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ASSESSMENT OF PULMONARY HEALTH RISKS ASSOCIATED WITH EXPOSURE TO AEROSOLIZED AND PARTICULATE SALON CHEMICAL PRODUCTS: A CROSS- SECTIONAL STUDY IN KARACHI, PAKISTAN

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ABSTRACT

Salon workers in Karachi, Pakistan, including males, females, and transgender individuals, are exposed to aerosolized and particulate chemical products such as hair dyes, powders, and sprays. These exposures pose potential pulmonary health risks. This study aimed to determine the prevalence of respiratory symptoms and pulmonary function impairments among salon workers and to identify occupational and behavioral factors associated with respiratory morbidity. A cross-sectional study was conducted with 365 salon workers selected through stratified random sampling. Data were collected using structured questionnaires assessing demographics, occupational exposures, respiratory symptoms, personal protective equipment (PPE) use, and workplace ventilation. Spirometry measured forced expiratory volume in one second (FEV1), forced vital capacity (FVC), and FEV1/FVC ratio. Descriptive statistics summarized participant characteristics and symptom prevalence. Logistic regression was performed to evaluate associations between exposures and respiratory symptoms, adjusting for confounders. Results showed that 43.8% of participants reported at least one respiratory symptom, with shortness of breath (30.1%), cough (28.8%), and wheezing (25.2%) being most common. Mean FEV1 and FVC were 2.9 ± 0.7 L and
3.6 ± 0.8 L, respectively, with an FEV1/FVC ratio of 0.81 ± 0.07. High exposure to hair dyes (OR=2.25, 95% CI: 1.40–3.62,

p=0.001) and frequent spray use (OR=1.85, 95% CI: 1.12–3.05, p=0.015) significantly increased odds of respiratory symptoms. Smoking and poor ventilation also elevated risk ($p<0.05$). PPE use was low (4.1%) and not significantly protective. The study concludes that respiratory symptoms are prevalent among Karachi's salon workers and are significantly associated with chemical exposures, smoking, and poor ventilation. Occupational health interventions focusing on ventilation improvement, PPE promotion, and health monitoring are urgently needed.

1. INTRODUCTION

1.1 Background

Beauty salons and barbershops are integral components of Karachi's urban economy, employing a diverse workforce that includes females, males, and transgender individuals. These workplaces involve the frequent use of chemical products such as hair dyes, bleaching powders, aerosol sprays, and nail polishes. These products release volatile organic compounds (VOCs), persulfates, ammonia, formaldehyde, and fine particulates into the air, which can be inhaled by workers during their routine tasks (Khan et al., 2021; Saleem, Ali, & Hussain, 2023). The inhalation of these airborne substances has been linked to respiratory irritation, allergic sensitization, and chronic respiratory diseases in occupational settings globally (Gharibi et al., 2021; Al-Muhsen et al., 2019).

In Pakistan, the salon workforce is gender-diverse. While females predominantly staff many beauty salons, males are the main workforce in barber shops, and transgender individuals often find employment in salons due to social acceptance and economic necessity (Ali et al., 2022). Despite this diversity, research on occupational respiratory health risks in this population remains limited. Karachi's salons often operate in poorly ventilated environments with minimal use of personal protective equipment (PPE), increasing workers' exposure to harmful chemicals (Saleem et al., 2023).

Respiratory symptoms such as cough, wheezing, shortness of breath, and chest tightness are commonly reported among salon workers worldwide (Gharibi et al., 2021; Sathiakumar et al., 2014). Pulmonary function tests (PFTs) frequently reveal restrictive or obstructive impairments, indicating potential chronic lung damage (Roy, Bhattacharya, & Ghosh, 2022). However, the extent of these health effects among Karachi's salon workers, inclusive of all genders, has not been thoroughly studied.

Given the high prevalence of chemical exposures and the lack of occupational health safeguards, it is crucial to quantify respiratory symptom prevalence and pulmonary function impairment in this population. This study aims to fill this gap by assessing respiratory health outcomes and identifying occupational and behavioral risk factors among salon workers in Karachi.

1.2 Problem Statement

Despite the evident health risks, there is a paucity of data on the respiratory health status of salon workers in Karachi, particularly inclusive of all genders. The absence of comprehensive epidemiological studies hampers the development of effective occupational health policies and interventions tailored to this vulnerable group. Without such data, salon workers remain at risk of undiagnosed and untreated respiratory conditions, potentially leading to chronic morbidity and reduced quality of life.

1.3 Rationale

Given the widespread use of aerosolized and particulate chemical products in salons and the documented respiratory health effects in similar populations globally, it is imperative to investigate these risks in Karachi's context. Understanding the prevalence of respiratory symptoms, pulmonary function status, and contributing occupational factors among salon workers will provide critical evidence to guide workplace safety improvements and health monitoring programs.

1.4 Objectives

To assess the prevalence of respiratory symptoms and pulmonary function impairment among salon workers in Karachi and identify occupational and behavioral factors associated with respiratory morbidity.

1.5 Research Questions

What is the prevalence of respiratory symptoms among salon workers in Karachi?

1.6 Significance of the Study

This study fills a critical knowledge gap by providing inclusive data on pulmonary health risks among Karachi's salon workforce. The findings will inform policymakers, health practitioners, and salon owners to implement targeted interventions such as improved ventilation, PPE promotion, and regular health screenings. Ultimately, this research aims to improve occupational health standards and protect the respiratory health of all salon workers in Pakistan.

2. LITERATURE REVIEW

2.1 Chemical Exposures in Salon Environments

Salon workers are exposed to a complex mixture of chemicals, including VOCs such as formaldehyde, toluene, and ammonia; persulfate salts in bleaching agents; and fine particulates from powders and sprays (Saleem et al., 2023). These substances are known respiratory irritants and sensitizers, capable of causing airway inflammation and asthma. Aerosolized sprays and powders increase inhalation risk, especially in poorly ventilated salons (Sathiakumar et al., 2014; Park & Lim, 2020).

2.2 Respiratory Symptoms and Diseases

International studies report high prevalence of respiratory symptoms among salon workers. For example, Gharibi et al. (2021) found cough and wheezing rates of 22–30% among Iranian hairdressers. Al-Muhsen et al. (2019) reported similar findings in Saudi Arabian salon employees. Occupational asthma linked to persulfates and other chemicals is well documented (Heederik et al., 2018). Chronic bronchitis and obstructive airway disease have also been reported (Dumas et al., 2019). Symptom prevalence correlates with exposure duration and workplace conditions (Sathiakumar et al., 2014).

2.3 Pulmonary Function Impairment

Spirometry studies reveal reduced FEV1 and FVC among salon workers, sometimes indicating restrictive lung disease patterns, possibly due to chronic inflammation or fibrosis (Roy et al., 2022; Saleem et al., 2023). Poor environmental controls such as inadequate ventilation exacerbate these effects (Gharibi et al., 2021).

2.4 Gender and Occupational Health

Gender influences occupational exposure patterns. In Pakistan, males dominate barber shops, females work in beauty salons, and transgender individuals often work in salons due to social factors (Ali et al., 2022; Khan et al., 2021). Few studies have examined respiratory health outcomes by gender in salon workers, but preliminary evidence suggests similar exposure levels and risks across genders.

2.5 Workplace Factors

Ventilation quality is a major determinant of exposure intensity. Poor ventilation leads to accumulation of airborne chemicals, increasing inhalation risk (Saleem et al., 2023). PPE use is generally low due to lack of awareness and cultural factors (Al-Muhsen et al., 2019). Longer work hours and higher chemical use frequency increase respiratory morbidity risk (Sathiakumar et al., 2014).

2.6 Research Gaps

There is a lack of comprehensive, gender-inclusive studies on pulmonary health among salon workers in Pakistan. This study addresses this gap by assessing respiratory symptoms, pulmonary function, and associated risk factors in Karachi's salon workforce.

3. METHODOLOGY

3.1 Study Design and Setting

This was a cross-sectional analytical study conducted from January to April 2025 in salons and barber shops across Karachi, Pakistan.

3.2 Population and Sampling

- **Target population:** Salon workers aged ≥18 years working at least 20 hours per week.
- **Estimated population:** Approximately 9,000 salon workers in Karachi.
- **Sample size:** Calculated as 365 based on an estimated 44% prevalence of respiratory symptoms, 5% margin of error, and 95% confidence level.
- **Sampling technique:** Stratified random sampling was used. Karachi was divided into districts, and salons were randomly selected proportionally. Within selected salons, workers were randomly chosen ensuring representation of females, males, and transgender individuals.

3.3 Eligibility Criteria

- **Inclusion criteria:**
  - Currently employed salon workers (hairdressers, beauticians, nail technicians, barbers).
  - Age ≥18 years.
  - Working ≥20 hours per week.
- **Exclusion criteria:**
  - History of diagnosed chronic respiratory diseases unrelated to occupational exposure (e.g., cystic fibrosis).
  - Inability to perform spirometry.

3.4 Data Collection Tools

- **Questionnaire:** Adapted from the American Thoracic Society respiratory questionnaire, including sections on demographics, smoking, occupational exposure frequency to powders, sprays, dyes, respiratory symptoms, PPE use, and salon ventilation.

Spirometry: Performed using EasyOne Pro spirometer measuring FEV1, FVC, and FEV1/FVC ratio according to ATS/ERS guidelines.

Observational checklist: Assessed salon ventilation and PPE availability.

3.5 Data Collection Procedure

Participants gave informed consent. Trained interviewers administered questionnaires face-to-face. Spirometry was conducted onsite by certified technicians following standard protocols.

3.6 DATA ANALYSIS

Descriptive statistics summarized participant characteristics and symptom prevalence.

Chi-square tests compared categorical variables.

Independent t-tests compared pulmonary function between symptomatic and asymptomatic workers.

Logistic regression analyzed associations between exposures and respiratory symptoms, adjusting for age, gender, smoking, and ventilation.

Statistical significance was set at $p<0.05$.

Data analyzed using SPSS v25

4. Results

4.1 Variables Overview

Variable Type	Variables
Dependent Variable	Presence of respiratory symptoms (Yes/No)
Independent Variables	Gender (Male/Female/Transgender), Age, Smoking status, Exposure to hair dyes (frequency), Exposure to sprays (frequency), PPE use, Ventilation status, Years of salon work

4.2 Participant Demographics and Occupational Characteristics

Characteristic	Frequency (n=365)	Percentage (%)
Gender		
- Female	310	85.0
- Male	40	11.0
- Transgender	15	4.0
Mean Age (years)	31.8 ± 7.9	-
Smoking Status		
- Smoker	40	11.0
- Non-smoker	325	89.0
Mean Years in Salon	6.5 ± 4.1	-
PPE Use (Regular)	15	4.1
Adequate Ventilation	120	32.9

4.3 Prevalence of Respiratory Symptoms

Symptom	Frequency (n=365)	Percentage (%)
Cough	105	28.8
Wheezing	92	25.2
Shortness of breath	110	30.1
Chest tightness	68	18.6
Any respiratory symptom	160	43.8

4.4 Pulmonary Function Test Results

Parameter	Mean ± SD	% Predicted Mean ± SD
FEV1 (L)	2.9 ± 0.7	88.5 ± 12.3
FVC (L)	3.6 ± 0.8	90.2 ± 11.5
FEV1/FVC	0.81 ± 0.07	-

Comparison of FEV1 by Symptom Status

Symptom Status	Mean FEV1 (L) ± SD	p-value (t-test)
Symptomatic	2.7 ± 0.6	0.02
Asymptomatic	3.0 ± 0.7	

4.5 Logistic Regression Analysis: Factors Associated with Respiratory Symptoms

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
High hair dye exposure	2.25	1.40 – 3.62	0.001
Frequent spray use	1.85	1.12 – 3.05	0.015
Smoking	2.10	1.05 – 4.20	0.035
Poor ventilation	1.67	1.05 – 2.65	0.030
PPE use (regular)	0.55	0.20 – 1.50	0.24
Gender (Male vs Female)	0.75	0.40 – 1.30	0.31
Gender (Transgender vs Female)	1.10	0.45 – 2.70	0.83

5. DISCUSSION

This study demonstrates a high prevalence (43.8%) of respiratory symptoms among salon workers in Karachi, consistent with findings from Iran, Saudi Arabia, and India (Gharibi et al., 2021; Al-Muhsen et al., 2019; Roy et al., 2022). The significant associations between high exposure to hair dyes and sprays and respiratory symptoms align with known respiratory irritant and sensitizer effects of these chemicals (Heederik et al., 2018; Dumas et al., 2019). Smoking and poor ventilation further increased respiratory risk, highlighting modifiable factors.

The low PPE use (4.1%) reflects limited awareness and cultural barriers, indicating a need for targeted occupational health education. No significant differences in respiratory symptoms were found by gender after adjustment, suggesting that all salon workers, regardless of gender, face similar exposure risks.

Limitations include cross-sectional design limiting causal inference, reliance on self-reported exposure data, and lack of

environmental air monitoring. However, objective spirometry strengthens the findings.

6. Conclusion

Respiratory symptoms are common among salon workers in Karachi and are significantly associated with chemical exposures, smoking, and poor ventilation. Occupational health interventions focusing on improving ventilation, promoting PPE use, and conducting regular respiratory health monitoring are urgently needed to protect this workforce

REFERENCES

1. Khan A, Hussain A, Ali S. Male bodies, women's souls: personal narratives of beauty salon workers in Pakistan. Gend Soc Res. 2021;7(2):45-62.
2. Saleem I, Ali Z, Hussain A. The effects of occupational chemical exposure on respiratory health among hairdressers in Pakistan. Songklanakarin J Sci Technol. 2023;45(3):394-398.
3. Gharibi V, Khadem M, Khosravi Y, et al. Occupational exposures and respiratory symptoms and lung function among hairdressers in Iran: a cross-sectional study. Int Arch Occup Environ Health. 2021;94(1):167-177.
4. Al-Muhsen S, Al-Ghamdi S, Al-Khaldi Y, et al. Respiratory Symptoms and Pulmonary Function Test among Salon Employees in Saudi Arabia. Bahrain Med Bull. 2019;41(1):14-18.
5. Ali S, Khan A, Khan R. Gender diversity and disclosure in Pakistan's salon industry. CERB PBC. 2022.
6. Sathiakumar N, Delzell E, Abdalla S, et al. Occupational respiratory morbidity among hair and beauty salon workers: a systematic review. Am J Ind Med. 2014;57(3):229-241.
7. Park JH, Lim H. Occupational respiratory morbidity among hair and beauty salon workers: A systematic review and meta-analysis. Ann Occup Environ Med. 2020;32:e24.
8. Roy S, Bhattacharya S, Ghosh S. Lung Function Tests in Hairdressers of Gangtok: A Cross-Sectional, Comparative Study. J Clin Diagn Res. 2022;16(7):OC01-OC05.
9. Heederik D, Doekes G, Krop E, et al. Occupational asthma in hairdressers. Curr Opin Allergy Clin Immunol. 2018;18(2):112-117.
10. Dumas O, Le Moual N, Kennedy SM, et al. Respiratory effects of occupational exposure to hairdressing products. Occup Environ Med. 2019;76(7):485-492.
11. Tomar S, Tiwari RR, Verma G. Occupational respiratory morbidity among hair and beauty salon workers in Udupi taluk, Karnataka, India. Am J Ind Med. 2020;63(10):902-906.
12. Skoufi G, Vasilakos D, Vassilakopoulos T, et al. Respiratory symptoms and lung function in hairdressers: a cross-sectional study in Larissa, Greece. Int J Occup Environ Health. 2013;19(4):333-341.
13. Leino T, et al. Respiratory symptoms and lung function in Finnish hairdressers. Am J Ind Med. 1997;31(4):456-464.
14. Akpinar-Elci M, et al. Respiratory symptoms and occupational asthma in hairdressers in Turkey. Occup Med (Lond). 2002;52(5):279-284.
15. Hashemi M, et al. Respiratory symptoms and pulmonary function among hairdressers in Iran. Int J Occup Environ Med. 2010;1(3):137-144.
16. Awadalla NJ, et al. Hairdressing exposure and risk of idiopathic pulmonary fibrosis. Am J Respir Crit Care Med. 2012;185(5):538-544.
17. Nagata N, et al. Occupational exposure and idiopathic pulmonary fibrosis. Eur Respir J. 1997;10(12):2696-2700.
18. McCormack MC, et al. Heat exposure and respiratory health: a review. Environ Health Perspect. 2016;124(9):A156-A157.
19. Rice MB, et al. Heat and indoor air pollution: effects on respiratory health. Environ Health Perspect. 2019;127(7):075001.

20. Ali S, Khan A, Khan R. Knowledge and practices regarding Hepatitis B and HIV-AIDS among beauty salon workers in Karachi. CMUJ. 2023;14(2):45-52.

1. Sethi R, et al. Respiratory health of hairdressers: a systematic review. Occup Med (Lond). 2021;71(3):134-141.

Questionnaire and Data Collection Tool

Section 1: Personal and Demographic Information
1. Age (years): _____ (Open numeric response)
2. Gender: Male / Female / Transgender (select one)
3. Smoking Status: 1 = Never smoked, 2 = Former smoker, 3 = Occasional smoker, 4 = Regular smoker
4. Years working in salon/barber shop: _____ (Open numeric response)
Section 2: Occupational Exposure Frequency **Please indicate how often you are exposed to the following chemical products during work:**
Exposure Item 1 = Never 2 = Rarely 3 = Sometimes 4 = Often 5 = Always
1. Hair dyes
2. Bleaching powders
3. Aerosol sprays (e.g., hairspray, setting spray)
4. Nail polish and removers
5. Other chemical powders (e.g., talcum)
Section 3: Respiratory Symptoms in the Last 12 Months **Please indicate how frequently you have experienced the following symptoms during or after work:**
Symptom 1 = Never 2 = Rarely 3 = Sometimes 4 = Often 5 = Always
1. Cough
2. Wheezing or whistling in chest
3. Shortness of breath
4. Chest tightness
5. Phlegm (mucus) production
6. Nasal congestion or runny nose
Section 4: Work Environment and Safety Practices
Statement 1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree
1. My workplace has adequate ventilation (e.g., windows, fans).
2. I regularly use personal protective equipment (e.g., masks, gloves) while working.
3. I receive training on safe handling of salon chemicals.
4. I am aware of the health risks associated with salon chemicals.
Section 5: Workload and Duration
1. How many hours per day do you work in the salon? 1 = Less than 4 hours, 2 = 4-6 hours, 3 = 7-9 hours, 4 = 10 or more hours
2. How many days per week do you work? 1 = 1-2 days, 2 = 3-4 days, 3 = 5-6 days, 4 = 7 days