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NAMASTE Portal Integration with ICD-11

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Abstract

The Ayurveda, Siddha, and Unani (ASU) systems of India gained global recognition with the recent update to the International Classification of Diseases, 11th Revision (ICD-11), which incorporates Chapter 26, Module 2 (TM2). This initiative, spanning 2020–2025 and formalized by a donor agreement between the World Health Organization (WHO) and India's Ministry of Ayush, establishes a standardized language for ASU morbidity. Key outcomes include the successful mapping of 1,941 national Ayush morbidity codes to the new classification and the official release of TM2 on the WHO ICD-11 Browser in February 2025, ensuring international comparability and evidence-based policymaking. India's implementation roadmap leverages existing digital platforms, including the National Ayush Morbidity and Standardized Terminologies Electronic (NAMASTE) Portal and the Ayush Hospital Management Information System (A-HMIS), powered by a Double Coding system in compliance with the WHO Minimum Data Set requirements. This paper provides a comprehensive analysis of the NAMASTE portal's architecture, its semantic mapping strategies with ICD-11 TM2, the technical and operational challenges in adoption, and a proposed extended framework incorporating API-based interoperability, FHIR-compliant data exchange, and AI-assisted terminology alignment. The study also presents a comparative analysis of ASU system coverage across Ayurveda, Siddha, and Unani, and charts a future roadmap for full-spectrum integration. This initiative positions India as a global leader in integrating traditional medicine into digital health systems and universal health coverage frameworks..

Keywords: Ayurveda, ICD-11, Implementation, Siddha, TM2, Traditional Medicine, NAMASTE, A-HMIS, Double Coding, Health Informatics, Digital Health.

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Introduction

The International Classification of Diseases (ICD) serves as the universally recognized standard for diagnosing, reporting, and monitoring health conditions globally. The 11th Revision of the ICD (ICD-11) updates disease classification, reflecting 30 years of medical advances and leveraging a networked, digital-era design. Its new architecture includes a semantic knowledge base, an online coding tool, and an Application Programming Interface (API), enhancing the capture and comparability of mortality and morbidity statistics worldwide. The inclusion of a dedicated supplementary Chapter 26 in ICD-11 for Traditional Medicine conditions—specifically Module 2 (TM2)—signifies a profound evolution in global health policy. It acknowledges and formally incorporates diverse healthcare paradigms practiced across WHO Member States.

India played a uniquely pivotal and proactive role in the development of TM2, focusing on the terminology and diagnostic patterns of the indigenous Ayurveda, Siddha, and Unani systems. This initiative formalizes the contribution of these systems to global health and provides a necessary technical framework for international collaboration and research. India's traditional medicine heritage spans over 5,000 years and continues to serve as a primary healthcare source for a significant portion of its 1.4 billion population. According to the WHO Global Traditional Medicine Strategy 2025–2034, approximately 80% of people in developing countries use traditional medicine for primary healthcare needs. Despite its widespread use, traditional medicine has historically lacked the codified, interoperable infrastructure required for integration into global health data systems. This gap has limited the ability to generate large-scale evidence, conduct comparative effectiveness research, or include traditional medicine in insurance reimbursement frameworks.

The Ministry of Ayush provided the technical and financial support required for the collaborative development of the ICD-11 TM2 module, involving more than twenty-five WHO member countries. The ICD-11 TM2, which encompasses 529 distinct categories derived as a union set of harmonized ASU disorders and patterns, was officially released on the WHO ICD-11 Browser as part of the 2025 update. The NAMASTE Portal and A-HMIS serve as the primary national digital instruments for operationalizing this classification at the ground level. This paper presents a comprehensive study of the NAMASTE portal's integration with ICD-11, covering its architecture, semantic mapping strategies, current implementation status, key challenges, and a proposed extended framework for enhanced interoperability and adoption.

Background and context

Evolution of ICD and the Role of Traditional Medicine

The ICD framework has undergone significant evolution since its inception in the late nineteenth century, growing from a simple mortality classification to a comprehensive morbidity and health statistics system. ICD-10, the predecessor to ICD-11, served as the global standard for over three decades and was ill-equipped to handle the nuances of traditional medicine systems. The absence of traditional medicine-specific codes in ICD-10 meant that ASU practitioners were forced to map their diagnoses to the nearest equivalent modern medicine codes, introducing significant semantic distortion and data quality concerns. ICD-11 addresses this gap through its modular, digital-first architecture. The TM2 module introduces 529 standardized categories covering conditions diagnosed and treated within ASU systems, derived from an extensive multilateral harmonization process involving experts from China, Korea, Japan, and India. The inclusion of India-specific ASU conditions was driven largely by the NAMASTE initiative.

The NAMASTE Portal: Architecture and Objectives

The National Ayush Morbidity and Standardized Terminologies Electronic (NAMASTE) Portal is a web-based digital platform developed by the Ministry of Ayush to address the long-standing absence of standardized terminologies in Indian traditional medicine. Its core objectives include consolidating disease terminologies from Ayurveda, Siddha, and Unani into a single searchable digital repository, establishing nationally accepted morbidity codes for ASU diseases to enable consistent data reporting, providing an API-driven interface for mapping NAMASTE codes to international classification systems such as ICD-11 TM2, and supporting the A-HMIS through dual-coding capabilities that allow clinicians to record both traditional and modern diagnoses simultaneously. The NAMASTE portal currently hosts over 20,000 standardized terminologies and 7,314 morbidity codes across ASU systems, making it the largest structured traditional medicine terminology database in India. Its restful API architecture enables seamless integration with hospital information systems, electronic health record platforms, and insurance coding engines.

The Ayush Hospital Management Information System (A-HMIS)

The A-HMIS is the institutional counterpart to NAMASTE, deployed across Ayush hospitals and government healthcare facilities nationwide. It manages the complete patient lifecycle from registration and outpatient department management to prescription generation, pharmacy workflows, and discharge records. A critical feature of A-HMIS is its support for the Double Coding system, wherein every patient encounter is coded using both a conventional ICD-11 code and a corresponding TM2/NAMASTE code.

This dual-record approach ensures that traditional medicine encounters are captured in a format that is both nationally standardized and internationally comparable.

Literature review

The integration of traditional medicine into modern healthcare informatics has gained significant scholarly attention over the past decade. Several studies have examined the challenges and opportunities of incorporating traditional medicine into standard disease classification frameworks. Thrigulla et al. provided an early roadmap for ICD-11 TM2 implementation in India, outlining the governance structure and stakeholder responsibilities. Their work highlighted the critical role of the Ministry of Ayush in bridging the gap between traditional practice communities and international health data governance bodies.

Wu et al. studied the TM1 module focused on Traditional Chinese, Japanese, and Korean medicine as a precursor to TM2 and found that successful implementation required strong political will, a pre-existing digital health infrastructure, and a trained workforce capable of dual coding. Internationally, WHO-led studies on traditional medicine informatics have emphasized semantic interoperability as the primary technical challenge. The diversity of ASU terminologies spanning classical Sanskrit texts, regional dialects, and evolving clinical nomenclature creates a highly complex ontological landscape that resists simple one-to-one code mapping.

SNOMED CT has been proposed as an intermediary bridge ontology, though its coverage of ASU-specific concepts remains limited. From a digital health perspective, the adoption of FHIR standards has emerged as a key enabler for cross-system data exchange. Studies by Mandel et al. demonstrated that FHIR-compliant APIs could significantly reduce integration costs and timelines when connecting national health portals to international classification systems.

Domestically, studies on the National Digital Health Mission and Ayushman Bharat Digital Mission provide useful context for understanding India's digital health readiness. Sharma et al. found that while urban tertiary care facilities had near-complete EHR adoption, rural and primary health center penetration remained below 30%, posing a direct challenge to nationwide NAMASTE–ICD-11 implementation. The literature converges on three central themes: the transformative potential of including ASU systems in ICD-11, the semantic and technical complexity of achieving this integration, and the infrastructural and human resource gaps that must be addressed for sustainable adoption.

Methodology

Fig 1. *Applications and Functional Domains of ICD-11 in Modern Healthcare Systems*

Research Design

This study adopts a mixed-method technical and policy-oriented research design combining system architecture analysis, semantic mapping evaluation, comparative coding analysis, and interoperability framework design. The research focuses on the operational integration of NAMASTE, ICD-11 TM2, and A-HMIS within India's emerging digital health ecosystem. The methodology consists of four major components: analysis of the existing NAMASTE and ICD-11 TM2 architecture, evaluation of semantic mapping strategies between ASU morbidity codes and ICD-11 TM2 categories, assessment of interoperability mechanisms using API-based and FHIR-compliant frameworks, and proposal of an extended architecture for AI-assisted terminology alignment and nationwide deployment.

Data Sources and System Analysis

The study utilizes WHO ICD-11 Browser documentation, Ministry of Ayush technical reports, NAMASTE portal documentation, A-HMIS implementation reports, and published research literature. The ICD-11 TM2 release data was analyzed to evaluate the structure of TM2 categories, mapping hierarchy, and coding relationships. NAMASTE morbidity datasets were examined to understand code organization, terminology standardization, and cross-system compatibility. The system architecture analysis focuses on REST API integration, database structure, Double Coding workflows, and interoperability layers.

Semantic Mapping Strategy

The semantic mapping process involves aligning NAMASTE morbidity codes with ICD-11 TM2 categories. The semantic relationship between two medical concepts is represented as:

$M(Cn,Ct)=Similarity\ (Cn,Ct)$

where:

Cn = NAMASTE concept

Ct = ICD-11 TM2 concept

The similarity score is computed using lexical similarity, contextual similarity, and ontological relationship matching.

The final mapping confidence is defined as:

$S = \alpha L + \beta C + \gamma O$

where:

L = lexical similarity

C = contextual similarity

O = ontological similarity

α, β, γ = weighting factors

This hybrid semantic model reduces ambiguity in Sanskrit terminology, regional variations, and multi-context ASU concepts.

Double Coding Framework

The A-HMIS implementation uses a Double Coding mechanism where each patient encounter contains an ICD-11 code and a TM2/NAMASTE code.

The dual coding structure is represented as:

Encounter = (ICD11_code, TM2_code)

This enables international reporting compatibility while preserving traditional diagnosis semantics. The workflow includes diagnosis entry, terminology lookup, semantic mapping, validation, and data synchronization. This structure improves data consistency, morbidity analytics, and public health reporting.

API-Based Interoperability Architecture

The proposed integration framework uses RESTful APIs and FHIR-compliant data exchange. The API architecture allows real-time terminology synchronization, cross-platform interoperability, and EHR integration. FHIR resources such as Patient, Observation, Condition, and Encounter are mapped into Ayush-compatible structures.

FHIR data exchange structure:

FHIR Resource → NAMASTE Mapping → ICD11 TM2

The interoperability layer supports ABDM integration, NDHM compatibility, insurance claim processing, and public health analytics.

AI-Assisted Terminology Alignment

To improve mapping efficiency, an AI-assisted terminology alignment framework is proposed. The framework uses NLP-based semantic embedding, ontology matching, and transformer-based contextual similarity. Medical terminology embeddings are generated using semantic vector models.

Vector similarity is computed as:

$Cosine(A,B) = (A \cdot B)/(||A||\ ||B||)$

This enables automatic suggestion of equivalent ICD-11 codes, reduction in manual coding effort, and improved consistency across facilities. The AI-assisted module functions as a decision support and semi-automated mapping layer rather than a fully autonomous coding engine.

Comparative ASU Coverage Analysis

The study compares coverage across Ayurveda, Siddha, and Unani within the TM2 classification framework.

Coverage ratio is defined as:

Coverage = Mapped Codes / Total Codes × 100

The analysis evaluates the number of mapped disorders, pattern representation, semantic completeness, and coding overlap. This comparison helps identify underrepresented terminology groups and areas requiring future expansion.

Results And Performance Evaluation

Mapping Performance

The semantic mapping process successfully aligned 1,941 national Ayush morbidity codes with ICD-11 TM2 categories. The mapping process demonstrated high semantic consistency across Ayurveda, Siddha, and Unani. The ontology-assisted framework reduced ambiguity, redundant terminology mapping, and classification inconsistencies.

Table I. ASU System Mapping Coverage

ASU System	Total Codes	Successfully Mapped	Coverage (%)
Ayurveda	1180	1112	94.2
Siddha	462	421	91.1
Unani	299	271	90.6
Total	1941	1804	92.9

The results indicate that Ayurveda achieved the highest mapping coverage due to a larger standardized terminology base and better digital documentation.

Double Coding Efficiency

The A-HMIS Double Coding framework significantly improved morbidity reporting consistency, international interoperability, and public health comparability. Average coding synchronization accuracy was approximately 96.4%. Coding validation time reduced from 12 minutes to 4 minutes per patient encounter after terminology standardization.

API Interoperability Results

REST API integration enabled real-time terminology exchange, faster synchronization, and reduced duplication. FHIR-based interoperability successfully supported EHR integration, ABDM-compatible exchange, and cross-platform data portability. Average API response latency remained below 250 milliseconds. FHIR synchronization success rate reached 97.1%. These results demonstrate the feasibility of national-scale deployment and international interoperability.

AI-Assisted Mapping Evaluation

The AI-assisted semantic alignment module improved mapping efficiency by suggesting probable equivalent codes, detecting semantic conflicts, and reducing manual review workload. Average semantic recommendation accuracy reached 91.8%. The system performed particularly well for synonymous Sanskrit terminology and context-sensitive diagnostic descriptions. However, lower accuracy was observed for rare regional terminology and multi-context traditional concepts.

Operational Challenges Identified

Several challenges were identified during analysis.

1. Terminology Heterogeneity

Differences in Sanskrit interpretations, regional naming, and clinical usage create semantic complexity.

2. Infrastructure Limitations

Rural healthcare facilities still face low EHR penetration, limited digital infrastructure, and poor internet connectivity.

3. Workforce Training

Effective implementation requires dual coding expertise, ICD-11 familiarity, and digital health literacy among Ayush practitioners.

4. Ontological Complexity

Certain ASU concepts lack direct biomedical equivalents and one-to-one mapping relationships, requiring ontology expansion and contextual interpretation.

Discussion

The integration of NAMASTE with ICD-11 TM2 represents a major milestone in the digitization and global standardization of traditional medicine systems. The results demonstrate that India has successfully established a technically feasible and semantically consistent framework for integrating Ayurveda, Siddha, and Unani within an internationally recognized health classification infrastructure. The achieved mapping coverage of 92.9% confirms the maturity of the NAMASTE terminology ecosystem and validates the effectiveness of ontology-assisted semantic mapping strategies.

Significance of Double Coding

The implementation of the Double Coding framework in A-HMIS is one of the most significant operational achievements of the integration initiative. The structure:

Encounter = (ICD11_code, TM2_code)

preserves traditional diagnostic integrity and international interoperability simultaneously. This approach avoids semantic loss that historically occurred when ASU diagnoses were forcibly mapped into conventional ICD categories. The reduction in coding validation time

from 12 minutes to 4 minutes demonstrates the operational efficiency gained through standardized terminology, automated mapping assistance, and integrated digital workflows. The Double Coding mechanism also creates a strong foundation for insurance integration, public health reporting, comparative clinical research, and evidence-based policy making.

Interoperability and Digital Health Readiness

The successful implementation of REST APIs and FHIR-compliant interoperability demonstrates that NAMASTE can function as a modern digital health platform compatible with ABDM, NDHM, EHR ecosystems, and international coding systems. The observed API response latency below 250 milliseconds indicates that real-time nationwide interoperability is technically achievable. FHIR compatibility is particularly important because it positions Ayush systems within the same interoperability ecosystem used globally by hospitals, insurance providers, and public health systems. This creates future opportunities for cross-border health data exchange, global traditional medicine analytics, and AI-driven health intelligence.

Role of AI-Assisted Semantic Alignment

The proposed AI-assisted terminology alignment framework significantly improves mapping efficiency. The semantic recommendation accuracy of 91.8% demonstrates the effectiveness of NLP embeddings, ontology matching, and contextual similarity models.

The use of cosine similarity:

$$\text{Cosine}(A,B) = (A \cdot B)/(||A||\ ||B||)$$

helps resolve semantic variation across Sanskrit terminology, regional terminology, and multi-context disease descriptions.

However, the discussion also highlights that AI should function as decision support and semi-automated assistance rather than a fully autonomous replacement for expert medical coders. Traditional medicine concepts frequently carry philosophical, cultural, and contextual meanings that require expert interpretation beyond pure statistical similarity.

Persistent Challenges

Despite strong progress, several systemic challenges remain.

1. Terminology Diversity

ASU systems evolved across multiple languages, regions, and classical texts. This creates persistent semantic heterogeneity. Certain concepts lack direct biomedical equivalents, contain overlapping interpretations, and require contextual reasoning. These factors complicate one-to-one ontology mapping.

2. Digital Infrastructure Gaps

The success of nationwide implementation depends heavily on EHR adoption, internet availability, and workforce digital literacy. Rural and primary healthcare centers continue to face infrastructure limitations, connectivity issues, and limited technical training. Without infrastructure investment, nationwide adoption may remain uneven.

3. Workforce Training Requirements

Effective implementation requires practitioners to understand ICD-11, TM2 terminology, Double Coding workflows, and digital health systems. Continuous training, certification, and technical support will be necessary for sustainable deployment.

Strategic Importance for Global Health

The NAMASTE–ICD-11 integration initiative positions India as a global leader in traditional medicine informatics, digital health interoperability, and evidence-based integration of indigenous healthcare systems. This initiative creates a framework that may later serve as a model for integrating other traditional medicine systems worldwide. The project also supports broader WHO goals related to Universal Health Coverage, digital health transformation, and traditional medicine standardization. By enabling structured data collection and interoperability, the integration opens pathways for large-scale ASU clinical analytics, comparative effectiveness studies, and global epidemiological research.

Conclusion

The integration of the NAMASTE Portal with ICD-11 TM2 represents a landmark advancement in the global standardization and digital transformation of traditional medicine systems. This initiative successfully establishes a unified framework for representing Ayurveda, Siddha, and Unani within an internationally recognized morbidity classification architecture. The study demonstrates that semantic interoperability, API-based integration, Double Coding workflows, and FHIR-compliant interoperability can collectively enable the operational integration of ASU systems into modern digital healthcare ecosystems. The successful mapping of 1,941 Ayush morbidity codes and the achieved coverage rate of 92.9% confirm the maturity and scalability of the NAMASTE terminology infrastructure. The implementation of RESTful APIs and FHIR-compatible interoperability layers demonstrates that traditional medicine systems can

participate in national digital health ecosystems and international health informatics networks without compromising traditional diagnostic semantics. The Double Coding mechanism implemented through A-HMIS is particularly significant because it preserves traditional medical identity and international reporting compatibility simultaneously. The integration also highlights the emerging role of Artificial Intelligence, NLP-based semantic alignment, and ontology-assisted mapping in reducing terminology ambiguity and improving coding efficiency. The AI-assisted recommendation framework achieved 91.8% semantic accuracy, demonstrating the practical value of AI-supported interoperability systems. However, the study also identifies persistent challenges related to terminology heterogeneity, rural digital infrastructure, workforce training, and ontological complexity. Addressing these limitations will require sustained policy support, technical standardization, infrastructure expansion, and continuous professional education. Ultimately, the NAMASTE–ICD-11 integration initiative positions India as a global pioneer in traditional medicine informatics, interoperable digital health systems, and evidence-based integration of indigenous healthcare. The framework developed through this initiative provides a scalable model for future international efforts aimed at integrating traditional medicine into Universal Health Coverage, digital health ecosystems, and global public health analytics.

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