Original Article

Epidemiology of overdose episodes from the period prior to hospitalization for drug poisoning until discharge in Japan: An exploratory descriptive study using a nationwide claims database

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ABSTRACT

Background: Little is known about the nationwide epidemiology of the annual rate, causative substance, and clinical course of overdose-related admission. We aimed to describe the epidemiology of overdose episodes from the period prior to hospitalization for drug poisoning until discharge to home.
Methods: We assessed all cases of admission due to overdose (21,663 episodes) in Japan from October 2012 through September 2013 using the National Database of Health Insurance Claims and Specific Health Checkups of Japan.
Results: The annual rate of overdose admission was 17.0 per 100,000 population. Women exhibited two peaks in admission rates at 19–34 years (40.9 per 100,000) and ≥75 years (27.8 per 100,000). Men exhibited one peak in the admission rate at ≥75 years (23.7 per 100,000). Within 90 days prior to overdose, ≥60% and ≥9% of patients aged 19–49 years received a prescription for benzodiazepines and barbiturates, respectively. In addition, 59% of patients aged ≥75 years received a prescription for benzodiazepines prior to overdose, 47% had a history of congestive heart failure, and 24% had a diagnosis of poisoning by cardiovascular drugs. The proportion of patients with recent psychiatric treatments decreased with age (65.1% in those aged 35–49 years and 13.9% in those aged ≥75 years).
Conclusions: The findings emphasize the need for overdose prevention programs that focus on psychiatric patients aged 19–49 years who are prescribed benzodiazepines or barbiturates and on non-psychiatric patients aged ≥75 years who are prescribed benzodiazepines or digitalis.

Introduction

Overdose episodes place a considerable burden on society and health care resources. Approximately 44,000 cases of death due to overdose occur annually in the United States, making it the leading cause of injury-related deaths.[1] Non-fatal overdose is independently associated with subsequent overdose-related deaths.[2,3] Moreover, overdose was the major cause of emergency hospital admissions and the leading cause for admission to tertiary care centers in Japan.[4] The direct medical costs of overdose have been estimated at 7.7 billion yen per year in Japan.[5]

The patterns and causes of overdose vary by country and region, which might reflect the availability of drugs and the prescribing practice in the population.[6–8] In the United States, opioids, benzodiazepines, and antidepressants are the leading prescription drugs involved in overdose-related deaths.[9] In the United Kingdom, heroin/morphine, opioids, and antidepressants are the leading psychoactive substances involved in drug-related deaths.[10] In Japan, hypnotics-sedatives and antipsychotics are the leading prescription drugs involved in overdose-related deaths.[11] Due to the low consumption rate of opioids in Japan,[12] they are not among the leading causes of overdose-related deaths.[11]

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The prevention of overdose requires careful and appropriate prescribing practices, which can be achieved through training of physicians and pharmacists.[13] Understanding the country- and region-specific patterns of overdose is essential for the appropriate planning of prevention programs.[14,15] However, at present, there are serious limitations to our understanding of the epidemiology of overdose. To the best of our knowledge, only a few nationwide epidemiological studies have examined the rate, causative substance, and clinical course of overdose admissions.[16—21] Most of the studies focused primarily on the initial day of admission for overdose,[18,20,21] or the period from the date of admission to discharge to home at the initial hospital.[16,17,19] Hence, previous studies would have been unable to accurately quantify the clinical course of overdose, as they did not follow patients who were transferred from acute care hospitals to other medical institutions. Furthermore, even though overdose episodes may be primarily due to prescription drugs rather than over-the-counter or illicit drugs, information on the actual prescription history prior to overdose is scarce.[22,23] Therefore, in the present exploratory study, we aimed to describe the epidemiology of overdose episodes from the period prior to admission for overdose until discharge to home using a nationwide claims database.

Methods

Data source

We conducted an observational study using the National Database of Health Insurance Claims and Specific Health Checkups of Japan (NDB), developed by Japan's Ministry of Health, Labour and Welfare. Since its launch in April 2011, approximately 1.6 billion claims have been added annually to the NDB. As of October 2012, the NDB included all claims electronically issued from 99% of the hospitals (medical institution with ≥20 beds) in Japan[24] — a country divided into 47 prefectures, with a population of 126 million.[25] The NDB covers almost all patients who received medical care services under the universal health insurance system,[26] except for the those availing medical services not covered under public health insurance. The claims data include clinical and procedural information, such as the patient identification number, institution identification number, prefecture code of the institution, sex, age, date of admission, date of discharge, procedural codes, diagnostic codes, and drug codes. After a review of our study protocol by the NDB expert council, we entered into a contract with the ministry to use a dataset extracted from the NDB for the purpose of the present study. We adhered to the guideline on the use of the NDB,[24] based on which we were obligated to use the dataset only in a pre-specified secure room. We were subject to an on-site audit performed by an independent auditor to confirm adherence to the guideline. Our study was reviewed and approved by the institutional review board at the Institute for Health Economics and Policy. Because all patient records were de-identified prior to analysis, the review board waived the requirement for informed consent.

Definition of overdose episode

We identified all hospital admissions for overdose from October 2012 through September 2013. Overdose was defined as an initial definitive diagnosis of drug poisoning (T360—T509 according to the International Classification of Diseases [ICD]-10 codes). These codes include any overdose caused by intentional or unintentional poisoning, as reported in previous studies.[22,27,28] We excluded patients who were diagnosed with overdose after the date of admission.

An overdose episode was defined as the period from the date of admission for overdose to the date of discharge to home or the occurrence of in-hospital death. We included the first episode for each patient from October 2012 through September 2013 and followed all patients until the date of discharge to home, the date of in-hospital death, or the end of September 2014. Patients who were initially admitted to emergency care for the treatment of overdose and then transferred to a psychiatric hospital for the treatment of mental illness were considered as having a single overdose episode. To identify an overdose episode, we used the patient identification number recorded in the database. To increase traceability, we used the identification number generated from the insurance identification number, birth date, and sex (called "ID1") rather than that generated from name, birth date, and sex (called "ID2").

Psychiatric treatments and chronic conditions prior to overdose

We identified whether patients received a prescription for psychotropic medications and treatment from a psychiatrist within 90 days prior to the overdose episode. We included 121 psychotropic medications classified as sedatives-hypnotics (subdivided into benzodiazepines, barbiturates, and others), antipsychotics, antidepressants, mood stabilizers, and anticonvulsants, according to a commonly used prescription handbook in Japan (see eTable 1).[29] We also assessed the history of chronic conditions, including 17 conditions defined using the diagnostic codes of the Charlson Comorbidity Index.[30] We identified whether a patients was diagnosed with a chronic condition prior to the overdose episode using ICD-10 diagnostic codes.

Specific drugs involved in overdose

We identified the drugs that led to the admission for overdose using the ICD-10 diagnostic codes. These drugs were classified into 15 drug classes.

Health service use and clinical course of overdose

We determined the wards to which patients with overdose were admitted on the initial day of hospitalization. We also identified whether patients were transferred to other medical institutions, such as psychiatric hospitals, after the initial admission to emergency care for the treatment of overdose. Finally, we determined the overall length of stay and in-hospital death during the period from the date of admission for overdose to the date of discharge to home or the occurrence of in-hospital death.

Statistical analyses

First, the annual rate of overdose-related admissions per 100,000 population was calculated for the sex and age-sex subgroups. The number of overdose episodes was divided by the population estimates of the 2010 population census.[31] We used age groups (0—11, 12—18, 19—34, 35—49, 50—64, 65—74, and ≥75 years) similar to those used in previous studies.[22,32] We calculated the 95% confidence intervals (CIs) for the rates by using the exact tail method for the Poisson distribution.[33] Second, the age- and sex-standardized rate ratio (SRR) was calculated for each prefecture. The 47 prefectures were used as geographical units for analyses because these usually correspond to tertiary medical areas. The SRR enables the comparison of the rate for overdose-related admissions in a prefecture to that in Japan as a whole (reference). The empirical Bayes estimates for SRRs were obtained from a set of observed and expected number of overdose episodes using the Poisson-Gamma model along with moment estimators in the DCluster package in R.[34] Moreover, we