

REVIEW ARTICLE

CHALLENGES OF INTERNATIONAL CLASSIFICATION OF DISEASE 11TH REVISION (ICD-11) ADOPTION: A SCOPING REVIEW

Anian, S. and Kamarudin, S.M.

School of Business and Management, KPJ Healthcare University, Lot PT 17010 Persiaran Seriemas, Kota Seriemas, 71800 Nilai, Negeri Sembilan, Malaysia.

*Corresponding author name and email: Syakinah Anian; ucn.syakinah@kpju.edu.my.

DOI: <https://doi.org/10.63719/johm.2025.22.1.01>

Date received: 30 May 2024

Date accepted: 04 September 2024

Published: 27 February 2025

Abstract

Background: The International Classification of Diseases (ICD) serves a broad range of uses globally and provides critical knowledge on the extent, causes, and consequences of human disease and death worldwide via data reported and coded with the ICD. One of the most important challenges is adapting the ICD to digital use by rebuilding the coding system. The transition to the 11th revision of ICD (ICD-11) aims to improve the accuracy and efficiency of the health information system (HIS). This review examines the challenges associated with the adoption of ICD-11 across various healthcare settings.

Methodology: A literature search of studies in the English language was carried out in several databases, including Scopus, PubMed, Science Direct, CINAHL, and EBSCOhost, to identify the challenges of ICD-11 in the study population. The time frame for the analysis was from January 2014 to January 2024. Data were extracted from 15 research studies which met the inclusion criteria for the review. The process of selecting research studies has been presented in the PRISMA flowchart diagram.

Result: Key challenges identified from the aspects of the technical, organisational, clinical, and policy challenges, which include the complexity of the new coding system, the need for extensive training and education for health professionals, and the significant advancement required in the context of clinical for upgrading existing HIS. Additionally, this review highlights issues related to data integration of ICD-11 with other health information standards and electronic health records. The global variability in healthcare infrastructure and resources also poses a substantial barrier, particularly in low- and middle-income countries.

Conclusion: These findings provide insights to policymakers, healthcare providers, and information technology (IT) professionals, assist them in comprehending the challenges and barriers, thereby facilitating a smoother transition and fully leveraging the benefits of ICD-11.

Keywords: ICD-11, digital health system, electronic health record, difficulties, constraints

Background

In the last few years, the healthcare industry has undergone a transformative shift towards a new era of global digitalisation of health systems. This shift has been mainly driven by the need to adopt advanced HIS with the aim of improving efficiency, accuracy, and access to medical services. In 2007, the World Health Organization (WHO) established a health system framework with six essential building blocks for achieving high quality: service delivery, health workforce, medical product and technology, financing, leadership and governance, and HIS. Among these, HIS plays a crucial role by enabling the collection, analysis, and use of health data to inform decision-making and optimise resource allocation (WHO, 2008).

HISs is integral to modern healthcare, facilitating the seamless exchange of information across various domains, including electronic health records (EHRs), laboratory information systems, and medical coding systems like ICD. (Parmar et al., 2020). The ICD, in particular, is a critical tool for standardising the classification of diseases, injuries, and other health conditions, making it indispensable for health data management, epidemiology, and public health research (WHO, 2022). ICD, developed by WHO, has gone through several revisions to keep pace with the changing needs of health, hence, ICD-11 represents the latest advancement.

The ICD-11, introduced in 2019, marks a significant evolution from its predecessors. It includes an elaborate structure with more than 55,000 discrete codes, enhanced features, and a design that allows for integration into digital health systems. The revision aims to achieve greater global health interoperability, facilitate better data capture for decision-making and enable accurate documentation and analysis of health records across multiple settings. However, despite these advancements, several challenges and barriers stand in the way that need to be addressed before they can accomplish this (Harrison et al., 2021).

The ICD system, originally developed in the 1800s to categorise causes of death, has evolved into a comprehensive classification system used globally to record and report medical conditions. The WHO updates the ICD. every ten years, which the data can be documented using a variety of categories, including diagnosis, conditions treated, reasons for admission, and reasons for consultation. The primary use of ICD is to systematically record, report, and categorise medical disorders, while also interpreting data on mortality that has been gathered by converting the medical conditions into an alphanumeric code, which makes it possible to store and retrieve data quickly (WHO, 2022).

The release of ICD-11 introduces several innovations, including a more granular coding structure, improved integration with EHRs and support for multilingual data entry, and advancing decision support in the digital age (Hirsch et al., 2016). ICD-11 introduces new disease grouping and incorporating more precise ways and coding to capture data on traditional medicine. This last part about the granular coding structure is particularly important in places where old practices are still commonly used. Also, ICD-11 now works with WHO's Digital Open Rule Integrated Cause of Death Selection (DORIS) tool. This team-up should make death data much more accurate, which helps public health teams act faster in compiling and standardising the data. The WHO has also made significant progress in linking various medical classifications and terminologies to enhance global health interoperability. This includes lossless mapping of the Medical Dictionary for Regulatory Activities (MedDRA) to facilitate accurate reporting of drug-related information and embedding medical device nomenclature for consistency across international health systems (WHO, 2023).

Despite the various advantages offered by ICD-11, its adoption has not been without challenges. Healthcare systems worldwide face various barriers, including technical, organisational, clinical, policy, cultural, and regulatory challenges, that can impede the successful implementation of this new standard. This review aims to explore these challenges, providing a comprehensive analysis of the factors that hinder the adoption of the digitalisation of I.C.D.s in different healthcare settings. By identifying these barriers, this study pursues to enlighten policymakers and healthcare providers on strategies to overcome them, thereby supporting the effective integration of ICD-11 into HIS globally. The objectives of this review are: i) to identify and categorise the challenges faced by the healthcare systems in adopting ICD-11, and ii) to analyse the impact of these challenges from various perspectives within the healthcare systems.

Methods

Study design

A review was performed using a standard literature database to identify scientific publications that have examined the value of integrating functioning information into ICD-11. The process involved four steps: electronic literature search, article selection, data extraction, and descriptive synthesis of results. The PRISMA guideline was applied to ensure transparent reporting of this scoping review.

Electronic literature search

The search was conducted in February 2024, with the timeframe over the ten years from January 2014 to January 2024, using the following databases: Scopus, PubMed, Science Direct, CINAHL, and EBSCOhost. This review began in 2014 to capture the early stages of discussions, planning, and preliminary research that laid the groundwork for the adoption of ICD-11. Although ICD-11 was officially implemented later, significant preparatory activities, stakeholder consultations, and pilot studies started well before the official adoption phase. These early activities provide valuable insights into the anticipated challenges, perceptions, and readiness of various healthcare systems for the transition of ICD-11. A standardised search strategy for all databases was developed with minor adaptations by using a PICO technique. The PICO technique has been used to find studies that focus on the challenges of ICD-11. PICO stands for population participant (P), intervention exposure (I), comparison control (C), and outcome (O). From this study, the PICO technique identified “clinical coders” as “P”, “challenges” as “I”, “automated” as “C”, and “ICD-11” as “O.” After identifying the main terms used in this study, to be applied in the PICO, the keyword development process started. The main terms have been searched for synonyms through previous systematic reviews and Google. The keywords generated by the main keywords in PICO for clinical coders are “medical coder,” “H.I.M. coder,” “certified coder,” and “nosologist.” Whereas challenges are “difficulties,” “barriers,” and “issues.” As for automated, the keywords are “computerised” or “electronic.” Lastly, the ICD-11 are “ICD Version 11,” “ICD-11 Coding System,” or “ICD-11 Classification.” This study focuses on the challenges of ICD-11, which involves an electronic search of a few databases. The search for relevant publications was performed by using query strings alongside their synonyms (“clinical coder”) AND (“challenges”) AND (“automated”) AND (“ICD-11”).

Article screening and selection

The selection of articles was conducted in a stepwise process. In the first step, the titles were screened and categorised based on PICO and pre-defined inclusion and exclusion criteria. Only studies that directly assessed the challenges of ICD-11 were included. The search was limited to journal articles and conference papers that were written in the English language and accessible in the full text, including quantitative and qualitative studies. Studies that focused solely on ICD-11 without discussing any challenges or issues, those published in other languages, or conceptual papers were excluded. Next, the abstracts of selected papers with related titles were screened. As the information in the abstract was sufficient to categorise the article, the full-text screening process began. **Figure 1** illustrates the PRISMA flowchart outlining the paper selection process for this study.

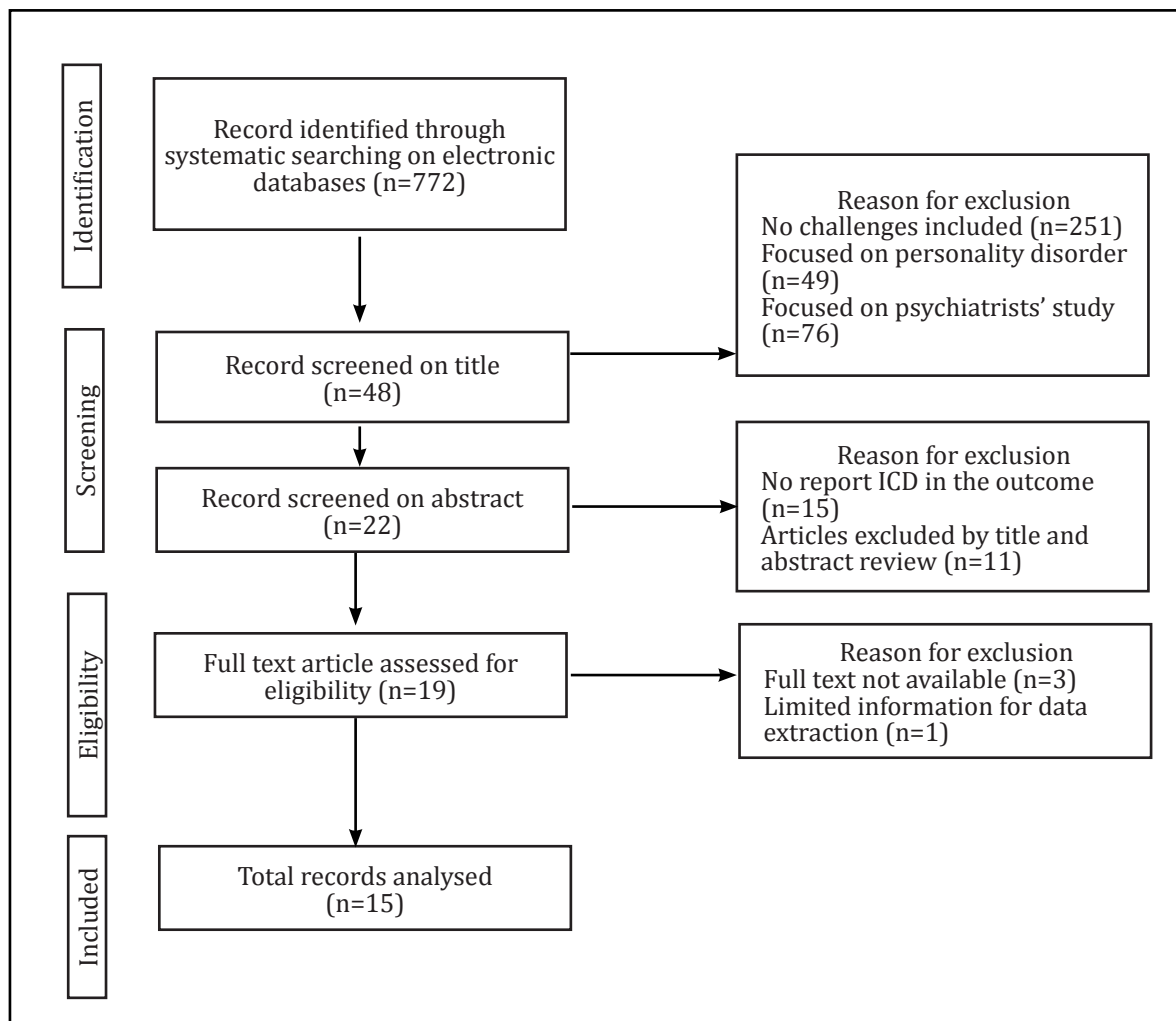


Figure 1: PRISMA flowchart of the selected papers process

Data extraction

Information about the significant key results was extracted. The operationalisation of functioning variables was retrieved in detail. Only relevant aspects of the study with regard to the research question were considered. Data extraction was conducted by two researchers independent of each other for more than 40% of the included studies, solving disagreement by consensus. Data extraction and analyses were conducted and documented using Microsoft Excel 2010. The quality of each study was evaluated through discussion with a third reviewer after extraction by the two researchers to ensure consistency and objectivity in the review process.

Descriptive synthesis of the results

The review process involved multiple reviewers to enhance credibility and minimise bias. Three independent reviewers were responsible for data extraction and synthesis, ensuring that different perspectives were considered.

For data synthesis, the characteristics of the included studies were first reviewed and documented to establish a comprehensive understanding of the context and scope of each study. This initial step facilitated the identification of relevant themes and trends. The focus was then directed toward examining key results pertaining to the challenges of adopting ICD-11. Specifically, the synthesis aimed to identify and categorise these challenges as experiences by different healthcare systems.

Data extraction was conducted iteratively, where extracted data was continuously reviewed and interpreted against the full text of the synthesised results, accurately reflected the challenges identified and maintained consistency across the findings. The synthesis aligned with the review's objectives by focusing on the identification of the challenges faced by healthcare systems in adopting ICD-11 and subsequently analysing the impact of these challenges, including technical, organisation, clinical, and policy.

Results

Challenges and barriers of ICD-11

Technical challenges

Technical challenges refer to the difficulties associated with the technological aspect of implementing ICD-11. These include the issue identified in technical challenges, which was the inability to cluster related diagnoses, hindering the comprehensive capture of the clinical picture and made it challenging to ensure the use of the most specific code. Clustering is important in linking all diagnoses associated with medical or procedural complications, thereby benefiting quality improvement efforts and enhancing patient care (Southern et al., 2016). It is supported by Feinstein et al. (2023) that the new "clustered" code structure of ICD-11 also requires modifications to data standards and EHR systems to accommodate longer character lengths. Successful implementation will depend on robust contextual reporting requirements, education, and adequate information technology and workforce support. Furthermore, the secondary use of coded data necessitates distributed data systems for extracting information from code clusters and enabling data-driven discovery and best evidence generation. The summary findings of overall challenges are presented in **Table 1**.

The transition to ICD-11 is designed for predominant electronic use, with IT systems needing to automatically offer relevant extension codes related to the selected starting code of a cluster to support detailed abstraction of clinical cases without increasing the burden on clinical coders at the point of care. Furthermore, the secondary use of coded data requires robust distributed data systems to extract information from code clusters and facilitate data-driven discovery and evidence generation (Drösler et al., 2021). The other scenario, studied by Gaebel et al. (2020), has been discussed in the new chapter structure of ICD-11 introduced. In their study, they found out that specific disorders, such as sleep-wake disorders and conditions related to sexual health, were cross-listed from other chapters. The shift aimed at reflecting development continuity across the lifespan. However, this restriction raises challenges in ensuring that all professionals adapt to the new categorisations seamlessly (Stein and Reed, 2019).

Table 1: Summary of findings

Author and year	Origin	Publication type	Key findings
Drösler et al. 2021	Germany	Research paper	The key finding was that the implementation of extension codes in the ICD-11 enhances the granularity and detail of clinical coding. This allows for a more comprehensive classification of diseases and injuries, improving clinical abstraction and supporting evidence-based healthcare. The use of these extension codes is expected to facilitate better data sharing among healthcare stakeholders, ultimately leading to improved patient care and health outcomes
Bach et al. 2022	Germany	Research paper	The findings discussed the perceived challenges and opportunities of using the ICD-11 approach with particular focus on its continuity and discontinuity with familiar personality disorder categories
Ibrahim et al. 2022	Switzerland	Report	Reported on the first ICD-11 morbidity’s pilot methodology, lessons learned in terms of facilitators and challenges, physical report opinion, and consideration for future implementation for inpatient discharges in a public general hospital. The physicians were satisfied with the experience. The challenges included potential IT problems, difficulties relating to training and engaging physicians, issues to consider Diagnostic-related groups (DRG) system requirements and comparability of ICD-11 pilot results from different countries
Killikelly et al. 2023	Switzerland	Research paper	The new ICD-11 guidelines reflect an emerging wave of interest in the global applicability of mental disorders. However, the selection of diagnostic core features in different contexts has yet to be determined. Semi-structured interviews among health professionals revealed symptoms of grief possibly missing in the ICD-11; thus, these barriers may challenge patients’ and clinicians’ acceptance of the new ICD-11 criteria
Kerig et al. 2020	United States of America	Report	There are a number of challenges to effective practice between two distinctly different sets of diagnostic criteria for stress disorder in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) versus ICD-11. It includes limitations of the existing measures for assessing and diagnosing the disorder; difficulties with differential diagnosis of overlapping disorders and detection of malingering
Eisma 2023	Netherlands	Report	The findings highlight the technological challenges related to IT infrastructure and system integration, as well as insufficient training and awareness among healthcare professionals. Besides, it discussed the limited financial and human resources, regulatory and policy inconsistencies across different countries, and resistance to change from established practices like ICD

con't Table 1

Author and year	Origin	Publication type	Key findings
Gaebel et al. 2020	Germany	Report	Evaluation of field studies of ICD-11, which provide evidence for higher reliability and clinical utility of ICD-11 compared with ICD-10. Despite the extensive revision process, changes from ICD-10 to ICD-11 were relatively modest in that both systems are categorical, classifying mental phenomena based on self-reported or clinically observable symptoms
Reed et al. 2016	Switzerland	Report	The proposed ICD-11 introduces a new classification for bodily distress disorder (BDD) to address issues of somatoform disorders. The new classification is under review through field studies to validate its effectiveness and capability
Feinstein et al. 2023	United States of America	Report	The finding in this study is that sustaining investment in the transition to ICD-11 is paramount. The development of specific transition tools is imperative. Resources such as mapping files, translation software, and dual-coded datasets (incorporating both ICD-10 and ICD-11 codes_ must be crafted well in advance and made accessible to healthcare personnel. Successful adoption of ICD-11 hinges on robust partnerships among federal, state, and industry entities to secure requisite funding and resources for training and implementation
Krawczyk and Świąćicki 2020	United States of America	Report	One of the key changes in ICD-11 is the complete overhaul of the coding system, which has been updated for digital use. This new system uses advanced alphanumeric coding to better capture complex medical situations, including the use of cluster coding to represent related health conditions more accurately. In addition to these changes, ICD-11 also introduces new categories that were not in previous editions, allowing for a more accurate representation of modern medical knowledge. These updates are important for making the classification system more relevant and useful for healthcare providers, researchers, and policymakers
Ndougue et al. 2022	Dutch	Report	The country is currently in the strengthening phase of its Health Observatory, which plays a significant role in facilitating evidence-based decision-making within its health system. This progress underscores the importance of strong political commitment from the beginning of the project, as such support is fundamental to the success and sustainability of the observatory. Moreover, genuine national ownership of both the process and the tools involved in establishing National Health Observatories is crucial. This ownership ensures that the observatories are tailored to the specific needs and contexts of the countries they serve. Nevertheless, the WHO's role in regularly assessing the progress of these observatories across different nations and providing constructive feedback is also vital for their effectiveness
Norouzi et al. 2024	Dutch	Report	The study underscores the importance of having a standardised set of evaluation indicators for HISS, given the critical role these systems play in healthcare delivery. The findings highlight the need for a tailored evaluation framework that can adapt to the diverse nature of HISS and provide meaningful insights into their performance and impact.

Author and year	Origin	Publication type	Key findings
Pine and Tompkins, 2024	United States of America	Report	The transition to ICD-10-CM revealed significant challenges, with many healthcare professionals expressing concerns that the expanded coding system did not deliver the expected clinical benefits. While the number of codes increased, this expansion did not translate into substantial improvements in patient care. As the United States considers moving to ICD-11, there is a strong focus on learning from these past experiences to avoid similar issues. Feedback from healthcare stakeholders underscores the need for clear guidance and support from the Department of Health and Human Services, particularly regarding the timing and content of the ICD-11 implementation. ICD-11 offers a more flexible and nuanced structure than its predecessor, which allows for a better representation of complex clinical information. One of its key features is post-coordination, enabling healthcare providers to combine codes in ways that more accurately capture the intricacies of patient conditions. This innovation holds the potential to improve the quality of clinical documentation and patient care.
Sharan and Hans, 2021	India	Report	The development of ICD-11 was marked by extensive engagement with diverse constituency groups and consultations with representatives from various geographical regions, ensuring a broad perspective in its formulation. A significant emphasis was placed on cultural inclusivity, as the classification adopted a more flexible approach to describing psychiatric disorders, utilising prototypical descriptions that account for cultural variations and contextual factors influencing diagnostic practices. Furthermore, systematic field studies were conducted to enhance the clinical utility and global applicability of ICD-11, ultimately improving the validity and reliability of various disorders across different cultural groups.
Stein and Reed, 2019	Brazil	Report	The classification of mental health disorders is primarily guided by two significant systems: the DSM-5 and ICD-11. The DSM-5, widely used in the United States, provides a comprehensive framework for diagnosing mental health conditions, while the ICD-11, released in 2019, aims for global applicability, particularly benefiting low- and middle-income countries. Despite their importance, both systems have faced criticism for their categorical approaches, with calls for a more nuanced, spectrum-based understanding of mental health disorders that incorporates insights from neuroscience and public health initiatives.
			Future advancements in psychiatric nosology should focus on enhancing the reliability and validity of diagnoses, ensuring that they reflect the complexities of mental health conditions in diverse populations.

The transition to ICD-11 is designed for predominant electronic use, with IT systems needing to automatically offer relevant extension codes related to the selected starting code of a cluster to support detailed abstraction of clinical without increasing the burden on clinical coders at the point of care. Furthermore, the secondary use of coded data requires robust distributed data systems to extract information from code clusters and facilitate data-driven discovery and evidence generation (Drösler et al., 2021). The other scenario studied by Gaebel et al. (2020) has discussed the new chapter structure of ICD-11 introduced. In their study, they found out that specific disorders, such as sleep-wake disorders and conditions related to sexual health, were cross-listed from other chapters. The shift aimed at reflecting development continuity across the lifespan. However, this restriction raises challenges in ensuring that all professionals adapt to the new categorisations seamlessly (Stein and Reed, 2019).

Another technical challenge identified was the lack of optimal compatibility between different versions of the ICD. The concerns were raised on the changes in coding rules, procedures, and approaches that were not consistently included in lookup tables, necessitating robust crosswalks between ICD-9, ICD-10, and ICD-11 to ensure continuity and standardisation in coding practices (Southern et al., 2016). International Comparability presents a technical challenge in ensuring that data coded using ICD-11 is comparable across different countries and healthcare systems. Standardising coding practices and promoting consistency in data collection and reporting are essential for international comparability and data harmonisation.

In addition, there is a need for clear mapping between the ICD and other reporting systems, such as Systematised Medical Nomenclature for Medicine – Clinical Terminology (SNOMED CT), to improve consistency in terminology and facilitate data interoperability across different coding systems and the dynamic nature coding rules and standards, emphasising the importance of having access to updated information tools to stay informed about new coding rules and standards (Southern et al., 2016). Feinstein et al. (2023) also highlighted that the technical challenges of implementing ICD-11 include the need for sophisticated crosswalk mapping of existing ICD-10 codes to ICD-11 codes, as not all codes have a one-to-one correspondence. This requires clinicians and coders to assign multiple post-coordination codes to capture the same level of information.

Apart from that, countries that have implemented the Diagnosis-Related Group (DRG) system need to be considered, as it is essential for interventions across all specialities to be integrated into ICD-11. For those countries that have established DRG systems, the ICD-11 and procedures codes might hold significant financial importance as they form the basis for provider reimbursement. A country which has not yet implemented a DRG system has more flexibility for a customisable, freely available DRG system based on ICD-11 codes, which can be developed with the assistance of the WHO (Ibrahim et al., 2022).

In some countries, their hospitals have utilised a web-enabled electronic HIS and have deployed the ICD-11 using a Docker container. Those physicians need to access the coding tool through the Google Chrome browser launched within the container. However, the coding tool is not directly embedded into the discharge screen. Instead, it opens in a secondary window next to an icon of ICD-11. This setting needs an extra step, in which the physician has to retype the diagnosis into the search box of the window or copy and paste the free text diagnosis from the original screen. This could be a challenge to the physician, and it might raise difficulties for those who lack IT literacy (Ibrahim et al., 2022).

Organisational challenges

Organisational challenges encompass the internal issues within healthcare institutions that can hinder the successful adoption of ICD-11. Based on studies, the previous version of ICD was perceived as an excessive burden when it comes to manually selecting the most suitable ICD-10 codes. This ICD-11 assists in easing the process with automation. However, it could limit human involvement in the coding process to review and oversight. This could limit the necessary human role in ensuring the validity of the clinical concepts expressed in the HER or in the natural clinical language (Pine and Tompkins, 2024). As the automation coding is introduced, a plan for conducting the training is needed. However, one study revealed that short training sessions, while convenient for physicians' busy schedules, were insufficient for covering chapter-specific details of ICD-11. Physicians primarily view ICD-11 as a tool for standardising diagnosis documentation and do not particularly use it as a guideline for morbidity coding and reporting, which becomes crucial if a DRG system is implemented later. In such a scenario, a team of experienced medical coders is essential to ensure that the principal diagnosis is correctly assigned and all relevant diagnoses are documented (Ibrahim et al., 2022).

In addition, guidance on implementation, training, and application in diverse settings remains limited. Integrating a new system into routine clinical practice is essential but challenging due to the perceived need for specialised skills and the time required for such assessments (Krawczyk and Świącicki, 2020; Sharan and Hans, 2021; Stein and Reed, 2019).

Moreover, the need for continuous education and training on evolving coding practices was underscored as essential for ensuring accurate and consistent coding across healthcare settings, according to (Southern et al., 2016). The challenges of implementing ICD-11 encompass the necessity for extensive training to ensure consistency in medical chart abstractions, the potential subjectivity in choosing among multiple modifiers during coding, and the need for computer-assisted code assignment to maintain high-quality coding. Furthermore, the overwhelming granularity of coding can be considered a limitation, and a detailed understanding of specific codes is required when not using a coding tool (Drösler et al., 2021).

According to Southern et al. (2016), the organisational challenge identified was the need for standardised rules and practices on coding, reporting, and documentation within healthcare organisations. The concern raised on the importance of precise coding rules to ensure consistency and accuracy in coding practices across different healthcare entities. The vagueness of descriptions in coding systems was highlighted as a barrier leading to inconsistent coding of the same conditions, indicating a need for standardised terminology and rules to promote uniformity in coding practices.

Another study reported that the lack of training and education on coding practices within healthcare organisations is becoming a burden not only to the organisation but also to the clinicians and coders. More comprehensive training programmes are needed to equip clinicians and coders with the necessary skills to report and document health data accurately. Poor documentation practices were cited as a significant challenge leading to difficulties in assigning appropriate codes, highlighting the importance of enhancing training on reporting and documentation to improve the quality of coded health data (Southern et al., 2016). Moreover, concerns are raised about financial motivations driving the use of ICD codes, with some expressing apprehensions about coding practices being overly influenced by billing requirements or government mandates. The need to shift the culture of using ICD codes solely for reimbursement purposes towards

utilising them for quality metrics and patient safety initiatives was emphasised as a critical organisational challenge that healthcare entities need to address. Feinstein et al. (2023) add the use of multiple codes for each situation, though aiding detailed documentation, may be perceived as complicated without proper electronic support tools like the ICD-11 browser and coding tool. As such, maintaining data quality and integrity is essential to upholding the reliability of health information coded using ICD-11. Organisations must implement measures to ensure the accuracy, consistency, and completeness of coded data to support informed decision-making and improve healthcare outcomes (Ooi et al., 2024).

Apart from that, the billing and quality measures will require redesign, data processing algorithms and software handling ICD codes will need updates, and there may be lags in translating tools to ICD-11, impacting real-world decisions (Feinstein et al., 2023). The implementation of the ICD-11 classification system introduces a set of defies that healthcare organisations and IT departments must address to ensure a successful transition. These challenges encompass legacy systems, data integration, coding burden, and international comparability. Ooi et al. (2024) also mentioned that legacy systems pose a significant challenge as countries with existing healthcare information systems may need to make substantial alterations to accommodate the new classification system, and ensuring data consistency and accuracy is crucial for a seamless transition. Besides, addressing these technical challenges requires a coordinated effort from healthcare organisations, IT departments, and stakeholders to ensure a smooth and effective transition to ICD-11. By proactively managing legacy systems, promoting data integration, addressing coding burden concerns, and ensuring international comparability, healthcare organisations can maximise the benefits of the new classification system and enhance the quality of health data for improved patient care and decision-making.

Clinical challenges

Clinical challenges involve issues related to the use and acceptance of ICD-11 by healthcare professionals, including doctors, nurses, and other clinicians. Studies by Pine and Tompkins (2024) raised concerns about disruptions associated with the conversion to ICD-11. Previously, the responses from the National Committee on Vital and Health Statistics had been concerned about how to reduce the transitional burdens beyond the careful evaluation of the undescribed systems to adopt. They revealed substantial gaps in knowledge about the nature and potential of ICD-11, including a lack of specific guidance to the industry regarding timing, support tools, or even the content of ICD-11. This uncertainty about content might have arisen from the structure of ICD-11, which departs substantially from previous versions of the ICD.

The challenges in adopting this new ICD-11 system are diagnostic reliability and the utility of severity classification for treatment decisions. The practitioner needs to determine the patient's level of severity: mild, moderate, or severe. The concern in this particular situation was that some patients' senses may be contradictory or inconsistent, while the other patients may be highly unstable or severe. For example, in determining the personality disorder codes in ICD-11, the classification may incorporate harm to self and others. Thus, the evaluation of severity may vary. The classification of severity should not be as diagnostic "criteria" but they should be used as guidelines for a more global evaluation. This is because, without considering typology, it may be vague, imprecise, and, therefore, not very informative (Bach et al., 2022).

Besides, Bach et al. (2022) have discussed how to move a fundamentally new classification system without abandoning the observed strengths of the previous one. In this respect, the official

inclusion of the borderline pattern specifier ensures the continuity and clinical utility of ICD-11 for all practitioners and patients by facilitating the identification of individuals who may respond to well-established evidence-based treatment.

Another challenge in implementing ICD-11 discovered by the studies of Kerig et al. (2020) in one of the areas of post-traumatic stress disorder (PTSD) is the distinction between ICD-11 and DSM-5 criteria. ICD-11 includes a diagnostic of complex PTSD, which DSM-5 does not, leading to different approaches in identifying and treating trauma-related disorders. This divergence can cause inconsistencies in clinical, which may potentially lead to varied outcomes in assessments and treatments. In addition, ICD-11 focuses on core PTSD symptoms, reducing overlap with other disorders and omitting the dissociative subtype, which is instead associated with PTSD. However, this streamlined approach might not capture all relevant aspects of trauma, particularly in diverse populations with complex trauma histories.

ICD-11 is known for maintaining its large categorical approach, which incorporates dimensional elements for some diagnoses to better reflect clinical reality. For instance, personality disorders are now classified based on severity and specific maladaptive traits. Despite these improvements, the challenge remains in balancing the categorical and dimensional aspects to enhance clinical utility without overwhelming practitioners with complexity (Gaebel et al., 2020).

Another significant clinical challenge identified was the lack of specificity and sensitivity of codes in ICD-9 and ICD-10, leading to difficulties in accurately capturing and categorising clinical conditions. Conspicuously, the general nature of codes, which were deemed insufficient for clinical use in various contexts, particularly in areas such as localising body parts for conditions like wounds and ulcers, paediatric care, quality indicators, and diabetic coding (Southern et al., 2016).

Moreover, the inadequacies in coding complications and adverse events in ICD-9 and ICD-10 emphasise the need for improved coding mechanisms in ICD-11 to better capture and classify these critical clinical events. Specific concerns were raised about the lack of information to indicate conditions as adverse events, the lack of specificity in external cause codes for injuries due to errors, and challenges in coding hospital-acquired infections. There is the inclusion of specific codes for patient safety and quality indicators to enhance the accuracy and relevance of coded health data for clinical applications (Southern et al., 2016).

There is a need for coders to balance the level of granularity in coding to accurately represent clinical conditions while meeting administrative and quality management needs. According to Ooi et al. (2024), maintaining high levels of accuracy in coding and classification to avoid misinterpretation of data could impact patient care, outcomes, and healthcare decision-making. Next, the selection of extension codes to provide additional information depends on individual coder motivation and the requirements of the health system. The complexity of assigning multiple codes for a single situation may be perceived as challenging, but electronic support tools like the ICD-11 browser and Coding tool can assist in generating or aiding in the assignment of codes (Drösler et al., 2021).

Based on the study conducted by Drösler et al. (2021), detailed knowledge of specific codes is crucial when not using a coding tool, and computer-assisted code assignment is essential for maintaining high-quality coding standards. The overwhelming granularity of coding can be seen as a limitation, and training is necessary to ensure consistency in medical chart abstractions. Additionally, the potential subjectivity in selecting modifiers during coding can impact reproducibility.

The implementation of ICD-11 also presents several clinical challenges that healthcare providers and professionals may encounter during the transition, such as i) clinical relevance, which is necessary to ensure that the new classification system accurately captures and reflects the clinical characteristics of diseases and conditions to support effective diagnosis, treatment, and research, and ii) clinical documentation improvement to encourage thorough and detailed clinical documentation to support accurate coding under ICD-11 and enhance the quality of healthcare data for clinical, administrative, and research purposes. Addressing these clinical challenges will be essential for healthcare providers to effectively leverage the benefits of ICD-11 in improving patient care, enhancing data quality, and advancing clinical research and decision-making process outcomes (Ooi et al., 2024).

Policy, cultural, and regulatory challenges

Policy challenges refer to the broader health policy environment that impacts the adoption of ICD-11, whereas cultural challenges include the attitudes, beliefs, and values of the healthcare professionals and organisations involved in the transition to ICD-11. The policy and regulatory challenges of implementing ICD-11 involve ensuring compliance with updated coding standards and regulations set forth by governing bodies. Organisations will need to align their policies and procedures with the new code structure of ICD-11 to meet regulatory requirements for accurate reporting and billing. This study also discussed how healthcare systems may need to adapt their data standards and electronic health record systems to accommodate the longer character lengths required for storing ICD-11 codes. Collaborations between policymakers, regulatory agencies, and healthcare organisations will be crucial to address any policy gaps and facilitate a smooth transition to ICD-11 (Feinstein et al., 2023).

Another barrier to using ICD-11 is the need for clear guidelines and regulations on the correct use of extension codes based on international recommendations or national documentation rules. The overwhelming granularity of coding can pose challenges in balancing the importance of representing clinical conditions while fulfilling administrative and quality management purposes (Drösler et al., 2021). The adoption and implementation of the ICD-11 classification system present a range of challenges that healthcare systems and institutions need to navigate effectively. These challenges encompass governance, training, change management, international collaboration, and data quality. Establishing robust governance structures is crucial to oversee the implementation, maintenance, and evolution of ICD-11, leading to effective governance that ensures the classification system remains relevant, accurate, and aligned with evolving healthcare practices and knowledge, according to Ooi et al. (2024). By aligning policies, ensuring regulatory compliance, implementing robust data governance practices, and promoting international harmonisation, stakeholders can facilitate a smooth and effective transition to ICD-11, ultimately improving the quality and interoperability of health data for better healthcare outcomes.

Discussion

The transition to ICD-11 presents several technical challenges that must be addressed to ensure successful implementation. The inability to cluster related diagnoses not only complicates coding but also impacts the overall quality of patient care. Clustering is essential for linking diagnoses associated with medical or procedural complications, which can enhance quality improvement efforts. Moreover, the lack of compatibility between different ICD versions raises concerns about standardisation in coding practices. This highlights the need for robust crosswalks to facilitate continuity in coding across various healthcare systems.

The necessity for clear mapping between ICD and other reporting systems, such as SNOMED CT, underscores the importance of data interoperability. As coding rules and standards evolve, access to updated information tools becomes critical for clinicians and coders to stay informed. Additionally, the financial implications of integrating ICD-11 into existing DRG systems must be carefully considered, as this can significantly affect provider reimbursement models. The user interface challenges faced by healthcare professionals in accessing coding tools can hinder the effective use of ICD-11, particularly for those with limited IT skills. Addressing these usability issues is vital for ensuring that the transition to ICD-11 does not impose an additional burden on clinicians.

The transition to ICD-11 presents both opportunities and challenges for healthcare organisations. While automation in coding can streamline processes, it also raises concerns about the diminishing role of human oversight, which is essential for maintaining the accuracy and validity of clinical data. The reliance on technology necessitates a robust training framework to equip healthcare professionals with the skills needed to navigate the complexities of the new coding system effectively. Moreover, the perception of ICD-11 as merely a documentation tool rather than a comprehensive coding system highlights the need for educational initiatives that emphasise the importance of accurate morbidity coding. As healthcare systems evolve, the integration of ICD-11 into routine clinical practice will require ongoing support and resources to ensure that all stakeholders are adequately prepared.

The call for standardised coding practices underscores the importance of consistency and accuracy in health data reporting. Addressing these organisational challenges through comprehensive training, clear guidelines, and a focus on the human element in coding will be crucial for the successful implementation of ICD-11 and the overall improvement of healthcare outcomes.

Next, the transition to the ICD-11 classification system presents several clinical challenges that healthcare providers must address to fully leverage its benefits. One of the primary concerns is the need to improve patient care, enhance data quality, and advance clinical research. To achieve these goals, it is essential for healthcare professionals to confront the identified clinical challenges head-on. This proactive approach will facilitate a smoother implementation of ICD-11 and ensure that it meets the needs of both practitioners and patients.

Training and support are critical components in this transition. The complexity of assigning multiple codes, coupled with the overwhelming granularity of coding, necessitates comprehensive training for healthcare providers. Utilising electronic support tools can aid in maintaining high-quality coding standards, which is vital for ensuring consistency in medical chart abstractions. Moreover, addressing the potential subjectivity in selecting modifiers during coding is crucial to avoid discrepancies that could impact patient outcomes. Another significant challenge lies in balancing the categorical and dimensional aspects of the ICD-11 system. While the new classification incorporates dimensional elements for certain diagnoses, it is essential to strike a balance that enhances clinical utility without overwhelming practitioners. This balance is vital for ensuring that the system remains user-friendly while still being comprehensive enough to capture the complexities of various clinical conditions.

Continuity and clinical utility are also paramount in the discussion surrounding ICD-11. The inclusion of specific guidelines for severity classification should be viewed not as rigid diagnostic criteria but as flexible guidelines for a more global evaluation of patient conditions. This approach ensures that practitioners can effectively identify individuals who may benefit from established

evidence-based treatments, thereby enhancing the overall quality of care. The divergence between ICD-11 and the DSM-5 criteria poses additional challenges, particularly in the realm of trauma-related disorders. This discrepancy may lead to varied outcomes in assessments and treatments, underscoring the need for consistent approaches in clinical practice. Inconsistencies in diagnostic criteria can adversely affect patient care, making it imperative for healthcare providers to align their practices with the new classification system. The substantial gaps in knowledge about ICD-11 among healthcare professionals can lead to disruptions during the transition. Addressing these knowledge gaps is crucial for reducing the transitional burdens associated with adopting the new system. By providing adequate resources, support, and training, healthcare organisations can facilitate a smoother transition to ICD-11, ultimately benefiting both practitioners and patients.

Policy challenges are at the forefront of the adoption process. The broader health policy environment significantly influences how organisations approach the transition to ICD-11. Compliance with updated coding standards is paramount, as organisations must align their internal policies and procedures with the new code structure. This alignment is essential not only for accurate reporting and billing but also for meeting the regulatory requirements set forth by governing bodies. The need for organisations to adapt their data standards and electronic health record systems to accommodate the longer character lengths required for ICD-11 codes further complicates this transition. Therefore, a comprehensive understanding of the policy landscape is crucial for healthcare organisations to navigate these challenges effectively. In addition to policy considerations, cultural challenges also play a significant role in the transition to ICD-11. The attitudes, beliefs, and values of healthcare professionals and organisations can either facilitate or hinder the adoption process. It is essential to recognise that the successful implementation of ICD-11 is not solely a technical endeavour but also requires a cultural shift within healthcare organisations. Engaging healthcare professionals and fostering a positive attitude towards the new coding system can enhance the likelihood of successful adoption. Addressing these cultural factors is vital for ensuring that all stakeholders are on board with the transition.

Regulatory compliance is another critical aspect of the ICD-11 implementation process. Organisations must ensure that they are compliant with the regulations set by governing bodies, which may involve significant changes to existing practices. The introduction of extension codes, for instance, necessitates clear guidelines and regulations to ensure their correct use. The granularity of coding in ICD-11 can pose challenges as organisations must balance the need for detailed representation of clinical conditions with the administrative and quality management purposes that coding services. This balance is essential for maintaining the integrity of health data while also fulfilling regulatory requirements. Moreover, establishing governance and training structures is crucial for overseeing the implementation and maintenance of ICD-11. Robust governance frameworks can help organisations manage the complexities of the transition, ensuring that the classification system remains relevant and accurate as healthcare practices evolve. Additionally, training healthcare professionals on the new coding system is necessary to ensure effective use and understanding. Without adequate training, the potential benefits of ICD-11 may not be fully realised.

Moreover, international collaboration among stakeholders is essential for addressing policy gaps and facilitating a smooth transition to ICD-11. Collaboration between policymakers, regulatory agencies, and healthcare organisations can enhance the quality and interoperability of health data, ultimately leading to better healthcare outcomes. By working together, stakeholders can share best practices, develop clear guidelines, and promote a unified approach to the adoption of

ICD-11. Hence, the adoption of ICD-11 presents a range of challenges that healthcare systems and institutions must navigate effectively. By addressing policy, cultural, and regulatory challenges, establishing a robust governance structure, and promoting international collaboration, stakeholders can facilitate a smooth and effective transition to ICD-11. This transition is not merely a technical upgrade; it represents an opportunity to improve the quality and interoperability of health data, ultimately leading to enhanced healthcare outcomes for patients worldwide

Limitation of the review

The limitation of this review study primarily concerns the scope, methodology, and generalisability of the findings. Firstly, the review's focus on English-language studies and specific databases may have excluded relevant research published in other languages or available elsewhere, introducing language and publication bias. Additionally, the inclusion of studies with diverse designs and methodologies introduces heterogeneity, complicating the synthesis of consistent results. The ten-year timeframe (2014-2024) used for the literature search might have overlooked significant earlier studies or recent publications not yet indexed, limiting the comprehensiveness of this review. Furthermore, although data extraction was conducted independently by two researchers for a subset of studies, there remains a potential for human error or subjective interpretation, impacting data accuracy and consistency. This review also focuses on identifying challenges and barriers without extensively exploring the outcomes of ICD-11 implementation, such as improvements in coding accuracy, healthcare delivery, or patient outcomes. Additionally, contextual factors such as healthcare policies, regulatory environments, and cultural differences, which might influence ICD-11 adoption, were not comprehensively addressed, affecting the applicability of the findings across different settings.

Recommendation

The adoption of ICD-11 presents a significant opportunity for healthcare systems worldwide to enhance the accuracy and utility of health information. However, the transition to ICD-11 is fraught with various challenges and barriers that must be addressed to ensure successful implementation. To facilitate this transition, several key recommendations emerge from this study's findings.

First and foremost, there is a critical need for enhanced training and education for clinical coders and healthcare professionals. The complexities of the ICD-11 coding system necessitate comprehensive training programmes that equip staff with the knowledge and skills required to navigate the new classification effectively. These programmes should include practical workshops, online courses, and ongoing education initiatives that focus on the nuances of ICD-11 coding. By investing in the continuous professional development of healthcare personnel, organisations can improve coding accuracy and ensure that the benefits of ICD-11 are fully realised.

In addition to training, fostering collaborations among policymakers, healthcare providers, and IT professionals is essential. This review emphasises the importance of aligning healthcare system policies and procedures with ICD-11 standards. This collaboration should focus on creating a supportive environment for implementation, addressing financial coding issues, and ensuring that all stakeholders are engaged in the transition process. By working together, these groups can develop strategies that facilitate smoother and mitigate potential disruptions to healthcare delivery.

Addressing technical barriers is another crucial aspect of successful ICD-11 adoption. Healthcare organisations must invest in the necessary IT infrastructure and resources to support the transition. This includes ensuring that electronic health record systems are compatible with ICD-11 and that adequate support systems are in place for coders to access and utilise the new classification effectively. By prioritising technological readiness, healthcare systems can minimise disruptions and enhance the overall efficiency of coding practices.

Moreover, comprehensive data collection and analysis are vital for monitoring the impact of ICD-11 adoption on healthcare delivery and patient outcomes. This review suggests implementing robust data collection methods to evaluate the effectiveness of training programmes and the accuracy of coding practices post-implementation. By systematically analysing these outcomes, healthcare organisations can identify areas for improvement and make informed decisions that enhance the quality of care provided to patients.

It is also essential to consider contextual factors that may influence the adoption of ICD-11. This review highlights the importance of recognising healthcare policies, regulatory environments, and cultural differences that can affect the implementation process. Tailoring strategies to fit the specific needs and circumstances of different healthcare systems can enhance the effectiveness of the transition. By adopting a context-sensitive approach, stakeholders can better navigate the complexities of ICD-11 adoption and ensure that the systems are integrated seamlessly into existing practices.

Establishing a continuous feedback mechanism is another recommendation that can significantly enhance the adoption process. Healthcare professionals should have avenues to report challenges and share experiences related to ICD-11 implementation. This feedback can help identify ongoing issues and facilitate timely adjustments to training and support initiatives. By fostering an open dialogue among stakeholders, healthcare organisations can create a culture of continuous improvement that supports the successful integration of ICD-11.

Finally, encouraging further research into the outcomes of ICD-11 implementation is crucial. This review underscores the need for studies that focus on improvements in coding accuracy, healthcare delivery, and patient outcomes. Building a robust evidence base for the benefits of transitioning to ICD-11 will not only inform future policy decisions but also provide valuable insights for healthcare systems seeking to enhance their practices.

In conclusion, the transition to ICD-11 presents both challenges and opportunities for healthcare systems worldwide. By implementing these recommendations – enhancing training and education, fostering collaboration, addressing technical barriers, conducting comprehensive data analysis, considering contextual factors, establishing feedback mechanisms, and promoting further research – healthcare organisations can navigate the complexities of ICD-11 adoption effectively. Ultimately, these efforts will contribute to improved health information systems, better patient care, and enhanced global health outcomes.

Future recommendations for research and practical applications in the adoption of ICD-11

The transition to the ICD-11 presents a myriad of challenges and barriers that healthcare systems must navigate. As highlighted in the systematic review of these challenges, it is essential to develop comprehensive recommendations that address both research and practical applications to facilitate a smoother transition and maximise the benefits of ICD-11. This essay outlines future

recommendations aimed at enhancing the understanding and implementation of ICD-11 across various healthcare settings.

To better understand the complexities surrounding the adoption of ICD-11, future research should focus on several key areas. First, conducting longitudinal studies is crucial to assess the long-term impacts of ICD-11 implementation on healthcare delivery, coding accuracy, and patient outcomes. Such studies should encompass a variety of healthcare settings, particularly in low- and middle-income countries, to capture the diverse effects of ICD adoption. By examining these long-term outcomes, researchers can provide valuable insights into the effectiveness of the new coding system.

Second, comparative studies between healthcare systems that have successfully adopted ICD-11 and those that have encountered significant challenges can yield important lessons. Identifying best practices and strategies that facilitate smoother transitions will be instrumental in guiding future implementations. This comparative approach can also highlight the contextual factors that influence the adoption process, such as healthcare policies, regulatory environments, and cultural differences.

Moreover, research should explore the effectiveness of training programmes designed to enhance coding accuracy and healthcare professionals' confidence in using ICD-11. By evaluating various training methodologies and content, researchers can identify the most effective approaches to education, ultimately leading to improved coding practices. Additionally, studies focusing on the integration of ICD-11 with existing EHR systems and other health information technologies are essential. Understanding the challenges and solutions related to technological integration will provide insights into best practices for ensuring data interoperability and readiness for the new coding system.

In parallel with research initiatives, practical applications must be developed to support the successful adoption of ICD-11. One of the primary recommendations is the creation of standardised training modules for healthcare professionals. These modules should be adaptable to different healthcare settings and cover the complexities of ICD-11 coding, practical applications, and relevant case studies. By providing comprehensive training resources, healthcare organisations can enhance their workforce's understanding and application of the new coding system.

Establishing support networks or communities of practice among healthcare organisations is another vital recommendation. These networks can facilitate knowledge exchange, allowing organisations to share experiences, challenges, and solutions related to ICD-11 adoption. By fostering collaboration and support, healthcare providers can navigate the transition more effectively. Furthermore, implementing structured feedback mechanisms will enable healthcare professionals to report challenges and successes during the ICD-11 implementation process. This feedback should be utilised to continuously improve training programmes and support resources, ensuring that they remain relevant and effective. Advocacy for policies that allocate resources and funding to support the transition to ICD-11 is also critical, particularly in under-resourced healthcare systems. Ensuring organisations have the necessary financial and technical support is essential for successful implementation and can significantly impact the quality of healthcare data and patient care.

Lastly, initiating pilot programmes in diverse healthcare settings to test different implementation strategies for ICD-11 can provide valuable insights. These pilots can help refine approaches before a broader rollout, ensuring the best practices are identified and adapted to various contexts.

Conclusion

The adoption of ICD-11 presents several challenges that healthcare systems must address for successful implementation. These challenges are categorised into four main aspects: technical, organisational, clinical, and policy-related. Technically, the complexity of the new coding system requires changes to HIS and EHR to support longer codes and maintain international comparability. Organisationally, standardised coding practices and comprehensive training for healthcare professionals are essential. Clinically, detailed documentation is needed to ensure accurate coding, while policy challenges involve aligning healthcare policies with ICD-11 standards and encouraging collaboration between stakeholders. Overcoming these challenges is crucial for improving the quality of health data and patient care. By addressing these barriers, healthcare systems can ensure a smoother transition to ICD-11, enhancing global HIS and outcomes.

Acknowledgements

We would like to express our sincere gratitude to KPJ Healthcare University for their valuable support in this study and Director General of Health Malaysia for his permission to publish the paper.

Conflict of interest statement

The authors declare that there are no conflicts of interest related to this study.

Funding statement

No funding was received for this study.

References

- Bach, B., Kramer, U., Doering, S., di Giacomo, E., Hutsebaut, J., Kaera, A., De Panfilis, C., et al., 2022. The ICD-11 classification of personality disorders: a European perspective on challenges and opportunities. *Borderline Personal Disord Emot Dysregul* 9(1), 1–11. <https://doi.org/10.1186/S40479-022-00182-0/TABLES/4>
- Drösler, S.E., Weber, S., Chute, C.G., 2021. ICD-11 extension codes support detailed clinical abstraction and comprehensive classification. *BMC Med Inform Decis Mak* 21(6), 1–9. <https://doi.org/10.1186/S12911-021-01635-2/FIGURES/2>
- Eisma, M.C., 2023. Prolonged grief disorder in ICD-11 and DSM-5-TR: Challenges and controversies. *Aust N Z J Psychiatry* 57(7), 944–951. <https://doi.org/10.1177/00048674231154206>
- Feinstein, J.A., Gill, P.J., Anderson, B.R., 2023. Preparing for the International Classification of Diseases, 11th Revision (ICD-11) in the US Health Care System. *JAMA Health Forum* 4(7), e232253–e232253. <https://doi.org/10.1001/JAMAHEALTHFORUM.2023.2253>
- Gaebel, W., Stricker, J., Kerst, A., 2020. Changes from ICD-10 to ICD-11 and future directions in psychiatric classification. *Dialogues Clin Neurosci* 22(1), 7–15. <https://doi.org/10.31887/DCNS.2020.22.1/WGAEBEL>
- Harrison, J.E., Weber, S., Jakob, R., Chute, C.G., 2021. ICD-11: an international classification of diseases for the twenty-first century. *BMC Med Inform Decis Mak* 21(6), 1–10. <https://doi.org/10.1186/S12911-021-01534-6/FIGURES/3>
- Hirsch, G., Trusheim, M., Cobbs, E., Bala, M., Garner, S., Hartman, D., Isaacs, K., Lumpkin, M., Lim, R., Oye, K., Pezalla, E., Saltonstall, P., Selker, H., 2016. Adaptive Biomedical Innovation: Evolving Our Global System to Sustainably and Safely Bring New Medicines to Patients in Need. *Clin Pharmacol Ther* 100(6), 685–698. <https://doi.org/10.1002/CPT.509>
- Ibrahim, I., Alrashidi, M., Al-Salamin, M., Kostanjsek, N., Jakob, R., Azam, S., Al-Mazeedi, N., et al., 2022. ICD-11 Morbidity Pilot in Kuwait: Methodology and Lessons Learned for Future Implementation. *International Journal of Environmental Research and Public Health* 2022, Vol. 19, Page 3057 19(5), 3057. <https://doi.org/10.3390/IJERPH19053057>
- Kerig, P.K., Mozley, M.M., Mendez, L., 2020. Forensic Assessment of PTSD Via DSM-5 Versus ICD-11 Criteria: Implications for Current Practice and Future Research. *Psychological Injury and Law* 2020 13:4 13(4), 383–411. <https://doi.org/10.1007/S12207-020-09397-4>
- Killikelly, C., Hasenöhr, A., Stelzer, E.M., Maercker, A., 2023. The New ICD-11 Prolonged Grief Disorder Guidelines in Japan: Findings and Implications from Key Informant Interviews. *Cult Med Psychiatry* 47(2), 519–542. <https://doi.org/10.1007/S11013-022-09781-6>
- Krawczyk, P. and Świącicki, Ł., 2020. ICD-11 vs. ICD-10 – a review of updates and novelties introduced in the latest version of the WHO International Classification of Diseases. *Psychiatr Pol* 54(1), 7–20. <https://doi.org/10.12740/PP/103876>
- Ndougue, V.F., Tiwoda, C., Gnigninanjouena, O., Bataliack, S., Mbondji, E., Labat, A., 2022. National Health Observatory: A tool to strengthen the health information system for evidence-based decision making and health policy formulation in Cameroon. *Health Policy Open* 3, 100085. <https://doi.org/10.1016/J.HPOPEN.2022.100085>
- Norouzi, H., Mehroolhassani, M.H., Hajesmaeel-Gohari, S., Ahmadian, L., Ghaemi, M.M., Mohammadi, M., Khajouei, R., 2024. Identification and classification of indicators for evaluating health information systems. *Health Policy Technol* 13(2), 100833. <https://doi.org/10.1016/J.HLPT.2023.100833>
- Ooi, E.C.W., Isa, Z.M., Manaf, M.R.A., Fuad, A.S.A., Ahmad, A., Mustapa, M.N., Marzuki, N.M., 2024. Factors influencing the intention to use the ICD-11 among medical record officers (MROs) and assistant medical record officers (AMROs) in Ministry of Health, Malaysia. *Scientific Reports* 2024 14:1 14(1), 1–18. <https://doi.org/10.1038/s41598-024-60439-2>
- Parmar, J., Anderson, S., Abbasi, M., Ahmadinejad, S., Brémault-Phillips, S., Chan, K., Charles, L., et al., 2020. Support for family caregivers: A scoping review of family physician's perspectives on their role in supporting family caregivers. *Health Soc Care Community* 28(3), 716–733. <https://doi.org/10.1111/HSC.12928>
- Pine, M. and Tompkins, C., 2024. Evolution of the International Classification of Diseases—From Hierarchical Classification to Linguistic Nuance. *JAMA Netw Open* 7(4), e246474–e246474. <https://doi.org/10.1001/JAMANETWORKOPEN.2024.6474>

- Reed, G.M., First, M.B., Elena Medina-Mora, M., Gureje, O., Pike, K.M., Saxena, S., 2016. Draft diagnostic guidelines for ICD-11 mental and behavioural disorders available for review and comment. *World Psychiatry* 15(2), 112–113. <https://doi.org/10.1002/WPS.20322>
- Sharan, P. and Hans, G., 2021. Cultural Issues Related to ICD-11 Mental, Behavioural and Neurodevelopmental Disorders. *Consortium Psychiatricum* 2(2), 7–15. <https://doi.org/10.17816/CP67>
- Southern, D.A., Hall, M., White, D.E., Romano, P.S., Sundararajan, V., Droesler, S.E., Pincus, H.A., Ghali, W.A., 2016. Opportunities and challenges for quality and safety applications in ICD-11: an international survey of users of coded health data. *International Journal for Quality in Health Care* 28(1), 129–135. <https://doi.org/10.1093/INTQHC/MZV096>
- Stein, D.J. and Reed, G.M., 2019. Global mental health and psychiatric nosology: DSM-5, ICD-11, and RDoC. *Brazilian Journal of Psychiatry* 41(1), 3–4. <https://doi.org/10.1590/1516-4446-2018-4101>
- WHO, 2008. Health information systems [WWW Document]. World Health Organization. URL <https://www.who.int/publications/m/item/health-information-systems>.
- WHO, 2023. International Classification of Diseases 11th Revision (ICD-11): The global standard for diagnostic health information [WWW Document]. URL <https://icd.who.int/en>
- WHO, 2022. WHO's new International Classification of Diseases (ICD-11) comes into effect [WWW Document]. World Health Organization. URL [https://www.who.int/news/item/11-02-2022-who-s-new-international-classification-of-diseases-\(icd-11\)-comes-into-effect](https://www.who.int/news/item/11-02-2022-who-s-new-international-classification-of-diseases-(icd-11)-comes-into-effect).