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Psychiatric intervention and repeated admission to emergency centres due to drug overdose

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Background
Repeated drug overdose is a major risk factor for suicide. Data are lacking on the effect of psychiatric intervention on preventing repeated drug overdose.

Aims
To investigate whether psychiatric intervention was associated with reduced readmission to emergency centres due to drug overdose.

Method
Using a Japanese national in-patient database, we identified patients who were first admitted to emergency centres for drug overdose in 2010–2012. We used propensity score matching for patient and hospital factors to compare readmission rates between intervention (patients undergoing psychosocial assessment) and unexposed groups.

Results
Of 29 564 eligible patients, 13 035 underwent psychiatric intervention. In the propensity-matched 7938 pairs, 1304 patients were readmitted because of drug overdose. Readmission rate was lower in the intervention than in the unexposed group (7.3% *v*. 9.1% respectively, $P<0.001$).

Conclusions
Psychiatric intervention was associated with reduced readmission in patients who had taken a drug overdose.

Declaration of interest
None.

Self-harm, with or without suicidal intent, substantially increases the risk of future suicide[1,2] and is known to be the strongest predictor of completed suicide.[3–7] Furthermore, repetition of self-harm is common:[8,9] 16% of patients who self-harmed were found to repeat a similar episode within 1 year.[7] Repetition of self-harm increases the risk of completed suicide.[8] One study found overdose to be the most prevalent type of suicide attempt that required admission,[10] and approximately 80% of self-harm episodes have been reported to involve overdose.[11] It is therefore necessary to prevent the repetition of self-harm by drug overdose. According to clinical guidelines on the management of self-harm published in 2004, it is recommended that every patient presenting to hospital with self-harm should undergo a psychosocial assessment by specialists before being discharged.[12,13] Despite this recommendation, some studies have found that many patients, especially those with repeated self-harm,[14] did not actually receive such assessments.[15–18] That would suggest that the guideline has not been widely used – possibly because it was not based on firm evidence. There is a lack of data on the influence of psychosocial assessments on preventing repetition of self-harm. Some studies have suggested that such assessments do have an influence, but they were based on a small sample size[14,19–21] or on a small number of highly advanced institutions.[17,22,23] The present study focused on patients with drug overdose who were admitted to emergency centres. Using a national in-patient database in Japan, it aimed to investigate whether psychiatric intervention before discharge was associated with reduced patient readmissions with drug overdose.

Method

Data source

The Diagnosis Procedure Combination (DPC) database is a national in-patient database in Japan that includes administrative claims data and detailed patient data.[24] As of 2012, the database included the data of approximately 7 million in-patients from more than 1000 hospitals in Japan, representing around 50% of all acute care in-patient admissions. The database consists of the following information: unique hospital identifiers; age and gender main diagnoses, comorbidities present on admission, and complications that occurred after admission recorded with text data in Japanese and using ICD-10[25] codes; procedures; and discharge status. The responsible physicians are obliged to record the diagnoses with reference to medical charts on discharge. For the main diagnosis, the physicians have to enter only one ICD code.

This study was approved by the Ethical Committee, Faculty of Medicine, The University of Tokyo (approval No. 3501). Because of the anonymous nature of the data, informed consent was not required.

Participant selection and data

We identified patients with a diagnosis of drug poisoning (ICD-10 codes: T360–T509) who were discharged from participating hospitals between 1 July 2010 and 31 March 2013 (33 months in total). We included patients aged 12 years or older with a first episode of drug overdose and who visited a hospital with at least one full-time psychiatrist during the study period. We excluded patients who died during admission to hospital.

We identified psychiatric intervention by means of procedure codes for 'interview for assessment and/or psychotherapy by a psychiatrist', coded using the Japanese Procedure Codes defined under the fee schedule of the national health insurance system. We divided the patients into two groups: (a) those who received a psychiatric intervention – the psychiatric intervention group; and (b) those who did not – the unexposed group.

Based on the protocol of Quan *et al*, we converted ICD-10 codes of comorbidities that were present on admission into scores for each patient to calculate the Charlson comorbidity index (CCI).[26] This index is used to predict mortality by classifying or weighting comorbidities to assess disease burden and case mix. Hospital volume was defined as the number of patients with the diagnosis of drug overdose annually at each hospital; it was

Table 1 Demographic and clinical characteristics of the psychiatric intervention and unexposed groups

	All patients					Propensity-matched patients				
	Unexposed group (*n*=16 529)		Psychiatric intervention group (*n*=13 035)		Absolute standardised difference	Unexposed group (*n*=7938)		Psychiatric intervention group (*n*=7938)		Absolute standardised difference
	n	%	*n*	%		*n*	%	*n*	%	
Female	10 944	66.2	9310	71.4	11.2	5620	70.8	5576	70.2	1.3
Age, years										
12–19	1044	6.3	884	6.8	2.0	550	6.9	523	6.6	1.2
20–29	3401	20.6	3181	24.4	9.1	1978	24.9	1877	23.6	3.0
30–39	3293	19.9	3315	25.4	13.2	1955	24.6	1934	24.4	0.5
40–49	2651	16.0	2564	19.7	9.7	1559	19.6	1558	19.6	0.0
50–59	1468	8.9	1343	10.3	4.8	786	9.9	791	10.0	0.3
60–69	1389	8.4	874	6.7	6.4	530	6.7	567	7.1	1.6
70–79	1441	8.7	548	4.2	18.4	358	4.6	400	5.0	1.9
80–89	1442	8.7	289	2.2	28.9	198	2.5	254	3.2	4.2
≥90	400	2.4	37	0.3	18.3	24	0.3	34	0.4	1.7
Toxic agent										
Non-opioid analgesics, anti-pyretics and anti-rheumatics	651	3.9	730	5.6	8.0	383	4.8	365	4.6	0.9
Anti-epileptic, sedative-hypnotic and anti-Parkinsonism drugs	4685	28.3	4109	31.5	7.0	2423	30.5	2469	31.1	1.3
Other psychotropic drugs	1172	7.1	1186	9.1	7.3	701	8.8	697	8.8	0.0
Other drugs	2113	12.8	273	2.1	41.6	143	1.8	234	2.9	7.3
Unspecified drugs	7908	47.8	6737	51.7	7.8	4288	54.0	4173	52.6	2.8
Classification of mental disorder										
Schizophrenia	1394	8.4	2210	17.0	26.0	1133	14.3	1154	14.5	0.6
Mood disorders	3845	23.3	5484	42.1	40.9	3006	37.9	3070	38.7	1.6
Organic mental disorders	260	1.6	178	1.4	1.6	114	1.4	127	1.6	1.6
Mental disorders due to psychoactive substance use	451	2.7	351	2.7	0.0	260	3.3	271	3.4	0.6
Disorders of personality and behaviour	261	1.6	461	3.5	12.1	210	2.6	217	2.7	0.6
Other mental disorder	1190	7.2	2042	15.7	26.9	1012	12.7	990	12.5	0.6
Not known	9128	55.2	2309	17.7	84.6	2203	27.8	2109	26.6	2.7
Level of consciousness on admission										
Alert	5299	32.1	2909	22.3	22.2	1983	25.0	1949	24.6	0.9
Dull	3746	22.7	3280	25.2	5.9	1886	23.8	1919	24.2	0.9
Somnolence	3416	20.7	2963	22.7	4.9	1846	23.3	1850	23.3	0.0
Coma	4068	24.6	3883	29.8	11.7	2223	28.0	2220	28.0	0.0
Charlson comorbidity index										
0	12 251	74.1	11 200	85.9	29.8	6775	85.3	6640	83.6	4.7
1	2524	15.3	1352	10.4	14.7	859	10.8	929	11.7	2.8
2	994	6.0	327	2.5	17.4	215	2.7	247	3.1	2.4
≥3	760	4.6	156	1.2	20.4	89	1.1	122	1.5	3.5

Table 1 (Continued)

	All patients					Propensity-matched patients				
	Unexposed group (n=16 529)		Psychiatric intervention group (n=13 035)		Absolute standardised difference	Unexposed group (n=7938)		Psychiatric intervention group (n=7938)		Absolute standardised difference
	n	%	n	%		n	%	n	%	
Tracheal intubation	1019	6.2	2130	16.3	32.4	787	9.9	816	10.3	1.3
Haemodialysis	203	1.2	249	1.9	5.7	97	1.2	111	1.4	1.8
Academic hospital	5532	33.5	6328	48.5	30.9	3269	41.2	3248	40.9	0.6
Hospital volume groups, per year										
Low (≤38)	6673	40.4	3240	24.9	33.5	2491	31.4	2444	30.8	1.3
Medium (39–84)	5529	33.5	4216	32.3	2.6	2651	33.4	2688	33.9	1.1
High (≥85)	4327	26.2	5579	42.8	35.5	2796	35.2	2806	35.3	0.2
Fiscal year of discharge										
2010	5825	35.2	3290	25.2	21.9	2454	30.9	2419	30.5	0.9
2011	5693	34.4	5002	38.4	8.3	2959	37.3	2949	37.2	0.2
2012	5011	30.3	4743	36.4	13.0	2525	31.8	2570	32.4	1.3

classified into three categories (low, medium and high volume), with approximately equal numbers of patients in each group.

Outcome

The primary outcome was readmission to the same hospital due to repeated drug overdose.

Statistical analyses

We conducted one-to-one matching between the psychiatric intervention group and unexposed group based on the estimated propensity score of each patient.[27] This approach avoided treatment selection bias, which is inherent in observational data analysis. In this approach, every patient in the intervention group was matched with a patient in the unexposed group based on the estimated propensity score, the probability of undergoing the intervention calculated using the observed potential confounders. The matched patients constituted two groups with similar characteristics, which resembled a randomised experiment-like situation. To estimate the propensity score, we fitted a logistic regression model with receipt of the psychiatric intervention as the outcome variable and the following as independent variables: age; gender; ICD-based information on toxic agents (non-opioid analgesics, anti-pyretics and anti-rheumatics [T39]; anti-epileptic, sedative, hypnotic and anti-Parkinsonian drugs [T42]; other psychotropic drugs [T43]; other drugs [T36–38, T41, T44–T49]; and unspecified drugs [T50]); ICD-based diagnoses of mental disorders (schizophrenia [F2]; mood disorders [F3]; organic mental disorders [F0]; mental disorders due to psychoactive substance use [F1]; disorders of personality and behaviour [F6]; and other mental disorder); Japan Coma Scale[28] on admission; CCI; tracheal intubation; haemodialysis; type of hospital (academic or non-academic); hospital volume category and fiscal year of discharge. The C-statistic was calculated to evaluate the goodness of fit.

We conducted one-to-one matching between the psychiatric intervention and unexposed groups using nearest-neighbour matching within a calliper. One unexposed patient with the closest propensity score was selected for each intervention patient – provided that the difference in propensity score was within a certain amount (a calliper). We set a calliper as 0.20 of the standard deviation of the estimated propensity scores to achieve good balance between the intervention and unexposed groups. We used standardised differences to compare the prevalence of characteristics between the two groups.[29] An absolute standardised difference of >10 has been suggested as signifying meaningful imbalance.[29] We performed a chi-squared test to compare the proportions of readmission between the psychiatric intervention and unexposed groups among the propensity-matched patients. Logistic regression analysis for readmission was performed to calculate the odds ratio and 95% confidence interval (CI) of the psychiatric intervention group with respect to the unexposed group. We performed subgroup analysis on propensity-matched patients by age group. The threshold for significance was $P<0.05$. All statistical analyses were conducted using IBM SPSS Statistics, version 22.0 (IBM SPSS, Armonk, New York, USA).

Results

We identified 29 564 eligible patients from 368 hospitals during the study period; they comprised the psychiatric intervention group (n=13 035; 44.1%) and unexposed group (n=16 529; 55.9%). In total, 1961 patients (6.6%) required repeated admission due to drug overdose. Using one-to-one propensity score matching, we obtained 7938 pairs of the psychiatric intervention and unexposed groups. The C-statistic for goodness of fit was 0.768. Table 1

shows the demographic characteristics of all patients (n=29 564) and the propensity score-matched patients (n=15 876). Patients in the psychiatric intervention group were more likely to have the following characteristics: be younger and female; have schizophrenia, mood disorder, or personality or behaviour disorders; take psychotropic drugs during their overdose episode; have a worse consciousness level; undergo tracheal intubation and haemodialysis; and be discharged after 2012. Academic hospitals and higher volume hospitals were more likely to perform psychiatric interventions. After propensity score matching, the patient distributions were closely balanced between the two groups.

Table 2 shows the proportion of readmissions due to drug overdose in each subgroup in the propensity score-matched groups. In the matched patients, 1304 patients (8.2%) required repeated admission due to drug overdose. Patients who were younger females, had personality disorders and took other psychotropic drugs during their overdose episode were more likely to be readmitted as a result of drug overdose. Patients who were admitted to higher volume hospitals or discharged before 2011 were also more likely to be readmitted.

The propensity score-matched analysis showed a significant difference in readmission due to drug overdose between the psychiatric intervention and unexposed groups (7.3% *v.* 9.1% respectively; P<0.001). Logistic regression analysis showed that the psychiatric intervention group had a significantly lower proportion of readmission through drug overdose than the unexposed group (adjusted odds ratio 0.79; 95% CI 0.71–0.89; P<0.001; Table 3).

Table 2 Proportions of readmission due to overdose in each subgroup in the propensity-matched patients (n=15 876)

	No. of patients	Readmission	%
Total	15 876	1304	8.2
Female	11 196	1032	9.2
Age, years			
12–19	1073	91	8.5
20–29	3855	358	9.3
30–39	3889	389	10.0
40–49	3117	278	8.9
50–59	1577	109	6.9
60–69	1097	52	4.7
70–79	758	20	2.6
≥80	510	7	1.4
Toxic agent			
Non-opioid analgesics, anti-pyretics and anti-rheumatics	748	35	4.7
Anti-epileptic, sedative-hypnotic and anti-Parkinsonism drugs	4892	395	8.1
Other psychotropic drugs	1398	121	8.7
Other drugs	377	19	5.0
Unspecified drugs	8461	734	8.7
Classification of mental disorder			
Schizophrenia	2287	206	9.0
Mood disorders	6076	507	8.3
Organic mental disorders	241	10	4.1
Mental disorders due to psychoactive substance use	531	28	5.3
Disorders of personality and behaviour	427	57	13.3
Other mental disorders	2002	154	7.7
Not known	4312	342	7.9
Level of consciousness on admission			
Alert	3932	334	8.5
Dull	3805	318	8.4
Somnolence	3696	317	8.6
Coma	4443	335	7.5
Charlson comorbidity index			
0	13,415	1164	8.7
1	1788	103	5.8
2	462	27	5.8
≥3	211	10	4.7
Tracheal intubation	1603	98	6.1
Haemodialysis	208	12	5.8
Academic hospital	6517	529	8.1
Hospital volume groups, per year			
Low (≤38)	4935	358	7.3
Medium (39–84)	5339	463	8.7
High (≥85)	5602	483	8.6
Fiscal year of discharge			
2010	4873	572	11.7
2011	5908	507	8.6
2012	5095	225	4.4

Table 3 Proportions of readmission due to overdose in the propensity-matched group (*n*=15 876)

Unexposed group (*n*=7938)		Psychiatric intervention group (*n*=7938)			
n	%	*n*	%	*P*	Odds ratio (95% CI)
722	9.1	582	7.3	<0.001	0.79 (0.71–0.89)

Subgroup analysis showed that psychiatric intervention was significantly associated with lower readmission in two age groups – patients in their 20s and 40s (Table 4).

Discussion

Using a national in-patient database in Japan, this study compared repeated admission due to drug overdose between a psychiatric intervention and an unexposed group. Only 44% of the admitted patients underwent psychiatric intervention. A propensity-matched analysis demonstrated that the proportion of repeated admission through drug overdose was lower in the psychiatric intervention than in the unexposed group. Although not statistically significant for some age groups, the results were consistent across the various age groups. Psychiatric intervention was associated with lower readmission in younger subgroups, which is consistent with the findings of other reports.[30,31]

Several studies have investigated the effect of psychiatric intervention before discharge on preventing repetition of self-harm. However, the generalisability of those reports was limited because they were based on small sample sizes[14,19–21] or were restricted to data from highly advanced institutions with specialist self-harm teams.[17,22,23] One strength of the present study was the that it was representative of the general in-patient population, being based on nationwide data from various types of hospitals.

Previous investigations have shown mixed results on the effect of psychiatric intervention.[17] Most of those studies adopted a conventional regression model, which failed to adjust for patient backgrounds and hospital factors. Our study included various factors that could affect the probability of undergoing psychiatric intervention. Those key factors enabled us to conduct a propensity score analysis, which further reduced selection bias when estimating intervention effects from observational data. The model used in the matching method exhibited good discriminating ability in estimating receipt of psychiatric intervention (area under the receiving operating characteristic curve 0.768; 95% CI 0.763–0.773).

The proportion of readmission within 1 year (4.4%) was lower than the proportions of repeated self-harm (16%) reported in one systematic review.[7] A recent systematic review of brief contact interventions also found a higher rate of repeated self-harm (intervention 9.8%; unexposed 11.1%).[32] The reviewed studies identified repeated episodes using various methods such as the use of catchment areas for including patients, follow-up interviews and checking medical records. In the present study, we were able to identify only same-hospital readmission due to overdose, and this was a potential source of underestimation.

Our findings suggest that psychiatric intervention following admission due to drug overdose was associated with reduced readmission. Clinical guidelines from the National Institute for Health and Care Excellence in 2004[12] and Royal College of Psychiatrists in 2004[13] recommend that a psychosocial assessment by a trained mental health specialist be carried out for all patients who self-harm. In the present study, interventions by psychiatrists were associated with reduced risk of readmission, which suggests that such interventions are effective. However, because we were unable to assess the effect of intervention by other specialists, our findings may not apply to hospitals without consultation liaison services provided by psychiatrists.

The intervention in the present study included two aspects – assessment and psychotherapy. Because the DPC database lacked information regarding classification of the performed intervention, we were unable to distinguish between assessment and psychotherapy; likewise, we could not identify which elements of the intervention were effective. In the context of brief hospital admission, however, we assume that the intervention reflected the effects of assessment.

Several limitations of this study warrant consideration. First, the database we used did not include the severity of mental disorder, which may have influenced the probability of undergoing psychiatric intervention. Second, the recorded diagnoses in administrative claims databases are less well validated than those based on prospective cohorts or registries. Third, a large proportion of unspecified drugs may have caused confounding bias and led to underestimating the true effect of the intervention.

In conclusion, our study demonstrated that psychiatric intervention by psychiatrists before discharge was associated with reduced risk of repeated admission to emergency centres. These findings indicate the importance of psychiatric intervention for drug overdose patients admitted to emergency centres in preventing repeated admission.

Table 4 Subgroup analysis with proportions of readmission due to overdose in the psychiatric intervention group (*n*=7938)

Unexposed group				Intervention group				
Age, years	No. of patients	Readmission	%	No. of patients	Readmission	%	*P*	Odds ratio (95% confidence interval)
Total	7938	722	9.1	7938	582	7.3	<0.001	0.79 (0.71–0.89)
12–19	550	47	8.5	523	44	8.4	1.000	0.98 (0.64–1.51)
20–29	1978	204	10.3	1877	154	8.2	0.026	0.78 (0.62–0.97)
30–39	1955	205	10.5	1934	184	9.5	0.336	0.90 (0.73–1.11)
40–49	1559	164	10.5	1558	114	7.3	0.002	0.67 (0.52–0.86)
50–59	786	62	7.9	791	47	5.9	0.137	0.74 (0.50–1.09)
60–69	530	28	5.3	567	24	4.2	0.478	0.79 (0.45–1.39)
≥70	580	12	2.1	688	15	2.2	1.000	1.06 (0.49–2.27)

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