Improving the Quality of Clinical Coding through Mapping of National Classification of Diseases (NCoD) and International Classification of Disease (ICD-10).

Ephrem Biruk[1], Tigist Habtamu[1], Girma Taye[1*], Wondimu Ayele[1], Brehan Tassew[1], Adiyam Nega[1], Ashagre Sisay[2]

Abstract

Introduction: Medical coding is the transformation of healthcare diagnosis, procedures, medical services, and equipment into universal medical alphanumeric codes. Utilization of international disease classification provides higher-quality information for measuring healthcare service quality, safety, and efficacy. The Ethiopian National classification of disease (NCoD) was developed as part of Health Management information System (HMIS) reform with consideration of accommodating code in International Classification of disease (ICD-10). There is limited resource about the utilization status and related determinants of NCoD by health care professionals at tertiary level hospitals. This study is designed to assess the utilization status of NCoD and improve the quality of clinical coding through mapping of NCoD and ICD-10.

Methods: Quasi-experimental study considering "Mapping" as an intervention was employed in this study. Retrospective medical record reviews were carried out to assess the utilization of NCoD and its challenges at Tikur Anebsa Specialized Hospital (TASH) for a period of one year (2018/2019). Qualitative approach used to get expert insight on NCoD implementation challenges and design of mapping exercises as an intervention. Seven thousand five hundred forty-seven (20%) of the medical records from the total of 37,734 medical records were selected randomly for review. A data abstraction checklist was developed to collect relevant information on individual patient charts, patient electronic records specific on a confirmed diagnosis. The reference mapping approach was employed for the mapping output between ICD-10 and NCoD. Both ICD-10 and NCoD were mapped side by side using percentage comparison and absolute difference.

Result: Data for document review was taken from the electronic medical record database. Out of the total, 3021 (40%) of records were miss-classified based on the national classification of disease. From the miss-coded record, 1749 (58%) of them used ICD code to classify the diagnosis. Reasons provided for poor utilization of NCoD among physicians include, perception of having a limited list of diagnosis in the NCoD, not being familiarized, inadequate capacity building about NCoD use, and absence of enforcing mechanism on the use of standard diagnostic coding among professionals. Utilization of disease classification coding provides higher-quality information for measuring healthcare service quality, safety, and efficacy. This will in turn provide better data for quality measurement and medical error reduction (patient safety), outcomes measurement, operational planning, and healthcare delivery systems design and reporting.

Conclusion: Extended NCoD categories were mapped from ICD-10. Standard ways of coding disease diagnosis and coding of new cases into the existing category was established. This study recommends that due emphasis should be given in monitoring and evaluation of medical coding knowledge and adherence of health professionals, and it should be supported with appropriate technologies to improve the accessibility and quality of health information.
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Introduction

The history of the systematic statistical classification of diseases dates back to the nineteenth century. Groundwork was done by early medical statisticians, such as William Farr (1807–83) and Jacques Bertillon (1851–1922). The French government convened the first International Conference for the revision of the Bertillon or International Classification of disease (ICD) in August 1900. The current revision, the ICD-10, consists of three volumes, and for correct coding all three volumes are necessary. It contains the tabular list, definitions and the WHO nomenclature regulations, the manual with extensive description of the classification and methods for use in mortality and morbidity and the alphabetical index. It also contains separate indices for diseases, external causes, and drugs/substances (1).

The aim of the ICD is to categorize diseases, health-related conditions, and external causes of disease and injury in order to be able to compile useful statistics in mortality and morbidity. Its categories are also useful for decision support systems, reimbursement systems, and as a common denominator to be used in language-independent documentation of medical information. The ICD is published by the WHO and used worldwide for morbidity and mortality statistics, reimbursement systems, and automated decision support in health care. This system is designed to promote international comparability in the collection, processing, classification, and presentation of these statistics. (2, 3)

ICD is the foundation for the identification of health trends and statistics globally, and the international standard for reporting diseases and health conditions. It is the diagnostic classification standard for all clinical and research purposes. ICD defines the universe of diseases, disorders, injuries and other related health conditions, listed in a comprehensive, hierarchical fashion that allows for: easy storage, retrieval and analysis of health information for evidenced-based decision-making, sharing and comparing health information between hospitals, regions, settings and countries; and data comparisons in the same location across different time periods (4).

[1] School of Public Health, College of health Sciences, Addis Ababa University, Addis Ababa, Ethiopia
[2]Addis Ababa City Administration Health Bureau, Addis Ababa, Ethiopia

Utilization of international disease classification provides higher-quality information for measuring healthcare service quality, safety, and efficacy. This will in turn provide better data for quality measurement and medical error reduction (patient safety); outcomes measurement; clinical research; clinical, financial, and administrative performance measurement; health policy planning; operational and strategic planning; and healthcare delivery systems design; reporting on use and effects of new medical technology; and managing care and disease processes (3,5,6).

In Ethiopia, before 2005, the Ministry of Health (MoH) used the sixth edition of ICD which was released in 1948, as the national disease reporting system (7). The Ethiopian NCoD was developed as part of HMIS reform with consideration of accommodating code in ICD-10, Integrated Disease Surveillance and Response (IDSR) data, an emerging epidemiological pattern of diseases, advancement in Information Technology (IT) use within the Electronic Health Management Information System (E-HMIS), new program development and public health priorities. NCoD is uniquely designed to the country's context which might contain conditions or disease not listed in ICD-10. It consists of unique identifiers, a tabular list of chapters, lists of diseases and conditions with a total of 21 chapters categorized into five themes. An extended version of NCoD which is ready for hospital-level incorporates 2055 diseases and conditions, though the ICD-10 contains over 70,000 (2,8).

There is limited information about the utilization and related determinants of NCoD by health care professionals at tertiary level Hospitals in Ethiopia. There is poor clinical documentation practice in Ethiopia that do not enhance clinical coding and it doesn't ensure the availability of reliable information for the production of quality and accurate data for patient care. To overcome the aforementioned problems, this study tried to provide a solution by assessing the utilization and challenges of NCoD and its mapping to the ICD-10 in capturing and coding more clinical details.

The sole purpose of mapping the NCoD to ICD-10 was to identify challenges in the use of NCoD and hence, enhance its utilization and improve the reporting system, which will help physicians by providing detailed and accurate documentation for their diagnosis and will ease the use of electronic medical records (9–11). Besides, this approach will be able to provide both the ICD-10 reporting as well as in the NCoD classification. The inability to conform to the international classification of the disease will lead to missing capturing internationally reportable disease as they occur. This study was designed to assess the level of utilization and the challenges of NCoD and its mapping with the ICD-10 at Tikur Anbesa Specialized hospital (TASH).

Material and methods

Study Setting

The study was conducted at TASH in Addis Ababa, Ethiopia, in 2019. TASH opened in 1972 and became the only site for training Medical Doctors. TASH has 203 General Practitioner, 221specialist Physicians, 50 Subspecialist Physicians, 854 Nurses, and 345 other health professionals providing health care services. The hospital also has 900 permanent and contract administration staff to support hospital activities. Besides, almost all regional and federal hospitals in Addis Ababa are affiliated to the School of Medicine as clinical services and training sites. The hospital provides a tertiary level referral treatment and is open 24 hours for emergency services. The hospital is administered by Addis Ababa University. It is the largest and oldest teaching hospital in Ethiopia, providing teaching for about 300 medical students and 350 Residents every year. TASH has more than 750 beds and offers diagnosis and treatment for approximately to 370,000- 400,000 patients a year. TASH has HMIS unit that coordinate the overall activities of data recording, collection and reporting system to support planning, management, and decision making in the hospital.

Design and period

Quasi-experimental study considering "Mapping" as an intervention were employed in this study. Retrospective medical record reviews were carried out to assess the utilization of NCoD and its challenges at TASH for a period of the year 2018 to 2019. Qualitative approach was used to get expert insight on NCoD implementation challenges and design of mapping exercises as an intervention.

Inclusion criteria:

All departments using EMR were included in the study.

Exclusion criteria:

Medical records that were not include full information about the diagnosis finding were excluded.

Sampling

Twenty percent of the medical records from the total of 37,734 were selected randomly using a computerized random number for review in order to insure representativeness. Units in the hospital were selected based on their utilization of electronic medical records since we are trying to understand the utilization and related challenges of medical coding practice in the clinics. A total of sixteen units in the hospital participated in the study: Cardiac clinics, Cardiothoracic department, Central Triage department, Chest & Gastrointestinal department, Diabetic department, Ear Nose and Throat (ENT) department, General Surgery department, Gynecology outpatient department, Hematology department, Neurology department, Neurosurgery department, Psychiatry department, Renal department, Rheumatology department, Staff Clinic, and Urology department.

For the qualitative part, six clinicians who are involved in patient data record using the national disease classification were interviewed with the aim of understanding the utilization and related challenges of medical coding practice in the clinics.

Source document

The source document of the study was one-year medical records extracted from the electronic medical record

dataset. And ICD-10 2019 version and NCoD version 2017 were used to map.

Data collection

A data extraction checklist was developed to collect relevant information on patient electronic records specific on a confirmed diagnosis. Specific disease type of diseases list was obtained from ICD-10. Selected clinicians were asked about their utilization of the national disease classification and its challenges and reasons for preferring ICD-10. Thirty general practitioners for mapping and two senior medical practitioners as supervisor were selected and trained on the objectives of the study, ethical considerations, and data abstraction technique. The data on diagnoses were extracted from the electronic medical record database. Those records with too much missing data or ambiguous recording were removed from the study. HMIS officers extracted one-year medical records and distributed them for data collectors to assess the status of NCoD utilization.

Data management quality and analysis

The data were entered, cleaned, and coded and checked for missing value and inconsistencies. Data obtained from electronic medical records were cross-matched for availability in NCoD and ICD-10. The diagnoses correctly matched and unmatched presented using proportion and frequency to summarize the finding. Data obtained on implementation challenges were narrated. Based on the expert opinion and document review finding, mapping exercise was carried out as intervention. The mapping of disease codes was done by using computer assistance mapping tool. Proportion and percentage value were used to compare between ICD-10 and NCoD and determine the existing discrepancy. Some health professionals were interviewed regarding the possible challenges in the use of NCoD and reason for preference in utilization of ICD-10 the result of which was summarized using excel after creating categories with separate codes.

Ethical Consideration

The researcher views that the ethical consideration is the most important element in the research process. Thus, it was tried to guarantee confidentiality and preserve anonymity of participants of the research. Whenever, necessary pseudo-names were used for participants. The researcher is also by the rules and regulations of the institution and to the moral standards of the institution obliged to avoid any data manufacturing and fraudulent reporting. In addition to the above ones, the researcher also tried not to violate accepted research practice in conducting the research, data analysis, and drawing conclusion and not to violate community or professional standards of conducts.

Results

Finding on NCoD utilization

After the review of health facility medical records, different coding problems were encountered. Out of the total, 40% (3021) of records were miss-classified based on the national classification of disease. From the miss-coded records, 58% of them used ICD code to classify the diagnosis and the rest (42%) were coded using neither ICD nor NCoD. Utilization of international disease classification provides higher-quality information for measuring healthcare service quality, safety, and efficacy. This will in turn provide better data for quality measurement and medical error reduction (patient safety), outcomes measurement, operational planning, and healthcare delivery systems design and reporting (see Table 1).

Table 1: Classification of diagnosis at different clinics in Tikur Anebesa Specialized Hospital, 2020

Clinics	Sample Records	Utilization of ICD-10 and NCoD					
		Miss classified based on NCoD		Diagnosis coded by using ICD		Diagnosis coded by using neither ICD nor NCoD	
		fi	%	fi	%	fi	%
Cardiac	895	376	42%	244	65%	132	35%
Cardiothoracic	77	35	46%	21	60%	14	40%
Central Triage	2369	971	41%	532	55%	437	45%
Chest & Gastro intestinal	572	246	43%	121	49%	124	50%
Diabetic	308	136	44%	96	71%	39	29%
ENT	286	114	40%	63	55%	52	46%
General Surgery	355	114	32%	83	73%	31	27%
Gynecology OPD	737	206	28%	95	46%	111	54%
Hematology	257	93	36%	42	45%	51	55%
Neurology	699	363	52%	236	65%	127	35%
Neurosurgery	221	90	41%	59	66%	32	36%
Psychiatry	70	32	46%	23	72%	10	31%
Renal	240	91	38%	62	68%	29	32%
Rheumatology	126	45	36%	23	51%	23	51%
Staff Clinic	141	44	31%	17	39%	27	61%
Urology	192	65	34%	32	49%	33	51%
Total	7547	3021	40%	1749	58%	1272	42%

Based on our qualitative assessment, most of health professionals did not use NCoD due to different reasons. Reasons provided for poor utilization of NCoD among physicians includes, perception of having a limited list of diagnosis in the NCoD, not being familiarized, inadequate capacity building on NCoD use, absence of enforcing mechanism on the use of standard diagnostic coding and roles & responsibilities between professionals, and the use of the international classification in the education system while the professionals are requested to use the national classification at work place. Furthermore, much emphasis was given for reporting formats by FMOH rather than the quality of disease classification recordings. As a result, most physicians fail to write a diagnosis using NCoD, resulting in the production of a very low-quality report that does not indicate the trends of disease burden using a standard diagnostic protocol. To overcome the problems related to the utilization of national classification of disease and to improve the diagnosis capacity of healthcare workers, ICD-10 codes were mapped to NCoD.

Mapping Approaches

The reference mapping approach was employed with careful consideration of the mapping output and different directions of a crosswalk between ICD-10 and NCoD, to avoid conversion problems. To facilitate "batch mapping" of many codes simultaneously, collaborators at I-Care created an automated stand-alone mapping tool, using the electronic mapping tool "forward," "backward," and "reverse" mapping. The forward and backward mapping methods refer to the intuitive process of determining which code(s) in the target classification correspond to code in the baseline classification. In this study the "forward" and "backward" signifying the NCoD to ICD-10 and the ICD-10 to NCoD directions, respectively. These two methods generally provide the best match in code descriptions. Reverse mapping revealed all codes that map to the original code, even if the original code does not map to them. It can involve either forward or backward applications: using ICD-10 codes in the NCoD to ICD-10 mapping to find all possible NCoD equivalents (reverse forward) or using NCoD codes in the ICD-10 to NCoD mappings to find all possible ICD-10 equivalents (reverse backward).

For example, 1874 "Food in bronchus causing asphyxiation, sequela" maps to 54245 "Asphyxiation" in the forward direction and, conversely, 54245 maps to 1874 in the backward direction. However, in the reverse backward direction, additional codes besides are revealed from reverse mapping. We incorporated all these methods to identify potentially suitable codes for the ICD-10 specifications.

Mapping review processes

First-Stage

The conversion process requires a review of all possible alternative codes and their descriptions. With automated mapping, we focused on reviewing the translation of meaning from ICD-10 to NCoD. Complicating factors included the following: changes in diagnosis specificity, such as encounter information and laterality; the complete revision of procedure codes with root objectives, approaches, and body parts; the absence of diagnoses in procedure codes; the use of multiple codes to represent what conceptually was one procedure in ICD-10; the absence of eponyms; changes in coding guidelines; and the absence of an appropriate code for specific procedures.

To review the automated mapping results of over 72,000 code sets, we convened two workgroups with a total of 32 health and other professionals including physicians and data users familiar with the ICD-10 code sets. Each workgroup had at least one coding expert, who served as a resource person to discuss coding guidelines and practices and to provide explanations as needed.

During October 2019, the workgroups evaluated the mapping results and participated in follow-up consultation calls to discuss all disagreements and to provide specific recommendations. Our team explained the rationale and function of each code set. Senior physicians recommended the deletion of mapped codes and suggested additional codes that were not mapped correctly from the automated tool. Although we attempted to remain faithful to the existing clinical intent of each, diagnosis in ICD-10 do not coincide completely with those in NCoD.

Second-Stage

After merging comments and recommendations for the sample code set, members of the team reviewed all candidate codes and categorized the recommendation. The recommendations included "inappropriate codes" involving clinical concepts that were never intended to be part of the diagnosis specifications. This recommendation intended to align the ICD-10 specifications as closely as possible to those in NCoD to create an "inheritance" version of the specifications. These inheritance specifications would primarily be of interest to users wanting to minimize the impact of the ICD-10 to NCoD transition in measuring performance trends over time.

Third Stage

Our team conducted a third level of clinical review to ensure that the NCoD resulting from the second level of the review was consistent with the original intent for each diagnosis. The primary aims of this review were to ensure consistency across the work of the workgroups and 32 experts who were involved in the first stage of the review process and to cross-check mappings against targeted manual look-up using the indices and tabular lists of NCoD.

ICD-10 and NCoD Mapped

Computer system assisted ICD-10 code was mapped with NCoD. The NCoD was very compressed and not specific. A total of 2055 codes of NCoD were mapped with the ICD-10. When we see chapter I of ICD-10, it contained 1103 diseases and it is 256 in the NCoD (table 2).

Table 2: Mapping of ICD-10 to NCoD by disease type and blocks.

Block	Title	ICD-10	NCoD
A00–B99	Certain infectious and parasitic diseases	1103	256
C00–D48	Neoplasms	1743	64
D50–D89	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	213	15
E00–E90	Endocrine, nutritional, and metabolic diseases	727	104
F00–F99	Mental and behavioral disorders	617	52
G00–G99	Diseases of the nervous system	1078	58
H00–H59	Diseases of the eye and adnexa	1924	50
H60–H95	Diseases of the ear and mastoid process	459	10
I00–I99	Diseases of the circulatory system	1550	100
J00–J99	Diseases of the respiratory system	329	31
K00–K93	Diseases of the digestive system	905	171
L00–L99	Diseases of the skin and subcutaneous tissue	810	94
M00–M99	Diseases of the musculoskeletal system and connective tissue	4744	70
N00–N99	Diseases of the genitourinary system	770	111
O00–O99	Pregnancy, childbirth, and the puerperium	2197	226
P00–P96	Certain conditions originating in the perinatal period	903	129
Q00–Q99	Congenital malformations, deformations, and chromosomal abnormalities	981	67
R00–R99	Symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified	840	168
S00–T98	Injury, poisoning, and certain other consequences of external causes	41556	128
V01–Y98	External causes of morbidity and mortality	6405	28
Z00–Z99	Factors influencing health status and contact with health services	2094	122
U00–U99	Codes for special purposes	4	1

Discussion

Medical coding is the transformation of healthcare diagnosis, procedures, medical services, and equipment into universal medical alphanumeric codes(1). The diagnoses and procedure codes are taken from medical record documentation, such as transcription of physician's notes, laboratory, and radiologic results, etc. Medical coding professionals help ensure the codes are applied correctly during the medical billing process, which includes abstracting the information from documentation, assigning the appropriate codes, and creating a claim to be paid by insurance carriers. Medical coding happens every time you see a healthcare provider. The healthcare provider reviews your complaint and medical history, makes an expert assessment of what's wrong and how to treat you and documents your visit (1,4,8,12,13).

The finding from this study can be used as insight to improve the ability to track outbreaks, monitor patient outcomes of treatment, and improve the capacity to manage population health by studying the trends of disease through enhancing the utilization of a coding system soon. To realize those benefits, it needs implementation strategies for overcoming barriers to transition to the ICD-10-CM coding system(10,14,15). The conduct of this retrospective medical record reviews and qualitative study supported the exploration of strategies used to overcome barriers to transition to the new coding system in TASH.

Improvements in medical errors, identification of top diagnoses for mortality and morbidity, population health, healthcare services planning, and public health decision making are all driven by the classification of diseases and procedures by alphanumeric codes via the ICD(2,16). It is known that FMoH modifies the ICD to the NCoD to accommodate resource allocation and its utility. This NCoD was used in different levels of health facilities since 2017(7).

Clinical codding was associated with primary leadership roles for implementation, a significant responsibility that is in line with their professional knowledge and skill sets. Clinical coding is a specialized skill requiring excellent knowledge of medical terminology, disease processes, and coding rules, as well as attention to detail and analytical skills (10,14,17). It is also consistent with the study done in Nigeria Hospitals that, clinical coding practice is being constrained by inadequate leadership, unmotivated workforce, and suboptimal clinical documentation by relying on paper-based health records system (18).

This study also suggested that tertiary level users of the NCoD demand to use the international classification of

disease to accommodate the specific diagnosis nature of the clients. So, the mapping of NCoD and ICD-10 was done to address the needs of physicians at the tertiary level. The participating physicians seemed ready for the change and wanted a more positive outlook on the change, so the hospital assigns interns to involve in the mapping process. They believe using ICD-10 parallel to NCoD will benefit the health sector.

The lack of standards has been a key barrier to electronic connectivity in health system. Standard clinical terminologies and classifications represent a common medical language, allowing clinical data to be effectively utilized and shared between electronic health records (EHR) systems. Therefore, standard clinical terminologies and classifications must be incorporated into EHR systems to achieve system interoperability and the benefits of a national health information infrastructure. A standard EHR and interoperable national health information infrastructure require the use of uniform health information standards, including a common medical language. Data must be collected and maintained in a standardized format, using uniform definitions, to link data within an EHR system, or share health information between systems(3,12,19).

Maps will standardize the translation of coding systems to a certain extent and therefore improve coding accuracy simply and efficiently. Experts review a code resulting from a map that was successful and necessary to ensure accuracy concerning the context of a specific patient encounter and compliance with applicable coding guidelines and reimbursement policies(20,21).

It is believed that the fully integrated IT systems containing ICD-10 codes as well as NCoD across the hospital and other integrated systems will benefit the health sector in resource allocation and generation of good medical records.

Strength and Limitation of the study

One of the strengths of this study is that it represents a comprehensive finding of different service provision units by having large sample size. Not presenting all the qualitative findings and lack of previous research studies on the topic were the limitations of this study.

Conclusions and recommendation

In conclusion, 2055 categories under NCoD were mapped from ICD-10. Standard ways of coding disease diagnosis and coding of new cases in to the existing category was establish. Besides, as a contribution to the health system, mapping prevented missing and inappropriate recording and reporting habit by cultivating standard ways of procedures hence, produced a reliable data that can be used for actions like determining disease burden and its trend. It was indicated that categories with the highest occurrence but missed in the exiting code can be captured that can be input into the revision of NCoD. Furthermore, the use of NCoD will show the diagnostic capacity of the health facility in terms of human and material resources. Therefore, the impact of the mapping system and its utilization will become increasingly important, both nationally and internationally.

The following recommendations were made by this study for the health system and health professionals.

- Installing an easy way automated system of coding to insure a standard way of coding across the health system.
- Monitoring and evaluate the coding aspect of HIS to strengthen experiential learning practice that will be used for future coding advancement.
- The coding system within NCoD as a curriculum should be incorporated into a teaching material for the school to lay the foundation in the health professionals' competency.
- Health professionals should refer NCoD in their service delivery which will help them to provide quality health care that will help them make evidence-based decisions.

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