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Development of the Korean Patient Safety Incidents Code Classification System

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Objectives: Attempts to understand patient safety using administrative data in Korea have been rare. This study develops a Korean patient safety incident code classification system and identifies its characteristics to boost diagnosis code usage for assessing patient safety.

Methods: Based on existing literature, we selected Korean Standard Classification of Diseases 7 codes for characterizing patient safety incidents using diagnosis codes. We conducted 2 rounds of review to evaluate the codes applicability to different patient safety incidents using the Delphi method. The verified diagnosis codes were then classified by incident type.

Results: Of the 54,259 Korean Standard Classification of Diseases 7 codes, 4509 were applicable for Korean patients, which were divided into 2435 code groups and 2074 candidate groups. The codes were classified into 6 categories (diagnosis, medication, patient care, operation or procedure, infection related, and other) and then further classified into 35 subcategories. The major categories of patient safety incidents, in the order of frequency, involved medication, fluid and blood related (1719, 38.1%), operation and procedure related (1339, 29.7%), and patient care related (991, 22.0%). Meanwhile, there were only 2 codes related to diagnosis.

Conclusions: Our study provides a basis for estimating patient safety incidents using diagnosis codes. We suggest that gradually increasing the utilization and accuracy of the patient safety incident codes will help develop effective patient safety indicators in Korea similar to other countries. Moreover, clinicians are also needed to be aware of using the developed code classification system.

Key Words: patient safety, patient safety incident, international classification of diseases, clinical coding, adverse event

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Patient safety is the most basic requirement of providing adequate health care.[1,2] However, it is not easy to obtain a comprehensive understanding of patient safety level. Thus, various methodologies such as analyses of medical malpractice litigation,[3] reporting and learning systems for patient safety incidents,[4] assessments of administrative data,[5,6] and review of medical records[7] have been used. Each method has its own strengths and weaknesses, and their interpretations vary depending on the type of patient safety incident.[8] This means that there is no one-size-fits-all approach to quantifying the level of patient safety. It also means choosing an appropriate method according to the purpose of the measurement.

Among the various methods for identifying the patient safety status, the method of analyzing administrative data is an approach that can comprehensively examine the patient safety status at the population level.[9] Approaches to this analysis such as using diagnosis codes for examining insurance claims are relatively inexpensive and easy to perform compared with other methods. Hence, studies examining patient safety by analyzing administrative data have been used to distinguish the various types of patient safety incidents, such as drug adverse effects and healthcare-associated infections.[10,11]

Furthermore, monitoring patient safety incidents using diagnosis codes can also serve as a tool for comparing patient safety in different countries. Attempts to quantify the burden of disease caused by patient safety incidents have been based on methods estimating the burden for different modeling methods.[12,13] In these methods, diagnosis codes play a critical role in defining the incidence or prevalence of patient safety incidents.[14] The aim to compare the global disease burden caused by patient safety incidents implies a need for a monitoring system using diagnosis codes.

However, it is well known that international discrepancies in interpreting and using the *International Classification of Diseases* (*ICD*).[15,16] Previous studies to identify the full range of patient safety incidents using administrative data are limited, and they used their own diagnosis codes in each country such as *ICD*, *Ninth Revision*, *Clinical Modification* (*ICD-9-CM*),[17] *ICD Tenth Revision*, *Australian Modification* (ICD-10-AM),[18] and *ICD Canadian Version* of *10th Revision* (*ICD-10-CA*).[19] Therefore, it is necessary to develop a patient safety incident code classification system in each country and continue to research and develop methods for better comparison by mapping the codes.

In Republic of Korea (hereinafter Korea), there have been attempts to understand patient safety using administrative data. Some studies have aimed at examining the occurrence of 6 types of patient safety incidents using the *ICD-10* codes found in the National Health Insurance Service–National Sample Cohort[5] and introducing patient safety indicators using the Korean National Hospital Discharge In-depth Injury Survey.[20] However, there is still need for conducting a comprehensive exam of patient safety using administrative data. In particular, it is necessary to review whether the administrative diagnosis codes used in previous studies sufficiently cover the various types of patient safety incidents.

Thus, this study aimed to develop and identify the characteristics of a Korean patient safety incident code classification system to more easily identify whether a patient safety incident has occurred using diagnosis codes.

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METHODS

The Concept of the Study

In this study, according to the definition stipulated by the World Health Organization, a patient safety incident was defined as "an event or circumstance that could have resulted, or did result, in unnecessary harm to a patient."[21] That is, the concept of a patient safety incident includes both adverse events and near misses.

This study also assumed that there were data for the present on admission (POA) that identified whether the diagnosis code existed before the time of admission,[22] and if the diagnosis code is considered to have occurred after admission, the code was classified as a patient safety incident. In these cases, the POA of the diagnosis code is tagged as "N."

Figure 1 shows the logical structure that allows us to determine whether a patient safety incident has occurred using the Korean patient safety incident code classification system derived from this study.

Search and Review of Candidate Patient Safety Incident Codes

One researcher mapped the *ICD-10* codes established in previous studies to identify patient safety incidents from 54,259 Korean Standard Classification of Diseases 7 (KCD-7) codes and selected 4557 codes for analysis after eliminating the duplicates.[10,14,19,23] The selected codes were evaluated for the probability score as a patient safety incident as follows: (1) patient safety incident highly likely, (2) patient safety incident likely, (3) possible patient safety incident, (4) previously reported as patient safety incident (cannot exclude the possibility of patient safety incident), and (5) no KCD-7 code available. The codes included after review were used in the Delphi review described hereinafter as candidate codes for the Korean patient safety incident code classification system.

Delphi Review of Candidate Patient Safety Incident Codes

The Delphi review of the candidate codes was conducted by experts with extensive research and practical experience in patient safety and the KCD-7 code classification system. A total of 5 experts participated in the review: 1 emergency medicine specialist, 1 preventative medicine specialist, 2 nursing professors, and 1 health information manager.

Before beginning the review, a meeting was held with the experts to introduce the study content. The first round of the Delphi review involved an anonymized evaluation of the probability of a patient safety incident of the Korean patient safety incident candidate codes. The reviewers used a 4-point rating scale to respond to the following questions: How appropriate is the probability score assigned to the code as a patient safety incident? How much do you agree with that score? The rating scale consisted of the following: strongly agree (1 point), agree (2 points), disagree (3 points), and strongly disagree (4 points). If applicable, reviewer comments for revisions on the probability score as a patient safety incident were collected separately.

In the second round of review, the results from the first round were anonymously shared with the reviewers, giving them the opportunity for suggesting revisions. Each round of the review lasted for approximately 1 month, and on average, 2 reminder emails were sent to the reviewer per round. Reviewer agreement was operationally defined as cases in which the coefficient of variation of the response was less than 0.5. One researcher reviewed and organized the results of the 2 rounds of the Delphi review and developed the Korean patient safety incident codes.

Categorization of Patient Safety Incident Codes

The researchers classified the Korean patient safety incident codes identified through the Delphi review based on the categories used in previous studies.[7,18,19,24–27] The codes were classified

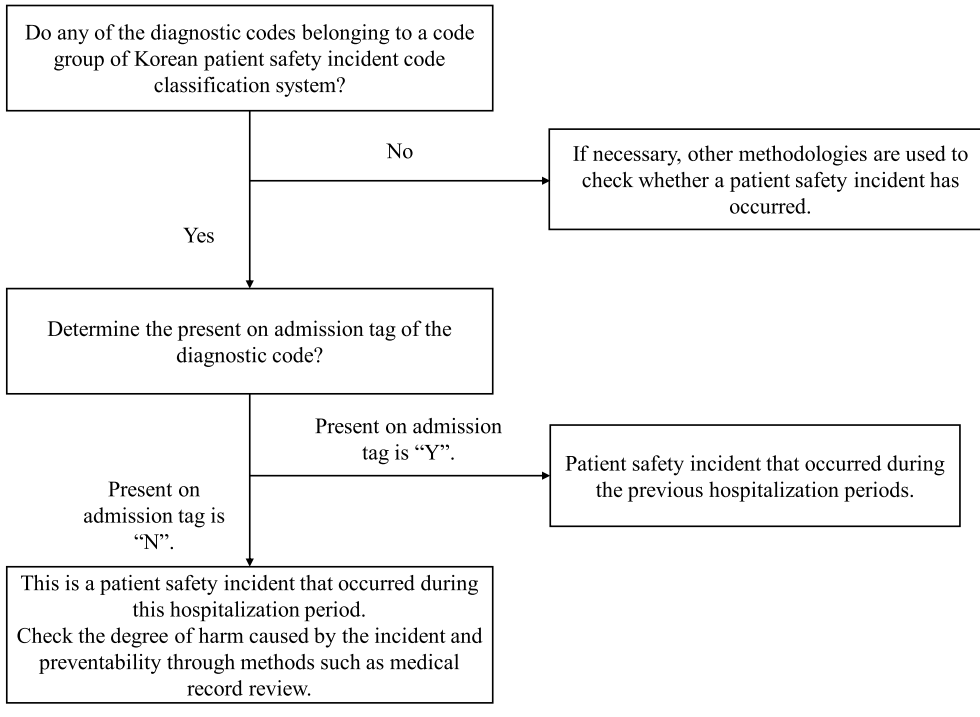

FIGURE 1. Process of determining whether a patient safety incident has occurred based on the patient safety incident code classification system.

into the most appropriate category based on the categorical name, description, and reviewer comments. For instance, if the categorical name, description, or comments included the key word, "drug-induced," the code was classified as a drug-related complication.

In addition, to increase the use of this classification system, the Korean patient safety incident codes were divided into code groups and candidate groups based on the probability score as a patient safety incident. The codes with probability score of 3 or lower were included as the code groups of the Korean patient safety incident code, while those with a score of 4 were included as the candidate groups. Forty-eight codes with the probability score of 5 were excluded, because they could be found in the *ICD-10* codes but not in the KCD-7.

Ethics Committee Approval

This study was approved by the institutional review boards of each participating hospital and of the National Evidence-Based Healthcare Collaborating Agency (approval number: NECAIRB18-020-10).

RESULTS

The Korean Patient Safety Incident Code Classification System

The Korean patient safety incident codes were classified into 6 categories and 35 subcategories (Table 1). The entire list of codes can be found in the supplement (Supplemental File 1, http://links.lww.com/JPS/A529).

The Distribution of Korean Patient Safety Incident Codes Into Categories

There are 4509 Korean patient safety incident codes, of which 2435 belong to code groups (54.0%) and 2074 to candidate groups (46.0%; Table 2). The major categories of patient safety incidents, in the order of frequency, involved medication, fluid- and blood-related (1719 codes, 38.1%), operation- and procedure-related (1339 codes, 29.7%), and patient care–related (991 codes, 22.0%). Meanwhile, there were only 2 codes related to diagnosis. Regarding only the code groups, medication-, fluid-, and blood-related incidents comprised more than half of the 2435 codes (1291

TABLE 1. The Korean Patient Safety Incident Code Classification System

Category	Subcategory
1. Diagnosis-related incidents	1.1 Non-administration of surgical and medical care
2. Medication-, fluid-, and blood-related incidents	2.1 Infusion/injection complications
	2.2 Drug-related complications
	2.3 Transfusion-related complications
	2.4 Others
3. Patient care–related incidents	3.1 Decubitus ulcer
	3.2 Delirium
	3.3 Falls
	3.4 Patient accidents
	3.5 Sequelae of events
	3.6 Others
4. Operation- and procedure-related incidents	4.1 Anesthesia-related complications
	4.2 Hemorrhage-related complications
	4.3 Puncture/amputations/injuries during the procedure
	4.4 Foreign body or substance left following the procedure
	4.5 Disruption and infection of operation wound
	4.6 Pregnancy- and childbirth-related complications
	4.7 Implants-related complications
	4.8 Procedure-related complications
	4.9 Post-procedural complications
	4.10 Medical device–related complications
	4.11 Radiation-related complications
	4.12 Other complications
5. Infection-related incidents	5.1 Sepsis
	5.2 Pneumonia
	5.3 Intestinal infectious diseases
	5.4 Urinary tract infection
	5.5 Infectious agents
	5.6 Other infections
6. Others	6.1 Endocrine, nutritional, and metabolic disease
	6.2 Circulatory system diseases
	6.3 Respiratory system diseases
	6.4 General symptoms and signs
	6.5 Patient status

TABLE 2. Patient Safety Incident Categories With Code Numbers of PSI Codes

	Total		Code Group		Candidate Group	
Categories	**n**	**%**	**n**	**%**	**n**	**%**
1. Diagnosis-related incidents	2	0.0	2	0.1	0	0.0
2. Medication-, fluid-, and blood-related incidents	1719	38.1	1291	53.0	428	20.6
3. Patient care-related incidents	991	22.0	53	2.2	938	45.2
4. Operation- and procedure-related incidents	1339	29.7	973	40.0	366	17.6
5. Infection-related incidents	203	4.5	108	4.4	95	4.6
6. Others	255	5.7	8	0.3	247	11.9
Total	4509	100.0	2435	100.0	2074	100.0

PSI, patient safety incident.

codes, 53.0%); 973 codes (40.0%) were medication-, fluid-, and blood-related incidents, and 53 (2.2%) codes were related to patient care.

Distribution of Korean Patient Safety Incident Codes Into Subcategories

Table 3 presents the Korean patient safety incident codes as subcategories. In the case of diagnosis-related patient safety incidents, there was only 1 subcategory—"nonadministration of surgical and medical care"—and 2 codes, both of which were in the code group. In medication-, fluid-, and blood-related incidents, "drugs-related complications" was the most common category, having 1119 codes. In contrast, "infusion/injection complications" consisted of only 35 codes, but all were included in the code group. Patient care–related incidents were mainly classified as patient accidents, but only 29 codes were included in the code group. Operation- and procedure-related incidents involved 333 "postprocedural complications" and 225 "pregnancy and childbirth-related complications." Not only are these numbers of codes quite substantial, but most of the codes in these subcategories were classified into the code group, which indicated a high probability of patient safety incidents. Although there were 202 codes in "puncture/amputations/injuries during procedures," only around a quarter of these were classified into the code group. For infection-related incidents, "other infections" were the most common with 119 codes. Although 26 codes were identified for "sepsis," a hospital-acquired infection, all of them were classified as candidates. Meanwhile, all 21 codes for "pneumonia" were classified as codes. For "other" patient safety incidents, many of the codes were pertaining to diseases or patient conditions, and most were classified as candidate codes.

Distribution of Korean Patient Safety Incident Codes Through KCD-7 Classification

The code and candidate groups comprised 4.5% (2435 codes) and 3.9% (2074 codes) of the 54,259 KCD-7 codes, respectively (Table 4). More specifically, an exam of the distribution of the Korean patient safety incident codes through KCD-7 classification revealed that "injury, poisoning, and other specific outcomes (S00–T98)" was the most common at 27.7%, followed by "extrinsic cause of morbidity and mortality (V01–Y98)" (16.1%) and "diseases of the musculoskeletal system and connective tissue (M00–M99)" (11.2%). An exam of the Korean patient safety incident codes through the KCD-7 classification demonstrated that 14.0% of the "pregnancy- and childbirth-related complications (O00–O99)" were considered codes, which made up the highest proportion. The second most prevalent KCD-7 classification was "specific conditions originating from the perinatal period (P00–P96)." With reference to the KCD-7 classification, 14.8% of the candidate codes in "factors affecting health status and exposure to health services (Z00–Z99)" and 14% of the candidate codes in "injury, poisoning, and other specific outcomes (S00–T98)," which made up a high proportion of the candidate group.

DISCUSSION

This study developed a Korean patient safety incident code classification system and examined its characteristics. Among 54,259 KCD-7 codes, 4509 were identified as Korean patient safety incident codes after a literature review, Delphi review, and deliberation among the researchers. The identified codes were then further classified into a code group (2435 codes, likely patient safety incident codes) and a candidate group (2074 codes, used as patient safety incident codes in other studies). Until now, there has not been any classification system for diagnosis codes in Korea that can comprehensively monitor the status of patient safety incidents. Indeed, this study is significant, in that the study outcomes can serve as a key clue for judging patient safety incidents using diagnosis codes.

Despite the strengths of diagnosis code-based methods in examining the incidence of patient safety incidents,[8,9] there has been a paucity of studies that review and classify diagnosis codes to obtain a comprehensive understanding of the occurrence of patient safety incidents. This study developed a Korean patient safety incident code classification system through a rigorous review process. First, a literature review was conducted to identify the various adverse drug events, including a systematic review of the *ICD-10* codes,[10] and the studies that aimed to obtain a comprehensive understanding of patient safety incidents using diagnosis codes.[14,18,19,23,26] Subsequently, the literature was reviewed by several experts from various fields experienced in patient safety and the Korean patient safety incident code classification system using the Delphi method. This methodology may be applied in future studies for developing and revising the patient safety incident code classification systems for other countries.

If any of the diagnosis codes belong to the code group of the patient safety incident code classification system, it may be possible to question whether a patient safety incident has occurred (Fig. 1). However, if the POA of the code is "N," it will be a patient safety incident that occurred during this hospitalization period. For example, even if a patient with decubitus ulcer was assigned the code "L890," if the POA for the code was "Y," it would be considered a previously occurring and not yet treated decubitus ulcer. If the POA is "N," additional characteristics of the patient safety incident should be identified through other additional methods, such as medical record review. In some cases, the degree of harm to the patient or the presence or absence of an error can be inferred

TABLE 3. Patient Safety Incident Subcategories With Code Numbers of PSI Codes

	Total		Code Group		Candidate Group	
Subcategories	**n**	**%**	**n**	**%**	**n**	**%**
Diagnosis-related incidents						
Nonadministration of surgical and medical care	2	0.0	2	0.1	0	0.0
Medication-, fluid-, and blood-related incidents						
Infusion/injection complications	35	0.8	35	1.4	0	0.0
Drug-related complications	1119	24.8	950	39.0	169	8.1
Transfusion-related complications	15	0.3	14	0.6	1	0.0
Others	550	12.2	292	12.0	258	12.4
Patient care–related incidents						
Decubitus ulcer	14	0.3	14	0.6	0	0.0
Delirium	14	0.3	5	0.2	9	0.4
Falls	3	0.1		0.0	3	0.1
Patient accidents	955	21.2	29	1.2	926	44.6
Sequelae of events	1	0.0	1	0.0	0	0.0
Others	4	0.1	4	0.2	0	0.0
Operation- and procedure-related incidents						
Anesthesia-related complications	74	1.6	73	3.0	1	0.0
Hemorrhage-related complications	11	0.2	3	0.1	8	0.4
Puncture/amputations/injuries during procedure	202	4.5	36	1.5	166	8.0
Foreign body or substance left following the procedure	21	0.5	20	0.8	1	0.0
Disruption and infection of operation wound	5	0.1	3	0.1	2	0.1
Pregnancy- and childbirth-related complications	225	5.0	221	9.1	4	0.2
Implant-related complications	135	3.0	97	4.0	38	1.8
Procedure-related complications	63	1.4	33	1.4	30	1.4
Post-procedural complications	331	7.3	320	13.1	11	0.5
Medical device–related complications	67	1.5	67	2.8	0	0.0
Radiation-related complications	24	0.5	23	0.9	1	0.0
Other complications	181	4.0	77	3.2	104	5.0
Infection-related incidents						
Sepsis	26	0.6		0.0	26	1.3
Pneumonia	21	0.5	21	0.9	0	0.0
Intestinal infectious diseases	16	0.4	3	0.1	13	0.6
Urinary tract infection	2	0.0	2	0.1	0	0.0
Infectious agents	19	0.4	9	0.4	10	0.5
Other infections	119	2.6	73	3.0	46	2.2
Others						
Endocrine, nutritional, and metabolic disease	79	1.8	6	0.2	73	3.5
Circulatory system diseases	73	1.6	2	0.1	71	3.4
Respiratory system diseases	4	0.1		0.0	4	0.2
General symptoms and signs	4	0.1		0.0	4	0.2
Patient status	95	2.1		0.0	95	4.6

from the title of diagnosis code, but in most cases, it is difficult to grasp the specific characteristics of the patient safety incident. This can be seen as a limitation of administrative data that does not contain clinical context.[8,9]

To monitor patient safety using diagnosis codes, it is necessary to not only develop a code classification system but also increase its utilization and ensure its accuracy.[28–30] This means that clinicians who would use the patient safety incident codes must be aware of the existence of such codes and implement them in the diagnosis process in the event of an incident. Furthermore, POA codes, which contain information that enables an estimation of the time at which the diagnosis code was generated, must be inputted accurately. Nevertheless, it is presumed that the accuracy of the POA codes is rather low, in addition to the fact that physicians often overlook inputting patient safety incident codes.[6] Thus, to increase the utility of the code classification system developed in this study, the accuracy of patient safety incidents and POA code recordkeeping must first be achieved.

Suggestions to improve recordkeeping may include using indicators that evaluate the accuracy of patient safety incidents or POA codes, rather than those evaluating the occurrence of patient safety incidents. In addition, it is necessary to conduct regular education on the correct input of patient safety incident codes and POA codes for healthcare professionals, especially clinicians. Notwithstanding some controversies, as in the United States, not paying compensation for certain patient safety incidents can also be a strategy to increase coding accuracy.[31,32]

TABLE 4. Korean Standard Classification of Diseases 7 Categories With Code Numbers Included in PSI Codes

Category	KCD-7 Codes	PSI Codes					
		Total		Code Group		Candidate Group	
	n	n	% Category Included	n	% Category Included	n	% Category Included
1 Infectious and parasitic diseases (A00–B99)	2212	140	6.3	88	4.0	52	2.4
2 Neoplasms (C00–D48)	2084	0	0.0	0	0.0	0	0.0
3 Blood diseases (D50–D89)	572	73	12.8	62	10.8	11	1.9
4 Endocrine (E00–E90)	3054	194	6.4	121	4.0	73	2.4
5 Mental and behavioral (F00–F99)	1669	183	11.0	42	2.5	141	8.4
6 Nervous system (G00–G99)	1049	91	8.7	83	7.9	8	0.8
7 Eye and adnexa (H00–H59)	1104	105	9.5	25	2.3	80	7.2
8 Ear and mastoid process (H60–H95)	397	13	3.3	12	3.0	1	0.3
9 Circulatory system (I00–I99)	1235	167	13.5	75	6.1	92	7.4
10 Respiratory system (J00–J99)	1002	88	8.8	56	5.6	32	3.2
11 Digestive system (K00–K93)	2162	248	11.5	219	10.1	29	1.3
12 Skin and subcutaneous tissue (L00–L99)	887	76	8.6	58	6.5	18	2.0
13 Musculoskeletal system (M00–M99)	17,455	505	2.9	417	2.4	88	0.5
14 Genitourinary system (N00–N99)	1279	86	6.7	54	4.2	32	2.5
15 Pregnancy and childbirth (O00–O99)	1392	199	14.3	195	14.0	4	0.3
16 Perinatal (P00–P96)	724	99	13.7	90	12.4	9	1.2
17 Congenital abnormalities (Q00–Q99)	1634	3	0.2	3	0.2	0	0.0
18 Symptoms NEC (R00–R99)	1341	61	4.5	13	1.0	48	3.6
19 Injuries (S00–T98)	6067	1247	20.6	399	6.6	848	14.0
20 External causes of morbidity and mortality (V01–Y98)	5238	727	13.9	420	8.0	307	5.9
21 Factors influencing health status (Z00–Z99)	1355	204	15.1	3	0.2	201	14.8
22 Codes for special purpose (U00–U99)	347	0	0.0	0	0.0	0	0.0
Total	54,259	4509	8.3	2435	4.5	2074	3.8

PSI, patient safety incident.

In particular, to ensure the accuracy of patient safety incidents and POA codes, it is important to match the classification system with investigations using other patient safety monitoring methods. The classification system developed in this study is consistent with that of the Korea National Patient Safety Incidents Inquiry Survey using the medical record review.[7] The accuracy of the patient safety incident and POA codes may be evaluated through codes related to patient safety incidents in the diagnosis codes of patients identified in the National Patient Safety Incidents Inquiry Survey, along with determining whether the POA code is "N."[6]

The scarcity of diagnosis-related patient safety incident codes is one major limitation of the developed patient safety incident code classification system. Among the 4509 patient safety incident codes, only 2 codes related to diagnosis were grouped under "nonadministration of surgical and medical care," which were not enough to cover all of the various diagnosis-related patient safety incidents. There is an additional need for diagnosis-related codes, such as those related to delayed or inaccurate diagnoses. Although, in this study, the diagnosis codes currently used were classified inductively, in the future, it may be necessary to develop codes specific to patient safety incidents. In addition, if an investigation is conducted to find patient safety incidents related to diagnosis, it seems more reasonable to use other methods such as interviews with patient and medical professionals rather than administrative data analysis.[24,25]

Another limitation is that the patient safety incident codes developed did not quantitatively examine the incidence of patient safety incidents. Although it was presumed that the utilization and accuracy of codes related to patient safety incidents were rather low in Korea,[5,6] it may be important to identify which types of codes are more or less used. In the future, it may be needed to evaluate the applicability of the patient safety incident code classification system using the National Health Insurance Service or Health Insurance Review and Assessment databases.

CONCLUSIONS

We developed a Korean patient safety incident code classification system for monitoring patient safety incidents through a rigorous review process using diagnosis codes found in administrative data. In Korea, no data have been collected on patient safety incidents, which were requested by the Organization for Economic Cooperation and Development, aside from the incidence of sepsis after abdominal surgery.[33] This study provided the basis for examining the incidence of various patient safety incidents using diagnosis codes. We suggest that by gradually increasing the utilization and accuracy of the patient safety incident codes, patient safety indicators comparable with other countries may be established. Furthermore, it will be necessary to increase clinicians' awareness regarding the code classification system developed in this study.

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