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A Conceptual Perspective of The Role of Medical Coding in Identifying Accurate Underlying Cause of Mortality in Saudi Arabia

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Abstract	Article Info
Accurate identification of the underlying cause of death is essential for producing reliable mortality statistics and supporting effective national preventive health programs. Medical coding, particularly through the correct application of the International Classification of Diseases (ICD) and the Medical Certificate of Cause of Death (MCCOD), plays a vital role in ensuring the quality of mortality data. A conceptual perspective methodology is undertakent through systematic revew of literature to provide a deeper understanding of the role of medical coding in identifying accurate underlying causes of mortality in Saudi Arabia. The study includes a qualitative, literature-based evidence from international and national, research studies on medical coding practices, including Saudi-specific studies, that is, cause-of-death certification, and mortality data accuracy. The findings highlight that deficiencies in documentation quality, medical coder training, adherence to ICD standards, and integration of health information systems contribute to misclassification of deaths, particularly for non-communicable diseases such as cardiovascular disease and diabetes. Most studies indicated that accurate mortality data is a fundamental requirement for effective planning, prioritization, and evaluation of national preventive health programs. This study underscores the importance of strengthening coding governance, MCCOD practices, and health information system integration to support data-driven preventive strategies and improve mortality reporting and correction classification in Saudi Arabia.	*Keywords:* Medical Coding, Mortality Data Accuracy, MCCOD, ICD-10, Preventive Programs, Health Information Systems, Saudi Arabia.

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INTRODUCTION

Reliable mortality data is crucial for assessing population health, understanding disease patterns, that guides national health planning. The increasing burden of non-communicable diseases (NCDs) has intensified the need for accurate identification of underlying causes of death to support preventive strategies and resource allocation (Johnson et al., 2021). Medical coding systems, particularly the International Classification of Diseases (ICD), play a central role in transforming mortality information into standardized datasets to enable accurate communication.

These challenges persist in coding governance, documentation quality, and validation of mortality data, which may distort national mortality trends and limit preventive planning (Olagundoye et al., 2021). While coding systems such as ICD-10 exist, there remains a high prevalence of coding the correct cause of death that led to cardiac arrest rather than the underlying cause (e.g. cardiac failure that is complicated by diabetes). This inaccuracy is not merely a technological error, but a structural failure caused by fragmented health information systems, suboptimal physician training in ICD-10 coding and a lack of accountability in the correct cause death certification documentation. Therefore, effectiveness of ICD-10 depends on high-quality certification, medical coder training, and adherence to standardized procedures, will invariably support comparable reporting, surveillance of public health and policy makers (WHO., 2024). The 2030 Vision imitative in Saudi Arabia represents an ideal context for health transformation and digital health systems expansion through the adoption of the ICD-10 medical coding. The purpose of this study aims to critically evaluate the role of medical coding within the Saudi healthcare context, identifying any human and systems barriers that may prevent the accurate documentation of the underlying cause of death (UCOD), and to assess how this inaccuracy undermines the efficiency of national preventive health programs. Saudi healthcare has a digital transformation system that is rapidly expanding but nevertheless a problem exists with the integrity of national mortality statistics that is compromised by a systemic data quality gap.

LITERATURE REVIEW

Overview of Medical Coding

Medical coding is a fundamental tool in any health information system, which makes clinical records classified as codes through a standardized medical coding process for easy communication both internationally and locally. ICD managed by the World Health Organization (WHO), provides the global framework for reporting diseases and tracking UCOD. Through the decades the tool has evolved from the ninth digital version (ICD-9), to the more current comprehensive version (ICD-10) that integrates digital architecture with past formats, thereby improving the process and systems for classifying deaths (WHO, 2024; Mutale et al., 2013). This system development has improved the reliability and accuracy of information related to medical conditions and UCOD, which in turn has provided accurate health statistical data that enables global comparability. Al-Kahtani et al., (2022) and Alyazidi et al., (2024) among other studies have highlighted that medical coding is a key determinant of mortality data quality and a crucial input for public health planning.

Conceptual Perspective

ICD-10 and Mortality Classification

Health care system diagnostic codes an important mechanism for monitoring health care trends and performance such as quality of care, disease prevalence, mortality and resource utilization (Caskey et al., 2018). The tenth version of ICD has expanded to include nearly five times the number of diagnostic categories thereby improving data validity (Horsky et al., 2017). These updates have enabled a much more accurate representation of clinical conditions/diseases thereby making contributing to the accurate UCOD, enhancing the usefulness of health statistics that enables global comparability. The transition from ICD-09 to ICD-10 has resulted in ambiguity of clinical information and financial disruption for internists and medicine subspecialists (Shepheard., 2019). Therefore, despite this progress, the accuracy of the medical certificate of cause of death and the quality of the documentation remains critical to the effective deployment of these systems. The WHO revised their coding system to version 10 (ICD-10) and increased the number of codes, including the overall organization of codes. The ICD-10 created by US has more detail than any other country modification in the world.

There are costs associated with making the transition current ICD-10 that has played a significant contributing element to the inaccuracy of mortality data, especially in low- and middle-income nations, is still errors in the medical codes for diseases (Rampatige et al., 2014; Shepheard., 2019).
This has led to the misclassification of the primary cause of death leads to inconsistencies in internally and national mortality records and that impacted public health planning globally.

Concept of underlying the Cause of Death (UCOD)

WHO defined the UCOD as *"(a) the disease or injury that initiated the train of morbid events leading directly to death or (b) the circumstances of the accident or violence that produced the fatal injury"* (WHO., 2022; Al Busaidi et al., 2023). UCOD documented in the death certificate is the foundation in mortality data that impacts governments effectiveness of their health care systems, policy developments and the socioeconomic status due to actual burden of disease and to design evidence-based preventative initiatives. As evidence, the degree to which the UCOD is recorded will show the creditability of the data that accurately represents the real medical state, that started the series of events that resulted in death.
Mortality data offer a solid basis for epidemiological analysis and the formulation of health policies when these components cooperate effectively as stated by WHO that reliable coding using the ICD framework for adequate sequencing, of medical documentation are all necessary for high-quality mortality data (WHO, 2023).
MCCOD employs a uniform structured method to record the immediate, intermediate, and UCOD, thus portraying as one of the most significant elements affecting the quality of mortality data. As evident in the study by Rampatige et al. (2014) more than 60% of death certificates in low- and middle-income nations have significant mistakes such improper sequencing, the use of vague diagnoses, or the omission of the underlying reason.
Literature reviewed indicate the similar challenge that the common types of ICD errors, related to the use of unspecified causes, such as “heart failure” or “respiratory failure,” which are diagnostic errors rather than correct underlying causes. The diagnostic errors contribute to incorrect sequencing of events, e.g. documenting diabetes as the direct cause instead the underlying cause. Failure to document comorbidities that contribute to death and inadequate clinical documentation of resulting complication limits the coder’s ability to correctly apply ICD rules.

Medical Coding Process, Coder Competence and Accuracy Mortality Coding, Documentation

Many countries face numerous challenges in ensuring high quality medical coding processing. The fundamental challenge is inadequate ongoing training of coders, id the main problem documented in many health systems across Asia, Europe, and the Middle East. A study by Alanazi et al., (2023) stated that, in Saudi Arabia nearly 40% of coding errors were related to insufficient training and inconsistency in the application of ICD-10 rules. A similar finding in a study by Wabe et al., (2021) supported the evidence that in Australia variations in coding accuracy was reported related to coder experience levels, documentation quality, and institutional workflow structure In the United States, the challenge with the initial transition to ICD-10 led to widespread coding inconsistencies, revealing gaps in the coder’s preparedness and clinical documentation practices (Caskey et al., 2018).
The lack of clinical documentation posed another global challenge which remains one of the strongest predictors of coding inaccuracy. Studies in the United Kingdom have shown that incomplete or ambiguous medical records have led to significant misclassification of diseases and deaths related (Turner et al., 2016). Other researchers observed widespread under-documentation of comorbidities and intermediate causes of death, resulting in inaccurate selection of the underlying cause in hospital particularly in India and Malaysia (Patel et al., 2011; Dash et al., 2014; Ishak et al., 2025). The finding in all these studies show that this lack of documentation hinders the accuracy of hospital morbidity and mortality statistics that has a ripple effect on the national mortality reporting systems.
Health information systems enabled coding improves consistency, reduces manual errors, and enhances traceability of coder decisions. An integration reliable health information system (HIS) plays a crucial role in improving coding quality This is evidenced in the studies by Lee & Kim, (2022) and Riley et al., (2023), that strong correlation in countries with advanced digital health ecosystems such as Australia and South Korea, that they have better outcomes with coding accuracy because of their automated decision support tools and

integrated electronic health records (EHRs) Many other countries, including several in the Middle East, have a fragmented health information systems and the absence of unified digital platforms continue to hinder coding accuracy and mortality data completeness.
WHO Civil Registration and Vital Statistics (CRVS) analyses highlight four recurring international challenges: weak capacity to train MCCOD, incomplete national death registration systems, inadequate auditing and quality assurance, and poor integration of health information systems. The literature reviewed show an underlying theme, that is, mortality record accuracy is affected by several interrelated factors, including the quality of clinical documentation, the competence of medical coders, the completeness of the MCCOD, the integration of HIS, and national auditing mechanisms. Therefore, strengthening each of these elements is essential for producing high-quality mortality statistics that reliably guide overall public health decisions.

Mortality Data and Preventive Programs

Inaccurate mortality data has serious consequences as the deaths are misclassified of thereby distorting the national health indicators, disease burden estimates, and resource allocation decisions. Naghavi et al. (2020) stated that the misclassification of comorbidities e.g. ischemic heart disease and diabetes significantly impacts international mortality classifications, leading to misleading trends. In countries that are challenge with low-resource, inaccurate health statistics often underestimates the deaths with regards to maternal, communicable, and noncommunicable disease, thus hindering law makers with regard to public health planning.
Accurate mortality data is a keystone for the development, implementation, and evaluation of preventive health care and maintenance programs. Preventive, wellbeing strategies rely on understanding the true distribution and prevalence of diseases, identifying at-risk groups, and recognizing disease patterns leading to premature death. This is evident by WHO., (2023) that countries with high-quality mortality data demonstrate better performance in non-communicable disease (NCD) prevention, epidemic preparedness, and early detection systems. Preventive programs for NCDs, including amongst others cardiovascular diseases, diabetes, chronic respiratory diseases, and cancer, that rely particularly on accurate mortality statistics. Many studies have shown evidence that countries who accurately identify the leading causes of deaths have better outcomes in reducing premature mortality. As stated by this study that long-term NCD programs related to cardiovascular diseases invariably show reduced mortality deaths after mortality-based surveillance identified dietary and lifestyle changing factors (Naghavi et al., 2020). A study by Sun et al., 2023 point a similar finding that cancer control programs in Japan also rely heavily on UCOD data to prioritize screening, particularly for stomach, colorectal, and breast cancers.

The Role of Accurate UCOD in National Preventive Programs

Preventive Programs targeting cardiovascular diseases require accurate mortality data to identify regional variations, gender differences, and age-adjusted mortality trends. Misclassification of these diseases can distort national data and hinder general to more specific intervention planning. Studies show that diabetes deaths are often misclassified as kidney failure or cardiovascular disease, leading to an underestimation of the true nature of the burden as mortality depends on the accurate primary-cause ratios (Shepheard, 2019).
In Saudi Arabia, preventive programs under the Vision 2030 Health Transformation Strategy rely heavily on mortality surveillance to guide screening programs, chronic disease management protocols, and risk factor interventions. The Ministry of Health depends on the usage of death records to accurately plan any national screening programs for any related diseases e.g. diabetes, hypertension, obesity, and cancer (Ministry of Health, 2022). Accurate recording system helps to identify emerging trends, such as the increasing community burden of ischemic heart disease and preventable stroke among young generation in the country. This is evident with international trends that also demonstrate how accurate mortality data can enhance any prevention programs.
As seen in the UK, the Quality of Outcomes Framework (QOF) uses validated mortality indicators to optimize primary healthcare interventions, leading to measurable improvements in survival rates with better quality of life. (Dusheiko et al., 2015).
Iran as well provides evidence that integrating this data into digital prevention systems has improved preventive programs (Shahmoradi & Habibi-Koolaee., 2016). On the other hand, inaccurate healthcare statistics can seriously undermine prevention planning thus leading to an increase in mortality with lower life expectancy.

Misclassifying deaths from non-communicable diseases may shift priorities and resources away from more pressing health issues that seriously impact the country as whole. Accurate identification of UCOD is an essential requirement for national and international preventive programs, as it enables policymakers to correctly prioritize diseases, design targeted interventions, and evaluate the impact of prevention strategies thereby improving the wellbeing of its citizens.

Challenges in the Saudi Context

Mortality data from the Ministry of Health Saudi Arabia and the WHO show that, between 2020 and 2023, cardiovascular diseases remained the leading cause of death, followed by diabetes, road traffic injuries, chronic respiratory diseases, and various types of cancer (Ministry of Health., 2023). These trends rely on accurate identification of UCOD that is pivotal for short and long-term planning. However, studies show that errors in MCCOD and coding may mask the true trends thereby posing a greater challenge to policy makers (Aljerian et al., 2022).

In Saudi Arabia, the Ministry of Health has implemented national guidelines for ICD-10 coding and mandated training for primary healthcare professionals (MCCOD) as part of the Health Transformation Program under Vision 2030. Despite this initiative, challenges have persist impacting the 2030 Vision. Researchers have indicated that discrepancies between medical records documentation accurate diagnosis and correct cause of deaths in the patient death certificates continue to always undermine the accuracy of mortality data (Alherz et al., 2025; Alotaibi et al., 2024). Furthermore, the limited auditing tools and mechanisms enables the lack of adherence to coding standards between regions that contribute to standardization inconsistencies in death reports documentations locally as well in the GCC region, where studies reveal similar concerns and challenges. Research study done in Saudi Arabia has also found that errors in death certificates remain common, particularly in public hospitals where clinicians receive only limited formal training on the MCCOD (Alyazidi et al., 2024). In Oman as study reported that the quality of death certification was suboptimal, which negatively affected ICD cause-of-death classification (Busaidi et al., 2023). Recent health transformation efforts in Saudi Arabia, including the mandatory nationwide implementation of ICD-10 and the integration of digital healthcare systems under Vision 2030, have led to improved completeness of death reporting. Nevertheless, persistent inconsistencies in quality documentation, varying coding practices among healthcare professionals, and the absence of standardized death audit systems continue to affect accuracy and wider health care planning to visualize Vision 2030 (Alanazi et al., 2023).

Summary of Literature Gaps

A systematic review of literature reveals several knowledge gaps. First, limited studies comprehensively assess the combined impact of the quality of ICD coding, the accuracy of MCCOD, and the integration HIS on national preventive programs. Secondly, research conducted in the Middle East, particularly in Saudi Arabia, remains limited that show the correlations in the validation of mortality coding, cause-of-death audits, and the evaluation of coders and physicians' competence. Thirdly, there is insufficient evidence that correlate improved coding practices to measurable improvements in the effectiveness of any preventive programs. Bridging these gaps is essential for building a more comprehensive understanding of how medical coding impacts national and international healthcare outcomes that should raise the quality-of-life including life expectancy. These knowledge gaps continue to exist despite extensive research worldwide. There is also a lack of country-level validation with limited studies in the GCC region that assess the true levels of misclassification, and insufficient studies that have explored the direct impact of improved mortality data accuracy on measurable prevention program outcomes, such as reduced mortality rates, improved risk factor control and any educational programs. A crucial gap in the current literature is that there is limited research in assessing how enhancement in medical coding is required to maintain standardization for easy communication. A knowledge gap exists in that there is a lack of studies that show how MCCOD data accuracy can directly affect the outcomes of preventive programs, particularly in Saudi Arabia and other Gulf States.

METHODOLOGY

This study adopts a conceptual framework that entails a structured qualitative, systematic literature-based methodology that synthesizes evidence from peer-reviewed academic publications and authoritative

institutional reports to examine how medical coding practices influence mortality data accuracy and its impacts on preventive health program planning. Data collection followed a systematic review of literature search across major scientific databases including Scopus, PubMed, Web of Science, ScienceDirect, and Emerald Insight, using keywords related to ICD-10 accuracy, MCCOD completeness, UCOD, HIS integration, and mortality misclassification. Foundational sources such as WHO mortality system guidelines (WHO, 2023; WHO, 2024), national statistical indicators from the Saudi Ministry of Health (2022), and global health information system analyses (Mutale et al., 2013; OECD., 2022) were included to contextualize coding practices internationally and nationally. Literature studies that were peer-reviewed that explored the coding accuracy, coder competency levels, documentation quality, and system-level factor influences on mortality classification were incorporated, including research demonstrating persistent ICD-10 coding challenges in hospital systems (Caskey et al., 2018; Wabe et al., 2021; Horsky et al., 2017). Widespread international documentation deficiencies affecting UCOD accuracy (Turner et al., 2016; Dash et al., 2014; Hazard et al., 2017), and the impact of HIS-supported coding infrastructures (Lee & Kim., 2022; Riley et al., 2023). The national studies that focused on Saudi Arabian were prioritized to understand regional and local system challenges, which are coder performance variability, MCCOD quality concerns, and gaps in documentation and training (Alanazi et al., 2023; Alherz et al., 2025; Alotaibi et al., 2024; Alyazidi et al., 2024). Studies examining the implications of inaccurate mortality classification on public health planning were also included, reflecting evidence that misclassification of diseases such as ischemic heart disease, diabetes, and cancer distorts national health priorities (Naghavi et al., 2020; Li et al., 2025; Shepheard, 2019). Inclusion criteria focused on studies published between 2010 and 2025 that addressed coding quality, mortality data accuracy, HIS integration, UCOD documentation, or preventive health programs, while studies without methodological rigor, full-text access, or direct relevance were excluded. A thematic analysis approach was applied to classify the selected literature into interconnected analytical domains: coding accuracy and ICD compliance, documentation and MCCOD quality, medical coder training and workflow, HIS and digital enablement, public health consequences of miscoding, and the role of accurate UCOD in preventive program planning This strategy allowed the current study to synthesize global insights, compare international and Saudi experiences, and identify recurring structural and operational determinants of mortality data quality. Comparative evidence from countries with strong HIS integration and mortality audit structures (Pan et al., 2025; Olagundoye et al., 2021; Shahmoradi & Habibi-Koolaee., 2016), was contrasted within the contexts of demonstrating fragmented systems or incomplete death registration, within several LMIC and GCC settings (Rampatige et al., 2014; Busaidi et al., 2023; Aljerian et al., 2022).
The methodology is anchored in three theoretical models: Information Quality Theory, which frames the assessment of data accuracy and reliability, the Donabedian Structure-Process-Outcome model, which maps documentation, coding workflows, and resulting mortality outcomes, and the Data-Driven Decision-Making framework, that explains how accurate UCOD data informs prioritization, allocation of vital resources, and preventive strategy development. This study integrated the three methodologies to provide an all-inclusive, coherent framework for better understanding that the improvement coding accuracy, MCCOD completeness, and HIS-supported processes can strengthen mortality statistics and enhance preventive health planning in Saudi Arabia thereby realizing the Vision 2030 Health Transformation Strategy.

RESULTS & DISCUSSION

A total of thirty-seven (37) studies were systematically reviewed in a methodological structured manner after screening for relevance, methodological rigor, and alignment with the research objective. Studies that sought after were conducted across worldwide to include diversity from all countries. That are Saudi Arabia, the GCC, Europe, South Asia, Australia, Korea, and global WHO datasets. Many studies focused on ICD-10 accuracy, MCCOD errors, coding governance, and health information system integration, while others examined mortality misclassification and its implications for preventive planning. Following paragraph is the thematic analysis and summary of characteristics of the literature reviewed, that captured their geographical scope, methodological orientation, and major findings.

Thematic Analysis - Summary of Characteristics of Included Studies

The studies collectively reveal six major themes:

(1) Widespread inaccuracies in MCCOD documentation reported in Saudi Arabia, India, Bangladesh, and Oman (Patel et al., 2011; Dash et al., 2014; Hazard et al., 2017; Busaidi et al., 2023).
(2) Coder competency, training, and compliance limitations, particularly in Saudi Arabia (Alanazi et al., 2023; Alherz et al., 2025; Alotaibi et al., 2024).
(3) Strong coding performance in countries with integrated HIS such as Korea and Australia (Lee & Kim, 2022; Riley et al., 2023).
(4) Frequent global misclassification of cardiovascular and diabetes-related deaths (Harriss et al., 2011; Naghavi et al., 2020; Li et al., 2025).
(5) The influence of documentation quality on UCOD determination (Turner et al., 2016; Dash et al., 2014).
(6) The role of structured mortality audit systems in improving death certification accuracy (Rampatige et al., 2014; Simpson et al., 2023).

Characteristics of Included Studies

The studies involved showed a consistent highlight of deficiencies in coding quality, documentation, medical coder training, and health system integration across multiple countries. Research from Saudi Arabia shows persistent MCCOD errors due to limited coder training, inconsistent use of ICD rules, and fragmented information systems (Aljerian et al., 2022; Alyazidi et al., 2024). Studies from South Asia, particularly India and Bangladesh, reported similar issues where clinicians frequently list mechanisms of death instead of true underlying causes (Patel et al., 2011; Hazard et al., 2017). In contrast, studies from Korea and Australia demonstrate that advanced HIS integration and electronic certification frameworks significantly reduce coding variability and improve mortality reporting (Lee & Kim., 2022; Riley et al., 2023). Overall, the studies showed correlation that with improvement the health systems that prioritize coder training, documentation standards, and HIS-supported workflows will achieve accurate mortality reporting (Mutale et al., 2013; OECD., 2022).

The Role of Medical Coding in Identifying Accurate Underlying Causes of Death

The literature consistently demonstrates that the accuracy of ICD-10 coding is one of the strongest determinants of correct UCOD identification. Countries with structured coding governance, standardized MCCOD procedures, and regular medical coder training, reports lower rates of misclassification (Lee & Kim., 2022; Riley et al., 2023). On the other hand, studies from Saudi Arabia reveal significant issues in documentation, coder competence, and adherence to ICD rules, contributing to errors in UCOD determination, particularly in diabetes and cardiovascular deaths (Aljerian et al., 2022; Alyazidi et al., 2024). Worldwide evidence reinforces this pattern, Rampatige et al., (2014) found that poor MCCOD practices are a leading cause of UCOD inaccuracy worldwide, while European studies indicate that ICD misclassification significantly distorts national mortality patterns, especially in cardiovascular disease (Harriss et al., 2011). This body of evidence emphasizes that improving coding governance and MCCOD accuracy is fundamental for reliable mortality surveillance.

The Impact of Medical Coding on National Preventive Programs

Accurate mortality data plays a pivotal role in guiding preventive health strategies for better healthcare outcomes. Countries with reliable UCOD statistics, such as Japan and the United Kingdom, have confirmed measurable improvements in cancer screening, cardiovascular prevention, and chronic disease management (Naghavi et al., 2020; Dusheiko et al., 2015; Sun et al., 2023). In Saudi Arabia, preventive programs under Vision 2030 heavily rely on mortality data to design NCD strategies and screening programs; however, the literature shows that misclassified deaths particularly diabetes and cardiovascular diseases undermine the accuracy of national health indicators and delay proper policy responses (Ministry of Health., 2022; Alherz et al., 2025). Studies also show that countries with integrated HIS–coding–MCCOD frameworks achieve stronger preventive outcomes due to higher UCOD reliability (Lee & Kim, 2022; Pan et al., 2025). On the contrary, health systems without integrated structures such as parts of the GCC and South Asia experience higher misclassification rates and weaker preventive program performance (Rampatige et al., 2014; Busaidi et al., 2023). The findings clearly indicate that accurate medical coding is not merely an administrative function but a foundational requirement for effective national preventive healthcare planning to improve people wellbeing and increase the quality-of-life expectancy thereby reducing healthcare costs.

The Practical Implications of the Conceptual Findings

This study has vital practical implications and a significant impact on the healthcare sector, to control factors affecting medical coding process, as this in turn enhances the accuracy of mortality data, greatly influences policymakers' decisions as a rippling effect. These factors include training medical coders and ensuring their adherence to ICD standards, as well as improving health information systems (Alanazi et al., 2023; Alherz et al., 2025; Mutale et al., 2013). Policymakers prioritize data-driven decisions, which have substantial financial costs on the country. Therefore, they must identify appropriate preventive programs and their geographical locations to optimize resource utilization and reduce mortality rates associated with these programs for future planning (Busaidi et al., 2023).

CONCLUSION

The systematic review of the literature demonstrates that the accuracy of mortality data is strongly influenced by the quality of medical coding, particularly the correct application of ICD standards and the completeness of MCCOD. The findings of the review disclosed that health systems with strong coding governance, standardized MCCOD procedures, structured coder training, and integrated health information systems achieved higher accuracy in identifying UCOD. In contrast, studies that had highlighted those deficiencies in documentation quality, coder competency, and adherence to ICD rules contributed significantly to the misclassification of deaths, particularly for non-communicable diseases such as cardiovascular disease and diabetes.
The review further indicates that MCCOD inaccuracies remain a major worldwide contributor to mortality misclassification, with consistent evidence reported across Saudi Arabia, the GCC region, South Asia, and Europe. These inaccuracies distort international and national mortality trends and weaken the reliability of health statistics used for public health surveillance and planning. Importantly, the results show that preventive health programs are highly dependent on accurate mortality data. Countries with reliable UCOD certification systems demonstrate more effective planning, prioritization, and evaluation of preventive interventions, while misclassified mortality data limits the effectiveness of national prevention strategies.
In the Saudi context, the findings suggest that although significant progress has been achieved through ICD-10 implementation and digital health transformation under Vision 2030, gaps remain in the integration of health information systems, coding workflows, MCCOD practices, and mortality audit mechanisms. Addressing these gaps is essential to improving the accuracy of mortality reporting and strengthening data-driven preventive initiatives. Overall, the study confirms that medical coding is a critical determinant of reliable mortality statistics and effective national preventive health planning.

RECOMMENDATIONS

The systematic review of the literature studies indicated that improving the accuracy of mortality data in Saudi Arabia requires strengthening key elements of the medical coding and certification process. First, standardized and continuous training for physicians and medical coders is essential to ensure that correct application of ICD rules and accurate completion of MCCOD, particularly in UCOD for non-communicable diseases. Second, the findings highlighted the need to improve the quality of clinical documentation, as incomplete or unclear medical records directly contribute to coding errors and misclassification of deaths. Enhancing documentation standards and routine feedback mechanisms can support more accurate mortality reporting.
Third, enhancing an integration of HIS with coding and death certification processes is vital to reducing manual errors and improving data consistency. Integrated digital systems can support real-time monitoring, standardized coding practices, and more reliable mortality statistics. Finally, the study recommends the implementation of regular national mortality audits and the systematic use of accurate mortality data in planning and evaluating preventive health programs under Saudi Vision 2030. Strengthening mortality data quality will support better prioritization, resource allocation, and assessment of preventive interventions to improve healthcare planning.

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