



Health professionals' perceptions of hemorrhagic fever with renal syndrome and climate change in China



Michael Xiaoliang Tong^a, Alana Hansen^a, Scott Hanson-Easey^a, Scott Cameron^a, Jianjun Xiang^a, Qiyong Liu^b, Xiaobo Liu^b, Yehuan Sun^c, Philip Weinstein^d, Gil-Soo Han^e, Craig Williams^f, Peng Bi^{a,*}

^a School of Public Health, The University of Adelaide, Adelaide, South Australia 5005, Australia

^b State Key Laboratory of Infectious Disease Prevention and Control, Collaborative Innovation Center for Diagnosis and Treatment of Infectious Diseases, National Institute for Communicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing 102206, China

^c Department of Epidemiology, Anhui Medical University, Hefei, Anhui 230032, China

^d School of Biological Sciences, The University of Adelaide, Adelaide, South Australia 5005, Australia

^e Communications & Media Studies, School of Media, Film and Journalism, Monash University, Clayton, Victoria 3800, Australia

^f School of Pharmacy & Medical Sciences, University of South Australia, Adelaide, South Australia 5001, Australia

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ABSTRACT

Background: Hemorrhagic fever with renal syndrome (HFRS) is a serious public health problem in China. Although the incidence of HFRS sharply reduced towards the end of the twentieth century, there has been a re-emergence of the disease after 2008 in some parts of China. The aim of this study was to gauge the perceptions of health professionals in China concerning HFRS control and climate change.

Methods: A cross-sectional survey about HFRS and climate change was conducted among staff in the Centers for Disease Control and Prevention (CDC) in Liaoning and Anhui Provinces, where HFRS is still a public health concern. Descriptive analyses were performed to assess survey results.

Results: In total, 412 questionnaires were distributed, and 381 participants completed the survey. >80% of participants thought climate change would have an influence on population health and infectious diseases. However, fewer participants (<60%) indicated that climate change would affect rodent-borne diseases, such as hantavirus infections. More than 40% of participants in Liaoning Province thought rodent populations had increased over the last ten years while 25.5% held this opinion in Anhui Province. Sixty-seven percent of participants in Liaoning indicated that HFRS had re-emerged, whereas <40% of participants in Anhui endorsed the statement. The majority of participants (70.9%) indicated there were rodent control programs in their area. However, less than half of participants thought these were effective in reducing HFRS incidence. Participants viewed the main risk factors for HFRS in China as being increased rodent density and infected rodents, contact with rodents, and lack of health awareness among the population.

Conclusions: Although most participants thought that climate change would have negative impacts on population health and infectious diseases, fewer participants believed it would contribute to the transmission of rodent-borne diseases, such as hantavirus infections. More participants in Liaoning indicated that HFRS had re-emerged, and current prevention programs, especially rodent control programs, need to be improved. Furthermore, more climate change-related research, health promotion programs, extended vaccination coverage, and better environmental management will likely be vital in addressing the threat of HFRS in the face of climate change. The results will be useful to inform HFRS control and prevention strategies.

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* Corresponding author at: School of Public Health, Faculty of Health Sciences, The University of Adelaide, Adelaide, SA 5005, Level 8, Hughes Building, North Terrace Campus, Australia.

E-mail addresses: michael.tong@adelaide.edu.au (M.X. Tong), alana.hansen@adelaide.edu.au (A. Hansen), scott.hanson-easey@adelaide.edu.au (S. Hanson-Easey), scott.cameron@adelaide.edu.au (S. Cameron), jianjun.xiang@adelaide.edu.au (J. Xiang), liuqiyong@icdc.cn (Q. Liu), liuxiaobo@icdc.cn (X. Liu), sun611007@163.com (Y. Sun), philip.weinstein@adelaide.edu.au (P. Weinstein), gil-soo.han@monash.edu (G.-S. Han), craig.williams@unisa.edu.au (C. Williams), peng.bi@adelaide.edu.au (P. Bi).

1. Introduction

Hemorrhagic fever with renal syndrome (HFRS) is a dangerous zoonotic disease caused by hantaviruses and is a serious public health problem in China in past decades (Zhang et al., 2010b; Liu et al., 2012). The disease is transmitted to humans via rodents and symptoms include fever, hemorrhage, hypotension and renal dysfunction (Xiao et al., 2014b; Zhang et al., 2011). About 90% of the world's cases are reported in China (Xiao et al., 2014b). Two species of hantavirus – Hantaan virus (HTNV) and Seoul virus (SEOV) are predominant in China (Zhang et al.,

2011). The hosts for these viruses are *Apodemus agrarius* and *Rattus norvegicus* respectively. Humans can be infected by inhaling aerosols that are contaminated with the virus shed in excreta, saliva and urine of infected animals or by contact with contaminated food, water, and infected rodent hosts (Bi et al., 2002; Hansen et al., 2015). *Apodemus agrarius* is prevalent in agricultural regions of China while *Rattus norvegicus* is prevalent in urban areas (Xiao et al., 2013a).

There were >1 million HFRS cases reported between 1931 and 1995 in China (Bi et al., 2002). Male farmers aged 30–50 years were the most vulnerable population (Liu et al., 2012). The incidence of HFRS peaked in 1986 (115,807 cases) and then declined in the late 1990s (about 20,000–50,000 cases annually) (Zhang et al., 2014a, 2014b). This reduction could be due to numerous control measures such as deratization strategies, an introduced vaccination program, better health care access and health education. However, the incidence once again rebounded after 2008 (Zhang et al., 2014b). The majority of these cases in China are concentrated in north-eastern, central and eastern China, in the provinces of Liaoning, Heilongjiang, Shanxi, and Anhui (Zhang et al., 2014b; Bi et al., 2005; Liu et al., 2011). During 2004 and 2005, Liaoning had the highest incidence of HFRS in China, and is still one of the high-risk areas (Liu et al., 2011). Before that period, the incidence rate of HFRS was very high in Anhui - > 10 per 100,000 population during the 1980s and 1990s, and nowadays there are still a number of cases reported annually (Zou et al., 2016). Fig. 1 shows the annual incidence of HFRS from 2002 to 2013 in Liaoning and Anhui (National Health and Family Planning Commission of the PRC, 2016). In both provinces, the incidence of HFRS reduced gradually after 2004. However, there has been an increasing trend of HFRS cases in those regions since 2008. In Liaoning, for example, the incidence increased from 1.71/100,000 in 2008 to 2.96/100,000 in 2013. In Anhui the incidence of HFRS rose from 0.17/100,000 in 2008 to 0.32/100,000 in 2013. Although continuous control and prevention measures have been implemented in these provinces, there are still about 30,000 to 60,000 HFRS cases reported annually in China (Hansen et al., 2015; Xiao et al., 2013a).

There are a number of studies indicating the increasing number of HFRS cases is associated with climatic variables and possibly climate change, such as increasing temperature, precipitation and relative humidity (Hansen et al., 2015; Liu et al., 2011; Li et al., 2013; Zhang et al., 2010a; Guan et al., 2009; Bi et al., 2005). According to the most recent Intergovernmental Panel on Climate Change report (IPCC Fifth Assessment Report) in 2014, the average global land and ocean surface temperature is predicted to increase 1.1–6.4 °C from 1990 to 2100 (Intergovernmental Panel on Climate Change, 2013). This may have an influence on the ecology of the rodents, and increase the

reproduction rate, and thus contribute to rodent-borne disease transmission (Xiao et al., 2014b; Hansen et al., 2015; Li et al., 2013; Liu et al., 2013).

In China, the Centers for Disease Control and Prevention (CDC) work to protect and improve population health and safety, and to control and prevent potential infectious disease threats (Chinese Center for Disease Control and Prevention, 2015). Although CDC health professionals are likely to be knowledgeable about HFRS and possible associations with climate change, to our knowledge there are no studies investigating health professionals' perceptions of this disease under the climate change scenario, which would contribute to our understanding of the relationship between climate change and HFRS.

The aim of this study was to gauge the perceptions of CDC health professionals in China concerning HFRS control and climate change. An examination of CDC professionals' understanding of the association between HFRS and climate change, and the main reasons responsible for HFRS emergence and re-emergence, will enhance understanding of this phenomenon, while providing policy makers and stakeholders with an evidence-base on which to formulate effective and feasible adaptation strategies for the control and prevention of HFRS in the future.

2. Methods

2.1. Study areas

A CDC-based cross-sectional survey was conducted in Liaoning and Anhui Provinces. These provinces were chosen as they historically have been high-risk areas for HFRS. They are also located in two different geographical areas of China and are in different climate zones.

Liaoning Province, located in Northeast China (Fig. 2), has a total area of 145,800 km², a population of 42.7 million (The People's Government of Liaoning Province, 2016b). There are 4.09 million hectares of agricultural areas and 5.69 million hectares of forestland areas, accounting for 27.6% and 38.5% of land size respectively in this province (The People's Government of Liaoning Province, 2016d). Liaoning has a temperate continental monsoon climate with four distinctive seasons (The People's Government of Liaoning Province, 2016c). The precipitation averages roughly 400 to 970 mm annually, and the average annual temperature is between 5.2 and 11.7 °C (The People's Government of Liaoning Province, 2016c). Liaoning can be divided into three areas according to the terrain: the east and west mountains, the central plain and the south coastal plain. The Liao River and about 300 small tributaries run through the province. There are 14 prefecture-level divisions, 17 county-level cities, 27 counties and 56 districts in Liaoning Province (The People's Government of Liaoning Province, 2016a).

Anhui Province, located in East China (Fig. 2), has a total area of 139,600 km² and a population of 60.8 million (The People's Government of Anhui Province, 2015b; The People's Government of Anhui Province, 2015c). There are 5.71 million hectares of agricultural land and 4.18 million hectares of forestland areas, accounting for 40.9% and 29.9% of land size respectively in this province (The People's Government of Anhui Province, 2016). Anhui has a warm-temperate, semi-humid monsoonal climate with an average annual temperature between 14 and 17 °C, and average annual rainfall between 800 and 1800 mm (The People's Government of Anhui Province, 2015b). Anhui can be divided into three areas according to the terrain: the north plain, the north-central Huai plain, and the west and south mountains. China's largest river the Yangtze, and the third-largest the Huai River run through the Province (The People's Government of Anhui Province, 2015b). There are 16 prefecture-level divisions, comprising 62 counties and 43 districts in Anhui Province (The People's Government of Anhui Province, 2015a). There is a CDC in each county/district, prefecture, and province nationwide.

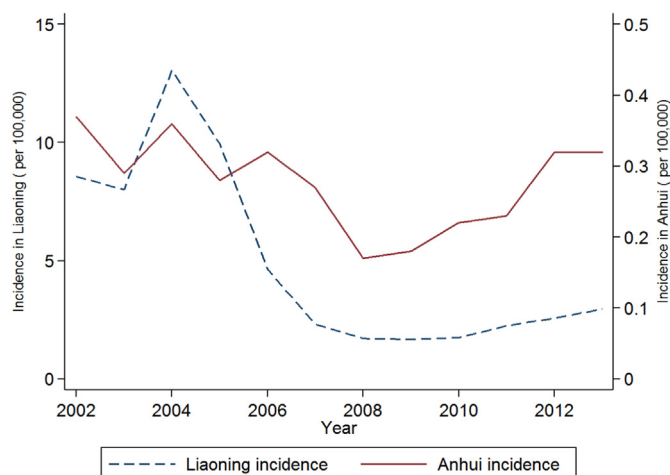


Fig. 1. Annual incidence of HFRS from 2002 to 2013 in Liaoning and Anhui Provinces. Data sourced from National Health and Family Planning Commission of the People's Republic of China. <http://www.nhfp.gov.cn/>

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