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ORIGINAL ARTICLE

Control of an H1N1 outbreak in a correctional facility in central Taiwan

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Abstract *Background:* Controlling the outbreak of H1N1 in correctional facilities is difficult due to the inevitable close and prolonged contact between inmates. The current study reports an H1N1 outbreak in a correction facility and investigates the effectiveness of oseltamivir to control the spread of H1N1.
Methods: All 2690 inmates at the prison received medical service from a single hospital. A list of patients with a diagnosis of influenza was compiled based on medical diagnoses with respiratory symptoms during the outbreak period. The outbreak was then investigated using both chart review and questionnaires.
Results: In the 4-week outbreak period, 24.6% (663/2690) of inmates experienced influenza-associated symptoms, 50.5% (335/663) fulfilled the criteria for influenza-like illness (ILI) with fever, and the overall attack rate of ILI was 12.8%. Twelve inmates were admitted for complicated influenza, and three of them experienced respiratory failure. Oseltamivir was provided at the end of the 2nd week, and the effectiveness of oseltamivir in the 1004 inmates from seven major sections in the prison was analyzed. The ILI incidence rate reduced from 12.6 $\pm$ 4.1% between the 1st and 2nd weeks to 4.8 $\pm$ 2.4% between the 3rd and 4th weeks ($p = 0.018$) after the oseltamivir intervention. In the 878 uninfected inmates 47.0% (413/878) of inmates received prophylactic oseltamivir at the end of the 2nd week, the incidence of ILI was lower than those without prophylaxis (6.2% versus 2.4%; $p = 0.013$).

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Conclusion: H1N1 influenza spread rapidly in the correctional facility. The use of oseltamivir may be a practical intervention to control an H1N1 outbreak an enclosed environment such as this.

Introduction

Influenza A (H1N1) pdm09 virus, a novel swine-origin virus, caused pandemic influenza in 2009 and is still a major threat in close-contact settings.[1] Epidemiological studies of laboratory-confirmed cases of the 2009 pandemic influenza show that the clinical attack rate ranged from 5.4% to 20.6% for community outbreaks, a higher attack rate was found in close-contact settings, including military units, schools, nursing homes, and correctional facilities.[2–5] In the school setting the reported attack rate for H1N1 influenza outbreaks ranged from 35% to 60%; and close-contact and prolonged contact were undoubtedly the major risk factors.[6,7] Correctional facilities, which are characterized by inevitable close and prolonged contact between inmates, are extremely vulnerable to H1N1 influenza outbreaks. However, little is known about what practical measures can be applied to facilitate early control of an outbreak in a correctional facility.[8]

In Taiwan, 66,106 inmates were under correctional supervision in prisons, detention centers, and juvenile detention houses at the end of 2012, and up to 53.4% (35,329/66,106) of these inmates had begun their period of incarceration in 2012. However, the capacity of all correctional facilities in Taiwan was only 54,593, so the over-capacity rate reached 21.1% in 2012.[9] Therefore, these inmates were extremely vulnerable to an outbreak of communicable diseases because of the over-crowded living conditions and the limited health resources.

Early use of oseltamivir in H1N1-infected patients has been shown to reduce the viral load with earlier resolution of symptoms; postexposure prophylactic use of oseltamivir was also proved to decrease the household secondary attack rate from 26.1% to 0.6%.[10,11] However, the use of oseltamivir in controlling an outbreak in a close-contact setting, in particular, the coverage necessary to establish adequate herd immunity in an H1N1 outbreak remains unclear.[12,13] In the current study, the prolonged control of an H1N1 outbreak in a correctional facility is reported and an analysis of the efficacy of oseltamivir is presented.

Materials and methods

Setting

The correctional facility investigated in the present study is located in central Taiwan and is one of the major prisons in Taiwan with 2614 ± 130 per day (mean ± SD) male inmates in the past 5 years. There are 14 large sections with 150–160 inmates in each section. In Taiwan, all inmates have been enrolled in the National Health Insurance (NHI) program since January 01, 2013, and both inpatient and outpatient healthcare services in the prison are provided by a single hospital, Taichung Veterans General Hospital, Chia-Yi branch, a 600-bed teaching hospital. In detail, the study hospital provides daily medical outpatient services within the prison from Monday to Friday, and inmates with flu-like symptoms were assessed by doctors including two chest physicians and one infection specialist. Those who were admitted for complicated influenza were cared for by the same medical team. Thus, it was possible to enroll all cases involved in the H1N1 outbreak at the prison.

Case enrollment and definitions

This study was approved by the Institutional Review Board of Taichung Veterans General Hospital (SF13215). Outpatient visit diagnoses from February 25 to March 26, 2013 were reviewed and a list of patients with respiratory illness, defined using the International Classification of Diseases, 9th Revision, for upper and/or lower respiratory infection, influenza, fever, pneumonia, sore throat, pharyngitis, rhinorrhea, and cough, was compiled. Influenza-like illness (ILI) was defined as a fever (temperature of 100°F [37.8°C] or greater) as well as a cough and/or a sore throat in the absence of a known cause other than influenza, based on the definition described by Taiwan's Center for Disease Control (CDC). During the outbreak period, body temperature was routinely checked every day for all inmates, and all febrile cases were sent to the outpatient clinic for further evaluation. Therefore, all ILI cases during the outbreak were detected.

Complicated or severe influenza cases were also recorded during the outbreak period. Inmates with respiratory distress were transferred to the hospital by a prisoner escort officer, and were admitted if lung infiltration was found on the chest X-ray. All admitted inmates received standard medical care from a chest physician or an infectious disease specialist, and were all reported to the Taiwan CDC as complicated influenza. A nasopharyngeal swab was then collected and sent to the central laboratory of the Taiwan CDC for analysis by real-time reverse transcriptase-polymerase chain reaction (RT-PCR) to detect the swine-origin influenza A (H1N1) virus (A/swH1). Briefly, the WHO-recommended method included a panel of oligonucleotide primers and dual-labeled hydrolysis (Taqman) probes to be used in RT-PCR assays for the *in vitro* detection and characterization of the novel H1N1/2009 strain in respiratory specimens.[14]