Hygienic Assessment of The Impact of Atmospheric Air Pollution in Residential Areas on Public Health and Living Conditions: A Population-Based Survey Study in Fergana Region

Maraimov Ulug'bek Muhammadkadirovich, Axunov Anvarbek Avazovich
Fergana Medical Institute of Public Health, Fergana, Uzbekistan

Abstract

This study assessed the hygienic impact of atmospheric air pollution in residential areas on public health and living conditions among the population of Fergana region. A cross-sectional survey involving 640 residents aged 18–70 years was conducted in 2026. The study evaluated environmental perception, respiratory complaints, allergic symptoms, housing conditions, and psycho-emotional discomfort associated with atmospheric pollution. The findings demonstrated that 68.4% of respondents regularly perceived dust accumulation and unpleasant industrial odors, while 52.8% reported chronic respiratory complaints. Residents living near industrial and high-traffic zones demonstrated significantly higher prevalence of headaches, allergic rhinitis, eye irritation, sleep disturbances, and reduced quality of life. The results indicate that atmospheric pollution substantially affects both public health and hygienic living conditions in residential areas.

Keywords: *atmospheric pollution, environmental hygiene, respiratory health, residential environment, public health, air quality, hygienic assessment, Fergana region*

INTRODUCTION

Atmospheric air is one of the most important environmental factors influencing human health and quality of life. Clean air is essential for maintaining normal respiratory function, cardiovascular stability, neurophysiological activity, and immune resistance. However, rapid industrialization, urbanization, increasing motor vehicle density, and environmental degradation have significantly worsened atmospheric air quality in many developing regions of the world.

Air pollution has become one of the leading environmental risk factors contributing to morbidity and mortality worldwide. According to the World Health Organization, millions of premature deaths annually are associated with exposure to polluted atmospheric air. Long-term inhalation of particulate matter, nitrogen oxides, sulfur compounds, carbon monoxide, volatile organic compounds, and industrial aerosols

increases the risk of chronic respiratory diseases, allergic disorders, cardiovascular pathology, malignant neoplasms, and neuropsychological disturbances.

Residential environments located near industrial enterprises and transportation corridors are especially vulnerable to atmospheric pollution. In such areas, the population experiences continuous exposure to contaminated air, resulting in both direct physiological effects and deterioration of living conditions. Poor environmental quality may negatively affect sleep, psychological comfort, work capacity, social well-being, and overall quality of life.

The Fergana region represents one of the most industrially developed territories of Uzbekistan. The region contains oil refining facilities, chemical enterprises, construction industries, dense traffic systems, and expanding residential zones. Environmental conditions are additionally influenced by geographical features of the Fergana Valley, where restricted atmospheric circulation and seasonal temperature inversions may promote accumulation of pollutants near the ground surface.

From a hygienic perspective, atmospheric pollution should be evaluated not only through laboratory monitoring of pollutants but also through assessment of population health complaints and subjective environmental perception. Residents living in polluted environments often demonstrate increased prevalence of respiratory symptoms, allergic conditions, chronic fatigue, headaches, emotional tension, and reduced environmental comfort.

Environmental hygiene studies increasingly emphasize the importance of population-based surveys because subjective environmental discomfort frequently reflects real ecological stress even before laboratory thresholds are exceeded. Such surveys provide valuable information regarding chronic exposure patterns and public adaptation to environmental conditions.

Despite growing environmental concerns, relatively limited studies in Uzbekistan have comprehensively evaluated the impact of atmospheric air pollution on both health indicators and residential living conditions using community-based questionnaire methods.

The present study aimed to conduct a hygienic assessment of the impact of atmospheric air pollution in residential areas on public health and living conditions among the population of Fergana region.

MATERIALS AND METHODS

A cross-sectional population-based survey study was conducted between February and June 2026 among residents of Fergana region. The study included 640 participants aged between 18 and 70 years selected using stratified random sampling. Participants represented urban residential districts with varying proximity to industrial enterprises, major roads, and relatively low-pollution suburban areas.

The study population included industrial workers, office employees, teachers, healthcare workers, students, retirees, and unemployed residents. Participation was voluntary and anonymous. Respondents were informed regarding the objectives of the study and provided verbal consent before participation.

Data collection was performed using the "Environmental Hygiene and Air Quality Assessment Questionnaire–2026," specifically designed for evaluation of environmental perception, respiratory health, allergic symptoms, psycho-emotional well-being, and residential hygienic conditions.

The questionnaire consisted of 38 items divided into several domains. Environmental perception indicators included frequency of unpleasant odor detection, visible dust accumulation, smoke exposure, and perception of air freshness. Participants additionally evaluated the cleanliness of their residential environment and subjective satisfaction with atmospheric air quality.

Health-related questions evaluated chronic cough, sputum production, dyspnea, allergic rhinitis, eye irritation, recurrent respiratory infections, headaches, sleep disturbances, chronic fatigue, and emotional discomfort. Respondents also reported smoking status, occupational exposure, ventilation quality in residential buildings, and average duration of outdoor activity.

Participants living within two kilometers of industrial facilities or major traffic zones were categorized as environmentally exposed residents. Those living in suburban or low-traffic areas were classified as the comparison group.

Statistical analysis included descriptive methods with calculation of frequencies and percentages. Comparative analyses were performed to evaluate differences between exposed and comparison groups.

RESULTS

The study demonstrated widespread perception of environmental pollution among residents of industrial and traffic-intensive districts. Approximately 68.4% of respondents reported regular detection of unpleasant industrial odors and visible dust accumulation in residential areas. Nearly half of respondents stated that windows and balconies accumulated dust rapidly after cleaning.

Air pollution complaints were significantly more common among participants living near industrial enterprises and high-density traffic corridors. Many respondents described a sensation of "heavy air," especially during summer heat and low-wind weather conditions.

Respiratory complaints represented one of the most prevalent health problems identified during the survey. Chronic cough was reported by 41.6% of respondents, while 34.7% experienced recurrent sputum production or throat irritation. Dyspnea during moderate physical activity was reported by 26.3%.

Allergic manifestations were also widespread. Allergic rhinitis was reported by 37.5% of participants, while 29.4% experienced recurrent eye irritation and conjunctival redness. Respondents frequently associated symptom exacerbation with periods of increased dust or industrial emissions.

Residents of environmentally exposed districts demonstrated significantly higher prevalence of respiratory and allergic symptoms compared with the comparison group. Chronic cough, eye irritation, and headaches were particularly common among individuals residing near industrial facilities.

Headaches and psycho-emotional discomfort were frequently reported. Approximately 43.8% of respondents experienced recurrent headaches, while 31.2% described chronic fatigue and reduced work capacity. Sleep disturbances were observed in 27.6%, particularly among residents exposed to traffic noise and unpleasant odors during nighttime hours.

Environmental discomfort substantially affected subjective quality of life. More than half of respondents living in industrial districts reported dissatisfaction with residential environmental conditions. Many participants expressed concern regarding long-term health consequences of atmospheric pollution for themselves and their children.

Housing conditions additionally influenced environmental exposure. Respondents living in poorly ventilated apartments more frequently reported respiratory complaints and headaches. Lack of green spaces and proximity to major roads were also associated with lower environmental satisfaction.

Smoking was reported by 21.5% of respondents and was associated with increased prevalence of respiratory symptoms. However, even non-smokers living in polluted districts demonstrated substantial symptom burden, suggesting an important contribution of environmental exposure.

The survey also revealed seasonal variability in environmental discomfort. Dust and odor complaints were most pronounced during summer and autumn periods characterized by dry weather and increased atmospheric stagnation.

Overall, 48.7% of respondents were classified as experiencing high environmental hygienic burden based on combined indicators of pollution perception, respiratory complaints, allergic symptoms, and reduced residential comfort.

DISCUSSION

The findings of this study demonstrate that atmospheric air pollution substantially affects both public health and living conditions among residents of Fergana region. Industrial emissions, traffic-related pollutants, and environmental dust appear to contribute significantly to respiratory morbidity, allergic symptoms, psycho-emotional discomfort, and reduced quality of life.

The high prevalence of chronic cough, allergic rhinitis, and eye irritation observed among residents of polluted districts corresponds with international environmental

health studies linking long-term exposure to particulate matter and industrial emissions with chronic respiratory inflammation.

The concept of environmental hygienic burden is particularly relevant to the present findings. Residents continuously exposed to unpleasant odors, visible dust, and poor air quality may develop not only physiological symptoms but also chronic psychological stress and environmental dissatisfaction.

The association between environmental pollution and headaches identified in the study may reflect combined effects of atmospheric contaminants, emotional tension, and reduced oxygenation in poorly ventilated environments. Similar findings have been reported in urban populations exposed to industrial and transportation pollution.

Seasonal increases in environmental discomfort are consistent with regional climatic and geographical characteristics of the Fergana Valley. Restricted atmospheric circulation and dry weather conditions may promote accumulation of pollutants and increase dust dispersion.

Housing conditions also play an important role in determining environmental exposure. Poor ventilation, insufficient greenery, and proximity to traffic corridors may amplify adverse health effects associated with polluted atmospheric air.

The study highlights the importance of population-based environmental hygiene assessment. Subjective complaints and environmental perception provide valuable information complementing laboratory environmental monitoring systems. Residents often perceive deterioration of environmental quality before objective measurements reach regulatory thresholds.

Several limitations should be acknowledged. The study relied on self-reported symptoms and environmental perception rather than direct laboratory measurement of pollutants. In addition, the cross-sectional design does not allow establishment of causal relationships. Nevertheless, the large sample size and comprehensive environmental assessment strengthen the reliability of the findings.

CONCLUSION

The present study demonstrated that atmospheric air pollution significantly affects public health and residential living conditions among the population of Fergana region. Residents living near industrial enterprises and high-traffic zones demonstrated increased prevalence of respiratory complaints, allergic manifestations, headaches, sleep disturbances, and psycho-emotional discomfort.

Approximately half of respondents experienced high environmental hygienic burden associated with atmospheric pollution. These findings emphasize the need for strengthening environmental hygiene measures, improving urban ecological management, expanding green infrastructure, and increasing public awareness regarding environmental health protection.

Comprehensive environmental monitoring combined with preventive public health interventions may substantially improve population well-being and reduce adverse health effects associated with atmospheric pollution.

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