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Impact of Regional Health Facilities Planning Disparity on Patient Health: A Comparative Study on Bogura and Joypurhat Districts of Bangladesh

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ABSTRACT

Regional healthcare planning significantly shapes patient health outcomes, particularly within district hospitals in developing countries such as Bangladesh. This study investigates the impact of regional healthcare planning disparities on patient health outcomes in Bangladesh through a comparative analysis of two 250-bed district hospitals—Bogura Mohammad Ali District Hospital (BMADH) and Joypurhat District Hospital (JDH). Data were collected from 60 inpatients (n = 30 per hospital) selected from only medicine ward patients, representing approximately 50% of the ward population. A mixed-methods approach of both qualitative and quantitative methods was employed for the data analysis. The qualitative data were analyzed thematically from regional healthcare infrastructure assessment and hospital environmental evaluation. The quantitative data were analyzed using descriptive statistics from the patient-reported health indicators. The findings indicate that patients at BMADH, despite better environmental and architectural conditions, experienced longer hospital stays, higher medication use, and lower perceived physical improvement compared to patients at JDH. The observed differences appear to be associated with variations in regional healthcare systems, whereby BMADH operates within a four-tier referral structure that accommodates more severe and complex cases, while JDH functions within a two-tier system that handles comparatively less severe patients and refers critical patients elsewhere. The study contributes to the literature by highlighting the potential influence of regional healthcare planning and referral structures over hospital design on observed patient outcomes in district hospitals. However, the findings should be interpreted with caution because the study relied on a relatively small sample and involved only medicine ward patients. It used descriptive rather than inferential statistical analysis and did not take into consideration clinical variables, including disease severity, comorbidities, and referral source. As a result, the findings show associations rather than causal relationships between patient health outcomes and regional healthcare planning.

INTRODUCTION

The healthcare delivery system in Bangladesh is organized into four hierarchical levels, such as primary, secondary, tertiary, and specialized care. This follows a regional planning model. Under this system, each region is expected to function as a relatively self-sufficient unit. Each region is anchored by a teaching hospital at the highest level of care, and supported by a network of lower-level facilities (Ara, 1994). The objective of this structure is to ensure equitable access to healthcare services and an efficient referral mechanism across regions.

The activities of Primary Health Care (PHC) are generally focused on minor treatments, maternal and child health, disease prevention and health promotion. Community Clinics (CCs), Union Health and Family Welfare Centres (UHFWCs) and Upazila Health Complexes (UHCs) provide PHC. Secondary health care (SHC) is mainly provided by district or general hospitals. It offers in-patient and out-patient care in medicine, surgery, gynaecology, paediatrics and pathology. SHC functions as referral centres for PHC facilities. Tertiary Health Care (THC) is delivered by medical college hospitals and postgraduate institutes. THC provides advanced diagnostic and treatment services, including complex surgeries and

radiotherapy. Specialized Health Care (SpHC) facilities offer highly advanced care in cardiology, neurosurgery, nephrology, oncology, and similar disciplines. SpHC serves as referral centres for tertiary hospitals (Ara, 1994). Within this hierarchical system, general hospitals referred to as district hospitals in Bangladesh play a critical role as secondary-level healthcare providers. These government-owned institutions are equipped with emergency departments, diagnostic facilities, operating theatres, inpatient wards, and outpatient services, and are staffed by multidisciplinary healthcare teams (ASHRAE, 2019). District hospitals act as the principal referral centres for primary healthcare facilities and manage a substantial share of inpatient admissions in the public healthcare system. With 62 district hospitals nationwide, they account for approximately 40% of public inpatient admissions and over one-fifth of government health expenditure (World Health Organization, 2015; DGHS, 2024).

Existing research shows that the health outcomes of patients are not only determined by the medical treatment but also by a variety of clinical, behavioural and environmental factors. Research demonstrates a strong correlation between health indicators including blood pressure, medication use, and physical health with

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the overall status of patient recovery and hospitalization outcomes (Biswas *et al.*, 2025). Also, environmental quality, psychological stress and lifestyle conditions have been acknowledged as important determinants of health status and patient well-being in healthcare settings (Monte, 2025). These findings highlight that both physical and systemic factors within healthcare environments can influence patient recovery experiences.

In addition to clinical conditions, patient health outcomes vary according to behavioural and environmental contexts. Health behaviours, perceived stress, and environmental conditions in institutional settings have been shown to shape physical and mental health outcomes (Ola-Akinlalu, 2025). In hospital environments, the spatial organization, ventilation, lighting, and noise levels may influence patient comfort, experiences during recovery, and perceived

health improvement. Health outcomes of patients must be evaluated in the context of the built environment of healthcare facilities, and the larger healthcare system in which the facilities are embedded.

Despite this structured framework, significant regional disparities exist in the distribution of healthcare facilities across Bangladesh. Districts with tertiary and specialized hospitals tend to attract and retain more severe and complex cases, while districts without higher-level facilities tend to manage only less severe cases locally, referring critically ill patients to other districts (Sarker, 2025). This imbalance has direct implications on patient health outcomes, length of hospital stay and perceived hospital performance. This paper examines the effect of differences in regional health facilities planning on patients' health.

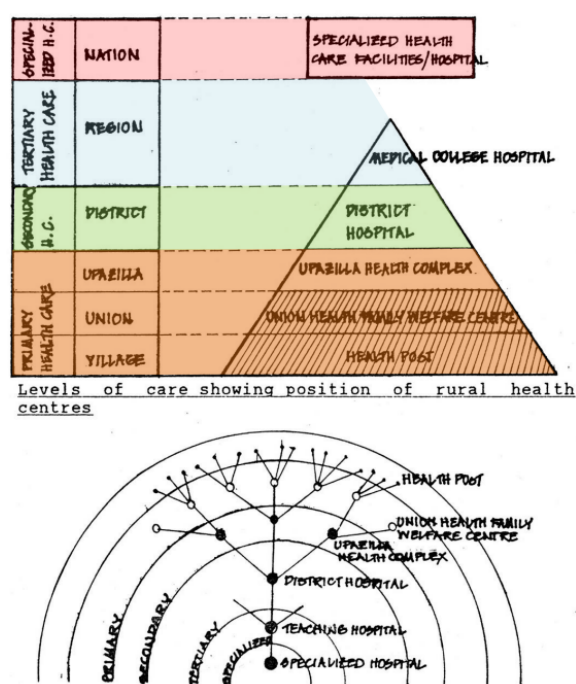


Figure 1: Level of Healthcare in Bangladesh (Adapted from Ara, 1994)

MATERIALS AND METHODS

This comparative study was conducted at the 250-bed Bogura Mohammad Ali District Hospital (BMADH) and the 250-bed Joypurhat District Hospital (JDH) to assess the impact of regional health facilities planning disparity on patient health. Each hospital comprises four main wards—such as medicine, surgery, gynecology, and pediatrics—with each ward accommodating approximately one-fourth of the total bed capacity (about 62–63 patients). The study population consisted of inpatients admitted to the medicine ward of both hospitals. Since the medicine ward represents approximately one-fourth of the total 250-bed capacity, selecting 30 patients from an estimated 62–63 patients in each ward constitutes nearly 50% of the ward population, which is considered adequate for comparative analysis within this study context. Therefore, the sample size ($n=60$) may seem relatively small but it represents approximately half of the medicine ward

population in each hospital and was considered sufficient for this exploratory comparative study. A simple random sampling method was used to select the patients. A total of 60 patients ($n = 30$ per hospital) were included, all aged 18–65 years, ambulatory, and not in critical condition; patients from surgical, gynecological, pediatric, and other wards were excluded due to their physical vulnerability, as they are often unable to walk or communicate effectively and are predominantly physically inactive. Data collection involved three components: gathering general information on district-level healthcare infrastructure from online sources and government records; administering structured patient questionnaires to measure health indicators (including pain medication use, food and sleep problems, physical activity, perceived stress, and physical discomfort); and conducting environmental assessments through a facility survey. Data analysis involved. A mixed-

method of both qualitative and quantitative approach. The questionnaire used in this study was approved by the Department of Architecture, Ahsanullah University of Science and Technology, ensuring its relevance and suitability for planning and architecture-based research. The instrument was designed to collect generalized patient health indicators and perceptions relevant to healthcare planning and environmental assessment rather than detailed clinical information. Because the primary focus of the study was on regional planning and hospital environmental conditions, clinical variables such as disease severity, comorbidities, diagnosis-specific outcomes, and referral source were not included in the analysis. Consequently, the findings should be interpreted as indicative of planning-related disparities rather than as a comprehensive clinical evaluation of patient health outcomes. Patients' blood pressure data were collected from hospital health records, while other health indicators were obtained through the questionnaire survey. Qualitative data from hospital infrastructure and environmental

assessments were analyzed thematically to characterize and contrast the ward conditions. Quantitative data from patient questionnaires and health records were analyzed using descriptive statistics, including percentages and averages, to compare patterns between the two hospitals. Inferential statistical tests (e.g., t-test, chi-square) were not performed because of the exploratory nature of the study, the relatively small sample size, and the absence of detailed clinical variables required for robust adjustment of confounding factors. Therefore, the analysis was intended to identify observable associations rather than establish statistically significant differences or causal relationships. Comparative analysis was then performed between the two hospitals based on infrastructure, ward environmental conditions and patient health outcomes to assess the overall impact on patient health.

RESULTS AND DISCUSSION

The comparison reveals a pronounced disparity in regional healthcare infrastructure between Bogura and

Table 1: Comparison of General Information in BMADH and JDH (Author, 2024; Hospitals & Clinics Section, 2024)

	BMADH	JDH
Location	Sherpur Road, Bogra 5800	Sadar Road, Joypurhat Sadar, Joypurhat, 5900
Type	Government hospital	Government hospital
Level of Care	Secondary (District general hospital)	Secondary (District general hospital)
Stories	2 storied building	Currently 3 storied building (Construction process ongoing for more stories)
No. of Beds	250	250
Population of District	3,734,297	956,431
Population of Town	443,742	84,910
Area of District	2,899 km ²	965 km ²
Area of Town	39 km ²	19 km ²
Number of Government Health Facilities for Inpatients	17	5
Primary Level of Care for Inpatients	14 (3 of 20 bed hospitals, 4 of 31 bed health complexes, and 7 of 50 bed health complexes)	4 (2 of 31 bed health complexes, and 2 of 50 bed health complexes)
Secondary Level of Care for Inpatients	1 (250 bed district hospital)	1 (250 bed district hospital)
Tertiary Level of Care for Inpatients	1 (500 bed medical college hospital)	0
Specialized Level of Care for Inpatients	1 (20 bed chest disease hospital)	0

Joypurhat districts. Bogura operates within a four-tier healthcare system, comprising 14 primary-level facilities, one secondary-level district hospital (BMADH), one tertiary-level medical college hospital, and one specialized hospital, totaling 17 government inpatient facilities. In

contrast, Joypurhat functions within only two levels of care, with four primary-level facilities and one secondary-level district hospital (JDH), and no tertiary or specialized healthcare institutions (Table 1).

Table 2: Comparison of Physical Observation Information in BMADH and JDH (Author, 2024; Hospitals & Clinics Section, 2024)

	BMADH	JDH
Ward Type	Open Nightingale type ward.	Rigs type ward.
Light	Enough natural light, no electrical light is needed at daytime.	Poor natural light, mostly dependent on electrical light.
Ventilation	Both natural ventilation and electrical fan.	Poor natural ventilation and mostly dependent on electrical fan.
Temperature	At daytime, temperature rises because of solar heat gain but no excess heat.	The area seems cool.
Smell	No odor is noticed.	The smell is not comfortable.
Noise	Not noisy.	Very noisy.
Ward Environment	The wards are moderately spacious and follow an open nightingale layout, with beds arranged along both long walls facing the windows, allowing adequate cross-ventilation, ample natural light, tolerable thermal conditions, and comfortable noise levels without noticeable odor. Corridors are wide and used for walking and daily activities such as drying clothes, offering views of the outdoor green space (OGS); however, cleanliness is inconsistent, and the placement of trash bins contributes to an unpleasant environment. Although the OGS is clearly visible from the corridors and three access gates are provided, these remain closed, preventing patient use. Moreover, the OGS itself is poorly maintained and unhygienic, characterized by overgrown vegetation, inadequate drainage, and scattered waste, with no seating, landscaping, or restorative features, rendering it effectively unusable.	The wards are highly congested and follow a rigs-type layout, with five groups of six beds arranged parallel to the windows, resulting in poor natural lighting and ventilation and complete dependence on artificial lighting and mechanical ventilation. Although the indoor temperature remains relatively cool, overcrowding causes unpleasant odors and high noise levels. Narrow linear verandahs run along both sides of the wards, limiting patient use and reducing the ability to enjoy views of the outdoor green spaces (OGSs); these areas are primarily used for drying clothes and dining by attendants and are generally unhygienic. While the OGSs are visually accessible from the verandahs, the absence of gates or pathways prevents physical access. The condition of the OGSs is uneven, with ongoing construction debris, localized waste accumulation, and unmaintained vegetation, and the lack of furniture or landscape features further limits their use for walking or relaxation.

Despite BMADH exhibiting superior ward design and environmental qualities—such as better natural lighting, ventilation, spatial organization, and visual connection to outdoor green spaces—patient health outcomes were poorer compared to JDH (Table 2)

Table 3: Health Outcomes Comparison (n=30 per hospital)

Health Indicator	BMADH	JDH
Normal BP (at survey)	63%	73%
Pain medication use	50%	33%
Food intake problems	57%	50%
Sleep problems	53%	43%
Physically active	43%	50%
Avg. length of stay	Longer (highest 19 days)	Shorter
Feel stressed in current settings	40%	53%
Experienced physical discomfort	27%	40%
Noticed physical health improvement	60%	77%
Noticed mental well-being improvement	57%	47%

BMADH patients showed longer hospital stays, higher medication intake, and lower rates of physical health improvement. Conversely, JDH demonstrated better patient health outcomes despite inferior ward design and poor environmental conditions (Table 3).

BMADH demonstrates comparatively better ward design and environmental qualities, including improved daylight, ventilation, and good outdoor and indoor environment, yet reports poorer patient health outcomes. In contrast, JDH exhibits inferior ward design and limited environmental benefits but shows better overall patient health. This apparent contradiction is primarily explained by regional health facilities planning rather than architectural conditions alone. Bogura operates within a four-tier healthcare system (primary, secondary, tertiary, and specialized care), resulting in the admission of more serious and complex cases at BMADH, while Joypurhat functions within only two levels of care (primary and secondary), leading JDH to admit mostly less severe patients and refer critical cases to nearby districts. Consequently, regional disparities in healthcare infrastructure indirectly shape patient profiles, length of stay, and health outcomes, often outweighing the direct benefits of ward design and environmental quality. This finding highlights that patient health is influenced not only by hospital environment but also, more fundamentally, by the broader regional planning and referral structure of healthcare facilities.

Discussion

The findings of this study reveal that regional health facilities planning plays a decisive role in shaping patient health outcomes, often outweighing the direct influence of hospital ward design and environmental quality. Although BMADH benefits from comparatively superior architectural and environmental conditions—such as adequate daylight, natural ventilation, spatial openness, and visual access to outdoor green spaces—its patients exhibited poorer health indicators, longer hospital stays, and higher medication dependency than those in JDH. This outcome contradicts much of the existing evidence-based design literature, which associates improved physical environments with better patient recovery, reduced stress, and enhanced well-being.

This apparent contradiction can be explained by differences in patient case mix resulting from regional healthcare infrastructure disparities. However, because disease severity, comorbidities, and referral source were not directly measured, this interpretation remains a planning-based explanation rather than a statistically verified clinical conclusion. Bogura's four-tier healthcare system, which includes tertiary and specialized facilities, attracts and retains more severe, complex, and referral-based cases at the district hospital level. As a result, BMADH functions not only as a secondary care provider but also as a de facto overflow and referral management facility for advanced cases, leading to longer stays and

comparatively poorer short-term health outcomes. In contrast, Joypurhat's limited two-tier system necessitates early referral of critical patients to neighbouring districts, leaving JDH to manage relatively less severe cases with shorter recovery periods. Consequently, JDH records better aggregate health outcomes despite its inferior ward conditions.

However, the findings must be interpreted within the context of several limitations. First, the sample size of 60 patients (30 per hospital) is relatively small, which may limit the statistical power and generalizability of the results. Second, although simple random sampling was employed within the medicine wards, the selection of only two districts and two hospitals purposively may introduce selection bias and restrict the representativeness of the findings to other regions of Bangladesh. Third, the study excluded patients from surgical, gynaecological, paediatric, and other wards due to their physical limitations, which means the findings are specific to general medicine inpatients and may not reflect the experiences of other patient populations. Fourth, critical and non-ambulatory patients were not included, potentially excluding those with the most severe health outcomes. Fifth, the cross-sectional nature of the data captures patient conditions at a single point in time, limiting the ability to assess long-term recovery trajectories. Finally, the absence of inferential statistical testing limits the ability to determine statistical significance; therefore, the observed differences should be regarded as indicative associations that support a planning-based interpretation rather than statistically verified causal relationships.

Future research should address these limitations by employing larger, more diverse samples across multiple districts, including patients from all ward types, and incorporating longitudinal designs to track patient outcomes over time. Comparative studies in districts with varying levels of healthcare infrastructure—including those with tertiary facilities—would further illuminate the complex interplay between regional planning and patient health. Additionally, qualitative research exploring patient and provider perspectives on referral processes and healthcare access could enrich understanding of the mechanisms underlying the observed disparities.

The results further suggest that patient-reported health improvements, stress levels, and length of stay are strongly influenced by systemic planning decisions rather than environmental quality alone. While architectural deficiencies in JDH such as overcrowding, poor ventilation, and lack of usable outdoor spaces, negatively affect comfort and perceived well-being, these factors do not translate into worse clinical outcomes due to the lower severity of admitted cases. This underscores the importance of interpreting hospital performance and patient outcomes within their broader regional and referral contexts, rather than in isolation at the building or ward level.

Overall, the study highlights that disparities in regional

health facilities planning indirectly shape patient health by determining where different categories of patients are treated, thereby influencing hospital workload, case severity, and outcome indicators. Hospital design remains important for patient comfort and long-term well-being, but its benefits may be muted or overshadowed when systemic planning imbalances persist.

CONCLUSION

The findings of this study suggest that patient health outcomes are influenced not only by hospital architecture and environmental quality but also by the broader regional planning and referral structure of healthcare facilities. The comparison between Bogura and Joypurhat indicates that hospitals located within regions containing tertiary and specialized facilities may manage more severe and complex cases compared to regions which handle only primary or secondary level of care. For this reason, patient health outcomes may seem poorer despite better physical environments because of patient health complexities. However, these findings should be interpreted with caution as the study was based on a relatively small sample from medicine wards only and did not include detailed clinical variables such as disease severity, comorbidities, or referral source. Moreover, the study is relied only on descriptive rather than inferential statistical analysis. Therefore, the results indicate associations rather than causal relationships. The study highlights the importance of considering regional healthcare infrastructure and referral patterns when evaluating hospital performance and patient outcomes. To address regional gaps, policymakers should focus on a fair distribution of tertiary and specialized healthcare services, enhance referral coordination, and balance patient load across districts. Combining regional healthcare planning with improvements in design and environment may help create more equitable healthcare delivery and better patient health across Bangladesh.

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