Journal of Affective Disorders 219 (2017) 31–36

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research paper

Increase in the prescription rate of antidepressants after the Sewol Ferry disaster in Ansan, South Korea

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ARTICLE INFO

Keywords:
Antidepressant
Anxiolytics
Disaster
Mental health
Prescription
Sewol Ferry disaster

ABSTRACT

Background: Previous pharmaco-epidemiological studies have reported increases in the prescription of psychotropic medications after a disaster, reflecting post-disaster changes in psychiatric conditions and mental health service utilization. We investigated changes in the prescription of psychotropic medications in the Danwon district of Ansan city (Ansan Danwon) compared to a control community before and after the Sewol Ferry disaster on April 16, 2014.

Methods: Data was collected from the Korean Health Insurance Review and Assessment Service database. We analyzed the prescription rates of psychotropic medications including antidepressants, anxiolytics, and sedatives/hypnotics, and investigated whether the time-series pattern of monthly prescriptions per 100,000 people was different in Ansan Danwon compared to that in Cheonan city after the Sewol Ferry disaster through difference-in-differences regression analysis.

Results: Ansan Danwon showed a significantly greater increase (5.6%) in the prescription rate of antidepressants compared to Cheonan city following the Sewol Ferry disaster. There were no significant differences in changes in the prescription rates of anxiolytics or sedatives/hypnotics. In the secondary analysis, a significantly greater increase in the prescription rate of antipsychotics was observed in Ansan Danwon compared to a control community after the disaster.

Limitations: We could not exclude the possibility that other events influenced changes in the prescription rates of psychotropic medications during the study period.

Conclusions: Pharmaco-epidemiological studies on psychotropic medication prescription after a disaster provide important information about population-level mental health. Our results suggest that the Sewol Ferry disaster exerted a harmful effect on the mental health status of the affected community.

1. Introduction

A disaster is an unanticipated, large-scale, catastrophic event that threatens the lives of individuals or a large group of people, and can cause social network collapse, the substantial loss of social resources, and adverse effects on community physical and mental health status (Birur et al., 2017). Traumatic events related to disaster can lead to severe, long-lasting psychological distress at an individual or population level (Usher et al., 2012). Previous studies have documented the increased prevalence of psychiatric conditions such as depression, anxiety, suicidal behaviors, post-traumatic symptoms, and substance abuse in the aftermath of disasters (Birur et al., 2017; Kolves et al., 2013; Tang et al., 2014; Vlahov et al., 2006). At a population level, manmade disasters are associated with more serious psychological consequences than natural disasters affecting a similar quantity of loss and damage, as they subvert basic social emotions of trust and solidarity (Morgan and Bhugra, 2010).

Several studies have indicated that individuals indirectly exposed to disaster such as residents living in close proximity to a disaster event can also experience post-traumatic psychological symptoms (i.e., in the absence of direct exposure) (DiMaggio et al., 2007; Galea et al., 2002a; Lee et al., 2017). For example, indirect exposure of New York City

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http://dx.doi.org/10.1016/j.jad.2017.05.026
Received 10 April 2017; Received in revised form 29 April 2017; Accepted 9 May 2017
Available online 10 May 2017
0165-0327/

residents to the large-scale terrorist attack in New York City on September 11, 2001 through mass media, family, or friends was associated with severe psychological distress (Chen et al., 2003; Galea et al., 2002a, 2002b). These results warrant better investigation of the adverse effects of disasters on mental health status at a population level.

Numerous pharmaco-epidemiological studies have utilized changes in prescription rates or the utilization of psychotropic medication as a proxy measure of post-disaster changes in psychiatric conditions or mental health service utilization in residents of disaster-affected regions (Boscarino et al., 2003; DiMaggio et al., 2007; Rossi et al., 2011; Trifiro et al., 2013; Usher et al., 2012). For example, Usher et al. found that the new prescription rate of antidepressants was increased in the affected community after Cyclone Yasi in North Queensland, Australia (Usher et al., 2012). Another study on the September 11, 2001 New York City terrorist attack indicated that the prescription rate of selective serotonin reuptake inhibitors (SSRIs) was increased after the terrorist attack among individuals residing within 3 miles of the World Trade Center site (DiMaggio et al., 2007). Pharmaco-epidemiological studies on psychotropic medication use after a disaster provide important information about population-level mental health service utilization as well as critical information for effective public health planning after disasters (Boscarino et al., 2003). Additional studies investigating changes in prescription rates of psychotropic medications in affected regions following disaster are thus necessary.

On April 16, 2014, the Sewol Ferry, a South Korean ship carrying 476 passengers from Incheon to Jeju Island, sank disastrously off the southwestern coast of the Yellow Sea. Among 305 passengers who were reported deceased or missing, 250 were students of Danwon High School on a school excursion. The high school is located in the Danwon district of Ansan city, Gyeonggi-do province, and most of the victims and their family members and relatives were residents of Ansan city. The disaster elicited enormous shock and overwhelming grief across South Korea, and has left a lasting mark on the community of Ansan city. Even though the Sewol Ferry disaster did not take place in physical proximity to the residence of the victims, about 800 Ansan city residents were family members of the victims, and thousands were acquaintances that were indirectly exposed to the disaster (Yang et al., 2015). Furthermore, residents were exposed to the scene of the capsized and sinking ferry as well as rescued crew members leaving most passengers onboard by a live broadcast (Woo et al., 2015). The delayed rescue effort, the government's incompetence in the process of the rescue operation, and the moral hazard of the captain and crew aggravated emotions of embitterment in residents of the affected community after the disaster (Park et al., 2016). Above all, the fact that most of the victims were young students accentuated the effects of the tragedy on the local community; in the sociocultural context of South Korea, the accidental death of youths in particular can lead to severe and prolonged grief reactions from affected families and acquaintances.

Only one previous study has described the adverse effects of the Sewol Ferry disaster on the mental health status of Ansan city residents (Yang et al., 2015). Yang et al. (2015) conducted a self-administered questionnaire survey in Ansan city 4–6 months after the disaster and investigated the prevalence of psychiatric symptoms. The authors found that respondents from Ansan city were significantly more likely to have depression, stress, anxiety, somatic symptoms, and suicidal ideation compared to those from other cities in Gyeonggi-do province (Yang et al., 2015); however, this study was based on a relatively small sample size (918 and 923 respondents from the Danwon and Sangnok districts in Ansan city, respectively) compared to previous pharmaco-epidemiological studies investigating the effects of disaster on local residents (e.g., 103,788 participants in the study by Rossi et al., 2011). Furthermore, no study to date has examined changes in the prescription rates of psychotropic medications in Ansan city after the Sewol Ferry disaster as a proxy measure of mental health service utilization and a macroscopic indicator of mental health status at a population level.

The goal of this study was to investigate changes in the prescription rates of psychotropic medications in the Danwon district of Ansan city (Ansan Danwon) following the Sewol Ferry disaster compared to a control community. We hypothesized that the disaster adversely affected the mental health status of residents in Ansan Danwon and caused a larger increase in the prescription rates of psychotropic medications compared to other regions. Our *a priori* hypothesis was as follows: Ansan Danwon will show greater increases in the prescription rates of antidepressants, anxiolytics, and/or sedatives after the Sewol Ferry disaster compared to a control community.

2. Methods

2.1. Data source

We used the Korean Health Insurance Review and Assessment Service (HIRA) database to collect data about the prescription rates of psychotropic medications before and after the Sewol Ferry disaster. In South Korea, all medical services are financially covered by the National Health Insurance (NHI) system, and medical suppliers must report information regarding medical services and patient personal details to the HIRA, which subsequently reviews and assesses the reimbursement of medical care (Shin et al., 2015). Data collected by the HIRA include information about medication prescription and health care utilization for approximately 50 million people in South Korea (Shin et al., 2017). We obtained data about the monthly prescription of antidepressants, anxiolytics, and sedative/hypnotics to outpatients in Ansan Danwon between January 2013 and June 2016. According to the anatomical therapeutic chemical classification system of World Health Organization (WHO), 351 medications were included as antidepressants (N06A), 158 medications were included as anxiolytics (N05B), and 70 medications were included as hypnotics or sedatives (N05C). The classification of psychotropic medications in the HIRA corresponds with the WHO classification system. Medications not covered by health insurance were not included in the dataset.

To compare prescription rates (i.e., prescriptions per 100,000 people) between Ansan Danwon and a control community, Cheonan city in Chungcheongnam-do province was selected as a control community in consideration of its demographic characteristics, industrial structure, and economic level. Both communities are newly developing cities in South Korea with mixed characteristics of urban and rural areas. The populations of Ansan Danwon on January 2013 and June 2016 were 333,496 and 316,833 people, respectively; and the populations of Cheonan city on January 2013 and June 2016 were 582,837 and 610,108 people, respectively. The populations of the 2 communities stratified by age and sex are described in Table 1. A map of the affected community (i.e., Ansan Danwon) and the control community (i.e., Cheonan city) is shown in Fig. 1. All data from the HIRA were anonymized and did not contain any personal identification information. The study protocol was approved by the institutional review board of Kyung Hee University Hospital and conformed to the tenets of the Declaration of Helsinki.

2.2. Statistical analysis

Our analysis tested the following null hypothesis: average changes in the monthly prescription rates of antidepressant, anxiolytics, and/or sedatives/hypnotics after the Sewol Ferry disaster (April 2014) did not differ between Ansan Danwon city and Cheonan city. A difference-in-differences (DID) regression was used for the analysis. The DID method is a statistical technique that calculates the effect of a treatment (i.e., independent variable) on time-series outcomes by measuring differences in average changes in a dependent variable over time between a treatment group and control group. This method has been used by numerous studies in the field of public health to investigate the effect of intervention or treatment on time-series patterns of prescription rate