

Institutional risk factors for outbreaks of acute gastroenteritis in homes for the elderly: a retrospective cohort analysis

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KEY MESSAGES

1. Norovirus is the major cause of acute gastroenteritis outbreaks in homes for the elderly in Hong Kong.
2. A larger home capacity and higher nursing staff-to-resident ratio were associated with increased outbreaks of acute gastroenteritis.
3. Installation of partitions between beds decreased the outbreaks of acute gastroenteritis.

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Introduction

In 2006, 12.4% of the Hong Kong population were aged over 65 years. In 2005, about 60 000 elderly people were residents in homes for the elderly, accounting for 7% of this population. Infection is an important cause of mortality and morbidity in the institutionalised elderly.¹ Vulnerability of the elderly to infection and the living environment of homes for the elderly predispose to infection outbreaks.

Infection control programmes in health care facilities and their relation to infections have been reported.² This study aimed to investigate the association between institutional risk factors and outbreaks of acute gastroenteritis in homes for the elderly in Hong Kong.

Methods

This retrospective cohort study was conducted from August 2008 to February 2010. The cohort comprised 759 homes for the elderly; the outcome variable was the outbreak status of the homes; the homes that had multiple outbreaks of acute gastroenteritis within 2 months were considered once. The follow-up time was from 1 January 2005 to 31 December 2007. Information about the potential predictor variables, such as resident characteristics, staffing support and environment and facility conditions, was already available from the Territory-wide Infection Control Checklist Survey conducted by the Elderly Health Service of the Department of Health in the autumn of 2004. Outbreak data were extracted from the Public Health Information System.

Survival analysis for the homes for the elderly was performed; the endpoint was an outbreak. Cox

proportional hazard models were used to estimate the relative risk (RR) and 95% confidence interval (CI) for various variables. The method by Wei³ was used. Univariate analysis was performed for each potential variable. Variables with a P value of <0.1 were included in the multivariate Cox regression model.

Results

A total of 759 homes for the elderly and 57 522 elderly residents were included. There were 273 lab-confirmed outbreaks of acute gastroenteritis; the overall incidence was 12 outbreaks per 100 home-years. There were 3459 infected residents; the overall incidence was 2% per person-year. Of the 273 outbreaks, 262 (96%) were caused by noroviruses; thus analysis focused on norovirus outbreaks.

In univariate analysis, increased acute gastroenteritis outbreak rate was associated with larger home capacity, higher nurse-to-resident ratio, higher percentage of residents aged >75 years, less partition between beds, and better wheelchair accessibility. The RR for 30-resident per home increment, and 1/30 increment in nurse staff-to-resident ratio was 1.44 (95% CI, 1.36-1.53) and 1.2 (95% CI, 1.1-1.3), respectively.

In the multivariate Cox regression model, after adjusting for potential confounders, increased acute gastroenteritis outbreak rates were associated with better wheelchair accessibility (RR=1.7; 95% CI, 1.1-2.7), larger home capacity (RR=1.4; 95% CI, 1.3-1.5 for per 30 additional resident increment in one elderly home), higher nurse-to-resident ratio (RR=1.2; 95% CI, 1.1-1.3 for per 1/30 of ratio increment), and less partitions between beds (RR=0.6; 95% CI, 0.4-0.8).

Discussion

Our study found that the incidence of norovirus in residents of Hong Kong homes for the elderly was 2% per person-year, twice that of the general population.⁴ Noroviruses are a growing threat in the community and health care facilities,⁵ and can persist in the environment for a long time.

Homes with more residents had a higher probability of introducing pathogens from the community as well as transmitting them within the home. The relative difficulty of serving more residents within one home, as well as the increased person-to-person contact among residents, their relatives, visitors and staff with different characteristics, might create a higher chance of introduction and transmission of acute gastroenteritis outbreaks in larger homes compared with smaller ones.

Homes with more nurses had higher probability of bringing pathogens from the community. Another explanation may be attendant-borne transmission,⁶ in which attendants' hands serve as the vehicle to transmit institutional-acquired infections. Hand washing compliance in Hong Kong health care workers was low. Pathogens can be transmitted from immobile persons to nurses and health care workers and to other residents by direct contact or indirectly through their use of health care facilities. Pathogens can also be transmitted to the vulnerable elderly by attendants who were infected but remained asymptomatic.

Homes for the elderly with better wheelchair accessibility had an elevated risk of norovirus outbreaks. Wheelchairs may shorten the distance between ill residents and susceptible ones, and may encourage mixing of residents and physical contact among the elderly and between residents, health care workers and visitors.

Partition between beds was protective against outbreaks of norovirus. The partition could serve as a barrier to roommate transmission, decrease physical contact among the elderly, and thus diminish the possibility of transmission within a small room.

One limitation of the study was under-reporting. Generally, homes for the elderly report only serious infections; mild, self-limiting episodes of infection may not be reported. Nonetheless, laboratory confirmed outbreaks were used. Collection of information about exposure was

relatively objective and free from recall bias, and all homes for the elderly were included and thus free from selection bias.

Conclusions

Proper infection control measures are recommended, especially in homes for the elderly with larger capacity and more nurses, easy wheelchair access, and a high proportion of residents aged >75 years. Partitions should be installed between beds. Stricter health care procedures should be implemented.

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References

1. Jiang X, Turf E, Hu J, et al. Outbreaks of gastroenteritis in elderly nursing homes and retirement facilities associated with human caliciviruses. *J Med Virol* 1996;50:335-41.
2. Lopman BA, Andrews N, Sarangi J, Vipond IB, Brown DW, Reacher MH. Institutional risk factors for outbreaks of nosocomial gastroenteritis: survival analysis of a cohort of hospital units in South-west England, 2002-2003. *J Hosp Infect* 2005;60:135-43.
3. Wei LJ, Lin DY, Wiessfeld L. Regression analysis of multivariate incomplete failure time data by modelling marginal distributions. *J Am Stat Assoc* 1989;84:1065-73.
4. Ho SC, Chau PH, Fung PK, Sham A, Nelson EA, Sung J. Acute gastroenteritis in Hong Kong: a population-based telephone survey. *Epidemiol Infect* 2010;138:982-91.
5. Tsang OT. Nosocomial norovirus infection. *Bull Hong Kong Soc Infect Dis* 2007;11:2-7.
6. Godoy P, Artigues A, Bartolome R, Dominguez A, Plasencia A. Norovirus gastroenteritis outbreak by person-to-person transmission in a nursing home [in Spanish]. *Med Clin (Barc)* 2006;127:538-41.