



Digital Transformation of Healthcare and Emerging Social Inequalities in Bihar: Special Reference to Katihar District

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ABSTRACT

The rapid growth of digital technologies has transformed healthcare delivery in India through initiatives such as the Ayushman Bharat Digital Mission (ABDM), Ayushman Bharat Health Account (ABHA), e-Sanjeevani telemedicine services, electronic health records, and mobile-based health applications. These innovations aim to improve healthcare accessibility, efficiency, transparency, and quality, particularly for populations residing in remote and underserved areas. However, the benefits of digital healthcare are not equally distributed among all social groups. Factors such as income, education, gender, caste, digital literacy, and geographical location significantly influence individuals' ability to access and utilize digital health services.

This study examines the relationship between digital healthcare transformation and emerging social inequalities in Bihar, with special reference to Katihar district. The research is based on secondary data obtained from NFHS-5, Census of India, Ministry of Health and Family Welfare reports, Ayushman Bharat Digital Mission documents, e-Sanjeevani statistics, Bihar Economic Survey reports, and relevant scholarly literature.

The findings reveal that inadequate digital literacy, gender disparities, socio-economic disadvantages, weak internet connectivity, and limited technological infrastructure continue to restrict equitable access to digital healthcare services. The study concludes that while digital healthcare has significant potential to improve health outcomes, its benefits can be fully realized only through inclusive policies that address structural inequalities and promote universal digital access and participation.



1. Introduction

The rapid growth of information and communication technologies has transformed healthcare systems across the world. Digital healthcare has emerged as a key component of modern health governance, incorporating technologies such as telemedicine, electronic health records, mobile health applications, artificial intelligence, and digital health identity systems. These innovations have improved healthcare accessibility, strengthened service delivery, reduced administrative burdens, and enhanced the management of health-related information.

The significance of digital healthcare became particularly evident during the COVID-19 pandemic. Restrictions on physical movement and the need for social distancing accelerated the use of teleconsultations, digital health monitoring, online appointment systems, and electronic vaccination records. As a result, digital healthcare evolved from a supplementary service into an essential mechanism for delivering healthcare and addressing public health emergencies effectively.

In India, healthcare digitization has been promoted through the Digital India initiative and various health-sector reforms. Programmes such as the Ayushman Bharat Digital Mission (ABDM), the Ayushman Bharat Health Account (ABHA), the Health Facility Registry (HFR), the Healthcare Professional Registry (HPR), and e-Sanjeevani telemedicine services aim to create an integrated digital health ecosystem. These initiatives seek to improve healthcare accessibility, particularly in rural and underserved areas where physical healthcare infrastructure remains inadequate.

Despite its considerable potential, digital healthcare also raises important concerns regarding social inequality. Access to digital health services depends not only on technological availability but also on factors such as income, education, gender, digital literacy, and place of residence. Individuals with greater socio-economic resources are generally better positioned to utilize digital healthcare platforms, while disadvantaged groups often encounter barriers to access and effective use.

The concept of the digital divide is therefore central to understanding contemporary healthcare inequalities. Differences in internet connectivity, smartphone ownership, and technological skills can result in unequal participation in digital healthcare systems. These disparities are particularly visible in economically less developed regions.



Bihar provides an important setting for examining these issues. Although the state has made progress in healthcare modernization and digital governance, challenges related to poverty, literacy, infrastructure, and healthcare accessibility continue to persist. Katihar district, with its predominantly rural population and socio-economic diversity, offers a valuable case for understanding how digital healthcare influences patterns of inclusion and exclusion. Against this background, the present study examines the relationship between digital healthcare transformation and emerging social inequalities in Bihar, with special reference to Katihar district.

2. Review of Literature

The relationship between digital healthcare and social inequality has become an important area of scholarly inquiry in recent years. Researchers from sociology, public health, development studies, and policy sciences have examined both the opportunities and challenges associated with digital health technologies.

Michael Marmot (2005) emphasized that health inequalities are fundamentally shaped by social determinants such as education, income, occupation, and social status. According to his analysis, healthcare interventions alone cannot eliminate disparities unless broader socio-economic inequalities are addressed. This argument remains highly relevant in the context of digital healthcare, where access to technology is unequally distributed across social groups.

Similarly, **Amartya Sen (1999)**, through his Capability Approach, argued that individuals require not only resources but also the capability to use those resources effectively. The mere availability of digital healthcare infrastructure does not guarantee equitable outcomes unless individuals possess the necessary skills, knowledge, and opportunities to utilize it.

Drèze and Sen (2013) further highlighted how socio-economic disadvantage influences access to public services in India. Their findings demonstrate that marginalized populations often remain excluded from developmental programmes despite policy commitments toward inclusion. The **World Health Organization (2021)**, in its *Global Strategy on Digital Health 2020–2025*, acknowledged the transformative role of digital technologies in achieving universal health coverage. However, it also stressed the need to ensure equity, affordability, accessibility, and digital inclusion.



Patel et al. (2018), through the *Lancet Commission on Global Mental Health and Sustainable Development*, argued that technological innovations alone cannot guarantee equitable health outcomes. They emphasized the importance of complementary social and institutional reforms.

Evidence from the **National Family Health Survey (IIPS & ICF, 2021)** indicates substantial disparities in internet usage, educational attainment, and healthcare access across rural and urban populations, gender groups, and socio-economic categories. Likewise, the **Telecom Regulatory Authority of India (TRAI, 2024)** documented significant growth in digital connectivity while noting persistent inequalities across regions and social groups.

The **World Bank (2021)** observed that digital transformation can contribute to inclusive development only when accompanied by investments in infrastructure, affordability, digital literacy, and institutional capacity. Similarly, the **National Health Authority (2024)** reported considerable progress in the implementation of the Ayushman Bharat Digital Mission but highlighted the continuing need for awareness generation and digital literacy programmes.

Reports such as the **Bihar Economic Survey (Government of Bihar, 2024)** and **Rural Health Statistics (MoHFW, 2024)** indicate that poverty, educational deprivation, shortages of healthcare personnel, and rural accessibility challenges continue to affect healthcare outcomes in Bihar.

The existing literature clearly demonstrates that while digital healthcare has the potential to improve healthcare accessibility and efficiency, its benefits are significantly influenced by existing socio-economic and technological inequalities. Furthermore, there remains a shortage of district-level sociological studies examining digital healthcare and social inequality in Bihar. The present study seeks to address this gap by focusing specifically on Katihar district.

3. Objectives of the Study

The study is guided by the following objectives:

1. To examine the nature and extent of digital transformation in the healthcare sector in Bihar.
2. To analyze the implementation of digital healthcare initiatives in Katihar district.
3. To identify socio-economic factors influencing access to digital healthcare services.
4. To examine emerging social inequalities associated with digital healthcare utilization.
5. To suggest policy measures for promoting equitable and inclusive digital healthcare systems.



4. Research Methodology

The study is entirely based on secondary data collected from multiple authoritative sources, including:

- National Family Health Survey (NFHS-5)
- Census of India
- Ministry of Health and Family Welfare reports
- Ayushman Bharat Digital Mission reports
- e-Sanjeevani telemedicine statistics
- National Sample Survey reports
- Bihar Economic Survey
- Government of Bihar publications
- World Health Organization reports
- Peer-reviewed journals, books, and research articles

A descriptive and analytical research design has been adopted. The interpretation of data is informed by sociological perspectives such as the Social Determinants of Health Framework, Digital Divide Theory, and theories of Health Inequality.

5. Conceptual Framework

The study assumes that utilization of digital healthcare services is influenced by an interaction between technological and social factors.

Independent Variables

- Income
- Education
- Gender
- Caste
- Place of Residence
- Digital Literacy
- Internet Connectivity



Intervening Variables

- Access to Smartphones
- Awareness of Digital Health Services
- Availability of Healthcare Infrastructure

Dependent Variable

- Utilization of Digital Healthcare Services

This framework suggests that the unequal distribution of socio-economic resources directly affects access to digital healthcare and may lead to the emergence of new forms of healthcare inequality.

6. Digital Transformation of Healthcare in India and Bihar

India's healthcare system has undergone significant digital transformation during the last decade. Expanding internet penetration, increasing smartphone ownership, technological innovation, and government-led digital initiatives have collectively contributed to the development of a more integrated and technology-driven healthcare ecosystem. The principal objective of these reforms is to improve accessibility, efficiency, transparency, and quality in healthcare delivery.

The COVID-19 pandemic accelerated this transformation by highlighting the necessity of remote healthcare services. Telemedicine, online consultations, digital health records, and electronic vaccination platforms became indispensable components of healthcare management.

To strengthen digital healthcare infrastructure, the Government of India introduced initiatives such as ABDM, ABHA, HFR, HPR, and the CoWIN platform. These programmes facilitate digital record management, enhance coordination among healthcare institutions, and improve patient access to healthcare services.

Bihar has actively participated in this transformation despite facing structural challenges such as poverty, inadequate infrastructure, and low digital literacy. Government hospitals, Primary Health Centres (PHCs), Community Health Centres (CHCs), and district hospitals increasingly utilize digital registration systems, teleconsultation services, and electronic health management tools. Nevertheless, significant disparities persist, particularly among rural populations, women, and economically weaker sections.



7. Digital Health Infrastructure: ABDM, ABHA, and e-Sanjeevani

7.1 Ayushman Bharat Digital Mission (ABDM)

The Ayushman Bharat Digital Mission, launched in September 2021, seeks to establish a comprehensive digital healthcare ecosystem that enables secure and seamless exchange of health information among healthcare stakeholders.

Table 1: Major Components of Ayushman Bharat Digital Mission (ABDM)

Component	Description	Purpose
ABHA (Ayushman Bharat Health Account)	Unique digital health identity	Centralized health records
HFR (Health Facility Registry)	National database of health facilities	Verification and interoperability
HPR (Healthcare Professional Registry)	Registry of healthcare professionals	Digital authentication
PHR (Personal Health Records)	Electronic patient health records	Continuity of care
UHI (Unified Health Interface)	Open digital network for health services	Digital consultation and service delivery

Source: National Health Authority (ABDM Portal), Government of India, 2025.

By February 2025, India had generated more than 73.98 crore ABHA accounts, linked over 49 crore health records, registered 3.63 lakh health facilities, and enrolled more than 5.64 lakh healthcare professionals.

7.2 Ayushman Bharat Health Account (ABHA)

ABHA provides individuals with a unique digital identity that allows secure storage and sharing of health information. It facilitates continuity of care, portability of records, and improved healthcare coordination, particularly for migrant workers, elderly populations, and patients requiring long-term treatment.

7.3 e-Sanjeevani Telemedicine Platform

The e-Sanjeevani platform represents India's national telemedicine service and operates through:

1. e-Sanjeevani AB-HWC (Hub-and-Spoke Model)
2. e-Sanjeevani OPD (Patient-to-Doctor Consultation)



By November 2025, the platform had facilitated more than 43 crore teleconsultations, making it one of the largest government-supported telemedicine systems globally.

Table 2: Growth of India's Digital Health Infrastructure

Indicator	Status (February 2025)
ABHA Accounts Created	73.98 Crore
Health Records Linked	49.06 Crore
Registered Health Facilities	3,63,520
Registered Healthcare Professionals	5,64,851
Health Facilities Using ABDM-enabled Software	1,59,020
e-Sanjeevani Teleconsultations (November 2025)	43+ Crore

Source: Ministry of Health and Family Welfare, Government of India (2025); National Health Authority (2025).

8. Katihar District Health Profile

Katihar district is located in the Seemanchal region of northeastern Bihar and is characterized by a predominantly rural population, agricultural dependence, and socio-economic diversity. According to Census 2011, the district had a population of approximately 3.07 million and a literacy rate of 52.24 percent, significantly lower than the national average.

Healthcare challenges in the district include maternal and child health concerns, communicable diseases, nutritional deficiencies, and limited access to specialized healthcare services. Government healthcare institutions continue to serve as the primary source of healthcare for a substantial proportion of the population.

Table 3: Selected Socio-Demographic and Health Profile of Katihar District

Indicator	Value
Total Population (Census 2011)	3,071,029
Rural Population (%)	Approximately 89%
Urban Population (%)	Approximately 11%
Literacy Rate (%)	52.24
Female Literacy Rate (%)	42.11
Sex Ratio (Females per 1000 Males)	919



Major Livelihood Source	Agriculture and Allied Activities
Administrative Blocks	16
Dominant Settlement Pattern	Rural

Source: Census of India 2011, District Census Handbook: Katihar, Bihar.

The gradual expansion of digital health infrastructure has reached Katihar through district hospitals, Health and Wellness Centres, Primary Health Centres, and telemedicine networks. However, access to digital healthcare remains uneven due to differences in educational attainment, internet connectivity, smartphone ownership, and digital literacy.

9. Digital Healthcare Expansion and Emerging Concerns in Katihar

The adoption of digital healthcare services in Katihar reflects broader developments occurring across Bihar. The increasing use of ABHA accounts, online OPD registration systems, telemedicine consultations, and digital health databases demonstrates the state's commitment to modernizing healthcare delivery.

However, the benefits of these technologies are not distributed equally among all social groups. Individuals possessing smartphones, internet connectivity, higher educational attainment, and greater digital literacy are generally more capable of utilizing digital healthcare services. In contrast, economically disadvantaged households, women, elderly populations, and residents of remote rural areas often face barriers that limit their participation in the digital health ecosystem. These inequalities raise important sociological questions regarding digital inclusion, healthcare equity, and social justice. Therefore, while digital transformation has expanded healthcare opportunities in Katihar district, it has simultaneously created new dimensions of social inequality that require systematic examination.

10. Emerging Social Inequalities in the Era of Digital Healthcare

Digital healthcare has become an important component of contemporary health systems. Telemedicine, online consultations, electronic health records, and mobile health applications have expanded healthcare access beyond traditional healthcare facilities. These innovations have reduced geographical barriers and improved service delivery. However, technological advancement does not automatically guarantee social equality. Existing social and economic disparities often influence who can benefit from digital healthcare services.



In Bihar, digital healthcare expansion has occurred within a context of poverty, low literacy, inadequate infrastructure, and social inequality. Programmes such as the Ayushman Bharat Digital Mission (ABDM), Ayushman Bharat Health Account (ABHA), and e-Sanjeevani have created new opportunities for healthcare access. Nevertheless, access to these services remains uneven. Differences in internet connectivity, smartphone ownership, digital literacy, and income have contributed to the emergence of a digital health divide.

Katihar district reflects many of these challenges. Its predominantly rural population, lower literacy levels, and socio-economic vulnerabilities affect participation in digital healthcare systems. Consequently, the benefits of healthcare digitization are not equally distributed among all sections of society.

11. Gender Digital Divide and Healthcare Access

Gender inequality remains a major barrier to digital healthcare access. Studies conducted in India show that women generally have less access to smartphones, internet services, and digital technologies than men. This disparity is particularly visible in rural and economically disadvantaged regions.

Data from the National Family Health Survey (NFHS-5) indicate that women use the internet far less frequently than men. Limited education, lower financial independence, mobility restrictions, and traditional social norms often reduce women's engagement with digital technologies. As a result, women face greater difficulties in accessing telemedicine services, online health information, digital appointments, and electronic health records.

The problem is particularly relevant in Katihar district, where female literacy remains considerably lower than male literacy. Lower literacy levels often reduce digital competence and limit the ability of women to use healthcare technologies independently.

Limited digital access can negatively affect maternal health services, reproductive healthcare, child health management, and preventive health awareness. Therefore, digital exclusion may reinforce existing gender inequalities in healthcare outcomes.

Table 4: Gender-Based Digital Divide and Potential Healthcare Access Challenges

Indicator	Bihar/India Situation
Women who have ever used the internet (NFHS-5 period)	Significantly lower than men



Digital device ownership among women	Lower than men
Female literacy in Katihar District	44.39%
Male literacy in Katihar District	59.36%
Likely impact on digital healthcare access	Reduced utilization of telemedicine and digital health platforms among women

Source: NFHS-5 (2019–21); Census of India 2011, Katihar District.

12. Rural–Urban Divide in Digital Healthcare

The rural–urban divide is another important source of inequality in digital healthcare. Effective use of digital health services requires internet connectivity, smartphones, electricity, and technological awareness. These resources are generally more available in urban areas.

Katihar district is largely rural, with more than 91 percent of its population living in villages. Urban residents usually have better access to telecommunications infrastructure, healthcare institutions, and digital services. Consequently, they are more likely to benefit from telemedicine and other digital healthcare facilities.

Rural populations often face challenges such as poor internet connectivity, inadequate infrastructure, and lower digital literacy. These limitations reduce access to online healthcare services and restrict the benefits of healthcare digitization.

Educational differences further strengthen these inequalities. Urban literacy rates are considerably higher than rural literacy rates. Since literacy is closely linked with digital skills, rural residents often face additional barriers in using digital healthcare platforms.

Table 5: Rural–Urban Disparities in Katihar District

Indicator	Rural Areas	Urban Areas
Population Share (%)	91.08	8.92
Literacy Rate (%)	49.60	77.27
Male Literacy (%)	56.90	82.46
Female Literacy (%)	41.59	71.40
Digital Infrastructure Availability	Relatively Limited	Relatively Better
Access to Specialized Healthcare	Lower	Higher

Source: Census of India 2011, District Census Handbook, Katihar.



The table indicates that rural residents face disadvantages in both education and digital infrastructure. Without focused policy interventions, digital healthcare may continue to favour urban populations.

13. Caste and Economic Inequality in Digital Healthcare

Caste and economic status continue to influence access to digital resources in India. Although digital technologies are widely available, their utilization often depends on socio-economic conditions.

Research suggests that socially disadvantaged groups generally have lower access to smartphones, internet services, and digital skills. Educational attainment and household income significantly influence participation in digital healthcare systems.

Katihar district has a sizeable population belonging to Scheduled Castes (SCs) and Scheduled Tribes (STs). These communities often experience disadvantages related to education, income, and access to technology. Such conditions limit their ability to benefit from digital healthcare initiatives.

Economic inequality further intensifies exclusion. Accessing digital healthcare usually requires smartphones, internet services, electricity, and basic technological knowledge. For low-income households, these expenses may create significant barriers despite the availability of free healthcare services.

Consequently, digital healthcare may unintentionally reproduce existing socio-economic inequalities unless targeted interventions are implemented to support marginalized populations.

14. Digital Literacy and Healthcare Access

Digital literacy is one of the most important determinants of digital healthcare utilization. It refers to the ability to access, understand, and effectively use digital technologies.

The presence of technology alone does not ensure healthcare access. Individuals must know how to operate smartphones, download applications, create digital accounts, and use telemedicine platforms. Without such skills, digital healthcare remains inaccessible.

This issue is particularly significant in Bihar, where literacy levels remain relatively low in several districts. Katihar's literacy rate of approximately 52.24 percent suggests that many residents may face difficulties in using technology-based healthcare services.



Older adults also face challenges because many are unfamiliar with digital technologies. Similarly, persons with disabilities often require specialized support that may not always be available.

Table 6: Social Determinants Influencing Digital Healthcare Access in Katihar

Determinant	Influence on Digital Healthcare Utilization
Education	Higher education increases digital capability
Literacy	Facilitates use of health applications and telemedicine
Income	Enables smartphone and internet ownership
Gender	Women often face lower digital access
Rural Residence	Associated with weaker connectivity and infrastructure
Caste Status	Linked to broader socio-economic inequalities
Digital Skills	Directly affects utilization of digital health services
Internet Connectivity	Essential for telemedicine and online health services

Source: Compiled from NFHS-5, Census of India 2011, and studies on digital inequality in India.

The evidence suggests that digital literacy has become an important social determinant of health. Individuals lacking digital skills are increasingly vulnerable to exclusion from healthcare systems that rely on digital technologies. Therefore, improving digital literacy is essential for achieving equitable access to healthcare in the digital era.

15. Discussion

The findings indicate that digital healthcare has become an integral component of contemporary healthcare governance in India. Through initiatives such as the Ayushman Bharat Digital Mission (ABDM), Ayushman Bharat Health Account (ABHA), e-Sanjeevani, Health Facility Registry (HFR), and Healthcare Professional Registry (HPR), the government has attempted to create an integrated healthcare ecosystem capable of improving healthcare delivery and continuity of care.

Bihar has demonstrated substantial progress in adopting digital healthcare technologies. Digital outpatient registration systems, telemedicine services, and electronic health records have improved administrative efficiency and expanded healthcare opportunities. However, the study reveals that access to these benefits remains uneven because technological resources are



embedded within broader social and economic structures.

Katihar district clearly illustrates these realities. The district's predominantly rural character, lower literacy rates, economic vulnerabilities, and gender disparities significantly influence access to digital healthcare. Although telemedicine reduces geographical barriers, its effectiveness remains dependent upon internet availability, electricity supply, smartphone ownership, and digital competence.

Gender inequality emerges as a particularly significant factor. Women often experience restricted access to digital technologies because of educational disadvantages and socio-cultural constraints. Similarly, rural residents continue to face infrastructural limitations that restrict their participation in digital healthcare systems. Caste and economic inequalities further shape patterns of digital healthcare utilization.

The study also identifies digital literacy as an emerging social determinant of health. Access to technology alone is insufficient unless individuals possess the knowledge required to use digital platforms effectively. Therefore, digital healthcare must be understood not merely as a technological innovation but as a social process deeply influenced by existing structures of inequality.

16. Major Findings of the Study

The major findings are summarized as follows:

1. India has witnessed rapid expansion of digital healthcare infrastructure through ABDM, ABHA, and e-Sanjeevani initiatives.
2. Bihar has emerged as a leading state in the implementation of digital healthcare services.
3. ABHA accounts and telemedicine platforms have improved healthcare accessibility.
4. Significant inequalities remain in access to digital healthcare services.
5. Utilization of digital healthcare is closely linked to education, income, and digital literacy.
6. Existing socio-economic inequalities influence participation in digital health systems.
7. Women face greater barriers due to lower digital access and literacy.
8. Female literacy in Katihar remains considerably lower than male literacy.
9. The gender digital divide may adversely affect maternal and reproductive healthcare.
10. Rural residents have comparatively lower access to digital infrastructure.
11. The predominantly rural nature of Katihar increases vulnerability to digital exclusion.



12. Telemedicine effectiveness depends on supporting infrastructure.
13. Household income strongly influences access to digital technologies.
14. Economically weaker households are less likely to utilize digital healthcare services.
15. Marginalized social groups continue to face educational and technological barriers.
16. Digital literacy has emerged as a key determinant of healthcare access.
17. Individuals lacking digital skills remain less likely to use digital healthcare platforms.
18. Elderly populations encounter additional technological challenges.
19. Digitalization alone cannot eliminate healthcare inequalities.
20. Inclusive policies are essential for ensuring equitable healthcare outcomes.

17. Policy Recommendations

To ensure inclusive digital healthcare development in Bihar and Katihar, the following measures are recommended:

1. Expand broadband connectivity in rural and underserved regions.
2. Implement large-scale digital literacy programmes through schools, community centres, and Health and Wellness Centres.
3. Introduce targeted programmes to reduce the gender digital divide.
4. Strengthen e-Sanjeevani infrastructure and technical support systems.
5. Integrate digital healthcare services with existing healthcare institutions.
6. Promote affordable smartphones and low-cost internet access for vulnerable households.
7. Conduct awareness campaigns regarding ABHA, telemedicine, and digital health records.
8. Strengthen privacy and data protection mechanisms.
9. Prioritize inclusion of women, SCs, STs, elderly persons, and economically disadvantaged communities.
10. Establish district-level monitoring systems to assess digital healthcare accessibility and utilization.

18. Conclusion

The digital transformation of healthcare represents one of the most important developments in India's contemporary healthcare system. Programmes such as the Ayushman Bharat Digital Mission (ABDM), Ayushman Bharat Health Account (ABHA), and e-Sanjeevani have significantly strengthened digital health infrastructure and expanded healthcare accessibility.



Bihar has also made noteworthy progress in adopting these initiatives, and districts such as Katihar are increasingly becoming part of the evolving digital health ecosystem.

However, the study demonstrates that the benefits of digital healthcare are not distributed equally. Access to digital health services is shaped by education, income, gender, caste, digital literacy, and place of residence. Consequently, pre-existing social inequalities continue to influence patterns of healthcare utilization in the digital era.

The experience of Katihar district highlights the challenges faced by rural populations, women, economically disadvantaged households, and digitally excluded groups. These findings emphasize that technological innovation alone cannot guarantee healthcare equity. Achieving inclusive digital healthcare requires simultaneous investments in digital infrastructure, education, digital literacy, gender empowerment, affordability, and public awareness.

Only through a socially inclusive approach can digital healthcare contribute to reducing existing inequalities and advancing the broader goals of health equity, social justice, and universal healthcare access.

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