not provide informed consent;
- submitted incomplete questionnaires or questionnaires containing evidently inconsistent responses, identified during data quality checks.

Research Instrument

The questionnaire was developed for self-administration in an online format, based on a review of the scientific literature on self-medication for skin conditions and the rational use of antimicrobial agents, as well as on established approaches to investigating knowledge, attitudes, and behaviours related to antibiotic use and antimicrobial resistance. The instrument was designed to assess the frequency and characteristics of self-medication for acne among young people; the reasons for choosing self-medication and preferred treatment approaches, including the use of antibiotics; sources of information and the level of basic medication-related awareness; and attitudes toward the safety, effectiveness, and acceptable limits of self-medication compared with consultation with a healthcare professional.

The questionnaire employed a predominantly closed-ended format, comprising single-choice items (selected from multiple presented options), multiple-choice items (allowing selection of more than one answer), and dichotomous (yes/no) items, with an "Other" option included for certain items to allow further specification. The introduction to the questionnaire presented the purpose of the study, emphasises the voluntary nature of participation, and guarantees the anonymity and confidentiality of the data. Access to the remaining sections was granted following electronic confirmation of informed consent to participate in the study.

The final instrument consisted of 58 items, organised into six thematic sections:

1. Physical and Psychoemotional Health and Psychosocial Factors (10 items): This section assessed respondents' general health status;

presence of chronic conditions; reproductive characteristics among female participants; psychological and emotional stress; social contacts; and experiences related to loneliness, anxiety, and negative comments regarding appearance.

2. Lifestyle and Dietary Habits (4 items): This section addressed sleep patterns, physical activity, subjective assessment of dietary patterns, and frequency of consumption of various food and beverage groups.
3. Tobacco, Psychoactive Substance, and Alcohol Use (8 items): This section examined tobacco smoking, the use of cannabis and other psychoactive substances, as well as frequency of alcohol consumption.
4. Skin Characteristics and Acne Profile (8 items): This section explored skin type, presence of acne, age of onset, duration of symptoms, location, severity of acne manifestations, family history, and seasonal fluctuations in disease course.
5. Knowledge, Attitudes, and Practices Regarding Acne and Its Treatment (20 items): This section investigated knowledge of the causes, risk factors, and treatment of acne; attitudes toward self-medication, antibiotic therapy, and the role of healthcare professionals in the diagnosis and management of the condition; and practices related to the choice and use of various therapeutic approaches, including topical and systemic medications, frequency of antibiotic use, sources of treatment-related information, and medication-taking behaviours. The section also included items pertaining to the rational use of antibiotics, awareness of potential adverse effects, duration of antibiotic therapy, adherence to therapeutic recommendations, and attitudes toward the safe use of antimicrobial agents, serving as indirect indicators of awareness of the risk of developing antimicrobial resistance.
6. Sociodemographic Characteristics and Socioeconomic Context (8 items): This section collected information on participants' age, sex,

anthropometric indicators, education, employment status, financial capacity, and place of residence.

Primary Data Collection Methods:

The questionnaire investigating the knowledge, attitudes, and behaviours of young people aged 18-35 regarding self-medication for skin problems was developed for self-administration in an online format and distributed via the Google Forms platform. Completed questionnaires were received automatically in the researcher's account on the platform, with data stored in a secure environment accessible only to the research team.

The following methods were used to reach potential respondents:

- Invitations containing a link to the online questionnaire were distributed among students enrolled in various academic programmes at Medical University – Varna through university and informal student communication channels, including email correspondence and group messages;
- Invitations containing a link to the questionnaire were sent via personal and group messages through the Viber application to students at higher education institutions across Bulgaria who were members of thematic and study-oriented student groups;
- With the prior approval of the administrators of the relevant groups, public invitations with survey links were posted in online youth communities and social media groups targeting young people;
- The survey link was disseminated using snowball sampling, with respondents encouraged to share the invitation with other young people in their social networks who fell within the study's age range.

The invitation to participate contained brief information about the purpose of the study, an assurance of the voluntary nature of

participation, a guarantee of anonymity and confidentiality of the data provided, and a link to the online questionnaire. Completion of the questionnaire was possible only after participants had provided electronic informed consent.

4.3. Study on Professional Cosmetologists' Knowledge, Attitudes, and Practices Concerning Infection Prevention and Control and Adherence to the Principles of Cross-Infection Prevention in Their Professional Practice, and Their Attitudes toward AMR

Study Design

From June to August 2025, a descriptive cross-sectional study was conducted to assess the knowledge, attitudes, and practices of practising cosmetologists in Bulgaria regarding infection control in their professional practice, including their attitudes toward AMR.

Participant Selection and Sampling Frame:

The sampling frame comprised all individuals practising in cosmetic salons operating in the Republic of Bulgaria and registered in the official registers of establishments of public significance maintained by the 28 Regional Health Inspectorates (RHIs) in the country, operating under the Ministry of Health.

Inclusion Criteria

Participants were eligible for inclusion if they:

- were practising as cosmetologists at the time of the study;
- were aged 18 years or older;
- provided informed consent to participate in the study electronically, prior to completing the questionnaire.

No restrictions were imposed with regard to education or professional experience, with the aim of achieving broader representation of the sector.

Exclusion Criteria

Participants were excluded if they:

- were not practising as cosmetologists at the time of the study;
- declined to participate or did not provide informed consent;
- submitted incomplete questionnaires or questionnaires containing evidently inconsistent responses, identified during data quality checks.

Research Instrument

The questionnaire was developed for self-administration in an online format, based on information from instruments used in other published studies, as well as established recommendations of the WHO and the European Centre for Disease Prevention and Control, and standards for the control of healthcare-associated infections and occupational safety.

The instrument was designed to assess cosmetologists' knowledge, attitudes, and practices relating to infection control and AMR in dermatological care. It examined awareness of cross-infections and measures for their prevention; knowledge of AMR and the factors contributing to its development; attitudes toward the significance of the problem and the role of cosmetic practice in containing it; and professional practices relating to hygiene, disinfection and sterilisation, the use of antimicrobial products, the application of protective measures, and interaction with dermatologists regarding clients with skin infections.

The questionnaire employed a predominantly closed-ended format, comprising single-choice items (selected from multiple presented options), multiple-choice items (allowing selection of more than one answer), dichotomous (yes/no) items, and, in a limited number of cases, items with graded categories for frequency or assessment. This format allowed for quantitative analysis of the knowledge, attitudes, and practices of the study population.

The final instrument consisted of 45 items, organised into six thematic sections:

1. Awareness of Infection Control and Cross-Infection Prevention in Cosmetic Salons (7 items): This section assessed self-reported awareness of measures for preventing infections; understanding of the concept of "cross-infection"; the availability of protocols and instructions for infection control in the salon; knowledge of effective preventive methods for infection control; recognition of infections and diseases transmitted during cosmetic procedures; understanding of the distinction between sterilisation and disinfection; and safety indicators in cases of blood exposure.
2. Infection Control Practices in Cosmetic Salons (12 items): This section covered hepatitis B vaccination status; the availability and type of disinfection and sterilisation equipment in the salon; the organisation of instrument processing; specific cleaning practices and the frequency of instrument replacement or processing between clients; the use of personal protective equipment; situations requiring hand hygiene; types of disinfectants used; injuries involving sharp objects; collection of information from clients regarding infections; and previous training and sources of information.
3. Attitudes toward Infection Control (4 items): This section assessed perceptions of the seriousness of the problem; perceived personal risk of infection; attitudes toward periodic training; and assessment of the level of infection control measures in the salon.
4. Knowledge and Awareness of AMR (4 items): This section assessed baseline awareness of AMR, including whether respondents had heard of the term; their understanding of the term through selection of a definition; recognition of key factors contributing to the development of AMR; and knowledge of skin infections that most commonly require antibiotic treatment.

5. Attitudes and Practices Related to AMR, Antimicrobial Products, and Professional Interaction (11 items): This section assessed attitudes toward the relationship between salon activities and AMR; perceptions of the seriousness of AMR as a problem in contemporary dermatological care; understanding of the role of hygiene and disinfection in limiting AMR; willingness to recommend alternative methods to avoid excessive antibiotic use; attitudes toward collaboration with dermatologists; self-assessed risk of transmitting resistant bacteria through direct contact and perceived need for further training; and self-reported practices, including the use of antimicrobial products and antiseptics, consultation with dermatologists, and training on AMR.
6. Sociodemographic and Professional Characteristics of Participants (7 items): This section collected information on participants' sex, age, and years of professional experience (open-ended responses); educational level and specialty; geographical area of practice (capital/regional city, small town/village); participation in specialised continuing education courses; and time elapsed since the most recent such training.

Primary Data Collection Methods:

The questionnaire investigating cosmetologists' knowledge, attitudes, and practices regarding infection control and AMR was developed for self-administration in an online format and distributed via the Google Forms platform. Completed questionnaires were received automatically in the researcher's account on the platform, with data stored in a secure environment accessible only to the research team.

The following methods were used to reach potential respondents:

- Invitations containing a link to the questionnaire were sent individually by email to potential respondents - practising cosmetologists - where contact details were available;

- Invitations containing a link to the questionnaire were sent through personal and group messages via the Viber application to potential respondents, using professional and informal contacts within the cosmetology community;
- With the prior approval of the relevant administrators, public invitations with survey links were posted in professional online groups and platforms targeting specialists in the field of cosmetology, including professional groups for cosmetologists and medical cosmetologists on social media;
- The survey link was disseminated using snowball sampling, with respondents encouraged to share the invitation with other practising cosmetologists within their professional networks.

The invitation to participate contained brief information about the purpose of the study, an assurance of the voluntary nature of participation, a guarantee of anonymity and confidentiality of the data provided, and a link to the online questionnaire. Completion of the questionnaire was possible only after participants had provided electronic informed consent.

5. Statistical Methods for Data Processing and Quantitative Analysis

The statistical methods employed were tailored to the specific aims and objectives of the study, the nature of the variables analysed, and their corresponding measurement scales. For descriptive analysis, categorical variables were presented as absolute frequencies and percentages (n, %), while continuous variables were expressed as mean ± standard deviation (SD) or median and interquartile range (IQR), depending on the distribution. Normality of the distribution was assessed in advance using the Kolmogorov–Smirnov test.

To test the research hypotheses, both non-parametric and parametric statistical methods were employed. Associations between categorical variables were analysed using the chi-square (χ^2) test of independence, with Fisher's exact test applied when the assumptions

for the chi-square test were not met. For comparisons of means, parametric tests were used, including the One-sample *z*-test, Student's *t*-test for independent samples, and one-way analysis of variance (ANOVA) for comparisons involving more than two independent groups.

To identify factors associated with the examined knowledge, attitudes, and practices, both simple and multiple linear regression analyses were performed. Categorical independent variables were entered into the regression models using dummy coding. The results of the regression analysis were interpreted using regression coefficients and their corresponding levels of statistical significance.

Data were visualised and presented using tables and figures to enhance clarity.

All statistical tests were two-tailed, with results considered statistically significant at a significance level of $\alpha = 0.05$.

Raw data were entered and prepared for analysis using Microsoft Excel, while statistical processing was conducted using IBM SPSS Statistics (Version 23). Graphical representations of the results were generated using Microsoft Excel.

RESULTS AND DISCUSSION

1. International and National Policies and Recommendations for Infection Prevention and Control in Cosmetic Salons

Over recent decades, the cosmetic and aesthetic services sector has grown rapidly, becoming one of the fastest-growing segments of the global service industry (Grand View Research, 2023). Growing demand for procedures designed to enhance physical appearance and maintain skin health has substantially expanded the range of cosmetic services available. This growth has brought increasing attention to the safety of service provision, as many cosmetic procedures involve disruption of the skin barrier and close physical contact between practitioners and clients, creating a potential risk of infection transmission, including transmission involving antimicrobial-resistant microorganisms (WHO, 2016; WHO, 2020; CDC, 2020).

Infection control in cosmetic salons is directly linked to containing antimicrobial resistance (AMR), through two main mechanisms:

1. Effective control of the cross-transmission of microorganisms among healthcare professionals, clients, and visitors in cosmetic salons also limits the transmission of antimicrobial-resistant microorganisms, thereby directly contributing to the efforts to contain AMR.

2. Inappropriate use of antimicrobial agents can directly influence the resistance profile of the skin microbiota. These agents include not only systemic and topical antibiotics, but also disinfectants used for environmental decontamination. Their use therefore represents a second direct mechanism through which AMR may be influenced in cosmetic salons. For these reasons, appropriate infection control measures and processes in cosmetic salons are of fundamental importance for containing AMR.

International Framework for Infection Prevention and Control in Cosmetic Salons.

International approaches to infection prevention and control (IPC) in cosmetic salons are grounded in the principles of Standard Precautions, as developed and systematised by the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) (WHO, 2022; CDC, 2024). These principles provide a common framework for reducing the risk of infection transmission across both healthcare and cosmetic practice settings.

Standard Precautions represent a universal approach applicable to all clients, regardless of their infectious status, and comprise the following core components:

1. Risk assessment
2. Hand hygiene
3. Respiratory hygiene / cough etiquette
4. Use of personal protective equipment (PPE)
5. Safe injection practices
6. Aseptic technique in cosmetologists' practice
7. Environmental requirements and cleaning
8. Decontamination and reprocessing of reusable instruments
9. Safe management of linen
10. Waste management

Within this general framework, the WHO and the CDC formulate recommendations that are broadly similar but differ in their level of detail and structure.

With regard to infection risk assessment, both the WHO and the CDC emphasise the need to tailor preventive measures to the nature of the procedure and the likelihood of exposure to blood, body fluids, damaged skin, mucous membranes, or contaminated materials and surfaces. The CDC emphasises risk assessment before each procedure, together with the appropriate selection of personal protective equipment (PPE) and environmental cleaning measures

(CDC, 2024). The WHO, by contrast, places risk assessment within a broader organisational approach to safety, which includes staff training, internal procedures, adequate resources, and monitoring of compliance (WHO, 2022).

Hand hygiene is a fundamental component of both approaches. The CDC recommends hand hygiene before and after client contact, following contact with potentially contaminated materials, after glove removal, and whenever hands are visibly soiled (CDC, 2024). The WHO further emphasises that consistent adherence to hand hygiene practices depends not only on individual behaviour and training, but also on appropriate organisational support (WHO, 2022).

Respiratory hygiene is likewise recognised as an important element of infection prevention in both approaches. The CDC incorporates respiratory hygiene into Standard Precautions as a measure for reducing the spread of respiratory secretions. Its relevance is particularly pronounced in cosmetic procedures performed in close proximity to the client's face. The WHO considers respiratory hygiene as part of a broader approach to respiratory infection prevention and control, linking its implementation to staff education, ventilation, mask use, and risk assessment in response to the prevailing epidemiological situation (WHO, 2022).

Personal protective equipment (PPE) is another key component addressed consistently in both approaches. In each case, the choice of PPE depends on the anticipated risk of exposure. Gloves, masks, eye protection, face shields, and protective clothing are selected according to the likelihood of contact with blood, body fluids, secretions, or contaminated materials (CDC, 2024). The WHO also emphasises the importance of appropriate use, staff training, availability, and rational management of PPE (WHO, 2022).

Safe injection practices are explicitly included by the CDC among the Standard Precautions. These include the use of sterile needles and syringes, avoidance of reuse, safe handling of sharps, and

measures to prevent contamination of injectable products (CDC, 2024). The WHO addresses these practices within the broader framework of safety during medical and invasive procedures, relating them to the prevention of blood borne infections and the protection of both clients and personnel (WHO, 2022).

Aseptic technique is intended to prevent microorganisms from entering clean or sterile areas, tissues, products, and instruments. The CDC addresses this principle in relation to safe injection practices, the proper handling and reprocessing of instruments, and the prevention of contamination (CDC, 2024). The WHO also emphasises training, written protocols, environmental control, and the proper use of sterile or disinfected materials (WHO, 2022).

The environment and cleaning practices represent another area of commonality between the two approaches. The CDC recommends systematic cleaning and disinfection of frequently touched surfaces and areas where there is a risk of contamination with biological material (CDC, 2024). The WHO considers environmental safety as part of the overall infection prevention and control framework, including written procedures, cleaning schedules, appropriate products, staff training, and monitoring of implementation (WHO, 2022).

Decontamination and reprocessing of instruments are particularly important in cosmetic salons, where many procedures involve reusable instruments. The CDC emphasises the need to distinguish clearly between single-use and reusable instruments, to separate used instruments promptly after use, and to carry out mechanical cleaning followed by disinfection or sterilisation according to the level of risk. Proper storage is also required to prevent recontamination (CDC, 2024). The WHO places these activities within a quality management framework aimed at ensuring their standardisation, traceability, and control (WHO, 2022).

The laundering and processing of used textiles are likewise included among the components of Standard Precautions. Proper

handling of used textiles is intended to prevent the spread of microorganisms to personnel, clients, and the working environment. The CDC recommends that used textiles be separated and transported in appropriate containers, laundered under suitable conditions, and kept separate from clean materials (CDC, 2024). The WHO addresses these activities in the context of the safe management of the environment and the movement of materials (WHO, 2022).

Waste management is another component addressed within both approaches. The CDC recommends separating general waste from potentially infectious waste and disposing of needles and other sharps safely in designated containers (CDC, 2024). The WHO incorporates waste management into the overall infection control system and links it to the protection of personnel, clients, the community, and the environment (WHO, 2022).

Regulatory Differences in the Application of Standard Precautions Pertaining to Cosmetic Salons Across Different Countries

International requirements and recommendations for infection prevention and control in cosmetic salons are based on broad public health protection principles. However, their scope, level of detail, and degree of legal enforceability differ between countries. These differences concern the procedures subject to regulation, professional qualification requirements, licensing arrangements, specific infection prevention and control measures, and the mechanisms used to monitor their implementation.

European Guidance and Standards for Infection Prevention and Control in the Cosmetic Sector

In Europe, guidance on infection prevention and control in the cosmetic sector has gradually developed from broad recommendations into more specific standards addressing quality and safety. Resolution ResAP(2008)1 of the Council of Europe focuses primarily on products and practices used in tattooing and

permanent make-up, but also sets out general requirements for instrument hygiene, disinfection, and sterilisation (Council of Europe, 2008). The standard BS EN 16844:2017+A2:2019 addresses non-surgical aesthetic medicine procedures and emphasises professional competence, environmental hygiene, instrument reprocessing, the use of personal protective equipment (PPE), and risk management. Although it is not legally binding, it provides a reference for good practice and a basis for the development of national regulations.

The standard EN 17226:2019 provides a broader framework for quality and safety in the delivery of beauty salon services. Its provisions include preliminary client assessment, hand hygiene, risk-based use of PPE, environmental cleaning, reprocessing of reusable instruments, prevention of cross-contamination, the use of single-use consumables, written procedures, staff training, and safe waste management (European Committee for Standardization, 2019). During the COVID-19 pandemic, these precautions were supplemented by client screening, the reorganisation of client flows, longer intervals between procedures, improved ventilation, and enhanced protection for procedures performed close to the face (Bertossi et al., 2020).

Benelux

Consensus recommendations for the Benelux countries - Belgium, the Netherlands, and Luxembourg - are aimed at reducing infectious complications associated with injections and other procedures that breach the skin barrier (Baharlou et al., 2023).

The guidelines describe a “stepwise model” for maintaining a high level of asepsis in practice, covering five aspects: (1) patient selection; (2) preparation of the patient's skin; (3) hand hygiene of the practitioner; (4) environmental requirements; and (5) obtaining informed consent and providing the patient with instructions for appropriate post-procedural care.

The Netherlands

Dutch expert guidelines for cosmetic practice were most recently revised in 2023–2024 (CMS, 2025). The Dutch approach distinguishes between cosmetic procedures according to their level of risk and the qualifications of the practitioners performing them. The main requirements include pre-procedural risk assessment, hand and environmental hygiene, appropriate use of PPE, and appropriate reprocessing of instruments. Procedures involving a breach of the skin barrier are classified as medical procedures and therefore carry more stringent requirements concerning professional competence, aseptic practice, and safety (CMS, 2025).

England

In England, infection prevention and control rests on a combination of general principles of infection safety and regulation of non-surgical aesthetic procedures (Department of Health, 2013). The NHS England National Infection Prevention and Control Manual covers hand hygiene, personal hygiene, risk-appropriate use of PPE, the processing of instruments and surfaces, staff training, and monitoring. The Manual is mandatory for NHS settings, but it was not developed specifically for the cosmetic sector; its principles may nevertheless be adapted for private and independent services (NHS England, 2022). Guidance from the UK Health Security Agency (UKHSA) provides additional recommendations on the cleaning and disinfection of instruments, equipment, and work surfaces (UKHSA, 2023). The Control of Substances Hazardous to Health (COSHH) regulations require practitioners to identify hazardous agents, assess occupational exposure pathways, and take appropriate measures to control the associated risks (Health and Safety Executive, 2025). The proposed regulatory model for non-surgical cosmetic procedures envisages multi-level licensing according to the level of risk and the likelihood of complications (CMS, 2025).

Wales

Public Health Wales guidelines provide a detailed, legally binding framework under which the application of Standard Precautions is a condition for licensing specialised cosmetic procedures. The measures include hand hygiene, antiseptic skin preparation, Aseptic Non-Touch Technique (ANTT), risk-appropriate PPE, environmental decontamination, safe management of waste and sharps, hepatitis B vaccination, and procedures to be followed after occupational exposure. The guidelines place particular emphasis on maintaining a unidirectional flow from contaminated to clean areas and on documenting sterilisation cycles (Public Health Wales, 2024).

USA

The American Med Spa Association considers medical aesthetic procedures to be medical activities that should be performed under the direction and ultimate responsibility of a qualified physician. Its guidelines include written protocols, staff training and supervision, preparedness to respond to complications, and restrictions on high-risk procedures to licensed medical professionals. Compared with the CDC Standard Precautions, these guidelines take a broader clinical and organisational focus. Because regulatory requirements differ between states, they represent a unified set of recommendations rather than a single binding national regulatory framework (American Med Spa Association, 2020; CDC, 2024).

Canada

In Canada, provincial authorities establish infection prevention and control requirements for cosmetic salons, and these requirements have continued to develop over time.

Ontario has introduced mandatory requirements for the organisation of facilities, separation of clean and contaminated areas, hand hygiene, pre-procedural client assessment, skin antisepsis, instrument reprocessing, sharps management, and documentation of sterilisation and incidents (Ministry of Health and Long-Term Care,

2017). Public Health Ontario guidance builds on these requirements with more detailed recommendations concerning PPE, training, immunisation, documentation, and waste management (Public Health Ontario, 2019). Risk assessment as a distinct component, respiratory hygiene, and requirements for safe injection practices and Aseptic Non-Touch Technique remain less developed. The regulatory model therefore combines mandatory requirements with expert recommendations.

Australia

In Australia, individual states and territories regulate infection prevention and control requirements for cosmetic salons. No single national framework exists; instead, state-level guidelines and standards apply.

Victoria. The Victorian guidelines include Standard Precautions, Aseptic Non-Touch Technique, safe handling of sharps, instrument reprocessing, and the organisation of the working environment, with a unidirectional flow from contaminated to clean areas. They are predominantly recommendatory in nature, with limited emphasis on enforcement mechanisms (Department of Health and Human Services, 2019).

Queensland. The Queensland guidelines set out procedures to be followed following exposure to blood, instrument reprocessing according to the level of risk, and the use of sterile instruments for procedures that breach the skin barrier. Health authorities monitor compliance through inspections (Queensland Health, 2024).

New South Wales**.** The requirements specify a strict and validated reprocessing process involving unidirectional flow, mechanical cleaning, packaging, autoclaving, indicator-based monitoring, and documentation of each cycle (NSW Health, 2025).

National clinical recommendations complement state-level requirements with provisions addressing professional competence, individual assessment, informed consent, and the management of complications (Ahpra & National Boards, 2025).

New Zealand

In New Zealand, professional standards relating to health, hygiene, and safety cover hand hygiene, PPE use, the processing of instruments and textile materials, waste management, and procedures following exposure to blood and body fluids. They also address informed consent, assessment of contraindications, and written instructions for post-procedural care. Risk assessment and respiratory hygiene remain undeveloped as separate components. The regulatory approach is professionally oriented: a professional organisation develops the standards, which serve as guidance for good practice (The New Zealand Association of Registered Beauty Professionals, 2022).

An analysis of international documents on infection control in cosmetic practice reveals two main trends: (1) over the past decade, there has been a clear trend toward the formal regulation of the cosmetic sector with regard to infection prevention and control; and (2) despite substantial differences in regulatory models across countries, the requirements for cosmetic salons show clear convergence around the universal principles of Standard Precautions introduced by the WHO.

Regulatory Framework for Infection Prevention and Control in Bulgarian Cosmetic Salons

In Bulgaria, hygiene and infection control requirements for cosmetic salons are laid down in Ordinance No. 15 of 21 August 1987 on the hygienic requirements for barber, hairdressing, and cosmetic salons, issued by the Ministry of Health (Ordinance No. 15, 1987). The Ordinance contains no provisions on risk assessment, hand hygiene, respiratory hygiene, the use of personal protective equipment (PPE), or the application of aseptic and antiseptic techniques.

The Ordinance establishes basic sanitary requirements for premises, equipment, water supply, ventilation, and general hygiene within the facilities. More specifically, it requires the use of individual

protective textiles - including sheets, towels, and clean, unused linen - for each client, which must be placed in covered receptacles after use. Notably, however, the regulation does not provide detailed requirements for the hygienic processing, laundering, or storage of reusable textiles.

The Ordinance places considerable emphasis on instrument disinfection and, for certain instruments, on sterilisation after each use, specifying the processing methods, solutions, and exposure times to be employed. For instance, manicure and pedicure instruments must be submerged for 60 minutes in a 3% chlorine solution or for 30 minutes in a 4% solution of “Disinfectant B”; tweezers and hair clippers are to be wiped with cotton wool moistened with a 4% solution of the same agent; and paraffin application instruments must be boiled for 20 minutes, followed by a 30-minute immersion in a 1% chloramine solution. The Ordinance further mandates that paraffin wax and depilatory wax be restricted to single-use applications per client. Although instruments that breach the skin barrier require mandatory sterilisation via autoclaving or dry heat, the Ordinance does not specify technical requirements for the sterilisation equipment itself, nor does it establish protocols for the validation, quality control, or monitoring of sterilisation processes.

In cases of sharps injury, the Ordinance recommends the application of iodine tincture and hydrogen peroxide as haemostatic agents.

With regard to work surfaces, daily disinfection by wet wiping after each shift is stipulated, with floors to be washed at the end of the workday using a 3% chlorine solution or a 1% chloramine solution. Waste disposal provisions mandate dust-free collection and storage in tightly sealed receptacles with covers.

The document was drafted at a time when modern cosmetic procedures involving skin barrier disruption were far more limited in scope; as such, it lacks detailed specifications for contemporary disinfectants, technologies, and invasive practices. The regulatory

approach embodied in the Ordinance is characterised by clearly defined and readily monitorable requirements, non-compliance with which is subject to administrative penalties.

While Ordinance No. 15 introduces basic requirements for disinfection and sterilisation, the Ordinance does not align with current international recommendations as set forth by the WHO, which advocate for the implementation of standard infection control precautions encompassing systematic risk assessment, hand hygiene, personal protective equipment, and aseptic technique. Furthermore, the disinfection regimens prescribed, such as the use of chlorine-based solutions with fixed contact times, are inconsistent with current risk-based approaches. The Ordinance also lacks provisions for the validation, traceability, and monitoring of sterilisation processes, as well as a clearly defined sequence of instrument reprocessing stages (cleaning, disinfection, and sterilisation). Other important components are likewise absent, including the segregation of clean and contaminated zones, safe waste disposal, and the safe management of linen. These omissions limit the effectiveness of the measures when compared with current safety standards.

A further normative instrument relevant to infection control in Bulgaria is Ordinance No. 3 of 8 May 2013, which approves a medical standard for the prevention and control of healthcare-associated infections (HAIs). The standard sets out requirements concerning the organisation of infection control, hygienic practices, sterilisation, and safety within healthcare facilities. However, under its defined scope, the document applies exclusively to healthcare institutions and does not cover cosmetic salons and centres. Its provisions are therefore not directly applicable to the cosmetic services sector, although certain principles may serve as a reference for good practice in the organisation of infection control activities within the sector.

In light of the above, efforts have been made in recent years to update the regulatory framework. In 2025, the Ministry of Health published a draft ordinance on the health requirements for barber,

hairdressing, and cosmetic salons, as well as tattoo and piercing studios, aimed at modernising the regulatory framework and bringing it into line with current practices and risk profiles in the sector (Draft Ordinance, 2025). The draft introduces more detailed requirements concerning environmental hygiene, instrument reprocessing and sterilisation, waste management, staff training, and infection prevention measures for procedures involving breaches of the skin barrier. However, the draft contains no provisions on the use of personal protective equipment, hand hygiene, or respiratory hygiene. Although it represents an attempt to introduce a more systematic approach to infection control, it remains considerably less developed than the regulatory models currently in place in other European countries.

2. Results of the Study on Knowledge, Attitudes, and the Frequency and Patterns of Antibiotic Self-Medication for Skin Problems among Young People in Bulgaria

The study population comprised young people aged 18-35 years in Bulgaria. The final sample included 234 participants. The sociodemographic characteristics of the study participants are presented in Table 1.

Table 1. Sociodemographic Characteristics of the Study Sample (n = 234)

Variable	Category	n	% / SD
Sex	Male	56	23,9
	Female	178	76,1
Age (years)	Mean age (years)	21,8	± 3,5
Age groups	18–19 years	62	26,5
	20–24,9 years	131	56,0
	≥ 25 years	41	17,5
Education	Secondary education / university students	181	77,4
	Completed higher education	53	22,6

Women predominated in the sample (76.1%), with a mean age of 21.8 ± 3.5 years. The largest age group was 20-24.9 years (56.0%), followed by those aged 18-19 years (26.5%). More than three-quarters of the participants had secondary education or were current university students, while 22.6% had completed higher education. The participants represented 20 regions of the country, although 83.7% were concentrated in eastern Bulgaria. Almost half were not employed at the time of the study, while 38.5% worked full-time, and 13.2% worked part-time. For 67.0% of participants, monthly disposable income did not exceed BGN 1,000.

Combination skin was the most commonly reported skin type (46.6%), followed by oily skin (18.4%) and normal skin (16.7%). Statistical analysis revealed a significant association between self-assessed skin type and participants' sex ($\chi^2 = 36.734$, $df = 4$, $p < 0.001$), as well as between skin type and age ($\chi^2 = 16.924$, $df = 8$, $p = 0.031$).

Prevalence of Acne

Overall, 62.8% of respondents reported current or past acne. No statistically significant difference by sex was observed ($p = 0.535$); however, a significant association was found with age ($p = 0.016$) (Figure 1).

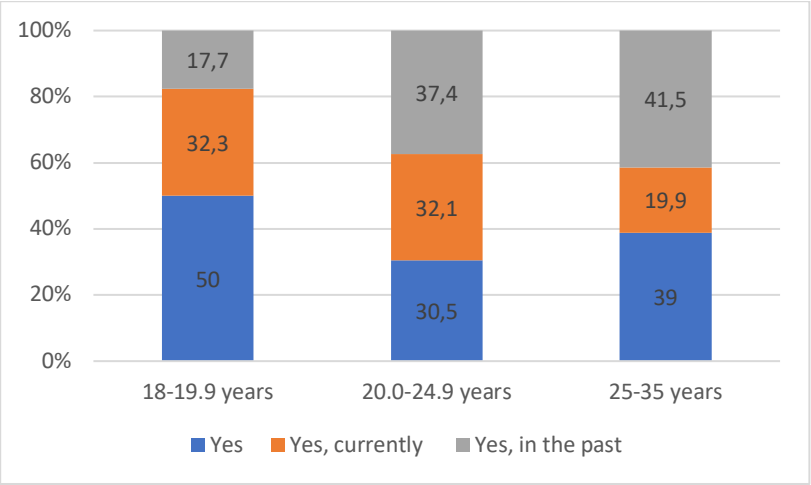


Figure 1. Distribution of Participants by Acne Prevalence %

The highest proportion of participants with current or past acne was recorded in the 20-24.9 years age group (69.5%).

Self-reported skin type was significantly associated with acne status ($\chi^2 = 35.765$, $df = 8$, $p < 0.001$). Participants with oily skin had the highest proportion of current acne (53.5%). The mean age at symptom onset was 14.6 years, with no significant difference between sexes (Student's t-test = 0.111, $p = 0.912$). In 67.6% of cases, acne had persisted for more than twelve months, suggesting a predominantly chronic disease course. Furthermore, the presence of acne was significantly associated with elevated anxiety levels ($p = 0.044$) and feelings of loneliness ($p = 0.041$). While these associations do not imply causation, they underscore the psychosocial burden of acne and argue against viewing it as a purely aesthetic issue.

Acne Severity

Acne severity was assessed using the Global Evaluation of Acne (GEA) Scale. Mild acne was reported in 44.0% of participants, moderate acne in 17.9%, and severe or very severe acne in 9.3%. Severity did not differ significantly by sex ($p = 0.171$) or age ($p =$

0.296). Skin type was significantly associated with acne severity, with a moderately strong association observed (χ^2 = 21.557, p < 0.001, *Cramer's V* = 0.383). The proportion of severe acne increased with increasing sebum production (Figure 2).

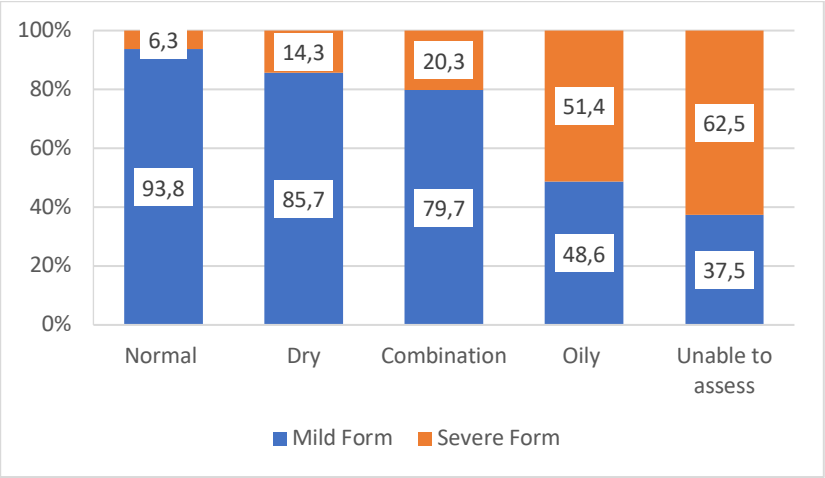


Figure 2. Distribution of Mild and Severe Forms of Acne by Skin Type (%)

Acne severity was also significantly associated with age at onset (F = 3.554, p = 0.031) and symptom duration (χ^2 = 32.023, p < 0.001, *Cramer's V* = 0.465). More severe acne was associated with later onset and a longer disease course. Severe acne was also more likely to involve multiple anatomical regions (χ^2 = 4.116, p = 0.042).

Knowledge, Attitudes, and Practices Related to Acne and Its Treatment

- **Sources of Information on Acne and Its Treatment**

The most commonly cited sources of information on acne and its treatment options were pharmacy professionals (66.2%), relatives and friends (60.4%), and the Internet. These findings indicate a

substantial influence of both professional advice and informal sources of information.

- **Awareness of the Causes and Factors Affecting the Course of Acne**

Participants most frequently identified hormonal imbalance (87.3%), poor diet (83.4%), and stress (82.8%) as the main causes of acne. However, nearly one-quarter of respondents 24.8% considered viruses to be a possible cause, indicating gaps in knowledge of acne aetiology. The most commonly reported factors worsening the course of acne were hormonal imbalance (81.3%), poor diet (78.7%), and stress (72.3%). Most participants (85.5%) believed that squeezing pimples could lead to scarring. This proportion was higher among females than males (90.8% vs. 72.7%).

- **Attitudes Toward Acne Treatment Options**

Regarding the role of antibiotics in acne treatment, 66.2% of participants believed that antibiotics treat the condition, while 22.5% expressed uncertainty. Age-related differences were observed, with uncertainty about the role of antibiotics more frequently reported among participants aged 25 years and older. Differences by sex were also identified, with females more likely to favour self-treatment than males (74% vs. 61%). A significant association was also found with professional help-seeking behaviour: participants who routinely consulted a physician or cosmetologist were less likely to regard antibiotics as a treatment option than those who favoured self-treatment.

- **Attitudes Toward Self-Treatment in Acne**

Regarding attitudes toward acne treatment, 86.3% of participants considered consultation with a physician and specialist follow-up necessary when acne is present, whereas 7.2% would rely solely on self-treatment. Despite this favourable attitude toward

professional consultation, 39.6% of participants reported always having acne treatment products available at home. Regarding antibiotic therapy, 71.4% believed that antibiotics can cause side effects. Nearly one-quarter of participants (24.8%) indicated an inappropriate duration of antibiotic treatment, with correct responses being more frequent among females than males (80.0% vs. 48.3%) and among participants aged 25 years and older than among younger participants (92.0% vs. 70.3%).

- **Frequency of Self-Treatment**

Self-treatment in response to acne-related problems was common practice, with 61.3% of respondents reporting that they usually managed their skin problems on their own, while 20.7% reported doing so less often (Figure 3).

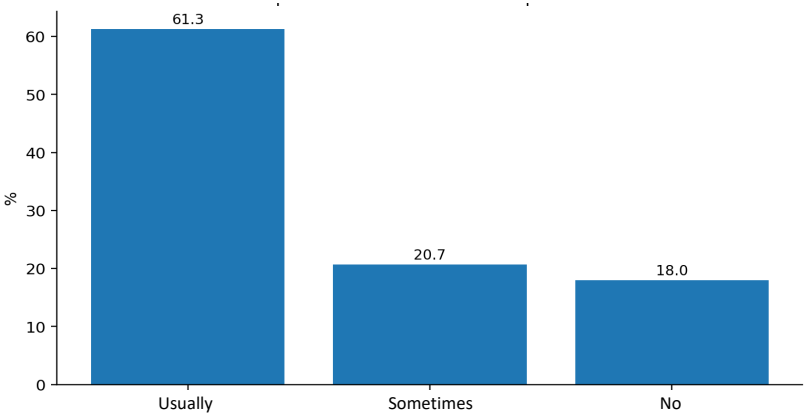


Figure 3. Self-Treatment Practices in Acne

No statistically significant differences by age were found in relation to self-treatment ($p = 0.142$). However, a statistically significant association was observed between self-treatment and acne severity ($\chi^2 = 3.903$, $p = 0.048$), being more common among participants with mild acne (Table 2).

Table 2. Self-Treatment According to Acne Severity

Behaviour	Mild Acne, n (%)	Moderate/Severe Acne, n (%)	Total, n (%)
Self-treat	73 (78,5)	20 (21,5)	93 (100,0)
Do not self-treat	37 (63,8)	21 (36,2)	58 (100,0)
Total	110 (72,8)	41 (27,2)	151 (100,0)

- **Motives for Self-Treatment**

Analysis of the motives for self-treatment revealed that the most frequently cited reasons were considering the problem non-serious (60.6%) and believing that they could manage on their own (22.6%). Financial difficulties and lack of time to visit a physician were reported considerably less often (Figure 4).

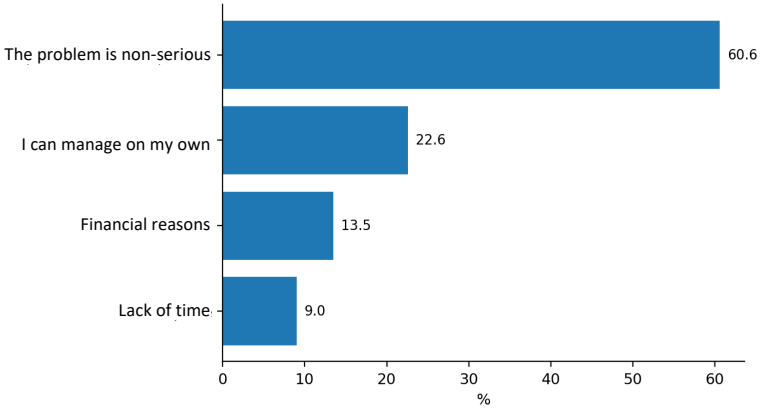


Figure 4. Main Motives for Self-Treatment

- **Products Used for Self-Treatment and Antibiotic Use**

Among the topical agents used for self-treatment, the most commonly cited were pharmacy-compounded preparations (45.2%), acid-based formulations (41.3%), and topical antibiotic products (21.3%). With respect to systemic therapies, vitamins (33.6%), antibiotics (13.2%), and brewer's yeast (12.5%) were the most

frequently used. The majority of respondents reported no antibiotic use during the preceding year - 67.7% for topical antibiotics and 73.5% for systemic antibiotics. Nonetheless, more than one-fifth of participants reported having used antibiotics to treat acne during the preceding year (Figure 5).

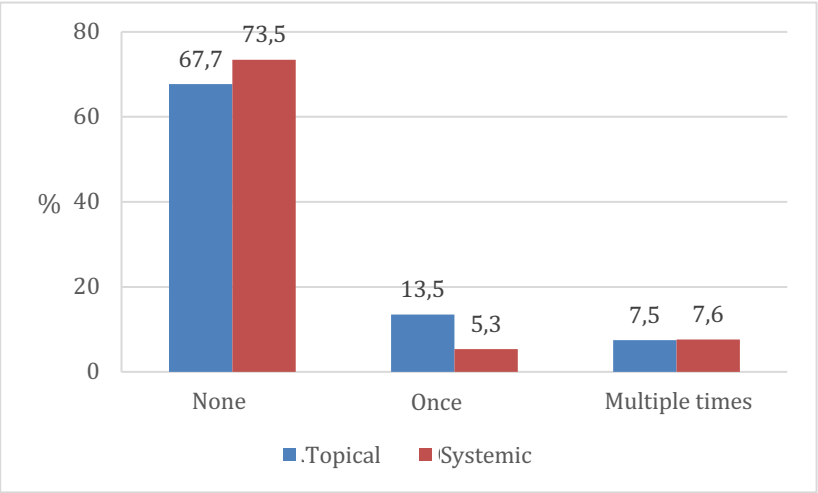


Figure 5. Frequency of Topical and Systemic Antibiotic Therapy for Acne During the Past Year (%)

- **Antibiotic Therapy-Related Practices**

Among respondents who had used antibiotics for acne, several practices potentially affecting the appropriate use of therapy were identified. While the majority (82.1%) adhered to the prescribed dosage, nearly one-fifth (17.9%) reported determining the dose independently. This practice was significantly more prevalent among males ($\chi^2 = 19.558$, $p < 0.001$) and among those who did not know the appropriate duration of antibiotic therapy ($\chi^2 = 14.182$, $p = 0.001$). Regarding treatment initiation, 76.7% of participants reported always reading the package leaflet, while 92.9% checked the expiry date before use. Females were significantly more likely than males to read

the package leaflet ($\chi^2 = 35.848$, $p < 0.001$), and this practice was also more common among participants with higher educational attainment ($\chi^2 = 10.862$, $p = 0.004$). Checking the expiry date was also more frequently reported by females ($p = 0.007$).

3. Results of the Study on Professional Cosmetologists' Knowledge, Attitudes, and Practices Related to Infection Prevention and Control and AMR in Cosmetic Salons in Bulgaria

The study population comprised practising professional cosmetologists in Bulgaria. The final sample included 256 participants. The sociodemographic characteristics of the study participants are presented in Table 3. The mean age of respondents was 32.0 ± 8.6 years, and mean professional experience was 7.6 ± 6.0 years. Females predominated in the sample (94.9%), while the distribution of participants by professional experience was relatively uniform. The majority of respondents had higher education (62.5%), including 33.7% who had specialised in Medical Cosmetology. Students at the time of the study accounted for 15.2% of participants. All regions of the country were represented in the sample, with the largest proportion of participants from South-western Bulgaria and Sofia (36.0%), followed by those from North-eastern Bulgaria (27.8%), indicating the broad geographical coverage of the study.

Table 3. Main Sociodemographic and Professional Characteristics of Cosmetologists (n = 256)

Variable	Category/Region	n	% / SD
Sex	Male	13	5,1
	Female	243	94,9
Age (years)	Mean age (years)	32,0	± 8,6
Professional experience	Mean professional experience	7,6	± 6,0
Professional experience	< 5 years	98	38,3
	5–9 years	78	30,5
	≥ 10 years	78	30,5
Education	Higher education (Bachelor's/Master's degree combined)	160	62,5
	Currently enrolled students	39	15,2
	Secondary vocational education in cosmetology	50	19,5
	Secondary education or lower	6	2,4
Geographical region of practice	Southwestern Bulgaria and the capital	92	36,0
	Northeastern Bulgaria	71	27,8
	South Central Region н	43	16,8
	North Central Region	20	8,0
	South-eastern Region	20	8,0
	North-western Region	9	3,5

The results of the study are presented into three sections, reflecting the structure of the data collection instrument:

- awareness of infection risks associated with professional practice, AMR, and infection control measures;
- attitudes toward infection prevention and control; and
- infection prevention and control practices in cosmetic salons.

Cosmetologists' Awareness of Occupational Infection Risks and AMR

- **Self-Assessment of Awareness**

Cosmetologists rated their awareness of infection prevention measures highly, with a mean score of 5.04 ± 0.975 on a scale ranging from 2 ("low") to 6 ("excellent"). Overall, 80.0% of participants rated their awareness as "very good" or "excellent." A statistically significant association was found between self-assessed awareness and participation in continuing professional education courses in cosmetology ($\chi^2 = 10.636$, $df = 2$, $p = 0.005$), with participants who had completed such training reporting higher levels of awareness.

- **Assessment of Theoretical Knowledge Regarding Infection Prevention and Control**

Only 37.9% of respondents correctly identified the definition of cross-infection. Cosmetologists with higher education were significantly more likely to select the correct response than those with lower educational attainment ($\chi^2 = 4.582$, $df = 1$, $p = 0.032$). The measures most frequently identified as effective for preventing infections were the use of disposable materials, disinfection and sterilisation of reusable instruments, and hand hygiene. In contrast, the use of PPE and the availability of adequate sanitary infrastructure were less frequently recognised as preventive measures. Bacterial and fungal infections were most frequently identified as potentially transmissible during cosmetic procedures. Only 14.1% of respondents

correctly identified all six disease groups, while 56.3% correctly identified HBV, HCV, and HIV.

- **Awareness of Disinfection and Sterilisation**

Most participants (83.7%) indicated that they understood the difference between disinfection and sterilisation, while 16.3% were either unfamiliar with the distinction or unsure how the two processes are carried out in cosmetic salons. Awareness was significantly higher among cosmetologists with higher education ($\chi^2 = 11.900$, $df = 2$, $p = 0.003$). Professional experience was also significantly associated with awareness, with uncertainty about the distinction between disinfection and sterilisation more common among those with longer professional experience ($\chi^2 = 8.607$, $df = 2$, $p = 0.014$).

- **Awareness Regarding AMR**

The assessment of theoretical knowledge identified important gaps in respondents' understanding of both infection control and antimicrobial resistance (AMR). Only 37.9% of respondents demonstrated a correct understanding of cross-infection (CI), while just 14.1% were able to name all groups of infections that may be transmitted during cosmetic procedures. Although 72.7% of respondents had heard of AMR, only 27.0% correctly identified the complete set of factors contributing to its development (Figure 6).

Awareness of AMR was significantly higher among participants aged 30 years and older than among younger respondents (79.6% vs. 63.0%; $p = 0.004$). This age-related difference was also significant among cosmetologists with higher education (82.9% vs. 62.5%; $p = 0.002$), whereas no significant difference was found among those with secondary or lower education ($p = 0.772$).

Overall, 80.5% of respondents demonstrated full or partial understanding of the nature of AMR. However, only 57.4% were aware of the possibility that resistant microorganisms could be transmitted during cosmetic procedures. Less than half of the

participants (45.7%) correctly identified bacterial infections as those most commonly requiring antibiotic treatment, while 50.8% were unable to answer the question.

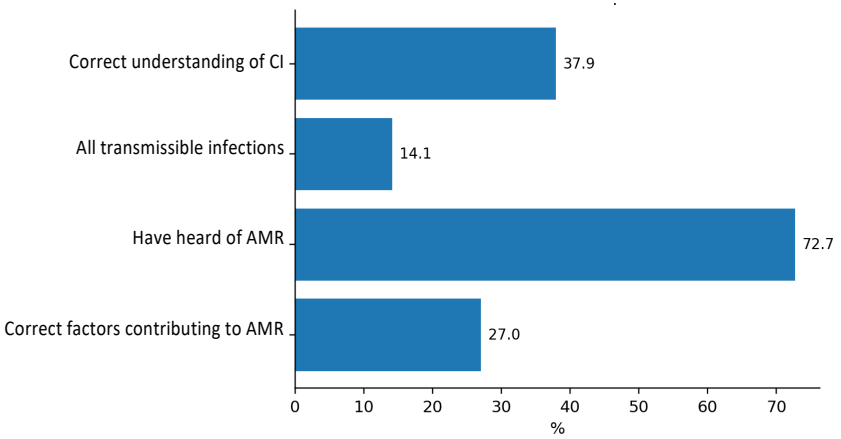


Figure 6. Key Indicators of Cosmetologists' Theoretical Knowledge

- **Availability of Good Practice Protocols for Infection Prevention and Control**

More than half of the respondents (59.1%) reported that a disinfection protocol was available in the salon where they practised. A protocol for the use of personal protective equipment (PPE) was available according to 49.6% of respondents, while 38.9% reported having a hand hygiene protocol and 38.5% reported the availability of a written cleaning schedule for procedures performed between individual clients. Overall, 8.0% of respondents reported that none of these infection control documents were available in their salon.

With regard to professional training, 41.8% of respondents had completed training in one of the infection control topics examined, while 36.7% had received training covering two topics. Training in three or four of the topics was reported by 13.3% of respondents. In contrast, 4.7% reported having received no training in any of the IPC and AMR topics considered in the study.

Textbooks were the main source of professional information (43.7%), followed by the Internet (20.2%), colleagues (16.5%), and professional training courses (14.0%). Leaflets and information campaigns were reported considerably less frequently, accounting for 5.2% of responses.

Cosmetologists' Attitudes toward AMR and Cross-Infections in Cosmetic Practice

- **Attitudes Toward Cross-Infections**

Nearly three-quarters of respondents considered cross-infections to be a serious professional issue; while 26.6% were uncertain about the extent of the problem. Most participants perceived their own occupational risk of infection as moderate (39.5%), followed by low (32.0%) and high (23.4%); only 5.1% considered themselves to be at no risk. Those who had completed additional training were more likely to rate their occupational risk as moderate or high ($\chi^2 = 10.673$, $df = 3$, $p = 0.014$).

Almost all respondents (94.1%) agreed that periodic infection control training was necessary. Overall, 76.4% rated the infection control measures implemented in their salons as "very good" or "excellent." This proportion was notably higher among cosmetologists who had completed formal cosmetology training than among those who had not (79.5% vs. 58.9%; $\chi^2 = 16.900$, $df = 3$, $p = 0.001$).

- **Attitudes Toward AMR**

Nearly three-quarters of respondents (74.2%) considered AMR a serious concern in contemporary dermatological care. Most respondents (87.1%) considered strict hygiene and disinfection practices essential for preventing AMR. This view was more common among cosmetologists with higher levels of education and those currently pursuing higher education ($\chi^2 = 12.727$, $df = 3$, $p = 0.005$). Perceptions of AMR were also significantly associated with whether respondents considered cross-infections to be a professional problem

($\chi^2 = 22.412$, $df = 6$, $p = 0.001$). Overall, 84.4% of respondents were willing to recommend alternatives to antibiotics for skin care to help reduce unnecessary antibiotic use, while 95.7% considered additional training on AMR necessary.

Practices Related to Infection Prevention and Control and AMR in Cosmetic Salons

The professional practices of cosmetologists were assessed across the main components of Standard Precautions for infection prevention and control:

1. decontamination, disinfection, and sterilisation of reusable instruments and equipment, and environmental hygiene;
2. hand hygiene practices;
3. use of personal protective equipment (PPE);
4. post-exposure management and HBV vaccination;
5. client preparation prior to cosmetic procedures; and
6. professional practices related to AMR prevention.

- **Disinfection of Reusable Instruments**

While 72.3% of cosmetologists used a steriliser for instrument processing, only 2.7% had access to an autoclave. A further 16.0% relied on methods that are neither regulated under the current national framework nor compliant with international recommendations. Overall, 95.7% of respondents reported performing disinfection and sterilisation themselves, highlighting the importance of professional training. The correct two-stage sequence - cleaning followed by appropriate sterilisation, was recognised by 66.3% of the respondents, whereas 24.8% selected an incorrect or incomplete approach to instrument processing.

For surface disinfection, more than three-quarters of respondents reported using alcohol-based products, while 36% used bleach and 7% used hypochlorous acid. Concurrently, chlorhexidine was reported by 43% of respondents, despite being primarily indicated

as an antiseptic for the skin and mucous membranes; nearly one-fifth used soap and water, and 2% used hydrogen peroxide. These findings reveal some ambiguities in distinguishing between antiseptics and surface disinfectants. Although almost all cosmetologists reported replacing instruments after each client, 2.7% did so only once a day, and one participant did so once a week. Inadequate practices were more prevalent among respondents from smaller localities ($\chi^2 = 9.079$, $df = 1$, $p = 0.007$).

- **Hand Hygiene Practices**

Hand hygiene practices differed substantially depending on the specific situation. While all participants reported washing their hands when visibly soiled, and 97.7% reported doing so before client contact, considerably lower proportions performed hand hygiene following exposure to body fluids (56.3%), after touching a contaminated surface (31.3%), or upon leaving the treatment room (8.2%). These findings indicate inconsistency in critical situations where contamination is not always visible (Figure 7).

With respect to hand hygiene agents, 80.5% used soap and water, 57.0% used alcohol-based antiseptics, and 55.9% used chlorhexidine. The use of water alone was reported by 33.2%, while 12.2% reported other inappropriate agents. These results highlight the need for practical training in selecting the appropriate method according to the specific situation and the presence or absence of visible contamination.

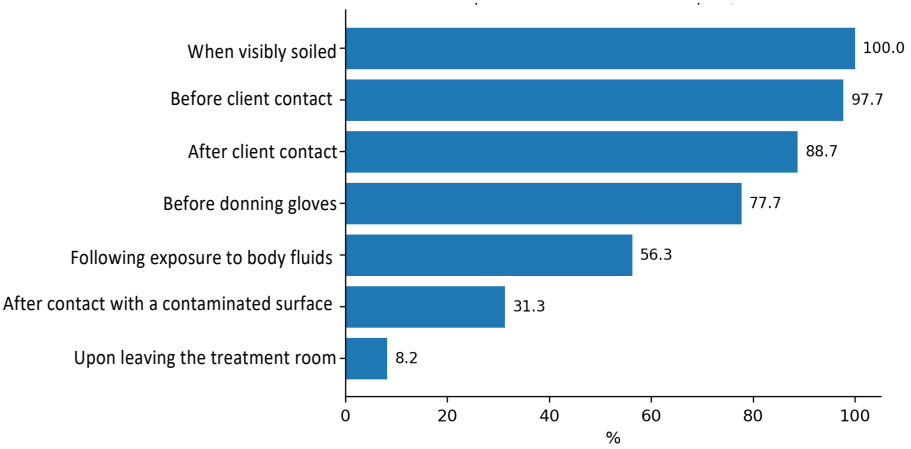


Figure 7. Hand Hygiene Practices According to the Specific Situation

- **Use of Personal Protective Equipment (PPE)**

Gloves represented the most widely used PPE item (92.2%), followed closely by work attire (90.6%), protective masks (69.1%), and protective eyewear (46.5%) (Figure 8). When evaluating multi-component protection, nearly half of respondents (46.5%) reported using three PPE types, 28.9% used four or more, and 19.9% relied on only two. Overall, the findings show widespread use of gloves and work attire, but incomplete combination of protective equipment among some cosmetologists.

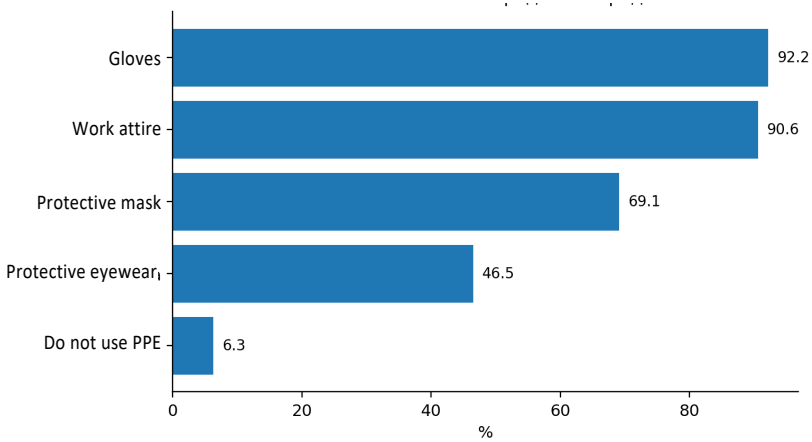


Figure 8. Use of Personal Protective Equipment Among Cosmetologists (%)

- **Post-Exposure Protocols and HBV Vaccination**

More than a quarter of respondents (27.0%; $n = 69$) reported experiencing a needle-stick or sharps injury during a cosmetic procedure. Only 3.5% correctly identified the immediate first-aid step - washing the affected area with soap and water - while 13.4% were uncertain about the appropriate protocol following such an incident. Uncertainty regarding correct post-exposure management was significantly more prevalent among cosmetologists practicing in smaller localities ($\chi^2 = 7.439$; $df = 2$; $p = 0.025$).

Over half of the participants (53.8%) reported not being vaccinated against hepatitis B (HBV). This reveals a major vulnerability in occupational health and safety regarding exposure to blood and other potentially infectious body fluids.

- **Client Preparation Prior to Cosmetic Procedures**

Of respondents, 77.7% evaluated clients for past or current infections, whereas 21.5% conducted no pre-procedure health

screening. Screening was significantly more common among cosmetologists who held or were pursuing a higher education degree than among those with secondary or lower education (81.3% vs. 67,3%; χ^2=4,987; *df*=1; *p*=0,026). Client screening was also associated with self-assessed awareness: health information was gathered by 59.2% of respondents reporting low or moderate awareness, 85.8% with very good awareness, and 97.3% with excellent self-assessed awareness (χ^2=14,402; *df*=2; *p*=0,001).

Hydrogen peroxide was the most common agent used for skin antisepsis (78.9%), followed by water (41.0%), alcohol-based products (34.0%), and aqueous chlorhexidine solutions (32.8%). However, over a quarter of participants (27.7%) reported using inappropriate products, highlighting uncertainty regarding proper antiseptic selection for skin preparation.

- **Professional Practices Related to AMR Prevention**

Just over a third of cosmetologists (37.9%) used antimicrobial products routinely in their professional practice, and a further 32.0% used them occasionally. Pre-procedure skin antisepsis was consistently performed by 58.2% of participants; 35.5% did this only sometimes, and 6.3% rarely or never used an antiseptic. When recommending products to clients with skin infections, just over half (52.3%) always consulted a dermatologist first, 33.6% did so occasionally, and 14.1% did not seek expert advice.

The clearest gap was in AMR training itself. Although 95.7% of respondents considered further training necessary, 56.6% had received none, 22.7% described their preparation as limited, and only 2.7% described it as comprehensive (Figure 9). Taken together, these findings point to a need for more structured AMR training and closer engagement with medical specialists.

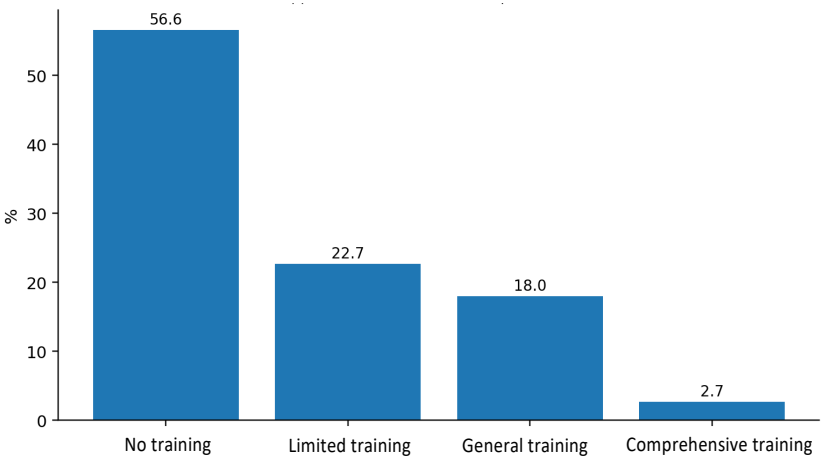


Figure 9. Cosmetologists' Professional Training in Antimicrobial Resistance

4. Synthesis of the Results of the Three Studies

The systematic review showed that international policies for infection prevention and control in cosmetic services are moving towards an integrated, risk-based approach centred on Standard Precautions, professional competence, written protocols, and regulatory oversight. The analysis of the Bulgarian regulatory framework showed that, although general sanitary and hygiene requirements are in place, existing regulations provide insufficient detail on contemporary infection risks, the implementation of Standard Precautions, and AMR prevention. In contrast to the international approaches reviewed, Bulgaria currently lacks practical guidance specifically addressing the safety of cosmetic services.

The study among young people in Bulgaria found a high prevalence of self-treatment for acne, accompanied by gaps in antibiotic literacy and risky behavioural patterns. Incorrect understanding of the appropriate duration of antibiotic therapy, self-determination of dosage, and the use of antibiotics without adequate professional supervision indicate that basic knowledge does not

always translate into responsible behaviour. The observed differences by sex and age point to groups with specific needs for targeted health information.

The study among professional cosmetologists revealed a gap between high self-reported awareness and the actual knowledge and implementation of certain infection control measures. Deficiencies were identified in instrument processing, hand hygiene, the use of personal protective equipment, client preparation, post-exposure procedures, and HBV vaccination. Despite generally positive attitudes towards the importance of infection control and AMR prevention, specialised training in these areas was limited. The observed associations between education, continuing professional training, awareness, and specific professional practices highlight the importance of adequate professional preparation for the safe provision of cosmetic services.

The findings provide varying degrees of support for the research hypotheses. Hypothesis 1 is largely supported by the identified gaps in antibiotic literacy and the widespread use of self-treatment for acne. Hypotheses 2 and 3 receive partial support, as sex- and age-related differences, as well as associations between awareness and behaviour, were observed for only some of the indicators examined. The findings lend support to Hypothesis 4, demonstrating differences between the national regulatory framework and international regulations and recommendations. The findings from the study among professional cosmetologists corroborate Hypothesis 5, indicating good overall knowledge of infection control principles alongside gaps in specific areas of knowledge and practice. Hypothesis 6 is partially supported, as higher awareness and more positive attitudes were associated with better implementation of certain measures, but not with all of the practices examined.

Taken together, the findings indicate that AMR prevention in the context of skin health requires coordinated action at three interconnected levels: individual behaviour, professional practice, and

the regulatory environment. The main priorities identified are strengthening antibiotic literacy among young people, developing specific national guidelines for infection control in cosmetic services, and introducing structured continuing education for professional cosmetologists in infection control and prevention and AMR.

CONCLUSIONS

1. The analysis of international documents and guidelines on infection prevention and control in cosmetic practice demonstrates a trend toward an integrated approach based on the six components of standard precautions defined by the World Health Organization (WHO).
2. The examination of the national regulatory framework established that the current requirements for cosmetic practice in Bulgaria do not correspond to international guidelines, as provisions regulating infection control in cosmetic practice in accordance with contemporary risks, standard precautions, and the principles of antimicrobial resistance (AMR) prevention are lacking.
3. The study conducted among young people in Bulgaria identified a high prevalence of acne in the 18–35 years age group, with the condition affecting nearly two-thirds of the target group (62.8%). More than one-quarter (27.2%) of participants with acne had moderate to very severe forms of the condition, for which antibiotic treatment may be necessary in accordance with current therapeutic recommendations.
4. Self-treatment for acne is widespread among young people in Bulgaria, with 61.3% of participants reporting that they manage acne independently and a further 20.7% reporting that they engage in such behaviour occasionally.
5. Assessment of knowledge and attitudes regarding antibiotic use for acne revealed gaps in antibiotic literacy. Approximately two-thirds of participants (66.2%) believed that antibiotics cure acne; 28.5% did not recognise the existence of adverse effects or were unable to assess whether such effects exist; and 24.8% demonstrated misconceptions regarding the duration of antibiotic treatment.

6. Investigation of antibiotic use behaviour identified several risky practices. The predominant motive for self-medication was the perception of the skin problem as non-serious (60.6%). Furthermore, 17.9% of those who had used antibiotics reported determining the dosage themselves, while 21.0% and 12.9% reported the use of topical and systemic antibiotics, respectively, during the past year. Significant sex- and age-related differences were identified, with females and participants aged 25 years and older demonstrating more accurate knowledge and safer behaviour regarding antibiotic use.
7. Pharmacists were the most frequently cited source of information on acne and its treatment options (66.2%), followed by relatives and friends and online sources.
8. Among Bulgarian cosmetologists, higher self-assessed awareness of infection control and more positive attitudes toward the significance of cross-infections and AMR were associated with a higher educational level and participation in postgraduate continuing education.
9. Assessment of theoretical knowledge revealed gaps concerning the nature of cross-infections, their causative agents, the sources of risks associated with cosmetic practice, and the factors contributing to the development of AMR.
10. Assessment of infection prevention and control practices in cosmetic services revealed substantial gaps in the application of standard precautions. These included incomplete compliance with recommended practices for instrument processing and disinfectant selection, gaps in hand hygiene, incomplete use of personal protective equipment (PPE), insufficient preparedness for post-exposure procedures, incomplete collection of anamnestic data, and ambiguities in skin preparation prior to procedures, as well as limited implementation of practices aimed at AMR prevention.

11. An association was established between the perception of cross-infections as a significant professional problem and awareness of AMR as a risk in cosmetic practice, underscoring the necessity of an integrated approach to training in infection prevention and control and antimicrobial resistance.

SUMMARY

Antimicrobial resistance constitutes one of the most serious public health challenges of the 21st century. Containing its impact requires a comprehensive approach that integrates the rational use of antibiotics, effective infection prevention and control, and improved antibiotic literacy among both the general population and professionals. This thesis examines AMR in the context of skin health through two complementary aspects: young people's self-treatment behaviour regarding acne and the professional infection control practices of cosmetologists.

The findings demonstrate that individual behaviour and professional practices in cosmetic services are important components of the public health approach to containing AMR. Among young people, gaps in antibiotic literacy and risky patterns of self-treatment for acne were identified. Among professional cosmetologists, high self-assessed awareness and favourable attitudes were not invariably accompanied by consistent implementation of Standard Precautions. Limited AMR training and identified gaps in infection control underscore the need for systematic continuing professional education and clearly defined standards for safe professional practice.

The scientific value of the thesis lies in its comprehensive examination of AMR in the context of skin health through the simultaneous analysis of young people's behaviour and cosmetologists' professional practices. Its practical significance lies in the potential for these findings to inform updates to the regulatory framework, the development of training programmes for professional cosmetologists, and the implementation of educational initiatives promoting the rational use of antibiotics among young people.

Containing AMR in the context of skin health requires coordinated and sustained efforts by health and educational institutions, professional organisations, and practising professionals. Integrating antibiotic literacy, Standard Precautions, and continuing

professional development provides a foundation for a sustained culture of safety and for reducing the risk of AMR development and spread.

RECOMMENDATIONS

I To the Legislative Authority:

1. The national regulatory framework governing hygienic requirements, infection prevention, and infection control in cosmetic salons should be updated to clarify and strengthen:
   1.1. Requirements for infection prevention and control specific to cosmetic practice, including procedures carrying a risk of breaching the skin barrier.
   1.2. Requirements for hand hygiene, the use of personal protective equipment, cleaning and disinfection of surfaces, sterilisation of instruments, safe handling of sharps, and procedures for managing contact with blood or body fluids.
   1.3. Requirements for premises and workflow organisation in cosmetic salons, including the provision of a designated zone or clearly defined area for cleaning, disinfection, sterilisation, and storage of processed instruments.
2. National practical guidelines for the prevention and control of cross-infections in cosmetic services should be developed and approved, taking into account the different levels of risk associated with individual procedures.
   2.1. The guidelines should distinguish between non-invasive cosmetic services and procedures carrying a risk of micro trauma, contact with blood, or breach of the skin barrier.
   2.2. The guidelines should include algorithms for refusing, postponing, or terminating a procedure when an active skin infection is suspected, together with guidance on referral to a dermatologist.
3. Requirements for the professional training of cosmetologists should be updated to include a standalone module on infection prevention and control in cosmetic practice as part of mandatory training.

3.1. Training should cover topics such as hand hygiene, disinfection, sterilisation, personal protective equipment, blood borne infections, vaccination against hepatitis B, and actions to be taken in the event of sharps injuries.

3.2. Basic training in antimicrobial resistance should also be included, with emphasis on the relationship between infection prevention, limiting unnecessary antibiotic use, and safe cosmetic practice.

II To Professional Organisations and Training Providers in Cosmetology:

1. Opportunities, arrangements, and conditions should be established for continuing professional education of cosmetologists in infection prevention and control throughout all stages of their professional development.
2. Practical tools should be developed to support cosmetologists in the daily implementation of infection prevention and control measures, including:
   2.1. Template protocols should be developed for disinfection, sterilisation, hand hygiene, the use of personal protective equipment, cleaning between clients, and procedures in the event of contact with blood or body fluids.
   2.2. Checklists should be prepared for the daily verification of hygienic practices and workplace safety.
3. Good practice rules for cosmetic services should be developed and proposed for approval, covering minimum standards for infection control, occupational safety, and conduct when dealing with clients with skin problems.
4. The inclusion of antimicrobial resistance in continuing education for cosmetologists should be encouraged, with emphasis on the role of cosmetic practice in infection prevention and limiting unnecessary antibiotic use.

III To the Ministry of Health and Regional Health Inspectorates (RHI):

1. Oversight of infection prevention and control practices in cosmetic salons should be strengthened, with particular attention to procedures involving breach of the skin barrier.
2. Standardised inspection tools should be developed to assess disinfection and sterilisation practices, hand hygiene, the use of personal protective equipment, and the availability of written infection control protocols.
3. Information and training initiatives aimed at preventing cross-infections and reducing the risk of antimicrobial resistance in cosmetic services should be encouraged.

IV To Health and Educational Institutions:

1. Educational initiatives should be developed and implemented to improve young people's knowledge of the appropriate use of antibiotics for acne and other skin problems.
2. Young people should be encouraged to seek professional medical advice for skin conditions, while self-medication with antibiotics should be limited.
3. Information materials should be developed on the risks associated with inappropriate antibiotic use and its relationship to antimicrobial resistance.

V To Professional Cosmetologists and Cosmetic Salons:

1. Written infection control protocols should be introduced and used in every cosmetic salon.
   1.1. The protocols should cover instrument disinfection and sterilisation, cleaning of work surfaces, hand hygiene, the use of personal protective equipment, and actions to be taken in the event of accidental exposure.

1.2. Records should be maintained of instrument processing, particularly for procedures carrying a risk of breaching the skin barrier.

2. Personal protective equipment should be used consistently according to the level of risk associated with each procedure.
   2.1. Gloves should be worn for all procedures involving a risk of contact with blood, biological material, a breach of the skin barrier, micro trauma, or contaminated instruments.
   2.2. Masks and protective eyewear should be worn during procedures involving a risk of splashes, aerosols, or contact with body fluids.
3. Hand hygiene practices should be improved, with hand washing and/or disinfection performed not only when hands are visibly soiled, but also before and after each client, after contact with contaminated surfaces, after removal of gloves, and when leaving the work area.
4. Hepatitis B vaccination coverage among professional cosmetologists should be increased, particularly among those performing procedures involving a risk of contact with blood, micro trauma, or the use of sharp instruments.
5. A practice should be established to postpone or decline a cosmetic procedure when an active skin infection is suspected or when other conditions requiring medical assessment are present.
6. Consultation and collaboration with dermatologists should be encouraged for clients with skin infections, severe acne, unexplained skin changes, or recurrent inflammatory conditions.

VI To Health Institutions and Public Health Specialists:

1. Information campaigns should be developed for the cosmetic sector, addressing the risks of cross-infections, the importance of standard precautions, and the relationship between infection control and antimicrobial resistance (AMR).

2. Support should be provided for the development and implementation of national recommendations and educational materials for cosmetologists, based on internationally recognised principles of infection prevention and control.
3. Collaboration among health authorities, training organisations, professional communities, dermatologists, and public health specialists should be encouraged to promote a sustainable culture of safety in cosmetic services.

SCIENTIFIC CONTRIBUTIONS

1. An in-depth review and analysis of the scientific literature on AMR, antibiotic use for acne, self-treatment for skin conditions, and the role of infection prevention and control in cosmetic services was conducted.
2. A systematic review of international recommendations, official documents, and regulatory requirements relating to infection prevention and control in cosmetic services was conducted, alongside an analysis of the applicable regulatory framework in Bulgaria.
3. For the first time in Bulgaria, a comprehensive study examined the knowledge, attitudes, frequency, and patterns of antibiotic self-medication for skin problems among young people, with particular attention to acne and the risk of irrational antibiotic use.
4. For the first time in Bulgaria, a study examined the knowledge, attitudes, and practices of professional cosmetologists in relation to infection control, cross-infection prevention, and their attitudes toward AMR as a problem.
5. The study identified gaps in antibiotic literacy and patterns of self-treatment among young people, as well as gaps in the knowledge, attitudes, and practices of professional cosmetologists concerning infection prevention and control and AMR.

PUBLICATIONS ASSOCIATED WITH THIS THESIS

1. Dimitrova D, Dokova K. Antibiotic resistance concerning dermatological practice—research approaches and scope of the problem. Social Medicine. 2023; 31(1): 11–19.
2. Dimitrova D, Dokova K. International guidelines for infection prevention and control in cosmetic centers. Scripta Scientifica Salutis Publicae. 2026; 12.