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Unique features of drug poisoning among the top 100 causes of emergency hospital admissions: a retrospective observational study using a nationwide administrative discharge database

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Key words Retrospective studies; overdose; emergency medical services; epidemiology

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ABSTRACT

Objective: To compare the clinical and procedural characteristics of the top 100 causes of emergency hospital admissions.

Design: Retrospective observational study.

Setting: Discharged patients from 855 acute care hospitals from 1 July to 31 December in 2008 in Japan.

Results: There were a total of 1 157 893 emergency hospital admissions. Among the top 100 causes, drug poisoning was ranked higher in terms of the percentage of patients using ambulatory (74.1%; 2nd) and tertiary emergency medical services (37.8%; 1st). Despite higher utilization of emergency care resources, drug poisoning ranked lower in terms of the median length of stay (2 days; 100th), percentage of requirement for surgery (1.7%; 91st), and in-hospital mortality ratio (0.3%; 74th).

Conclusion: Drug poisoning is unique among the top 100 causes of emergency admissions. Our findings suggest that drug poisoning imposes a greater burden on emergency care resources but has a less severe clinical course than other causes of admissions. Future research should focus on strategies to reduce the burden of drug poisoning on emergency medical systems.

Article Summary

Article focus

■ Only a few studies have compared resource use and clinical course among patients in a nationally representative sample. Our aim was to compare the clinical and procedural characteristics of the top 100 causes of emergency hospital admissions using a nationally representative sample of inpatients.

Key messages

■ Drug poisoning is in an anomalous position among the top 100 causes of emergency admissions.

■ Patients with drug poisoning had a less severe clinical course than those with other causes, although they had higher utilization of emergency care resources.

Strengths and limitations of this study

■ A large data from a nationwide discharge database was studied.

■ Our results are limited to inpatient admissions to acute care hospitals.

INTRODUCTION

A better understanding of epidemiology in emergency medical services (EMS) is important for planning EMS resource use and EMS personnel training needs.[1] Drug poisoning is a major cause of admissions to acute care hospitals and places a considerable burden on EMS resources. Drug poisoning accounts for over 15% of all admissions to intensive care units.[2 3] However, most cases of drug poisoning do not result in clinical toxicity. Of patients with drug poisoning admitted to an intensive care unit, 91% do not require advanced treatments.[2] Over 75% of patients admitted to emergency departments can be released from medical observation after a brief period (i.e., 1–2 days).[4-6] Less than 1% of cases result in mortality.[7 8] These previous studies suggest that drug poisoning may impose a needless burden on high-level EMS despite their limited requirements for advanced treatments.[2 9]

Although a number of studies have examined the detailed epidemiology of drug poisoning,[2-8] only a few studies compare resource use and clinical course among patients in a nationally representative sample.[10-12] It remains unknown whether drug poisoning imposes a greater burden on emergency care resources and has a less severe clinical course among major causes of admissions. We thus aimed to compare the clinical and procedural characteristics of the top 100 causes of emergency hospital admissions using a nationally representative sample of inpatients.

METHODS

Data source

We conducted a observational study using the nationwide discharge administrative database of the Diagnosis Procedure Combination/Per-Diem Payment System (DPC/PDPS), a Japanese case-mix classification system launched in 2002 by the Ministry of Health, Labour and Welfare of Japan.[13] Every year, the DPC Research Group conducts a survey of DPC/PDPS hospitals. In 2008, 855 of 1 558 DPC/PDPS hospitals participated in the survey. The DPC/PDPS database includes clinical and procedural information on all inpatients discharged from the participating hospitals between 1 July and 31 December. The database includes 2.86 million admissions, representing approximately 40% of all inpatient admissions to acute hospitals (excluding psychiatric and tuberculosis hospitals).[14] In the present study, we included all emergency hospital admissions and excluded planned admissions to the DPC/PDPS hospitals.

Setting

In Japan, the EMS system is divided into 3 categories:[15] (1) primary EMS that provides care to patients who can be discharged without hospitalization; (2) secondary EMS that provides care to patients who require admission to a regular inpatient bed; and (3) tertiary EMS that provides care to severely ill and trauma patients who require intensive care. In 2008, there were 18 892 clinics and 963 hospitals for primary EMS, 3 053 hospitals for secondary EMS, and 214 hospitals for tertiary EMS.[14] In the present study, we focused on secondary and tertiary EMS rather than primary EMS, because the DPC/PDPS database is an inpatient database.

Clinical and procedural characteristics

To describe clinical and procedural characteristics of emergency hospital admissions, we used the following study variables: (1) age; (2) gender; (3) major disease categories; (4) comorbidities at admissions; (5) level of consciousness assessed by the Japan Coma Scale (JCS);[16] (6) use of ambulance service; (7) use of tertiary EMS; (8) requirement for surgery; (9) length of stay (days); and (10) in-hospital mortality.

Physicians recorded information on diagnoses using the International Classification of Diseases 10th revision (ICD-10) codes. According to the ICD-10 codes, 506 major disease categories were defined in 2008. In the database, patients with drug, chemical, and unspecified poisoning (ICD-10 codes T360–T509, T510–T659, and T887, respectively) have the same major disease code (disease code 161070). In the present study, we modified the disease code to separate drug poisoning from chemical and unspecified poisoning.

In the database, up to 4 diagnosed comorbidities per patient were recorded. Using the criteria developed by the Global Burden of Disease study with some modifications,[17] we defined comorbid status of mental illness as being diagnosed with any of the following ICD-10 codes: unipolar depressive disorders (F32–F33); bipolar affective disorder (F30–F31); schizophrenia (F20–F29); alcohol use disorders (F10); drug use disorders (F11–F16 and F18–F19); post-traumatic stress disorder (F431); obsessive-compulsive disorder (F42); panic disorder (F400 and F410); or insomnia (F51).

Statistical analyses

First, we conducted univariate analyses to summarize the clinical and procedural characteristics of all emergency admissions. Second, we compared 8 variables among the top 100 emergency causes of admissions. These variables were: (1) percentage of patients aged 65 years or older; (2) percentage of patients comorbid with mental illness; (3) percentage of patients admitted to hospitals with deep coma (JCS scores ≥ 100, corresponding to scores of ≤ 7 on the Glasgow Coma Scale);[16] (4) percentage of patients using ambulatory services; (5) percentage of patients using tertiary EMS; (6) percentage of patients requiring surgery; (7) median length of stay; and (8) percentage of in-hospital mortality. To maximize interpretability, we restricted this analysis to patients with one of the top 100 causes of admissions. We used a predictive principal component analysis (PCA) biplot to reduce the dimensionality of multivariate data (i.e., 100 causes of admissions × 8 variables) and then to visualize 2 dimensions with minimal loss of information.[18] Before conducting the predictive PCA biplot, we standardized each variable with a mean of 0 and a standard deviation of 1 because the measurement units of 8 variables were incommensurable. In the predictive PCA biplot, the 8 variables were represented by 8 biplot axes to read off predictive values of the variables for each of the top 100 causes. All statistical analyses were performed with R version 2.4.1.[19] The predictive PCA biplot was performed using the BiplotGUI package under R.[19]

RESULTS

Characteristics of all emergency hospital admissions

During the study period, there were a total of 1 157 893 emergency hospital admissions to 855 hospitals. Characteristics of these admissions are presented in Table 1. The majority (51.7%) of admissions were for patients aged ≥ 65 years. Patients aged 0–14 years accounted for less than one-sixth (15.3%) of the admissions. The most prevalent diagnosis was pneumonia, accounting for 10.2% of all admissions, followed by stroke (5.5%) and heart failure (2.8%). Drug poisoning ranked in the top 41 causes of admissions. Less than 5% of patients used tertiary EMS. Of those patients, 88.3% stayed for more than 3 days. About 7% of patients died during hospitalization.

Insert Table 1 here

Comparison of drug poisoning and other causes of admissions

The top 100 causes of admissions cover 83% (965 749 admissions) of all admissions. Characteristics by cause of admission are shown in Table 2 for the top 10 causes and drug poisoning; the top 100 causes are also shown in the Supplemental Table. The predictive PCA biplot with 2 dimensions accounts for 62.9% of the variance in the data from the top 100 causes. The predictive PCA biplot revealed that drug poisoning was in a unique position (Figure 1). Among the top 100causes, patients with drug poisoning were less likely to be aged ≥ 65 years (13.4%; 86th) and most likely to be diagnosed with mental illness (33.7%; 1st). In addition, patients with drug poisoning were more likely to be admitted to hospitals with deep coma (26.2%; 2nd), more likely to use ambulatory services (74.1%; 2nd), and most likely to use

tertiary EMS (37.8%; 1st). Despite the higher utilization of emergency care resources, clinical course of drug poisoning was less severe. Among the top 100 causes, patients with drug poisoning had the shortest median length of stay (2 days; 100th), were less likely to require surgery (1.7%; 91st), and were less likely to die during hospitalization (0.3%; 74th).

Insert Table 2 and Figure 1 here

DISCUSSION

To our knowledge, this is the first study that used a nationally representative sample to compare detailed clinical and procedural characteristics between drug poisoning and other causes of emergency hospital admissions. We found that drug poisoning was unique among the top 100 causes of emergency admissions. Patients with drug poisoning had a less severe clinical course than those with other causes, although they had higher utilization of emergency care resources. Our findings suggest that drug poisoning imposes a higher burden on emergency care resources than other causes of emergency admissions.

Our results are consistent with those of a case-control study conducted in Australia and New Zealand.[10] That study found that median length of stay in patients with drug poisoning was 3 days, which was much lower than the overall median length of stay (9 days) in patients with 1 of the 8 most common diagnoses in a tertiary intensive care unit. One possible explanation for the potential over-utilization of high-level EMS resource is that staff with significant experience in psychosocial assessment might be more available in high-level EMS facilities. In Japan, 85% of tertiary EMS hospitals have psychiatric departments, while 23% of secondary EMS hospitals are so equipped.[14] Because most patients with drug poisoning have attempted suicide,[20] and self-harm patients should receive a specialist psychosocial assessment according to the clinical guideline,[21] patients with drug poisoning are transferred to high-level EMS in which mental health specialists are more available.

Another explanation for the potential over-utilization is that staff in secondary EMS hospitals might decline to manage patients with drug poisoning. A survey conducted in Osaka city revealed that ambulance officers contacted more hospitals to transport patients with drug poisoning than all patients (average number of contacted hospitals: 7.6 vs. 1.8, respectively).[22]

It would be of great value to investigate triage tools predicting the need for advanced treatments based on information not only from early admission factors,[23] but also from pre-hospital factors.[24]

Our study has several limitations. First, our results cannot be generalized and are limited to inpatient admissions to acute care hospitals rather than emergency outpatient admissions or emergency admissions to psychiatric hospitals, because we used the DPC/PDPS database. Second, we were unable to evaluate variables not included in the DPC/PDPS database. As a result, we could not assess other potentially important factors predicting the need for advanced treatments, such as acute physiology and chronic health evaluation (APACHE) scores at admission[23] or clinical management and course during pre-hospital period.[24] Third, although the database included approximately 40% of all inpatient admissions in Japan, participation in the survey was voluntary for each hospital and the patient selection procedure was not based on a random sampling technique from all acute hospitals.

In conclusion, we have demonstrated that drug poisoning is unique among the top 100 causes of emergency admissions. Future research should focus on strategies to reduce the burden of drug poisoning on emergency medical systems.

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Competing Interest

None.

Ethic approval

The study protocol was approved by the institutional review board of the University of Occupational and Environmental Health, Fukuoka, Japan.

Contributors

SM, KBI, and KF conducted data collection, data synthesis, and data management. KF and HI obtained funding. YO participated in study concept and design, analysis and interpretation of data, drafting of the manuscript, and critical revision of the manuscript. SS supervised data analysis. SS, KBI, KF, and HI participated in interpretation of data and critical revision of the

manuscript for important intellectual content. All authors contributed to and approved the final manuscript.

Provenance and peer review

Not commissioned; externally peer reviewed.

Data sharing information

No additional data are available.

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Table 1 Characteristics of emergency hospital admissions

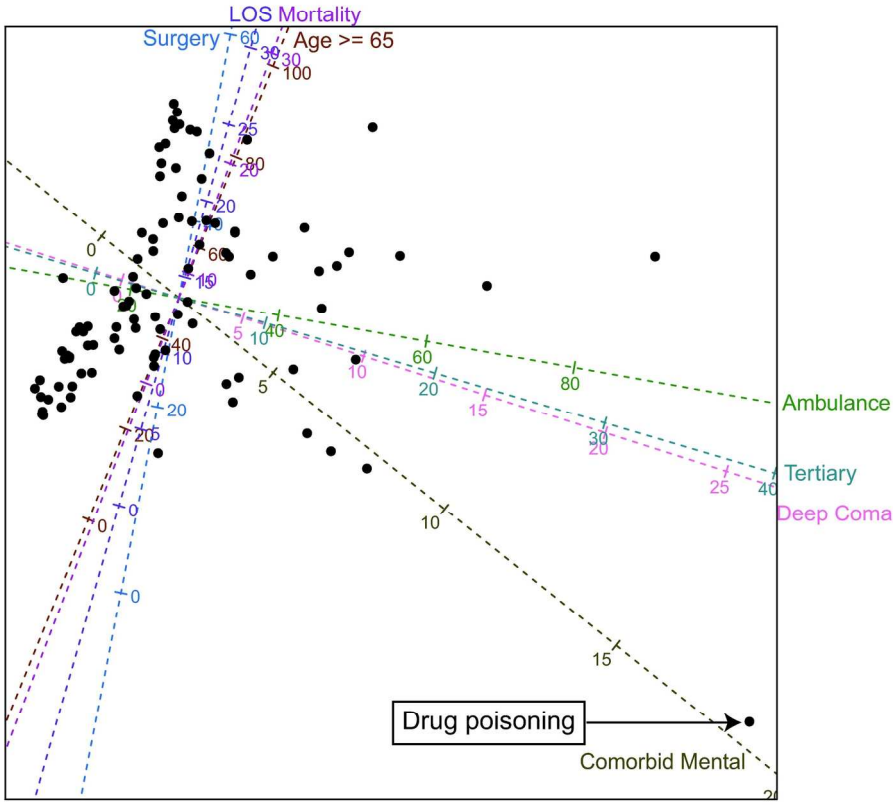
Characteristic	N of admissions	% of admissions	95% CI
Age			
0–14	177 092	15.3	15.2–15.4
15–64	382 025	33.0	32.9–33.1
≥ 65	598 776	51.7	51.6–51.8
Gender women	547 280	47.3	47.2–47.3
Top 10 causes of admissions and drug poisoning (Disease code)			
1. Pneumonia, acute bronchitis, acute bronchiolitis (040080)	117 649	10.2	10.1–10.2
2. Stroke (010060)	63 931	5.5	5.5–5.6
3. Heart failure (050130)	32 993	2.8	2.8–2.9
4. Intestinal obstruction without hernia (060210)	28 701	2.5	2.5–2.5
5. Fracture of proximal femur (160800)	25 905	2.2	2.2–2.3
6. Viral enteritis (150010)	24 920	2.2	2.1–2.2
7. Asthma (040100)	23 858	2.1	2.0–2.1
8. Angina pectoris, chronic ischemic heart disease (050050)	20 775	1.8	1.8–1.8
9. Disorder associated with shortened gestation period or low birth weight (140010)	20 540	1.8	1.8–1.8
10. Renal infection (110310)	19 853	1.7	1.7–1.7
41. Drug poisoning (161070)	6 748	0.6	0.6–0.6
Other causes	769 326	66.4	66.4–66.5
Comorbid mental illness	23 279	2.0	2.0–2.0
Deep coma	26 792	2.3	2.3–2.3
Ambulance services	311 333	26.9	26.8–27.0
Tertiary EMS	54 938	4.7	4.7–4.8
Surgery	321 974	27.8	27.7–27.9
Length of stay (days)			
≤ 3	135 096	11.7	11.6–11.7
4–7	266 651	23.0	23.0–23.1
8–14	296 549	25.6	25.5–25.7
15–30	258 717	22.3	22.3–22.4
31–60	136 014	11.7	11.7–11.8
≥ 60	64 866	5.6	5.6–5.6
Death during hospitalization	78 226	6.8	6.7–6.8

Comorbidity of mental illness was defined as the following ICD-10 codes as comorbidities: unipolar depressive disorders (F32–F33), bipolar affective disorder (F30–F31), schizophrenia (F20–F29), alcohol use disorders (F10), drug use disorders (F11–F16 and F18–F19), post-traumatic stress disorder (F431), obsessive-compulsive disorder (F42), panic disorder (F400 and F410), or insomnia (F51). Deep coma was defined as a score on the Japan Soma Scale of 100 or more.
EMS, emergency medical services.

Table 2 Characteristics of poisoning and other causes of admissions

Rank	Top 10 causes of admissions and drug poisoning (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
1	Pneumonia, acute bronchitis, acute bronchiolitis (040080)	A370, A378, A379, A481, B012, B052, B371, B59, J13, J14, J15*, J16*, J17*, J18*, J20*, J21*, J22, J69*	117 649	10.2	48.7 (57)	1.5 (53)	2.2 (23)	19.3 (53)	2.2 (43)	5.7 (82)	9.0 (62)	7.9 (29)
2	Stroke (010060)	G45*, G46*, I63*, I65*, I66*, I675, I679, I693, I978	63 931	5.5	77.8 (11)	1.5 (53)	4.0 (14)	44.1 (21)	8.0 (21)	8.0 (77)	17.0 (30)	5.2 (35)
3	Heart failure (050130)	I50*	32 993	2.8	86.0 (4)	1.3 (60)	1.6 (26)	34.3 (27)	9.3 (19)	11.5 (67)	18.0 (27)	11.1 (24)
4	Intestinal obstruction without hernia (060210)	K560, K562, K563, K564, K565, K566, K567, K913	28 701	2.5	64.3 (33)	1.9 (40)	0.2 (68)	18.1 (59)	2.0 (48)	19.3 (57)	11.0 (51)	2.4 (48)
5	Fracture of proximal femur (160800)	M2435, M2445, S7200, S7210, S7220, S7230, S7270, S7280, S7290, S730	25 905	2.2	90.6 (1)	3.7 (9)	0.1 (75)	49.5 (14)	1.5 (58)	91.0 (5)	30.0 (2)	1.4 (58)
6	Viral enteritis (150010)	A08*, A09	24 920	2.2	23.4 (80)	0.9 (73)	0.1 (75)	14.9 (67)	0.3 (87)	0.8 (95)	5.0 (89)	0.2 (79)
7	Asthma (040100)	J45*, J46	23 858	2.1	12.0 (87)	0.8 (76)	0.4 (52)	9.5 (85)	1.2 (64)	0.5 (97)	6.0 (82)	0.3 (74)
8	Angina pectoris, chronic ischemic heart disease (050050)	I20*, I25*	20 775	1.8	68.2 (23)	0.9 (73)	0.4 (52)	31.9 (31)	7.7 (22)	43.7 (29)	7.0 (78)	0.8 (64)
9	Disorder associated with shortened gestation period or low birth weight (140010)	P00*, P01*, P02*, P03*, P04*, P05*, P07*, P08*, P10*, P11*, P12*, P13*, P15*, P20*, P21*, P22*, P23*, P24*, P25*, P26*, P27*, P28*, P29*, P35*, P36*, P37*, P38, P39*, P50*, P51*, P52*, P53, P54*, P55*, P56*, P57*, P58*, P590, P591, P592, P593, P598, P599, P60, P61*, P70*, P71*, P72*, P74*, P75, P76*, P77, P780, P781, P782, P783, P789, P80*, P81*, P83*, P90, P91*, P92*, P93, P94*, P95, P96*	20 540	1.8	0.0 (95)	0.0 (98)	0.4 (52)	9.4 (86)	0.0 (97)	10.5 (71)	8.0 (70)	0.5 (69)
10	Renal infection (110310)	N10, N151, N390	19 853	1.7	63.7 (34)	1.7 (44)	1.1 (32)	22.5 (47)	1.3 (63)	6.7 (80)	10.0 (55)	1.5 (56)
41	Drug poisoning* (161070)	T36*, T37*, T38*, T39*, T40*, T41*, T42*, T43*, T44*, T45*	6 748	0.6	13.4 (86)	33.7 (1)	26.2 (2)	74.1 (2)	37.8 (1)	1.7 (91)	2.0 (100)	0.3 (74)

Rankings were based on data from the top 100 causes of admissions. Comorbidity of mental illness was defined as the following ICD-10 codes as comorbidities: unipolar depressive disorders (F32–F33), bipolar affective disorder (F30–F31), schizophrenia (F20–F29), alcohol use disorders (F10), drug use disorders (F11–F16 and F18–F19), post-traumatic stress disorder (F431), obsessive-compulsive disorder (F42), panic disorder (F400 and F410), or insomnia (F51). Deep coma was defined as a score on the Japan Soma Scale of 100 or more. Ambulance, ambulance service; LOS, median length of stay; Mortality, in-hospital mortality; Tertiary, tertiary emergency medical services; *, wild card.



The predictive principal component biplot on data from the characteristics of the top 100 causes. Each dot represents one of the causes. Eight axes are positioned and calibrated so that the orthogonal projection of a dot onto an axis 'predicts' as best as is graphically possible the value of the corresponding disease on the corresponding variable. Ambulance, ambulance services; LOS, median length of stay; Mortality, in-hospital mortality; Surgery, surgical procedures; Tertiary, tertiary emergency medical services.
177x177mm (300 x 300 DPI)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
1	Pneumonia, acute bronchitis, acute bronchiolitis (040080)	A370, A378, A379, A481, B012, B052, B371, B59, J13, J14, J15*, J16*, J17*, J18*, J20*, J21*, J22, J69*	117 649	10.2	48.7 (57)	1.5 (53)	2.2 (23)	19.3 (53)	2.2 (43)	5.7 (82)	9.0 (62)	7.9 (29)
2	Stroke (010060)	G45*, G46*, I63*, I65*, I66*, I675, I679, I693, I978	63 931	5.5	77.8 (11)	1.5 (53)	4.0 (14)	44.1 (21)	8.0 (21)	8.0 (77)	17.0 (30)	5.2 (35)
3	Heart failure (050130)	I50*	32 993	2.8	86.0 (4)	1.3 (60)	1.6 (26)	34.3 (27)	9.3 (19)	11.5 (67)	18.0 (27)	11.1 (24)
4	Intestinal obstruction without hernia (060210)	K560, K562, K563, K564, K565, K566, K567, K913	28 701	2.5	64.3 (33)	1.9 (40)	0.2 (68)	18.1 (59)	2.0 (48)	19.3 (57)	11.0 (51)	2.4 (48)
5	Fracture of proximal femur (160800)	M2435, M2445, S7200, S7210, S7220, S7230, S7270, S7280, S7290, S730	25 905	2.2	90.6 (1)	3.7 (9)	0.1 (75)	49.5 (14)	1.5 (58)	91.0 (5)	30.0 (2)	1.4 (58)
6	Viral enteritis (150010)	A08*, A09	24 920	2.2	23.4 (80)	0.9 (73)	0.1 (75)	14.9 (67)	0.3 (87)	0.8 (95)	5.0 (89)	0.2 (79)
7	Asthma (040100)	J45*, J46	23 858	2.1	12.0 (87)	0.8 (76)	0.4 (52)	9.5 (85)	1.2 (64)	0.5 (97)	6.0 (82)	0.3 (74)
8	Angina pectoris, chronic ischemic heart disease (050050)	I20*, I25*	20 775	1.8	68.2 (23)	0.9 (73)	0.4 (52)	31.9 (31)	7.7 (22)	43.7 (29)	7.0 (78)	0.8 (64)
9	Disorder associated with shortened gestation period or low birth weight (140010)	P00*, P01*, P02*, P03*, P04*, P05*, P07*, P08*, P10*, P11*, P12*, P13*, P15*, P20*, P21*, P22*, P23*, P24*, P25*, P26*, P27*, P28*, P29*, P35*, P36*, P37*, P38, P39*, P50*, P51*, P52*, P53, P54*, P55*, P56*, P57*, P58*, P590, P591, P592, P593, P598, P599, P60, P61*, P70*, P71*, P72*, P74*, P75, P76*, P77, P780, P781, P782, P783, P789, P80*, P81*, P83*, P90, P91*, P92*, P93, P94*, P95, P96*	20 540	1.8	0.0 (95)	0.0 (98)	0.4 (52)	9.4 (86)	0.0 (97)	10.5 (71)	8.0 (70)	0.5 (69)
10	Renal infection (110310)	N10, N151, N390	19 853	1.7	63.7 (34)	1.7 (44)	1.1 (32)	22.5 (47)	1.3 (63)	6.7 (80)	10.0 (55)	1.5 (56)
11	Gastroduodenal ulcer, gastric diverticulum, pyloric stenosis (060140)	K25*, K26*, K311, K312, K314	19 387	1.7	53.5 (52)	1.6 (47)	0.4 (52)	37.2 (25)	6.6 (26)	62.1 (17)	11.0 (51)	1.8 (55)
12	Chronic nephritic syndrome/chronic interstitial nephritis/chronic renal failure (110280)	I120, I129, N02*, N03*, N05*, N06*, N07*, N08*, N11*, N12, N14*, N18*, N391, N392	19 295	1.7	67.3 (27)	1.4 (58)	1.0 (33)	18.7 (55)	3.0 (37)	31.2 (43)	16.0 (34)	6.8 (33)
13	Appendicitis (060150)	K35*, K36, K37, K38*	18 566	1.6	11.9 (88)	0.8 (76)	0.0 (82)	9.1 (88)	1.5 (58)	75.4 (10)	6.0 (82)	0.0 (85)
14	Bile duct (intra/extra hepatic) lithiasis (060340)	K803, K804, K805, K830, K831, K832, K833, K834, K838, K839, K915	17 869	1.5	75.6 (13)	1.1 (68)	0.3 (60)	16.9 (64)	2.3 (42)	68.3 (14)	14.0 (44)	2.9 (43)
15	Inflammation of oesophagus, stomach, duodenum and other intestines (other benign diseases) (060130)	B054, I880, K20, K21*, K220, K221, K222, K223, K224, K225, K226, K228, K229, K23*, K27*, K28*, K29*, K30, K310, K313, K315, K316, K318, K52*, K58*, K627, K633, K634, K638, K639, K90*, K910, K911, K912, K914, K92*, K93*	17 715	1.5	60.8 (47)	2.3 (28)	0.5 (50)	25.9 (42)	4.0 (33)	31.8 (42)	9.0 (62)	2.3 (49)
16	Skull and intracranial injury (160100)	S000, S007, S008, S009, S010, S017, S018, S019, S020*, S021*, S06*, S071, S079, S080, S089, S090, S091, S097	17 372	1.5	57.9 (49)	2.6 (22)	8.1 (9)	63.9 (6)	18.0 (8)	44.4 (28)	8.0 (70)	5.8 (34)
17	Nontraumatic intracranial haematoma (excluding nontraumatic subdural haematoma) (010040)	I61*, I629, I680, Q280, Q281, Q282, Q283	16 389	1.4	62.2 (42)	1.1 (68)	19.6 (3)	70.0 (3)	21.8 (3)	22.3 (55)	23.0 (11)	15.6 (21)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
18	Acute myocardial infarction, recurrent myocardial infarction (050030)	I21*, I22*, I24*	15 812	1.4	63.6 (35)	0.8 (76)	3.0 (19)	56.5 (8)	21.5 (4)	85.2 (6)	15.0 (38)	7.9 (29)
19	Benign disease of small and large intestine (including benign tumour) (060100)	D12*, D133, D191, D197, D199, D201, D372, D373, D374, D375, K57*, K620, K621, K635	13 657	1.2	43.6 (64)	0.7 (82)	0.0 (82)	7.9 (90)	1.1 (65)	45.9 (27)	7.0 (78)	0.3 (74)
20	Malignant pulmonary tumour (040040)	C33, C34*, C780, D021, D022, D024	13 327	1.2	75.3 (14)	2.3 (28)	0.8 (38)	19.5 (52)	1.4 (60)	10.9 (69)	21.0 (20)	40.5 (4)
21	Epilepsy (010230)	G40*, G41*	12 668	1.1	34.6 (70)	3.3 (12)	12.7 (5)	68.6 (4)	10.4 (15)	2.3 (88)	5.0 (89)	0.9 (62)
22	Vestibular dysfunction (030400)	H810, H811, H812, H813, H818, H819	12 589	1.1	56.8 (51)	1.2 (66)	0.0 (82)	48.3 (15)	0.4 (86)	0.3 (99)	5.0 (89)	0.0 (85)
23	Hydrops of gallbladder, cholecystitis (060335)	D135, K800, K801, K81*, K820, K821, K822, K823, K824, K828, K829, K835, K870	11 924	1.0	63.2 (39)	1.5 (53)	0.3 (60)	18.2 (58)	2.2 (43)	55.5 (22)	15.0 (38)	1.5 (56)
24	Malignant gastric tumour (060020)	C16*, D002	11 210	1.0	73.7 (16)	1.6 (47)	0.4 (52)	15.4 (66)	1.1 (65)	43.4 (30)	23.0 (11)	29.2 (7)
25	Blood poisoning (180010)	A021, A327, A391, A392, A393, A394, A395, A398, A399, A40*, A41*, B007, B250, B252, B376, B377, B387, B393, B407, B417, B427, B447, B464	10 923	0.9	67.4 (26)	2.1 (31)	6.2 (11)	40.8 (23)	12.1 (12)	29.7 (46)	17.0 (30)	25.9 (10)
26	Acute pyoderma (080011)	A46, L00, L01*, L020, L021, L022, L024, L028, L029, L03*, L08*	10 547	0.9	49.7 (55)	1.1 (68)	0.2 (68)	9.3 (87)	0.7 (75)	13.5 (63)	10.0 (55)	0.5 (69)
27	Upper respiratory tract inflammation (030270)	B302, J00, J02*, J06*, J31*	10 124	0.9	6.4 (90)	0.3 (93)	0.2 (68)	7.9 (90)	0.1 (91)	0.3 (99)	5.0 (89)	0.0 (85)
28	Impairment from fracture of thoracic or lumbar vertebra or lower (including thoracic/lumbar spinal cord injury) (160690)	S220*, S221*, S230, S231, S232, S233, S240, S241, S242, S245, S320*, S330, S331, S340, S341, S342, S343, S344, S345, T08*	9 547	0.8	82.9 (8)	2.7 (19)	0.1 (75)	45.3 (19)	2.4 (39)	8.2 (76)	26.0 (6)	0.3 (74)
29	Cirrhosis (including biliary cirrhosis) (060300)	I81, I820, I850, I859, I864, I982, K717, K721, K729, K740, K741, K742, K743, K744, K745, K746, K765, K766	9 189	0.8	61.7 (44)	2.7 (19)	3.3 (17)	33.4 (28)	6.2 (27)	39.5 (33)	17.0 (30)	19.4 (17)
30	Malignant tumour of liver/intrahepatic bile duct (including secondary tumour) (060050)	C22*, C787, D015, D376	8 854	0.8	74.5 (15)	1.5 (53)	1.0 (33)	18.0 (60)	1.6 (55)	31.2 (43)	17.0 (30)	42.9 (3)
31	Acute tonsillitis, acute laryngopharyngitis (040060)	A691, J03*, J04*, J05*, J390, J391, J392, J393, J399	8 795	0.8	6.3 (91)	0.5 (87)	0.1 (75)	5.6 (93)	0.5 (80)	2.7 (87)	5.0 (89)	0.1 (82)
32	Pneumothorax (040200)	J93*	8 764	0.8	27.4 (77)	0.6 (85)	0.3 (60)	14.6 (68)	2.2 (43)	37.3 (37)	9.0 (62)	1.3 (59)
33	Malignant tumour of colon (ascending to sigmoid colon) (060035)	C18*, C260, C269, C775, C785, D010	8 409	0.7	71.6 (19)	1.5 (53)	0.3 (60)	12.7 (77)	1.4 (60)	62.2 (16)	24.0 (9)	17.2 (18)
34	Dehydration (100380)	E86	8 380	0.7	61.5 (45)	3.2 (13)	1.5 (29)	30.2 (35)	1.6 (55)	2.1 (89)	6.0 (82)	2.6 (47)
35	Tachyarrhythmia (050070)	I456, I47*, I48, I490, I491, I492, I493, I494, I498	7 779	0.7	65.5 (30)	1.4 (58)	2.5 (22)	33.3 (29)	6.7 (25)	21.6 (56)	9.0 (62)	2.2 (51)
36	Bradyarrhythmia (050210)	I440, I441, I442, I443, I444, I445, I446, I447, I450, I451, I452, I453, I454, I455, I458, I459, I46*, I495, T821	7 331	0.6	85.8 (5)	1.8 (43)	16.0 (4)	47.0 (17)	16.3 (9)	62.3 (15)	13.0 (50)	17.1 (19)
37	Premature labour, threatened premature labour (120170)	O470, O471, O479, O60	7 161	0.6	0.0 (95)	0.5 (87)	0.0 (82)	13.7 (71)	0.0 (97)	17.9 (59)	16.0 (34)	0.0 (85)
38	Other infectious disease	A060, A061, A062, A063, A067, A068, A069, A07*,	6 959	0.6	22.5 (82)	0.3 (93)	0.8 (38)	11.6 (82)	1.9 (51)	9.3 (73)	6.0 (82)	5.1 (36)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)						
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
	(excluding fungal infection) (180030)	A180, A181, A184, A185, A186, A187, A188, A20*, A21*, A22*, A23*, A24*, A25*, A26*, A27*, A28*, A30*, A311, A318, A320, A328, A329, A33, A34, A35, A36*, A371, A38, A42*, A43*, A44*, A482, A484, A488, A49*, A68*, A690, A692, A698, A699, A70, A748, A749, A75*, A77*, A78, A79*, A90, A91, A92*, A93*, A94, A95*, A96*, A98*, A99, B001, B002, B008, B009, B03, B04, B07, B080, B081, B082, B084, B085, B088, B09, B258, B259, B260, B268, B269, B33*, B34*, B35*, B36*, B370, B372, B373, B374, B378, B379, B380, B381, B382, B383, B388, B389, B390, B391, B392, B394, B395, B399, B400, B401, B402, B403, B408, B409, B410, B418, B419, B420, B421, B428, B429, B430, B432, B438, B439, B442, B448, B449, B460, B461, B462, B463, B465, B468, B469, B47*, B48*, B49, B50*, B51*, B52*, B53*, B54, B55*, B56*, B57*, B580, B581, B583, B588, B589, B60*, B64, B650, B651, B652, B653, B658, B660, B661, B662, B663, B665, B668, B669, B67*, B68*, B69*, B70*, B71*, B72, B73, B74*, B75, B76*, B77*, B78*, B79, B80, B81*, B82*, B83*, B85*, B86, B87*, B88*, B90*, B91, B92, B94*, T793, U049										
39	Complications due to operation and procedure (180040)	T80*, T81*, T820, T822, T823, T824, T825, T826, T827, T828, T829, T83*, T84*, T85*, T86*, T87*, T880, T881, T882, T883, T884, T885, T886, T888, T889	6 943	0.6	53.2 (54)	1.3 (60)	0.6 (45)	12.5 (80)	2.0 (48)	60.0 (19)	10.0 (55)	2.3 (49)
40	Pancreas and spleen tumor (06007x)	C25*, C261, D136, D137, D377	6 815	0.6	72.6 (17)	1.9 (40)	0.6 (45)	12.0 (81)	0.6 (78)	41.2 (31)	22.0 (18)	34.9 (5)
41	Drug poisoning (161070)	T36*, T37*, T38*, T39*, T40*, T41*, T42*, T43*, T44*, T45*	6 748	0.6	13.4 (86)	33.7 (1)	26.2 (2)	74.1 (2)	37.8 (1)	1.7 (91)	2.0 (100)	0.3 (74)
42	Peritonitis, abdominal abscess (excluding female genital organs) (060370)	A183, K630, K631, K632, K65*, K67*	6 746	0.6	48.0 (59)	1.6 (47)	1.0 (33)	28.5 (37)	7.0 (24)	56.6 (21)	16.0 (34)	7.7 (32)
43	Acute pancreatitis (060350)	B263, K85, K863, K871	6 494	0.6	43.6 (64)	3.9 (7)	0.3 (60)	24.3 (44)	4.5 (30)	17.2 (61)	14.0 (44)	2.8 (45)
44	Type 2 diabetes (excluding diabetic ketoacidosis) (100070)	E112, E113, E114, E115, E116, E117, E118, E119	6 265	0.5	58.1 (48)	3.9 (7)	1.0 (33)	18.5 (57)	1.0 (68)	8.9 (74)	18.0 (27)	0.9 (62)
45	Inflammation with cerebrospinal infection (010080)	A066, A321, A390, A80*, A82*, A838, A839, A858, A88*, A89, B003, B004, B005, B010, B011, B020, B021, B050, B051, B060, B261, B262, B375, B384, B431, B582, G00*, G02*, G03*, G041, G042, G048, G049, G05*, G06*, G07, G08, G09, G958	5 850	0.5	15.0 (85)	1.3 (60)	4.0 (14)	20.8 (50)	4.6 (28)	8.0 (77)	9.0 (62)	2.2 (51)
46	Subarachnoid haemorrhage, ruptured cerebral aneurysm (010020)	I60*	5 779	0.5	47.9 (60)	0.8 (76)	33.9 (1)	76.0 (1)	30.3 (2)	73.2 (11)	28.0 (4)	26.9 (9)
47	Bacterial enteritis (150020)	A00*, A01*, A020, A022, A028, A029, A030, A031, A032, A033, A038, A039, A040, A041, A042, A043, A044, A045, A046, A047, A048, A049, A050, A052,	5 632	0.5	25.1 (78)	0.8 (76)	0.2 (68)	13.1 (74)	0.6 (78)	1.7 (91)	6.0 (82)	1.0 (60)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
		A053, A054, A058, A059										
48	Herpes zoster (080020)	B022, B023, B027, B028, B029	5 542	0.5	63.3 (38)	2.6 (22)	0.0 (82)	2.8 (97)	0.1 (91)	0.9 (94)	8.0 (70)	0.1 (82)
49	Respiratory failure (040130)	J96*	5 501	0.5	71.4 (20)	2.7 (19)	9.5 (7)	42.3 (22)	11.3 (13)	10.9 (69)	14.0 (44)	21.8 (14)
50	Upper urinary tract disease (11012x)	D301, D302, N132, N20*, N281, N288	5 291	0.5	28.8 (75)	0.7 (82)	0.2 (68)	21.8 (48)	0.9 (71)	38.9 (34)	4.0 (95)	0.1 (82)
51	Interstitial pneumonia (040110)	J60, J61, J62*, J63*, J64, J65, J66*, J67*, J68*, J70*, J82, J84*, J990, J991	5 266	0.5	78.8 (10)	2.1 (31)	1.0 (33)	21.2 (49)	4.6 (28)	6.3 (81)	21.0 (20)	25.3 (11)
52	Ischemic enterocolitis (060190)	K55*	5 265	0.5	63.4 (37)	1.1 (68)	0.6 (45)	17.3 (63)	2.4 (39)	11.1 (68)	10.0 (55)	4.1 (38)
53	Malignant tumour of gallbladder (060060)	C23, C24*	5 159	0.4	84.1 (7)	1.3 (60)	0.3 (60)	13.1 (74)	0.8 (73)	58.2 (20)	23.0 (11)	28.8 (8)
54	Brain tumour (010010)	C700, C709, C71*, C722, C723, C724, C793, D320, D329, D330, D331, D332, D333, D337, D339, D420, D429, D430, D431, D432, D433, D437, D439, G131, G132	4 883	0.4	47.6 (62)	1.7 (44)	3.2 (18)	28.2 (38)	4.4 (31)	34.2 (40)	23.0 (11)	17.1 (19)
55	Spinal stenosis (including spondylosis) (07034x)	G551, G552, G553, G558, G950, G951, G952, G959, M4320, M4321, M4322, M4323, M4324, M4325, M4326, M4327, M4328, M4329, M4700, M4701, M4702, M4703, M4704, M4705, M4706, M4707, M4708, M4709, M4710, M4711, M4712, M4713, M4714, M4715, M4716, M4717, M4718, M4719, M4720, M4721, M4722, M4723, M4724, M4725, M4726, M4727, M4728, M4729, M4780, M4781, M4782, M4783, M4784, M4785, M4786, M4787, M4788, M4789, M4790, M4791, M4792, M4793, M4794, M4795, M4796, M4797, M4798, M4799, M4800, M4801, M4802, M4803, M4804, M4805, M4806, M4807, M4808, M4809, M4810, M4811, M4812, M4813, M4814, M4815, M4816, M4817, M4818, M4819, M4820, M4821, M4822, M4823, M4824, M4825, M4826, M4827, M4828, M4829, M4830, M4831, M4832, M4833, M4834, M4835, M4836, M4837, M4838, M4839, M4840, M4841, M4842, M4843, M4844, M4845, M4846, M4847, M4848, M4849, M4850, M4851, M4852, M4853, M4854, M4855, M4856, M4857, M4858, M4859, M4880, M4881, M4882, M4883, M4884, M4885, M4886, M4887, M4888, M4889, M4890, M4891, M4892, M4893, M4894, M4895, M4896, M4897, M4898, M4899, M4940, M4941, M4942, M4943, M4944, M4945, M4946, M4947, M4948, M4949, M4980, M4981, M4982, M4983, M4984, M4985, M4986, M4987, M4988, M4989, M5300, M5301, M5302, M5303, M5304, M5305, M5306, M5307, M5308, M5309, M5310, M5311, M5312, M5313, M5314, M5315, M5316, M5317, M5318, M5319, M5330, M5331, M5332, M5333, M5334, M5335, M5336, M5337, M5338, M5339, M5380, M5381, M5382, M5383, M5384, M5385, M5386,	4 807	0.4	77.3 (12)	2.0 (37)	0.0 (82)	23.6 (45)	1.0 (68)	23.5 (52)	20.0 (25)	0.5 (69)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
		M5387, M5388, M5389, M5390, M5391, M5392, M5393, M5394, M5395, M5396, M5397, M5398, M5399, M9950, M9951, M9952, M9953, M9954, M9955, M9956, M9957, M9958, M9959, M9960, M9961, M9962, M9963, M9964, M9965, M9966, M9967, M9968, M9969, M9970, M9971, M9972, M9973, M9974, M9975, M9976, M9977, M9978, M9979										
56	Anaemia (130090)	D500, D501, D508, D509, D510, D511, D512, D513, D518, D519, D520, D521, D528, D529, D530, D531, D532, D538, D539, D550, D551, D552, D559, D560, D561, D562, D563, D564, D569, D570, D571, D572, D573, D580, D581, D582, D588, D589, D590, D591, D592, D593, D594, D595, D596, D599, D62, D640, D641, D642, D643, D644, D648, D649	4 756	0.4	63.1 (40)	2.0 (37)	0.6 (45)	18.6 (56)	1.9 (51)	37.7 (36)	11.0 (51)	3.8 (39)
57	Maternal care related to the fetus and amniotic cavity and possible delivery problems (120180)	O30*, O31*, O32*, O33*, O34*, O35*, O36*, O40, O41*, O42*, O43*, O44*, O45*, O46*, O48	4 658	0.4	0.0 (95)	0.4 (90)	0.0 (82)	13.3 (73)	0.1 (91)	70.6 (12)	9.0 (62)	0.0 (85)
58	Malignant tumour of rectum and anus (rectosigmoid colon to anus) (060040)	C19, C20, C21*, D011, D012, D013, D014	4 646	0.4	63.6 (35)	1.9 (40)	0.4 (52)	14.6 (68)	1.1 (65)	49.8 (25)	23.0 (11)	21.0 (16)
59	Nontraumatic subdural haemorrhage (010050)	I620, I621	4 606	0.4	85.8 (5)	2.2 (30)	2.7 (20)	27.9 (39)	9.7 (18)	92.6 (4)	10.0 (55)	1.9 (54)
60	Acute renal failure (110290)	K767, N17*	4 034	0.3	70.1 (21)	3.0 (16)	2.7 (20)	31.5 (32)	7.3 (23)	27.0 (49)	15.0 (38)	14.2 (22)
61	Intervertebral disk degeneration, disk herniation (070350)	M50*, M51*	4 004	0.3	20.2 (84)	1.6 (47)	0.0 (82)	27.4 (40)	0.2 (89)	28.8 (47)	15.0 (38)	0.0 (85)
62	Autoimmune disease with systemic organ disease (070560)	D86*, I00, L88, L92*, L93*, L940, L941, L942, L943, L95*, L982, L983, M0200, M0208, M0209, M0210, M0218, M0219, M0220, M0228, M0229, M0280, M0288, M0289, M0290, M0298, M0299, M0300, M0310, M0320, M0360, M0720, M0740, M0748, M0749, M0750, M0758, M0759, M0760, M0768, M0769, M0830, M0838, M0839, M0840, M0848, M0849, M0880, M0888, M0889, M0890, M0898, M0899, M091*, M092*, M098*, M120*, M121*, M1230, M1238, M1239, M1300, M1302, M1303, M1305, M1310, M1380, M1390, M150, M153, M154, M158, M159, M1900, M300, M301, M302, M308, M31*, M32*, M330, M331, M332, M339, M34*, M350, M351, M352, M353, M354, M355, M356, M357, M358, M359, M36*, M633	3 864	0.3	45.3 (63)	3.0 (16)	0.5 (50)	12.9 (76)	1.8 (53)	11.6 (66)	21.0 (20)	4.5 (37)
63	Peritonsillar abscess (030240)	J36	3 811	0.3	10.3 (89)	0.3 (93)	0.0 (82)	2.3 (98)	0.2 (89)	35.0 (39)	6.0 (82)	0.0 (85)
64	Dystocia with complication of labour or obstetric operation (120260)	O61*, O62*, O63*, O64*, O65*, O66*, O67*, O68*, O69*, O70*, O71*, O720, O721, O722, O73*, O74*, O75*, O81*, O82*, O83*, O84*	3 646	0.3	0.0 (95)	0.4 (90)	0.0 (82)	13.6 (72)	0.5 (80)	84.8 (7)	8.0 (70)	0.0 (85)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
65	Disseminated intravascular coagulation (130100)	D65, D683, O723	3 631	0.3	72.0 (18)	2.1 (31)	8.3 (8)	45.5 (18)	13.9 (11)	49.6 (26)	23.0 (11)	46.0 (1)
66	Other humoral/electrolyte/acid–base balance disorders (100393)	E870, E871, E872, E873, E874, E875, E877, E878	3 622	0.3	61.5 (45)	7.0 (4)	4.0 (14)	32.3 (30)	8.3 (20)	4.6 (86)	8.0 (70)	2.7 (46)
67	Kawasaki disease (1500709)	M303	3 576	0.3	0.0 (95)	0.0 (98)	0.0 (82)	2.1 (99)	0.0 (97)	0.8 (95)	11.0 (51)	0.0 (85)
68	Retinal detachment (020160)	H330, H332, H333, H334, H335	3 566	0.3	23.4 (80)	0.3 (93)	0.0 (82)	0.2 (100)	0.0 (97)	99.2 (1)	14.0 (44)	0.0 (85)
69	Non–Hodgkin lymphoma (130030)	C820, C821, C822, C827, C829, C830, C831, C832, C833, C834, C835, C836, C837, C838, C839, C840, C841, C842, C843, C844, C845, C850, C851, C857, C859	3 492	0.3	68.0 (24)	1.7 (44)	0.7 (41)	13.9 (70)	2.0 (48)	38.5 (35)	29.0 (3)	24.3 (13)
70	Sudden idiopathic hearing loss (030428)	H912	3 489	0.3	33.9 (71)	0.6 (85)	0.0 (82)	5.3 (94)	0.1 (91)	2.1 (89)	10.0 (55)	0.0 (85)
71	Hypertension or other diseases associated with pregnancy/labour/puerperium (120160)	O10*, O11, O12*, O13, O14*, O15*, O16, O21*, O22*, O23*, O25, O26*	3 480	0.3	0.1 (93)	0.8 (76)	0.1 (75)	10.7 (84)	0.3 (87)	30.6 (45)	9.0 (62)	0.0 (85)
72	Other digestive tract disorders (060570)	K00*, K01*, K02*, K03*, K04*, K05*, K06*, K08*, K09*, K10*, K14*, K319, K590, K591, K592, K594, K598, K599, K629, K66*, K759, K764, K769, K918, K919	3 420	0.3	48.2 (58)	2.6 (22)	0.3 (60)	17.7 (61)	2.2 (43)	10.0 (72)	8.0 (70)	2.0 (53)
73	Arteriosclerosis obliterans (050170)	I700, I702, I708, I709, I720, I721, I724, I73*, I740, I741, I742, I743, I744, I745, I748, I749	3 393	0.3	82.1 (9)	1.1 (68)	0.6 (45)	22.9 (46)	4.4 (31)	60.9 (18)	18.0 (27)	9.1 (28)
74	Febrile convulsion (150040)	R560	3 365	0.3	0.1 (93)	0.0 (98)	4.2 (13)	55.2 (9)	1.0 (68)	0.4 (98)	4.0 (95)	0.0 (85)
75	Fracture/dislocation of ankle joint or foot (160850)	M8437, S8250, S8260, S8280, S9200, S9210, S9220, S9230, S9240, S9250, S9270, S9290, S930, S931, S932, S933	3 345	0.3	36.3 (69)	2.1 (31)	0.0 (82)	28.8 (36)	1.8 (53)	83.5 (8)	27.0 (5)	0.0 (85)
76	Periarticular fracture/dislocation of knee (160820)	S7240, S8200, S8210, S8270	3 343	0.3	66.3 (29)	2.4 (27)	0.2 (68)	38.6 (24)	1.4 (60)	69.1 (13)	35.0 (1)	0.4 (73)
77	Influenza, viral pneumonia (040070)	J10*, J11*, J12*	3 309	0.3	4.4 (92)	0.3 (93)	0.3 (60)	6.8 (92)	0.1 (91)	1.2 (93)	6.0 (82)	0.2 (79)
78	Multiple injuries (160990)	S434, S435, S436, S437, S49*, S59*, S69*, S79*, S89*, S99*, T00*, T01*, T02*, T03*, T04*, T06*, T07	3 254	0.3	57.3 (50)	3.6 (10)	1.6 (26)	65.2 (5)	15.9 (10)	40.5 (32)	19.0 (26)	0.8 (64)
79	Fulminant hepatitis, acute liver failure, acute hepatitis (060270)	B150, B159, B160, B161, B162, B169, B170, B171, B172, B178, B19*, B251, K710, K711, K712, K719, K720, K762, K763	3 212	0.3	28.8 (75)	2.1 (31)	1.2 (31)	10.8 (83)	2.8 (38)	6.8 (79)	14.0 (44)	7.8 (31)
80	Chronic obstructive lung disease (040120)	J43*, J44*	3 165	0.3	87.7 (3)	2.1 (31)	1.5 (29)	31.4 (33)	3.8 (34)	4.7 (85)	15.0 (38)	10.7 (25)
81	Unspecified injury (161060)	T090, T091, T092, T093, T094, T095, T098, T099, T10*, T110, T119, T12*, T130, T131, T132, T133, T134, T135, T138, T139, T140, T141, T142*, T143, T144, T145, T146, T148, T149, T189, T288, T289, T66, T71, T73*, T751, T753, T758, T782, T783, T784, T788, T789, T794, T795, T797, T798, T799	3 127	0.3	32.7 (73)	2.9 (18)	5.5 (12)	54.2 (10)	20.1 (7)	25.7 (50)	3.0 (98)	3.8 (39)
82	Haemorrhage in early	O20*	3 108	0.3	0.0 (95)	0.4 (90)	0.0 (82)	5.2 (95)	0.1 (91)	8.3 (75)	9.0 (62)	0.0 (85)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
	pregnancy (120150)											
83	Leucocytic disease (130070)	D70, D720, D721, D728, D729	3 049	0.3	48.9 (56)	1.2 (66)	0.1 (75)	4.8 (96)	0.5 (80)	17.7 (60)	7.0 (78)	2.9 (43)
84	Dissecting aneurysm (050161)	I710	2 974	0.3	64.4 (32)	1.6 (47)	2.2 (23)	58.8 (7)	21.5 (4)	33.7 (41)	23.0 (11)	10.2 (26)
85	Alcoholic liver disease (060280)	K70*	2 964	0.3	30.7 (74)	14.7 (2)	1.6 (26)	25.2 (43)	2.4 (39)	12.7 (64)	14.0 (44)	9.4 (27)
86	Male genital diseas (11022x)	D294, I861, N41*, N43*, N44, N45*, N46, N47, N48*, N508	2 841	0.2	53.3 (53)	0.9 (73)	0.0 (82)	8.9 (89)	0.7 (75)	15.3 (62)	8.0 (70)	0.3 (74)
87	Pulmonary/mediastinal infection and abscess (040150)	A065, B440, B441, B45*, B659, B664, E321, E328, J850, J851, J852, J853, J86*, J985	2 834	0.2	62.2 (42)	2.6 (22)	0.7 (41)	20.4 (51)	3.8 (34)	18.9 (58)	24.0 (9)	11.4 (23)
88	Malignant tumour of oesophagus (including cervical region) (060010)	C150, C151, C152, C153, C154, C155, C158, C159, D001	2 805	0.2	66.6 (28)	2.0 (37)	0.4 (52)	12.7 (77)	0.7 (75)	36.5 (38)	22.0 (18)	30.9 (6)
89	Pelvic injury (160980)	S321*, S322*, S323*, S324*, S325*, S327*, S328*, S332, S333, S334, S335, S336, S337, S348, S377*, S378*, S379*, S383, S39*	2 783	0.2	67.7 (25)	3.2 (13)	0.7 (41)	53.3 (12)	10.2 (17)	22.6 (54)	25.0 (7)	1.0 (60)
90	Muscle and tendon injury of the extremities (160610)	M620*, M621*, M623*, M626*, M628*, M629*, M660*, M661*, M662*, M663*, M664*, M665*, S46*, S534, S56*, S633, S634, S635, S636, S637, S66*, S731, S76*, S86*, S934, S935, S936, S96*, T112, T115	2 700	0.2	33.3 (72)	4.5 (5)	0.8 (38)	30.8 (34)	3.6 (36)	55.5 (22)	10.0 (55)	0.6 (66)
91	Retroperitoneal disease (110050)	C786, D200, D483	2 695	0.2	65.1 (31)	1.6 (47)	0.4 (52)	12.7 (77)	0.9 (71)	28.4 (48)	21.0 (20)	45.7 (2)
92	Chemical poisoning (161070)	T46*, T47*, T48*, T49*, T50*, T51*, T52*, T53*, T54*, T55, T56*, T57*, T58, T59*, T60*, T61*, T62*, T63*, T64, T65*, T887	2 694	0.2	40.5 (68)	9.0 (3)	7.9 (10)	52.6 (13)	21.3 (6)	12.7 (64)	3.0 (98)	3.8 (39)
93	Facial injury (including oral/pharyngeal injury) (160200)	S003, S004, S005, S012, S013, S014, S015, S022*, S023*, S024*, S025*, S026*, S027*, S028*, S029*, S041, S042, S043, S044, S045, S046, S047, S048, S049, S070, S078, S081, S088, S099, S100, S101, T180	2 576	0.2	24.3 (79)	2.6 (22)	1.9 (25)	53.4 (11)	11.3 (13)	55.0 (24)	5.0 (89)	0.6 (66)
94	Malignant tumour of bone or soft tissue (excluding spine and spinal cord) (070040)	C400, C401, C402, C403, C408, C409, C413, C418, C419, C471, C472, C473, C474, C475, C476, C478, C479, C491, C492, C493, C494, C495, C496, C498, C499, C764, C765, C773, C774, C795, C96*, D092, D097	2 550	0.2	63.1 (40)	3.5 (11)	0.2 (68)	17.5 (62)	0.5 (80)	24.1 (51)	25.0 (7)	24.4 (12)
95	Malignant prostatic tumour (110080)	C61, C637, D075	2 549	0.2	90.3 (2)	1.3 (60)	0.7 (41)	15.6 (65)	0.5 (80)	23.1 (53)	16.0 (34)	21.8 (14)
96	Periarticular fracture/dislocation of elbow (160740)	S4240, S5200, S5210, S530, S531	2 494	0.2	20.3 (83)	0.7 (82)	0.0 (82)	18.8 (54)	0.8 (73)	95.8 (2)	4.0 (95)	0.2 (79)
97	Fracture of forearm (160760)	S5220, S5230, S5240, S5250, S5270, S5280, S5290	2 463	0.2	41.0 (67)	0.5 (87)	0.1 (75)	27.1 (41)	1.6 (55)	95.4 (3)	7.0 (78)	0.0 (85)
98	Diabetic ketoacidosis, nonketotic coma (100040)	E100, E101, E110, E111, E130, E131, E140, E141	2 444	0.2	41.7 (66)	4.0 (6)	9.8 (6)	44.7 (20)	10.4 (15)	4.9 (84)	15.0 (38)	3.4 (42)
99	Other musculoskeletal/connective tissue diseases (071030)	M!!!!, M0000, M0008, M0009, M0010, M0018, M0019, M0020, M0028, M0029, M0080, M0088, M0089, M0090, M0098, M0099, M0100, M0108, M0109, M0110, M0118, M0119, M0120, M0128, M0129, M0130, M0138, M0139, M0140, M0148,	2 389	0.2	47.7 (61)	1.3 (60)	0.0 (82)	47.1 (16)	0.5 (80)	5.5 (83)	8.0 (70)	0.5 (69)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)						
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance Tertiary	Surgery	LOS	Mortality
		M0149, M0150, M0158, M0159, M0160, M0168, M0169, M0180, M0188, M0189, M0308, M0309, M0312, M0318, M0319, M0328, M0329, M0368, M0369, M1240, M1248, M1249, M1250, M1258, M1259, M1280, M1288, M1289, M1309, M1319, M1389, M1399, M1908, M1909, M1910, M1918, M1919, M1920, M1928, M1929, M1980, M1988, M1989, M1990, M1998, M1999, M2100, M2108, M2109, M2110, M2118, M2119, M2120, M2128, M2129, M2170, M2178, M2179, M2180, M2188, M2189, M2190, M2198, M2199, M2450, M2458, M2459, M2460, M2468, M2469, M2480, M2488, M2489, M2500, M2508, M2509, M2510, M2518, M2519, M2540, M2548, M2549, M2550, M2551, M2552, M2554, M2555, M2556, M2557, M2558, M2559, M2560, M2568, M2569, M2570, M2578, M2579, M2580, M2588, M2589, M2590, M2598, M2599, M540*, M541*, M542*, M543*, M544*, M545*, M546*, M548*, M549*, M671, M678, M679, M798*, M799*, M8300, M8301, M8302, M8303, M8304, M8305, M8307, M8308, M8309, M8310, M8311, M8312, M8313, M8314, M8315, M8317, M8318, M8319, M8320, M8321, M8322, M8323, M8324, M8325, M8327, M8328, M8329, M8330, M8331, M8332, M8333, M8334, M8335, M8337, M8338, M8339, M8340, M8341, M8342, M8343, M8344, M8345, M8347, M8348, M8349, M8350, M8351, M8352, M8353, M8354, M8355, M8357, M8358, M8359, M8380, M8381, M8382, M8383, M8384, M8385, M8387, M8388, M8389, M8390, M8391, M8392, M8393, M8394, M8395, M8397, M8398, M8399, M852*, M858*, M859*, M8600, M8800, M8801, M8802, M8803, M8804, M8805, M8806, M8807, M8809, M889*, M900*, M901*, M902*, M906*, M907*, M913*, M938, M951, M952, M953, M954, M955, M958, M959, M961, M966, M968, M969, M990*, M991*, M992*, M993*, M994*, M998*, M999*									
100	Fracture or dislocation around the shoulder (160720)	M2431, M2441, S4220, S4230, S4270, S4280, S4290, S430, S431, S432, S433	2 370	0.2	68.9 (22)	3.1 (15)	0.0 (82)	35.6 (26)	2.2 (43)	76.8 (9)	21.0 (20)	0.6 (66)

Rankings were based on data from the top 100 causes of admissions. Comorbidity of mental illness was defined as the following ICD-10 codes as comorbidities: unipolar depressive disorders (F32–F33), bipolar affective disorder (F30–F31), schizophrenia (F20–F29), alcohol use disorders (F10), drug use disorders (F11–F16 and F18–F19), post-traumatic stress disorder (F431), obsessive-compulsive disorder (F42), panic disorder (F400 and F410), or insomnia (F51). Deep coma was defined as a score on the Japan Soma Scale of 100 or more.
Ambulance, ambulance service; LOS, median length of stay; Mortality, in-hospital mortality; Tertiary, tertiary emergency medical services; *, wild card; M!!!!, ICD-10 code numbers starting with 'M' not elsewhere classified.

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Comparison of emergency hospital admissions for drug poisoning and major diseases: a retrospective observational study using a nationwide administrative discharge database

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ABSTRACT

Objective: To compare the clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseases.

Design: Retrospective observational study.

Setting: Discharged patients from 855 acute care hospitals from 1 July to 31 December in 2008 in Japan.

Results: There were a total of 1 157 893 emergency hospital admissions. Among the top 100 causes, drug poisoning was ranked higher in terms of the percentage of patients using ambulance services (74.1%; 2nd) and tertiary emergency medical services (37.8%; 1st). Despite higher utilization of emergency care resources, drug poisoning ranked lower in terms of the median length of stay (2 days; 100th), percentage of requirement for surgical procedures (1.7%; 91st), and in-hospital mortality ratio (0.3%; 74th).

Conclusion: Drug poisoning is unique among the top 100 causes of emergency admissions. Our findings suggest that drug poisoning imposes a greater burden on emergency care resources but has a less severe clinical course than other causes of admissions. Future research should focus on strategies to reduce the burden of drug poisoning on emergency medical systems.

Article Summary

Article focus

■ Only a few multicenter studies have compared resource use and clinical course of emergency hospital admissions. Our aim was to compare the clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseases by using a nationwide administrative discharge database.

Key messages

■ Drug poisoning is in an anomalous position among the top 100 causes of emergency admissions.

■ Patients with drug poisoning had a less severe clinical course than those with other causes, although they had higher utilization of emergency care resources.

Strengths and limitations of this study

■ A large data from a nationwide discharge database was studied.

■ Our results are limited to inpatient admissions to acute care hospitals.

INTRODUCTION

A better understanding of epidemiology in emergency medical services (EMS) is important for planning EMS resource use and EMS personnel training needs.[1] Drug poisoning is a major cause of admissions to acute care hospitals and places a considerable burden on EMS resources. Drug poisoning accounts for over 15% of all admissions to intensive care units.[2 3] However, most cases of drug poisoning do not result in clinical toxicity. Of patients with drug poisoning admitted to an intensive care unit, 91% do not require advanced treatments.[2] Over 75% of patients admitted to emergency departments can be released from medical observation after a brief period (i.e., 1–2 days).[4-6] Less than 1% of cases result in mortality.[7 8] These previous studies suggest that drug poisoning may impose a needless burden on high-level EMS despite their limited requirements for advanced treatments.[2 9]

Although a number of studies have examined the detailed epidemiology of drug poisoning,[2-8] only a few multicenter studies have compared resource use and clinical course of emergency hospital admissions.[10-12] It remains unknown whether drug poisoning imposes a greater burden on emergency care resources and has a less severe clinical course among major causes of admissions. We thus aimed to compare the clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseases by using a nationwide administrative discharge database.

METHODS

Data source

We conducted an observational study using the nationwide discharge administrative database of the Diagnosis Procedure Combination/Per-Diem Payment System (DPC/PDPS), a Japanese case-mix classification system launched in 2002 by the Ministry of Health, Labour and Welfare of Japan.[13] Every year, the DPC Research Group conducts a survey of DPC/PDPS hospitals. In 2008, 855 of 1 558 DPC/PDPS hospitals voluntarily participated in the survey. The DPC/PDPS database includes clinical and procedural information on *all* inpatients discharged from the participating hospitals between 1 July and 31 December. All the data for each patient were recorded at discharge. The database includes 2.86 million admissions, representing approximately 40% of all inpatient admissions to acute care hospitals in Japan (excluding psychiatric and tuberculosis hospitals).[14] In the present study, we included all emergency hospital admissions and excluded planned admissions to the DPC/PDPS hospitals.

Setting

In Japan, the EMS system is divided into 3 categories:[15] (1) primary EMS that provides care to patients who can be discharged without hospitalization; (2) secondary EMS that provides care to patients who require admission to a regular inpatient bed; and (3) tertiary EMS that provides care to severely ill and trauma patients who require intensive care. In 2008, there were 18 892 clinics and 963 hospitals for primary EMS, 3 053 hospitals for secondary EMS, and 214 hospitals for tertiary EMS.[14] In the present study, we focused on secondary and tertiary EMS rather than primary EMS, because the DPC/PDPS database is an inpatient database. Among the 855 participating hospitals in the DPC/PDPS database, 130 provide tertiary EMS.

Clinical and procedural characteristics

To describe clinical and procedural characteristics of emergency hospital admissions, we used the following study variables: (1) age; (2) gender; (3) major disease categories; (4) comorbidities at admissions; (5) level of consciousness assessed by the Japan Coma Scale (JCS);[16] (6) use of ambulance service; (7) use of tertiary EMS; (8) requirement for surgical procedures that include both major surgery and suturing in an emergency department; (9) length of stay (days); and (10) in-hospital mortality.

Physicians recorded information on diagnoses using the International Classification of Diseases 10th revision (ICD-10) codes. According to the ICD-10 codes, 506 major disease categories were defined in 2008 (see Supplemental Table). In the database, patients with drug, chemical, and unspecified poisoning (ICD-10 codes T360–T509, T510–T659, and T887, respectively) have the same major disease code (disease code 161070). In the present study, we modified the disease code to separate drug poisoning (modified disease code 161070a) from chemical and unspecified poisoning (modified disease code 161070b) according to their ICD-10 codes.

In the database, up to 4 diagnosed comorbidities per patient were recorded. Using the criteria developed by the Global Burden of Disease study with some modifications,[17] we defined comorbid status of mental illness as being diagnosed with any of the following ICD-10 codes: unipolar depressive disorders (F32–F33); bipolar affective disorder (F30–F31); schizophrenia (F20–F29); alcohol use disorders (F10); drug use disorders (F11–F16 and F18–F19); post-traumatic stress disorder (F431); obsessive-compulsive disorder (F42); panic disorder (F400 and F410); or insomnia (F51).

Statistical analyses

First, we conducted univariate analyses to summarize the clinical and procedural characteristics of all emergency admissions. Second, we selected patients diagnosed with one of the top 100 major disease codes and calculated summary statistics of 8 variables by disease code. These variables were as follows: (1) percentage of patients aged 65 years or older; (2) percentage of patients comorbid with mental illness; (3) percentage of patients admitted to hospitals with deep coma (JCS scores ≥ 100, corresponding to scores of ≤ 7 on the Glasgow Coma Scale);[16] (4) percentage of patients using ambulance services; (5) percentage of patients using tertiary EMS; (6) percentage of patients requiring surgical procedures; (7) median length of stay; and (8) percentage of in-hospital mortality. To maximize interpretability, we restricted this analysis to patients with one of the top 100 causes of admissions. We used a predictive principal component analysis (PCA) biplot to reduce the dimensionality of multivariate data (i.e., 100 causes of admissions × 8 variables) and then to visualize 2 dimensions with minimal loss of information.[18] Before conducting the predictive PCA biplot, we standardized each variable with a mean of 0 and a standard deviation of 1 because the measurement units of 8 variables were incommensurable. In the predictive PCA biplot, the 8 variables were represented by 8 biplot axes to read off predictive values of the variables for each of the top 100 causes. All statistical analyses were performed with R version 2.4.1.[19] The predictive PCA biplot was performed using the BiplotGUI package under R.[19]

RESULTS

Characteristics of all emergency hospital admissions

During the study period, there were a total of 1 157 893 emergency hospital admissions to 855 hospitals. Characteristics of these admissions are presented in Table 1. The majority (51.7%) of admissions were for patients aged ≥ 65 years. Patients aged 0–14 years accounted for less than one-sixth (15.3%) of the admissions. The most prevalent diagnosis was pneumonia, accounting for 10.2% of all admissions, followed by stroke (5.5%) and heart failure (2.8%). Drug poisoning ranked 41st among causes of admissions. Less than 5% of patients used tertiary EMS. Of those patients, 88.3% stayed for more than 3 days. About 7% of patients died during hospitalization.

Insert Table 1 here

Comparison of drug poisoning and major diseases

The top 100 causes of admissions covered 83% (965 749 admissions) of all admissions. Characteristics by cause of admission are shown in Table 2 for the top 10 causes and drug poisoning; the top 100 causes are also shown in Supplemental Table. The predictive PCA biplot with 2 dimensions accounts for 62.9% of the variance in the data from the top 100 causes. The predictive PCA biplot revealed that drug poisoning was in a unique position (Figure 1). Among the top 100causes, patients with drug poisoning were less likely to be aged ≥ 65 years (13.4%; 86th) and most likely to be diagnosed with mental illness (33.7%; 1st). In addition, patients with drug poisoning were more likely to be admitted to hospitals with deep coma (26.2%; 2nd), more likely to use ambulance services (74.1%; 2nd), and most likely to use tertiary EMS (37.8%; 1st).

Despite the higher utilization of emergency care resources, clinical course of drug poisoning was less severe. Among the top 100 causes, patients with drug poisoning had the shortest median length of stay (2 days; 100th), were less likely to require surgical procedures (1.7%; 91st), and were less likely to die during hospitalization (0.3%; 74th).

In terms of the percentage of patients admitted to tertiary EMS, subarachnoid haemorrhage and ruptured cerebral aneurysm (disease code 010020) ranked second (30.3%; 2nd; see the 46th row in Supplemental Table). Patients with subarachnoid haemorrhage and ruptured cerebral aneurysm were most likely to be admitted to hospitals with deep coma (33.9%; 1st) and most likely to use ambulance services (76.0%; 1st). They had a longer median length of stay (28 days; 4th), were more likely to require surgical procedures (73.2%; 11st), and were more likely to die during hospitalization (26.9%; 9th).

Insert Table 2 and Figure 1 here

DISCUSSION

To our knowledge, this is the first study that used a nationwide administrative discharge database to compare detailed clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseases. We found that drug poisoning was unique among the top 100 causes of emergency admissions. Patients with drug poisoning had a less severe clinical course than those with other causes, although they had higher utilization of emergency care resources. Our findings suggest that drug poisoning imposes a higher burden on emergency care resources than other causes of emergency admissions.

Our results are consistent with those of a case-control study conducted in Australia and New Zealand.[10] That study found that the median length of stay in patients with drug poisoning was 3 days, which was much lower than the overall median length of stay (9 days) in patients with 1 of the 8 most common diagnoses in a tertiary intensive care unit. One possible explanation for the potential over-utilization of high-level EMS resources is that staff with significant experience in psychosocial assessment might be more available in high-level EMS facilities. In Japan, 85% of tertiary EMS hospitals have psychiatric departments, while 23% of secondary EMS hospitals are so equipped.[14] Because most patients with drug poisoning have attempted suicide,[20] and self-harm patients should receive a specialist psychosocial assessment according to the clinical guideline,[21] patients with drug poisoning are transferred to high-level EMS in which mental health specialists are more available.

Another explanation for the potential over-utilization may relate to difficulties that confront ambulance officers. First, staff in secondary EMS hospitals might decline to manage patients with drug poisoning. A survey conducted in Osaka city revealed that ambulance officers contacted more hospitals to transport patients with drug poisoning than all patients (average

number of contacted hospitals: 7.6 vs. 1.8, respectively).[22] Second, ambulance officers might transport patients with drug poisoning to high-level EMS because of their deep coma. Drug poisoning ranked within the top 2 in terms of the percentage of patients with deep coma and percentage of patients admitted to tertiary EMS. However, patients with drug poisoning had a less severe clinical course than those with other causes. For example, subarachnoid haemorrhage and ruptured cerebral aneurysm had the second highest percentage of patients admitted to tertiary EMS and had a much more severe clinical course than drug poisoning. It would be of great value to investigate triage tools predicting the need for advanced treatments based on information not only from early admission factors,[23] but also from pre-hospital factors.[24]

Our study has several limitations. First, our results cannot be generalized and are limited to inpatient admissions to acute care hospitals rather than emergency outpatient admissions or emergency admissions to psychiatric hospitals, because we used the DPC/PDPS database. Second, we were unable to evaluate variables not included in the DPC/PDPS database. As a result, we could not assess other potentially important factors predicting the need for advanced treatments, such as acute physiology and chronic health evaluation (APACHE) scores at admission[23] or clinical management and course during pre-hospital period.[24] Third, we included all types of drug poisoning (i.e., deliberate, accidental, and undetermined intent) as in a previous study,[7] because data on external causes (ICD-10 codes V01–Y98) are not recorded in the DPC/PDPS database. As a result, we could not distinguish between deliberate and accidental drug poisoning. Fourth, although the database included approximately 40% of all inpatient admissions in Japan, participation in the survey was voluntary for each hospital and the patient selection procedure was not based on a random sampling technique from all acute hospitals.

In conclusion, we have demonstrated that drug poisoning is unique among the top 100 causes

of emergency admissions. Future research should focus on strategies to reduce the burden of drug poisoning on emergency medical systems.

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Competing Interest

None.

Ethic approval

The study protocol was approved by the institutional review board of the University of Occupational and Environmental Health, Fukuoka, Japan.

Contributors

SM, KBI, and KF conducted data collection, data synthesis, and data management. KF and HI obtained funding. YO participated in study concept and design, analysis and interpretation of data, drafting of the manuscript, and critical revision of the manuscript. SS supervised data analysis. SS, KBI, KF, and HI participated in interpretation of data and critical revision of the

manuscript for important intellectual content. All authors contributed to and approved the final manuscript.

Provenance and peer review

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Data sharing information

No additional data are available.

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Table 1 Characteristics of emergency hospital admissions

Characteristic	N of admissions	% of admissions	95% CI
Age			
0–14	177 092	15.3	15.2–15.4
15–64	382 025	33.0	32.9–33.1
≥ 65	598 776	51.7	51.6–51.8
Gender women	547 280	47.3	47.2–47.3
Top 10 causes of admissions and drug poisoning (Disease code)			
1. Pneumonia, acute bronchitis, acute bronchiolitis (040080)	117 649	10.2	10.1–10.2
2. Stroke (010060)	63 931	5.5	5.5–5.6
3. Heart failure (050130)	32 993	2.8	2.8–2.9
4. Intestinal obstruction without hernia (060210)	28 701	2.5	2.5–2.5
5. Fracture of proximal femur (160800)	25 905	2.2	2.2–2.3
6. Viral enteritis (150010)	24 920	2.2	2.1–2.2
7. Asthma (040100)	23 858	2.1	2.0–2.1
8. Angina pectoris, chronic ischemic heart disease (050050)	20 775	1.8	1.8–1.8
9. Disorder associated with shortened gestation period or low birth weight (140010)	20 540	1.8	1.8–1.8
10. Renal infection (110310)	19 853	1.7	1.7–1.7
41. Drug poisoning (161070a)	6 748	0.6	0.6–0.6
Other causes	769 326	66.4	66.4–66.5
Comorbid mental illness	23 279	2.0	2.0–2.0
Deep coma	26 792	2.3	2.3–2.3
Ambulance services	311 333	26.9	26.8–27.0
Tertiary EMS	54 938	4.7	4.7–4.8
Surgical procedures	321 974	27.8	27.7–27.9
Length of stay (days)			
≤ 3	135 096	11.7	11.6–11.7
4–7	266 651	23.0	23.0–23.1
8–14	296 549	25.6	25.5–25.7
15–30	258 717	22.3	22.3–22.4
31–60	136 014	11.7	11.7–11.8
≥ 60	64 866	5.6	5.6–5.6
Death during hospitalization	78 226	6.8	6.7–6.8

Comorbidity of mental illness was defined as the following ICD-10 codes as comorbidities: unipolar depressive disorders (F32–F33), bipolar affective disorder (F30–F31), schizophrenia (F20–F29), alcohol use disorders (F10), drug use disorders (F11–F16 and F18–F19), post-traumatic stress disorder (F431), obsessive-compulsive disorder (F42), panic disorder (F400 and F410), or insomnia (F51). Deep coma was defined as a score on the Japan Soma Scale of 100 or more.
EMS, emergency medical services.

Table 2 Characteristics of poisoning and other causes of admissions

Rank	Top 10 causes of admissions and drug poisoning (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
1	Pneumonia, acute bronchitis, acute bronchiolitis (040080)	A370, A378, A379, A481, B012, B052, B371, B59, J13, J14, J15*, J16*, J17*, J18*, J20*, J21*, J22, J69*	117 649	10.2	48.7 (57)	1.5 (53)	2.2 (23)	19.3 (53)	2.2 (43)	5.7 (82)	9.0 (62)	7.9 (29)
2	Stroke (010060)	G45*, G46*, I63*, I65*, I66*, I675, I679, I693, I978	63 931	5.5	77.8 (11)	1.5 (53)	4.0 (14)	44.1 (21)	8.0 (21)	8.0 (77)	17.0 (30)	5.2 (35)
3	Heart failure (050130)	I50*	32 993	2.8	86.0 (4)	1.3 (60)	1.6 (26)	34.3 (27)	9.3 (19)	11.5 (67)	18.0 (27)	11.1 (24)
4	Intestinal obstruction without hernia (060210)	K560, K562, K563, K564, K565, K566, K567, K913	28 701	2.5	64.3 (33)	1.9 (40)	0.2 (68)	18.1 (59)	2.0 (48)	19.3 (57)	11.0 (51)	2.4 (48)
5	Fracture of proximal femur (160800)	M2435, M2445, S7200, S7210, S7220, S7230, S7270, S7280, S7290, S730	25 905	2.2	90.6 (1)	3.7 (9)	0.1 (75)	49.5 (14)	1.5 (58)	91.0 (5)	30.0 (2)	1.4 (58)
6	Viral enteritis (150010)	A08*, A09	24 920	2.2	23.4 (80)	0.9 (73)	0.1 (75)	14.9 (67)	0.3 (87)	0.8 (95)	5.0 (89)	0.2 (79)
7	Asthma (040100)	J45*, J46	23 858	2.1	12.0 (87)	0.8 (76)	0.4 (52)	9.5 (85)	1.2 (64)	0.5 (97)	6.0 (82)	0.3 (74)
8	Angina pectoris, chronic ischemic heart disease (050050)	I20*, I25*	20 775	1.8	68.2 (23)	0.9 (73)	0.4 (52)	31.9 (31)	7.7 (22)	43.7 (29)	7.0 (78)	0.8 (64)
9	Disorder associated with shortened gestation period or low birth weight (140010)	P00*, P01*, P02*, P03*, P04*, P05*, P07*, P08*, P10*, P11*, P12*, P13*, P15*, P20*, P21*, P22*, P23*, P24*, P25*, P26*, P27*, P28*, P29*, P35*, P36*, P37*, P38, P39*, P50*, P51*, P52*, P53, P54*, P55*, P56*, P57*, P58*, P590, P591, P592, P593, P598, P599, P60, P61*, P70*, P71*, P72*, P74*, P75, P76*, P77, P780, P781, P782, P783, P789, P80*, P81*, P83*, P90, P91*, P92*, P93, P94*, P95, P96*	20 540	1.8	0.0 (95)	0.0 (98)	0.4 (52)	9.4 (86)	0.0 (97)	10.5 (71)	8.0 (70)	0.5 (69)
10	Renal infection (110310)	N10, N151, N390	19 853	1.7	63.7 (34)	1.7 (44)	1.1 (32)	22.5 (47)	1.3 (63)	6.7 (80)	10.0 (55)	1.5 (56)
41	Drug poisoning (161070a)	T36*, T37*, T38*, T39*, T40*, T41*, T42*, T43*, T44*, T45*	6 748	0.6	13.4 (86)	33.7 (1)	26.2 (2)	74.1 (2)	37.8 (1)	1.7 (91)	2.0 (100)	0.3 (74)

Rankings were based on data from the top 100 causes of admissions. Comorbidity of mental illness was defined as the following ICD-10 codes as comorbidities: unipolar depressive disorders (F32–F33), bipolar affective disorder (F30–F31), schizophrenia (F20–F29), alcohol use disorders (F10), drug use disorders (F11–F16 and F18–F19), post-traumatic stress disorder (F431), obsessive-compulsive disorder (F42), panic disorder (F400 and F410), or insomnia (F51). Deep coma was defined as a score on the Japan Soma Scale of 100 or more. Ambulance, ambulance services; LOS, median length of stay; Mortality, in-hospital mortality; Surgery, surgical procedures; Tertiary, tertiary emergency medical services; *, wild card.

Comparison of emergency hospital admissions for drug poisoning and major diseases: a retrospective observational study using a nationwide administrative discharge database

~~Unique features of drug poisoning among the top 100 causes of emergency hospital admissions: a retrospective observational study using a nationwide administrative discharge database~~

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Key words Retrospective studies; overdose; emergency medical services; epidemiology

Word count: 2224 word

ABSTRACT

Objective: To compare the clinical and procedural characteristics of emergency hospital admissions for ~~the top 100~~ drug poisoning and major diseases.~~causes of emergency hospital admissions.~~

Design: Retrospective observational study.

Setting: Discharged patients from 855 acute care hospitals from 1 July to 31 December in 2008 in Japan.

Results: There were a total of 1 157 893 emergency hospital admissions. Among the top 100 causes, drug poisoning was ranked higher in terms of the percentage of patients using ~~ambulatory~~ ambulance services (74.1%; 2nd) and tertiary emergency medical services (37.8%; 1st). Despite higher utilization of emergency care resources, drug poisoning ranked lower in terms of the median length of stay (2 days; 100th), percentage of requirement for ~~surgery~~ surgical procedures (1.7%; 91st), and in-hospital mortality ratio (0.3%; 74th).

Conclusion: Drug poisoning is unique among the top 100 causes of emergency admissions. Our findings suggest that drug poisoning imposes a greater burden on emergency care resources but has a less severe clinical course than other causes of admissions. Future research should focus on strategies to reduce the burden of drug poisoning on emergency medical systems.

Article Summary

Article focus

■ Only a few multicenter studies have compared resource use and clinical course of emergency hospital admissions. ~~Only a few studies have compared resource use and clinical course among patients in a nationally representative sample.~~ Our aim was to compare the clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseases by using a nationwide administrative discharge database. ~~compare the clinical and procedural characteristics of the top 100 causes of emergency hospital admissions using a nationally representative sample of inpatients.~~

Key messages

■ Drug poisoning is in an anomalous position among the top 100 causes of emergency admissions.

■ Patients with drug poisoning had a less severe clinical course than those with other causes, although they had higher utilization of emergency care resources.

Strengths and limitations of this study

■ A large data from a nationwide discharge database was studied.

■ Our results are limited to inpatient admissions to acute care hospitals.

INTRODUCTION

A better understanding of epidemiology in emergency medical services (EMS) is important for planning EMS resource use and EMS personnel training needs.[1] Drug poisoning is a major cause of admissions to acute care hospitals and places a considerable burden on EMS resources. Drug poisoning accounts for over 15% of all admissions to intensive care units.[2 3] However, most cases of drug poisoning do not result in clinical toxicity. Of patients with drug poisoning admitted to an intensive care unit, 91% do not require advanced treatments.[2] Over 75% of patients admitted to emergency departments can be released from medical observation after a brief period (i.e., 1–2 days).[4-6] Less than 1% of cases result in mortality.[7 8] These previous studies suggest that drug poisoning may impose a needless burden on high-level EMS despite their limited requirements for advanced treatments.[2 9]

Although a number of studies have examined the detailed epidemiology of drug poisoning,[2-8] only a few multicenter studies have compared resource use and clinical course ofamong emergency hospital admissionspatients in a nationally representative sample.[10-12] It remains unknown whether drug poisoning imposes a greater burden on emergency care resources and has a less severe clinical course among major causes of admissions. We thus aimed to compare the clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseasesthe top 100 causes of emergency hospital admissions by using a nationwide administrative discharge databasenationally representative sample of inpatients.

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METHODS

Data source

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Setting

In Japan, the EMS system is divided into 3 categories:[15] (1) primary EMS that provides care to patients who can be discharged without hospitalization; (2) secondary EMS that provides care to patients who require admission to a regular inpatient bed; and (3) tertiary EMS that provides care to severely ill and trauma patients who require intensive care. In 2008, there were 18 892 clinics and 963 hospitals for primary EMS, 3 053 hospitals for secondary EMS, and 214 hospitals for tertiary EMS.[14] In the present study, we focused on secondary and tertiary EMS rather than primary EMS, because the DPC/PDPS database is an inpatient database. Among the 855 participating hospitals in the DPC/PDPS database, 130 provide tertiary EMS.

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Clinical and procedural characteristics

To describe clinical and procedural characteristics of emergency hospital admissions, we used the following study variables: (1) age; (2) gender; (3) major disease categories; (4) comorbidities at admissions; (5) level of consciousness assessed by the Japan Coma Scale (JCS);[16] (6) use of ambulance service; (7) use of tertiary EMS; (8) requirement for ~~surgery~~surgical procedures that include both major surgery and suturing in an emergency department; (9) length of stay (days); and (10) in-hospital mortality.

Physicians recorded information on diagnoses using the International Classification of Diseases 10th revision (ICD-10) codes. According to the ICD-10 codes, 506 major disease categories were defined in 2008 (see Supplemental Table). In the database, patients with drug, chemical, and unspecified poisoning (ICD-10 codes T360–T509, T510–T659, and T887, respectively) have the same major disease code (disease code 161070). In the present study, we modified the disease code to separate drug poisoning (modified disease code 161070a) from chemical and unspecified poisoning (modified disease code 161070b) according to their ICD-10 codes.

In the database, up to 4 diagnosed comorbidities per patient were recorded. Using the criteria developed by the Global Burden of Disease study with some modifications,[17] ~~17~~ we defined comorbid status of mental illness as being diagnosed with any of the following ICD-10 codes: unipolar depressive disorders (F32–F33); bipolar affective disorder (F30–F31); schizophrenia (F20–F29); alcohol use disorders (F10); drug use disorders (F11–F16 and F18–F19); post-traumatic stress disorder (F431); obsessive-compulsive disorder (F42); panic disorder (F400 and F410); or insomnia (F51).

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Statistical analyses

First, we conducted univariate analyses to summarize the clinical and procedural characteristics of all emergency admissions. Second, we selected patients diagnosed with one of the top 100 major disease codes and calculated ~~compared~~ summary statistics of 8 variables ~~8 variables among~~ by ~~the top~~ disease code~~100 emergency causes of admissions~~. These variables were as follows: (1) percentage of patients aged 65 years or older; (2) percentage of patients comorbid with mental illness; (3) percentage of patients admitted to hospitals with deep coma (JCS scores ≥ 100, corresponding to scores of ≤ 7 on the Glasgow Coma Scale);[16] (4) percentage of patients using ~~ambulatory~~ ambulance services; (5) percentage of patients using tertiary EMS; (6) percentage of patients requiring ~~surgery~~surgical procedures; (7) median length of stay; and (8) percentage of in-hospital mortality. To maximize interpretability, we restricted this analysis to patients with one of the top 100 causes of admissions. We used a predictive principal component analysis (PCA) biplot to reduce the dimensionality of multivariate data (i.e., 100 causes of admissions × 8 variables) and then to visualize 2 dimensions with minimal loss of information.[18 ~~18~~] Before conducting the predictive PCA biplot, we standardized each variable with a mean of 0 and a standard deviation of 1 because the measurement units of 8 variables were incommensurable. In the predictive PCA biplot, the 8 variables were represented by 8 biplot axes to read off predictive values of the variables for each of the top 100 causes. All statistical analyses were performed with R version 2.4.1.[19 ~~19~~] The predictive PCA biplot was performed using the BiplotGUI package under R.[19 ~~19~~]

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RESULTS

Characteristics of all emergency hospital admissions

During the study period, there were a total of 1–157–893 emergency hospital admissions to 855 hospitals. Characteristics of these admissions are presented in Table 1. The majority (51.7%) of admissions were for patients aged ≥ 65 years. Patients aged 0–14 years accounted for less than one-sixth (15.3%) of the admissions. The most prevalent diagnosis was pneumonia, accounting for 10.2% of all admissions, followed by stroke (5.5%) and heart failure (2.8%). Drug poisoning ranked ~~in the top~~ 41st among causes of admissions. Less than 5% of patients used tertiary EMS. Of those patients, 88.3% stayed for more than 3 days. About 7% of patients died during hospitalization.

Insert Table 1 here

Comparison of drug poisoning and major diseases~~other causes of admissions~~

The top 100 causes of admissions covered 83% (965–749 admissions) of all admissions. Characteristics by cause of admission are shown in Table 2 for the top 10 causes and drug poisoning; the top 100 causes are also shown in Supplemental Table. The predictive PCA biplot with 2 dimensions accounts for 62.9% of the variance in the data from the top 100 causes. The predictive PCA biplot revealed that drug poisoning was in a unique position (Figure 1). Among the top 100causes, patients with drug poisoning were less likely to be aged ≥ 65 years (13.4%; 86th) and most likely to be diagnosed with mental illness (33.7%; 1st). In addition, patients with drug poisoning were more likely to be admitted to hospitals with deep coma (26.2%; 2nd), more

likely to use ambulance services~~ambulatory services~~ (74.1%; 2nd), and most likely to use tertiary EMS (37.8%; 1st). Despite the higher utilization of emergency care resources, clinical course of drug poisoning was less severe. Among the top 100 causes, patients with drug poisoning had the shortest median length of stay (2 days; 100th), were less likely to require ~~surgery~~ surgical procedures (1.7%; 91st), and were less likely to die during hospitalization (0.3%; 74th).

In terms of the percentage of patients admitted to tertiary EMS, subarachnoid haemorrhage and ruptured cerebral aneurysm (disease code 010020) ranked second (30.3%; 2nd; see the 46th row in Supplemental Table). Patients with subarachnoid haemorrhage and ruptured cerebral aneurysm were most likely to be admitted to hospitals with deep coma (33.9%; 1st) and most likely to use ambulance services (76.0%; 1st). They had a longer median length of stay (28 days; 4th), were more likely to require surgical procedures (73.2%; 11st), and were more likely to die during hospitalization (26.9%; 9th).

Insert Table 2 and Figure 1 here

DISCUSSION

To our knowledge, this is the first study that used ~~a~~ a nationwide administrative discharge database ~~nationally representative sample~~ to compare detailed clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseases~~between drug poisoning and other causes of emergency hospital admissions~~. We found that drug poisoning was unique among the top 100 causes of emergency admissions. Patients with drug poisoning had a less severe clinical course than those with other causes, although they had higher utilization of emergency care resources. Our findings suggest that drug poisoning imposes a higher burden on emergency care resources than other causes of emergency admissions.

Our results are consistent with those of a case-control study conducted in Australia and New Zealand.[10] That study found that the median length of stay in patients with drug poisoning was 3 days, which was much lower than the overall median length of stay (9 days) in patients with 1 of the 8 most common diagnoses in a tertiary intensive care unit. One possible explanation for the potential over-utilization of high-level EMS resources is that staff with significant experience in psychosocial assessment might be more available in high-level EMS facilities. In Japan, 85% of tertiary EMS hospitals have psychiatric departments, while 23% of secondary EMS hospitals are so equipped.[14] Because most patients with drug poisoning have attempted suicide,[20 ~~20~~] and self-harm patients should receive a specialist psychosocial assessment according to the clinical guideline,[21 ~~21~~] patients with drug poisoning are transferred to high-level EMS in which mental health specialists are more available.

Another explanation for the potential over-utilization may relate to ~~is that~~ difficulties that confront ambulance officers. First, staff in secondary EMS hospitals might decline to manage patients with drug poisoning. ~~staff in secondary EMS hospitals might decline to manage patients~~

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~~with drug poisoning.~~ A survey conducted in Osaka city revealed that ambulance officers contacted more hospitals to transport patients with drug poisoning than all patients (average number of contacted hospitals: 7.6 vs. 1.8, respectively).[~~22~~ 22] Second, ambulance officers might transport patients with drug poisoning to high-level EMS because of their deep coma. Drug poisoning ranked within the top 2 in terms of the percentage of patients with deep coma and percentage of patients admitted to tertiary EMS. However, patients with drug poisoning had a less severe clinical course than those with other causes. For example, subarachnoid haemorrhage and ruptured cerebral aneurysm had the second highest percentage of patients admitted to tertiary EMS and had a much more severe clinical course than drug poisoning. It would be of great value to investigate triage tools predicting the need for advanced treatments based on information not only from early admission factors,[~~23~~ 23] but also from pre-hospital factors.[~~24~~ 24]

Our study has several limitations. First, our results cannot be generalized and are limited to inpatient admissions to acute care hospitals rather than emergency outpatient admissions or emergency admissions to psychiatric hospitals, because we used the DPC/PDPS database. Second, we were unable to evaluate variables not included in the DPC/PDPS database. As a result, we could not assess other potentially important factors predicting the need for advanced treatments, such as acute physiology and chronic health evaluation (APACHE) scores at admission[~~23~~ 23] or clinical management and course during pre-hospital period.[~~24~~ 24] Third, we included all types of drug poisoning (i.e., deliberate, accidental, and undetermined intent) as in a previous study,[7] because data on external causes (ICD-10 codes V01–Y98) are not recorded in the DPC/PDPS database. As a result, we could not distinguish between deliberate and accidental drug poisoning. Fourth~~Third~~, although the database included approximately 40% of all inpatient admissions in Japan, participation in the survey was voluntary for each hospital and the patient

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selection procedure was not based on a random sampling technique from all acute hospitals.

In conclusion, we have demonstrated that drug poisoning is unique among the top 100 causes of emergency admissions. Future research should focus on strategies to reduce the burden of drug poisoning on emergency medical systems.

Acknowledgements

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Competing Interest

None.

Ethic approval

The study protocol was approved by the institutional review board of the University of Occupational and Environmental Health, Fukuoka, Japan.

Contributors

SM, KBI, and KF conducted data collection, data synthesis, and data management. KF and HI obtained funding. YO participated in study concept and design, analysis and interpretation of data, drafting of the manuscript, and critical revision of the manuscript. SS supervised data analysis. SS, KBI, KF, and HI participated in interpretation of data and critical revision of the

manuscript for important intellectual content. All authors contributed to and approved the final manuscript.

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Data sharing information

No additional data are available.

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Table 1 Characteristics of emergency hospital admissions

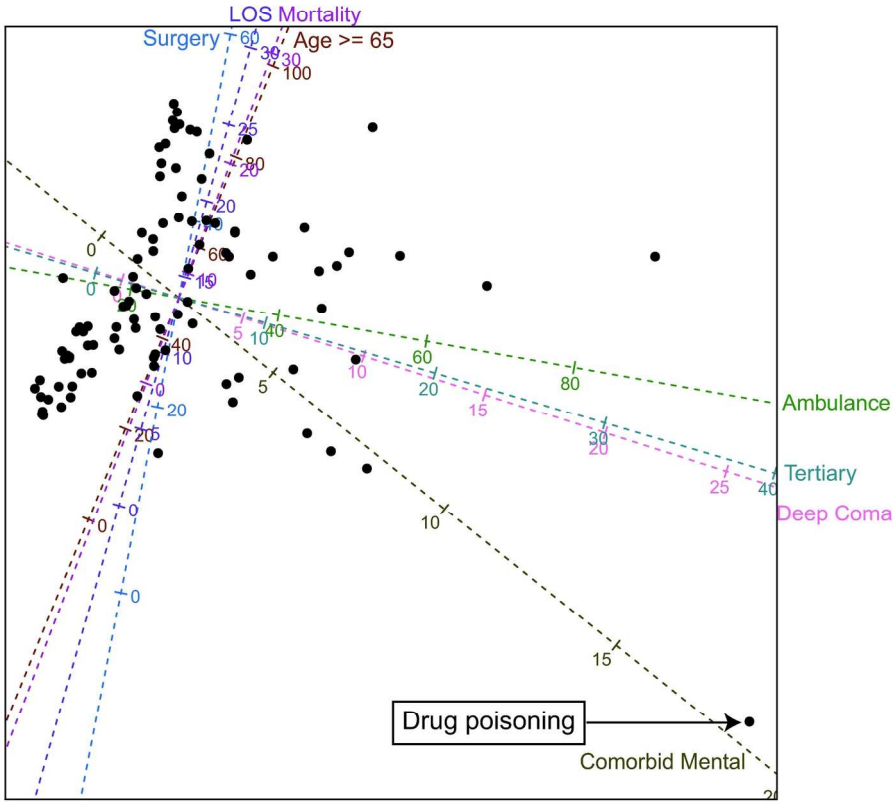
Characteristic	N of admissions	% of admissions	95% CI
Age			
0–14	177 092	15.3	15.2–15.4
15–64	382 025	33.0	32.9–33.1
≥ 65	598 776	51.7	51.6–51.8
Gender women	547 280	47.3	47.2–47.3
Top 10 causes of admissions and drug poisoning (Disease code)			
1. Pneumonia, acute bronchitis, acute bronchiolitis (040080)	117 649	10.2	10.1–10.2
2. Stroke (010060)	63 931	5.5	5.5–5.6
3. Heart failure (050130)	32 993	2.8	2.8–2.9
4. Intestinal obstruction without hernia (060210)	28 701	2.5	2.5–2.5
5. Fracture of proximal femur (160800)	25 905	2.2	2.2–2.3
6. Viral enteritis (150010)	24 920	2.2	2.1–2.2
7. Asthma (040100)	23 858	2.1	2.0–2.1
8. Angina pectoris, chronic ischemic heart disease (050050)	20 775	1.8	1.8–1.8
9. Disorder associated with shortened gestation period or low birth weight (140010)	20 540	1.8	1.8–1.8
10. Renal infection (110310)	19 853	1.7	1.7–1.7
41. Drug poisoning (161070a)	6 748	0.6	0.6–0.6
Other causes	769 326	66.4	66.4–66.5
Comorbid mental illness	23 279	2.0	2.0–2.0
Deep coma	26 792	2.3	2.3–2.3
Ambulance services	311 333	26.9	26.8–27.0
Tertiary EMS	54 938	4.7	4.7–4.8
~~Surgery~~Surgical procedures	321 –974	27.8	27.7–27.9
Length of stay (days)			
≤ 3	135 096	11.7	11.6–11.7
4–7	266 651	23.0	23.0–23.1
8–14	296 549	25.6	25.5–25.7
15–30	258 717	22.3	22.3–22.4
31–60	136 014	11.7	11.7–11.8
≥ 60	64 866	5.6	5.6–5.6
Death during hospitalization	78 226	6.8	6.7–6.8

Comorbidity of mental illness was defined as the following ICD-10 codes as comorbidities: unipolar depressive disorders (F32–F33), bipolar affective disorder (F30–F31), schizophrenia (F20–F29), alcohol use disorders (F10), drug use disorders (F11–F16 and F18–F19), post-traumatic stress disorder (F431), obsessive-compulsive disorder (F42), panic disorder (F400 and F410), or insomnia (F51). Deep coma was defined as a score on the Japan Soma Scale of 100 or more.
EMS, emergency medical services.

Table 2 Characteristics of poisoning and other causes of admissions

Rank	Top 10 causes of admissions and drug poisoning (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
1	Pneumonia, acute bronchitis, acute bronchiolitis (040080)	A370, A378, A379, A481, B012, B052, B371, B59, J13, J14, J15*, J16*, J17*, J18*, J20*, J21*, J22, J69*	117 649	10.2	48.7 (57)	1.5 (53)	2.2 (23)	19.3 (53)	2.2 (43)	5.7 (82)	9.0 (62)	7.9 (29)
2	Stroke (010060)	G45*, G46*, I63*, I65*, I66*, I675, I679, I693, I978	63 931	5.5	77.8 (11)	1.5 (53)	4.0 (14)	44.1 (21)	8.0 (21)	8.0 (77)	17.0 (30)	5.2 (35)
3	Heart failure (050130)	I50*	32 993	2.8	86.0 (4)	1.3 (60)	1.6 (26)	34.3 (27)	9.3 (19)	11.5 (67)	18.0 (27)	11.1 (24)
4	Intestinal obstruction without hernia (060210)	K560, K562, K563, K564, K565, K566, K567, K913	28 701	2.5	64.3 (33)	1.9 (40)	0.2 (68)	18.1 (59)	2.0 (48)	19.3 (57)	11.0 (51)	2.4 (48)
5	Fracture of proximal femur (160800)	M2435, M2445, S7200, S7210, S7220, S7230, S7270, S7280, S7290, S730	25 905	2.2	90.6 (1)	3.7 (9)	0.1 (75)	49.5 (14)	1.5 (58)	91.0 (5)	30.0 (2)	1.4 (58)
6	Viral enteritis (150010)	A08*, A09	24 920	2.2	23.4 (80)	0.9 (73)	0.1 (75)	14.9 (67)	0.3 (87)	0.8 (95)	5.0 (89)	0.2 (79)
7	Asthma (040100)	J45*, J46	23 858	2.1	12.0 (87)	0.8 (76)	0.4 (52)	9.5 (85)	1.2 (64)	0.5 (97)	6.0 (82)	0.3 (74)
8	Angina pectoris, chronic ischemic heart disease (050050)	I20*, I25*	20 775	1.8	68.2 (23)	0.9 (73)	0.4 (52)	31.9 (31)	7.7 (22)	43.7 (29)	7.0 (78)	0.8 (64)
9	Disorder associated with shortened gestation period or low birth weight (140010)	P00*, P01*, P02*, P03*, P04*, P05*, P07*, P08*, P10*, P11*, P12*, P13*, P15*, P20*, P21*, P22*, P23*, P24*, P25*, P26*, P27*, P28*, P29*, P35*, P36*, P37*, P38, P39*, P50*, P51*, P52*, P53, P54*, P55*, P56*, P57*, P58*, P590, P591, P592, P593, P598, P599, P60, P61*, P70*, P71*, P72*, P74*, P75, P76*, P77, P780, P781, P782, P783, P789, P80*, P81*, P83*, P90, P91*, P92*, P93, P94*, P95, P96*	20 540	1.8	0.0 (95)	0.0 (98)	0.4 (52)	9.4 (86)	0.0 (97)	10.5 (71)	8.0 (70)	0.5 (69)
10	Renal infection (110310)	N10, N151, N390	19 853	1.7	63.7 (34)	1.7 (44)	1.1 (32)	22.5 (47)	1.3 (63)	6.7 (80)	10.0 (55)	1.5 (56)
41	Drug poisoning* (161070a)	T36*, T37*, T38*, T39*, T40*, T41*, T42*, T43*, T44*, T45*	6 748	0.6	13.4 (86)	33.7 (1)	26.2 (2)	74.1 (2)	37.8 (1)	1.7 (91)	2.0 (100)	0.3 (74)

Rankings were based on data from the top 100 causes of admissions. Comorbidity of mental illness was defined as the following ICD-10 codes as comorbidities: unipolar depressive disorders (F32–F33), bipolar affective disorder (F30–F31), schizophrenia (F20–F29), alcohol use disorders (F10), drug use disorders (F11–F16 and F18–F19), post-traumatic stress disorder (F431), obsessive-compulsive disorder (F42), panic disorder (F400 and F410), or insomnia (F51). Deep coma was defined as a score on the Japan Soma Scale of 100 or more. Ambulance, ambulance services; LOS, median length of stay; Mortality, in-hospital mortality; Surgery, surgical procedures; Tertiary, tertiary emergency medical services; *, wild card.



The predictive principal component biplot on data from the characteristics of the top 100 causes. Each dot represents one of the causes. Eight axes are positioned and calibrated so that the orthogonal projection of a dot onto an axis 'predicts' as best as is graphically possible the value of the corresponding disease on the corresponding variable. Ambulance, ambulance services; LOS, median length of stay; Mortality, in-hospital mortality; Surgery, surgical procedures; Tertiary, tertiary emergency medical services.
177x177mm (300 x 300 DPI)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
1	Pneumonia, acute bronchitis, acute bronchiolitis (040080)	A370, A378, A379, A481, B012, B052, B371, B59, J13, J14, J15*, J16*, J17*, J18*, J20*, J21*, J22, J69*	117 649	10.2	48.7 (57)	1.5 (53)	2.2 (23)	19.3 (53)	2.2 (43)	5.7 (82)	9.0 (62)	7.9 (29)
2	Stroke (010060)	G45*, G46*, I63*, I65*, I66*, I675, I679, I693, I978	63 931	5.5	77.8 (11)	1.5 (53)	4.0 (14)	44.1 (21)	8.0 (21)	8.0 (77)	17.0 (30)	5.2 (35)
3	Heart failure (050130)	I50*	32 993	2.8	86.0 (4)	1.3 (60)	1.6 (26)	34.3 (27)	9.3 (19)	11.5 (67)	18.0 (27)	11.1 (24)
4	Intestinal obstruction without hernia (060210)	K560, K562, K563, K564, K565, K566, K567, K913	28 701	2.5	64.3 (33)	1.9 (40)	0.2 (68)	18.1 (59)	2.0 (48)	19.3 (57)	11.0 (51)	2.4 (48)
5	Fracture of proximal femur (160800)	M2435, M2445, S7200, S7210, S7220, S7230, S7270, S7280, S7290, S730	25 905	2.2	90.6 (1)	3.7 (9)	0.1 (75)	49.5 (14)	1.5 (58)	91.0 (5)	30.0 (2)	1.4 (58)
6	Viral enteritis (150010)	A08*, A09	24 920	2.2	23.4 (80)	0.9 (73)	0.1 (75)	14.9 (67)	0.3 (87)	0.8 (95)	5.0 (89)	0.2 (79)
7	Asthma (040100)	J45*, J46	23 858	2.1	12.0 (87)	0.8 (76)	0.4 (52)	9.5 (85)	1.2 (64)	0.5 (97)	6.0 (82)	0.3 (74)
8	Angina pectoris, chronic ischemic heart disease (050050)	I20*, I25*	20 775	1.8	68.2 (23)	0.9 (73)	0.4 (52)	31.9 (31)	7.7 (22)	43.7 (29)	7.0 (78)	0.8 (64)
9	Disorder associated with shortened gestation period or low birth weight (140010)	P00*, P01*, P02*, P03*, P04*, P05*, P07*, P08*, P10*, P11*, P12*, P13*, P15*, P20*, P21*, P22*, P23*, P24*, P25*, P26*, P27*, P28*, P29*, P35*, P36*, P37*, P38, P39*, P50*, P51*, P52*, P53, P54*, P55*, P56*, P57*, P58*, P590, P591, P592, P593, P598, P599, P60, P61*, P70*, P71*, P72*, P74*, P75, P76*, P77, P780, P781, P782, P783, P789, P80*, P81*, P83*, P90, P91*, P92*, P93, P94*, P95, P96*	20 540	1.8	0.0 (95)	0.0 (98)	0.4 (52)	9.4 (86)	0.0 (97)	10.5 (71)	8.0 (70)	0.5 (69)
10	Renal infection (110310)	N10, N151, N390	19 853	1.7	63.7 (34)	1.7 (44)	1.1 (32)	22.5 (47)	1.3 (63)	6.7 (80)	10.0 (55)	1.5 (56)
11	Gastroduodenal ulcer, gastric diverticulum, pyloric stenosis (060140)	K25*, K26*, K311, K312, K314	19 387	1.7	53.5 (52)	1.6 (47)	0.4 (52)	37.2 (25)	6.6 (26)	62.1 (17)	11.0 (51)	1.8 (55)
12	Chronic nephritic syndrome/chronic interstitial nephritis/chronic renal failure (110280)	I120, I129, N02*, N03*, N05*, N06*, N07*, N08*, N11*, N12, N14*, N18*, N391, N392	19 295	1.7	67.3 (27)	1.4 (58)	1.0 (33)	18.7 (55)	3.0 (37)	31.2 (43)	16.0 (34)	6.8 (33)
13	Appendicitis (060150)	K35*, K36, K37, K38*	18 566	1.6	11.9 (88)	0.8 (76)	0.0 (82)	9.1 (88)	1.5 (58)	75.4 (10)	6.0 (82)	0.0 (85)
14	Bile duct (intra/extra hepatic) lithiasis (060340)	K803, K804, K805, K830, K831, K832, K833, K834, K838, K839, K915	17 869	1.5	75.6 (13)	1.1 (68)	0.3 (60)	16.9 (64)	2.3 (42)	68.3 (14)	14.0 (44)	2.9 (43)
15	Inflammation of oesophagus, stomach, duodenum and other intestines (other benign diseases) (060130)	B054, I880, K20, K21*, K220, K221, K222, K223, K224, K225, K226, K228, K229, K23*, K27*, K28*, K29*, K30, K310, K313, K315, K316, K318, K52*, K58*, K627, K633, K634, K638, K639, K90*, K910, K911, K912, K914, K92*, K93*	17 715	1.5	60.8 (47)	2.3 (28)	0.5 (50)	25.9 (42)	4.0 (33)	31.8 (42)	9.0 (62)	2.3 (49)
16	Skull and intracranial injury (160100)	S000, S007, S008, S009, S010, S017, S018, S019, S020*, S021*, S06*, S071, S079, S080, S089, S090, S091, S097	17 372	1.5	57.9 (49)	2.6 (22)	8.1 (9)	63.9 (6)	18.0 (8)	44.4 (28)	8.0 (70)	5.8 (34)
17	Nontraumatic intracranial haematoma (excluding nontraumatic subdural haematoma) (010040)	I61*, I629, I680, Q280, Q281, Q282, Q283	16 389	1.4	62.2 (42)	1.1 (68)	19.6 (3)	70.0 (3)	21.8 (3)	22.3 (55)	23.0 (11)	15.6 (21)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
18	Acute myocardial infarction, recurrent myocardial infarction (050030)	I21*, I22*, I24*	15 812	1.4	63.6 (35)	0.8 (76)	3.0 (19)	56.5 (8)	21.5 (4)	85.2 (6)	15.0 (38)	7.9 (29)
19	Benign disease of small and large intestine (including benign tumour) (060100)	D12*, D133, D191, D197, D199, D201, D372, D373, D374, D375, K57*, K620, K621, K635	13 657	1.2	43.6 (64)	0.7 (82)	0.0 (82)	7.9 (90)	1.1 (65)	45.9 (27)	7.0 (78)	0.3 (74)
20	Malignant pulmonary tumour (040040)	C33, C34*, C780, D021, D022, D024	13 327	1.2	75.3 (14)	2.3 (28)	0.8 (38)	19.5 (52)	1.4 (60)	10.9 (69)	21.0 (20)	40.5 (4)
21	Epilepsy (010230)	G40*, G41*	12 668	1.1	34.6 (70)	3.3 (12)	12.7 (5)	68.6 (4)	10.4 (15)	2.3 (88)	5.0 (89)	0.9 (62)
22	Vestibular dysfunction (030400)	H810, H811, H812, H813, H818, H819	12 589	1.1	56.8 (51)	1.2 (66)	0.0 (82)	48.3 (15)	0.4 (86)	0.3 (99)	5.0 (89)	0.0 (85)
23	Hydrops of gallbladder, cholecystitis (060335)	D135, K800, K801, K81*, K820, K821, K822, K823, K824, K828, K829, K835, K870	11 924	1.0	63.2 (39)	1.5 (53)	0.3 (60)	18.2 (58)	2.2 (43)	55.5 (22)	15.0 (38)	1.5 (56)
24	Malignant gastric tumour (060020)	C16*, D002	11 210	1.0	73.7 (16)	1.6 (47)	0.4 (52)	15.4 (66)	1.1 (65)	43.4 (30)	23.0 (11)	29.2 (7)
25	Blood poisoning (180010)	A021, A327, A391, A392, A393, A394, A395, A398, A399, A40*, A41*, B007, B250, B252, B376, B377, B387, B393, B407, B417, B427, B447, B464	10 923	0.9	67.4 (26)	2.1 (31)	6.2 (11)	40.8 (23)	12.1 (12)	29.7 (46)	17.0 (30)	25.9 (10)
26	Acute pyoderma (080011)	A46, L00, L01*, L020, L021, L022, L024, L028, L029, L03*, L08*	10 547	0.9	49.7 (55)	1.1 (68)	0.2 (68)	9.3 (87)	0.7 (75)	13.5 (63)	10.0 (55)	0.5 (69)
27	Upper respiratory tract inflammation (030270)	B302, J00, J02*, J06*, J31*	10 124	0.9	6.4 (90)	0.3 (93)	0.2 (68)	7.9 (90)	0.1 (91)	0.3 (99)	5.0 (89)	0.0 (85)
28	Impairment from fracture of thoracic or lumbar vertebra or lower (including thoracic/lumbar spinal cord injury) (160690)	S220*, S221*, S230, S231, S232, S233, S240, S241, S242, S245, S320*, S330, S331, S340, S341, S342, S343, S344, S345, T08*	9 547	0.8	82.9 (8)	2.7 (19)	0.1 (75)	45.3 (19)	2.4 (39)	8.2 (76)	26.0 (6)	0.3 (74)
29	Cirrhosis (including biliary cirrhosis) (060300)	I81, I820, I850, I859, I864, I982, K717, K721, K729, K740, K741, K742, K743, K744, K745, K746, K765, K766	9 189	0.8	61.7 (44)	2.7 (19)	3.3 (17)	33.4 (28)	6.2 (27)	39.5 (33)	17.0 (30)	19.4 (17)
30	Malignant tumour of liver/intrahepatic bile duct (including secondary tumour) (060050)	C22*, C787, D015, D376	8 854	0.8	74.5 (15)	1.5 (53)	1.0 (33)	18.0 (60)	1.6 (55)	31.2 (43)	17.0 (30)	42.9 (3)
31	Acute tonsillitis, acute laryngopharyngitis (040060)	A691, J03*, J04*, J05*, J390, J391, J392, J393, J399	8 795	0.8	6.3 (91)	0.5 (87)	0.1 (75)	5.6 (93)	0.5 (80)	2.7 (87)	5.0 (89)	0.1 (82)
32	Pneumothorax (040200)	J93*	8 764	0.8	27.4 (77)	0.6 (85)	0.3 (60)	14.6 (68)	2.2 (43)	37.3 (37)	9.0 (62)	1.3 (59)
33	Malignant tumour of colon (ascending to sigmoid colon) (060035)	C18*, C260, C269, C775, C785, D010	8 409	0.7	71.6 (19)	1.5 (53)	0.3 (60)	12.7 (77)	1.4 (60)	62.2 (16)	24.0 (9)	17.2 (18)
34	Dehydration (100380)	E86	8 380	0.7	61.5 (45)	3.2 (13)	1.5 (29)	30.2 (35)	1.6 (55)	2.1 (89)	6.0 (82)	2.6 (47)
35	Tachyarrhythmia (050070)	I456, I47*, I48, I490, I491, I492, I493, I494, I498	7 779	0.7	65.5 (30)	1.4 (58)	2.5 (22)	33.3 (29)	6.7 (25)	21.6 (56)	9.0 (62)	2.2 (51)
36	Bradyarrhythmia (050210)	I440, I441, I442, I443, I444, I445, I446, I447, I450, I451, I452, I453, I454, I455, I458, I459, I46*, I495, T821	7 331	0.6	85.8 (5)	1.8 (43)	16.0 (4)	47.0 (17)	16.3 (9)	62.3 (15)	13.0 (50)	17.1 (19)
37	Premature labour, threatened premature labour (120170)	O470, O471, O479, O60	7 161	0.6	0.0 (95)	0.5 (87)	0.0 (82)	13.7 (71)	0.0 (97)	17.9 (59)	16.0 (34)	0.0 (85)
38	Other infectious disease	A060, A061, A062, A063, A067, A068, A069, A07*,	6 959	0.6	22.5 (82)	0.3 (93)	0.8 (38)	11.6 (82)	1.9 (51)	9.3 (73)	6.0 (82)	5.1 (36)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)						
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance Tertiary	Surgery	LOS	Mortality
	(excluding fungal infection) (180030)	A180, A181, A184, A185, A186, A187, A188, A20*, A21*, A22*, A23*, A24*, A25*, A26*, A27*, A28*, A30*, A311, A318, A320, A328, A329, A33, A34, A35, A36*, A371, A38, A42*, A43*, A44*, A482, A484, A488, A49*, A68*, A690, A692, A698, A699, A70, A748, A749, A75*, A77*, A78, A79*, A90, A91, A92*, A93*, A94, A95*, A96*, A98*, A99, B001, B002, B008, B009, B03, B04, B07, B080, B081, B082, B084, B085, B088, B09, B258, B259, B260, B268, B269, B33*, B34*, B35*, B36*, B370, B372, B373, B374, B378, B379, B380, B381, B382, B383, B388, B389, B390, B391, B392, B394, B395, B399, B400, B401, B402, B403, B408, B409, B410, B418, B419, B420, B421, B428, B429, B430, B432, B438, B439, B442, B448, B449, B460, B461, B462, B463, B465, B468, B469, B47*, B48*, B49, B50*, B51*, B52*, B53*, B54, B55*, B56*, B57*, B580, B581, B583, B588, B589, B60*, B64, B650, B651, B652, B653, B658, B660, B661, B662, B663, B665, B668, B669, B67*, B68*, B69*, B70*, B71*, B72, B73, B74*, B75, B76*, B77*, B78*, B79, B80, B81*, B82*, B83*, B85*, B86, B87*, B88*, B90*, B91, B92, B94*, T793, U049									
39	Complications due to operation and procedure (180040)	T80*, T81*, T820, T822, T823, T824, T825, T826, T827, T828, T829, T83*, T84*, T85*, T86*, T87*, T880, T881, T882, T883, T884, T885, T886, T888, T889	6 943	0.6	53.2 (54)	1.3 (60)	0.6 (45)	12.5 (80)	2.0 (48)	60.0 (19)	10.0 (55)	2.3 (49)
40	Pancreas and spleen tumor (06007x)	C25*, C261, D136, D137, D377	6 815	0.6	72.6 (17)	1.9 (40)	0.6 (45)	12.0 (81)	0.6 (78)	41.2 (31)	22.0 (18)	34.9 (5)
41	Drug poisoning (161070a)	T36*, T37*, T38*, T39*, T40*, T41*, T42*, T43*, T44*, T45*	6 748	0.6	13.4 (86)	33.7 (1)	26.2 (2)	74.1 (2)	37.8 (1)	1.7 (91)	2.0 (100)	0.3 (74)
42	Peritonitis, abdominal abscess (excluding female genital organs) (060370)	A183, K630, K631, K632, K65*, K67*	6 746	0.6	48.0 (59)	1.6 (47)	1.0 (33)	28.5 (37)	7.0 (24)	56.6 (21)	16.0 (34)	7.7 (32)
43	Acute pancreatitis (060350)	B263, K85, K863, K871	6 494	0.6	43.6 (64)	3.9 (7)	0.3 (60)	24.3 (44)	4.5 (30)	17.2 (61)	14.0 (44)	2.8 (45)
44	Type 2 diabetes (excluding diabetic ketoacidosis) (100070)	E112, E113, E114, E115, E116, E117, E118, E119	6 265	0.5	58.1 (48)	3.9 (7)	1.0 (33)	18.5 (57)	1.0 (68)	8.9 (74)	18.0 (27)	0.9 (62)
45	Inflammation with cerebrospinal infection (010080)	A066, A321, A390, A80*, A82*, A838, A839, A858, A88*, A89, B003, B004, B005, B010, B011, B020, B021, B050, B051, B060, B261, B262, B375, B384, B431, B582, G00*, G02*, G03*, G041, G042, G048, G049, G05*, G06*, G07, G08, G09, G958	5 850	0.5	15.0 (85)	1.3 (60)	4.0 (14)	20.8 (50)	4.6 (28)	8.0 (77)	9.0 (62)	2.2 (51)
46	Subarachnoid haemorrhage, ruptured cerebral aneurysm (010020)	I60*	5 779	0.5	47.9 (60)	0.8 (76)	33.9 (1)	76.0 (1)	30.3 (2)	73.2 (11)	28.0 (4)	26.9 (9)
47	Bacterial enteritis (150020)	A00*, A01*, A020, A022, A028, A029, A030, A031, A032, A033, A038, A039, A040, A041, A042, A043, A044, A045, A046, A047, A048, A049, A050, A052,	5 632	0.5	25.1 (78)	0.8 (76)	0.2 (68)	13.1 (74)	0.6 (78)	1.7 (91)	6.0 (82)	1.0 (60)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
		A053, A054, A058, A059										
48	Herpes zoster (080020)	B022, B023, B027, B028, B029	5 542	0.5	63.3 (38)	2.6 (22)	0.0 (82)	2.8 (97)	0.1 (91)	0.9 (94)	8.0 (70)	0.1 (82)
49	Respiratory failure (040130)	J96*	5 501	0.5	71.4 (20)	2.7 (19)	9.5 (7)	42.3 (22)	11.3 (13)	10.9 (69)	14.0 (44)	21.8 (14)
50	Upper urinary tract disease (11012x)	D301, D302, N132, N20*, N281, N288	5 291	0.5	28.8 (75)	0.7 (82)	0.2 (68)	21.8 (48)	0.9 (71)	38.9 (34)	4.0 (95)	0.1 (82)
51	Interstitial pneumonia (040110)	J60, J61, J62*, J63*, J64, J65, J66*, J67*, J68*, J70*, J82, J84*, J990, J991	5 266	0.5	78.8 (10)	2.1 (31)	1.0 (33)	21.2 (49)	4.6 (28)	6.3 (81)	21.0 (20)	25.3 (11)
52	Ischemic enterocolitis (060190)	K55*	5 265	0.5	63.4 (37)	1.1 (68)	0.6 (45)	17.3 (63)	2.4 (39)	11.1 (68)	10.0 (55)	4.1 (38)
53	Malignant tumour of gallbladder (060060)	C23, C24*	5 159	0.4	84.1 (7)	1.3 (60)	0.3 (60)	13.1 (74)	0.8 (73)	58.2 (20)	23.0 (11)	28.8 (8)
54	Brain tumour (010010)	C700, C709, C71*, C722, C723, C724, C793, D320, D329, D330, D331, D332, D333, D337, D339, D420, D429, D430, D431, D432, D433, D437, D439, G131, G132	4 883	0.4	47.6 (62)	1.7 (44)	3.2 (18)	28.2 (38)	4.4 (31)	34.2 (40)	23.0 (11)	17.1 (19)
55	Spinal stenosis (including spondylosis) (07034x)	G551, G552, G553, G558, G950, G951, G952, G959, M4320, M4321, M4322, M4323, M4324, M4325, M4326, M4327, M4328, M4329, M4700, M4701, M4702, M4703, M4704, M4705, M4706, M4707, M4708, M4709, M4710, M4711, M4712, M4713, M4714, M4715, M4716, M4717, M4718, M4719, M4720, M4721, M4722, M4723, M4724, M4725, M4726, M4727, M4728, M4729, M4780, M4781, M4782, M4783, M4784, M4785, M4786, M4787, M4788, M4789, M4790, M4791, M4792, M4793, M4794, M4795, M4796, M4797, M4798, M4799, M4800, M4801, M4802, M4803, M4804, M4805, M4806, M4807, M4808, M4809, M4810, M4811, M4812, M4813, M4814, M4815, M4816, M4817, M4818, M4819, M4820, M4821, M4822, M4823, M4824, M4825, M4826, M4827, M4828, M4829, M4830, M4831, M4832, M4833, M4834, M4835, M4836, M4837, M4838, M4839, M4840, M4841, M4842, M4843, M4844, M4845, M4846, M4847, M4848, M4849, M4850, M4851, M4852, M4853, M4854, M4855, M4856, M4857, M4858, M4859, M4880, M4881, M4882, M4883, M4884, M4885, M4886, M4887, M4888, M4889, M4890, M4891, M4892, M4893, M4894, M4895, M4896, M4897, M4898, M4899, M4940, M4941, M4942, M4943, M4944, M4945, M4946, M4947, M4948, M4949, M4980, M4981, M4982, M4983, M4984, M4985, M4986, M4987, M4988, M4989, M5300, M5301, M5302, M5303, M5304, M5305, M5306, M5307, M5308, M5309, M5310, M5311, M5312, M5313, M5314, M5315, M5316, M5317, M5318, M5319, M5330, M5331, M5332, M5333, M5334, M5335, M5336, M5337, M5338, M5339, M5380, M5381, M5382, M5383, M5384, M5385, M5386,	4 807	0.4	77.3 (12)	2.0 (37)	0.0 (82)	23.6 (45)	1.0 (68)	23.5 (52)	20.0 (25)	0.5 (69)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
		M5387, M5388, M5389, M5390, M5391, M5392, M5393, M5394, M5395, M5396, M5397, M5398, M5399, M9950, M9951, M9952, M9953, M9954, M9955, M9956, M9957, M9958, M9959, M9960, M9961, M9962, M9963, M9964, M9965, M9966, M9967, M9968, M9969, M9970, M9971, M9972, M9973, M9974, M9975, M9976, M9977, M9978, M9979										
56	Anaemia (130090)	D500, D501, D508, D509, D510, D511, D512, D513, D518, D519, D520, D521, D528, D529, D530, D531, D532, D538, D539, D550, D551, D552, D559, D560, D561, D562, D563, D564, D569, D570, D571, D572, D573, D580, D581, D582, D588, D589, D590, D591, D592, D593, D594, D595, D596, D599, D62, D640, D641, D642, D643, D644, D648, D649	4 756	0.4	63.1 (40)	2.0 (37)	0.6 (45)	18.6 (56)	1.9 (51)	37.7 (36)	11.0 (51)	3.8 (39)
57	Maternal care related to the fetus and amniotic cavity and possible delivery problems (120180)	O30*, O31*, O32*, O33*, O34*, O35*, O36*, O40, O41*, O42*, O43*, O44*, O45*, O46*, O48	4 658	0.4	0.0 (95)	0.4 (90)	0.0 (82)	13.3 (73)	0.1 (91)	70.6 (12)	9.0 (62)	0.0 (85)
58	Malignant tumour of rectum and anus (rectosigmoid colon to anus) (060040)	C19, C20, C21*, D011, D012, D013, D014	4 646	0.4	63.6 (35)	1.9 (40)	0.4 (52)	14.6 (68)	1.1 (65)	49.8 (25)	23.0 (11)	21.0 (16)
59	Nontraumatic subdural haemorrhage (010050)	I620, I621	4 606	0.4	85.8 (5)	2.2 (30)	2.7 (20)	27.9 (39)	9.7 (18)	92.6 (4)	10.0 (55)	1.9 (54)
60	Acute renal failure (110290)	K767, N17*	4 034	0.3	70.1 (21)	3.0 (16)	2.7 (20)	31.5 (32)	7.3 (23)	27.0 (49)	15.0 (38)	14.2 (22)
61	Intervertebral disk degeneration, disk herniation (070350)	M50*, M51*	4 004	0.3	20.2 (84)	1.6 (47)	0.0 (82)	27.4 (40)	0.2 (89)	28.8 (47)	15.0 (38)	0.0 (85)
62	Autoimmune disease with systemic organ disease (070560)	D86*, I00, L88, L92*, L93*, L940, L941, L942, L943, L95*, L982, L983, M0200, M0208, M0209, M0210, M0218, M0219, M0220, M0228, M0229, M0280, M0288, M0289, M0290, M0298, M0299, M0300, M0310, M0320, M0360, M0720, M0740, M0748, M0749, M0750, M0758, M0759, M0760, M0768, M0769, M0830, M0838, M0839, M0840, M0848, M0849, M0880, M0888, M0889, M0890, M0898, M0899, M091*, M092*, M098*, M120*, M121*, M1230, M1238, M1239, M1300, M1302, M1303, M1305, M1310, M1380, M1390, M150, M153, M154, M158, M159, M1900, M300, M301, M302, M308, M31*, M32*, M330, M331, M332, M339, M34*, M350, M351, M352, M353, M354, M355, M356, M357, M358, M359, M36*, M633	3 864	0.3	45.3 (63)	3.0 (16)	0.5 (50)	12.9 (76)	1.8 (53)	11.6 (66)	21.0 (20)	4.5 (37)
63	Peritonsillar abscess (030240)	J36	3 811	0.3	10.3 (89)	0.3 (93)	0.0 (82)	2.3 (98)	0.2 (89)	35.0 (39)	6.0 (82)	0.0 (85)
64	Dystocia with complication of labour or obstetric operation (120260)	O61*, O62*, O63*, O64*, O65*, O66*, O67*, O68*, O69*, O70*, O71*, O720, O721, O722, O73*, O74*, O75*, O81*, O82*, O83*, O84*	3 646	0.3	0.0 (95)	0.4 (90)	0.0 (82)	13.6 (72)	0.5 (80)	84.8 (7)	8.0 (70)	0.0 (85)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
65	Disseminated intravascular coagulation (130100)	D65, D683, O723	3 631	0.3	72.0 (18)	2.1 (31)	8.3 (8)	45.5 (18)	13.9 (11)	49.6 (26)	23.0 (11)	46.0 (1)
66	Other humoral/electrolyte/acid–base balance disorders (100393)	E870, E871, E872, E873, E874, E875, E877, E878	3 622	0.3	61.5 (45)	7.0 (4)	4.0 (14)	32.3 (30)	8.3 (20)	4.6 (86)	8.0 (70)	2.7 (46)
67	Kawasaki disease (1500709)	M303	3 576	0.3	0.0 (95)	0.0 (98)	0.0 (82)	2.1 (99)	0.0 (97)	0.8 (95)	11.0 (51)	0.0 (85)
68	Retinal detachment (020160)	H330, H332, H333, H334, H335	3 566	0.3	23.4 (80)	0.3 (93)	0.0 (82)	0.2 (100)	0.0 (97)	99.2 (1)	14.0 (44)	0.0 (85)
69	Non–Hodgkin lymphoma (130030)	C820, C821, C822, C827, C829, C830, C831, C832, C833, C834, C835, C836, C837, C838, C839, C840, C841, C842, C843, C844, C845, C850, C851, C857, C859	3 492	0.3	68.0 (24)	1.7 (44)	0.7 (41)	13.9 (70)	2.0 (48)	38.5 (35)	29.0 (3)	24.3 (13)
70	Sudden idiopathic hearing loss (030428)	H912	3 489	0.3	33.9 (71)	0.6 (85)	0.0 (82)	5.3 (94)	0.1 (91)	2.1 (89)	10.0 (55)	0.0 (85)
71	Hypertension or other diseases associated with pregnancy/labour/puerperium (120160)	O10*, O11, O12*, O13, O14*, O15*, O16, O21*, O22*, O23*, O25, O26*	3 480	0.3	0.1 (93)	0.8 (76)	0.1 (75)	10.7 (84)	0.3 (87)	30.6 (45)	9.0 (62)	0.0 (85)
72	Other digestive tract disorders (060570)	K00*, K01*, K02*, K03*, K04*, K05*, K06*, K08*, K09*, K10*, K14*, K319, K590, K591, K592, K594, K598, K599, K629, K66*, K759, K764, K769, K918, K919	3 420	0.3	48.2 (58)	2.6 (22)	0.3 (60)	17.7 (61)	2.2 (43)	10.0 (72)	8.0 (70)	2.0 (53)
73	Arteriosclerosis obliterans (050170)	I700, I702, I708, I709, I720, I721, I724, I73*, I740, I741, I742, I743, I744, I745, I748, I749	3 393	0.3	82.1 (9)	1.1 (68)	0.6 (45)	22.9 (46)	4.4 (31)	60.9 (18)	18.0 (27)	9.1 (28)
74	Febrile convulsion (150040)	R560	3 365	0.3	0.1 (93)	0.0 (98)	4.2 (13)	55.2 (9)	1.0 (68)	0.4 (98)	4.0 (95)	0.0 (85)
75	Fracture/dislocation of ankle joint or foot (160850)	M8437, S8250, S8260, S8280, S9200, S9210, S9220, S9230, S9240, S9250, S9270, S9290, S930, S931, S932, S933	3 345	0.3	36.3 (69)	2.1 (31)	0.0 (82)	28.8 (36)	1.8 (53)	83.5 (8)	27.0 (5)	0.0 (85)
76	Periarticular fracture/dislocation of knee (160820)	S7240, S8200, S8210, S8270	3 343	0.3	66.3 (29)	2.4 (27)	0.2 (68)	38.6 (24)	1.4 (60)	69.1 (13)	35.0 (1)	0.4 (73)
77	Influenza, viral pneumonia (040070)	J10*, J11*, J12*	3 309	0.3	4.4 (92)	0.3 (93)	0.3 (60)	6.8 (92)	0.1 (91)	1.2 (93)	6.0 (82)	0.2 (79)
78	Multiple injuries (160990)	S434, S435, S436, S437, S49*, S59*, S69*, S79*, S89*, S99*, T00*, T01*, T02*, T03*, T04*, T06*, T07	3 254	0.3	57.3 (50)	3.6 (10)	1.6 (26)	65.2 (5)	15.9 (10)	40.5 (32)	19.0 (26)	0.8 (64)
79	Fulminant hepatitis, acute liver failure, acute hepatitis (060270)	B150, B159, B160, B161, B162, B169, B170, B171, B172, B178, B19*, B251, K710, K711, K712, K719, K720, K762, K763	3 212	0.3	28.8 (75)	2.1 (31)	1.2 (31)	10.8 (83)	2.8 (38)	6.8 (79)	14.0 (44)	7.8 (31)
80	Chronic obstructive lung disease (040120)	J43*, J44*	3 165	0.3	87.7 (3)	2.1 (31)	1.5 (29)	31.4 (33)	3.8 (34)	4.7 (85)	15.0 (38)	10.7 (25)
81	Unspecified injury (161060)	T090, T091, T092, T093, T094, T095, T098, T099, T10*, T110, T119, T12*, T130, T131, T132, T133, T134, T135, T138, T139, T140, T141, T142*, T143, T144, T145, T146, T148, T149, T189, T288, T289, T66, T71, T73*, T751, T753, T758, T782, T783, T784, T788, T789, T794, T795, T797, T798, T799	3 127	0.3	32.7 (73)	2.9 (18)	5.5 (12)	54.2 (10)	20.1 (7)	25.7 (50)	3.0 (98)	3.8 (39)
82	Haemorrhage in early	O20*	3 108	0.3	0.0 (95)	0.4 (90)	0.0 (82)	5.2 (95)	0.1 (91)	8.3 (75)	9.0 (62)	0.0 (85)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
	pregnancy (120150)											
83	Leucocytic disease (130070)	D70, D720, D721, D728, D729	3 049	0.3	48.9 (56)	1.2 (66)	0.1 (75)	4.8 (96)	0.5 (80)	17.7 (60)	7.0 (78)	2.9 (43)
84	Dissecting aneurysm (050161)	I710	2 974	0.3	64.4 (32)	1.6 (47)	2.2 (23)	58.8 (7)	21.5 (4)	33.7 (41)	23.0 (11)	10.2 (26)
85	Alcoholic liver disease (060280)	K70*	2 964	0.3	30.7 (74)	14.7 (2)	1.6 (26)	25.2 (43)	2.4 (39)	12.7 (64)	14.0 (44)	9.4 (27)
86	Male genital diseas (11022x)	D294, I861, N41*, N43*, N44, N45*, N46, N47, N48*, N508	2 841	0.2	53.3 (53)	0.9 (73)	0.0 (82)	8.9 (89)	0.7 (75)	15.3 (62)	8.0 (70)	0.3 (74)
87	Pulmonary/mediastinal infection and abscess (040150)	A065, B440, B441, B45*, B659, B664, E321, E328, J850, J851, J852, J853, J86*, J985	2 834	0.2	62.2 (42)	2.6 (22)	0.7 (41)	20.4 (51)	3.8 (34)	18.9 (58)	24.0 (9)	11.4 (23)
88	Malignant tumour of oesophagus (including cervical region) (060010)	C150, C151, C152, C153, C154, C155, C158, C159, D001	2 805	0.2	66.6 (28)	2.0 (37)	0.4 (52)	12.7 (77)	0.7 (75)	36.5 (38)	22.0 (18)	30.9 (6)
89	Pelvic injury (160980)	S321*, S322*, S323*, S324*, S325*, S327*, S328*, S332, S333, S334, S335, S336, S337, S348, S377*, S378*, S379*, S383, S39*	2 783	0.2	67.7 (25)	3.2 (13)	0.7 (41)	53.3 (12)	10.2 (17)	22.6 (54)	25.0 (7)	1.0 (60)
90	Muscle and tendon injury of the extremities (160610)	M620*, M621*, M623*, M626*, M628*, M629*, M660*, M661*, M662*, M663*, M664*, M665*, S46*, S534, S56*, S633, S634, S635, S636, S637, S66*, S731, S76*, S86*, S934, S935, S936, S96*, T112, T115	2 700	0.2	33.3 (72)	4.5 (5)	0.8 (38)	30.8 (34)	3.6 (36)	55.5 (22)	10.0 (55)	0.6 (66)
91	Retroperitoneal disease (110050)	C786, D200, D483	2 695	0.2	65.1 (31)	1.6 (47)	0.4 (52)	12.7 (77)	0.9 (71)	28.4 (48)	21.0 (20)	45.7 (2)
92	Chemical poisoning (161070b)	T46*, T47*, T48*, T49*, T50*, T51*, T52*, T53*, T54*, T55, T56*, T57*, T58, T59*, T60*, T61*, T62*, T63*, T64, T65*, T887	2 694	0.2	40.5 (68)	9.0 (3)	7.9 (10)	52.6 (13)	21.3 (6)	12.7 (64)	3.0 (98)	3.8 (39)
93	Facial injury (including oral/pharyngeal injury) (160200)	S003, S004, S005, S012, S013, S014, S015, S022*, S023*, S024*, S025*, S026*, S027*, S028*, S029*, S041, S042, S043, S044, S045, S046, S047, S048, S049, S070, S078, S081, S088, S099, S100, S101, T180	2 576	0.2	24.3 (79)	2.6 (22)	1.9 (25)	53.4 (11)	11.3 (13)	55.0 (24)	5.0 (89)	0.6 (66)
94	Malignant tumour of bone or soft tissue (excluding spine and spinal cord) (070040)	C400, C401, C402, C403, C408, C409, C413, C418, C419, C471, C472, C473, C474, C475, C476, C478, C479, C491, C492, C493, C494, C495, C496, C498, C499, C764, C765, C773, C774, C795, C96*, D092, D097	2 550	0.2	63.1 (40)	3.5 (11)	0.2 (68)	17.5 (62)	0.5 (80)	24.1 (51)	25.0 (7)	24.4 (12)
95	Malignant prostatic tumour (110080)	C61, C637, D075	2 549	0.2	90.3 (2)	1.3 (60)	0.7 (41)	15.6 (65)	0.5 (80)	23.1 (53)	16.0 (34)	21.8 (14)
96	Periarticular fracture/dislocation of elbow (160740)	S4240, S5200, S5210, S530, S531	2 494	0.2	20.3 (83)	0.7 (82)	0.0 (82)	18.8 (54)	0.8 (73)	95.8 (2)	4.0 (95)	0.2 (79)
97	Fracture of forearm (160760)	S5220, S5230, S5240, S5250, S5270, S5280, S5290	2 463	0.2	41.0 (67)	0.5 (87)	0.1 (75)	27.1 (41)	1.6 (55)	95.4 (3)	7.0 (78)	0.0 (85)
98	Diabetic ketoacidosis, nonketotic coma (100040)	E100, E101, E110, E111, E130, E131, E140, E141	2 444	0.2	41.7 (66)	4.0 (6)	9.8 (6)	44.7 (20)	10.4 (15)	4.9 (84)	15.0 (38)	3.4 (42)
99	Other musculoskeletal/connective tissue diseases (071030)	M!!!!, M0000, M0008, M0009, M0010, M0018, M0019, M0020, M0028, M0029, M0080, M0088, M0089, M0090, M0098, M0099, M0100, M0108, M0109, M0110, M0118, M0119, M0120, M0128, M0129, M0130, M0138, M0139, M0140, M0148,	2 389	0.2	47.7 (61)	1.3 (60)	0.0 (82)	47.1 (16)	0.5 (80)	5.5 (83)	8.0 (70)	0.5 (69)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)						
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance Tertiary	Surgery	LOS	Mortality
		M0149, M0150, M0158, M0159, M0160, M0168, M0169, M0180, M0188, M0189, M0308, M0309, M0312, M0318, M0319, M0328, M0329, M0368, M0369, M1240, M1248, M1249, M1250, M1258, M1259, M1280, M1288, M1289, M1309, M1319, M1389, M1399, M1908, M1909, M1910, M1918, M1919, M1920, M1928, M1929, M1980, M1988, M1989, M1990, M1998, M1999, M2100, M2108, M2109, M2110, M2118, M2119, M2120, M2128, M2129, M2170, M2178, M2179, M2180, M2188, M2189, M2190, M2198, M2199, M2450, M2458, M2459, M2460, M2468, M2469, M2480, M2488, M2489, M2500, M2508, M2509, M2510, M2518, M2519, M2540, M2548, M2549, M2550, M2551, M2552, M2554, M2555, M2556, M2557, M2558, M2559, M2560, M2568, M2569, M2570, M2578, M2579, M2580, M2588, M2589, M2590, M2598, M2599, M540*, M541*, M542*, M543*, M544*, M545*, M546*, M548*, M549*, M671, M678, M679, M798*, M799*, M8300, M8301, M8302, M8303, M8304, M8305, M8307, M8308, M8309, M8310, M8311, M8312, M8313, M8314, M8315, M8317, M8318, M8319, M8320, M8321, M8322, M8323, M8324, M8325, M8327, M8328, M8329, M8330, M8331, M8332, M8333, M8334, M8335, M8337, M8338, M8339, M8340, M8341, M8342, M8343, M8344, M8345, M8347, M8348, M8349, M8350, M8351, M8352, M8353, M8354, M8355, M8357, M8358, M8359, M8380, M8381, M8382, M8383, M8384, M8385, M8387, M8388, M8389, M8390, M8391, M8392, M8393, M8394, M8395, M8397, M8398, M8399, M852*, M858*, M859*, M8600, M8800, M8801, M8802, M8803, M8804, M8805, M8806, M8807, M8809, M889*, M900*, M901*, M902*, M906*, M907*, M913*, M938, M951, M952, M953, M954, M955, M958, M959, M961, M966, M968, M969, M990*, M991*, M992*, M993*, M994*, M998*, M999*									
100	Fracture or dislocation around the shoulder (160720)	M2431, M2441, S4220, S4230, S4270, S4280, S4290, S430, S431, S432, S433	2 370	0.2	68.9 (22)	3.1 (15)	0.0 (82)	35.6 (26)	2.2 (43)	76.8 (9)	21.0 (20)	0.6 (66)

Rankings were based on data from the top 100 causes of admissions. Comorbidity of mental illness was defined as the following ICD-10 codes as comorbidities: unipolar depressive disorders (F32–F33), bipolar affective disorder (F30–F31), schizophrenia (F20–F29), alcohol use disorders (F10), drug use disorders (F11–F16 and F18–F19), post-traumatic stress disorder (F431), obsessive-compulsive disorder (F42), panic disorder (F400 and F410), or insomnia (F51). Deep coma was defined as a score on the Japan Soma Scale of 100 or more.
Ambulance, ambulance services; LOS, median length of stay; Mortality, in-hospital mortality; Surgery, surgical procedures; Tertiary, tertiary emergency medical services; *, wild card; M!!!!, ICD-10 code numbers starting with 'M' not elsewhere classified.

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Comparison of emergency hospital admissions for drug poisoning and major diseases: a retrospective observational study using a nationwide administrative discharge database

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ABSTRACT

Objective: To compare the clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseases.

Design: Retrospective observational study.

Setting: Discharged patients from 855 acute care hospitals from 1 July to 31 December in 2008 in Japan.

Results: There were a total of 1 157 893 emergency hospital admissions. Among the top 100 causes, drug poisoning was ranked higher in terms of the percentage of patients using ambulance services (74.1%; 2nd) and tertiary emergency medical services (37.8%; 1st). Despite higher utilization of emergency care resources, drug poisoning ranked lower in terms of the median length of stay (2 days; 100th), percentage of requirement for surgical procedures (1.7%; 91st), and in-hospital mortality ratio (0.3%; 74th).

Conclusion: Drug poisoning is unique among the top 100 causes of emergency admissions. Our findings suggest that drug poisoning imposes a greater burden on emergency care resources but has a less severe clinical course than other causes of admissions. Future research should focus on strategies to reduce the burden of drug poisoning on emergency medical systems.

Article Summary

Article focus

■ Only a few multicenter studies have compared resource use and clinical course of emergency hospital admissions. Our aim was to compare the clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseases by using a nationwide administrative discharge database.

Key messages

■ Drug poisoning is in an anomalous position among the top 100 causes of emergency admissions.

■ Patients with drug poisoning had a less severe clinical course than those with other causes, although they had higher utilization of emergency care resources.

Strengths and limitations of this study

■ A large data from a nationwide discharge database was studied.

■ Our results are limited to inpatient admissions to acute care hospitals.

INTRODUCTION

A better understanding of epidemiology in emergency medical services (EMS) is important for planning EMS resource use and EMS personnel training needs.[1] Drug poisoning is a major cause of admissions to acute care hospitals and places a considerable burden on EMS resources. Drug poisoning accounts for over 15% of all admissions to intensive care units.[2 3] However, most cases of drug poisoning do not result in clinical toxicity. Of patients with drug poisoning admitted to an intensive care unit, 91% do not require advanced treatments.[2] Over 75% of patients admitted to emergency departments can be released from medical observation after a brief period (i.e., 1–2 days).[4-6] Less than 1% of cases result in mortality.[7 8] These previous studies suggest that drug poisoning may impose a needless burden on high-level EMS despite their limited requirements for advanced treatments.[2 9]

Although a number of studies have examined the detailed epidemiology of drug poisoning,[2-8] only a few multicenter studies have compared resource use and clinical course of emergency hospital admissions.[10-12] It remains unknown whether drug poisoning imposes a greater burden on emergency care resources and has a less severe clinical course among major causes of admissions. We thus aimed to compare the clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseases by using a nationwide administrative discharge database.

METHODS

Data source

We conducted an observational study using the nationwide discharge administrative database of the Diagnosis Procedure Combination/Per-Diem Payment System (DPC/PDPS), a Japanese case-mix classification system launched in 2002 by the Ministry of Health, Labour and Welfare of Japan.[13] Every year, the DPC Research Group conducts a survey of DPC/PDPS hospitals. In 2008, 855 of 1 558 DPC/PDPS hospitals voluntarily participated in the survey. The DPC/PDPS database includes clinical and procedural information on *all* inpatients discharged from the participating hospitals between 1 July and 31 December. All the data for each patient were recorded at discharge. The database includes 2.86 million admissions, representing approximately 40% of all inpatient admissions to acute care hospitals in Japan (excluding psychiatric and tuberculosis hospitals).[14] In the present study, we included all emergency hospital admissions and excluded planned admissions to the DPC/PDPS hospitals.

Setting

In Japan, the EMS system is divided into 3 categories:[15] (1) primary EMS that provides care to patients who can be discharged without hospitalization; (2) secondary EMS that provides care to patients who require admission to a regular inpatient bed; and (3) tertiary EMS that provides care to severely ill and trauma patients who require intensive care. In 2008, there were 18 892 clinics and 963 hospitals for primary EMS, 3 053 hospitals for secondary EMS, and 214 hospitals for tertiary EMS.[14] In the present study, we focused on secondary and tertiary EMS rather than primary EMS, because the DPC/PDPS database is an inpatient database. Among the 855 participating hospitals in the DPC/PDPS database, 725 provide only secondary EMS and the

other 130 provide tertiary EMS. Although some of the participating hospitals also provide primary EMS, data on emergency outpatient admissions are not included in the database.

Clinical and procedural characteristics

To describe clinical and procedural characteristics of emergency hospital admissions, we used the following study variables: (1) age; (2) gender; (3) major disease categories; (4) comorbidities at admissions; (5) level of consciousness assessed by the Japan Coma Scale (JCS);[16] (6) use of ambulance service; (7) use of tertiary EMS; (8) requirement for surgical procedures that include both major surgery and suturing in an emergency department; (9) length of stay (days); and (10) in-hospital mortality.

Physicians recorded information on diagnoses using the International Classification of Diseases 10th revision (ICD-10) codes. According to the ICD-10 codes, 506 major disease categories were defined in 2008 (see Supplemental Table). In the database, patients with drug, chemical, and unspecified poisoning (ICD-10 codes T360–T509, T510–T659, and T887, respectively) have the same major disease code (disease code 161070). In the present study, we modified the disease code to separate drug poisoning (modified disease code 161070a) from chemical and unspecified poisoning (modified disease code 161070b) according to their ICD-10 codes.

In the database, up to 4 diagnosed comorbidities per patient were recorded. Using the criteria developed by the Global Burden of Disease study with some modifications,[17] we defined comorbid status of mental illness as being diagnosed with any of the following ICD-10 codes: unipolar depressive disorders (F32–F33); bipolar affective disorder (F30–F31); schizophrenia (F20–F29); alcohol use disorders (F10); drug use disorders (F11–F16 and F18–F19); post-traumatic stress disorder (F431); obsessive-compulsive disorder (F42); panic disorder (F400

and F410); or insomnia (F51).

Statistical analyses

First, we conducted univariate analyses to summarize the clinical and procedural characteristics of all emergency admissions. Second, we selected patients diagnosed with one of the top 100 major disease codes and calculated summary statistics of 8 variables by disease code. These variables were as follows: (1) percentage of patients aged 65 years or older; (2) percentage of patients comorbid with mental illness; (3) percentage of patients admitted to hospitals with deep coma (JCS scores ≥ 100, corresponding to scores of ≤ 7 on the Glasgow Coma Scale);[16] (4) percentage of patients using ambulance services; (5) percentage of patients using tertiary EMS; (6) percentage of patients requiring surgical procedures; (7) median length of stay; and (8) percentage of in-hospital mortality. To maximize interpretability, we restricted this analysis to patients with one of the top 100 causes of admissions. We used a predictive principal component analysis (PCA) biplot to reduce the dimensionality of multivariate data (i.e., 100 causes of admissions × 8 variables) and then to visualize 2 dimensions with minimal loss of information.[18] Before conducting the predictive PCA biplot, we standardized each variable with a mean of 0 and a standard deviation of 1 because the measurement units of 8 variables were incommensurable. In the predictive PCA biplot, the 8 variables were represented by 8 biplot axes to read off predictive values of the variables for each of the top 100 causes. All statistical analyses were performed with R version 2.4.1.[19] The predictive PCA biplot was performed using the BiplotGUI package under R.[19]

RESULTS

Characteristics of all emergency hospital admissions

During the study period, there were a total of 1 157 893 emergency hospital admissions to 855 hospitals. Characteristics of these admissions are presented in Table 1. The majority (51.7%) of admissions were for patients aged ≥ 65 years. Patients aged 0–14 years accounted for less than one-sixth (15.3%) of the admissions. The most prevalent diagnosis was pneumonia, accounting for 10.2% of all admissions, followed by stroke (5.5%) and heart failure (2.8%). Drug poisoning ranked 41st among causes of admissions. Less than 5% of patients used tertiary EMS. Of those patients, 88.3% stayed for more than 3 days. About 7% of patients died during hospitalization.

Insert Table 1 here

Comparison of drug poisoning and major diseases

The top 100 causes of admissions covered 83% (965 749 admissions) of all admissions. Characteristics by cause of admission are shown in Table 2 for the top 10 causes and drug poisoning; the top 100 causes are also shown in Supplemental Table. The predictive PCA biplot with 2 dimensions accounts for 62.9% of the variance in the data from the top 100 causes. The predictive PCA biplot revealed that drug poisoning was in a unique position (Figure 1). Among the top 100causes, patients with drug poisoning were less likely to be aged ≥ 65 years (13.4%; 86th) and most likely to be diagnosed with mental illness (33.7%; 1st). In addition, patients with drug poisoning were more likely to be admitted to hospitals with deep coma (26.2%; 2nd), more likely to use ambulance services (74.1%; 2nd), and most likely to use tertiary EMS (37.8%; 1st).

Despite the higher utilization of emergency care resources, clinical course of drug poisoning was less severe. Among the top 100 causes, patients with drug poisoning had the shortest median length of stay (2 days; 100th), were less likely to require surgical procedures (1.7%; 91st), and were less likely to die during hospitalization (0.3%; 74th).

In terms of the percentage of patients admitted to tertiary EMS, subarachnoid haemorrhage and ruptured cerebral aneurysm (disease code 010020) ranked second (30.3%; 2nd; see the 46th row in Supplemental Table). Patients with subarachnoid haemorrhage and ruptured cerebral aneurysm were most likely to be admitted to hospitals with deep coma (33.9%; 1st) and most likely to use ambulance services (76.0%; 1st). They had a longer median length of stay (28 days; 4th), were more likely to require surgical procedures (73.2%; 11st), and were more likely to die during hospitalization (26.9%; 9th).

Insert Table 2 and Figure 1 here

DISCUSSION

To our knowledge, this is the first study that used a nationwide administrative discharge database to compare detailed clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseases. We found that drug poisoning was unique among the top 100 causes of emergency admissions. Patients with drug poisoning had a less severe clinical course than those with other causes, although they had higher utilization of emergency care resources. Our findings suggest that drug poisoning imposes a higher burden on emergency care resources than other causes of emergency admissions.

Our results are consistent with those of a case-control study conducted in Australia and New Zealand.[10] That study found that the median length of stay in patients with drug poisoning was 3 days, which was much lower than the overall median length of stay (9 days) in patients with 1 of the 8 most common diagnoses in a tertiary intensive care unit. One possible explanation for the potential over-utilization of high-level EMS resources is that staff with significant experience in psychosocial assessment might be more available in high-level EMS facilities. In Japan, 85% of tertiary EMS hospitals have psychiatric departments, while 23% of secondary EMS hospitals are so equipped.[14] Because most patients with drug poisoning have attempted suicide,[20] and self-harm patients should receive a specialist psychosocial assessment according to the clinical guideline,[21] patients with drug poisoning are transferred to high-level EMS in which mental health specialists are more available.

Another explanation for the potential over-utilization may relate to difficulties that confront ambulance officers. First, staff in secondary EMS hospitals might decline to manage patients with drug poisoning. A survey conducted in Osaka city revealed that ambulance officers contacted more hospitals to transport patients with drug poisoning than all patients (average

number of contacted hospitals: 7.6 vs. 1.8, respectively).[22] Second, ambulance officers might transport patients with drug poisoning to high-level EMS because of their deep coma. Drug poisoning ranked within the top 2 in terms of the percentage of patients with deep coma and percentage of patients admitted to tertiary EMS. However, patients with drug poisoning had a less severe clinical course than those with other causes. For example, in terms of the percentage of patients admitted to tertiary EMS, drug poisoning ranked first, followed by subarachnoid haemorrhage and ruptured cerebral aneurysm, which had a much more severe clinical course than drug poisoning. It would be of great value to investigate triage tools predicting the need for advanced treatments based on information not only from early admission factors,[23] but also from pre-hospital factors.[24]

Our study has several limitations. First, our results cannot be generalized and are limited to inpatient admissions to acute care hospitals rather than emergency outpatient admissions or emergency admissions to psychiatric hospitals, because we used the DPC/PDPS database. Second, we were unable to evaluate variables not included in the DPC/PDPS database. As a result, we could not assess other potentially important factors predicting the need for advanced treatments, such as acute physiology and chronic health evaluation (APACHE) scores at admission[23] or clinical management and course during pre-hospital period.[24] Third, we included all types of drug poisoning (i.e., deliberate, accidental, and undetermined intent) as in a previous study,[7] because data on external causes (ICD-10 codes V01–Y98) are not recorded in the DPC/PDPS database. As a result, we could not distinguish between deliberate and accidental drug poisoning. Fourth, although the database included approximately 40% of all inpatient admissions in Japan, participation in the survey was voluntary for each hospital and the patient selection procedure was not based on a random sampling technique from all acute hospitals.

In conclusion, we have demonstrated that drug poisoning is unique among the top 100 causes of emergency admissions. Future research should focus on strategies to reduce the burden of drug poisoning on emergency medical systems.

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Competing Interest

None.

Ethic approval

The study protocol was approved by the institutional review board of the University of Occupational and Environmental Health, Fukuoka, Japan.

Contributors

SM, KBI, and KF conducted data collection, data synthesis, and data management. KF and HI obtained funding. YO participated in study concept and design, analysis and interpretation of data, drafting of the manuscript, and critical revision of the manuscript. SS supervised data analysis. SS, KBI, KF, and HI participated in interpretation of data and critical revision of the

manuscript for important intellectual content. All authors contributed to and approved the final manuscript.

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No additional data are available.

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Table 1 Characteristics of emergency hospital admissions

Characteristic	N of admissions	% of admissions	95% CI
Age			
0–14	177 092	15.3	15.2–15.4
15–64	382 025	33.0	32.9–33.1
≥ 65	598 776	51.7	51.6–51.8
Gender women	547 280	47.3	47.2–47.3
Top 10 causes of admissions and drug poisoning (Disease code)			
1. Pneumonia, acute bronchitis, acute bronchiolitis (040080)	117 649	10.2	10.1–10.2
2. Stroke (010060)	63 931	5.5	5.5–5.6
3. Heart failure (050130)	32 993	2.8	2.8–2.9
4. Intestinal obstruction without hernia (060210)	28 701	2.5	2.5–2.5
5. Fracture of proximal femur (160800)	25 905	2.2	2.2–2.3
6. Viral enteritis (150010)	24 920	2.2	2.1–2.2
7. Asthma (040100)	23 858	2.1	2.0–2.1
8. Angina pectoris, chronic ischemic heart disease (050050)	20 775	1.8	1.8–1.8
9. Disorder associated with shortened gestation period or low birth weight (140010)	20 540	1.8	1.8–1.8
10. Renal infection (110310)	19 853	1.7	1.7–1.7
41. Drug poisoning (161070a)	6 748	0.6	0.6–0.6
Other causes	769 326	66.4	66.4–66.5
Comorbid mental illness	23 279	2.0	2.0–2.0
Deep coma	26 792	2.3	2.3–2.3
Ambulance services	311 333	26.9	26.8–27.0
Tertiary EMS	54 938	4.7	4.7–4.8
Surgical procedures	321 974	27.8	27.7–27.9
Length of stay (days)			
≤ 3	135 096	11.7	11.6–11.7
4–7	266 651	23.0	23.0–23.1
8–14	296 549	25.6	25.5–25.7
15–30	258 717	22.3	22.3–22.4
31–60	136 014	11.7	11.7–11.8
≥ 60	64 866	5.6	5.6–5.6
Death during hospitalization	78 226	6.8	6.7–6.8

Comorbidity of mental illness was defined as the following ICD-10 codes as comorbidities: unipolar depressive disorders (F32–F33), bipolar affective disorder (F30–F31), schizophrenia (F20–F29), alcohol use disorders (F10), drug use disorders (F11–F16 and F18–F19), post-traumatic stress disorder (F431), obsessive-compulsive disorder (F42), panic disorder (F400 and F410), or insomnia (F51). Deep coma was defined as a score on the Japan Soma Scale of 100 or more.
EMS, emergency medical services.

Table 2 Characteristics of poisoning and other causes of admissions

Rank	Top 10 causes of admissions and drug poisoning (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
1	Pneumonia, acute bronchitis, acute bronchiolitis (040080)	A370, A378, A379, A481, B012, B052, B371, B59, J13, J14, J15*, J16*, J17*, J18*, J20*, J21*, J22, J69*	117 649	10.2	48.7 (57)	1.5 (53)	2.2 (23)	19.3 (53)	2.2 (43)	5.7 (82)	9.0 (62)	7.9 (29)
2	Stroke (010060)	G45*, G46*, I63*, I65*, I66*, I675, I679, I693, I978	63 931	5.5	77.8 (11)	1.5 (53)	4.0 (14)	44.1 (21)	8.0 (21)	8.0 (77)	17.0 (30)	5.2 (35)
3	Heart failure (050130)	I50*	32 993	2.8	86.0 (4)	1.3 (60)	1.6 (26)	34.3 (27)	9.3 (19)	11.5 (67)	18.0 (27)	11.1 (24)
4	Intestinal obstruction without hernia (060210)	K560, K562, K563, K564, K565, K566, K567, K913	28 701	2.5	64.3 (33)	1.9 (40)	0.2 (68)	18.1 (59)	2.0 (48)	19.3 (57)	11.0 (51)	2.4 (48)
5	Fracture of proximal femur (160800)	M2435, M2445, S7200, S7210, S7220, S7230, S7270, S7280, S7290, S730	25 905	2.2	90.6 (1)	3.7 (9)	0.1 (75)	49.5 (14)	1.5 (58)	91.0 (5)	30.0 (2)	1.4 (58)
6	Viral enteritis (150010)	A08*, A09	24 920	2.2	23.4 (80)	0.9 (73)	0.1 (75)	14.9 (67)	0.3 (87)	0.8 (95)	5.0 (89)	0.2 (79)
7	Asthma (040100)	J45*, J46	23 858	2.1	12.0 (87)	0.8 (76)	0.4 (52)	9.5 (85)	1.2 (64)	0.5 (97)	6.0 (82)	0.3 (74)
8	Angina pectoris, chronic ischemic heart disease (050050)	I20*, I25*	20 775	1.8	68.2 (23)	0.9 (73)	0.4 (52)	31.9 (31)	7.7 (22)	43.7 (29)	7.0 (78)	0.8 (64)
9	Disorder associated with shortened gestation period or low birth weight (140010)	P00*, P01*, P02*, P03*, P04*, P05*, P07*, P08*, P10*, P11*, P12*, P13*, P15*, P20*, P21*, P22*, P23*, P24*, P25*, P26*, P27*, P28*, P29*, P35*, P36*, P37*, P38, P39*, P50*, P51*, P52*, P53, P54*, P55*, P56*, P57*, P58*, P590, P591, P592, P593, P598, P599, P60, P61*, P70*, P71*, P72*, P74*, P75, P76*, P77, P780, P781, P782, P783, P789, P80*, P81*, P83*, P90, P91*, P92*, P93, P94*, P95, P96*	20 540	1.8	0.0 (95)	0.0 (98)	0.4 (52)	9.4 (86)	0.0 (97)	10.5 (71)	8.0 (70)	0.5 (69)
10	Renal infection (110310)	N10, N151, N390	19 853	1.7	63.7 (34)	1.7 (44)	1.1 (32)	22.5 (47)	1.3 (63)	6.7 (80)	10.0 (55)	1.5 (56)
41	Drug poisoning (161070a)	T36*, T37*, T38*, T39*, T40*, T41*, T42*, T43*, T44*, T45*	6 748	0.6	13.4 (86)	33.7 (1)	26.2 (2)	74.1 (2)	37.8 (1)	1.7 (91)	2.0 (100)	0.3 (74)

Rankings were based on data from the top 100 causes of admissions. Comorbidity of mental illness was defined as the following ICD-10 codes as comorbidities: unipolar depressive disorders (F32–F33), bipolar affective disorder (F30–F31), schizophrenia (F20–F29), alcohol use disorders (F10), drug use disorders (F11–F16 and F18–F19), post-traumatic stress disorder (F431), obsessive-compulsive disorder (F42), panic disorder (F400 and F410), or insomnia (F51). Deep coma was defined as a score on the Japan Soma Scale of 100 or more. Ambulance, ambulance services; LOS, median length of stay; Mortality, in-hospital mortality; Surgery, surgical procedures; Tertiary, tertiary emergency medical services; *, wild card.

Comparison of emergency hospital admissions for drug poisoning and major diseases: a retrospective observational study using a nationwide administrative discharge database

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Key words Retrospective studies; overdose; emergency medical services; epidemiology

Word count: 2366 word

ABSTRACT

Objective: To compare the clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseases.

Design: Retrospective observational study.

Setting: Discharged patients from 855 acute care hospitals from 1 July to 31 December in 2008 in Japan.

Results: There were a total of 1 157 893 emergency hospital admissions. Among the top 100 causes, drug poisoning was ranked higher in terms of the percentage of patients using ambulance services (74.1%; 2nd) and tertiary emergency medical services (37.8%; 1st). Despite higher utilization of emergency care resources, drug poisoning ranked lower in terms of the median length of stay (2 days; 100th), percentage of requirement for surgical procedures (1.7%; 91st), and in-hospital mortality ratio (0.3%; 74th).

Conclusion: Drug poisoning is unique among the top 100 causes of emergency admissions. Our findings suggest that drug poisoning imposes a greater burden on emergency care resources but has a less severe clinical course than other causes of admissions. Future research should focus on strategies to reduce the burden of drug poisoning on emergency medical systems.

Article Summary

Article focus

■ Only a few multicenter studies have compared resource use and clinical course of emergency hospital admissions. Our aim was to compare the clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseases by using a nationwide administrative discharge database.

Key messages

■ Drug poisoning is in an anomalous position among the top 100 causes of emergency admissions.

■ Patients with drug poisoning had a less severe clinical course than those with other causes, although they had higher utilization of emergency care resources.

Strengths and limitations of this study

■ A large data from a nationwide discharge database was studied.

■ Our results are limited to inpatient admissions to acute care hospitals.

INTRODUCTION

A better understanding of epidemiology in emergency medical services (EMS) is important for planning EMS resource use and EMS personnel training needs.[1] Drug poisoning is a major cause of admissions to acute care hospitals and places a considerable burden on EMS resources. Drug poisoning accounts for over 15% of all admissions to intensive care units.[2 3] However, most cases of drug poisoning do not result in clinical toxicity. Of patients with drug poisoning admitted to an intensive care unit, 91% do not require advanced treatments.[2] Over 75% of patients admitted to emergency departments can be released from medical observation after a brief period (i.e., 1–2 days).[4-6] Less than 1% of cases result in mortality.[7 8] These previous studies suggest that drug poisoning may impose a needless burden on high-level EMS despite their limited requirements for advanced treatments.[2 9]

Although a number of studies have examined the detailed epidemiology of drug poisoning,[2-8] only a few multicenter studies have compared resource use and clinical course of emergency hospital admissions.[10-12] It remains unknown whether drug poisoning imposes a greater burden on emergency care resources and has a less severe clinical course among major causes of admissions. We thus aimed to compare the clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseases by using a nationwide administrative discharge database.

METHODS

Data source

We conducted an observational study using the nationwide discharge administrative database of the Diagnosis Procedure Combination/Per-Diem Payment System (DPC/PDPS), a Japanese case-mix classification system launched in 2002 by the Ministry of Health, Labour and Welfare of Japan.[13] Every year, the DPC Research Group conducts a survey of DPC/PDPS hospitals. In 2008, 855 of 1 558 DPC/PDPS hospitals voluntarily participated in the survey. The DPC/PDPS database includes clinical and procedural information on *all* inpatients discharged from the participating hospitals between 1 July and 31 December. All the data for each patient were recorded at discharge. The database includes 2.86 million admissions, representing approximately 40% of all inpatient admissions to acute care hospitals in Japan (excluding psychiatric and tuberculosis hospitals).[14] In the present study, we included all emergency hospital admissions and excluded planned admissions to the DPC/PDPS hospitals.

Setting

In Japan, the EMS system is divided into 3 categories:[15] (1) primary EMS that provides care to patients who can be discharged without hospitalization; (2) secondary EMS that provides care to patients who require admission to a regular inpatient bed; and (3) tertiary EMS that provides care to severely ill and trauma patients who require intensive care. In 2008, there were 18 892 clinics and 963 hospitals for primary EMS, 3 053 hospitals for secondary EMS, and 214 hospitals for tertiary EMS.[14] In the present study, we focused on secondary and tertiary EMS rather than primary EMS, because the DPC/PDPS database is an inpatient database. Among the 855 participating hospitals in the DPC/PDPS database, 725 provide only secondary EMS and the

other 130 provide tertiary EMS. Although some of the participating hospitals also provide primary EMS, data on emergency outpatient admissions are not included in the database.

Clinical and procedural characteristics

To describe clinical and procedural characteristics of emergency hospital admissions, we used the following study variables: (1) age; (2) gender; (3) major disease categories; (4) comorbidities at admissions; (5) level of consciousness assessed by the Japan Coma Scale (JCS);[16] (6) use of ambulance service; (7) use of tertiary EMS; (8) requirement for surgical procedures that include both major surgery and suturing in an emergency department; (9) length of stay (days); and (10) in-hospital mortality.

Physicians recorded information on diagnoses using the International Classification of Diseases 10th revision (ICD-10) codes. According to the ICD-10 codes, 506 major disease categories were defined in 2008 (see Supplemental Table). In the database, patients with drug, chemical, and unspecified poisoning (ICD-10 codes T360–T509, T510–T659, and T887, respectively) have the same major disease code (disease code 161070). In the present study, we modified the disease code to separate drug poisoning (modified disease code 161070a) from chemical and unspecified poisoning (modified disease code 161070b) according to their ICD-10 codes.

In the database, up to 4 diagnosed comorbidities per patient were recorded. Using the criteria developed by the Global Burden of Disease study with some modifications,[17] we defined comorbid status of mental illness as being diagnosed with any of the following ICD-10 codes: unipolar depressive disorders (F32–F33); bipolar affective disorder (F30–F31); schizophrenia (F20–F29); alcohol use disorders (F10); drug use disorders (F11–F16 and F18–F19); post-traumatic stress disorder (F431); obsessive-compulsive disorder (F42); panic disorder (F400

and F410); or insomnia (F51).

Statistical analyses

First, we conducted univariate analyses to summarize the clinical and procedural characteristics of all emergency admissions. Second, we selected patients diagnosed with one of the top 100 major disease codes and calculated summary statistics of 8 variables by disease code. These variables were as follows: (1) percentage of patients aged 65 years or older; (2) percentage of patients comorbid with mental illness; (3) percentage of patients admitted to hospitals with deep coma (JCS scores ≥ 100, corresponding to scores of ≤ 7 on the Glasgow Coma Scale);[16] (4) percentage of patients using ambulance services; (5) percentage of patients using tertiary EMS; (6) percentage of patients requiring surgical procedures; (7) median length of stay; and (8) percentage of in-hospital mortality. To maximize interpretability, we restricted this analysis to patients with one of the top 100 causes of admissions. We used a predictive principal component analysis (PCA) biplot to reduce the dimensionality of multivariate data (i.e., 100 causes of admissions × 8 variables) and then to visualize 2 dimensions with minimal loss of information.[18] Before conducting the predictive PCA biplot, we standardized each variable with a mean of 0 and a standard deviation of 1 because the measurement units of 8 variables were incommensurable. In the predictive PCA biplot, the 8 variables were represented by 8 biplot axes to read off predictive values of the variables for each of the top 100 causes. All statistical analyses were performed with R version 2.4.1.[19] The predictive PCA biplot was performed using the BiplotGUI package under R.[19]

RESULTS

Characteristics of all emergency hospital admissions

During the study period, there were a total of 1 157 893 emergency hospital admissions to 855 hospitals. Characteristics of these admissions are presented in Table 1. The majority (51.7%) of admissions were for patients aged ≥ 65 years. Patients aged 0–14 years accounted for less than one-sixth (15.3%) of the admissions. The most prevalent diagnosis was pneumonia, accounting for 10.2% of all admissions, followed by stroke (5.5%) and heart failure (2.8%). Drug poisoning ranked 41st among causes of admissions. Less than 5% of patients used tertiary EMS. Of those patients, 88.3% stayed for more than 3 days. About 7% of patients died during hospitalization.

Insert Table 1 here

Comparison of drug poisoning and major diseases

The top 100 causes of admissions covered 83% (965 749 admissions) of all admissions. Characteristics by cause of admission are shown in Table 2 for the top 10 causes and drug poisoning; the top 100 causes are also shown in Supplemental Table. The predictive PCA biplot with 2 dimensions accounts for 62.9% of the variance in the data from the top 100 causes. The predictive PCA biplot revealed that drug poisoning was in a unique position (Figure 1). Among the top 100causes, patients with drug poisoning were less likely to be aged ≥ 65 years (13.4%; 86th) and most likely to be diagnosed with mental illness (33.7%; 1st). In addition, patients with drug poisoning were more likely to be admitted to hospitals with deep coma (26.2%; 2nd), more likely to use ambulance services (74.1%; 2nd), and most likely to use tertiary EMS (37.8%; 1st).

Despite the higher utilization of emergency care resources, clinical course of drug poisoning was less severe. Among the top 100 causes, patients with drug poisoning had the shortest median length of stay (2 days; 100th), were less likely to require surgical procedures (1.7%; 91st), and were less likely to die during hospitalization (0.3%; 74th).

In terms of the percentage of patients admitted to tertiary EMS, subarachnoid haemorrhage and ruptured cerebral aneurysm (disease code 010020) ranked second (30.3%; 2nd; see the 46th row in Supplemental Table). Patients with subarachnoid haemorrhage and ruptured cerebral aneurysm were most likely to be admitted to hospitals with deep coma (33.9%; 1st) and most likely to use ambulance services (76.0%; 1st). They had a longer median length of stay (28 days; 4th), were more likely to require surgical procedures (73.2%; 11st), and were more likely to die during hospitalization (26.9%; 9th).

Insert Table 2 and Figure 1 here

DISCUSSION

To our knowledge, this is the first study that used a nationwide administrative discharge database to compare detailed clinical and procedural characteristics of emergency hospital admissions for drug poisoning and major diseases. We found that drug poisoning was unique among the top 100 causes of emergency admissions. Patients with drug poisoning had a less severe clinical course than those with other causes, although they had higher utilization of emergency care resources. Our findings suggest that drug poisoning imposes a higher burden on emergency care resources than other causes of emergency admissions.

Our results are consistent with those of a case-control study conducted in Australia and New Zealand.[10] That study found that the median length of stay in patients with drug poisoning was 3 days, which was much lower than the overall median length of stay (9 days) in patients with 1 of the 8 most common diagnoses in a tertiary intensive care unit. One possible explanation for the potential over-utilization of high-level EMS resources is that staff with significant experience in psychosocial assessment might be more available in high-level EMS facilities. In Japan, 85% of tertiary EMS hospitals have psychiatric departments, while 23% of secondary EMS hospitals are so equipped.[14] Because most patients with drug poisoning have attempted suicide,[20] and self-harm patients should receive a specialist psychosocial assessment according to the clinical guideline,[21] patients with drug poisoning are transferred to high-level EMS in which mental health specialists are more available.

Another explanation for the potential over-utilization may relate to difficulties that confront ambulance officers. First, staff in secondary EMS hospitals might decline to manage patients with drug poisoning. A survey conducted in Osaka city revealed that ambulance officers contacted more hospitals to transport patients with drug poisoning than all patients (average

number of contacted hospitals: 7.6 vs. 1.8, respectively).[22] Second, ambulance officers might transport patients with drug poisoning to high-level EMS because of their deep coma. Drug poisoning ranked within the top 2 in terms of the percentage of patients with deep coma and percentage of patients admitted to tertiary EMS. However, patients with drug poisoning had a less severe clinical course than those with other causes. For example, in terms of the percentage of patients admitted to tertiary EMS, drug poisoning ranked first, followed by subarachnoid haemorrhage and ruptured cerebral aneurysm, which had a much more severe clinical course than drug poisoning. It would be of great value to investigate triage tools predicting the need for advanced treatments based on information not only from early admission factors,[23] but also from pre-hospital factors.[24]

Our study has several limitations. First, our results cannot be generalized and are limited to inpatient admissions to acute care hospitals rather than emergency outpatient admissions or emergency admissions to psychiatric hospitals, because we used the DPC/PDPS database. Second, we were unable to evaluate variables not included in the DPC/PDPS database. As a result, we could not assess other potentially important factors predicting the need for advanced treatments, such as acute physiology and chronic health evaluation (APACHE) scores at admission[23] or clinical management and course during pre-hospital period.[24] Third, we included all types of drug poisoning (i.e., deliberate, accidental, and undetermined intent) as in a previous study,[7] because data on external causes (ICD-10 codes V01–Y98) are not recorded in the DPC/PDPS database. As a result, we could not distinguish between deliberate and accidental drug poisoning. Fourth, although the database included approximately 40% of all inpatient admissions in Japan, participation in the survey was voluntary for each hospital and the patient selection procedure was not based on a random sampling technique from all acute hospitals.

In conclusion, we have demonstrated that drug poisoning is unique among the top 100 causes of emergency admissions. Future research should focus on strategies to reduce the burden of drug poisoning on emergency medical systems.

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Competing Interest

None.

Ethic approval

The study protocol was approved by the institutional review board of the University of Occupational and Environmental Health, Fukuoka, Japan.

Contributors

SM, KBI, and KF conducted data collection, data synthesis, and data management. KF and HI obtained funding. YO participated in study concept and design, analysis and interpretation of data, drafting of the manuscript, and critical revision of the manuscript. SS supervised data analysis. SS, KBI, KF, and HI participated in interpretation of data and critical revision of the

manuscript for important intellectual content. All authors contributed to and approved the final manuscript.

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Data sharing information

No additional data are available.

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Table 1 Characteristics of emergency hospital admissions

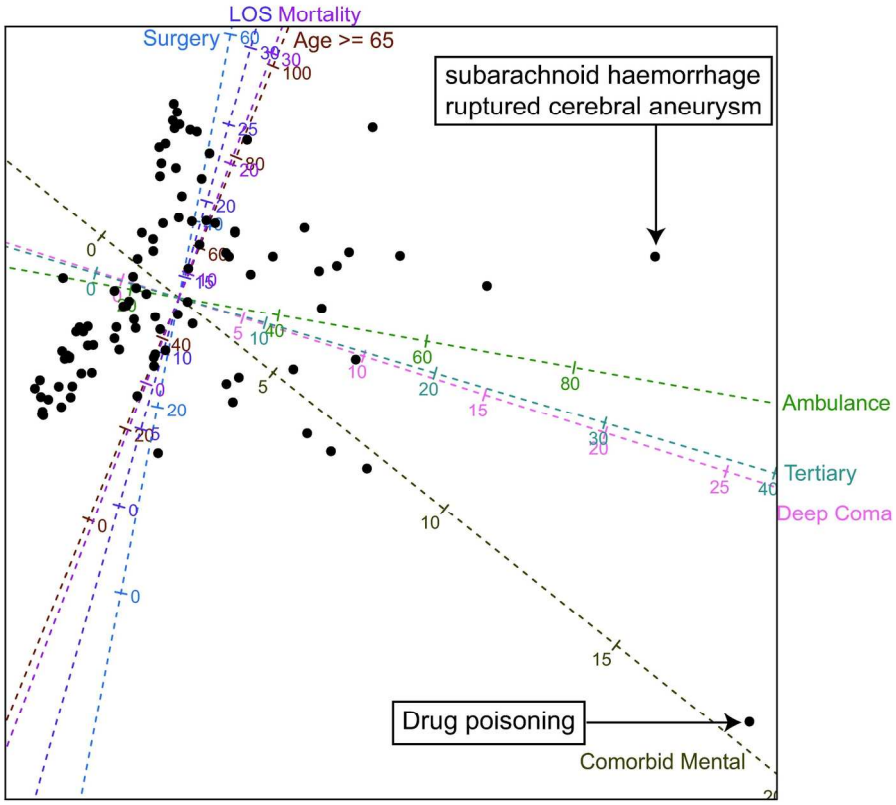
Characteristic	N of admissions	% of admissions	95% CI
Age			
0–14	177 092	15.3	15.2–15.4
15–64	382 025	33.0	32.9–33.1
≥ 65	598 776	51.7	51.6–51.8
Gender women	547 280	47.3	47.2–47.3
Top 10 causes of admissions and drug poisoning (Disease code)			
1. Pneumonia, acute bronchitis, acute bronchiolitis (040080)	117 649	10.2	10.1–10.2
2. Stroke (010060)	63 931	5.5	5.5–5.6
3. Heart failure (050130)	32 993	2.8	2.8–2.9
4. Intestinal obstruction without hernia (060210)	28 701	2.5	2.5–2.5
5. Fracture of proximal femur (160800)	25 905	2.2	2.2–2.3
6. Viral enteritis (150010)	24 920	2.2	2.1–2.2
7. Asthma (040100)	23 858	2.1	2.0–2.1
8. Angina pectoris, chronic ischemic heart disease (050050)	20 775	1.8	1.8–1.8
9. Disorder associated with shortened gestation period or low birth weight (140010)	20 540	1.8	1.8–1.8
10. Renal infection (110310)	19 853	1.7	1.7–1.7
41. Drug poisoning (161070a)	6 748	0.6	0.6–0.6
Other causes	769 326	66.4	66.4–66.5
Comorbid mental illness	23 279	2.0	2.0–2.0
Deep coma	26 792	2.3	2.3–2.3
Ambulance services	311 333	26.9	26.8–27.0
Tertiary EMS	54 938	4.7	4.7–4.8
Surgical procedures	321 974	27.8	27.7–27.9
Length of stay (days)			
≤ 3	135 096	11.7	11.6–11.7
4–7	266 651	23.0	23.0–23.1
8–14	296 549	25.6	25.5–25.7
15–30	258 717	22.3	22.3–22.4
31–60	136 014	11.7	11.7–11.8
≥ 60	64 866	5.6	5.6–5.6
Death during hospitalization	78 226	6.8	6.7–6.8

Comorbidity of mental illness was defined as the following ICD-10 codes as comorbidities: unipolar depressive disorders (F32–F33), bipolar affective disorder (F30–F31), schizophrenia (F20–F29), alcohol use disorders (F10), drug use disorders (F11–F16 and F18–F19), post-traumatic stress disorder (F431), obsessive-compulsive disorder (F42), panic disorder (F400 and F410), or insomnia (F51). Deep coma was defined as a score on the Japan Soma Scale of 100 or more.
EMS, emergency medical services.

Table 2 Characteristics of poisoning and other causes of admissions

Rank	Top 10 causes of admissions and drug poisoning (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
1	Pneumonia, acute bronchitis, acute bronchiolitis (040080)	A370, A378, A379, A481, B012, B052, B371, B59, J13, J14, J15*, J16*, J17*, J18*, J20*, J21*, J22, J69*	117 649	10.2	48.7 (57)	1.5 (53)	2.2 (23)	19.3 (53)	2.2 (43)	5.7 (82)	9.0 (62)	7.9 (29)
2	Stroke (010060)	G45*, G46*, I63*, I65*, I66*, I675, I679, I693, I978	63 931	5.5	77.8 (11)	1.5 (53)	4.0 (14)	44.1 (21)	8.0 (21)	8.0 (77)	17.0 (30)	5.2 (35)
3	Heart failure (050130)	I50*	32 993	2.8	86.0 (4)	1.3 (60)	1.6 (26)	34.3 (27)	9.3 (19)	11.5 (67)	18.0 (27)	11.1 (24)
4	Intestinal obstruction without hernia (060210)	K560, K562, K563, K564, K565, K566, K567, K913	28 701	2.5	64.3 (33)	1.9 (40)	0.2 (68)	18.1 (59)	2.0 (48)	19.3 (57)	11.0 (51)	2.4 (48)
5	Fracture of proximal femur (160800)	M2435, M2445, S7200, S7210, S7220, S7230, S7270, S7280, S7290, S730	25 905	2.2	90.6 (1)	3.7 (9)	0.1 (75)	49.5 (14)	1.5 (58)	91.0 (5)	30.0 (2)	1.4 (58)
6	Viral enteritis (150010)	A08*, A09	24 920	2.2	23.4 (80)	0.9 (73)	0.1 (75)	14.9 (67)	0.3 (87)	0.8 (95)	5.0 (89)	0.2 (79)
7	Asthma (040100)	J45*, J46	23 858	2.1	12.0 (87)	0.8 (76)	0.4 (52)	9.5 (85)	1.2 (64)	0.5 (97)	6.0 (82)	0.3 (74)
8	Angina pectoris, chronic ischemic heart disease (050050)	I20*, I25*	20 775	1.8	68.2 (23)	0.9 (73)	0.4 (52)	31.9 (31)	7.7 (22)	43.7 (29)	7.0 (78)	0.8 (64)
9	Disorder associated with shortened gestation period or low birth weight (140010)	P00*, P01*, P02*, P03*, P04*, P05*, P07*, P08*, P10*, P11*, P12*, P13*, P15*, P20*, P21*, P22*, P23*, P24*, P25*, P26*, P27*, P28*, P29*, P35*, P36*, P37*, P38, P39*, P50*, P51*, P52*, P53, P54*, P55*, P56*, P57*, P58*, P590, P591, P592, P593, P598, P599, P60, P61*, P70*, P71*, P72*, P74*, P75, P76*, P77, P780, P781, P782, P783, P789, P80*, P81*, P83*, P90, P91*, P92*, P93, P94*, P95, P96*	20 540	1.8	0.0 (95)	0.0 (98)	0.4 (52)	9.4 (86)	0.0 (97)	10.5 (71)	8.0 (70)	0.5 (69)
10	Renal infection (110310)	N10, N151, N390	19 853	1.7	63.7 (34)	1.7 (44)	1.1 (32)	22.5 (47)	1.3 (63)	6.7 (80)	10.0 (55)	1.5 (56)
41	Drug poisoning (161070a)	T36*, T37*, T38*, T39*, T40*, T41*, T42*, T43*, T44*, T45*	6 748	0.6	13.4 (86)	33.7 (1)	26.2 (2)	74.1 (2)	37.8 (1)	1.7 (91)	2.0 (100)	0.3 (74)

Rankings were based on data from the top 100 causes of admissions. Comorbidity of mental illness was defined as the following ICD-10 codes as comorbidities: unipolar depressive disorders (F32–F33), bipolar affective disorder (F30–F31), schizophrenia (F20–F29), alcohol use disorders (F10), drug use disorders (F11–F16 and F18–F19), post-traumatic stress disorder (F431), obsessive-compulsive disorder (F42), panic disorder (F400 and F410), or insomnia (F51). Deep coma was defined as a score on the Japan Soma Scale of 100 or more. Ambulance, ambulance services; LOS, median length of stay; Mortality, in-hospital mortality; Surgery, surgical procedures; Tertiary, tertiary emergency medical services; *, wild card.



The predictive principal component biplot on data from the characteristics of the top 100 causes. Each dot represents one of the causes. Eight axes are positioned and calibrated so that the orthogonal projection of a dot onto an axis 'predicts' as best as is graphically possible the value of the corresponding disease on the corresponding variable. Ambulance, ambulance services; LOS, median length of stay; Mortality, in-hospital mortality; Surgery, surgical procedures; Tertiary, tertiary emergency medical services.
177x177mm (300 x 300 DPI)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
1	Pneumonia, acute bronchitis, acute bronchiolitis (040080)	A370, A378, A379, A481, B012, B052, B371, B59, J13, J14, J15*, J16*, J17*, J18*, J20*, J21*, J22, J69*	117 649	10.2	48.7 (57)	1.5 (53)	2.2 (23)	19.3 (53)	2.2 (43)	5.7 (82)	9.0 (62)	7.9 (29)
2	Stroke (010060)	G45*, G46*, I63*, I65*, I66*, I675, I679, I693, I978	63 931	5.5	77.8 (11)	1.5 (53)	4.0 (14)	44.1 (21)	8.0 (21)	8.0 (77)	17.0 (30)	5.2 (35)
3	Heart failure (050130)	I50*	32 993	2.8	86.0 (4)	1.3 (60)	1.6 (26)	34.3 (27)	9.3 (19)	11.5 (67)	18.0 (27)	11.1 (24)
4	Intestinal obstruction without hernia (060210)	K560, K562, K563, K564, K565, K566, K567, K913	28 701	2.5	64.3 (33)	1.9 (40)	0.2 (68)	18.1 (59)	2.0 (48)	19.3 (57)	11.0 (51)	2.4 (48)
5	Fracture of proximal femur (160800)	M2435, M2445, S7200, S7210, S7220, S7230, S7270, S7280, S7290, S730	25 905	2.2	90.6 (1)	3.7 (9)	0.1 (75)	49.5 (14)	1.5 (58)	91.0 (5)	30.0 (2)	1.4 (58)
6	Viral enteritis (150010)	A08*, A09	24 920	2.2	23.4 (80)	0.9 (73)	0.1 (75)	14.9 (67)	0.3 (87)	0.8 (95)	5.0 (89)	0.2 (79)
7	Asthma (040100)	J45*, J46	23 858	2.1	12.0 (87)	0.8 (76)	0.4 (52)	9.5 (85)	1.2 (64)	0.5 (97)	6.0 (82)	0.3 (74)
8	Angina pectoris, chronic ischemic heart disease (050050)	I20*, I25*	20 775	1.8	68.2 (23)	0.9 (73)	0.4 (52)	31.9 (31)	7.7 (22)	43.7 (29)	7.0 (78)	0.8 (64)
9	Disorder associated with shortened gestation period or low birth weight (140010)	P00*, P01*, P02*, P03*, P04*, P05*, P07*, P08*, P10*, P11*, P12*, P13*, P15*, P20*, P21*, P22*, P23*, P24*, P25*, P26*, P27*, P28*, P29*, P35*, P36*, P37*, P38, P39*, P50*, P51*, P52*, P53, P54*, P55*, P56*, P57*, P58*, P590, P591, P592, P593, P598, P599, P60, P61*, P70*, P71*, P72*, P74*, P75, P76*, P77, P780, P781, P782, P783, P789, P80*, P81*, P83*, P90, P91*, P92*, P93, P94*, P95, P96*	20 540	1.8	0.0 (95)	0.0 (98)	0.4 (52)	9.4 (86)	0.0 (97)	10.5 (71)	8.0 (70)	0.5 (69)
10	Renal infection (110310)	N10, N151, N390	19 853	1.7	63.7 (34)	1.7 (44)	1.1 (32)	22.5 (47)	1.3 (63)	6.7 (80)	10.0 (55)	1.5 (56)
11	Gastroduodenal ulcer, gastric diverticulum, pyloric stenosis (060140)	K25*, K26*, K311, K312, K314	19 387	1.7	53.5 (52)	1.6 (47)	0.4 (52)	37.2 (25)	6.6 (26)	62.1 (17)	11.0 (51)	1.8 (55)
12	Chronic nephritic syndrome/chronic interstitial nephritis/chronic renal failure (110280)	I120, I129, N02*, N03*, N05*, N06*, N07*, N08*, N11*, N12, N14*, N18*, N391, N392	19 295	1.7	67.3 (27)	1.4 (58)	1.0 (33)	18.7 (55)	3.0 (37)	31.2 (43)	16.0 (34)	6.8 (33)
13	Appendicitis (060150)	K35*, K36, K37, K38*	18 566	1.6	11.9 (88)	0.8 (76)	0.0 (82)	9.1 (88)	1.5 (58)	75.4 (10)	6.0 (82)	0.0 (85)
14	Bile duct (intra/extra hepatic) lithiasis (060340)	K803, K804, K805, K830, K831, K832, K833, K834, K838, K839, K915	17 869	1.5	75.6 (13)	1.1 (68)	0.3 (60)	16.9 (64)	2.3 (42)	68.3 (14)	14.0 (44)	2.9 (43)
15	Inflammation of oesophagus, stomach, duodenum and other intestines (other benign diseases) (060130)	B054, I880, K20, K21*, K220, K221, K222, K223, K224, K225, K226, K228, K229, K23*, K27*, K28*, K29*, K30, K310, K313, K315, K316, K318, K52*, K58*, K627, K633, K634, K638, K639, K90*, K910, K911, K912, K914, K92*, K93*	17 715	1.5	60.8 (47)	2.3 (28)	0.5 (50)	25.9 (42)	4.0 (33)	31.8 (42)	9.0 (62)	2.3 (49)
16	Skull and intracranial injury (160100)	S000, S007, S008, S009, S010, S017, S018, S019, S020*, S021*, S06*, S071, S079, S080, S089, S090, S091, S097	17 372	1.5	57.9 (49)	2.6 (22)	8.1 (9)	63.9 (6)	18.0 (8)	44.4 (28)	8.0 (70)	5.8 (34)
17	Nontraumatic intracranial haematoma (excluding nontraumatic subdural haematoma) (010040)	I61*, I629, I680, Q280, Q281, Q282, Q283	16 389	1.4	62.2 (42)	1.1 (68)	19.6 (3)	70.0 (3)	21.8 (3)	22.3 (55)	23.0 (11)	15.6 (21)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
18	Acute myocardial infarction, recurrent myocardial infarction (050030)	I21*, I22*, I24*	15 812	1.4	63.6 (35)	0.8 (76)	3.0 (19)	56.5 (8)	21.5 (4)	85.2 (6)	15.0 (38)	7.9 (29)
19	Benign disease of small and large intestine (including benign tumour) (060100)	D12*, D133, D191, D197, D199, D201, D372, D373, D374, D375, K57*, K620, K621, K635	13 657	1.2	43.6 (64)	0.7 (82)	0.0 (82)	7.9 (90)	1.1 (65)	45.9 (27)	7.0 (78)	0.3 (74)
20	Malignant pulmonary tumour (040040)	C33, C34*, C780, D021, D022, D024	13 327	1.2	75.3 (14)	2.3 (28)	0.8 (38)	19.5 (52)	1.4 (60)	10.9 (69)	21.0 (20)	40.5 (4)
21	Epilepsy (010230)	G40*, G41*	12 668	1.1	34.6 (70)	3.3 (12)	12.7 (5)	68.6 (4)	10.4 (15)	2.3 (88)	5.0 (89)	0.9 (62)
22	Vestibular dysfunction (030400)	H810, H811, H812, H813, H818, H819	12 589	1.1	56.8 (51)	1.2 (66)	0.0 (82)	48.3 (15)	0.4 (86)	0.3 (99)	5.0 (89)	0.0 (85)
23	Hydrops of gallbladder, cholecystitis (060335)	D135, K800, K801, K81*, K820, K821, K822, K823, K824, K828, K829, K835, K870	11 924	1.0	63.2 (39)	1.5 (53)	0.3 (60)	18.2 (58)	2.2 (43)	55.5 (22)	15.0 (38)	1.5 (56)
24	Malignant gastric tumour (060020)	C16*, D002	11 210	1.0	73.7 (16)	1.6 (47)	0.4 (52)	15.4 (66)	1.1 (65)	43.4 (30)	23.0 (11)	29.2 (7)
25	Blood poisoning (180010)	A021, A327, A391, A392, A393, A394, A395, A398, A399, A40*, A41*, B007, B250, B252, B376, B377, B387, B393, B407, B417, B427, B447, B464	10 923	0.9	67.4 (26)	2.1 (31)	6.2 (11)	40.8 (23)	12.1 (12)	29.7 (46)	17.0 (30)	25.9 (10)
26	Acute pyoderma (080011)	A46, L00, L01*, L020, L021, L022, L024, L028, L029, L03*, L08*	10 547	0.9	49.7 (55)	1.1 (68)	0.2 (68)	9.3 (87)	0.7 (75)	13.5 (63)	10.0 (55)	0.5 (69)
27	Upper respiratory tract inflammation (030270)	B302, J00, J02*, J06*, J31*	10 124	0.9	6.4 (90)	0.3 (93)	0.2 (68)	7.9 (90)	0.1 (91)	0.3 (99)	5.0 (89)	0.0 (85)
28	Impairment from fracture of thoracic or lumbar vertebra or lower (including thoracic/lumbar spinal cord injury) (160690)	S220*, S221*, S230, S231, S232, S233, S240, S241, S242, S245, S320*, S330, S331, S340, S341, S342, S343, S344, S345, T08*	9 547	0.8	82.9 (8)	2.7 (19)	0.1 (75)	45.3 (19)	2.4 (39)	8.2 (76)	26.0 (6)	0.3 (74)
29	Cirrhosis (including biliary cirrhosis) (060300)	I81, I820, I850, I859, I864, I982, K717, K721, K729, K740, K741, K742, K743, K744, K745, K746, K765, K766	9 189	0.8	61.7 (44)	2.7 (19)	3.3 (17)	33.4 (28)	6.2 (27)	39.5 (33)	17.0 (30)	19.4 (17)
30	Malignant tumour of liver/intrahepatic bile duct (including secondary tumour) (060050)	C22*, C787, D015, D376	8 854	0.8	74.5 (15)	1.5 (53)	1.0 (33)	18.0 (60)	1.6 (55)	31.2 (43)	17.0 (30)	42.9 (3)
31	Acute tonsillitis, acute laryngopharyngitis (040060)	A691, J03*, J04*, J05*, J390, J391, J392, J393, J399	8 795	0.8	6.3 (91)	0.5 (87)	0.1 (75)	5.6 (93)	0.5 (80)	2.7 (87)	5.0 (89)	0.1 (82)
32	Pneumothorax (040200)	J93*	8 764	0.8	27.4 (77)	0.6 (85)	0.3 (60)	14.6 (68)	2.2 (43)	37.3 (37)	9.0 (62)	1.3 (59)
33	Malignant tumour of colon (ascending to sigmoid colon) (060035)	C18*, C260, C269, C775, C785, D010	8 409	0.7	71.6 (19)	1.5 (53)	0.3 (60)	12.7 (77)	1.4 (60)	62.2 (16)	24.0 (9)	17.2 (18)
34	Dehydration (100380)	E86	8 380	0.7	61.5 (45)	3.2 (13)	1.5 (29)	30.2 (35)	1.6 (55)	2.1 (89)	6.0 (82)	2.6 (47)
35	Tachyarrhythmia (050070)	I456, I47*, I48, I490, I491, I492, I493, I494, I498	7 779	0.7	65.5 (30)	1.4 (58)	2.5 (22)	33.3 (29)	6.7 (25)	21.6 (56)	9.0 (62)	2.2 (51)
36	Bradyarrhythmia (050210)	I440, I441, I442, I443, I444, I445, I446, I447, I450, I451, I452, I453, I454, I455, I458, I459, I46*, I495, T821	7 331	0.6	85.8 (5)	1.8 (43)	16.0 (4)	47.0 (17)	16.3 (9)	62.3 (15)	13.0 (50)	17.1 (19)
37	Premature labour, threatened premature labour (120170)	O470, O471, O479, O60	7 161	0.6	0.0 (95)	0.5 (87)	0.0 (82)	13.7 (71)	0.0 (97)	17.9 (59)	16.0 (34)	0.0 (85)
38	Other infectious disease	A060, A061, A062, A063, A067, A068, A069, A07*,	6 959	0.6	22.5 (82)	0.3 (93)	0.8 (38)	11.6 (82)	1.9 (51)	9.3 (73)	6.0 (82)	5.1 (36)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)						
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance Tertiary	Surgery	LOS	Mortality
	(excluding fungal infection) (180030)	A180, A181, A184, A185, A186, A187, A188, A20*, A21*, A22*, A23*, A24*, A25*, A26*, A27*, A28*, A30*, A311, A318, A320, A328, A329, A33, A34, A35, A36*, A371, A38, A42*, A43*, A44*, A482, A484, A488, A49*, A68*, A690, A692, A698, A699, A70, A748, A749, A75*, A77*, A78, A79*, A90, A91, A92*, A93*, A94, A95*, A96*, A98*, A99, B001, B002, B008, B009, B03, B04, B07, B080, B081, B082, B084, B085, B088, B09, B258, B259, B260, B268, B269, B33*, B34*, B35*, B36*, B370, B372, B373, B374, B378, B379, B380, B381, B382, B383, B388, B389, B390, B391, B392, B394, B395, B399, B400, B401, B402, B403, B408, B409, B410, B418, B419, B420, B421, B428, B429, B430, B432, B438, B439, B442, B448, B449, B460, B461, B462, B463, B465, B468, B469, B47*, B48*, B49, B50*, B51*, B52*, B53*, B54, B55*, B56*, B57*, B580, B581, B583, B588, B589, B60*, B64, B650, B651, B652, B653, B658, B660, B661, B662, B663, B665, B668, B669, B67*, B68*, B69*, B70*, B71*, B72, B73, B74*, B75, B76*, B77*, B78*, B79, B80, B81*, B82*, B83*, B85*, B86, B87*, B88*, B90*, B91, B92, B94*, T793, U049									
39	Complications due to operation and procedure (180040)	T80*, T81*, T820, T822, T823, T824, T825, T826, T827, T828, T829, T83*, T84*, T85*, T86*, T87*, T880, T881, T882, T883, T884, T885, T886, T888, T889	6 943	0.6	53.2 (54)	1.3 (60)	0.6 (45)	12.5 (80)	2.0 (48)	60.0 (19)	10.0 (55)	2.3 (49)
40	Pancreas and spleen tumor (06007x)	C25*, C261, D136, D137, D377	6 815	0.6	72.6 (17)	1.9 (40)	0.6 (45)	12.0 (81)	0.6 (78)	41.2 (31)	22.0 (18)	34.9 (5)
41	Drug poisoning (161070a)	T36*, T37*, T38*, T39*, T40*, T41*, T42*, T43*, T44*, T45*	6 748	0.6	13.4 (86)	33.7 (1)	26.2 (2)	74.1 (2)	37.8 (1)	1.7 (91)	2.0 (100)	0.3 (74)
42	Peritonitis, abdominal abscess (excluding female genital organs) (060370)	A183, K630, K631, K632, K65*, K67*	6 746	0.6	48.0 (59)	1.6 (47)	1.0 (33)	28.5 (37)	7.0 (24)	56.6 (21)	16.0 (34)	7.7 (32)
43	Acute pancreatitis (060350)	B263, K85, K863, K871	6 494	0.6	43.6 (64)	3.9 (7)	0.3 (60)	24.3 (44)	4.5 (30)	17.2 (61)	14.0 (44)	2.8 (45)
44	Type 2 diabetes (excluding diabetic ketoacidosis) (100070)	E112, E113, E114, E115, E116, E117, E118, E119	6 265	0.5	58.1 (48)	3.9 (7)	1.0 (33)	18.5 (57)	1.0 (68)	8.9 (74)	18.0 (27)	0.9 (62)
45	Inflammation with cerebrospinal infection (010080)	A066, A321, A390, A80*, A82*, A838, A839, A858, A88*, A89, B003, B004, B005, B010, B011, B020, B021, B050, B051, B060, B261, B262, B375, B384, B431, B582, G00*, G02*, G03*, G041, G042, G048, G049, G05*, G06*, G07, G08, G09, G958	5 850	0.5	15.0 (85)	1.3 (60)	4.0 (14)	20.8 (50)	4.6 (28)	8.0 (77)	9.0 (62)	2.2 (51)
46	Subarachnoid haemorrhage, ruptured cerebral aneurysm (010020)	I60*	5 779	0.5	47.9 (60)	0.8 (76)	33.9 (1)	76.0 (1)	30.3 (2)	73.2 (11)	28.0 (4)	26.9 (9)
47	Bacterial enteritis (150020)	A00*, A01*, A020, A022, A028, A029, A030, A031, A032, A033, A038, A039, A040, A041, A042, A043, A044, A045, A046, A047, A048, A049, A050, A052,	5 632	0.5	25.1 (78)	0.8 (76)	0.2 (68)	13.1 (74)	0.6 (78)	1.7 (91)	6.0 (82)	1.0 (60)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
		A053, A054, A058, A059										
48	Herpes zoster (080020)	B022, B023, B027, B028, B029	5 542	0.5	63.3 (38)	2.6 (22)	0.0 (82)	2.8 (97)	0.1 (91)	0.9 (94)	8.0 (70)	0.1 (82)
49	Respiratory failure (040130)	J96*	5 501	0.5	71.4 (20)	2.7 (19)	9.5 (7)	42.3 (22)	11.3 (13)	10.9 (69)	14.0 (44)	21.8 (14)
50	Upper urinary tract disease (11012x)	D301, D302, N132, N20*, N281, N288	5 291	0.5	28.8 (75)	0.7 (82)	0.2 (68)	21.8 (48)	0.9 (71)	38.9 (34)	4.0 (95)	0.1 (82)
51	Interstitial pneumonia (040110)	J60, J61, J62*, J63*, J64, J65, J66*, J67*, J68*, J70*, J82, J84*, J990, J991	5 266	0.5	78.8 (10)	2.1 (31)	1.0 (33)	21.2 (49)	4.6 (28)	6.3 (81)	21.0 (20)	25.3 (11)
52	Ischemic enterocolitis (060190)	K55*	5 265	0.5	63.4 (37)	1.1 (68)	0.6 (45)	17.3 (63)	2.4 (39)	11.1 (68)	10.0 (55)	4.1 (38)
53	Malignant tumour of gallbladder (060060)	C23, C24*	5 159	0.4	84.1 (7)	1.3 (60)	0.3 (60)	13.1 (74)	0.8 (73)	58.2 (20)	23.0 (11)	28.8 (8)
54	Brain tumour (010010)	C700, C709, C71*, C722, C723, C724, C793, D320, D329, D330, D331, D332, D333, D337, D339, D420, D429, D430, D431, D432, D433, D437, D439, G131, G132	4 883	0.4	47.6 (62)	1.7 (44)	3.2 (18)	28.2 (38)	4.4 (31)	34.2 (40)	23.0 (11)	17.1 (19)
55	Spinal stenosis (including spondylosis) (07034x)	G551, G552, G553, G558, G950, G951, G952, G959, M4320, M4321, M4322, M4323, M4324, M4325, M4326, M4327, M4328, M4329, M4700, M4701, M4702, M4703, M4704, M4705, M4706, M4707, M4708, M4709, M4710, M4711, M4712, M4713, M4714, M4715, M4716, M4717, M4718, M4719, M4720, M4721, M4722, M4723, M4724, M4725, M4726, M4727, M4728, M4729, M4780, M4781, M4782, M4783, M4784, M4785, M4786, M4787, M4788, M4789, M4790, M4791, M4792, M4793, M4794, M4795, M4796, M4797, M4798, M4799, M4800, M4801, M4802, M4803, M4804, M4805, M4806, M4807, M4808, M4809, M4810, M4811, M4812, M4813, M4814, M4815, M4816, M4817, M4818, M4819, M4820, M4821, M4822, M4823, M4824, M4825, M4826, M4827, M4828, M4829, M4830, M4831, M4832, M4833, M4834, M4835, M4836, M4837, M4838, M4839, M4840, M4841, M4842, M4843, M4844, M4845, M4846, M4847, M4848, M4849, M4850, M4851, M4852, M4853, M4854, M4855, M4856, M4857, M4858, M4859, M4880, M4881, M4882, M4883, M4884, M4885, M4886, M4887, M4888, M4889, M4890, M4891, M4892, M4893, M4894, M4895, M4896, M4897, M4898, M4899, M4940, M4941, M4942, M4943, M4944, M4945, M4946, M4947, M4948, M4949, M4980, M4981, M4982, M4983, M4984, M4985, M4986, M4987, M4988, M4989, M5300, M5301, M5302, M5303, M5304, M5305, M5306, M5307, M5308, M5309, M5310, M5311, M5312, M5313, M5314, M5315, M5316, M5317, M5318, M5319, M5330, M5331, M5332, M5333, M5334, M5335, M5336, M5337, M5338, M5339, M5380, M5381, M5382, M5383, M5384, M5385, M5386,	4 807	0.4	77.3 (12)	2.0 (37)	0.0 (82)	23.6 (45)	1.0 (68)	23.5 (52)	20.0 (25)	0.5 (69)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
		M5387, M5388, M5389, M5390, M5391, M5392, M5393, M5394, M5395, M5396, M5397, M5398, M5399, M9950, M9951, M9952, M9953, M9954, M9955, M9956, M9957, M9958, M9959, M9960, M9961, M9962, M9963, M9964, M9965, M9966, M9967, M9968, M9969, M9970, M9971, M9972, M9973, M9974, M9975, M9976, M9977, M9978, M9979										
56	Anaemia (130090)	D500, D501, D508, D509, D510, D511, D512, D513, D518, D519, D520, D521, D528, D529, D530, D531, D532, D538, D539, D550, D551, D552, D559, D560, D561, D562, D563, D564, D569, D570, D571, D572, D573, D580, D581, D582, D588, D589, D590, D591, D592, D593, D594, D595, D596, D599, D62, D640, D641, D642, D643, D644, D648, D649	4 756	0.4	63.1 (40)	2.0 (37)	0.6 (45)	18.6 (56)	1.9 (51)	37.7 (36)	11.0 (51)	3.8 (39)
57	Maternal care related to the fetus and amniotic cavity and possible delivery problems (120180)	O30*, O31*, O32*, O33*, O34*, O35*, O36*, O40, O41*, O42*, O43*, O44*, O45*, O46*, O48	4 658	0.4	0.0 (95)	0.4 (90)	0.0 (82)	13.3 (73)	0.1 (91)	70.6 (12)	9.0 (62)	0.0 (85)
58	Malignant tumour of rectum and anus (rectosigmoid colon to anus) (060040)	C19, C20, C21*, D011, D012, D013, D014	4 646	0.4	63.6 (35)	1.9 (40)	0.4 (52)	14.6 (68)	1.1 (65)	49.8 (25)	23.0 (11)	21.0 (16)
59	Nontraumatic subdural haemorrhage (010050)	I620, I621	4 606	0.4	85.8 (5)	2.2 (30)	2.7 (20)	27.9 (39)	9.7 (18)	92.6 (4)	10.0 (55)	1.9 (54)
60	Acute renal failure (110290)	K767, N17*	4 034	0.3	70.1 (21)	3.0 (16)	2.7 (20)	31.5 (32)	7.3 (23)	27.0 (49)	15.0 (38)	14.2 (22)
61	Intervertebral disk degeneration, disk herniation (070350)	M50*, M51*	4 004	0.3	20.2 (84)	1.6 (47)	0.0 (82)	27.4 (40)	0.2 (89)	28.8 (47)	15.0 (38)	0.0 (85)
62	Autoimmune disease with systemic organ disease (070560)	D86*, I00, L88, L92*, L93*, L940, L941, L942, L943, L95*, L982, L983, M0200, M0208, M0209, M0210, M0218, M0219, M0220, M0228, M0229, M0280, M0288, M0289, M0290, M0298, M0299, M0300, M0310, M0320, M0360, M0720, M0740, M0748, M0749, M0750, M0758, M0759, M0760, M0768, M0769, M0830, M0838, M0839, M0840, M0848, M0849, M0880, M0888, M0889, M0890, M0898, M0899, M091*, M092*, M098*, M120*, M121*, M1230, M1238, M1239, M1300, M1302, M1303, M1305, M1310, M1380, M1390, M150, M153, M154, M158, M159, M1900, M300, M301, M302, M308, M31*, M32*, M330, M331, M332, M339, M34*, M350, M351, M352, M353, M354, M355, M356, M357, M358, M359, M36*, M633	3 864	0.3	45.3 (63)	3.0 (16)	0.5 (50)	12.9 (76)	1.8 (53)	11.6 (66)	21.0 (20)	4.5 (37)
63	Peritonsillar abscess (030240)	J36	3 811	0.3	10.3 (89)	0.3 (93)	0.0 (82)	2.3 (98)	0.2 (89)	35.0 (39)	6.0 (82)	0.0 (85)
64	Dystocia with complication of labour or obstetric operation (120260)	O61*, O62*, O63*, O64*, O65*, O66*, O67*, O68*, O69*, O70*, O71*, O720, O721, O722, O73*, O74*, O75*, O81*, O82*, O83*, O84*	3 646	0.3	0.0 (95)	0.4 (90)	0.0 (82)	13.6 (72)	0.5 (80)	84.8 (7)	8.0 (70)	0.0 (85)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
65	Disseminated intravascular coagulation (130100)	D65, D683, O723	3 631	0.3	72.0 (18)	2.1 (31)	8.3 (8)	45.5 (18)	13.9 (11)	49.6 (26)	23.0 (11)	46.0 (1)
66	Other humoral/electrolyte/acid–base balance disorders (100393)	E870, E871, E872, E873, E874, E875, E877, E878	3 622	0.3	61.5 (45)	7.0 (4)	4.0 (14)	32.3 (30)	8.3 (20)	4.6 (86)	8.0 (70)	2.7 (46)
67	Kawasaki disease (1500709)	M303	3 576	0.3	0.0 (95)	0.0 (98)	0.0 (82)	2.1 (99)	0.0 (97)	0.8 (95)	11.0 (51)	0.0 (85)
68	Retinal detachment (020160)	H330, H332, H333, H334, H335	3 566	0.3	23.4 (80)	0.3 (93)	0.0 (82)	0.2 (100)	0.0 (97)	99.2 (1)	14.0 (44)	0.0 (85)
69	Non–Hodgkin lymphoma (130030)	C820, C821, C822, C827, C829, C830, C831, C832, C833, C834, C835, C836, C837, C838, C839, C840, C841, C842, C843, C844, C845, C850, C851, C857, C859	3 492	0.3	68.0 (24)	1.7 (44)	0.7 (41)	13.9 (70)	2.0 (48)	38.5 (35)	29.0 (3)	24.3 (13)
70	Sudden idiopathic hearing loss (030428)	H912	3 489	0.3	33.9 (71)	0.6 (85)	0.0 (82)	5.3 (94)	0.1 (91)	2.1 (89)	10.0 (55)	0.0 (85)
71	Hypertension or other diseases associated with pregnancy/labour/puerperium (120160)	O10*, O11, O12*, O13, O14*, O15*, O16, O21*, O22*, O23*, O25, O26*	3 480	0.3	0.1 (93)	0.8 (76)	0.1 (75)	10.7 (84)	0.3 (87)	30.6 (45)	9.0 (62)	0.0 (85)
72	Other digestive tract disorders (060570)	K00*, K01*, K02*, K03*, K04*, K05*, K06*, K08*, K09*, K10*, K14*, K319, K590, K591, K592, K594, K598, K599, K629, K66*, K759, K764, K769, K918, K919	3 420	0.3	48.2 (58)	2.6 (22)	0.3 (60)	17.7 (61)	2.2 (43)	10.0 (72)	8.0 (70)	2.0 (53)
73	Arteriosclerosis obliterans (050170)	I700, I702, I708, I709, I720, I721, I724, I73*, I740, I741, I742, I743, I744, I745, I748, I749	3 393	0.3	82.1 (9)	1.1 (68)	0.6 (45)	22.9 (46)	4.4 (31)	60.9 (18)	18.0 (27)	9.1 (28)
74	Febrile convulsion (150040)	R560	3 365	0.3	0.1 (93)	0.0 (98)	4.2 (13)	55.2 (9)	1.0 (68)	0.4 (98)	4.0 (95)	0.0 (85)
75	Fracture/dislocation of ankle joint or foot (160850)	M8437, S8250, S8260, S8280, S9200, S9210, S9220, S9230, S9240, S9250, S9270, S9290, S930, S931, S932, S933	3 345	0.3	36.3 (69)	2.1 (31)	0.0 (82)	28.8 (36)	1.8 (53)	83.5 (8)	27.0 (5)	0.0 (85)
76	Periarticular fracture/dislocation of knee (160820)	S7240, S8200, S8210, S8270	3 343	0.3	66.3 (29)	2.4 (27)	0.2 (68)	38.6 (24)	1.4 (60)	69.1 (13)	35.0 (1)	0.4 (73)
77	Influenza, viral pneumonia (040070)	J10*, J11*, J12*	3 309	0.3	4.4 (92)	0.3 (93)	0.3 (60)	6.8 (92)	0.1 (91)	1.2 (93)	6.0 (82)	0.2 (79)
78	Multiple injuries (160990)	S434, S435, S436, S437, S49*, S59*, S69*, S79*, S89*, S99*, T00*, T01*, T02*, T03*, T04*, T06*, T07	3 254	0.3	57.3 (50)	3.6 (10)	1.6 (26)	65.2 (5)	15.9 (10)	40.5 (32)	19.0 (26)	0.8 (64)
79	Fulminant hepatitis, acute liver failure, acute hepatitis (060270)	B150, B159, B160, B161, B162, B169, B170, B171, B172, B178, B19*, B251, K710, K711, K712, K719, K720, K762, K763	3 212	0.3	28.8 (75)	2.1 (31)	1.2 (31)	10.8 (83)	2.8 (38)	6.8 (79)	14.0 (44)	7.8 (31)
80	Chronic obstructive lung disease (040120)	J43*, J44*	3 165	0.3	87.7 (3)	2.1 (31)	1.5 (29)	31.4 (33)	3.8 (34)	4.7 (85)	15.0 (38)	10.7 (25)
81	Unspecified injury (161060)	T090, T091, T092, T093, T094, T095, T098, T099, T10*, T110, T119, T12*, T130, T131, T132, T133, T134, T135, T138, T139, T140, T141, T142*, T143, T144, T145, T146, T148, T149, T189, T288, T289, T66, T71, T73*, T751, T753, T758, T782, T783, T784, T788, T789, T794, T795, T797, T798, T799	3 127	0.3	32.7 (73)	2.9 (18)	5.5 (12)	54.2 (10)	20.1 (7)	25.7 (50)	3.0 (98)	3.8 (39)
82	Haemorrhage in early	O20*	3 108	0.3	0.0 (95)	0.4 (90)	0.0 (82)	5.2 (95)	0.1 (91)	8.3 (75)	9.0 (62)	0.0 (85)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)							
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance	Tertiary	Surgery	LOS	Mortality
	pregnancy (120150)											
83	Leucocytic disease (130070)	D70, D720, D721, D728, D729	3 049	0.3	48.9 (56)	1.2 (66)	0.1 (75)	4.8 (96)	0.5 (80)	17.7 (60)	7.0 (78)	2.9 (43)
84	Dissecting aneurysm (050161)	I710	2 974	0.3	64.4 (32)	1.6 (47)	2.2 (23)	58.8 (7)	21.5 (4)	33.7 (41)	23.0 (11)	10.2 (26)
85	Alcoholic liver disease (060280)	K70*	2 964	0.3	30.7 (74)	14.7 (2)	1.6 (26)	25.2 (43)	2.4 (39)	12.7 (64)	14.0 (44)	9.4 (27)
86	Male genital diseas (11022x)	D294, I861, N41*, N43*, N44, N45*, N46, N47, N48*, N508	2 841	0.2	53.3 (53)	0.9 (73)	0.0 (82)	8.9 (89)	0.7 (75)	15.3 (62)	8.0 (70)	0.3 (74)
87	Pulmonary/mediastinal infection and abscess (040150)	A065, B440, B441, B45*, B659, B664, E321, E328, J850, J851, J852, J853, J86*, J985	2 834	0.2	62.2 (42)	2.6 (22)	0.7 (41)	20.4 (51)	3.8 (34)	18.9 (58)	24.0 (9)	11.4 (23)
88	Malignant tumour of oesophagus (including cervical region) (060010)	C150, C151, C152, C153, C154, C155, C158, C159, D001	2 805	0.2	66.6 (28)	2.0 (37)	0.4 (52)	12.7 (77)	0.7 (75)	36.5 (38)	22.0 (18)	30.9 (6)
89	Pelvic injury (160980)	S321*, S322*, S323*, S324*, S325*, S327*, S328*, S332, S333, S334, S335, S336, S337, S348, S377*, S378*, S379*, S383, S39*	2 783	0.2	67.7 (25)	3.2 (13)	0.7 (41)	53.3 (12)	10.2 (17)	22.6 (54)	25.0 (7)	1.0 (60)
90	Muscle and tendon injury of the extremities (160610)	M620*, M621*, M623*, M626*, M628*, M629*, M660*, M661*, M662*, M663*, M664*, M665*, S46*, S534, S56*, S633, S634, S635, S636, S637, S66*, S731, S76*, S86*, S934, S935, S936, S96*, T112, T115	2 700	0.2	33.3 (72)	4.5 (5)	0.8 (38)	30.8 (34)	3.6 (36)	55.5 (22)	10.0 (55)	0.6 (66)
91	Retroperitoneal disease (110050)	C786, D200, D483	2 695	0.2	65.1 (31)	1.6 (47)	0.4 (52)	12.7 (77)	0.9 (71)	28.4 (48)	21.0 (20)	45.7 (2)
92	Chemical poisoning (161070b)	T46*, T47*, T48*, T49*, T50*, T51*, T52*, T53*, T54*, T55, T56*, T57*, T58, T59*, T60*, T61*, T62*, T63*, T64, T65*, T887	2 694	0.2	40.5 (68)	9.0 (3)	7.9 (10)	52.6 (13)	21.3 (6)	12.7 (64)	3.0 (98)	3.8 (39)
93	Facial injury (including oral/pharyngeal injury) (160200)	S003, S004, S005, S012, S013, S014, S015, S022*, S023*, S024*, S025*, S026*, S027*, S028*, S029*, S041, S042, S043, S044, S045, S046, S047, S048, S049, S070, S078, S081, S088, S099, S100, S101, T180	2 576	0.2	24.3 (79)	2.6 (22)	1.9 (25)	53.4 (11)	11.3 (13)	55.0 (24)	5.0 (89)	0.6 (66)
94	Malignant tumour of bone or soft tissue (excluding spine and spinal cord) (070040)	C400, C401, C402, C403, C408, C409, C413, C418, C419, C471, C472, C473, C474, C475, C476, C478, C479, C491, C492, C493, C494, C495, C496, C498, C499, C764, C765, C773, C774, C795, C96*, D092, D097	2 550	0.2	63.1 (40)	3.5 (11)	0.2 (68)	17.5 (62)	0.5 (80)	24.1 (51)	25.0 (7)	24.4 (12)
95	Malignant prostatic tumour (110080)	C61, C637, D075	2 549	0.2	90.3 (2)	1.3 (60)	0.7 (41)	15.6 (65)	0.5 (80)	23.1 (53)	16.0 (34)	21.8 (14)
96	Periarticular fracture/dislocation of elbow (160740)	S4240, S5200, S5210, S530, S531	2 494	0.2	20.3 (83)	0.7 (82)	0.0 (82)	18.8 (54)	0.8 (73)	95.8 (2)	4.0 (95)	0.2 (79)
97	Fracture of forearm (160760)	S5220, S5230, S5240, S5250, S5270, S5280, S5290	2 463	0.2	41.0 (67)	0.5 (87)	0.1 (75)	27.1 (41)	1.6 (55)	95.4 (3)	7.0 (78)	0.0 (85)
98	Diabetic ketoacidosis, nonketotic coma (100040)	E100, E101, E110, E111, E130, E131, E140, E141	2 444	0.2	41.7 (66)	4.0 (6)	9.8 (6)	44.7 (20)	10.4 (15)	4.9 (84)	15.0 (38)	3.4 (42)
99	Other musculoskeletal/connective tissue diseases (071030)	M!!!!, M0000, M0008, M0009, M0010, M0018, M0019, M0020, M0028, M0029, M0080, M0088, M0089, M0090, M0098, M0099, M0100, M0108, M0109, M0110, M0118, M0119, M0120, M0128, M0129, M0130, M0138, M0139, M0140, M0148,	2 389	0.2	47.7 (61)	1.3 (60)	0.0 (82)	47.1 (16)	0.5 (80)	5.5 (83)	8.0 (70)	0.5 (69)

Supplemental Table

Rank	Clinical diagnosis (Disease code)	ICD-10 codes	N	%	Clinical and procedual characteristics, %/median, (rank)						
					Age ≥ 65	Comorbid Mental	Deep Coma	Ambulance Tertiary	Surgery	LOS	Mortality
		M0149, M0150, M0158, M0159, M0160, M0168, M0169, M0180, M0188, M0189, M0308, M0309, M0312, M0318, M0319, M0328, M0329, M0368, M0369, M1240, M1248, M1249, M1250, M1258, M1259, M1280, M1288, M1289, M1309, M1319, M1389, M1399, M1908, M1909, M1910, M1918, M1919, M1920, M1928, M1929, M1980, M1988, M1989, M1990, M1998, M1999, M2100, M2108, M2109, M2110, M2118, M2119, M2120, M2128, M2129, M2170, M2178, M2179, M2180, M2188, M2189, M2190, M2198, M2199, M2450, M2458, M2459, M2460, M2468, M2469, M2480, M2488, M2489, M2500, M2508, M2509, M2510, M2518, M2519, M2540, M2548, M2549, M2550, M2551, M2552, M2554, M2555, M2556, M2557, M2558, M2559, M2560, M2568, M2569, M2570, M2578, M2579, M2580, M2588, M2589, M2590, M2598, M2599, M540*, M541*, M542*, M543*, M544*, M545*, M546*, M548*, M549*, M671, M678, M679, M798*, M799*, M8300, M8301, M8302, M8303, M8304, M8305, M8307, M8308, M8309, M8310, M8311, M8312, M8313, M8314, M8315, M8317, M8318, M8319, M8320, M8321, M8322, M8323, M8324, M8325, M8327, M8328, M8329, M8330, M8331, M8332, M8333, M8334, M8335, M8337, M8338, M8339, M8340, M8341, M8342, M8343, M8344, M8345, M8347, M8348, M8349, M8350, M8351, M8352, M8353, M8354, M8355, M8357, M8358, M8359, M8380, M8381, M8382, M8383, M8384, M8385, M8387, M8388, M8389, M8390, M8391, M8392, M8393, M8394, M8395, M8397, M8398, M8399, M852*, M858*, M859*, M8600, M8800, M8801, M8802, M8803, M8804, M8805, M8806, M8807, M8809, M889*, M900*, M901*, M902*, M906*, M907*, M913*, M938, M951, M952, M953, M954, M955, M958, M959, M961, M966, M968, M969, M990*, M991*, M992*, M993*, M994*, M998*, M999*									
100	Fracture or dislocation around the shoulder (160720)	M2431, M2441, S4220, S4230, S4270, S4280, S4290, S430, S431, S432, S433	2 370	0.2	68.9 (22)	3.1 (15)	0.0 (82)	35.6 (26)	2.2 (43)	76.8 (9)	21.0 (20)	0.6 (66)

Rankings were based on data from the top 100 causes of admissions. Comorbidity of mental illness was defined as the following ICD-10 codes as comorbidities: unipolar depressive disorders (F32–F33), bipolar affective disorder (F30–F31), schizophrenia (F20–F29), alcohol use disorders (F10), drug use disorders (F11–F16 and F18–F19), post-traumatic stress disorder (F431), obsessive-compulsive disorder (F42), panic disorder (F400 and F410), or insomnia (F51). Deep coma was defined as a score on the Japan Soma Scale of 100 or more.
Ambulance, ambulance services; LOS, median length of stay; Mortality, in-hospital mortality; Surgery, surgical procedures; Tertiary, tertiary emergency medical services; *, wild card; M!!!!, ICD-10 code numbers starting with 'M' not elsewhere classified.