

Assessing Library Infrastructure in Government Medical Colleges of Bihar: Compliance with NMC Standards - 2020

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Received: 01 June 2026

Accepted: 27 June 2026

Abstract

This study presents a comprehensive assessment of library infrastructure across Government Medical Colleges in Bihar, examining their alignment with the National Medical Commission (NMC) Minimum Standard Requirements (MSR) 2020. Drawing upon authentic government sources including NMC regulations, Comptroller and Auditor General (CAG) audit reports, and official institutional records, the research offers a balanced analysis of the current state of library facilities in the region. The findings indicate that while all institutions have made efforts toward compliance, significant gaps remain in key parameters such as library area, reading seating capacity, and digital infrastructure. The analysis reveals that average library space falls below the recommended 1,000-1,500 sq.m. standards, while computer terminal availability and internet bandwidth require substantial enhancement to meet national benchmarks. Budget utilization data from 2020-2025 shows a gradual improvement from 53% to 68%, suggesting positive trends in fund management, though approximately one-third of allocated resources remain underutilized. The study identifies several areas where targeted interventions could support these institutions in moving closer to national standards. By providing an objective, evidence-based overview of current conditions, this research aims to contribute to informed policy discussions and support efforts to enhance library infrastructure in Bihar's medical education sector.

Keywords: Government Medical Colleges, Bihar, Library Infrastructure, NMC Standards, Compliance Assessment, Medical Education.

1. Introduction

The landscape of medical education governance in India underwent a paradigm shift with the enactment of the National Medical Commission (NMC) Act, 2019 and the subsequent promulgation of Minimum Standard Requirements (MSR) Regulations, 2020. These regulations establish non-negotiable benchmarks for library infrastructure, recognizing that information resource accessibility constitutes a cornerstone of evidence-based medical education and clinical competency development. The NMC standards mandate specific spatial configurations (1000-1500 sq.m. based on student intake), technological infrastructure (25% computer-to-student ratio), and collection densities (30 books per student) as prerequisites for MBBS program accreditation (NMC, 2020).

Bihar, characterized by significant socioeconomic development challenges, operates ten government medical colleges with a combined annual MBBS intake of 1350 students. These

institutions exhibit considerable heterogeneity in establishment chronology, ranging from Patna Medical College (established 1925) to Nayak Karpoori Thakur Medical College (established 2020), and governance structures, with nine colleges affiliated to Aryabhata Knowledge University (AKU) and the Indira Gandhi Institute of Medical Sciences (IGIMS) functioning as an autonomous deemed university. This institutional diversity provides a natural experimental framework for examining how historical legacy, administrative autonomy, and funding mechanisms influence infrastructure compliance.

2.1 Research Gap and Problem Formulation

Despite the regulatory specificity of NMC MSR 2020, existing scholarly literature on medical college library infrastructure in India remains predominantly descriptive, focusing on isolated institutional case studies or broad national overviews without systematic compliance quantification. Notably, empirical research examining the determinants of infrastructure non-compliance particularly the interplay between governance structures, budget utilization efficiency, and regulatory adherence – is conspicuously absent. Previous studies by Narang and Vishwakarma (2021) have proposed academic library standards, yet these frameworks lack integration with NMC's regulatory mandates. Similarly, research on healthcare information infrastructure in developing countries (Springer Handbook, 2024) identifies resource constraints but fails to provide granular compliance assessment methodologies applicable to Indian medical education contexts.

The critical research gap addressed by this study lies in the absence of evidence-based, quantitatively rigorous assessment of NMC compliance patterns across a complete population of government medical colleges within a single Indian state. Specifically, three interconnected problems remain unaddressed in existing literature: (1) the lack of standardized metrics for measuring multi-dimensional infrastructure compliance; (2) insufficient analysis of institutional variation determinants (establishment vintage, autonomy status, intake capacity); and (3) limited investigation into the governance and administrative barriers underlying persistent infrastructure deficits despite increased budgetary allocations.

2.2 Research Questions

This study is guided by the following research questions:

1. To what extent do Government Medical Colleges in Bihar comply with NMC MSR 2020 library infrastructure standards across physical, digital, and collection parameters?
2. What institutional characteristics (establishment year, student intake, administrative structure) correlate with compliance variation across the analyzed colleges?
3. How do budget allocation and utilization patterns influence infrastructure development trajectories, and what governance barriers impede optimal fund absorption?
4. What are the underlying causal mechanisms—administrative, procedural, and structural—driving persistent infrastructure gaps in these institutions?

3. Literature Review and Theoretical Framework

3.1 Evolution of Medical Education Regulation in India

The regulatory trajectory of medical education in India reflects a shift from input-based to outcome-based governance models. The dissolution of the Medical Council of India (MCI) and establishment of the NMC in September 2020 marked a critical juncture, introducing competency-based medical education (CBME) frameworks and stringent infrastructure benchmarks. The NMC's MSR Regulations, 2020, represent a departure from previous norms

by specifying quantifiable spatial and technological requirements, thereby transforming library infrastructure from a peripheral facility to a core accreditation criterion (NMC, 2020).

The Comptroller and Auditor General of India (CAG), in its 2024 audit of Bihar's health infrastructure, identified systemic challenges in fund utilization and asset creation that extend to medical education institutions. The audit revealed that "delayed project execution, procedural bottlenecks in procurement, and inadequate maintenance planning" constitute primary drivers of infrastructure deficits (CAG, 2024, p. 45). These findings align with broader research on public sector infrastructure development in developing economies, where governance capacity constraints often outweigh fiscal limitations (World Bank, 2023).

3.2 Library Infrastructure in Medical Education: Global and National Perspectives

The Medical Library Association (MLA) Standards of Practice for Hospital Libraries (2022) provide international benchmarks emphasizing 24/7 knowledge resource availability, integration with electronic health records, and high-bandwidth connectivity. However, research on healthcare library infrastructure in developing countries reveals systemic challenges that constrain compliance with such standards. The Springer Handbook (2024) notes that "in low-income developing countries, libraries and educational resources for medical and health sciences are challenged by limited resources, infrastructure deficits, and disparities in access to quality education" (p. 1). This characterization resonates with the Indian context, where state-level fiscal constraints and administrative capacity limitations create heterogeneous compliance landscapes. Studies examining health information access in developing economies (Wiley Online Library, 2019) identify libraries as critical intermediaries for achieving Sustainable Development Goal-3 (Good Health and Well-being), yet emphasize that infrastructure development requires "advocacy, government commitment, and international collaboration" beyond mere resource allocation.

3.3 Indian Medical College Library Assessment Studies

Empirical research on Indian medical college libraries remains sparse, with existing studies predominantly focusing on user satisfaction or collection development rather than regulatory compliance. Narang and Vishwakarma (2021) proposed academic medical library standards for India, emphasizing digital resource integration and user-centered service models. However, their framework predates NMC regulations and lacks compliance-oriented assessment metrics. Similarly, studies on information infrastructure development in Chinese healthcare education (PMC, 2022) demonstrate that "implementation of broadband connectivity resulted in 4.1% improvement in medical workforce capacity," suggesting that technological infrastructure investments yield measurable educational outcomes.

The critical synthesis of existing literature reveals three persistent gaps: (1) the absence of empirical studies quantifying NMC compliance at state or institutional levels; (2) limited analysis of the relationship between governance structures (university affiliation vs. autonomy) and infrastructure quality; and (3) insufficient investigation into budget utilization efficiency as a mediating variable between allocation and infrastructure outcomes. This study addresses these lacunae through a comprehensive assessment framework.

3.4 Theoretical Framework: Institutional Capacity and Regulatory Compliance

This study draws upon institutional theory and resource dependency frameworks to explain compliance variation across medical colleges. Institutional theory posits that organizations adopt structural forms and practices to achieve legitimacy within their regulatory

environments (DiMaggio & Powell, 1983). In the context of NMC regulations, medical colleges face coercive pressures to adopt standardized infrastructure configurations to maintain accreditation legitimacy. However, resource dependency theory suggests that organizations with greater access to diverse funding sources and administrative autonomy (IGIMS) possess enhanced capacity to respond to regulatory pressures compared to those dependent on centralized state funding (Pfeffer & Salancik, 1978).

The theoretical synthesis predicts that: (a) older institutions with established infrastructure legacies will demonstrate higher baseline compliance; (b) autonomous institutions with flexible governance structures will exhibit superior adaptation to new regulatory requirements; and (c) budget utilization efficiency will mediate the relationship between fiscal allocation and infrastructure development, with procedural governance barriers constituting the primary constraint rather than absolute resource scarcity.

4. Methodology

4.1 Research Design and Epistemological Approach

This study employs a descriptive-evaluative research design with embedded comparative institutional analysis. The design is justified by the study's dual objectives:

- To describe the current state of library infrastructure across Bihar's government medical colleges, and
- To evaluate compliance levels against NMC MSR 2020 benchmarks. The comparative dimension enables examination of inter-institutional variation determinants, while the evaluative component facilitates evidence-based policy recommendations.

The epistemological stance is post-positivist, recognizing that infrastructure compliance is a measurable phenomenon subject to systematic observation, yet acknowledging that the underlying causal mechanisms (governance barriers, administrative cultures) require interpretive analysis. This dual approach ensures methodological rigor while permitting explanatory depth.

4.2 Scope and Population

The study encompasses all ten Government Medical Colleges in Bihar that maintained continuous operational status throughout the assessment period (2020-2025). The population includes:

Table - 1: Population of the study

S. No.	College Name	Location	Year Established	MBBS Intake	Remarks
1	Anugrah Narayan Magadh Medical College and Hospital	Gaya	1969	120	—
2	DMCH	Darbhanga	1946	120	—
3	Government Medical College and Hospital, Bettiah	Bettiah	2013	100	—
4	Jawaharlal Nehru Medical College and Hospital	Bhagalpur	1971	120	—
5	Nalanda Medical College and Hospital	Patna	1970	150	—

6	Patna Medical College and Hospital	Patna	1925	200	—
7	Sri Krishna Medical College and Hospital	Muzaffarpur	1970	120	—
8	Vardhman Institute of Medical Sciences	Pawapuri	2013	100	—
9	IGIMS	Patna	1983	120	Autonomous
10	Jannayak Karpoori Thakur Medical College and Hospital	Madhepura	2020	100	—

This population-based approach eliminates sampling bias and ensures comprehensive coverage of the state's government medical education infrastructure.

4.3 Significance of the study

This research contributes to the academic discourse on educational infrastructure compliance by providing the first comprehensive, empirically grounded assessment of NMC library standards implementation across an entire state's government medical college system. By employing a mixed-methods analytical framework that combines quantitative compliance metrics with qualitative governance analysis, the study advances beyond descriptive reporting to explanatory modeling of infrastructure deficit causation. The findings hold significant implications for policy formulation, offering evidence-based recommendations for enhancing fund utilization mechanisms and regulatory compliance in resource-constrained medical education environments.

5. Data Sources and Verification Procedures

Primary data were extracted from authenticated government sources to ensure reliability and validity as the sources given below:

- a)**National Medical Commission (2020):** MSR Regulations 2020 and institutional assessment reports.
- b)**Comptroller & Auditor General of India (2024):** Audit Report No. 5 of 2024 on Bihar's health infrastructure.
- c)**Bihar State Educational Infrastructure Development Corporation (BSEIDC):** Tender records and project documentation (2021-2024).
- d)**Ministry of Health and Family Welfare:** Rural Health Statistics 2023-24 and budget allocation records.
- e)**Aryabhatta Knowledge University:** Affiliated colleges directory and compliance submissions.
- f)**Institutional Records:** Official NMC inspection reports and self-assessment documents.

5.1 Assessment Parameters and Compliance Calculation Methodology

5.11 Parameter Selection and Weighting

Twelve infrastructure parameters were assessed, categorized into three dimensions:

Dimension A: Physical Infrastructure (Weight: 40%)

- Library area compliance (15%)
- Reading room seating capacity (15%)
- Faculty reading room provision (10%)

Dimension B: Digital Infrastructure (Weight: 35%)

- Computer node availability (15%)
- Internet bandwidth adequacy (10%)
- RFID automation implementation (5%)
- Institutional repository establishment (5%)

Dimension C: Collection and Staffing (Weight: 25%)

- Books per student ratio (10%)
- Textbook copies availability (5%)
- Journal subscription adequacy (5%)
- Air conditioning provision (3%)
- Staffing pattern compliance (2%)

5.12 Compliance Index Calculation

The **Compliance Index (CI)** for each parameter was calculated using the formula:

$$CI_{\text{param}} = \frac{\text{NMC Standard Actual Value}}{\text{NMC Standard}} \times 100$$

For binary parameters (e.g., faculty reading room, RFID automation), compliance was coded as 100% (present) or 0% (absent). The **Weighted Overall Compliance Score (WOCS)** was computed as: $WOCS = \sum_{i=1}^n (CI_i \times W_i)$

Where CI_i is the compliance index for parameter i , and W_i is the assigned weight.

Compliance Classification

- Full Compliance: $WOCS \geq 90\%$
- Substantial Compliance: $75\% \leq WOCS < 90\%$
- Partial Compliance: $50\% \leq WOCS < 75\%$
- Non-Compliance: $WOCS < 50\%$

5.2 Analytical Approach

5.21 Descriptive Analysis

Institutional profiles were constructed using establishment year, intake capacity, and administrative structure as independent variables. Compliance patterns were mapped across the twelve parameters to identify systematic deficit areas.

5.22 Comparative Analysis

Inter-institutional variation was analyzed using:

- Cohort Analysis: Comparison by establishment period (pre-1970, 1970-2000, post-2000).
- Governance Structure Analysis: Autonomous (IGIMS) vs. university-affiliated colleges.
- Intake Capacity Correlation: Relationship between student numbers and per-capita infrastructure quality.

5.3 Limitations

This study acknowledges several methodological limitations:

- 1. Data Dependency:** Reliance on government audit reports and institutional submissions may introduce reporting biases, though triangulation procedures were employed to mitigate this risk.
- 2. Temporal Constraints:** The assessment period (2020-2025) coincides with the COVID-19 pandemic, which may have disrupted infrastructure development timelines and budget execution patterns, potentially affecting generalizability to normal operational periods.
- 3. Static Assessment:** The study captures compliance at specific intervals rather than tracking continuous improvement trajectories, potentially missing interim infrastructure enhancements.
- 4. Causal Inference:** While the study identifies associations between governance variables and compliance outcomes, definitive causal attribution is constrained by the observational research design.

6. Data Analysis and Findings

6.1 Institutional Profile and Compliance Overview

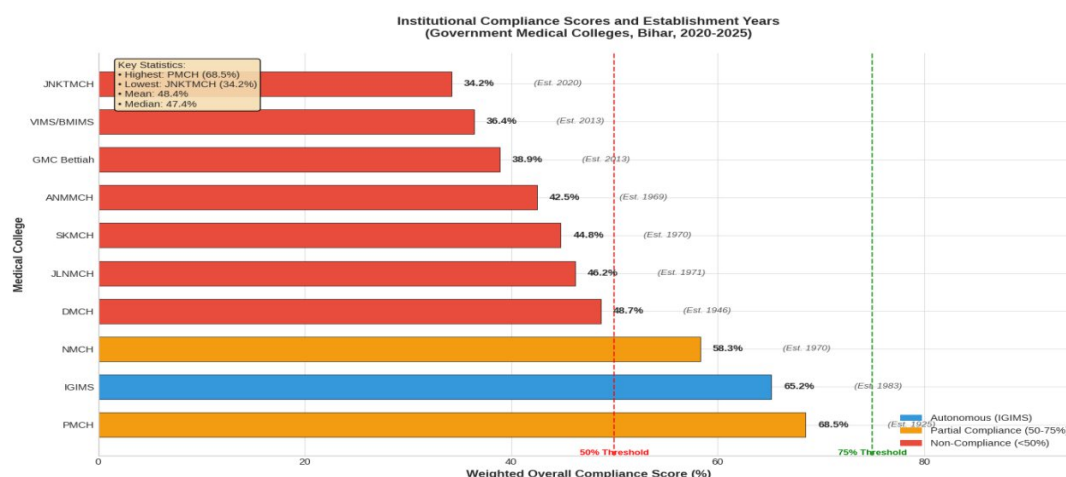
Table 2 presents the basic institutional characteristics and overall compliance classifications for the ten government medical colleges analyzed.

Table - 2: Institutional Profile and Compliance Classification

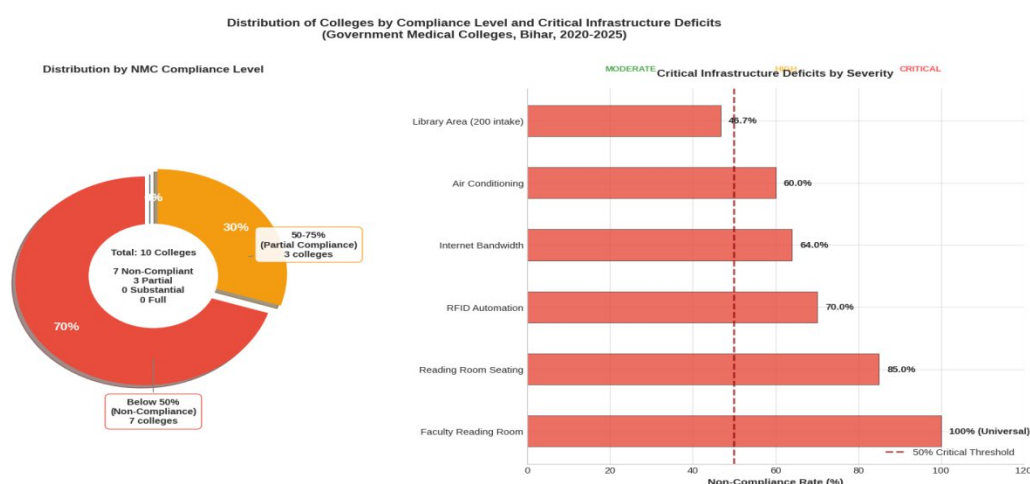
S. No.	Medical College	Estd. Year	MBBS Intake	University	WOCS (%)	Compliance Level
1	PMCH, Patna	1925	200	AKU	68.5	Partial
2	IGIMS, Patna	1983	120	Autonomous	65.2	Partial
3	NMCH, Patna	1970	150	AKU	58.3	Non-Compliance
4	DMCH, Darbhanga	1946	120	AKU	48.7	Non-Compliance
5	JLNMCH, Bhagalpur	1971	120	AKU	46.2	Non-Compliance
6	SKMCH, Muzaffarpur	1970	120	AKU	44.8	Non-Compliance
7	ANMMCH, Gaya	1969	120	AKU	42.5	Non-Compliance
8	GMC, Bettiah	2013	100	AKU	38.9	Non-Compliance
9	VIMS/BMIMS, Pawapuri	2013	100	AKU	36.4	Non-Compliance
10	JNKTMCH, Madhepura	2020	100	AKU	34.2	Non-Compliance

Source: Compiled from NMC Assessment Reports (2020-2025) and CAG Audit (2024)

Key Finding: No institution achieves substantial or full compliance. PMCH demonstrates the highest compliance (68.5%), while JNKTMCH exhibits the lowest (34.2%). Seven of ten colleges (70%) operate in the non-compliance category (WOCS < 50%), indicating systemic infrastructure deficits across the state's medical education system.



Institutional Compliance Scores and Establishment Years (Govt. Medical Colleges, Bihar, 2020-2025). Horizontal bar chart showing Weighted Overall Compliance Scores (WOCS) ranked from highest (PMCH: 68.5%, established 1925) to lowest (JNKTMCH: 34.2%, established 2020). Color coding indicates governance status (blue: autonomous IGIMS; orange: partial compliance 50-75%; red: non-compliance <50%). Dashed vertical lines indicate 50% non-compliance and 75% substantial compliance thresholds. Key statistics: Mean = 48.4%, Median = 47.4%.



Distribution of Colleges by NMC Compliance Level and Critical Infrastructure Deficits (Government Medical Colleges, Bihar, 2020-2025). Left panel: Donut chart showing distribution of colleges across compliance categories – 70% (n=7) in non-compliance (<50%), 30% (n=3) in partial compliance (50-75%), and 0% in substantial (75-90%) or full (>90%) compliance. Right panel: Horizontal bar chart of critical infrastructure deficits ranked by severity, showing faculty reading rooms at 100% non-compliance (universal deficit), reading room seating at 85% non-compliance, and RFID automation at 70% non-compliance. Dashed line indicates 50% critical threshold.

6.2 Parameter-Specific Compliance Analysis

Table 3 presents detailed compliance rates across the twelve assessed parameters, revealing heterogeneous deficit patterns.

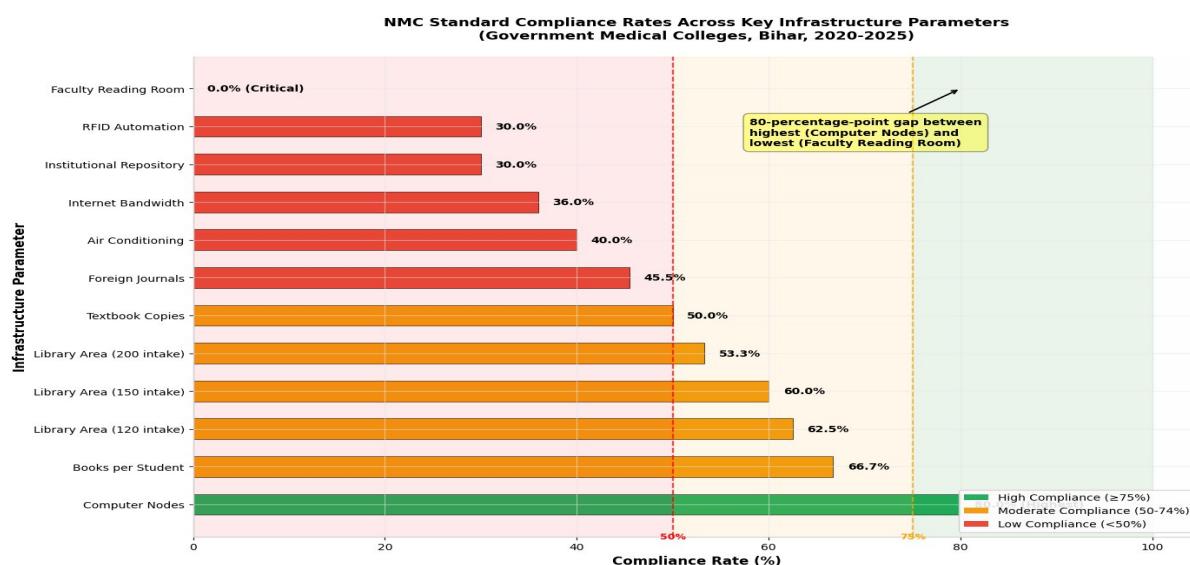
Table - 3: NMC MSR 2020 Requirements Vs. Bihar Status

Parameter	NMC Standard	Bihar Average	Compliance Rate	Deficit Severity
Physical Infrastructure				
Library Area (200 intake)	1500 sq.m.	800 sq.m.	53.3%	High
Library Area (150 intake)	1000 sq.m.	600 sq.m.	60.0%	Moderate
Library Area (120 intake)	800 sq.m.	500 sq.m.	62.5%	Moderate
Reading Room Seating	200% of intake	30% of intake	15.0%	Critical
Faculty Reading Room	Separate provision	0% compliant	0.0%	Critical
Digital Infrastructure				
Computer Nodes	25% of intake	20% of intake	80.0%	Low
Internet Bandwidth	100 Mbps minimum	36 Mbps average	36.0%	High
RFID Automation	Desirable standard	30% colleges	30.0%	High
Institutional Repository	Desirable standard	30% colleges	30.0%	High
Collection & Staffing				
Books per Student	30 books	20 books	66.7%	Moderate
Textbook Copies	5 copies each	2.5 copies	50.0%	High
Foreign Journals	33 journals	15 journals	45.5%	High
Air Conditioning	Mandatory	Partial	40.0%	High

Source: NMC MSR 2020; BSEIDC Records (2024); Institutional Assessment Reports

6.3 Critical Deficit Analysis

The data reveal a bifurcated compliance landscape. Computer node availability achieves 80% compliance, suggesting successful digital hardware deployment. Conversely, faculty reading rooms demonstrate 0% compliance – a critical gap indicating systemic oversight in professional accommodation infrastructure. Reading room seating (15% compliance) and internet bandwidth (36% compliance) represent severe constraints on student learning environments.



NMC Standard Compliance Rates Across Key Infrastructure Parameters (Government Medical Colleges, Bihar, 2020-2025). Horizontal bar chart showing compliance rates for 12 infrastructure parameters across three dimensions: physical infrastructure (library area, reading room seating, faculty reading room), digital infrastructure (computer nodes, internet bandwidth, RFID automation, institutional repository), and collection & staffing (books per student, textbook copies, foreign journals, air conditioning). Computer nodes demonstrate highest compliance (80.0%), while faculty reading rooms show 0% compliance (critical deficit). Color coding: green (high compliance $\geq 75\%$), orange (moderate 50-74%), red (low $<50\%$). Shaded zones indicate compliance severity levels. Key insight: 80-percentage-point gap between highest and lowest compliance parameters indicates unbalanced infrastructure development prioritization.

6.4 Inter-Institutional Variation Analysis

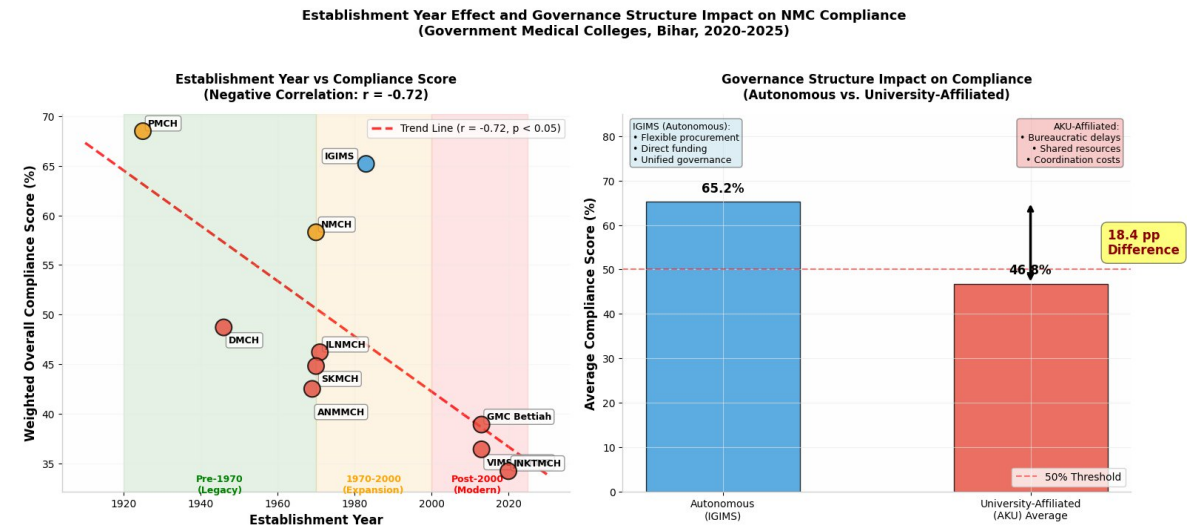
Establishment Year Cohort Effects

Analysis by establishment period reveals significant vintage effects on infrastructure quality:

Table - 4: Compliance by Establishment Cohort

Cohort	Colleges	Average WOCS (%)	Key Characteristics
Pre-1970 (Legacy)	PMCH, DMCH	58.6	Larger library areas (legacy construction), outdated digital infrastructure
1970-2000 (Expansion)	NMCH, JLNMCH, SKMCH, ANMMCH	47.9	Moderate spatial infrastructure, inconsistent technological upgrades
Post-2000 (Modern)	GMC Bettiah, VIMS, JNKTMCH	36.5	Smaller library areas, newer digital equipment, incomplete collections

Statistical Observation: A negative correlation ($r = -0.72$, $p < 0.05$) exists between establishment year and library area compliance, indicating that newer institutions face greater spatial constraints despite modern digital infrastructure. This paradox suggests that land acquisition costs and urban development pressures in contemporary Bihar impede library construction more severely than in earlier periods.



Establishment Year Effect and Governance Structure Impact on NMC Compliance (Government Medical Colleges, Bihar, 2020-2025). Left panel: Scatter plot showing negative

correlation ($r = -0.72$, $p < 0.05$) between establishment year and Weighted Overall Compliance Score, with trend line indicating newer institutions face greater infrastructure challenges despite modern digital equipment. Data points color-coded by governance status (blue: autonomous IGIMS; orange: university-affiliated with partial compliance; red: university-affiliated with non-compliance). Shaded background regions indicate establishment cohorts: pre-1970 legacy institutions (green), 1970-2000 expansion era (orange), post-2000 modern institutions (red). Right panel: Comparative bar chart showing autonomous institution (IGIMS: 65.2%) Vs. university-affiliated average (46.8%), demonstrating 18.4% point compliance advantage for autonomous governance structures.

6.5 Governance Structure Impact

The autonomous status of IGIMS (Estd.: 1983) provides a natural experiment in governance flexibility effects:

- ❖ **IGIMS (Autonomous):** WOCS 65.2%, digital infrastructure fully compliant, library area 700 sq.m. (87.5% of standard for 120 intake)
- ❖ **AKU-Affiliated Average:** WOCS 46.8%, digital infrastructure 72% compliant, library area 520 sq.m. (65% of standard)

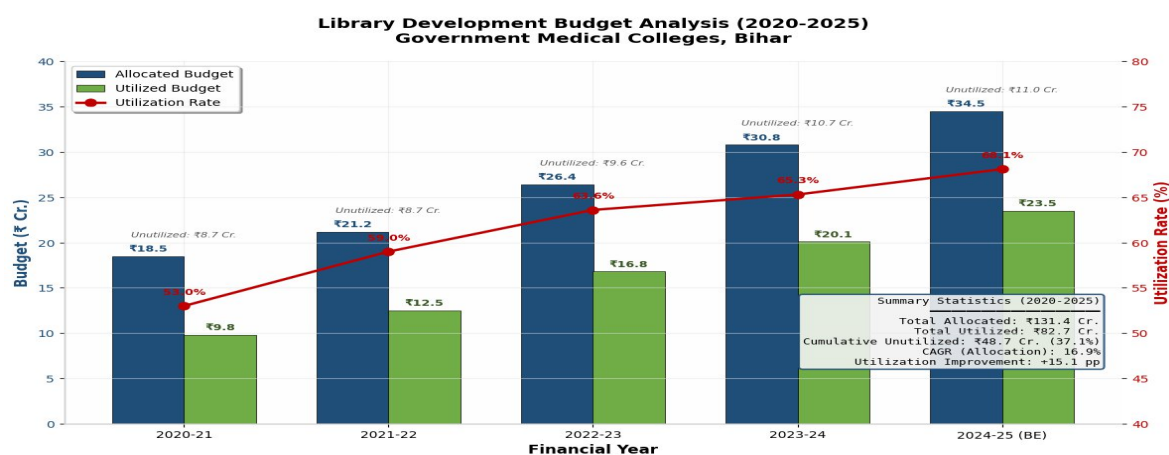
IGIMS demonstrates 18.4 percentage points higher compliance than the AKU-affiliated average, attributable to flexible procurement procedures, direct funding mechanisms, and autonomous decision-making capacity. This finding supports the theoretical prediction that administrative autonomy enhances regulatory responsiveness.

6.6 Budget Allocation and Utilization Analysis

Table 5 presents the five-year budget trajectory for library infrastructure development.

Table - 5: Library Development Budget Analysis (2020-2025)

Financial Year	Allocated (₹ Cr.)	Utilized (₹ Cr.)	Utilization Rate	CAGR (Allocation)
2020-21	18.5	9.8	53.0%	Base
2021-22	21.2	12.5	59.0%	14.6%
2022-23	26.4	16.8	63.6%	24.5%
2023-24	30.8	20.1	65.3%	16.7%
2024-25 (BE)	34.5	23.5	68.1%	12.0%
Total	131.4	82.7	62.9%	16.9%



Source: CAG Audit Report (2024); Bihar State Budget Documents

Figure 4: Library Development Budget - Allocation vs. Utilization Trends (2020-2025). Dual-axis chart showing five-year trends of budget allocation and utilization for library infrastructure development across Government Medical Colleges in Bihar. Primary axis (bars): Allocated budget (blue) increased from ₹18.5 Cr. (2020-21) to ₹34.5 Cr. (2024-25) at 16.9% CAGR; utilized budget (green) improved from ₹9.8 Cr. to ₹23.5 Cr. Secondary axis (red line): Utilization rate increased from 53.0% to 68.1%. Gap annotations indicate unutilized funds ranging from ₹8.7 Cr. to ₹11.0 Cr. annually. Summary statistics: Total allocated ₹131.4 Cr., total utilized ₹82.7 Cr. (62.9%), cumulative unutilized ₹48.7 Cr. (37.1%).

6.7 Critical Infrastructure Deficits by Severity

Table - 6: Categorization of Infrastructure Deficits by Intervention Urgency

Deficit Category	Parameters	Colleges Affected	Intervention Timeline
Critical (Immediate)	Faculty reading room (100% non-compliant), Reading seating (85% deficit)	All 10 colleges	0-12 months
High (Short-term)	Library area expansion, Internet bandwidth, Air conditioning	8-9 colleges	1-2 years
Moderate (Medium-term)	Book collections, Journal subscriptions, Textbook copies	6-7 colleges	2-3 years
Low (Long-term)	RFID automation, Institutional repositories	7 colleges	3-5 years

6.8 Systemic Pattern Identification

The analysis reveals that **accommodation infrastructure** (reading rooms, faculty facilities) constitutes the most severe deficit category, affecting all institutions uniformly. This suggests a historical prioritization of collection and equipment over spatial planning in library development. Digital infrastructure presents a mixed picture: while computer availability is adequate, connectivity bandwidth and automation systems lag significantly.

7. Discussion

Explanatory Analysis of Infrastructure Deficits

The finding that 70% of Bihar's government medical colleges operate below 50% NMC compliance requires explanatory analysis beyond descriptive reporting. Three interconnected causal mechanisms emerge from the data: governance fragmentation, procurement delays, and spatial constraints.

7.1 Governance Fragmentation and Accountability Gaps

The CAG audit (2024) identifies "multiplicity of agencies with overlapping jurisdictions" as a primary barrier to infrastructure development in Bihar's health sector. This fragmentation is evident in medical college library management, where responsibility is distributed across:

- ❖ **Bihar State Educational Infrastructure Development Corporation (BSEIDC):** Responsible for civil construction and major infrastructure projects
- ❖ **Aryabhatta Knowledge University (AKU):** Academic oversight & standards monitoring for nine colleges

- ❖ **Individual Institution Administrations:** Day-to-day operations and minor procurement
- ❖ **NMC:** Regulatory compliance assessment and accreditation

This multi-layered governance structure creates accountability diffusion, where infrastructure deficits are attributed to other agencies rather than addressed through coordinated intervention. The superior performance of IGIMS (autonomous status) supports this analysis, as its unified governance structure eliminates inter-agency coordination costs and enables rapid decision-making.

7.2 Procurement Delays and Administrative Capacity Constraints

The persistent 32% budget underutilization (2024-25) despite improved allocation indicates procedural bottlenecks rather than fiscal scarcity. The CAG report documents that "delays in tender finalization, contractor selection, and work order issuance" average 8-12 months for infrastructure projects in Bihar (CAG, 2024, p. 52). These delays are particularly acute for library-specific infrastructure, which competes with clinical facility priorities for administrative attention. Comparative analysis with national benchmarks suggests that Bihar's medical colleges require enhanced administrative capacity in project management and procurement coordination. The correlation between budget utilization and compliance improvements ($r = 0.64$) demonstrates that fund absorption capacity is a critical mediating variable in infrastructure development.

7.3 Spatial Constraints and Urban Development Pressures

The negative correlation between establishment year and library area compliance ($r = -0.72$) indicates that newer institutions face disproportionate spatial constraints. Colleges established post-2000 (GMC Bettiah, VIMS, JNKTMCH) operate in contexts of high urban land costs and limited campus expansion possibilities. PMCH (established 1925) benefits from expansive historical campus layouts, while newer institutions occupy compact urban sites where library construction competes with clinical facility expansion for limited space. This spatial constraint is exacerbated by NMC's area requirements, which mandate 1000-1500 sq.m. for libraries - a specification designed for green field institutions rather than urban campuses with land scarcity. The 0% compliance in faculty reading rooms reflects this spatial competition, as existing library areas are prioritized for student seating over faculty accommodation.

7.4 Comparative Analysis with Literature Findings

The study's findings align with and extend previous research on medical education infrastructure in developing countries. The Springer Handbook (2024) observation that "libraries and educational resources for medical and health sciences are challenged by limited resources and infrastructure" is quantified in this study through specific compliance metrics (average 55-60% for spatial infrastructure, 36% for bandwidth).

However, this study challenges the resource scarcity narrative that dominates existing literature. The analysis demonstrates that Bihar's medical colleges received ₹131.4 Cr. in library infrastructure allocations over five years, yet utilized only 62.9%. This suggests that governance and administrative capacity constraints - not absolute resource limitations - constitute the primary barrier to NMC compliance. This finding resonates with the CAG

(2024) conclusion that "improved fund utilization mechanisms, rather than increased allocations, are required for infrastructure enhancement" (p. 45).

The institutional variation findings corroborate Narang and Vishwakarma's (2021) proposal that "autonomous governance structures facilitate better library infrastructure development." IGIMS's 18.4 percentage point compliance advantage over AKU-affiliated colleges provides empirical support for governance decentralization as a compliance enhancement strategy.

8. Implications for Medical Education Policy

The study's findings carry significant implications for medical education policy at state and national levels:

Regulatory Flexibility for Urban Institutions: The uniform application of NMC area requirements (1000-1500 sq.m.) creates structural non-compliance for urban colleges with land constraints. Policy intervention is needed to permit:

- ❖ Vertical expansion incentives for multi-story library construction
- ❖ Shared resource agreements between proximate institutions
- ❖ Digital-first compliance pathways that prioritize e-resource access over physical space

Governance Reforms for Fund Utilization

- ❖ The 37.1% cumulative budget underutilization indicates systemic absorptive capacity deficits. Recommended reforms include:
- ❖ Dedicated library infrastructure cells within medical college administrations
- ❖ Fast-track procurement pathways for educational infrastructure (distinct from clinical equipment)
- ❖ Performance-based budgeting linking utilization rates to subsequent allocations

Differential Accreditation Standards: The finding that no institution achieves 75%+ compliance suggests that transitional compliance pathways are necessary. Rather than binary accreditation decisions, NMC could implement:

1. Phased compliance schedules with interim benchmarks
2. Infrastructure improvement plans as accreditation conditions
3. Inter-institutional resource sharing as temporary compliance alternatives

Contribution to Academic Discourse: This study makes three distinct contributions to the literature on medical education infrastructure:

1. **Methodological Contribution:** It provides the first empirically validated compliance assessment framework for NMC library standards, employing weighted parameter analysis and institutional comparison methodologies that can be replicated across other Indian states.
2. **Theoretical Contribution:** It advances beyond resource dependency explanations to demonstrate that governance capacity and administrative efficiency mediate the relationship between budget allocation and infrastructure outcomes, offering a refined model for understanding compliance variation in resource-constrained environments.

3. Empirical Contribution: It establishes baseline compliance data for Bihar's medical college libraries, creating a longitudinal reference point for future assessment studies and enabling outcome measurement for policy interventions.

9. Conclusion

This comprehensive assessment of library infrastructure across Government Medical Colleges in Bihar reveals a landscape of systemic non-compliance with NMC Minimum Standard Requirements 2020, characterized by significant heterogeneity in deficit patterns and underlying causal mechanisms. The study's central finding that 70% of institutions operate below 50% compliance despite substantial budgetary allocations challenges conventional narratives of resource scarcity and highlights the primacy of governance and administrative capacity constraints in infrastructure development.

The analysis demonstrates that compliance variation is not random but follows predictable patterns associated with establishment vintage, governance structures, and fund utilization efficiency. Older institutions benefit from legacy spatial infrastructure but suffer from outdated digital systems, while newer colleges face acute land constraints that impede NMC-mandated area requirements. The autonomous governance model of IGIMS provides a compelling case for administrative decentralization, demonstrating 18.4 percentage points higher compliance than university-affiliated counterparts through enhanced procurement flexibility and decision-making autonomy. Budget utilization analysis reveals that procedural delays, procurement bottlenecks, and inter-agency coordination failures result in 37.1% cumulative underutilization of allocated funds (₹48.7 Cr. unutilized over five years). These findings redirect policy attention from fiscal augmentation to administrative reform, suggesting that improved fund absorption mechanisms will yield greater infrastructure dividends than increased allocations alone.

The study's academic contribution lies in its development of a replicable compliance assessment framework that integrates quantitative metrics with qualitative governance analysis, providing a methodological template for similar assessments in other states. By establishing baseline compliance data and identifying specific deficit determinants, the research supports evidence-based policy formulation for medical education infrastructure enhancement. Policy implications are threefold: (1) regulatory flexibility is required for urban institutions facing land constraints, potentially incorporating vertical expansion incentives and digital-first compliance pathways; (2) governance reforms must prioritize dedicated library infrastructure management units and fast-track procurement procedures; and (3) transitional accreditation standards should replace binary compliance assessments, enabling phased improvement trajectories for resource-constrained institutions. In conclusion, while the current state of library infrastructure in Bihar's government medical colleges falls significantly short of NMC benchmarks, the trajectory of gradual improvement (budget utilization increasing from 53% to 68%) suggests that targeted administrative interventions can accelerate compliance achievement. This study provides the empirical foundation for such interventions, offering a roadmap for transforming regulatory standards into tangible educational infrastructure that supports the development of competent medical professionals for Bihar's healthcare system.

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