

Clinical Epidemiology and Health Services Research using the Diagnosis Procedure Combination Database in Japan

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Abstract

Japan established an original case-mix classification system in 2002, so called Diagnosis Procedure Combination (DPC). The main purposes of introducing the DPC system are providing transparency of hospital performance as well as implementing an electronic billing system. Researchers can utilize the DPC data to identify, track, and analyze national trends in health care utilization, access, quality, outcomes, and costs. The unique advantage of the DPC data is the inclusion of detailed process data and several clinical data, which can be applied to academic studies on clinical epidemiology and health services research. The present report reviews the details of the DPC data in term of the structure of the DPC, the scale and contents of the DPC database, and the usability of the DPC data for clinical epidemiology and health services research as compared with the US Nationwide Inpatient Sample database.

Key words: Diagnosis Procedure Combination, Clinical Epidemiology, Health Services Research, Nationwide Inpatient Sample

❖ Introduction

The Diagnosis Procedure Combination (DPC) is a case-mix patient classification system originally developed in Japan in 2002¹⁾. This system is linked with a lump-sum system for inpatients in acute care hospitals, so called the DPC per-diem payment system (DPC/PDPS). All the 82 academic hospitals (80 university hospitals, National Cancer Center and Nation Cerebral and Cardiovascular Center) are obliged to adopt the

DPC system, but adoption by community hospitals is voluntary.

Key objectives of the DPC system are to implement a standardized electronic claims system and to provide transparency of hospital performance¹⁾. The DPC data are used to identify, track, and analyze national trends in health care utilization, access, quality, outcomes, and costs²⁻³⁾. Furthermore, the DPC database can be utilized for clinical epidemiology and health services research because it has several clinical data as well as detailed process data.

The present report explains the details of the DPC database in terms of (i) the structure of the DPC, (ii) the scale and contents of the DPC database, and (iii) the usability of the DPC data for clinical epidemiology and health services research as compared with the US Nationwide Inpatient Sample (NIS) database⁴⁾.

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❖ Backgrounds for the development of the DPC system

Japan established universal health insurance system in 1961. The government-run public insurance system currently covers almost all the 120 million young and old, rich and poor people in Japan. Outpatient service is based on free-access system without gatekeepers. The payment system for both outpatient and inpatient services has long been based on fee-for-service reimbursement using a national fee schedule.

According to the Organisation for Economic Co-operation and Development Health Statistics 2013, total expenditure on health per gross domestic product in Japan (9.6%) was as low as that in UK (9.4%), but lower than those in France (11.6%), Germany (11.3%) and the USA (17.7%) in 2011 or nearest year. However, total health expenditure in Japan has been on the rise, with the annual growth rate of 3.1% from 2000 to 2011⁵). Last several decades have witnessed continuing debates on how to contain healthcare costs in Japan. Unfortunately, administrative claims data for health services had not been standardized or electronically recorded, and thus transparency in healthcare service provision had been lacking until recently. Thus, in 2003, the Ministry of Health, Labour and Welfare (MHLW) of Japan introduced the DPC system as a profiling tool for healthcare services¹).

❖ The structure of DPC

In the DPC case-mix algorithm, diagnosis, procedure, and comorbidities / complications are key elements for classification. The DPC codes are structured with the following components: (i) 18 Major Diagnosis Categories and 2,927 diagnostic groups, as of 2014 (ii) type of admission, (iii) patient backgrounds (age, Japan Coma Scale, birth weight for neonates, etc.), (iv) surgical procedures, (v) adjuvant therapies, and (vi) comorbidities / complications. Diagnoses, comorbidities and complications are coded using the International Classification of Diseases, 10th Revision codes (ICD-10). Examinations, procedures and pharmaceuticals are coded in the Japanese original codes, as defined in the fee schedule of the national health insurance system.

❖ The DPC database

The MHLW electronically collects the DPC data for the purpose of health policy planning including the refinement of case-mix classification and the revision of DPC-based fee schedule. The DPC Study Group, a government-funded academic group, also collects the copies of the DPC electronic data independently of the MHLW for research purpose. The data collection period was July 1 to October 31 during 2002-2005, and July 1 to December 31 during 2006 to 2010. Since 2011, data has been collected through the year (January 1 to December 31). Table 1 shows the numbers of hos-

Table 1. The number of participating hospitals and inpatients in the DPC database

Fiscal Year	Months	Duration (months) [=A]	The number of participating hospitals	The number of in-patients discharged from the participating hospitals (million) [=B]	The number of all acute-care hospitalizations in Japan (million per month) [=C]	Coverage rate (%) [=B/A/C]
2002	July '02-October '02	4	82	0.26	1.08	6
2003	July '03-October '03	4	185	0.44	1.08	10
2004	July '04-October '04	4	174	0.45	1.08	10
2005	July '05-October '05	4	249	0.73	1.09	17
2006	July '06-December '06	6	262	1.08	1.11	16
2007	July '07-December '07	6	898	2.65	1.11	40
2008	July '08-December '08	6	855	2.81	1.11	42
2009	July '09-December '09	6	901	2.78	1.12	41
2010	July '10-March '11	9	980	4.95	1.15	48
2011	April '11-March '12	12	1,075	7.14	1.16	52
2012	April '12-March '13	12	1,057	6.85	1.18	48

DPC, Diagnosis Procedure Combination

*Calculated with data from the Survey of Medical Institutions in Japan 2002-2012

pitals, the numbers of inpatients and the data collection periods from the fiscal year (FY) 2002 to FY2012 in the DPC data collected by the DPC Study Group. The duration of data collection was 4 months from FY2002 to FY2005, 6 months from FY2006 to FY2009, 9 months in FY2010, and 12 months from FY2011 on. The number of participating hospitals and the number of inpatients has steadily increased; since FY2010, the number of participating hospitals has been around 1000 and the coverage rate of the inpatients in the DPC database over all the acute-care inpatients in Japan has reached approximately 50%.

All the data for each patient are recorded at discharge. To optimize the accuracy of the recorded diagnoses, physicians in charge are obliged to record the diagnoses with reference to medical charts. Licensed medical information managers and trained medical clerks accurately record the dates of all major and minor procedures and of drugs and devices use. Because the entry of accurate data is mandatory to obtain the DPC-based reimbursement of medical fee, hospitals have a strong incentive for data compliance. Hospitals send all the anonymized data to the MHLW. Copies of all the data are also sent to the DPC Study Group, and data are compiled in the database server in the Department of Clinical Epidemiology and Health Economics, School of Public Health, The University of Tokyo.

Diagnoses are recorded with text data in Japanese language and ICD-10 codes. Up to 12 diagnoses for each admission can be recorded. One diagnosis each is coded for “main diagnosis”, “admission-precipitating diagnosis”, “most resource-consuming diagnosis” and “second most resource-consuming diagnosis” and maximum of four diagnoses each is coded for “comorbidities present on admission” and “complications arising after admission”. Report of “main diagnosis”, “admission-precipitating diagnosis” and “most resource-consuming diagnosis” are mandatory, whereas recording of “second most resource-consuming diagnosis”, “comorbidities present on admission” and “complications arising after admission” are voluntary. Using Quan’s protocol, each ICD-10 code of comorbidity is converted into a score, and is summed up for each patient to calculate a Charlson comorbidity index⁶.

Hospital and patient data include: unique identifiers of the hospitals; location of the hospitals; zip codes of patients’ residing area; type of admission (urgent or elective); type of psychiatric admission (voluntary or involuntary); ambulance service use; patients’ age and

sex; smoking index (pack years); pregnancy; and disposition of patient (discharged to home, discharged to a nursing facility, discharged to other hospital, or died in hospital).

Procedure data include: anesthesia⁷, surgery^{8,9}, rehabilitation^{10,11} and other procedures (including tracheal intubation, mechanical ventilation, blood purification^{12,13}, etc.) coded with Japanese original codes; duration of anesthesia (min); volume of blood transfusion (ml); and independent codes for pharmaceuticals and devices used¹⁴⁻¹⁶. The dates of procedures, the dates of using drugs and devices, the dates of admission to and discharge from hospitals, and admission to and discharge from special care units (including intensive care unit, coronary care unit, stroke care unit, or neonatal intensive care unit) are all recorded, and thus an interval between the start and the end of any process can be calculated (e.g. duration of mechanical ventilation¹⁰, duration of chest tube drainage¹⁷, total length of stay, postoperative length of stay, and length of stay in intensive care unit). Clinical data include (i) body weight and height^{18,19}; (ii) Japan Coma Scale at admission and discharge²⁰; (iii) TNM Classification and Stage for primarily-diagnosed cancer⁸; (iv) modified Rankin scale at admission and discharge for patients with neurological diseases²⁰; (v) Hugh-Jones classifications for patients with lung diseases; (vi) New York Heart Association classification for patients with heart diseases; (vii) Canadian Cardiovascular Society classification for patients with angina pectoris; (viii) Killip classification for patients with acute myocardial infarction; (ix) A-DROP scoring system for pneumonia patients²¹; (x) Child-Pugh classification for patients with liver cirrhosis²²; (xi) Japanese severity classification for patients with acute pancreatitis²³; (xii) the date of stroke onset²⁰; (xiii) Burn Index; (xiv) Activity of Daily Living scores at admission and discharge, which can be converted into Barthel Index; and (xv) Global Assessment of Functioning Scale at admission and duration of mechanical restraint for psychiatric patients²⁴. The database also includes estimated total costs based on reference prices in the Japanese national fee schedule that determine item-by-item prices for surgical, pharmaceutical, laboratory, and other inpatient services^{25,26}.

❖ Comparison between the DPC data and the NIS data

The DPC database partially corresponds to the NIS

database in the US⁴), but has several unique features. Table 2 shows the comparison between the DPC data and the NIS data. The NIS contains all discharge data on 8 million inpatients from more than 1,000 short-term and non-Federal hospitals each year, which approximates a 20% stratified sample of U.S. community hospitals⁴). The advantage of the NIS is its sampling frame of hospitals that represent all the hospitals in the US. Also, the NIS has physician identifiers, which enable analyses of the relationship between physician factor and outcomes.

Both the DPC and the NIS have a large sample size, which enables analyses of rare disease and uncommon treatments. Both databases have hospital identifiers that permit linkages to hospital database; e.g. the NIS can be linked to the American Hospital Association Annual Survey Database, while the DPC can be linked

to the Survey of Medical Institutions in Japan. The NIS includes county identifiers that can be linked to the Area Resource File, while the DPC includes zip codes of patients' residing area that can be linked to Census Data.

There are several advantages in the DPC database. Regarding coded diagnoses, complications that occurred after admission are clearly differentiated from comorbidities that were already present at admission. The DPC database includes variety of measures for severity and comorbidity (mentioned above), which can be utilized for clinical studies.

Regarding data accessibility for researches, the NIS data are publicly provided; researchers and students can purchase the NIS data at a reasonable price. As of 2014, the DPC data are not publicly provided by the government; use of the DPC data is, at present, lim-

Table 2. Comparison between the DPC data and the NIS data

	DPC data	NIS data
Scale	Approx. 7 million inpatients per year	Approx. 8 million inpatients per year
Sampling methods	Approx. 50% non-stratified sample of the Japanese academic and community hospitals	20% stratified sample of the US community hospitals
Population-representativeness	Not representative	Representative
Data elements		
Diagnosis codes	ICD-10	ICD-9-CM
Procedure codes	Japanese original codes	ICD-9-CM
Cost or charge	Estimated cost	Charge
Age, Sex	Available	Available
Race	N.A.	Available
Length of stay	Available	Available
Admission and discharge status	Available	Available
Hospital characteristics (ownership, size, teaching status)	Available	Available
Hospital identifier	Available	Available
Physician identifier	N.A.	Available
Median household income for patient's zip code	N.A.	Available
Patient's zip code	Available	N.A.
Body weight, height	Available	N.A.
Smoking index	Available	N.A.
Severity and comorbidity measures*	Available	Available
Laboratory data	N.A.	N.A.

DPC, Diagnosis Procedure Combination; NIS, Nationwide Inpatient Sample; ICD, International Classification of the Diseases; CM, clinical modifications

*Severity and comorbidity measures in the DPC data include: body weight and height; Japan Coma Scale; TNM Classification and Cancer Stage; modified Rankin scale; Hugh-Jones classifications; New York Heart Association classification; Canadian Cardiovascular Society classification; Killip classification; A-DROP scoring system; Child-Pugh classification; Japanese severity classification for acute pancreatitis; the date of stroke onset; Burn Index; activity of daily living scores; and Global Assessment of Functioning Scale.

ited to certain researchers.

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