

Toxic beauty: exposure to chemical hazards and respiratory health among informal workers in beauty centers in Bogotá

Belleza tóxica: Exposición a peligros químicos y salud respiratoria en trabajadores informales de centros de belleza en Bogotá

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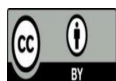
ABSTRACT

Introduction: In beauty centers, various chemical products are used for treatments, but the potential risks to the respiratory health of informal workers in these settings may not be properly identified.

Objectives: To identify chemical risk factors influencing the onset of respiratory symptoms among workers in beauty centers.

Methods: A non-probabilistic convenience sample of hairdressers in Bogotá was used, employing a qualiquantitative approach through participant observation, interviews, perceived morbidity questionnaires, and an expert panel.

Results: In these informal jobs, it was found that most workers are women, around



35 years old, with basic education and in common-law relationships. Job characteristics and levels of exposure to hazardous chemicals were assessed, and their association with reported respiratory symptoms was analyzed. It was found that adherence to the use of personal protective equipment is low, with a primary risk factor being the lack of risk awareness among workers. Between 6 and 10% of respondents reported experiencing symptoms that could contribute to respiratory issues.

Conclusions: Although the products used for beauty procedures are over the counter, they may contain components such as formaldehyde that can affect the respiratory system. According to current regulations, these products are exempt from the Globally Harmonized System application. With the support of multidisciplinary experts in occupational safety and health, recommendations are made to improve the occupational well-being of exposed individuals.

Keywords: respiratory system; risk factors; chemical compounds; informal sector; beauty and aesthetics salons; safety and health at work

RESUMEN

Introducción: En los centros estéticos se usan productos químicos para diferentes tratamientos que probablemente no estén identificando el potencial de peligro para la salud respiratoria de los trabajadores informales en estas unidades productivas.

Objetivo: Identificar factores de riesgo químico que influyen en la aparición de síntomas de enfermedades respiratorias en trabajadores de centros de belleza.

Métodos: En una muestra no probabilística por conveniencia con peluqueros de Bogotá, en un enfoque cualicuantitativo a través de observación participante, entrevista, cuestionarios de morbilidad sentida y panel de expertos.

Resultados: En estos trabajos informales se identifica que la mayoría son mujeres de



35 años con escolaridad básica y en unión libre. Se establecen características del puesto de trabajo y niveles de exposición en aplicación de sustancias químicas peligrosas, para luego asociar a la sintomatología respiratoria reportada, se encuentra que la adherencia al uso de elementos de protección personal es baja, y como principal factor de riesgo la falta de conocimiento de los riesgos por parte de los trabajadores. Entre el 6 y 10 % de los entrevistados manifestaron haber presentado síntomas que podrían influir en la aparición de síntomas respiratorios.

Conclusión: Aunque los productos usados para los procedimientos de belleza son de venta libre, pueden contener componentes que afecten el sistema respiratorio como formaldehidos, de acuerdo con la normatividad vigente, se exceptúan de la aplicación del Sistema Globalmente Armonizado. Con apoyo de expertos multidisciplinarios relacionados en el área de seguridad y salud ocupacional, se realizan recomendaciones para mejorar el bienestar laboral de las personas expuestas.

Palabras clave: sistema respiratorio; factores de riesgo; compuestos químicos; sector informal; centros de belleza y estética; seguridad y salud en en trabajo

Received: May 29th of 2026

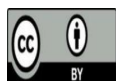
Accepted: August 26th of 2026

Published: August 30th of 2026

Editor in charge on: MSc. Jesús Salvador Hernández Romero

Introduction

This research focuses on identifying the chemical risk factors that influence the onset



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of respiratory disease symptoms in stylists working in selected beauty salons in the city. This study arises from the need to broaden the research field toward the study of occupational hazards affecting informal sector workers in Bogota (Colombia), considering that occupational health and safety prevention and protection measures may be minimal or, in some cases, nonexistent for these informal workers.

Informal activities are defined as “all remunerative activities that are not regulated by the state in social environments where similar activities are regulated”⁽¹⁾ On the other hand, it is important to note that:

“(...) informal work in Colombia has become a practice with a variable trend (sometimes decreasing, sometimes increasing), as evidenced in the report presented by the Office of the Comptroller General of the Republic (CGR). “Informality, measured in the thirteen cities and metropolitan areas, during the April–June quarter of each year, went from 60.6 in 2003 to 56.6 in 2007”.⁽²⁾ These economic dynamics affect various aspects of the national economy, in ways that this document seeks to analyze through the lens of economic theory and thought in a broad sense, as well as from the perspective of Occupational Health and Safety in a more specific sense”.⁽²⁾

According to the Gran Encuesta Integrada de Hogares (GEIH), in its July/2024 bulletin, “For the total of the 23 cities and metropolitan areas, the informality rate stood at 42.7%, representing a decrease of 0.7 percentage points compared to the March–May/2023 moving quarter (43.3%)”.⁽³⁾ Bogotá is the city with the lowest proportion of the population in informal employment, at 33.5%. Between March and May/2024, the number of people working informally was 1 429 000.

This survey defines functional groups to classify workers according to occupational position, in which the beauty salon and hairdressing sector may be included under: informal self-employed workers, totaling 2.834 million workers. For this research project, in the annexes of the GEIH – Informal Labor Market and Social Security



between April and June/2024, no official structure is identified that could be used to link a detailed classification of beauty salon workers' occupations.

Although the hairdressing sector employs a significant number of workers, it is arguably one of the least protected in terms of occupational safety and health, starting with employment relationships (piecework, shifts, day labor, etc.). Additionally, information related to the risks associated with tasks performed by workers and their exposure is also largely unknown.⁽⁴⁾

Due to precarious occupational safety and health conditions, and the informal nature of their activities, the occupational risks they face are traditionally under-researched and therefore lack appropriate prevention or management controls. Furthermore, procedures and incentives for their identification are minimal. For this reason, this research considered it important to explore exposure to chemical risk factors present in the daily activities of beauty salon workers.

Beauty sector workers—hairdressers and beauticians—are exposed to many chemicals during their work, most of which are toxic: hair dyes, skincare and nail products, perm solutions, shampoos, makeup paints, cleaning and disinfecting agents, etc. These contaminants, if proper safety measures are not taken, can pose serious health risks for workers.⁽⁵⁾

On the one hand, informality in labor constitutes a form of social organization that links economic and social dynamics. On the other hand, the informal sector maintains close ties with the regulated economic sector, both in their similar activities and in their reasons for existence—or for resistance—due to the formal economy's inability to meet people's needs. Informal work is present in all activities—rural, service, commercial, urban, and even in the public sector. Informal subcontracting relies on large international companies, and repair and maintenance workshops are supplied by the formal market. There is such interdependence



between formal and informal work that one cannot be understood independently of the other. In fact, both formal and informal activities are often combined to meet needs (e.g., a salaried job in a public ministry combined with a home-based cooked food business or the use of office materials for personal purposes).⁽⁶⁾

Safety data sheets

Workers in this sector are exposed to various chemical substances such as formaldehyde, ammonia, hydrogen peroxide, and sulfates, which may contain toxic, corrosive, or respiratory and dermal sensitizing components. These substances pose a risk to the respiratory health of stylists, according to the information provided in the safety data sheets (SDS) of the respective chemical products, as illustrated in figure 1.

	Formaldehyde Solution Signal Word: Danger: Vomiting, Corrosion, bicorporation, Allergic reactions, Irritation, Coughing, Shortness of breath, Headache, Toss, orossivos ightheadedness, Loss of consciousness.
	Hydrogen Peroxide 50 % Signal Word: Danger: Coughing, sorns of breath, Pulmonay irritation
	Ammonia in Solution Signal Word: Danger: Irritation of the respiratory tract, coughing, shortness of breath. Causes severe burns can cause wounds that are difficult to heal
	Toluene Signal Word: Danger: Vomiting, aspiration hazard, conjunctivitis, causes mild to moderate eye and skin irritation, mild to moderate respiratory tract irritation, cough, headache, convulsions, difficulty breathing.

Source: Own elaboration based on SDS.

Fig. 1. Hazards of chemical substances found.

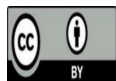
It is important to highlight that laboratories or companies that manufacture products

such as keratin treatments, hair straighteners, shampoos, and hair dyes often do not provide safety data sheets for these products. In the previous table, the abbreviation N/A (Not Available) is used because, as these are informal workplaces, the types of substances or chemical products used do not correspond to industrial-grade supplies with appropriate safety data sheets defined under the Globally Harmonized System (GHS). Instead, they mostly consist of household-use products.

This research includes procedures through which the necessary characteristics were identified to understand the work activities of stylists, their risk factors, and the level of exposure associated with their daily tasks depending on their specific roles. To achieve this, it is essential to know characteristics such as the population, their sociodemographic profile, and health conditions. It is thus indispensable to apply perceived morbidity questionnaires, observe the workplaces, and conduct interviews with the selected sample of stylists working in beauty and aesthetics centers in various areas of Bogotá.

In 2023, 87.4% of micro-business owners did not make monthly contributions to the contributory health system nor to a pension fund. This figure drops for those located in municipal centers (83.2%) and rises for those in rural or scattered areas (97.6%). On the other hand, 9.4% of micro-business owners contributed to both health and pension systems in 2023. In addition, 93.1% did not make mandatory payments to occupational risk administrators (ARL), while only 6.9% did so that year.⁽⁷⁾

Back in 2019, a sectoral study had already identified patterns of avoidance and evasion of responsibilities regarding the affiliation of workers to the Social Security and Labor systems in this specific micro-business sector.⁽⁸⁾ For these reasons, it is crucial from the Occupational Safety and Health perspective to strengthen studies aimed at identifying conditions that could influence the occurrence of occupational disease symptoms—especially in work environments where research on the subject



is limited, and even more so where the level of labor informality is high or very high. Taking into account the difficulty in accessing a significant sector-level sample size to identify prevalent chemical risks and worker morbidity in the small-scale beauty center industry, the scope of this research is limited. This is due to the lack of updated registries of the number of beauty and aesthetics centers in the country, as well as the absence of census data. Additionally, many of these workers do not operate from a fixed workplace but also perform their duties at clients' homes.

Precursor factors in exposure to chemical hazards among informal beauty salon workers

Based on the findings from the documentary review of prior research projects conducted in the field of this study, the following factors have been identified as precursors to chemical hazard exposure among informal workers in beauty salons:

The level of knowledge about chemical risk exposure in hair salons often leads workers to expose themselves without understanding the consequences for their health. Moreover, according to various studies, due to informality, occupational safety and health standards in these establishments are deficient. Consequently, the proper identification of hazards, risk assessment, and implementation of control measures are often not adequately carried out. As a result, workers are left unprotected in terms of preventive and control measures, which increases their level of exposure to risk.^(4,5,9,10)

Health impacts from chemical hazard exposure on the respiratory system of informal beauty salon workers

The respiratory system is not the only system affected by exposure to chemical contaminants. Based on the pathologies reported in various studies, it has been found



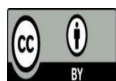
that the integumentary, neurological, reproductive, renal, cardiovascular, hematopoietic, and immune systems also undergo physiological changes when exposed to chemical agents for extended periods. Unlike the respiratory system, however, the conditions affecting these systems tend to be milder and require longer exposure times to develop. Nevertheless, it would be a mistake to underestimate these effects, as they can lead to serious complications or even result in the death of workers.⁽⁹⁾

Even though the hairdressing sector employs a significant number of workers, it remains one of the least protected in terms of occupational health and safety—starting with employment conditions such as pay-per-service, shift work, and daily contracts. In addition, information regarding the risks associated with salon tasks and workers' exposure to these risks is largely unknown.⁽⁴⁾

Therefore, in the absence of preventive programs and procedures—including protective measures during the application of straighteners or keratin treatments, ammonia-based hair dyes, and bleaching agents—these tasks may be carried out without any worker protection. This leads to exposure through inhalation or dermal contact with chemical products, which, in turn, results in various health conditions among workers in this sector. This was demonstrated in the study conducted by Caraballo Arias et al,⁽¹⁰⁾ where the results showed:

75% of workers reported inhaling toxic gases while performing their duties—gases which, according to some workers, are intolerable and cause respiratory discomfort. 15% had been diagnosed with rhinitis and reported that their symptoms worsened due to substances used in the workplace.⁽¹⁰⁾

The objective of this research was to identify chemical risk factors influencing the onset of respiratory symptoms among workers in beauty centers.



Methods

The target population for this project consists of individuals working as stylists and hairdressers in Bogotá, Colombia. A non-probabilistic or purposive sampling method was used to administer 30 self-reported morbidity questionnaires through digital means. The results and findings were subsequently presented to a panel of experts via videoconference.

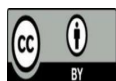
The research employed a qualiquantitative approach based on case study methodology. It was a cross-sectional study with a non-experimental, observational design, and had an exploratory scope. As a complementary technique, workplace observation was carried out following the guidelines of the Colombian Technical Standard NTC4114.⁽¹¹⁾

The main study variables were grouped into the following categories:

- ✓ Sociodemographic characteristics
- ✓ Job-related aspects
- ✓ Aspects related to the handling of chemical substances
- ✓ Knowledge of chemical exposure among informal workers.

Informed Consent

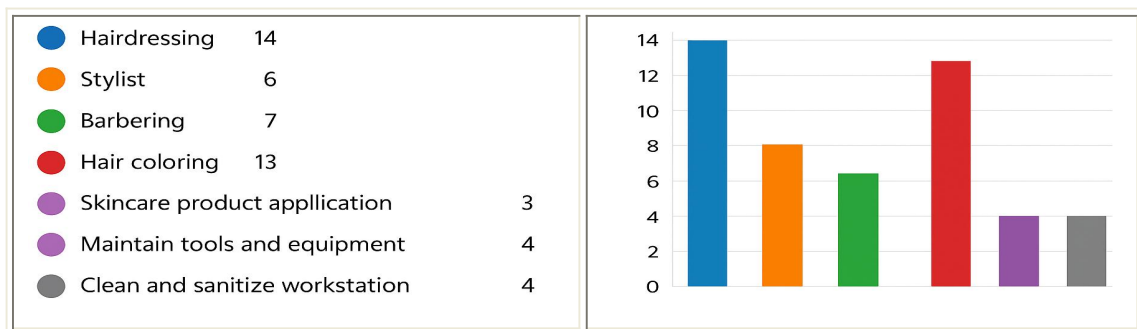
All informal workers, researchers, and expert participants in this study were duly informed about the scope of the research and provided explicit consent. The researchers confirm that the study adhered to the ethical guidelines for research involving human subjects as outlined in Rectoral Resolution No. 1416 of May 25/2017, issued by UNIMINUTO, as well as all applicable regulations in force at the time of the study. Full resolution available at: <https://shorturl.at/M0R1h>



Results

Results and Findings from the Application of the Self-Reported Morbidity Questionnaire are presented, sequentially according to the answers.

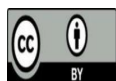
The main activities performed by stylists in hair salons are primarily related to hair cutting, followed by hair dye application, which is the second most common task and most closely related to exposure to chemical risk factors that can contribute to the development of respiratory diseases. Although dyeing is often accompanied by other tasks involving potential contact with chemicals such as hydrogen peroxide and silver nitrate, these substances, according to their respective safety data sheets, can release inorganic vapors and cause respiratory sensitivity. Individually, they may not be classified as harmful, but when used as part of mixtures, respiratory protection is recommended to mitigate potential health effects (figure 2).



Source: Own elaboration.

Fig. 2. Tabulation of question: Which of the following activities do you normally perform at your workplace?

Length of service is considered an indicator of the duration of exposure during work



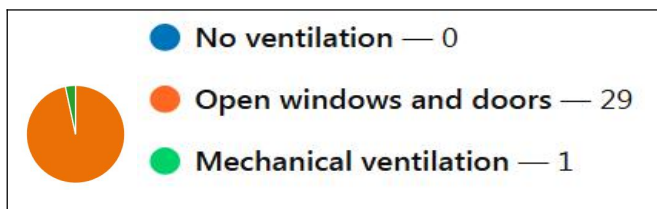
activities. The most relevant ranges are 1–5 years and 10–15 years of service. However, this does not necessarily mean that individuals were constantly exposed to the chemical components in dyes and other substances throughout that entire period, as their job duties include other tasks such as haircuts and hair washing, which may not involve direct chemical exposure. Nevertheless, according to a 2010 study conducted by the National Cancer Institute, hairdressers may have an increased risk of developing bladder cancer (figure 3).⁽¹²⁾



Source: Own elaboration.

Fig. 3. Tabulation of question: What is your length of service in your current position?

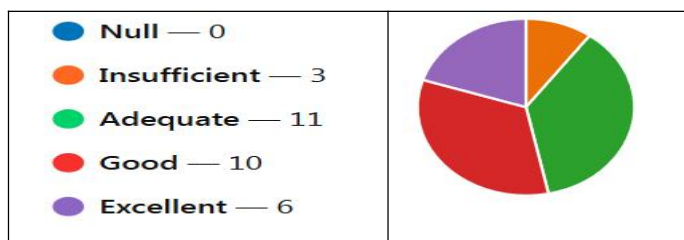
Depending on the workplace, different ventilation possibilities may be considered. In this case, in hair salons, it is evident that 29 out of the 30 people who completed the questionnaire indicated that their workplaces have open windows and doors, and only one of them has a mechanical ventilation system. However, it is not specified which type of mechanical ventilation is used (figure 4).



Source: Own elaboration.

Fig. 4. Tabulation of question: What type of ventilation is there in the establishment where you work?

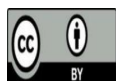
The 97% of the respondents state that the ventilation used in their workplaces is good or adequate for the procedures they carry out within the establishments. However, the number of people working in the place while performing similar aesthetic procedures is not taken into account, so the ventilation may be affected without them noticing it noticeably. This result likely reflects that those who answered that it is insufficient recognize that it is indeed inadequate.



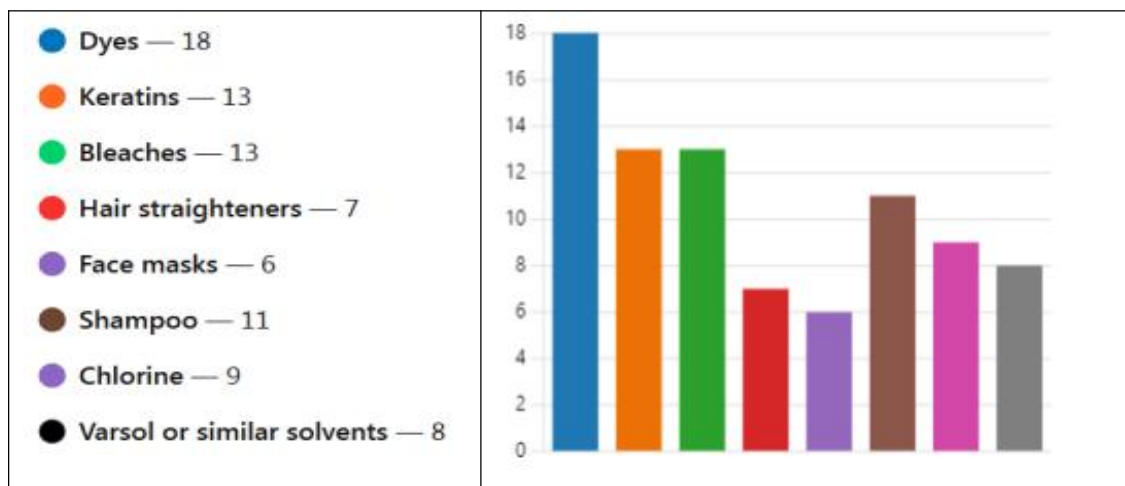
Source: Own elaboration.

Fig. 5. Tabulation of question: How do you consider the ventilation in your workplace?

When referring to beauty salons, some of the substances used in these workplaces are described. Regarding the substances most commonly used, there is a correlation with the job profiles of those who use the different substances, as reflected in figure 6. The substances that predominated in the identification were dyes, followed by



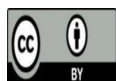
keratins, bleaches, and shampoo. However, other substances cannot be dismissed, as they contain chemicals, and when used incorrectly or in excess, they have the potential to cause mild or severe injuries depending on their characteristics and the exposure time.

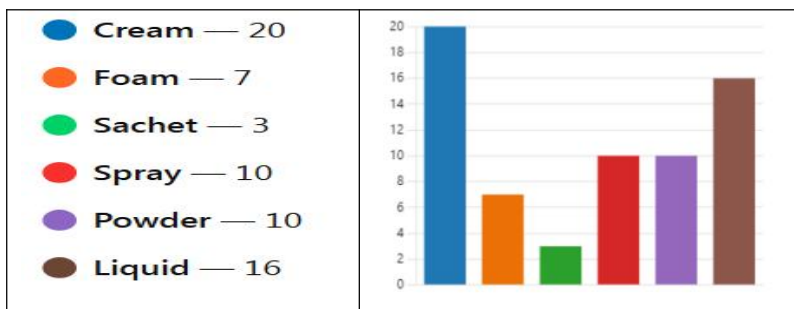


Source: Own elaboration.

Fig. 6. Tabulation of question: Which of the following chemicals do you use in your daily work?

The 60% use products with some more delicate components, and their application method is cream-based. In this sense, the effects can occur due to contact, such as skin burns. On the other hand, the substances are presented in liquid form, so there are risks of splashes in the eyes, mucous membranes, and skin, leading to potential issues due to exposure to chemicals in these sensitive areas, which are typically unprotected due to the lack of or poor use of Personal Protective Equipment (figure 7).





Source: Own elaboration.

Fig. 7. Tabulation of question: What is the application method of the products you use?

The colors in the graph highlight the average number of hours that workers spend on the application of dyes, as well as brushing and straightening with keratins. In the first and third procedures, the orange and blue colors appear similar, as this can vary based on the preparation of the product and the length of the hair being worked on. In the second procedure, the orange color predominated – corresponding to average levels of exposure – as a hairdryer and flat iron are used if the client requires it, possibly increasing the risk of exposure when applying heat to the chemicals manipulated in these procedures.



Source: Own elaboration.

Fig. 8. Tabulation of question: What is the average time spent per day on the following procedures?

These results, after being tabulated and organized, were presented to the expert panel, which consisted of the following professionals, each with their level of experience in the field and their characteristic profile to support a variety of expert opinions on the results, as shown in the chart 1.

Chart 1. Expert panel profiles

Expert Name and Education
<u>Maritza Sarmiento Linares</u> Professional in Chemical Engineering, Universidad Fundación Universitaria de América Specialist in Occupational Hygiene, Safety, and Health, Universidad Distrital Francisco José de Caldas.
Profile
Extensive experience in designing and implementing elements, tools, and methodologies to identify chemical hazards, prioritize, and intervene to prevent workplace accidents and diseases. Teacher, Trainer, and Coach in both in-person and virtual environments.
<u>Esleny Patricia González Maldonado</u> Professional in Chemical Engineering, Universidad Nacional de Colombia Specialist in Occupational Health and Labor Risks, Universidad Manuela Beltrán.
Technical consulting, support, and training for companies in various economic sectors to design, implement, and continuously improve comprehensive chemical risk management programs in accordance with applicable legal regulations and the needs of each company; knowledge in industrial hygiene and safety, management



systems, safe handling and storage of chemicals and hazardous waste, process safety, Globally Harmonized System for classification and labeling of chemicals (GHS).

María Fernanda Rodríguez Joya

Medical Surgeon, Universidad Nacional de Colombia

Specialist in Occupational Health, Universidad del Rosario.

Master's in Occupational Toxicology, Colegio Oficial de Químicos. (Chemical Official College)

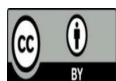
Specialist in Occupational Health with over 10 years of experience supporting companies in various sectors including manufacturing, textiles, transportation, education, health, ICT, services, etc., providing support for the design and implementation of preventive medicine and work activities (surveillance systems, promotion, and prevention programs, etc.) in line with current legislation.

Source: Research's documents.

Below are the questions asked to the expert panel and the responses they provided based on their experience and expertise:

What aspects do you consider relevant in the study conducted?

- ✓ Maritza Sarmiento Linares: Identifying the name of the hazard (solvents) used to understand the compounds they contain and the damage they can cause to the health of those who use them.
- ✓ Esleny Patricia González Maldonado: Validating the most used chemicals according to the specific tasks that yielded the highest percentage in the methodology (self-reported morbidity questionnaire) applied. It is also important to consider Personal Protective Equipment (PPE) and whether there is a distinction between the use of half-face respirators and face masks.



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What considerations, based on your experience, regarding the activities carried out by hairdressers and the relationship with exposure to chemical risks could you contribute to the topic?

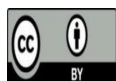
✓ Maritza Sarmiento Linares: The study is conducted in the context of informal work, where conditions depend on the economic resources of the people running these establishments. The focus should be on the knowledge and use of PPE (conducting exposure level studies on the activity and ensuring workers use PPE). However, ideally, products would not contain formaldehyde, although in informal businesses, which are a source of income, reducing exposure is difficult.

✓ Esleny Patricia González Maldonado: Since the products are classified as cosmetics, they are not required to have a safety data sheet or a label that clearly identifies the hazard classifications. It would be advisable to obtain at least the main composition and concentration of chemicals present in the products already identified in the workplaces. This would allow correlating hazardous components with possible respiratory effects.

What aspects of the research do you highlight as applicable for the development of a proposal to improve working conditions?

✓ Esleny Patricia González Maldonado: The statistics identified tasks most related to the use of chemicals that may have respiratory effects. It is important to prioritize working conditions to propose improvements, especially regarding the lack of information about the products. Disseminating relevant information is essential to raise awareness about self-care, prevention, and the use of PPE.

✓ Maritza Sarmiento Linares: The study focuses on informal work, where conditions depend on the resources of the establishments. The approach should



include studies on exposure levels in the activities and promote the use of PPE by workers. However, ideally, products would not contain formaldehyde, though reducing exposure is difficult in informal businesses.

If all companies, regardless of their business type, must apply OSH standards, why do you think hair salons are not included? What recommendations would you give to the research team to address the study of chemical risks in informal workers and hair salons?

✓ Esleny Patricia González Maldonado: There is a lack of capacity within the ministry to verify compliance with standards. Although there are regulations and responsible entities, in reality, adequate validation is not carried out (e.g., in hair salons, the Health Secretariat). Culturally, if no incident occurs, things tend to remain unchanged.

✓ Maritza Sarmiento Linares: Not enough efforts are made to develop prevention programs for risks. The Ministry of Labor has not paid sufficient attention to this area, and it would be important to conclude that there is a lack of a governmental approach to risk prevention in informality, especially considering the current situation.

What strategy do you recommend to raise awareness about chemical risk factors and their effects in this group of workers?

✓ Maritza Sarmiento Linares: It is crucial to understand how willing people are to develop safe habits and behaviors, considering that the primary value is caring for their health.

✓ Esleny Patricia González Maldonado: I would recommend developing deliverable materials, such as guides and charts, to raise awareness in a simple and



understandable way, summarizing prevention measures. It would also be helpful to have access to a chemical safety visit report to check which requirements are currently in place, as well as establish control through surveillance and review of regulations and requirements applicable to hair salons, from their formation to the collection of biosanitary material.

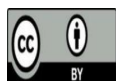
From the preventive medicine perspective, and considering the accessible resources for hair salons, what preventive measures would you recommend to minimize symptoms associated with respiratory conditions?

✓ María Fernanda Rodríguez Joya: It is essential to characterize exposure and respiratory effects, both acute and chronic. In cases of acute symptoms, people may not present immediate consequences, but ideally, individuals with respiratory conditions should not be exposed to these products. It is recommended to work in open spaces and perform spirometry, although in informal settings it is difficult to determine the origin of diseases. Additionally, it would be useful to apply validated questionnaires for their evaluation.

Based on the symptomatology results presented in the study, what signs do you consider important alarms for identifying the presence of an occupational disease?

✓ Maritza Sarmiento Linares: It is necessary to filter the identified substances by their respiratory effects, as this is the central focus of the research. This way, these hazards are not confused with others that may arise.

✓ Esleny Patricia González Maldonado: Since there is no safety data sheet for the prioritized products, it is important to identify the main components and analyze their possible toxicological effects on the respiratory system. Furthermore, cases



associated with these substances should be investigated, and correlations should be made between symptoms and hazardous substances with higher concentrations, considering the potential respiratory effects they may cause.

✓ María Fernanda Rodríguez Joya: Spirometry tests are useful, but it depends on who conducts and interprets them. In informal settings, it is difficult to establish the origin of diseases. Alarm signs include persistent cough for more than 15 days, frequent presence of mucus, difficulty walking, and weight loss. Many of the substances used in this activity are respiratory sensitizers, which may lead to asthma attacks or chronic problems similar to asthma. However, these substances are not typically associated with lung cancer.

If all companies, regardless of their business type, must apply OSH standards, what do you consider to be the factors that contribute to hair salons not meeting these standards?

✓ María Fernanda Rodríguez Joya: Informality in these businesses is a serious problem, as workers usually receive daily pay and are unaware of the risks they are exposed to. If large companies find it challenging to meet standards, in these establishments, misinformation and the type of contract make the situation even more difficult.

Discussion

The handling of chemical substances in establishments such as hair salons, barber shops, etc., where the level of exposure may be considered low, nevertheless, due to the type of components contained in the products used, they can be considered dangerous even at lower concentrations. In informal work settings, it is



recommended to give greater importance to these aspects to promote compliance with minimum occupational health and safety requirements, as a complement to the activities that local hospitals carry out regarding sanitation, where substances are identified and characterized, along with their adverse health effects. The study consistently identified that the products used by workers in their activities are considered and marketed as for domestic use, which is why safety data sheets and usage recommendations are not developed considering the types and frequencies of industrial or daily exposure during working hours, including hazardous materials such as ammonia or formaldehyde among their components.

In beauty parlors, especially those operating informally, there is a noticeable lack of compliance with Occupational Health and Safety (OHS) regulations. This is due to both the lack of capacity by authorities to verify standards and general misinformation about the dangers workers are exposed to. This situation puts the health of employees at risk, as they often lack the resources and necessary information to protect themselves from the dangers associated with chemical products.

Despite the existence of cosmetics that can affect health, there is insufficient information about their components or adequate measures to reduce exposure. In addition to this and considering the limited knowledge about the consequences of exposure to these hazardous substances, it is recommended to conduct targeted communication and dissemination campaigns for this population, prioritizing these aspects to encourage the correct use of Personal Protective Equipment (PPE), focusing on self-care procedures and the handling of hazardous substances, no longer as domestic use but as industrial use with safety data sheets and hazard characteristics and labeling based on the Globally Harmonized System. Likewise, disseminating everything related to the prevention of respiratory diseases.



However, further and broader studies are needed to fully understand the phenomenon and obtain statistically representative results to broaden the discussion and develop strategies that foster a safer working environment for informal workers.

Conclusions

Although the products used for beauty procedures are over the counter, they may contain components such as formaldehyde that can affect the respiratory system. According to current regulations, these products are exempt from the Globally Harmonized System (GHS) application. With the support of multidisciplinary experts in occupational safety and health, recommendations are made to improve the occupational well-being of exposed individuals.

Data Availability Statement

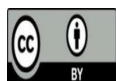
The data supporting the findings of this study are available from the corresponding author, upon reasonable request.

Funding

This research was developed as a part of project C124-200-6644- “AI-based digital engineering control for workplace psychosocial risk factors among informals workers associated with digital platforms”, funded within the 2025 Scientific research call of the Minuto de Dios University Corporation (UNIMINUTO).

Acknowledgements

The authors would like to express gratitude to God for the opportunity to continue

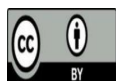


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the personal and professional growth of the research team throughout the learning process. The authors also extend thanks to the research group leader for their contributions, guidance, and ongoing support and motivation during the research process. Special thanks to the expert panel members -Maritza Sarmiento Linares, Esleny Patricia Gonzalez, and María Fernanda Rodriguez Joya- for their valuable insights in their respective areas of expertise. The authors would also like to acknowledge the Cuban Journal of Health and Work (CJHW) for providing the platform to publish the results of this research, as well as to the informal workers who participated in the study, who face daily risks to their safety and health, contributing through their work to societies around the world and providing for their families.

Bibliographic references

1. Portes A; Roberts BR. Empleo y desigualdad urbanos bajo el libre mercado. Nueva Soc. 2004 [access 25/05/2026];193:76–96. Available from:
<https://nuso.org/articulo/empleo-y-desigualdad-urbanos-bajo-el-libre-mercado-consecuencias-del-experimento-neoliberal/>
2. Puello-Socarrás GE; Ballén Buitrago DM. Seguridad y salud para el trabajador informal: Ruta de innovación social para el trabajo digno; Corporación Universitaria Minuto de Dios – UNIMINUTO, 2022 [access 25/05/2026]. Available from:
<https://doi.org/10.26620/uniminuto/978-958-763-555-3>
3. DANE. Gran Encuesta Integrada de Hogares (GEIH), Boletín julio de 2024; DANE, 2024 [access 25/05/2026]. Available from:
<https://www.dane.gov.co/files/operaciones/GEIH/bol-GEIH-jun2024.pdf>
4. Molina Pérez IS; Sánchez Puentes FA. Evaluación de la exposición ocupacional a



sustancias químicas en peluquerías: Un estudio de caso. Universidad El Bosque.

2020 [access 25/05/2026]. Available from:

<https://repositorio.unbosque.edu.co/server/api/core/bitstreams/0b91c154-ecdf-4974-953b-b38dd3036eb8/content>

5. Lozano Ramírez T; Montero Martínez R. Análisis de los riesgos ocupacionales que se originan en peluquerías y lugares de estéticas: Propositiones para su control. Hombre Máquina. 2015 [access 25/05/2026];46(59):71. Available from: Disponible en: <https://www.redalyc.org/pdf/478/47843368008.pdf>

6. Manvoutouka T. ¿Hasta qué punto y cómo puede conceptualizarse el trabajo informal? Laboreal. 2013;9(2):e5674. DOI: <https://doi.org/10.4000/laboreal.5674>

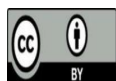
7. DANE. Encuesta de Micronegocios (EMICRON) 2023; DANE. 2023 [access 25/05/2026]. Available from: <https://www.dane.gov.co/files/operaciones/EMICRON/bol-EMICRON-2023.pdf>

8. DANE. Informe Ejecutivo Micronegocios – Peluquería y otros tratamientos de belleza; DANE. 2019 [access 25/05/2026]. Available from: <https://www.dane.gov.co/files/investigaciones/boletines/ech/micro/2019-ene-dic-informe-micronegocio-peluqueria-tratamientos-belleza.pdf>

9. Pertuz Meza YB; Rebolledo Castillo MV; Vásquez Brochero HY; Gil Escamilla MJ. Efectos para la salud respiratoria de los trabajadores que usan sustancias químicas en su medio laboral: Una revisión sistemática. Rev. Cienc. Salud Uninorte. 2022;38(2):560–85. DOI: <https://doi.org/10.14482/sun.38.2.616.2>

10. Caraballo-Arias Y; Rodríguez AR; RiveroÁJ; Rangel RG; Barrios Covaro M. Riesgos laborales en trabajadores de barberías y peluquerías de economía informal: Caracas, Venezuela. Cienc. Trab. 2013;15(46):18–23. DOI: <https://doi.org/10.4067/S0718-24492013000100005>

11. Instituto Colombiano de Normas Técnicas - ICONTEC. Norma Técnica



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Colombiana NTC4114; ICONTEC. 1997 [access 25/05/2026]. Available from:

<https://syiconsultoress.wordpress.com/wp-content/uploads/2018/09/ntc-4114-realizacion-de-inspecciones-planeadas.pdf>

12. Instituto Nacional del Cáncer (NIH). Productos para el cabello y el riesgo de cáncer; NIH, 2022 [access 25/05/2026]. Available from:

<https://www.cancer.gov/espanol/cancer/causas-prevencion/riesgo/sustancias/hoja-informativa-tintes-para-cabello>

Conflict of interest

The authors declare that they don't have conflict of interest.

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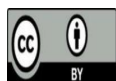
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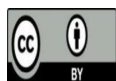


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