

# International variation in the definition of ‘main condition’ in ICD-coded health data

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## Abstract

Hospital-based medical records are abstracted to create International Classification of Disease (ICD) coded discharge health data in many countries. The ‘main condition’ is not defined in a consistent manner internationally. Some countries employ a ‘reason for admission’ rule as the basis for the main condition, while other countries employ a ‘resource use’ rule. A few countries have recently transitioned from one of these approaches to the other. The definition of ‘main condition’ in such ICD data matters when it is used to define a disease cohort to assign diagnosis-related groups and to perform risk adjustment. We propose a method of harmonizing the international definition to enable researchers and international organizations using ICD-coded health data to aggregate or compare hospital care and outcomes across countries in a consistent manner. Inter-observer reliability of alternative harmonization approaches should be evaluated before finalizing the definition and adopting it worldwide.

**Keywords:** standards, measurement of quality, benchmarking, international classification of disease

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## Background

Hospital records contain rich demographic and clinical information, including patient age, sex, weight, medical history, diagnoses, procedures, treatments given, consultations, diagnostic test results and other clinical events. In many countries, these medical record data are abstracted to create coded health data, which are widely used for disease surveillance, case-mix costing, tracking healthcare system performance, policy-making and research [1].

Diagnoses in coded health data are classified using the International Classification of Diseases (ICD) or its clinical modifications, such as ICD-9-CM in the USA, Spain and Italy, ICD-10-AM in Australia and New Zealand, ICD-10-GM in Germany and Switzerland, and ICD-10-CA in Canada [2]. A coded health data record can have a varying number of diagnostic codes. One of these diagnoses is coded as the main condition, which may also be known as the ‘main diagnosis’, ‘major diagnosis’, ‘primary diagnosis’, ‘principal diagnosis’, ‘most responsible diagnosis’ and ‘discharge diagnosis’.

The current definition of the main condition in the most recent edition of the World Health Organization (WHO) ICD-10 [3] is: ‘the condition, diagnosed at the end of the episode of health care, primarily responsible for the patient’s need for treatment or investigation. If there is more than one such condition, the one held most responsible for the greatest use of resources should be selected. If no diagnosis was made, the main symptom, abnormal finding or problem should be selected as the main condition’. The selection of the main condition is ultimately the responsibility of the physician caring for the patient, but in some countries, health record coders select the main condition based on their own review of clinical documentation recorded in medical records by physicians and others. Note that the current WHO definition does not stipulate whether the ‘main condition’ must be present at the beginning of the hospital admission.

In 2017, the WHO plans to release the 11th revision of the ICD [4]. Key components of the revision process are ‘Topic Advisory Groups’ (TAGs), which serve as the planning and coordinating advisory bodies for specific issues that are key

**Table 1** Main condition definition in ICD-coded health data

Country	Definition	Respondents (consistent answers)	Coding system
Australia	Reason for admission	3 (Yes)	ICD-10
Belgium <sup>a</sup>	Reason for admission	1	ICD-9
Brazil	Resource use	1	ICD-10
Canada	Resource use (reason for admission in Province of Quebec)	2 (Yes)	ICD-10
China	Reason for admission	2 (Yes)	ICD-10
Denmark	Resource use	1	ICD-10
Finland <sup>a</sup>	Resource use	2 (No)	ICD-10
France	Reason for admission (changed in 2009)	1	ICD-10
Germany	Reason for admission (Changed in 2001)	2 (No)	ICD-10
Iceland	Resource use	1	ICD-10
Ireland <sup>a</sup>	Reason for admission	1	ICD-10
Italy <sup>a</sup>	Resource use	4 (No)	ICD-9-CM
Japan	Resource use (changed in 2002)	1	ICD-10
Latvia <sup>a</sup>	Reason for admission	1	ICD-10
Mexico	Resource use	2 (Yes)	ICD-10
Netherlands	Reason for admission	2 (Yes)	ICD-9-CM/ ICD-10
New Zealand	Reason for admission	1	ICD-10
Nicaragua	Reason for admission	1	ICD-10
Norway	Resource use	1	ICD-10
Portugal <sup>a</sup>	Reason for admission	1	ICD-9
Singapore <sup>a</sup>	Reason for admission	1	ICD-9
South Africa	Resource use	2 (Yes)	ICD-10
South Korea	Reason for admission (changed in 2012)	3 (No)	ICD-10
Spain <sup>a</sup>	Reason for admission	1	ICD-9
Sweden	Reason for admission	4 (No)	ICD-10
Switzerland	Resource use	2 (No)	ICD-10
Thailand	Resource use	1	ICD-10
UK	Reason for admission	1	ICD-10
USA	Reason for admission	2 (Yes)	ICD-9-CM
Venezuela	Resource use	1	ICD-10

<sup>a</sup>Note: from the OECD survey.

topics in the revision process. In addition to the ‘vertical’ TAGs that have responsibility for specific sections or chapters of the classification (e.g. mental health, oncology), there are ‘horizontal’ TAGs that focus on ‘use cases’ that crosscut the sections of the ICD. The Quality and Safety TAG (QS-TAG), one of the horizontal TAGs, has been charged with proposing concepts and defining terms to support the quality and safety ‘use case’ for ICD-11 implementation. As part of this process, the TAG discussed several desirable meta-features of morbidity data sets, such as the number of allowable diagnoses, the reporting of diagnosis timing and the preferred definition of main condition.

In this paper, we describe how the ‘main condition’ is currently defined across countries, explore the impact of these definitions on research and analysis, and present QS-TAG recommendations for international harmonization of the definition.

### Defining ‘main condition’

There are two definitions that have been used for the ‘main condition’ in ICD-coded health data: a ‘resource use’ definition and a ‘reason for admission’ definition. We conducted two online surveys among members of the WHO Family of International Classification (WHO-FIC) Network [5], the International Methodology Consortium of Coded Health Information (www.IMECCHI.org) and TAGs in 2012, and member countries of the Organisation for Economic Co-operation and Development (OECD) that voluntarily participated in patient safety data collection in 2009. Our survey uncovered inconsistencies across countries and within countries (Table 1). Several countries have established specific definitions for the main condition.

In Canada, the ‘most responsible diagnosis’ is the one diagnosis or condition that can be described as being most

responsible for the patient's stay in hospital. If there is more than one such condition, the one held most responsible for the greatest portion of the length of stay or greatest use of resources (i.e. operating room time, investigative technology, etc.) is selected. If no definite diagnosis was made, the main symptom, abnormal finding or problem should be selected as the 'most responsible diagnosis' [6].

In the USA, the term 'principal diagnosis' is used and is defined as 'that condition established after study to be chiefly responsible for occasioning the admission of the patient to the hospital for care' [7]. When there are two or more interrelated conditions (such as diseases in the same ICD-9-CM chapter or manifestations characteristically associated with a certain disease) potentially meeting the definition of principal diagnosis, either condition may be sequenced first, unless the circumstances of the admission, the therapy provided, the tabular list (of ICD-9-CM codes) or the alphabetic index (to ICD-9-CM) indicate otherwise [7].

In Australia, the definition for main condition is: 'The diagnosis established after study to be chiefly responsible for occasioning an episode of admitted patient care, an episode of residential care or an attendance at the health care establishment, as represented by a code' [8]. As Germany adopted the Australian reimbursement system with its coding rules in 2003, the German definition closely corresponds to the Australian [9].

In Korea, the main condition is defined as the condition that is, finally diagnosed after study, most responsible for the patient's admission or visit to a healthcare facility [10].

In South Africa, 'the main condition is defined as the condition, diagnosed at the end of the episode of healthcare, primarily responsible for the patient's need for treatment or investigation. It is the 'main condition treated'. If there is more than one 'main condition treated', then the most clinically severe or life-threatening condition should be selected. If this cannot be established then the condition held most responsible for the greatest use of resources should be selected. The coder should revert to the default rule that allows the selection of the first condition recorded by the responsible clinician in circumstances where there is more than one 'main condition' treated and no information is available to determine which of the conditions is the most severe or life threatening, or which one is responsible for the greatest use of resources. If no diagnosis was made, the main symptom, abnormal finding or problem should be selected as the 'main condition'.

Finally, some countries have recently gone through some definition changes. France changed its definition from 'resource use' to 'reason for admission' in 2009, Korea changed its definition similarly in 2012 and Japan changed its definition from 'reason for admission' to 'resource use' in 2002.

## Matters of main condition definition

Differing definitions for the 'main condition' can impact the validity and usability of ICD-coded health data both within countries and in international comparisons. Many countries use ICD-coded health data for estimating disease burden, defining research cohorts, adjusting for severity of illness in assessing

quality and safety, and paying hospitals and physicians. Clearly, understanding which of these definitions of 'main condition' is being used is important to data users, because the main condition coding rule can influence case selection and inferences made from coded health data.

The implications of defining main condition in terms of 'resource use' versus 'reason for admission' may be clarified by the following clinical scenario: a patient visits the Emergency Department due to severe chest pain and is admitted to hospital. Shortly after admission, it is confirmed that the chest pain is caused by an acute myocardial infarction (AMI). After treatment, the chest pain resolves, but the patient suffers a cardio-embolic stroke and his or her hospital stay is extended significantly (i.e. more than doubled in duration) due to the stroke. The patient has diabetes and hypertension on admission.

In this clinical scenario, AMI is the 'reason for admission' because the symptom chest pain is the clinical manifestation of an AMI, which is diagnosed shortly after admission. The main condition is AMI based on the 'reason for admission' definition, with stroke, diabetes and hypertension coded in the secondary diagnosis fields. If the main condition is defined according to 'resource use', then it would be coded as the stroke suffered after admission, rather than the initial diagnosis of AMI that prompted the admission to hospital. In this 'resource use' definition, the AMI, diabetes and hypertension would be coded in the secondary diagnosis fields. Problems arise when data collected under the 'resource use' definition for main condition are used for secondary purposes such as estimating AMI disease burden or defining AMI study cohorts. For example, to examine the incidence of AMI, researchers extracted all hospital separations with the main condition diagnosis field coded with the ICD-9 root code '410' or the ICD-10 root code 'I21' [11, 12]. This method underestimates the true population incidence of AMI when the 'resource use' definition underlies the coding of the main condition. Furthermore, a cohort of AMI cases selected in the context of a 'resource use' definition for main condition would only capture the subset of actual AMI admissions for which there was no later complication or secondary diagnosis that consumed more hospital resources. The result would be an outcome-based subset of AMI cases.

Statistical adjustment for disease severity at admission is generally required in outcomes research, report cards or measurement of performance. Such adjustment is usually performed using ICD-coded algorithms, as in the Charlson index and the AHRQ (Elixhauser) comorbidity coding algorithm [13–15]. When defining these comorbidities for risk adjustment, conditions that arise after admission should be excluded. Most countries, with the notable exceptions of Australia, Canada and the USA, do not require the coding of diagnosis timing (called 'diagnosis onset type' in Australian data, 'present on admission' in US data, and 'diagnosis type' in Canadian data). In the absence of such a flag of diagnosis timing, researchers often assume that the main condition was present on admission, and then treat conditions coded in the secondary diagnosis fields as comorbidities for risk adjustment [16]. For example, in our clinical scenario presented above, using the 'resource use' definition, stroke would be assigned as the main condition and AMI as comorbidity to be used in risk

adjustment. The fact that the stroke occurred following hospitalization would be missed if it were coded as the main condition.

Disease grouping methods based on ICD-coded health data have been developed for hospital payment. These methods are commonly known as diagnosis-related groups (DRGs). Several countries have developed their own DRG approaches; for example, the US uses Medicare-Severity DRGs (MS-DRGs) to classify inpatients into one of 751 groups [17] based on ICD-coded diagnoses, procedures, age, sex and other clinical information. The purpose of DRGs is to group hospitalizations that are expected to use similar levels of hospital resources. Other country-specific DRG systems include Australian Refined Diagnosis Related Groups in Australia, Case Mix Groups (CMG) in Canada, Diagnosis–Treatment Combinations in the Netherlands and Healthcare Resource Groups in the UK [18–20]. Commercial vendors have developed DRG-based systems that can be applied to pediatric as well as adult populations, and used to adjust for severity of illness, such as 3M's All Patient Refined DRGs (APR-DRGs). For all such systems, main condition definitions are of crucial importance to the grouping methodology. For example, the CMG method assigns inpatients to one of 25 mutually exclusive major clinical categories (MCC) based on 'main condition', then further classifies them according to age group and complexity level based on ICD diagnosis and procedure codes in the remaining fields. Patients in the same CMG are assumed to be relatively homogeneous. For our clinical scenario, the patient would be assigned to MCC 05 (Circulatory System) and CMG 194 (Myocardial Infarction/Shock/Arrest without Coronary Angiogram) given data coded with the 'reason for admission' definition for main condition. Given the 'resource use' definition, however, the case would be assigned to MCC 01 (Nervous System) and MCG 025 (Hemorrhagic Event of Central Nervous System). Such differences in the CMG grouper assignment will generate a very different weight in the calculation of estimated cost.

## Harmonizing the main condition definition

The QS-TAG recommends that the term 'main condition' should be discarded in the context of ICD-coded hospital data because its definition is inconsistent and confusing. It should be replaced with more explicit terms for the 'condition leading to admission' or the 'condition leading to the most resource use'. Ideally, all countries undertaking ICD coding of hospital episodes would code both the 'reason for admission' and 'resource use' as key conditions in their ICD-coded health data. For countries that define main condition according to 'resource use', the 'condition leading to admission' could be incorporated as a supplementary designated field. Similarly, a specially designated field for the 'condition leading to the most resource use' could be added to the data of countries that use 'reason for admission' as the main condition. Coding according to both definitions would facilitate international comparisons using ICD-coded health data, and would prevent the selection biases that would otherwise compromise such comparisons. In our opening clinical scenario, AMI as the 'condition leading to admission' and

stroke as the 'condition leading to the most resource use' could both be coded and understood simultaneously for their relevance to the patient's hospital course.

This recommendation of dual coding of 'reason for admission' and 'resource use' key conditions was presented to WHO-FIC Network member countries at the Network's annual meeting in Brasilia, Brazil in October 2012. Despite the arguments described above, this option was not uniformly endorsed by representatives of all WHO-FIC Network countries. Concerns included that some countries with a long history of collecting ICD-coded health data may not be willing to change their definitions, as any change may hamper their ability to analyze historical trends in the prevalence and incidence of certain diseases. Changing the definition also requires the widespread training of coders and physicians, a challenging and expensive process. Data quality may be adversely affected in transitional periods. Nevertheless, the QS-TAG believes that such concerns do not outweigh the arguments for dual coding of both reason for admission and the main resource condition as key conditions. Further international dialog on this proposal, under the auspices of the WHO, will be undertaken.

When only one data element for main condition must be chosen, the QS-TAG recommends that the 'reason for admission' is preferable. This recommendation is made with recognition that determining the main condition can be complex. Rules need to be developed for selecting the main condition when two diagnoses are equally responsible for the admission. To guide decision-making in this circumstance, a method using multi-step decision algorithms has been proposed by the WHO-FIC Morbidity Reference Group [21]:

'Rule 1: Assign as the main condition the condition that is determined to be the reason for admission, established at the end of the episode of health care.

Rule 2: If there is more than one reason for admission, assign as main condition the reason for admission that required the greatest use of resources during the episode of health care.

Rule 3: If a condition arose during the episode of health care and A) consumed more resources than any of the reasons for admission and B) was not a consequence of any of the reasons for admission (neither the condition itself nor its treatment), assign as main condition the condition that arose during the episode of health care'.

These proposed rules for physicians have not been adopted internationally. There are some concerns regarding reliability among physicians, particularly for Rule 3. In our earlier example, clinical judgment regarding the nature of the patient's stroke is crucial to code selection for the main condition. If the stroke is confidently judged to be cardio-embolic stroke in nature, then AMI would remain the main condition because the stroke was a consequence of the AMI. If, on the other hand, there is uncertainty regarding the etiology and type of stroke (as is often true in clinical medicine), then the main condition selection decision becomes more difficult. The view of the QS-TAG is that this alternative approach warrants further testing. The crucial test for implementation of this potential model will be its reproducibility in code–recode studies involving coding personnel.

## Conclusions

The definition of 'main condition' is not consistent internationally. Some countries employ a 'reason for admission' coding rule, while others employ a 'resource use' coding rule. A few countries have transitioned from the latter approach to the former. These differences have considerable implications for creating clinical cohorts and conducting surveillance and quality of care studies. Harmonizing international data definitions to reduce variation in results should be a shared goal. The QS-TAG is working with the WHO and the WHO-FIC network to build international consensus around this important matter through field testing.

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