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Epidemiology of bus fires in mainland China from 2006 to 2015

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ARTICLE INFO

Article history:

Accepted 28 May 2017

Available online xxx

Keywords:

Burns

Bus fire

Epidemiology

Casualties

Arson

ABSTRACT

Objective: This study analyses the epidemiological characteristics of bus fires in mainland China over the past 10 years to develop prevention strategies and emergency procedures for such incidence and the resulting casualties.

Methods: We collected reports on bus fires from the media and news websites and looked up on Medline, PubMed, and Chinese National Knowledge Infrastructure databases for relevant publications in English or Chinese from January 1, 2006 to December 31, 2015.

Results: In the past 10 years, there were 382 bus fires in mainland China. The frequency of fires was markedly higher in 2013 and 2014. The vast majority (89.1%) of the fires were caused by spontaneous combustion, followed by arson (5.0%). There were reports of casualties in 41 (10.7%) of the bus fires, including 144 deaths and 567 injuries. The fires leading to casualties resulted from spontaneous combustion in 22 (53.7%) incidents, arson in 12 (29.3%) incidents, and traffic accidents in 7 (17.1%) incidents. Arson caused the most casualties, including 91 deaths and 323 injuries.

Conclusions: This epidemiological study presents characteristic findings related to bus fires in China mainland. The general trend of bus fires showed a gradual increase but with a fluctuation in several years. The regional distribution of bus fires revealed some specific characteristics, and most of bus fires happened in those regions locating in the eastern area of China mainland. The largest number of bus fires were caused by spontaneous combustion. Bus fires caused by arson accounting for only 5% of the total bus fires resulted in the most severe casualties. Most of bus arson occurred in the morning and evening rush hours.

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1. Introduction

As a result of the growing urban population, public transportation by motor vehicles has been emerging as the main means

of transport in China, accounting for 59.4% of all public motor traffic according to the 2014 Ministry of Transport Statistical Bulletin (Fig. 1). However, there are ongoing problems with the safety of public transport in China. Bus fires resulted from

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<http://dx.doi.org/10.1016/j.burns.2017.05.024>

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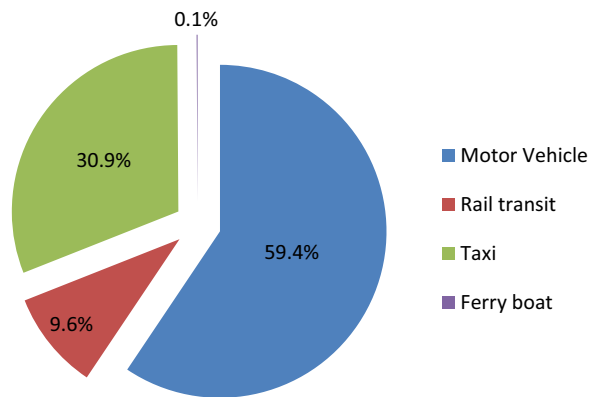


Fig. 1 – Public motor traffic composition in 2014.

mechanical faults, arson and human factors, occurred frequently in the mainland China in recent years. Some vicious bus fire events causing severe casualties draw public attention on the safety of bus traffic. For example, on June 5th 2009, the country was shocked when an arsonist started a fire in one bus in Chengdu, which left 27 dead and 74 injured [1]. On July 5th 2010, one bus with a large number of passengers caught fire, and resulted in 19 injuries and 24 deaths. On July 5th 2014, arson on a bus in Hangzhou West Lake resulted in 33 persons with varying degrees of burns [2,3]. Bus fires can be a potential and serious threat to public safety and social stability in China. Herein we investigated bus fire events that occurred in mainland China from January 2006 through December 2015, with the purposes to garner public awareness to this kind of problem, and provide some suggestions for preventing or reducing casualties.

2. Methods

Using the Baidu search engine and the keywords “bus”; “city traffic”; “burning”; and “fire”; we consolidated reports from the local media from January 2006 through December 2015. Meanwhile; the PubMed database and Chinese National Knowledge Infrastructure (CNKI) database were also utilized to collect the events of bus fire happening in the mainland China. Three investigators were respectively assigned to conduct the searching work; and the results were checked up carefully according to the time and places the bus fire events happened; and the bus information; cause of bus fires; and with or without casualties. Based on these results mentioned above; the epidemiological characteristics of bus fires in the mainland China were further analysed.

Herein the “bus” can include the large and medium-sized vehicles, such as urban public buses, tram units, and BRT vehicles.

3. Results

3.1. Annual distribution of bus fires

This epidemiological study included 382 bus fires that occurred throughout mainland China. The frequency data

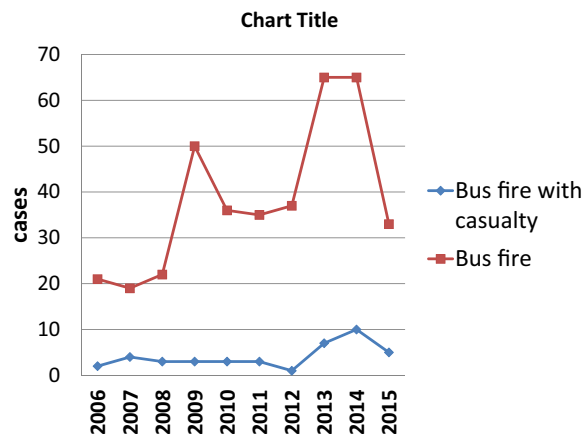


Fig. 2 – Annual distribution of bus fire incidents and casualties.

reflect a general upward trend from January 2006 to December 2015. From 2006 to 2008, approximately 20 bus fires occurred each year. There were 50 in 2009, and there were 65 in both 2013 and 2014. Additionally, there were many more bus fire fatalities in 2013 and 2014, with 7 and 10, respectively; these accounted for 41.5% of the 41 bus fires resulting in casualties in the past 10 years (Fig. 2).

3.2. Regional distribution

The regional distribution of bus fires, as well as the regional population situations, was listed in Table 1. As known, there are seven regions in the mainland of China. The largest number of the bus fires occurred in the eastern region (108 fires, 28.1%), followed by the north-eastern region (73 fires, 19.0%), the southern region (55 fires, 14.3%), the northern region (45 fires, 11.7%), the central region (44 fires, 11.5%), the south-western region (37 fires, 9.6%) and the north-western region (22 fires, 5.7%) of China. the number of bus fires per (million) capita in different regions were also calculated, and the results indicated that the top 3 regions were Northeast (0.67/million), East (0.28/million) and North (0.27/million).

3.3. Causes of bus fires

The most common cause of bus fires was spontaneous combustion, accounting for 89.1% of the fires; followed by arson (5.0%), traffic accidents (3.1%), and unknown causes (2.8%) (Fig. 3).

3.4. Distribution of casualties of bus fires

In the past 10 years, of 382 bus fires, 41 bus fires resulted in casualties, totalling 144 deaths and 576 injuries. The causes of the fires with casualties were spontaneous combustion (22 cases, 53.7%), arson (12 cases, 29.3%), and traffic accidents (7 cases, 17.1%) (Fig. 4). In terms of the severity of the casualties, arson resulted in 91 deaths (63.2%) and 323 injured individuals (57.0%), followed by spontaneous combustion (42 dead, 196 injured), and traffic accidents (11 dead, 48 injured) (Fig. 5). There were 19 cases of arson, and these occurred at two peak

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