A Study on ICD-11 through Mapping to KCD-8
- Focusing on the Circulatory and Respiratory System -

Hyun-Kyung LEE[1], Yoo-Kyung BOO[2]

[1. First Author] Assistant Professor, Department of Health Administration, Jaenueng University, Korea,
Email: lhk2022@jeui.ac.kr
[2. Corresponding Author] Professor, Department of Health Administration, Dankook University, Korea,
Email: dkykb0926@dankook.ac.kr

Abstract

Purpose: This research aims to facilitate a smooth transition from KCD-8 to ICD-11 through the study of ICD-11. **Research design, data and methodology:** Skilled Health Information Managers (HIMs) in Korea performed manual mapping and conducted a study of the code structure of ICD-11 chapters 11 and 12. **Results:** When comparing the granularity between ICD-11 and KCD-8, 58.1% of ICD-11 codes showed higher granularity, and 38.6% had similar granularity. The granularity of the circulatory system was higher than that of the respiratory system. When comparing the KCD-8 codes mapped by ICD-11 with the total 924 KCD-8 codes, it was found that about 50% of KCD-8 codes were not mapped to ICD-11. This means that 50% of diseases in the KCD-8 do not have individual codes as they did in ICD-11. **Conclusions:** ICD-11 demonstrated high granularity, indicating its effectiveness in describing cutting-edge medical technology in modern society. However, we also observed that some diseases were removed from KCD-8, while others were added to ICD-11. To ensure smooth statistics transition from KCD-8 to ICD-11, especially for leading domestic diseases, integrated management, including the preparation of KCD-9 reflecting ICD-11 and ICD-11 training, will be necessary through the analysis of new codes and the removal of codes.

Keywords : ICD-11, KCD-8, Disease Classification, Concept Mapping, Disease Codes

JEL Classification Codes : I00, I10, I12, I18, I19

1. Introduction

Medical Records (MRs) recorded and managed for patient care and treatment are widely used by medical institutions, insurance companies, and research institutes, and are also used as important data for setting and reviewing patient medical services fee (Safran et al., 2007; Lee, 2021; Eastwood et al., 2022). The International Classification of Disease (ICD) provided by the World Health Organization (WHO) has been used to classify diseases in MRs for the past 25 years to ensure comparability and consistent medical data, thereby contributing to the use of various research and statistics in that fields (Chen, et al., 2019; Ibrahim et al., 2022).

After tremendous advances in medical information and technology (Haux, 2006), WHO around 2005 organized a

meeting to revise ICD-11 to flexibly respond to the accelerating development of computers, medicine, and knowledge expression in the 21st century (Chute et al., 2022), and completed ICD-11 after years of research and meetings (Harrison et al., 2021). At the 72nd World Health Assembly (WHA) of WHO in 2019, WHO decided to adopt ICD-11, which became effective and available from January 2022 (Lam et al., 2019; Fiorillo & Falkai, 2021).

Significant features of ICD-11 include providing a web browser and using post- coordination of codes, and it completed an innovative structure for clinical coding by combining extension codes to stem codes or combining various clinical features through a cluster code method that connects stem codes and stem codes (Drosler et al., 2021; Lee & Kim, 2022). Post-coordination of codes is a function introduced to enhance the clinical accuracy of code expression. ICD-11 has the intention of expanding the scope of application of disease codes not only to assign diagnosis names but also to clinical decision-making, medical research, and ontology to expand data analysis using Artificial Intelligence(AI) in a variety of ways by including the causes of patients' diseases, body parts, secondary diseases, and causative substances in the code. This method is almost similar to the post-coordination method of Systematized Nomenclature Of Medicine-Clinical Terms(SNOMED-CT), the most widely used clinically controlled terminology in the Electronic Medical Record System (EMRS), so it is much easier to integrate into the EMRS (Gaebel et al., 2020; Pezzella, 2022).

In Korea, ICD-11 began to use Korean Classification of Disease (KCD) by modifying ICD-10 6th to a Korean version in 1952. In KCD has been using the KCD-8 version since 2021, and it is revised every 5 years to subdivide medical classification and reflect Orphan Diseases (OD) and traditionally oriental medicine diseases to create health statistics that reflect Korea's major health concerns. The National Statistical Office of Korea has conducted ICD-11 research since 2017 for a stable transition from ICD-10 to ICD-11. This study included ICD-11 translation, ICD-11 and KCD mapping, and field test studies targeting Health Information Managers(HIMs) for ICD-11 classification for various diseases have been conducted.

This research was analyzed based on the results of the mapping study of ICD-11 and KCD among the 'International Classification of Diseases, Korea Modified Edition Field Trial 3rd Study - 2020' of the National Statistical Office. The National Statistical Office's research in 2020 was conducted mainly on Disease of the Circulatory System in Chapter 11 of ICD-11 and disease of the Respiratory System in Chapter 12, which is one of

the strains in which the disease classification system has changed the most.

The purpose of this study is to help apply ICD-11 in Korea by organizing the structural differences between ICD-11 and KCD codes and the differences in code subdivision through analysis of ICD-11 and KCD structure and mapping study results on two chapters, chapter 11 (respiratory system) and chapter 12 (circulatory system) of ICD-11.

2. Research Methods and Materials

2.1. Structural Analysis Subject and Research Method

The study was conducted from April to June 2020, involving the mapping of ICD-11 to KCD-8 for 5 Health Information Managers with an average of 10 years or more of disease classification experience in general hospitals and tertiary hospitals.

The mapping targets were chapter 11 (circulatory system) and chapter 12 (respiratory system) of the March 21, 2020 version of ICD-11 MMS (mortality and morbidity), comprising a total of 909 codes, with 559 codes in chapter 11 and 350 codes in chapter 12. The mapping process occurred in two stages. Initially, the 909 codes were divided, and each HIM mapped 200 codes. In the second stage, two HIMs cross-examined the mapping results, and any disagreements were resolved through a full staff meeting. Subsequently, based on a re-analysis of the research results in 2020, the mapping was revised in 2023 to include the ICD-11 MMS (January 2023 version) and KCD-8. In 2023, a total of 937 cases were analyzed in the ICD-11 version, comprising 591 cases for the circulatory system in Chapter 11 and 346 for the respiratory system in Chapter 12.

2.2. Contents of Structural Analysis and Data Analysis

The main focus of the structural analysis was to examine and understand the overall code structure of Chapters 11 and 12 in ICD-11, and then compare it with the code structures of ICD-10 and KCD-8.

To conduct the analysis of the code organizational system, two key aspects were considered. Firstly, the length of codes in ICD-11 was compared with the corresponding codes in ICD-10 and KCD-8. Secondly, the specific contents of each code were mutually analyzed. This included a detailed examination of various items such as code descriptions, the use of post-coordination,

inclusion and exclusion criteria, and coding notes provided alongside the codes. These elements were crucial for understanding how the code structure differed among the three classification systems.

2.2.1. ICD-11 to KCD-8 *Mapping*

The main method used for mapping was to convert ICD-11 codes to KCD-8 codes based on the ICD-11 classification system. The general mapping principle followed was to map one KCD code to one ICD-11 code. However, in some situations where a single ICD-11 code required multiple KCDs to express the same concept accurately, two or more KCD codes were used for mapping. The mapping process also involved categorizing the mapping types into four distinct categories:

1. Same Diagnosis Name mapping was possible when the diagnosis names were identical between ICD-11 and KCD-8.

2. Closest Diagnosis Name mapping was done with the closest diagnosis name when an exact match was not available.

3. One-to-Multiple Mapping: In cases where one ICD-11 code was mapped to two or more KCD-8 codes to express the same concept adequately.

4. Impossible Mapping: Instances where mapping was not feasible due to discrepancies in the classification systems or the absence of suitable KCD-8 codes for a specific ICD-11 diagnosis.

The mapping process involved aligning codes at the same digit level, with the third-character code in ICD-11 being mapped with the subclass code, and the fourth-character code being mapped with the subclass code of another class. If mapping at the same level was not possible, a semantically appropriate mapping was performed, and the mapping type was marked as "impossible" if there was no suitable KCD-8 code for the specific ICD-11 diagnosis.

During mapping, the level of granularity between ICD-11 and KCD-8 was compared. The subdivision of mapping was categorized into three major groups:

1. More Subdivision in ICD-11: Cases where ICD-11 had a higher level of subdivision compared to KCD-8.

2. More Subdivision in KCD-8: Cases where KCD-8 had a higher level of subdivision compared to ICD-11.

3. Similar Subdivision in KCD-8 and ICD-11: Cases where KCD-8 and ICD-11 had a similar level of subdivision.

After the mapping process was completed, the ICD-11 codes and their corresponding mapped KCD-8 codes were arranged and compared with the entire master code set of KCD-8. Additionally, the study reviewed codes that were not mapped to ICD-11 among all KCD-8 codes used in Korea. The types and reasons for codes not being mapped to ICD-11 were analyzed to confirm any cases where the ICD code was missing. Table 1 was used to present the mapping items, the basic ICD-11 code structure, and the content analysis table.

Table 1: Items for ICD-11 Code Analysis and Study

ID	Items	Description	Classification
1	ID		
2	ICDCODE	ICD-11 code	Code
3	TITLE	Code title	Text
5	Description	Whether there is a code description in that code	1: Yes 0 : No
6	Inclusion	Whether there are inclusions in that code	1: Yes 0 : No
7	Exclusion	Whether there are exclusions in that code	1: Yes 0 : No
8	Code also	Whether there is a code also in that code	1: Yes 0 : No
9	Code elsewhere	Whether there is code elsewhere in that code	1: Yes 0 : No
10	Note (Yes/No)	Whether there are notes in that code	1: Yes 0 : No
11	Post-coordination	Whether there is post coordination in that code	1: Yes 0 : No
12	Associated with	Whether there is an associated with in post coordination	1: Yes 0 : No
13	Has manifestation	Whether there is an associated with in post coordination	1: Yes 0 : No
14	Has causing condition	Whether there is an associated with in post coordination	1: Yes 0 : No
15	Laterality	Whether there is an associated with in post coordination	1: Yes 0 : No
16	Specified anatomy	Whether there is an associated with in post coordination	1: Yes 0 : No
17	Infection agent	Whether there is an associated with in post coordination	1: Yes 0 : No
21	Entering KCD code	ICD-11 code and KCD-8 code that can be mapped	KCD-8
22	KCD title	KCD-code title	
23	Results of mapping code analysis of ICD-11 and KCD-8	Granularity	1. Similar 2. ICD-11>KCD-8 3. ICD-11<KCD-8 4. Not comparable
24	Results of mapping code analysis of ICD-11 and	Analysis of KCD mapping type of ICD	1. Same diagnosis mapping 2. Map to the closes codes 3. Map with more than two KCD-8 codes

	KCD-8		4. Unable to map with same depth code 5. unable to map
24	Other comments	Comment on the analysis	Text

2.2.2. Data Used for Analysis

We used below data sets for this study.

- ICD-11 codes (download from WHO ICD-11 MMS 2020. Mar)

- One category ICD-11 to ICD-10 Map -each ICD-11 code maps to only 1 ICD-10 code (Downloaded from WHO ICD-11 website) MMS 2020. Mar

- ICD-11 codes (download from WHO ICD-11 MMS 2023. Jan)

- KCD-8 master table (source from Statistical Office)

- One category ICD-11 to ICD-10 Map -each ICD-11 code maps to only 1 ICD-10 code (Downloaded from WHO ICD-11 website) MMS 2023. Jan

3. Research Results and Discussion

3.1. Comparison of Code Length

ICD-11 and KCD-8 differ in terms of code structure, with varying numbers of digit in their codes. In ICD-11, the codes are categorized into 4-digit, 5-digit, and 6-digit codes. Among these, the most common codes found in chapters 11 and 12 are the 5-digit codes. On the other hand, ICD-10 codes consist of 3-digit and 4-digit codes, with approximately 80% of the codes being 4-digit codes.

Regarding KCD-8 codes in chapter 11 (circulatory system), they consist of 3-digit, 4-digit, 5-digit, and 6-digit codes. The most prevalent type of code is the 4-digit code, accounting for about 67.7% of the codes in this chapter. Furthermore, the 5-digit and 6-digit codes in KCD-8 are exclusively composed of Korean codes.

Within the KCD-8 codes in chapter 11, a total of 107 out of 560 codes, or 19%, are classified as Korean codes. In chapter 12 (respiratory system), KCD-8 codes are structured as 3 digits, 4 digits, and 5 digits. The majority of the codes, approximately 59.9%, are 4-digit codes, and 22.5% are 5-digit codes. All 5-digit codes in this chapter are Korean-type codes, and there are a total of 84 Korean-type codes out of 364 codes, accounting for 23%. For further details and a clear representation of the number of code digits in chapter 11 and chapter 12 is provided in table 2.

Table 2: Comparison of ICD-11, ICD-10, and KCD-8 Code Lengths by Chapters

Chapter	ICD-11			ICD-10		KCD-8			
	Code digit	Frequency	%	Frequency	%	Frequency	Korean modification	Total	%
Chapter 11. Circulatory System	3	-	-	76	16.8	76	-	76	13.6
	4	161	27.2	377	83.2	377	2	379	67.7
	5	291	49.2	-		-	93	93	16.6
	6	139	23.5	-		-	12	12	2.1
	Total	591	100	453	100	453	107	560	100
Chapter 12. Respiratory System	3	-	-	-		-	-	-	-
	4	80	23.1	64	22.9	64	-	64	17.6
	5	193	55.8	215	77.1	216	2	218	59.9
	6	73	21.1				82	82	22.5
	Total	346	100	279	100	280	84	324	100.0

3.2. Analysis of Code Contents of ICD-11

In ICD-11, a significant and notable change is the introduction of descriptive descriptions for code diseases. This means that codes now come with more comprehensive and explanatory descriptions of the corresponding diseases or conditions. Additionally, ICD-11 provides valuable coding notes to assist in the coding process. These coding notes offer helpful guidance and clarifications when assigning the appropriate codes. Moreover, ICD-11 includes information on inclusion and exclusion criteria, as well as suggested codes for use, similar to what is available in KCD-8.

In the context of the code descriptions, 52% of all codes in ICD-11 are accompanied by detailed descriptions of the diseases or conditions they represent. More

specifically, among circulatory codes, 48.7% have descriptive descriptions, and among respiratory codes, this percentage is higher at 57.5%.

within those chapters. Furthermore, ICD-11 offers supplementary information in the form of additional details and specifications. For the circulatory system, there are 19 such pieces of additional information, and for the respiratory system, there are 21 additional details available.

Regarding coding notes, ICD-11 provides 9 coding notes for the respiratory system and 6 coding notes for the circulatory system. These coding notes serve as additional instructions and explanations related to specific codes

To get a more comprehensive view of this data, Table 3 provides a breakdown of the code descriptions, coding notes, and additional information in ICD-11 for both the circulatory and respiratory systems.

Table 3: Code Contents Analysis

Code contents	Chapter 11 Circulatory system		Chapter 12 Respiratory system		Total	
	cases	%	cases	%	cases	%
Description	288	48.7	199	57.5	487	52.0
Inclusion	36	6.1	33	9.5	69	7.4
Exclusion	52	8.8	56	16.2	108	11.5
Code also	-	0.0	-	0.0	0	0.0
Code elsewhere	53	9.0	32	9.2	85	9.1
Coding note	6	1.0	9	2.6	15	1.6

3.3. Postcoordination Analysis

In the total of 937 ICD-11 codes analyzed, postcoordination was presented in 622 cases, with 381 codes in the circulatory system and 241 codes in the respiratory system. This means that approximately 66.4% of the codes had postcoordination applied to them.

Among the postcoordinations suggested in ICD-11, there were a total of fourteen types, including 'associated with,' 'has manifestation,' 'has causing condition,' 'laterality,' and 'specified anatomy.' Among these suggested postcoordinations, the two most frequently used

were "specified anatomy" (25.2%) and "laterality" (20.6%).

In the circulatory system, the most commonly suggested postcoordination was 'specified anatomy' at 34.7%, followed by 'severity' at 14.4%, 'manifestation' at 13.4%, and 'associated' at 12.0%. In contrast, in the respiratory system, the most frequently suggested postcoordination was 'laterality' at 36.1%, followed by 'associated with' at 20.5%, and 'infection agent' at 13.3%.

Table 4 presents a comprehensive analysis of the postcoordination types provided by ICD-11, showing the distribution and frequency of their usage in both the circulatory and respiratory systems.

Table 4: ICD-11 Postcoordination Analysis (chapter 11 and chapter 12)

Post-coordination type	Chapter 11 Circulatory system		Chapter 12 Respiratory system		Total	
	cases	%	cases	%	cases	%
Post-coordination provision	381	64.5	241	69.7	622	66.4
Associated with	71	12.0	71	20.5	142	15.2
Has manifestation	79	13.4	31	9.0	110	11.7
Has causing condition	60	10.2	27	7.8	87	9.3
Laterality	68	11.5	125	36.1	193	20.6
Specified anatomy	205	34.7	31	9.0	236	25.2
Infection agent	4	0.7	46	13.3	50	5.3

Has severity	85	14.4	17	4.9	102	10.9
Has alternative severity	1	0.2		0.0	1	0.1
Course	55	9.3	5	1.4	60	6.4
Temporal pattern and onset	2	0.3		0.0	2	0.2
Casualty	1	0.2	26	7.5	27	2.9
Distribution	4	0.7		0.0	4	0.4
Time in life	1	0.2	3	0.9	4	0.4
Chemical agent	0	0.0	1	0.3	1	0.1
Total	636		383		1,019	

3.4. Comparison of Granularity between ICD-11 and KCD-8

In the circulatory system, out of the 591 cases analyzed, ICD-11 was the most detailed in 411 cases, accounting for 69.5% of the total. In 161 cases (27.2%), ICD-11 and KCD-8 were found to be similar in terms of level of detail. KCD-8 was more detailed than ICD-11 in 15 cases (2.5%).

As for the respiratory system, out of the 346 cases analyzed, 201 cases (58.1%) had a similar level of detail in both ICD-11 and KCD-8. In 133 cases (38.4%), ICD-11 was more detailed than KCD-8. In the remaining 18 cases, KCD-8 was more detailed than ICD-11, with 15 cases from the circulatory system and 3 cases from the respiratory system. There were also 13 cases (1.4%) where a detailed comparison between KCD-8 and ICD-11 was not possible due to mapping limitations between the two systems.

Table 5 provides a comprehensive presentation of the detailed comparison results between KCD-8 and ICD-11 for both the circulatory and respiratory systems. This table illustrates the distribution and frequency of cases where one system was more detailed than the other or where the systems were similar in detail.

Table 5: Comparison of Granularity between ICD-11 and KCD-8

Granularity	Similar		ICD-11>KCD-8		ICD-11<KCD-8		Not comparable		Total
	cases	%	cases	%	cases	%	cases	%	cases
Circulatory system	161	27.2	411	69.5	15	2.5	4	0.7	591
Respiratory system	201	58.1	133	38.4	3	0.9	9	2.6	346
Total	362	38.6	544	58.1	18	1.9	13	1.4	937

In the mapping process between ICD-11 and KCD-8, specific examples demonstrate how the level of detail or subdivision can vary between the two classification systems.

1.   'BC63.0 Atrioventricular block, first degree' of ICD-11 was mapped to 'I44.0 Atrioventricular block, first degree' of KCD-8, and both codes were classified as having the same level of detail.

2.   'CA23.31 Unspecified asthma with status asthmaticus' of ICD-11 was mapped to two codes in KCD-8, 'J45.9 Asthma' and 'J46 asthmaticus.' In this case, ICD-11 was considered more detailed than KCD-8 because it provided a more specific code for the condition.

3.   'CA44 Pyothorax' of ICD-11 was divided into 'J86.0' and 'J86.9' based on the presence of a fistula in KCD-8. As a result, it was mapped with two codes, indicating that KCD-8 was more subdivided than ICD-11 in this particular case.

4.   'CA60 Pneumoconiosis' of ICD-11 did not have a clear subclass code for pneumoconiosis in KCD-8. Therefore, it was mapped to the KCD-8 category 'J60-J70,' and it was considered unclassifiable in detail.

These examples illustrate how the level of detail and subdivision can differ between ICD-11 and KCD-8 for specific medical conditions during the mapping process. Depending on the specific condition and the available

codes in each classification system, one system may be more detailed, or they may have the same level of detail. In some cases, the mapping might result in uncertainty due to differences in code structure or categorization between the two systems.

3.5. Analysis of ICD-11, KCD-8 Mapping Type

In the circulatory system, even though ICD-11 and KCD-8 do not have the exact same diagnosis names, 51.1% of the cases could be mapped with the closest code available. This indicates that despite the differences in naming, there were similarities between the codes that allowed for a close match during mapping. Additionally, 30.8% of cases were successfully mapped with the same diagnosis names, meaning there were instances where the names aligned between the two systems.

Conversely, in the respiratory system, the highest proportion of cases (59.0%) could be mapped with the

same diagnosis name in both ICD-11 and KCD-8. This suggests that there was a significant overlap in the naming of respiratory conditions between the two systems. Furthermore, in 26.6% of cases, mapping was possible with the closest code, indicating that even when the diagnosis names were not exactly the same, there were close matches available for mapping.

Table 6 provides additional insights into the mapping process. It shows that there were a total of 40 cases where one ICD-11 code was mapped with two or more KCD-8 codes, indicating instances where a single ICD-11 code was associated with multiple options in KCD-8. Moreover, there were 87 cases (9.3%) where mapping at the same level was not possible, and 30 cases (3.2%) where mapping between the two systems was not possible at all. These results highlight the complexities and challenges that can arise during the mapping process, particularly when the coding systems differ significantly in their structure and terminology.

Table 6: Results of Mapping Type

Mapping type	Same diagnoses mapping		Map to the closest codes		Map with more than two KCD-8 codes		Mapping unable				Total
							Unable to map with same depth code		Mapping unable		
	cases	%	cases	%	cases	%	cases	%	cases	%	
Circulatory system	182	30.8	302	51.1	22	3.7	64	10.8	21	6.1	346
Respiratory system	204	59.0	92	26.6	18	5.2	23	6.6	9	1.5	591
Total	386	41.2	410	43.8	40	4.3	87	9.3	30	3.2	937

In the case of 'BA40.1 Stable angina' in ICD-11, the heading is different from the corresponding code in KCD-8, which is mapped to 'I20.88 Other forms of angina pectoris.' However, it appears that cases included in the subdiagnosis of 'I20.88' were considered as mapping ICD-11 and KCD-8 to the same diagnosis. This means that despite the difference in the heading or main category, the specific subcategories within 'I20.88' were deemed similar enough to be mapped to the 'BA40.1 Stable angina' in ICD-11.

This mapping approach illustrates how even though the overall heading or category names may not be identical between ICD-11 and KCD-8, the specific subcategories or codes within those headings can align closely enough to facilitate mapping to the same diagnosis. This flexibility in the mapping process allows for a more nuanced and accurate representation of medical conditions across different coding systems. Table 7 likely shows the mapping process and highlights the cases where the subdiagnoses in 'I20.88' were considered equivalent to 'BA40.1' in ICD-11.

Table 7: Comparison of Codes in Stable Angina(cited from KCD-8 and ICD-11)

Classification system	Code	Description
KCD-8	**I20.88**	Other forms of angina pectoris **Stable angina**

	BA40	Angina pectoris
	BA40.0	Unstable angina
ICD-11	**BA40.1**	**Stable angina**
	BA40.Y	Other specified angina pectoris
	BA40.Z	Angina pectoris, unspecified

The mapping process between ICD-11 and KCD-8 can sometimes be complex, especially when the level of detail or the structure of codes differs between the two classification systems. Here are some specific examples and scenarios:

1. When the same diagnosis in ICD-11 could not be directly mapped to a corresponding code in KCD-8, the mapping was performed with the closest code according to the disease classification principle. For instance, 'BA00.1 Isolated diastolic hypertension' in ICD-11 was more detailed than KCD-8. In this case, KCD-8 was mapped to the closest code available, which was 'I10.9 Other and unspecified primary hypertension,' as KCD-8 did not have detailed diagnoses except for hypertension.

2. There were cases where two or more KCD-8 codes were mapped to one ICD-11 code. In one example, 'CA44 pyothorax' in ICD-11 was subdivided into 'J86.0 pyothorax with fistula' and 'J86.9 pyothorax without fistula' in KCD-8. Thus, both KCD-8 codes were mapped together to the single ICD-11 code.

3. Conversely, even if ICD-11 was more detailed than KCD-8, it required two KCD-8 codes to express one ICD-11 code. For instance, 'BD93.10 Lymphoedema due to venous insufficiency' in ICD-11 was expressed using two KCD-8 codes, 'I89.0 Lymphoedema' and 'I87.2 venous insufficiency.'

4. In cases where ICD-11 and KCD-8 had subclass codes that could be mapped with each other, it was considered mapping at the same level. For example, 'BA00 Essential hypertension' in ICD-11 was a subclass code of 'KCD-8 hypertensive disease' and was an incomplete code. To map to the same code digit in ICD-11 from KCD-8, it was mapped with the incomplete code 'I10 Essential (primary) hypertension' rather than the complete code 'I10.9 other and unspecified primary hypertension.'

5. On the other hand, 'ICD-11 BC42 myocarditis' had subclass codes like BC42.0 and BC42.1, but in KCD-8, myocarditis was mapped with the subclass code 'I51.4 myocarditis, NOS.'(Figure 1) This meant that myocarditis was more subdivided in ICD-11 than in KCD-8, and mapping to the same level was considered impossible. There were approximately 100 codes similar to this scenario.
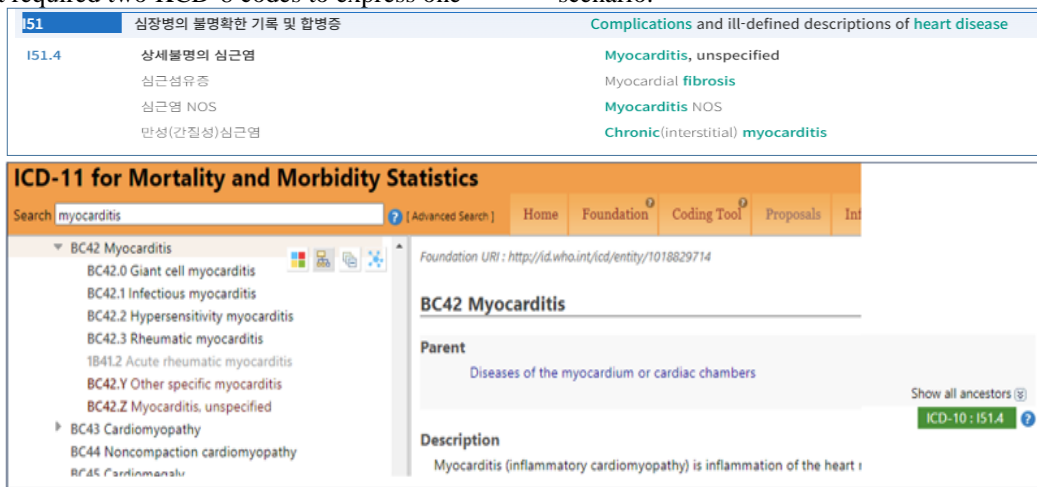

Figure 1: Comparison of Codes for Myocarditis (cited from web browser KOICD and ICD-11)

These examples highlight the intricacies of mapping between different classification systems and the need for careful consideration of the level of detail and structure of codes to ensure accurate representation and alignment of medical conditions.

In some cases, the level of subdivision in ICD-11 can be more detailed than that of KCD-8, leading to challenges in mapping between the two classification systems. One such example is 'BC02 Acquired abnormality of congenitally malformed valve' in ICD-11, which is a new code added after 2020. This code provides detailed diseases related to specific parts, such as 'BC02.1 Acquired truncal valvar abnormality' as a sub-code. However, in the KCD-8 classification, there might not be a single code that expresses both congenital and acquired diseases of the same valve or anatomical part. As a result,

it becomes difficult to find a direct match or equivalent code in KCD-8 for the detailed subdivision provided in ICD-11.

In this situation, where the level of detail is not matched in both classification systems, the code is considered as "unmapping possible" because there is no precise equivalent in the other system. This issue highlights the challenges that can arise when mapping between different code sets, especially when one system offers more granularity and specificity than the other. In such cases, adjustments may be needed in the mapping process, or additional codes may need to be developed or updated in one of the classification systems to ensure comprehensive representation and comparability.

3.6. Mapping Method

The process of mapping between different classification systems, such as ICD-11 and KCD-8, can be complex and challenging. To improve the validity and concordance of the mapping, several approaches have been utilized in various studies.

1.   Natural Language Processing (NLP) tools and mapping algorithms: In the study 'Manual Evaluation of the Automatic Mapping of ICD-11 (in French),' French NLP tools and mapping algorithms were used to map ICD-11 terms and health terms. This approach leverages computational techniques to identify the most lexically similar French terms and map them between the two classification systems.

2.   Round trip method and manual review: The round trip method involves mapping between ICD-10 and ICD-11 to identify equivalent codes. In the comparative analysis of ICD-11, ICD-10, and ICD-10-CM, this method was employed, and the results were verified through limited manual review. This iterative process helps ensure consistency and accuracy in the mapping.

3.   Multiple researchers and consultation: To increase the mapping validity, multiple skilled researchers with substantial disease classification experience were involved in manually mapping ICD-11 and KCD-8. When disagreements arose in the mapping results, coordination and consultation among the researchers were conducted to arrive at a consensus.

4.   Quantified mapping tools and detailed rules: To further enhance the mapping validity and consistency, the use of quantified mapping tools and well-defined rules is recommended. These tools can aid researchers in making precise mappings and reduce discrepancies in the results.

Mapping between different classification systems is a critical step in ensuring interoperability and comparability of health data across various healthcare settings. By employing advanced computational techniques, involving experienced researchers, and implementing standardized mapping approaches, the validity and reliability of the mapping process can be significantly improved.

3.7. Comparison of the Entire Code of the KCD-8 Master Table and the KCD-8 Code Mapped with ICD-11

When we compared the mapped KCD-8 codes with KCD-8 master table, it revealed that a significant proportion of KCD-8 codes of the circulatory and respiratory systems (51% of the total 924 codes) in the KCD-8 master table were missing. It means those codes are not available in ICD-11.

The reasons for codes missing were as follows:

1.   Changes in disease categorization: Some circulatory and respiratory diseases in KCD-8 were later moved to other major categories in ICD-11. For instance, 'J89.0 Cardiovascular syphilis' was moved to '1A62.1' in ICD-11, and 'J09 Influenza due to identified zoonotic or pandemic influenza virus' was moved to '1E31.' This indicates that certain diseases were reclassified from anatomical disease categories to infectious disease categories in ICD-11.

2.   Title disease inclusion in all index terms in ICD-11: In the case of KCD-8, some diseases had their own specific codes, but in ICD-11, these diseases were included as all index terms. This led to the loss of the specific codes for those diseases in some cases. For example, 'J18.1 lobar pneumonia' in KCD-8 was included as an all-index term for 'CA40.Z Pneumonia, organism unspecified' in ICD-11, resulting in the elimination of its own specific code for lobar pneumonia(Figure2).

These reasons highlight the changes and differences in disease categorization and coding practices between the two classification systems, which can lead to challenges in mapping certain codes accurately. Mapping between different coding systems requires careful consideration of the nuances and revisions made in each system, and it is essential to ensure that the mapping process is robust and accounts for any changes in disease classification or coding conventions.

The comparison and mapping between ICD-11 and KCD-8 revealed several cases where the code level did not match due to changes in the depth or hierarchy of disease codes in the two classification systems. For example, the code for 'J01 acute sinusitis' in KCD-8 was changed to the 'CA01' subclass code in ICD-11, and 'I08 multiple valve diseases' was moved from a subcategory to a 'BC00' subcategory. Such changes in code depth or hierarchy can result in challenges during the mapping process.

Additionally, certain existing codes in KCD-8 were removed in ICD-11. However, in cases of secondary

diseases, cause-effect diseases, or connective tissue-linked diseases, post-coordination was used to enable code coordination. This post-coordination approach allows for the expression of complex relationships between diseases using a combination of codes, even if specific codes have been removed or changed in ICD-11.

The study comparing ICD-11 to ICD-10-CM in the United States found that only 60% of the codes could be assigned when mapping ICD-10-CM to ICD-11 for frequent diseases. This highlights the challenges in transitioning between different coding systems and the need for careful consideration when mapping codes between the two systems.

A limitation of the current study is that mapping and structural analysis were not performed for all body systems. However, the research focused on the body system with the most changes, which allows for the methodology and results to be applied to other systems as well. Further research and mapping studies would be valuable to comprehensively assess the compatibility and differences between ICD-11 and KCD-8 in various body systems and to ensure the accuracy and applicability of the mapping process in a broader context.

Figure 2: Comparison of Codes for Lobar pneumonia(modified from web browser KOICD and ICD-11)

4. Conclusions

The mapping results between KCD-8 and ICD-11 showed that 98% of ICD-11 codes were successfully mapped to KCD-8, indicating a high level of compatibility between the two classification systems. ICD-11 was found to be a classification system that allows for more detailed and modern expression of medical information, making it a valuable tool for healthcare and research.

However, around 50% of the KCD-8 codes used in existing statistics and healthcare institutions were not avalable as identical disease titles in ICD-11. Most of those codes were mapped to ICD-11 codes but the previously having been used title of the codes were not available. Sometimes, the specific codes could be made using post-coordination, but for some other codes, it was not possible. Therefore, it needs to be identified whether there would be no problem in disease statictics in the national statstics or local medical institutions even though those codes titles which had been used in KCD-8 are not available in ICD-11. To keep the continuity of the data when converting to ICD-11, It is important to analyze the individual causes for those missing KCD-8 codes and prepare in advance for any potential issues.

The use of post-coordination in mapping could be beneficial in ensuring a smoother transition to ICD-11. By applying post-coordination to diseases frequently used in Korea and creating a mapping table with this approach, the utilization of ICD-11's detailed information can be maximized, reducing confusion during its implementation. The government and the National Statistical Office are taking step-by-step preparations with the aim of using ICD-11 by 2030. A comprehensive review of diseases newly added to ICD-11, diseases to be

deleted from ICD-11, and frequent domestic diseases in KCD-8 will help facilitate a smooth transition to ICD-11.

Given the wide range of users of the disease classification system, including medical institutions, insurance companies, researchers, and policy institutions, careful change management is crucial. This includes education and training for the new system, master data conversion of information systems, and changes in work processes where disease codes are used.

Overall, the successful implementation of ICD-11 requires thorough preparation including analysis of linkage with existing codes, and careful management of changes in various aspects of the healthcare system to ensure a seamless transition and effective utilization of the new classification system.

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