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APPLICATION OF FLORENCE NIGHTINGALE'S THEORY TO THE TUBERCULOSIS SITUATION IN A SMALL COMMUNITY LIVING IN HINDUKUSH

Original Research

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ABSTRACT

Background: Tuberculosis (TB) continues to pose a major public health threat in Pakistan, particularly in remote regions like Chitral, Khyber Pakhtunkhwa. Despite multiple governmental and non-governmental TB control initiatives, the disease remains endemic in certain valleys. The emergence of Multi-Drug Resistant Tuberculosis (MDR-TB) has further complicated the burden. One key limitation of current interventions is their narrow biomedical focus. Florence Nightingale's Environmental Theory offers a broader framework to explore the environmental and social dimensions influencing TB transmission.

Objective: To analyze the environmental, sociocultural, and structural risk factors contributing to TB in a rural community of Chitral district, and to apply Florence Nightingale's Environmental Theory as a guiding model for integrated public health interventions.

Methods: A qualitative observational study was conducted using the windshield survey method in a TB-endemic village of Chitral. Environmental and housing conditions, sociocultural practices, and health system accessibility were assessed. Household-level data were gathered through informal interviews with community members, including one TB-diagnosed individual. Ethical approval was obtained, and informed verbal consent was secured. Thematic analysis was conducted within the framework of Nightingale's theory, focusing on its core paradigms and thirteen environmental canons.

Results: Over 80% of houses surveyed were built with mud and lacked adequate ventilation. Approximately 90% used indoor wood fires for heating, with sealed windows and no direct sunlight, contributing to poor air quality. Most families (average size: 9–12 members) lived in overcrowded, single-room dwellings. Stigma surrounding TB was evident, with affected individuals socially isolated despite being under treatment. Animal sheds located adjacent to homes, along with fodder piles on rooftops, limited airflow and sanitation.

Conclusion: TB control in such communities requires a multidimensional approach. Integrating Florence Nightingale's environmental principles can enhance disease prevention by addressing socioeconomic, cultural, and infrastructural determinants of health.

Keywords: Chitral; Environmental Theory; Khyber Pakhtunkhwa; MDR-TB; Public Health Nursing; Tuberculosis; Ventilation.

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INTRODUCTION

Nursing, as both a discipline and a practice, is grounded in various theoretical frameworks that inform care delivery, clinical judgment, and public health engagement. Among these, Florence Nightingale's Environmental Theory stands as a foundational model with enduring relevance. Her emphasis on the interplay between the environment and health outcomes has remained applicable across diverse healthcare settings—from bedside hospital care to community-based interventions and broader public health strategies. Nightingale, often regarded as the pioneer of modern nursing, asserted that the role of the nurse extends beyond the immediate treatment of disease; rather, it involves optimizing the patient's surroundings to facilitate the natural healing process. Her conviction is captured in her assertion, "Never think that you have done anything effectual in nursing in London till you nurse, not only the sick poor in workhouses, but those at home" (1). Born in 1820 in Florence, Italy, Nightingale's early education in nursing at Kaiserwerth, Germany, and her subsequent service during the Crimean War in Turkey exposed her to the grave consequences of unsanitary and poorly ventilated conditions. At Scutari, she became known as the "Lady with the Lamp," a symbol of compassionate care and evidence-based reform (2,3). Her observations during this period crystallized into the Environmental Theory, which posits that the health of individuals is significantly shaped by environmental factors such as fresh air, clean water, efficient drainage, cleanliness, and light. She proposed that nurses have a responsibility to manipulate the environment to support the body's reparative processes (4).

In contemporary practice, the principles of this theory remain central to nursing care, particularly within the domain of community and public health nursing. As healthcare delivery increasingly extends beyond institutional settings, nurses are at the forefront of managing and preventing diseases at the population level. This role has become even more critical in light of the global burden of non-communicable diseases and the persistent threat of infectious diseases (5,6). Nurses serve not only as caregivers but also as educators, researchers, and advocates who coordinate with multidisciplinary teams to enhance public health outcomes. Tuberculosis (TB) remains a significant public health challenge, especially in developing nations. According to the World Health Organization, the annual rate of TB reduction has stagnated at 6.3% from 2015 to 2018, falling short of the targeted 20% reduction by 2020 (7). The situation has been further exacerbated by disruptions in health services during the COVID-19 pandemic (8). Pakistan is among the top 20 countries with the highest TB burden, with an estimated 369,548 cases annually and an incidence rate of 265 per 100,000 population (9). Alarmingly, the country also ranks fifth globally in cases of multidrug-resistant TB (MDR-TB) (8,9), with Khyber Pakhtunkhwa reporting particularly high prevalence rates (10). Northern districts, including Arundu and Domel in Chitral, have shown disproportionately high TB incidence, especially among women (11,12). These statistics underscore a critical gap in community-level TB prevention and control efforts, particularly in marginalized and high-risk areas. The application of Nightingale's theory to such settings offers a framework for nurses to address environmental determinants of health through localized, culturally informed, and preventive interventions. This study aims to explore the relevance and practical application of Florence Nightingale's Environmental Theory in community health nursing, focusing on tuberculosis control in underserved districts of Khyber Pakhtunkhwa, Pakistan.

METHODS

This study adopted a qualitative, observational design utilizing the windshield survey method to assess the selected community in the district of Khyber Pakhtunkhwa, Pakistan. The windshield survey is a systematic approach in which the researcher walks through or drives across a defined geographical area to observe and document visible indicators of community health. These indicators include housing structures, waste management practices, availability and condition of public utilities, sanitation, presence of healthcare facilities, transportation infrastructure, and environmental hygiene. Given the manageable size of the community, a walking survey was conducted, which allowed for close-up observations and informal interactions with community members. Additionally, to enhance the depth of understanding and contextual accuracy, the researcher visited a small number of households to gather firsthand insights into domestic environmental conditions, ventilation, cleanliness, and lifestyle-related practices that may contribute to the risk or transmission of tuberculosis. The target population consisted of residents of a rural community with previously documented high incidence of tuberculosis. Inclusion criteria included permanent residents aged 18 years or older, residing in the community for more than six months, and willing to provide verbal consent. Transient populations and individuals with cognitive impairments that hindered communication were excluded. The researcher conducted face-to-face informal interviews and brief observations during household visits, ensuring

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minimal disruption to daily routines. No structured questionnaire was employed in this phase, as the focus remained on environmental and community-level assessment rather than individual-level clinical data.

Ethical considerations were strictly observed throughout the study. The research proposal was submitted to and approved by the Institutional Review Board (IRB). Informed consent, primarily verbal due to local literacy barriers, was obtained from all household participants before initiating any observation or inquiry. Participants were assured of anonymity, voluntary participation, and confidentiality of any information shared during the visits. No statistical tools or software were required at this stage as the methodology focused on descriptive observational data. However, the findings from the windshield survey informed the later phases of community health planning and intervention, aligning with the principles outlined in Nightingale's Environmental Theory regarding the significance of environmental assessment in disease prevention.

RESULTS

Community Survey: The environmental and structural conditions of the surveyed community revealed several risk factors for the persistence and transmission of tuberculosis. A majority of the houses were constructed using mud, with dwellings built in extremely close proximity to one another. The inter-house spacing was minimal, and most connecting streets were narrow, often allowing passage of only one individual at a time. Ventilation in the homes was markedly inadequate; windows and small ventilators were commonly covered with plastic sheets as insulation against the cold, thereby limiting airflow and natural light. Overcrowding was evident, with extended families—typically comprising 8 to 12 members—living together in limited shared space, often without designated separate rooms for individuals. Heating and cooking practices were also observed to pose respiratory hazards. Due to heavy snowfall and sub-zero winter temperatures, the community predominantly relied on burning wood indoors for warmth and domestic use, exposing residents to indoor air pollutants known to exacerbate respiratory conditions. While the village had access to a clean drinking water supply, other environmental conditions contributed significantly to poor respiratory health outcomes.

Literacy levels in the village were observed to be relatively lower compared to adjacent settlements, potentially impacting health literacy and awareness of infection control measures. The primary source of livelihood was animal husbandry, and cattle sheds were located immediately adjacent to human residences. These sheds, often with fodder piled on the roofs, restricted both sunlight and air circulation to the adjoining houses, creating conditions conducive to microbial growth and infection transmission. Access to diagnostic facilities was limited. The nearest center providing sputum acid-fast bacillus (AFB) testing was located at a considerable distance from the village, posing a barrier to timely diagnosis and treatment initiation. Although a government-run tuberculosis control program operated in the district, offering screening, referrals, diagnosis, treatment, and follow-up services, and NGOs such as Aga Khan Health Services (AKHSP), Marie Adelaide Leprosy Centre (MALC), and Green Star Marketing were actively involved in TB control efforts, the region remained endemic for tuberculosis. High incidence rates persisted, particularly in remote valleys including the surveyed location.

Household Survey: During the household assessment, one detailed case revealed the social and psychological dimensions of tuberculosis in the community. A 60-year-old male resident reported living with a joint family of ten members, including his elderly parents, three brothers, his wife, and five children. He had been diagnosed with tuberculosis and was actively receiving anti-tubercular therapy. Despite showing no current symptoms such as cough or fever, he reported experiencing social isolation within his home. His family had separated his belongings and restricted his interaction with other household members due to fear of infection, resulting in emotional distress and feelings of abandonment. Additionally, his elderly father had recently developed a persistent cough and fever, suggesting a possible new case within the same household, though no formal evaluation or diagnosis had been confirmed at the time of the survey.

DISCUSSION

Economic Determinants of Health

The findings of this study clearly demonstrate that economic deprivation played a critical role in perpetuating the burden of tuberculosis within the surveyed community. Similar to previous evidence from low-income regions, where financial insecurity often outweighs health-seeking behaviors, the residents' dependence on subsistence livelihoods—particularly animal husbandry—constrained their capacity to invest in hygienic and structurally sound housing. The World Health Organization emphasizes income inequality and poverty

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as major health determinants, reinforcing the observation that health cannot be prioritized when day-to-day survival remains uncertain (6,7). Structural poverty, underpinned by lack of income diversification and minimal support systems, translated into overcrowded, under-ventilated housing—known risk environments for airborne diseases such as tuberculosis.

Sociocultural Determinants of Health

Cultural beliefs and social stigmas surrounding tuberculosis presented a significant barrier to timely diagnosis and psychosocial wellbeing of patients. The household-level narrative illustrated how patients experienced ostracization despite being on treatment and non-infectious. The stigma surrounding TB, as reported in similar contexts, is deeply entrenched in fear and misinformation. The collective family structure, while traditionally supportive, becomes a source of vulnerability when space is limited and awareness is lacking. WHO asserts that social values, traditions, and perceptions significantly shape health-seeking behaviors, and in this context, stigma limited community cohesion and undermined recovery (6). Such sociocultural barriers not only inhibit early reporting but also affect treatment adherence and mental health of patients.

Environmental Determinants of Health

Environmental assessments revealed the contribution of poor housing, lack of ventilation, and proximity to livestock in accelerating TB transmission risks. The harsh winters, compounded by the use of indoor wood fires and plastic-sealed windows, created microenvironments conducive to respiratory infections. According to WHO, clean air, sunlight, and healthy housing are essential environmental prerequisites for health (7). This aligns with earlier research linking poor indoor air quality and housing structures with higher rates of pulmonary diseases. The practice of constructing cattle sheds near residential areas, and storing animal fodder on rooftops, further degraded air quality and impeded natural light and airflow. These findings point to a critical need for architectural and environmental redesign, especially in TB-endemic regions.

Education

The low literacy rate in the community correlated with inadequate awareness regarding tuberculosis, its symptoms, mode of transmission, and prevention strategies. Educational deficiencies have long been associated with suboptimal health outcomes, as individuals are unable to access, interpret, or act upon health information effectively. This has been consistently reported in national TB control evaluations, where communities with lower educational attainment exhibited lower health service utilization and delayed treatment initiation. As WHO affirms, education is a central determinant of health, influencing both individual choices and community-level resilience (7). The absence of structured, culturally relevant health education programmes in the area is a critical gap that must be addressed to enhance TB control efforts.

META-PARADIGMS OF NIGHTINGALE'S THEORY

1. Environment

The theory's focus on environmental factors finds direct application in the current scenario. The geography, harsh weather, and inadequately designed houses created conditions that favored the persistence of tuberculosis. The physical environment, coupled with inadequate ventilation and lack of sunlight, undermined natural reparative processes. Equally important was the social environment, where the patient's family members—constituting his immediate psychosocial setting—failed to provide the emotional support necessary for healing (13).

2. Person

In alignment with Nightingale's paradigm, the 'person' receiving care in this study extended beyond individual patients to the community at large. Each household member, whether diagnosed or at risk, required nursing interventions encompassing education, preventive strategies, and psychosocial support (14). This interpretation is consistent with modern community health nursing, which positions the entire population as the recipient of care.

3. Nursing

Nursing care in this scenario transcended bedside care and encompassed a multidimensional public health role. Community-based screening, health promotion, education, and facilitation of treatment adherence were all components of comprehensive nursing practice

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(15). The organizations working in the region delivered aspects of this care, although the limited impact indicates a need to realign their approaches with the holistic, environment-centered care advocated by Nightingale.

4. Health

Health, in the Nightingalean sense, was compromised not only by disease but by the inability of individuals to use their full physiological and psychological capacities. The findings reveal that structural and social constraints prevented community members from achieving optimal health, reinforcing the idea that curative care alone is insufficient without modifying environmental and social determinants.

MAJOR CONCEPTS IN THE NIGHTINGALE'S THEORY

1. Ventilation and Warmth

Poor ventilation, sealed windows, and reliance on wood-burning stoves for heat contributed to stagnant indoor air rich in particulate matter. These conditions mirrored Nightingale's concern that "badly constructed houses do for the healthy what badly constructed hospitals do for the sick" (16-18). The compounded effect of crowding, lack of fresh air, and indoor smoke exposure created ideal conditions for tuberculosis transmission and exacerbation. Nightingale's assertion that proper airflow is non-negotiable in disease prevention remains particularly relevant in this scenario.

2. Health of Houses

As emphasized by Nightingale, the fundamental elements of a healthy dwelling—pure air, efficient drainage, cleanliness, and light—were lacking. The positioning of cattle homes adjacent to living spaces, poor waste management, and obstruction of sunlight compromised these standards. The unhealthy co-existence of humans and livestock is an overlooked but critical environmental determinant. Her warning that dung heaps near windows compromise air quality underscores the need for spatial segregation of human and animal shelters (19,20).

3. Petty Management

The principles of effective care management in the absence of professional supervision were notably missing. Although the TB control programme enrolled patients and provided treatment, little emphasis was placed on equipping family members with the knowledge and skills required for daily supervision under Directly Observed Therapy, Short-course (DOTS). Training lay carers within the household could strengthen treatment adherence and patient support, as suggested in other successful TB programs. Nightingale's concept of ensuring continuity of care—even in the nurse's absence—highlights the need to involve family in caregiving in a structured and informed manner (21).

4. Light

The absence of direct sunlight within homes, due to plastic-covered windows and dense structural design, denied residents a natural disinfectant. Sunlight, with its bactericidal properties, plays a vital role in infection control and was notably missing from the interior spaces surveyed. The findings echoed Nightingale's emphasis on the visible and therapeutic value of light, and further support current recommendations advocating for architectural designs that facilitate solar access to reduce indoor microbial load (21,22).

The strength of this study lies in its contextual grounding and integration of theoretical frameworks with field observations. It effectively connects classical nursing theory with real-world public health challenges. However, the study was limited by its lack of quantitative data and absence of laboratory-confirmed secondary cases during household assessments. Future studies should incorporate mixed-methods approaches to quantify environmental risks, assess community knowledge levels, and evaluate the impact of targeted environmental interventions. Cross-sector collaborations involving public health, architecture, and education can yield sustainable improvements in TB control. A key implication of this study is that tuberculosis control in high-burden settings requires a paradigm shift. Moving beyond one-dimensional biomedical models, there is a need for integrated, theory-guided community interventions that address economic, sociocultural, educational, and environmental determinants. Collaborative involvement of organizations such as rural development agencies and housing services may complement existing TB programmes by addressing upstream factors. Nightingale's Environmental Theory, though developed in the 19th century, offers a timeless and practical framework for this transformation.

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CONCLUSION

This study highlighted the persistent burden of tuberculosis in a vulnerable community and underscored the critical role of Florence Nightingale's Environmental Theory in guiding more effective, multidimensional health interventions. The findings revealed that current programs remain largely biomedical and overlook the broader determinants of health such as poverty, housing conditions, environmental exposure, and social stigma. By integrating economic upliftment, improved infrastructure, community education, and culturally sensitive care practices into existing health strategies, more sustainable outcomes can be achieved. Partnering with organizations focused on rural development and housing can enhance the effectiveness of TB control efforts. Ultimately, a comprehensive approach rooted in Nightingale's principles offers a powerful pathway to not only reduce disease incidence but also to uplift the overall wellbeing of communities most at risk.

AUTHOR CONTRIBUTION

Author	Contribution
Sohail Nasir*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Tauqeer Ahmed	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Zohaib Javed	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Ghaffar Ahmad	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

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