Trends in injury morbidity in China, 1993–2013: A longitudinal analysis of population-based survey data

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ARTICLE INFO

ABSTRACT

Understanding long-term trends in injury morbidity is critical to prevention and intervention planning. The aim of this study was to assess long-term trends in injury morbidity rates in China from 1993 to 2013. Using data from the National Health Service Survey (NHSS), which is conducted every five years, crude and age-standardized prevalence during the previous two weeks and hospitalization rates in the last 12 months with 95% confidence intervals (CI) were calculated. The Rao-Scott Chi-square test examined injury morbidity differences across the five survey years by location (urban/rural), sex, age group, and household income. Percent changes in morbidity rate were approximated using logistic regressions. Sampling weights were applied to all analyses. In 2013, crude two-week injury prevalence in China was 0.46% (95% CI: 0.40%, 0.52%) and 12-month crude hospitalization rate was 0.70% (95% CI: 0.63%, 0.77%). Age-standardized injury prevalence increased 31.4% (95% CI: 7.6%, 60.6%) between 1993 and 2013 (29.4%, 95% CI: 6.7%, 56.9% from 1993–2003; 1.6%, 95% CI: -14.8%, 21.0% from 2003–2013), and age-standardized hospitalization rates rose 107.2% (95% CI: 75.1%, 145.2%) from 1993 to 2013 (-9.5%, 95% CI: -24.6%, 8.6% from 1993–2003 and 129.0%, 95% CI: 93.9%, 170.4% from 2003–2013). Subgroup analyses showed similar trends over time. The leading cause of injury was dislocation, sprain or strain for prevalence, and fractures for hospitalization. In conclusion, injury morbidity increased substantially from 1993 to 2013 in China. Inconsistent changes in two-week prevalence and 12-month hospitalization rate merit attention from researchers and policy-makers.

1. Introduction

According to Global Burden of Disease (GBD) estimates, injury-induced deaths caused approximately 4.7 million deaths and 255.4 million life years lost worldwide in 2016 (Institute for Health Metrics and Evaluation, 2017). Injuries present a major public health challenge in China as well, with 773,268 injury deaths occurring in 2016.

Reliable morbidity and mortality data are essential for calculating the burden and examining trends of diseases and injuries, shaping health priorities, as well as developing and evaluating the effectiveness of global and national policies. In China, the Disease Surveillance Points

(DSPs) data provide an overview of injury mortality (National Center for Chronic and Non-Communicable Disease Control and Prevention, 2013; National Health and Family Planning Commission of People's Republic of China, 2014; Yang et al., 2005). However, as in most low- and middle-income countries, routine injury morbidity data are scarce in China, leading to the situation that the current and potential burden of nonfatal injury is poorly understood (Warner and Chen, 2012). In fact, the only available national estimates for injury morbidity in China are those from the GBD 2016 update. Those estimates are primarily based on the National Injury Surveillance System (Duan et al., 2015; GBD 2016 Disease and Injury Incidence and Prevalence Collaborators,

2017), which has provided data since 2006. To estimate injury morbidity rates prior to 2006, GBD 2016 depended on advanced mathematical models that used fragmented epidemiological publications as input to the model (GBD 2016 Disease and Injury Incidence and Prevalence Collaborators, 2017). Beyond GBD 2016 estimates, several cross-sectional studies have surveyed injury morbidity rates using self-report or face-to-face interview methods for specific local sub-populations in China (e.g., in PuCheng by Li et al., 2013, and in Zunyi by Shi et al., 2014).

The National Health Service Survey (NHSS) is a population-based, nationally representative survey that collects information on health service demand and utilization, plus expenditure for health services every five years in China (Center for Health Statistics and Information of the National Health and Family Planning Commission of the People's Republic of China, 2016). Five rounds of the NHSS have been completed in China, in 1993, 1998, 2003, 2008, and 2013. The NHSS dataset offers a unique and previously-unexplored national dataset to examine trends and rates of injury morbidity in China. The primary goal of this present study was to examine China's injury morbidity burden over the last two decades, based on the five rounds of NHSS data.

2. Methods

2.1. Study design

The present study comprised a longitudinal analysis of injury morbidity rates in China. This study is organized in compliance with the REporting of studies Conducted using Observational Routinely-collected Data (RECORD) Statement (Benchimol et al., 2015).

2.2. Data source

All five rounds (1993, 1998, 2003, 2008, and 2013) of the NHSS were completed using a multi-stage sampling and face-to-face interviewing method (Center for Health Statistics Ministry of Health and Information, 2004; Hu et al., 2010b; Qian et al., 2010; Zhou et al., 2013). The structured interview questionnaires remained essentially unchanged over the five rounds of the NHSS, except a few items were updated due to the changes in relevant health policies. For example, response options for a question on the type of social medical insurance were expanded as the result of the introduction of new types of insurance schemes.

NHSS questionnaires investigate individual and family characteristics, self-reported health status (including prevalence and hospitalization of diseases and injury), protective and risk factors of health, and health service utilization. In line with the International Classification of Diseases (ICD), NHSS divides all diseases, injuries, and health conditions into 133 kinds of diseases, signs, symptoms, and abnormalities. Residents aged 15 years and older were interviewed directly, and information about children under age 15 was provided by adults (Center for Health Statistics and Information, 2004).

According to relevant health data management regulations, NHSS data can be accessed through the Center for Statistics and Information, National Health and Family Planning Commission of the People's Republic of China (Tel: 86-010-68792483).

2.3. Outcome measures

Two injury morbidity indicators were calculated, injury prevalence during the previous two weeks and injury hospitalization rate in the last 12 months.

An injury event was defined as the occurrence of any of the following during the previous two weeks: (i) receiving medical treatment at a hospital/clinic (including any medical facility with physicians or other health care professionals present) following an injury; (ii)

receiving medical treatment outside a hospital/clinic following an injury (e.g. treatment by self or others at home, such as taking medications or receiving massage, or hot compress); and/or (iii) being off work or school, or in bed more than one day following an injury (Wu et al., 2017).

A hospitalization event was identified if the respondent answered affirmatively as having received a hospitalization treatment following an injury in the last 12 months and provided relevant medical records.

The NHSS classified the nature of injuries into seven categories: (i) fracture, (ii) dislocation, sprain, or strain, (iii) internal organ injury, (iv) open wound or blood vessel injury, (v) burn, (vi) poisoning or toxic effects, and (vii) all others (Center for Health Statistics and Information of the National Health and Family Planning Commission of the People's Republic of China, 2016).

2.4. Socio-demographic factors

Based on data availability and previous publications (Hu et al., 2010b; Wu et al., 2017), this study included location (urban/rural), sex, age group, and household income as factors relevant to injury risk. Household income was divided into four levels (lowest, low, high, and highest) based on the quartiles of monthly household income per capita in each NHSS.

3. Statistical analysis

The survey sample from 2013 that was similar to total population of China in that year (Center for Health Statistics and Information of the National Health and Family Planning Commission of the People's Republic of China, 2016), was used as the reference population to calculated age-standardized two-week injury prevalence and injury hospitalization rate in the last 12 months and their 95% confidence intervals (CIs).

As performed previously (Meng et al., 2012), the Rao-Scott Chi-square test was used to examine overall and sub-group morbidity rate differences across the five survey years. Area graphs plotted changes in cause spectrum for morbidity based on the nature of injuries using Microsoft Office Excel 2007. Percent changes in rates from 1993 to 2003, 2003 to 2013, and 1993 to 2013 were calculated to measure morbidity changes in three time periods, each computed as "$\frac{\text{rate in the later year} - \text{rate in the earlier year}}{\text{rate in the earlier year}} \times 100\%$". When rates are extremely low (less than 10%), odds ratio (OR) is an appropriate metric to approximate relative risk (RR) (Zhang and Yu, 1998); since all two-week injury prevalence and 12-month hospitalization rates in this study were less than 2%, OR was used to approximate RR. Thus, percent changes in morbidity were approximated as "$(OR-1) \times 100\%$". Univariate logistic regressions were run to obtain OR estimates. Sample weights were considered in all statistical analyses. Statistical analyses were performed using SAS 9.2 and STATA 12.1. Statistical significance was based on 2-sided tests at the level of 0.05.

3.1. Ethical issues

The research protocol was approved by the ethics committee of Xiangya School of Public Health, Central South University (No. XYGW-2016-22). Data analysis was de-identified and informed consent was not required.

4. Results

4.1. Sample characteristics

A total of 1,074,236 individuals from 319,070 households in 532 counties/districts of China were interviewed across the five NHSS rounds (Table 1). A Rao-Scott Chi-square test showed that demographic