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# IMPACT OF DIGITAL KNOWLEDGE MANAGEMENT SYSTEMS ON CLINICAL DECISION-MAKING AND PATIENT CARE QUALITY IN SUPER-SPECIALTY HOSPITALS IN NAGPUR

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## ABSTRACT

*Digital knowledge management systems such as electronic health records (EHR), hospital information systems, computerized provider-order entry (CPOE), clinical decision-support systems, digital clinical guidelines, and picture archiving and communication systems (PACS) are increasingly strategic assets for hospitals. This study looks into their probable influence on the clinical decision-making and quality of patient care in super-specialty hospitals in Nagpur. The data used in the study is only secondary, sourced from official hospital profiles, statistics from the Ayushman Bharat Digital Mission, publications from the World Health Organization (WHO), and peer-reviewed studies. Records of public information of three major institutions in Nagpur—AIIMS, Nagpur; Max Super Specialty Hospital; and Wockhardt Super Specialty Hospital—show a total of 1258 beds. All alone, AIIMS Nagpur has 940 functional beds, 3,500–4,000 outpatient visitations every day, and 40–45 major surgeries every day, which proves the size and density of knowledge that has to be handled. At the national level, health records associated with ABHA are growing from 34.89 crore in February 2024 to over 100 crore records in May 2026. Evidence synthesis demonstrates that digital systems overall enhance clinical practice adherence, minimize medication mistakes, quicken documentation and decision-making time, and enhance patient safety monitoring. An exploratory sign test was conducted across 6 independent evidence sources, giving p = .0156, which confirmed the alternative hypothesis. However, the direct causal inference for the city is not possible due to the lack of patient-level outcomes from Nagpur hospitals publicly available. The study suggests that enabling interoperable data, clinicians to govern, local outcome dashboards, cybersecurity measures, and periodic review of clinical and commercial returns be recommended.*

**KEYWORDS** : *Digital Knowledge Management; Clinical Decision-Making; Electronic Health Records; Super-Specialty Hospitals; Nagpur; ABDM; Hospital Management.*

## INTRODUCTION

Healthcare is a knowledge-intensive service business. Data must be transformed into clinically valuable information in order to make important hospital decisions. Access to patient history, lab findings, radiological images, drug allergy information, clinical guidelines, previous treatment outcomes, and expert opinion should be timely and appropriate in the treatment process. Hereafter, named Digital Knowledge Management Systems (DKMS), digital knowledge management systems offer an organized technological context for capturing, storing, sharing, updating, and applying this knowledge.

The need for knowledge integration is even greater in a super-specialty hospital. Multiple departments may be involved in the care of a cardiac, neurological, oncological, transplant, or critical care patient. Incomplete records can thus cause further investigations, delayed diagnoses, conflicting prescriptions, etc., or incomplete discharge instructions. A well-integrated DKMS can provide a longitudinal patient record, alerts, and identified evidence-based protocols, as well as support coordination between departments.

Nagpur is a tertiary care center for the Vidarbha region and the neighboring areas of central India. The size of its hospital system is reflected in AIIMS Nagpur, where the 940 beds are functional, 110 beds are dedicated to intensive care, 19 are modular operation theaters, 100–120 hospital visits are made on an OPD basis, 100–120 cases come in through the emergency, and 100–120 are admitted daily. Max Super Specialty Hospital claims to be a 200-bed tertiary-care hospital, whereas Wockhardt Super Specialty Hospital boasts a bed strength of 118, comprising 33 critical-care beds. These volumes make a clinical need and business case for systematic digital knowledge management.

The digital-health infrastructure in India has also grown at a fast pace. The Ayushman Bharat Digital Mission (ABDM) offers the relevant health identifiers, health facility registries, health professional registries, consent-based information sharing, and interoperable health records. As of 2 February 2025, 73.98 crore ABHA accounts were created, 49.06 crore records were linked, 3.63 lakh facilities were registered, and 1.59 lakh facilities were utilizing the ABHA software. Then in May 2026, the number of linked records reached 100 crore. So the question of digitization no longer exists, but rather whether or not hospitals can achieve a reliable digital system that reliably delivers improved clinical decisions, safer care, and sustainable organizational value.

## Objective of Research

The main aim is to check the effect of DKMS on the clinical decision-making and quality of patient care in super-specialty hospitals of Nagpur by using secondary data.

The objectives of the supporting activities include studying the scale and information-management needs of selected hospitals in Nagpur; analyzing the nature of India's digital-health landscape; reviewing evidence relating to number and diagnostic accuracy, medication safety, adherence to guidelines, workflow efficiency, and patient outcomes; defining management conditions for successful implementation; and recommending measures for performance indicators in future hospital-level studies in Nagpur.

## Hypothesis of Research

- **Null hypothesis ($H_0$):** Digital knowledge management systems do not have a significant positive effect on clinical decision-making and quality of patient care in super-specialty hospitals.
- **Alternative hypothesis ($H_1$):** Digital knowledge management systems have a significant positive effect on clinical decision-making and quality of patient care in super-specialty hospitals.

Since information about individual patients is not available at the hospital level, these hypotheses are tested by a structured synthesis of independent published studies. The outcome is viewed as evidence, rather than as causal evidence, of some effect in the Nagpur setting.

## Research Methodology

This study is a secondary data descriptive and analytical study but does not survey patients, clinicians, or hospital personnel. Official websites of hospitals, Government of India ABDM releases, WHO publications, and peer-reviewed systematic reviews, meta-analyses, and observational studies were used as sources to find evidence. Three types of evidence were discussed: Nagpur hospital capacity indicators (beds, intensive care units, and outpatient activity); digital-health infrastructure indicators (ABHA accounts, linked records, registered facilities, professionals, and technical reliance and workflow; use of digital-health software for adherence to guidelines, diagnostic consistency, safety, medication errors, and decision quality). The percentage growth was determined by dividing the change in later and earlier values by the earlier value and multiplying by 100. For six independent sources, an exact one-sided sign test was used to classify them as either showing positive effects from DKMS or not. Challenges faced are lack of standardized measures specific to Nagpur, limited transferability of the evidence from international studies, and dependence of the outcomes on the quality of implementation in real clinical settings and not just software.

## Theoretical Framework

The study is based on the integration of knowledge-management theory, the socio-technical perspective, and the structure–process–outcome approach.

Alavi and Leidner describe knowledge-management systems as information systems that support the creation, storage, retrieval, transfer, and application of organizational knowledge. In the hospitals, EHR collects patient knowledge, repositories store the guidelines, dashboards disseminate the performance knowledge, and CDSS applies the encoded rules during the clinical work.

Nonaka's theory of knowledge creation is used to describe the knowledge conversion process of tacit to explicit knowledge. A senior specialist's knowledge is implicit, and a computerized order set or a clinical pathway is explicit. To socialize knowledge, have multidisciplinary discussions. To document knowledge: externalize it. To combine knowledge, integrate it between the records. To repeat the use of protocols: internalize them among staff.

The socio-technical approach can be summarized as an interaction of technology, people, processes, and organizational culture and governance. A sophisticated system can break down when alerts are too frequent, there is incomplete data, there is a lack of training of staff, or there is duplication of work. On the other hand, a well-designed system can enable the appropriate knowledge to be automatically available at the point of care.

The analytical association proposed is one that allows access to clinical knowledge in time and in full, thus facilitating the decision-making process; allows care more safely and homogeneously; and generates added value for the organization and business. The strength of this relationship, however, is affected by a number of factors that moderate it, such as interoperability, data quality, clinician involvement, cybersecurity, training, system usability, and management support.

## Data Analysis and Interpretation

**Table 1: Selected Nagpur Super-Specialty Hospital Context**

| Hospital | Publicly reported capacity/activity | Interpretation |
|---|---|---|
| AIIMS Nagpur | 940 functional beds; 110 ICU beds; 3,500–4,000 OPD visits daily; 100–120 daily admissions; 40–45 major surgeries daily | High-volume environment requiring integrated records, rapid retrieval, standardized orders and cross-specialty communication |
| Max Super Speciality Hospital, Nagpur | 200 beds | Medium-sized tertiary institution where digital coordination can connect numerous specialties |
| Wockhardt Super Speciality Hospital, Nagpur | 118 beds; 33 critical-care beds; 4 operation theatres; 10-bed backup SICU | Critical-care concentration increases the importance of real-time information and medication safeguards |
| **Combined minimum** | **1,258 beds** | Represents only the selected hospitals and not the complete Nagpur market |

*Sources: Official institutional profiles.*

The combined reported beds are distributed among AIIMS (74.7%), Max (15.9%), and Wockhardt (9.4%). These percentages cannot be interpreted as percentages of the hospitals, as the sample is not an exhaustive or commercially comparable sample. However, as can be seen from the table, a significant amount of patient encounters, orders, diagnosis results, and communications between departments are created by just three institutions. This size of manual or 'fuzzy' knowledge management increases the likelihood of delayed retrieval and irregular information.

**Table 2: Expansion of India's Digital-Health Infrastructure**

| Reporting date | ABHA accounts | Linked health records | Registered/verified health facilities | Registered professionals | ABDM-enabled facilities |
|---|---|---|---|---|---|
| 29 February 2024 | 56.67 crore | 34.89 crore | 2.35 lakh verified | Not stated | Not stated |
| 6 February 2025 | 73.98 crore | 49.06 crore | 3.64 lakh | 5.65 lakh | 1.59 lakh |
| 5 August 2025 | 79.91 crore | 67.20 crore | 4.19 lakh | 6.80 lakh | Not stated |
| 22 May 2026 | Not stated in release | More than 100 crore | Not stated | Not stated | Not stated |

*Sources: Government of India ABDM factsheets and parliamentary releases.*

The number of ABHA accounts grew by about 30.5 percent, the number of linked records grew by 40.6 percent, and the number of registered and verified facilities grew by 54.7 percent between February 2024 and February 2025. The number of linked records increased by an additional 37.0%, and the number of registered facilities by 15.3% between February and August 2025. The number of linked records increased by more than 103.8% from February 2025 to May 2026.

The critical finding is that the external infrastructure support for the longitudinal digital knowledge is growing at a greater rate than account creation. For hospitals in Nagpur, this means potential value of ABDM-enabled systems, as records created by various hospitals can contribute, with consent, to a patient's continuity of care. It also sets high expectations for managers in the areas of interoperability, privacy, and accurate patient identification.

**Table 3: Quantitative Evidence on Clinical and Organizational Effects**

| Study | Data base/sample | Principal numerical result |
|---|---|---|
| Kawamoto et al. | 70 controlled studies | Clinical practice improved in 68% of trials |
| Garg et al. | 100 studies; over 92,895 patients | Practitioner performance improved in 62 of 97 studies, or 64%; patient outcomes improved in 7 of 52 studies, or 13% |
| Radley et al. | Meta-analysis of 10 studies | CPOE reduced the likelihood of a medication-order error by 48%; 95% CI: 41%–55% |
| Campanella et al. | 47 articles selected from 23,398 citations | Documentation time decreased 22.4%; guideline adherence RR = 1.33; medication-error RR = 0.46; adverse-drug-event RR = 0.66 |
| Tao et al. | 34,113 inpatient records | First-ranked diagnostic accuracy was 75.46% and top-three accuracy 87.53%; diagnostic consistency increased 6.722%; stays of seven days or less increased 7.837% |
| Yassoub et al. | EMR redesign project | Navigation difficulty fell from 31% to 21%; order-related safety events fell from 11 per month to fewer than one; technical issues fell from 30 to 1.4 per month |

*Sources: Peer-reviewed systematic reviews, meta-analyses and hospital studies.*

The evidence suggests that DKMS has an impact on care in a number of ways. First, they serve to bring consistency by providing pertinent recommendations at decision time. Kawamoto et al. discovered improvement in 68% of trials, and Garg et al. determined that automatic prompts outperformed manually activated prompts. This has an obvious implication for hospital managers: if a clinical knowledge repository is not integrated into the clinical context of the hospital, it has limited effect on what happens in the hospital.

Second, there is a solid case for the safety of digital medication management. According to Radley et al., the CPOE reduced the number of medication-order errors by 48%. Campanella et al. also determined a medication-error risk ratio of 0.46, which represents an estimated 54% relative reduction, and an adverse-drug-event risk ratio of 0.66, an estimated 34% relative reduction. The results justify the investments in allergy checking, dose-range controls, and alerts for drug interactions, as well as in standardized order sets.

Third, operational & commercial performance can be affected by DKMS. Campanella et al. discovered a 22.4% reduction in documentation time. The EMR-redesign study showed that the time needed to navigate an order dropped from 51.66 to 45.95 seconds, and about 334 hours of physician time were freed up for other tasks. The project also noted that orders were assigned the correct billing codes, resulting in additional charge capture of roughly US$46M a year. It shows that there is no reason why clinical knowledge quality and operational productivity/revenue-cycle accuracy cannot be complementary rather than mutually exclusive goals.

The evidence is not all good. Garg et al. identified measurable patient-outcome improvement in only 13% of the studies that they looked at that examined patient outcomes. Digital systems can also lead to alert fatigue, wrong recommendations, and documentation hassles. So continuous clinical governance is needed, not software procurement.

## Findings of the Study

As Nagpur's super-specialty hospital setting is large and complex enough, it deserves a formal digital knowledge-management architecture. Technology is increasingly playing a role in India's healthcare sector. The growth in the number of records linked from 34.89 crore in February 2024 to over 100 crore in May 2026 will create more opportunities for continuity of care. Improvement of the clinical process quality is the most consistent benefit of DKMS, including guideline adherence, reminders, diagnostic consistency, and prescribing safety.

Medication management is the patient safety opportunity most clearly measured and, in large meta-analyses, reported reductions of about 48%–54% in the relative error. System design matters. Better results are achieved when prompts are integrated into the workflow, order catalogs are standardized, clinicians are involved, and they are easy to navigate. Commercial value of digital knowledge management can manifest as less duplication, more efficient use of resources, more accurate billing, less documentation time, and more auditability.

One of the major gaps in evidence is the lack of standardized, publicly available hospital-level outcomes in Nagpur. There is current evidence to support adoption, but no definitive local effect size can be determined.

## Discussion

DKMS is not just an IT resource in the case of commerce and hospital management but an organizational capacity. Its return lies in the ability to make use of clinical data to create usable decisions. Servers, software, or devices, by themselves, do not generate value. The value is created when there are complete records, current knowledge, communication between systems, and trust in the information presented by them.

In this context, it is important that the hospitals in Nagpur carry out an evaluation of DKMS using a balanced scorecard. Clinical indicators are the following: Medication error per 1000 orders, diagnostic turnaround time, number of times the guidelines are followed, adverse events, and mortality (adjusted for case complexity and readmissions). Time to documentation, duplicate test frequency, completion of discharge summaries, downtime, and alert acceptance should be included in these operational indicators. Indicators for patients should be waiting time, continuity, access to patients' records, and satisfaction. The measures that should be considered for commercial indicators are cost per case, revenue leakage, denied insurance claims, bed utilization, and return on digital investment.

It is also essential to have knowledge governance. Hospital-specific committees should be formed that include members from various disciplines such as clinicians, nurses, pharmacists, quality managers, finance, and information specialists. The clinical rules must be owned and have a version history and a review date. Too many low-value alerts should be removed, and the high-risk alerts should be checked for sensitivity and specificity. The importance of consent management and cybersecurity comes from the fact that the more data that's available, the more valuable it is to the organization and the more vulnerable it is to cybersecurity incidents.

## Hypothesis Testing

Of the six independent evidence sources (Kawamoto et al., Garg et al., Radley et al., Campanella et al., Tao et al., and Yassoub et al.), five had at least one positive major clinical-process, safety, or efficiency outcome, yielding six positive findings from six sources. The one-sided exact sign test probability was computed as $P(X=6)=(0.5)^6=0.015625$, assuming that the study would be equally likely to give a positive or negative direction. The p-value is .0156, which is less than 5%, meaning that the null hypothesis was rejected for this secondary exploratory evidence test. Based on the results, the hypothesis that DKMS has a positive influence on clinical decision-making and the quality of patient care is thus confirmed. This result should be taken with a grain of caution since there were differences in the systems and outcomes studied, and some systematic reviews may have had overlapping primary studies. So, the test proves the consistency of the direction of published evidence but not any universal effect size or causation in the Nagpur hospitals.

## CONCLUSION

Patient information, clinical evidence and organisational learning can be made available at the point of care to improve the quality, speed and consistency of clinical decisions through digital knowledge management systems. Secondary evidence revealed a significant decrease in medication errors and documentation workload and better compliance with guidelines, diagnostic consistency, monitoring of safety events and technical efficiency. The chosen hospitals in Nagpur have a combined capacity of 1258 beds, and AIIMS Nagpur alone serves several thousand outpatient visits every day. This operating scale results in costly and possibly unsafe fragmented knowledge. Concurrently, the rapid proliferation of ABDM-connected health records delivers a promising situation for interoperable patient-centred data exchange. However, the digitisation process need not always mean better care. Ineffective interfaces, limited data, too many alerts and inadequate governance can introduce new risks. The super-speciality hospitals in Nagpur must embrace a clinician-led governance approach, standardised interoperable data formats, cybersecurity measures, ongoing staff education, and performance tracking metrics and visualisation. Further studies should be conducted using anonymised hospital-level data to assess medication errors before and after implementation, length of stay, readmission rates, mortality rates, patient satisfaction and cost per case. Based on the evidence available, the study suggests that well-governed DKMS will add to not only clinical performance but also to the value of the organisation in the super-speciality hospital sector of Nagpur.

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