Volume 4, Issue 2, February 2026 ISSN (E): 2938-3765

INFLUENCE OF AIR POLLUTION LEVEL ON THE INCIDENCE AND SEVERITY OF PNEUMONIA IN CHILDREN

Yuldasheva F. U.
Shomuradova K.
Tashkent State Medical University

Abstract
In recent decades, air pollution has become one of the most significant challenges shaping the environment, public health, and sustainable development of nations. Despite the development of international environmental initiatives and the implementation of environmental standards, pollutant emissions continue to rise in most densely populated regions of the world. Urbanization, industrialization, the growth of the vehicle fleet, the expansion of the energy sector, and inadequate infrastructure modernization are leading to a steady increase in concentrations of suspended particles, nitrogen oxides, sulfur compounds, ozone, and volatile organic compounds. These processes create unfavorable conditions under which air ceases to fulfill its natural function of supporting human life and ecosystems.

Keywords: Ecology, morbidity, urbanization, air, pneumonia, complications, PM2.5, health.

Introduction

Pneumonia remains a leading cause of illness and hospitalization in infants and preschool-aged children worldwide and remains a significant cause of childhood mortality, particularly in developing countries. Despite advances in modern pediatrics, the introduction of vaccination programs, and improved antibacterial therapy, severe and complicated pneumonia in children remains a persistent problem. This is due to both age-related anatomical and physiological characteristics of the respiratory system and the impact of external factors, including increasing attention to environmental factors.

In recent years, a significant amount of data has accumulated demonstrating the adverse impact of air pollution on the health of children. Fine particles, particularly PM2.5, can penetrate the distal respiratory tract, causing epithelial damage, enhancing the inflammatory response, impairing mucociliary clearance, and weakening the respiratory system's local defense mechanisms. In children, especially young children, these mechanisms are more pronounced due to the immaturity of the immune system and the increased sensitivity of the respiratory tract to inhalation exposure.

The regions of the Republic of Uzbekistan are characterized by markedly heterogeneous environmental conditions. Large cities and industrialized areas, such as Tashkent and the Tashkent region, are characterized by high vehicle traffic density, industrial congestion, frequent use of solid fuels, and unfavorable meteorological conditions that contribute to the accumulation of pollutants in the ground layer of the atmosphere. Meanwhile, in a number of regions with less anthropogenic impact, air pollution levels remain relatively lower. Data from the Ministry of Ecology and open

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

monitoring systems indicate persistently elevated PM2.5 concentrations in several regions of the country, particularly in the autumn and winter. Despite some studies examining the impact of air pollution on the incidence of respiratory illnesses in children, its role in the development of severe and complicated forms of pneumonia remains understudied at the regional level. Data comparing the clinical course of pneumonia in children with the environmental characteristics of specific regions and areas are particularly limited, making it difficult to develop a comprehensive understanding of the contribution of environmental factors to the severity of the disease.

In this regard, it is relevant to study the clinical characteristics of pneumonia in young and preschool-aged children, taking into account the region of residence and environmental conditions. Analysis of regional differences in the severity of the disease and the incidence of respiratory failure, combined with data on air pollution, allows us to consider environmental factors as potential modifiers of the clinical course of pneumonia. The obtained results may have practical implications for the development of preventive measures aimed at reducing the risk of severe forms of the disease in children living in ecologically unfavorable regions.

Materials and Methods

The study included medical records of 100 infants and preschool-aged children hospitalized with pneumonia at the TSMU Clinic, in the Pediatric Pulmonology Department, and in the Neonatal Pathology Department, for the period from January to March 2025. Patients were recruited from various regions and districts of the republic. Age, region of residence, clinical form of pneumonia, presence of respiratory failure, and complications were analyzed. Cases with insufficiently documented data or severe chronic diseases were excluded.

Results

An analysis of clinical data from young and preschool-aged children (roughly 5–7 years old) hospitalized with pneumonia in early 2025 revealed significant regional differences in disease severity, which correlated with the environmental conditions in the regions of residence, primarily with air pollution levels. Severe pneumonia cases predominated in the overall pattern of observations, accounting for over 65%. A significant proportion of patients developed respiratory failure, which was detected in approximately 60–65% of children. Stage I respiratory failure was recorded in 45–50% of cases, while stage II respiratory failure occurred in 10–15% of cases. Complicated pneumonia, including acute bronchiolitis and septic conditions, was observed in 7–10% of cases.

The most severe pneumonia cases were recorded in children living in Tashkent city and Tashkent region, including the Zangiata , Yangiyul , Kibray , Chinaz , Akkurgan , and Srednechirchik districts. In this group, the proportion of severe pneumonia cases reached 70–75%, and respiratory failure of varying degrees was detected in 65–70% of patients. The incidence of grade 2 respiratory failure in Tashkent and adjacent districts of Tashkent region was higher than in other regions, reaching 15–18%. The most severe complicated forms of the disease were also observed in this group, including a combination of pneumonia with acute bronchiolitis and isolated cases of pneumonia complicated by sepsis.

Tashkent and the Tashkent region are characterized by persistently unfavorable environmental conditions due to high vehicle traffic density, industrial emissions, solid fuel use, and frequent

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

temperature inversions. According to open-source environmental monitoring data, the average annual concentration of fine particulate matter (PM2.5) in the region in 2024–2025 exceeded the World Health Organization recommended levels by 6–8 times. This creates a chronic inhalation burden on the respiratory system of children and can contribute to more severe inflammatory lung diseases.

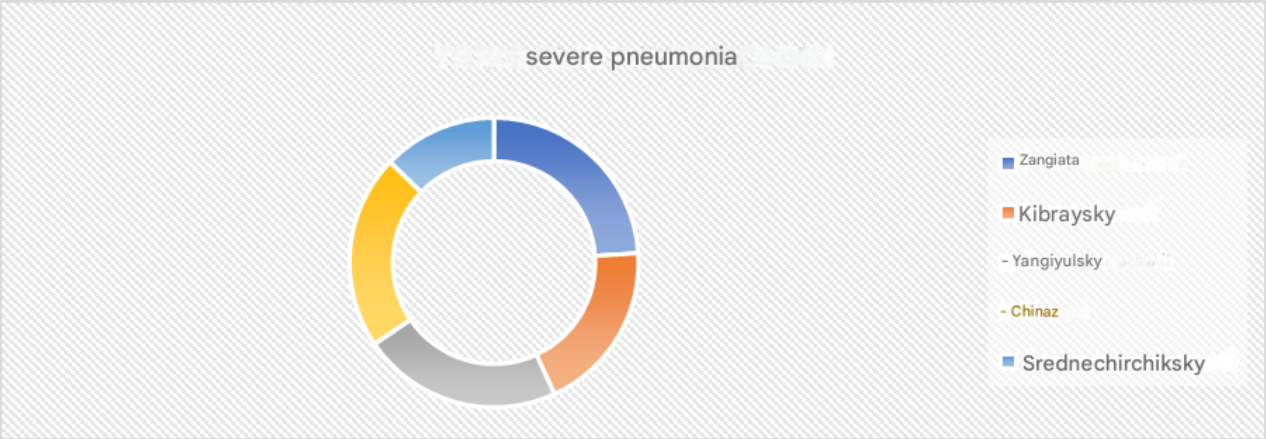


Fig. 1. Comparison of pneumonia severity by district within the Tashkent region

In the Kashkadarya region, including the Shakhrisabz district, the proportion of severe pneumonia cases was approximately 65-68%, with signs of respiratory failure detected in approximately 60% of children. Stage II respiratory failure was recorded in 10-12% of cases. The environmental situation in the region is characterized by increased air dust levels and exceeding permissible concentrations of fine particles, which is associated with both industrial activity and natural climatic conditions. These factors likely contribute to damage to the respiratory epithelium and a weakening of local defense mechanisms in children.

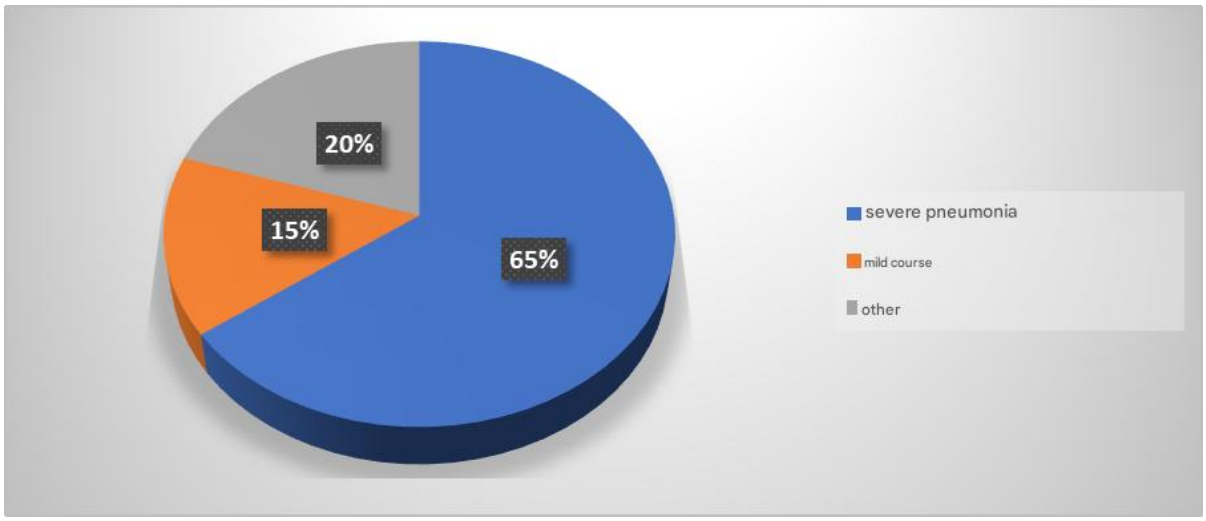


Fig. 2. Percentage distribution of complicated pneumonia in children from the Kashkadarya region

In the Surkhandarya region, severe forms of pneumonia accounted for over 60% of all cases, and respiratory failure was observed in approximately half of patients, primarily stage I. The proportion of stage II respiratory failure reached 8-10%. The region is periodically exposed to dust aerosols and

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

is characterized by episodes of significantly elevated PM2.5 concentrations, which creates an unfavorable environment for respiratory diseases, especially in young children.

In the Syrdarya region, including the city of Gulistan, severe pneumonia was recorded in 55–60% of cases, and respiratory failure in 50–55%. Despite its relatively lower level of urbanization, the region is subject to chronic exposure to dust particles, which can contribute to the severity of respiratory tract inflammation in children.

In the Samarkand region, the proportion of severe pneumonia cases was 60–65%, and respiratory failure was detected in more than half of patients.

The environmental situation in the region is characterized by moderately elevated levels of air pollution, which, combined with seasonal climate fluctuations, can increase the susceptibility of children to infectious diseases of the lower respiratory tract.

In the Fergana region, severe forms of pneumonia were detected in 50–55% of cases, which was lower than in Tashkent and the Kashkadarya region. Respiratory failure was recorded in 45–50% of cases and was predominantly stage 1. According to environmental monitoring, air pollution levels in the region are assessed as moderate, which may explain the less severe course of the disease compared to industrially and transport- heavy areas.

The most favorable clinical picture was observed in children from the Bukhara region, where severe pneumonia occurred in 40–45% of cases, and respiratory failure occurred in less than 40% of patients. The region's relatively favorable environmental conditions, including lower concentrations of fine particulate matter in the air, may act as a protective factor, reducing the risk of developing severe and complicated forms of the disease.

A comparison of clinical data with environmental indicators revealed that in regions with chronically high levels of air pollution, particularly elevated PM2.5 concentrations, severe forms of pneumonia in children are recorded 15–25% more frequently, and respiratory failure is 20–30% more frequently, than in regions with relatively more favorable environmental conditions. These results indicate that environmental stress, particularly prolonged exposure to fine aerosols, can be considered a significant modifying factor aggravating the clinical course of pneumonia in infants and preschool-aged children.

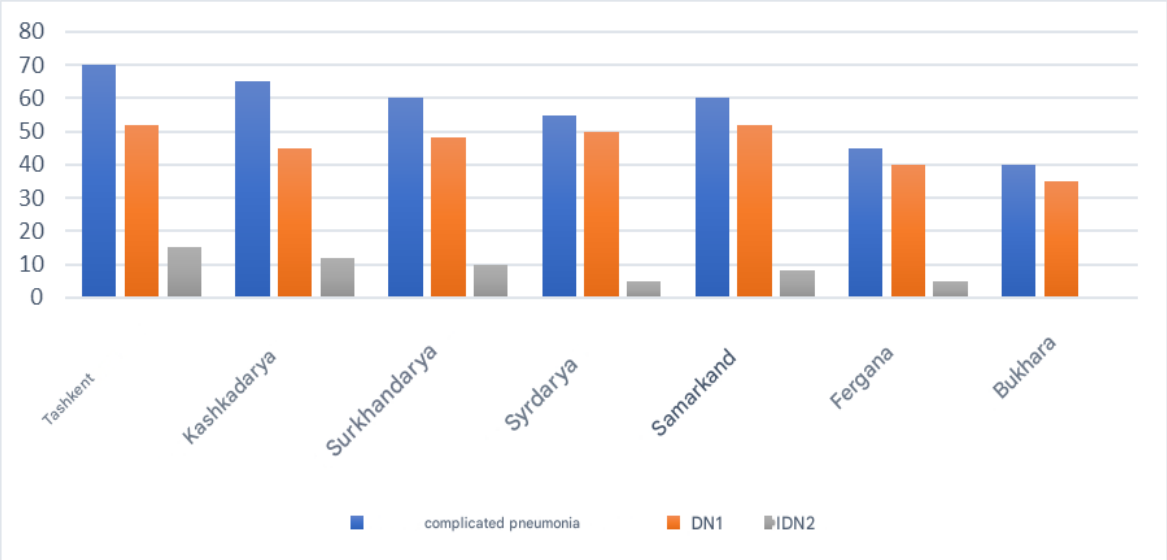
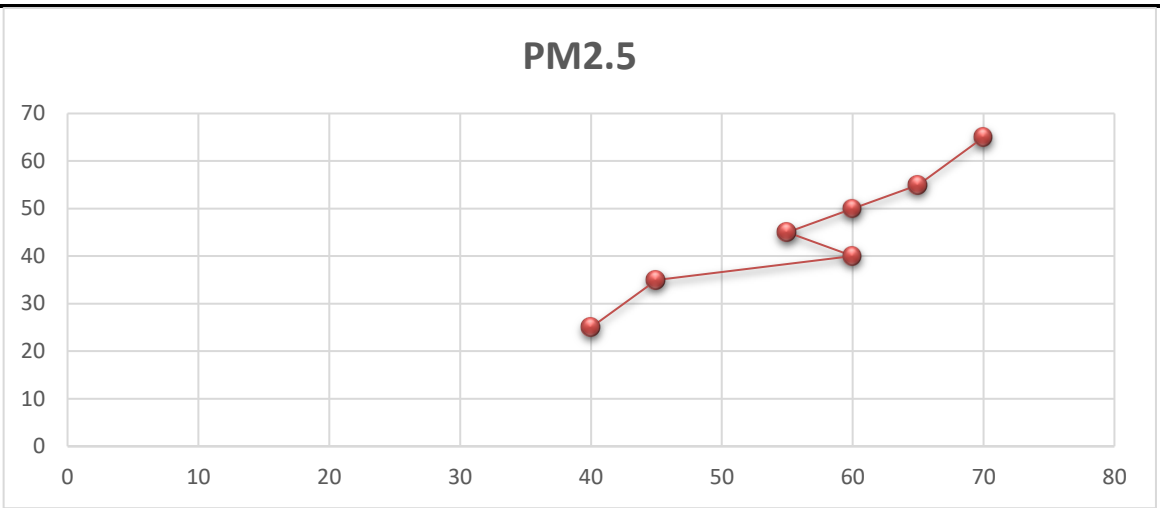


Fig. 3. Severity of pneumonia by region

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5



X-axis - data on pneumonia severity
Y- axis - air pollution data

Fig. 4. Dependence of pneumonia severity on the level of air pollution (PM 2.5)

At the same time, in regions with more favorable environmental conditions, such as Fergana, Samarkand, and Bukhara, the proportion of severe and complicated forms of pneumonia was significantly lower, suggesting that air pollution is an important modifying factor that increases children's susceptibility to respiratory infections. The findings confirm the critical role of external environmental factors in the development of severe pneumonia and respiratory failure in children, emphasizing the need for systematic air quality monitoring, preventive measures among the child population, and the development of regionally targeted strategies to reduce the risk of severe respiratory diseases. Furthermore, the study results demonstrate the relevance of a comprehensive approach to studying the impact of the environment on children's health, including combining clinical analysis with air pollution assessments. This allows us to identify patterns in the distribution of disease severity depending on environmental conditions and identify priority areas for prevention and early intervention.

Conclusions

The study results show that severe forms of pneumonia, often complicated by varying degrees of respiratory failure, predominate in infants and preschool-aged children. The most pronounced clinical manifestations are observed in children living in Tashkent, the Tashkent region, and the Kashkadarya region. These regions are characterized by high levels of air pollution and consistently elevated concentrations of fine particulate matter (PM2.5), which appears to be directly related to the severity of the disease and the increased incidence of complications.

References

1. Popova N.N. Fundamentals of Rational Nutrition. *Study Guide.* Voronezh. 2013; 106.
2. Yuldasheva F. U. SOCIO-HYGIENIC STUDY OF THE HEALTH OF CHILDREN BORN WITH HIGH WEIGHT. *International Scientific Journal ISJ &Applied Science Philadelphia , USA* issue 11 volume 67 published November 30 , 2018 . .

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

3. Yuldasheva F.U., & Toshmatova , G.A. PROVIDING MEDICAL AND SOCIAL ASSISTANCE TO THE POPULATION. *Journal of Modern Science: Current Issues of Social and Economic Development. 2023;153-164. (In Russ .).*
4. Хайитов, Ж. Б., Бурибоев, Э. М., & Ниязова, О. А. (2023). Исследование и оценка фактического питания детей и подростков спортсменов. Academic research in educational sciences, 4(TMA Conference), 449-454.
5. Саломова, Ф. И., Ахмадалиева, Н. О., Ниязова, О. А., & Хайруллаева, Л. Г. (2022). Изучение и гигиеническая оценка питания студентов Высших учебных заведений (узбекистан, германия).
6. Jalolov, N. (2022). Maktabgacha yoshdagi bolalarda sog ‘lom turmush tarzini shakllantirishning dasturiy platformasi.
7. Ниязова, О., & Саломова, Ф. (2022). Studying changes in the health state of school children arising from incorrect fiting.
8. Axmadaliyeva, N., Imamova, A., Nigmatullayeva, D., Jalolov, N., & Niyazova, O. (2022). Maktabgacha yoshdagi bolalarda sog ‘lom turmush tarzini shakllantirishning dasturiy platformasi.
9. Akhmadalieva, N. O., Imamova, A. O., Niyazova, O. A., Muratbayeva, A. P., & Umarov, B. A. (2023). HYGIENIC CHARACTERISTICS OF HARMFUL FACTORS OF WORKING CONDITIONS OF INFECTIOUS DISEASES DOCTORS.
10. Salomova, F. I., Bobomuratov, T. A., Akhmadaliyeva, N. O., Imamova, A. O., & Niyozova, O. A. (2022, November). Formation of the principles of a healthy lifestyle in preschool children. Uzbekistan-Japan International Conference «Energy-Earth-Environment-Engineering», November 17-18, 2022, Uzbek-Japan Innovation Center of Youth, Tashkent, Uzbekistan.
11. Ниязова, О. А., & Валиулин, Р. И. (2022). Изучение и гигиеническая оценка фактического питания студентов (Doctoral dissertation, Молодежный инновационный вестник. Научно-практический журнал Том 11) (Doctoral dissertation, Doctoral dissertation, Молодежный инновационный вестник. Научно-практический журнал).
12. Ниязова, О. А., Ахмадалиева, Н. О., Валиулин, Р. И., & Болтаев, М. М. (2022). Comperative assessment of nutrition of university students of medical and nonmedicdl profile (Doctoral dissertation, Doctoral dissertation, European multidisciplinary journal of modern science).
13. Niyazova, O. A. (2018). Study of the influence of physical education on the functional state of the organism of pupils of comprehensive schools. Medical Scientific Bulletin of Central Chernozemye (Naučno-medicinskij vestnik Central′nogo Černozem′â), (73), 54-58.
14. Niyazova, O. A., Yuldasheva, F. U., & Norqulov, S. J. (2025). SLEEP HYGIENE OF STUDENTS. In Innovate Conferences (pp. 13-16).
15. Sherkuzieva, G. F., Salomova, F. I., Samigova, N. R., & Yuldasheva, F. U. (2023). RESULTS OF TOXICITY STUDY OF BIOLOGICAL FERTILIZER" YER MALHAMI" FOR INHALATION CHRONIC EFFECTS.
16. Шеркузиева, Г. Ф., Саломова, Ф. И., & Юлдашева, Ф. У. (2023). Токсичность “Ер малхами” при ингаляционном хроническом воздействии.
17. Юлдашева, Ф. (2018). Socio-Hygienic Study Of The Health Of Children Born With High Weight. International Scientific Journal ISJ &Applied Scince Philadelphia, USA, (11).

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

18. Тахиров, М. Т., Бекжанова, Е. Е., & Юлдашева, Ф. У. (1991). К обоснованию ПДК зерновой пыли в атмосферном воздухе. Гигиена и санитария, (8), 14-16.
19. Salomova, F. I., Yuldasheva, F. U., Sherkuzieva, G. F., & Sharipova, S. A. (2024). STUDYING THE EFFECT OF IRRATIONAL NUTRITION ON THE STUDENT'S BODY.
20. Шеркузиева, Г. Ф., Саломова, Ф. И., Самигова, Н. Р., & Юлдашева, Ф. У. (2023). Результаты изучения токсичности биологического удобрения «Ер малхами» при ингаляционном хроническом воздействии. Журнал новый день в медицине, 5, 55-58.
21. Sherkuzieva, G. F., Salomova, F. I., & Yuldasheva, F. U. (2023). RESULTS OF STUDYING THE INFLUENCE OF BIO-FERTILIZER “YER MALHAMI” ON THE QUALITY OF WATER BODIES. Central Asian Journal of Medicine,(4), 109-120.
22. Юлдашева, Ф. У., & Имамова, А. О. (2022). Роль спорта в формировании здорового образа жизни у молодежи. Европейский международный журнал междисциплинарных исследований и управленческих исследований, 2(11), 85-89.
23. Salomova, F. I. (2022). Problems of atmospheric air pollution in the Republic of Uzbekistan and the ways of their solution. In Uzbekistan-Japan International Conference «Energy-Earth-Environment-Engineering.
24. Salomova, F. I., Imamova, A. O., Mirshina, O. P., & Voronina, N. V. (2023). HYGIENIC ASSESSMENT OF THE CONDITIONS OF WATER USE OF THE POPULATION OF THE ARAL REGION. Academic research in educational sciences, 4(TMA Conference), 968-973.
25. Imamova, A. O. K., Bobomurotov, T. A., & Akhmadaliyeva, N. O. (2023). IMPROVING THE HEALTH STATUS OF FREQUENTLY ILL CHILDREN IN PRE-SCHOOL EDUCATIONAL INSTITUTIONS AND THEIR PRINCIPLES OF HEALTHY LIFESTYLE. Academic research in educational sciences, 4(TMA Conference), 180-185.
26. Akhmadaliyeva, N. O., Salomova, F. I., Sadullayeva, K. A., Abdukadirova, L. K., & Imamova, A. O. (2024). RETRACTED: Nutrition of frequently ill preschool children in organized collectives. In BIO Web of Conferences (Vol. 84, p. 01011). EDP Sciences.
27. Imamova, A. O., & Bobonazarova, M. N. (2022, November). Renewable energy sources as a measure to prevent the depletion of the ozone layer. In Uzbekistan-Japan International Conference «Energy-Earth-Environment-Engineering.
28. "Water Resource Use and Protection in Uzbekistan: Current Status and Development Paths." Report of the scientific and practical seminar of the State Committee for Nature Protection , the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan , and the Tashkent Institute of Irrigation and Land Reclamation, March 18, 2013.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5