

Prevalence of infections in residential care homes for the elderly in Hong Kong

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Objectives To study the prevalence of commonly occurring infections among residents of residential care homes for the elderly and their associated risk factors.

Design Point prevalence survey.

Setting Residential care homes for the elderly in Hong Kong.

Participants Residential care homes for the elderly were treated as a cluster and about 30% of the residents from each home were selected by systematic sampling with bed numbers ending with the digits of 2, 5, and 8. Selected residents were invited to participate.

Results Data from 1603 residents aged 60 years or older from 43 residential care homes for the elderly were analysed. Most (85%) of the residents had underlying medical problems and 55% had more than one problem. The overall prevalence of infection among these residents was 5.7% (95% confidence interval, 4.2-7.1%). The three most common infections were: common cold or pharyngitis (1.9%; 95% confidence interval, 0.9-3.0%), skin and soft-tissue infections (1.4%; 0.5-2.4%), and symptomatic urinary tract infections (0.6%; 0.2-0.9%). Being 'bed-ridden' was a significant risk factor for skin and soft-tissue infections (odds ratio=3.1; 95% confidence interval, 1.4-6.9). Presence of a urinary catheter was a significant risk factor for symptomatic urinary tract infections (odds ratio=62.8; 95% confidence interval, 18.2-217.0). Chronic obstructive pulmonary disease was a significant risk factor for lower respiratory tract infection (odds ratio=16.5; 95% confidence interval, 3.4-81.2).

Conclusions This is the first territory-wide prevalence survey of infections among residents in residential care homes for the elderly in Hong Kong. The data retrieved enable us to target our infection control programme in residential care homes for the elderly to those with a high prevalence. So as to monitor seasonal and secular trends, targeted regular surveillance is needed for better profiling of the actual situation.

Key words

Cross infection; Homes for the aged; Institutionalization; Long-term care; Prevalence

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Introduction

Hong Kong is facing an ageing population. Residential Care Homes for the Elderly (RCHE) are a heterogeneous group of institutions that provide varying levels of care for aged people, who, for personal, social, health or other reasons, can no longer live alone or with their families.¹ As the population continues to age, each year more and more people require temporary or permanent placement in RCHE. Many of these residents are frail with different underlying medical problems, which in turn predispose them to increased risk of infections. Infections lead to increased morbidity, hospital admissions, and mortality. Prevention of infection among residents poses a great challenge to health care workers and infection control officers in RCHE.

Surveillance for infections has been clearly established to be a key to all infection control programmes. Overseas studies demonstrated a wide range of overall infections in long-term care facilities; prevalence estimates have varied from 1.6 to 32.7%.²⁻⁵ The most commonly involved sites are: urinary, respiratory, and skin.^{3,6-11} The prevalence of infection varies with the different institutional environments within which its residents live and socialise,¹² as well as their innate characteristics, such as age, underlying co-morbidities, mobility, and use of invasive devices (eg urinary catheters).⁶ Perceived prevalence also varies according to the intensity of surveillance carried out.¹²

There are no territory-wide data regarding the point prevalence of common infections among residents of RCHE in Hong Kong. Our study was designed to determine the same and to identify specific risk factors predisposing to such infections.

Hospital surveillance definitions depend heavily on laboratory data and recorded clinical observations.¹³ In RCHE, radiology and microbiology data are not readily available. In this survey, the diagnosis of infection was made following modified long-term care facilities specific surveillance criteria developed by a Canadian consensus conference.¹⁴ This definition was intended specifically for residents of elderly residential homes and was mainly based on acute symptoms.

Methods

We conducted a territory-wide point prevalence survey of common infections among residents of RCHE in Hong Kong on a single day in December 2006.

Study design

Our target population included residents in all types of RCHE throughout the territory. The updated list of all such homes was obtained from the Licensing Office of Residential Care Homes of the Social Welfare Department. Stratified cluster sampling was employed within regions (Hong Kong Island, Kowloon, and New Territories) and for types of homes (private and non-private). Selected RCHE were invited to participate and a training workshop for staff was organised.

The recruited home was treated as a cluster and about 30% of the residents from each home were selected by systematic sampling with bed numbers ending in digits of 2, 5, and 8. Selected residents were invited to participate and verbal consents were obtained. Consenting residents were interviewed on the survey day.

In November 2006, a RCHE Prevalence Study Group was formed by participants of the infection control training course in long-term care facilities. They were health care workers (mainly doctors and nurses) looking after elderly patients in public hospitals or in the community. They visited the recruited homes and interviewed consenting residents on the survey day.

A survey form (divided into two parts) was designed for data collection. The first part collected demographic data on the residents and their underlying medical conditions. The second part was a checklist of acute symptoms of common infections. The form was in Chinese and distributed to the homes before the survey. The forms were filled by

香港安老院舍的感染患病率

目的 研究安老院舍住客常見感染病的患病率，及其風險因素。

設計 時點患病率調查。

安排 香港的安老院舍。

參與者 把香港的安老院舍組成聯網，然後系統抽樣每間院舍的床位編號最後數字為2、5、及8的住客，即邀請約30%院舍住客參與本研究。

結果 共分析43間安老院舍及1603位60歲或以上的院舍住客的數據。大多數住客（85%）有潛藏的毛病，55%有多於一種的身體毛病。研究對象的總患病率為5.7%（95%置信區間：4.2-7.1%）。三種最常見的感染分別為：普通傷風或咽炎（1.9%；95%置信區間：0.9-3.0%），皮膚及軟組織感染（1.4%；0.5-2.4%），及症狀性尿道感染（0.6%；0.2-0.9%）。「臥床」是皮膚及軟組織感染的顯著風險因素（風險比值=3.1，95%置信區間：1.4-6.9）；導尿管是症狀性尿道感染的顯著風險因素（風險比值=62.8，95%置信區間：18.2-217.0）；慢性阻塞性肺部疾病則是下呼吸道感染的顯著風險因素（風險比值=16.5，95%置信區間：3.4-81.2）。

結論 作為首個對香港安老院舍的地方性感染病的患病率研究，得出的數據有助制定針對有高感染率的安老院舍的防疫措施。要監控季節性和長期感染病，及掌握到較佳的實際情況，針對性的常年監測是必要的。

members of the RCHE Prevalence Study Group, with the assistance of the RCHE staff or residents' relatives.

Acute symptoms were recorded and the diagnosis of infection was subsequently made following modified long-term care facilities specific surveillance criteria, developed by a Canadian consensus conference (Appendix).¹⁴ Symptoms were checked by interviewing the residents or their relatives with the help of RCHE staff. A brief physical examination was carried out if feasible. Medical records were reviewed after the interview. Infections were identified when symptoms or signs fulfilled the above surveillance criteria, or were diagnosed by the attending physician or nurses (as stated in the medical record), or when the resident was still on antibiotics prescribed for a specific condition. The prevalence of each infection was determined and associated risk factors were identified.

The survey was conducted in an anonymous manner; residents were identified only if follow-up action was needed. If the resident was admitted to a hospital, consulted a doctor, or had a specimen sent for culture within 24 hours following recruitment, the patient's outcome was traced by reviewing the hospital discharge summary and culture results.

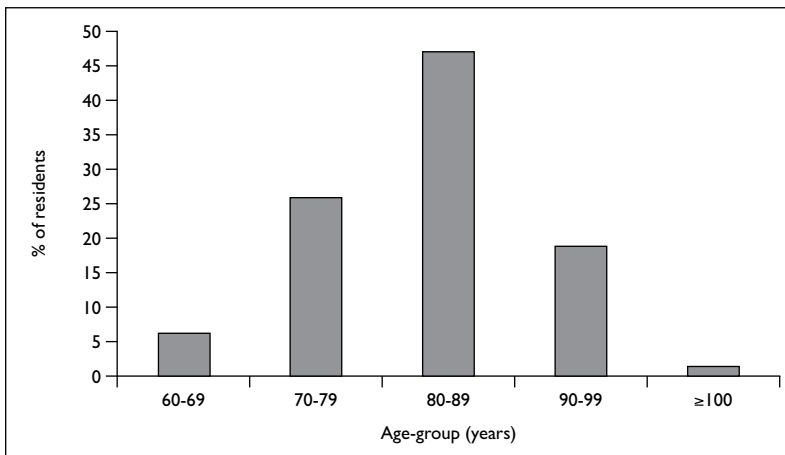


FIG 1. Age distribution of residents in residential care homes for the elderly

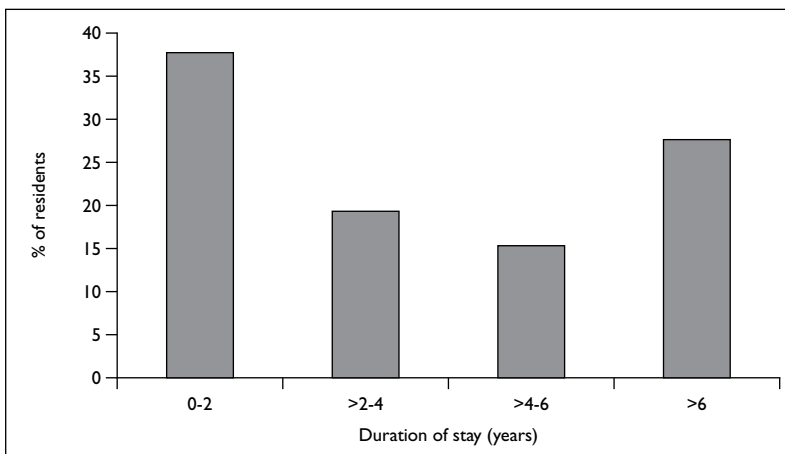


FIG 2. Duration of stay of residents in residential care homes for the elderly

Inclusion and exclusion criteria

Because the assistance of RCHE staff was necessary on the day of the survey and in order not to take up too much RCHE staff's time and disturb their daily routine, only 30% of the residents present at 9am on that day were invited to participate. Homes with a capacity of less than 50 beds were excluded, as were residents who only attended day programmes.

Sample size and power estimation

The primary objective was to assess the prevalence of commonly occurring infections among residents of RCHE. Assuming the local prevalence was around 6% and the desired width of the 95% confidence interval was 1.6%, 850 residents were needed to achieve a power of 80%. With stratified cluster sampling, the design effect was estimated to be 1.765 with an intraclass correlation coefficient of 0.025 and an

average cluster size of 31.61 (ie the average number of residents sampled per home with 30% selection). Assuming a response rate of 95%, the final sample size needed for stratified cluster sampling was estimated to be 1580.

Statistical analysis

For statistical analyses, the software programs used were: SPSS (version 12.0 for Windows), Stata (version 7.0), and Epi-Info (version 3.3.2). The point prevalence of residents with infection in RCHE was defined as the number of residents with infection/number of residents surveyed. Generalised estimating equations were used to identify possible risk factors for different types of infections. All analyses took account of the stratified cluster sampling frame. Stata's survey mean function (svymean) and Epi-Info's complex survey mean function were used to produce standard errors for the clustered data.

Results

A total of 43 RCHE were visited. There were 4645 residents and 289 staff in these facilities, with a staff-to-resident ratio of 1:16. The working experience of the staff varied; in 22% of the staff it was less than 1 year, in 18% it was 1 to 3 years, while in 60% it was more than 3 years.

Demographics and underlying co-morbidity of residents

A total of 1626 residents were interviewed; 23 residents with ages ranging from 41 to 59 years were excluded from the analysis. Data of the remaining 1603 residents aged 60 years or more were analysed. Among all surveyed residents the mean age was 83 years (range, 60-107 years), the female-to-male ratio was 2.1:1, and the vast majority were Chinese (99.6%). Nearly 50% were aged 80 to 89 years (Fig 1). The mean ages for female and male residents were 84.4 and 79.6 years, respectively. Their duration of stay in these homes varied; in 38% it was less than 2 years, in 19% it was 2 to 4 years, in 15% it was 4 to 6 years, and in 28% it was more than 6 years (Fig 2). Slightly more than a third of the residents were ambulatory and about one tenth were bed-ridden (Fig 3).

Chronic medical illness was reported among 85% of the residents. Hypertension was the most common underlying diagnosis (59%), followed by stroke (31%), dementia (25%), and diabetes mellitus (24%) [Table 1]. In all, 55% of the residents had more than one underlying co-morbidity.

Prevalence of infections in the residents

The estimated overall prevalence of residents with

infections was 5.7% (91/1603; 95% confidence interval [CI], 4.2-7.1%). Three residents had two infections and the rest (88/91) had only one infection. None had more than two infections.

The most common infection was common cold or pharyngitis, followed in descending order by skin and soft-tissue infection, symptomatic urinary tract infection, lower respiratory tract infection, conjunctivitis, influenza-like illness, tuberculosis, gastroenteritis, and scabies (Table 2).

Risk factors associated with infectious diseases

Generalised estimating equations were used to identify possible risk factors for different types of infections. Being 'bed-ridden' was a significant risk factor for skin and soft-tissue infection (odds ratio [OR]=3.1; 95% CI, 1.4-6.9). Presence of a urinary catheter was a significant risk factor for symptomatic urinary tract infection, with an OR of 62.8 (95% CI, 18.2-217.0). Chronic obstructive pulmonary disease was a significant risk factor for lower respiratory tract infection, with an OR of 16.5 (95% CI, 3.4-81.2).

The prevalence of lower respiratory tract infection was significantly higher in private (0.8%) compared to non-private facilities (0.0%; difference: 0.8%; 95% CI, 0.2-1.4%). There was no significant difference in prevalence between private and non-private RCHes for the other infections.

Discussion

Residents in the nursing homes are susceptible to infections because they are old and often have co-morbidity that predisposes to infections.¹⁵ Thus, 85% of our surveyed residents had underlying medical problems and 55% had more than one problem.

The diagnosis of infection among RCHE residents was often difficult, because they frequently had cognitive deficits and were unable to communicate symptoms or show signs that provide early clues to the presence of infection.¹⁶ Moreover, the clinical presentations of infections in such residents are frequently atypical or non-specific. Prevalence rates of infections in nursing home residents differ from one institution to another.⁷ This is related to the fact that infections in this population are difficult to diagnose, definitions of infection vary from study to study, resident populations are dissimilar, and the intensity of surveillance efforts varies.

The prevalence was expected to be higher among residents who were more functionally impaired and had more severe co-morbidity. It was expected to be even higher among those who required intensive care, had recently been hospitalised, or were managed with invasive catheters or tubes.¹² By univariate analysis, our survey failed to demonstrate a statistical significant

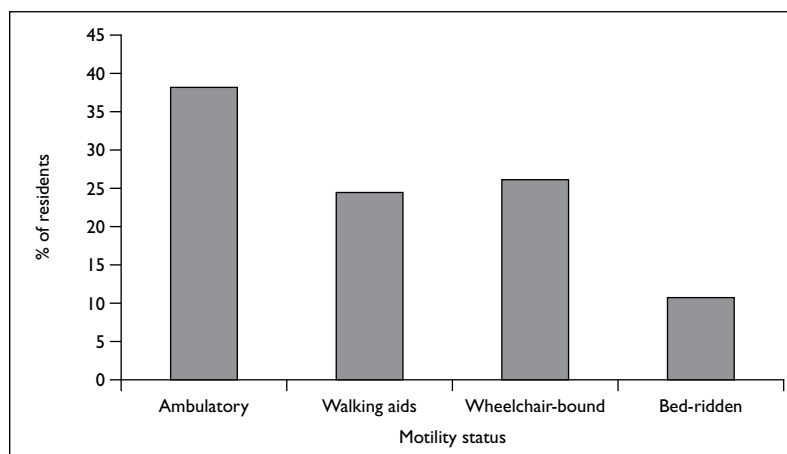


FIG 3. Motility status of residents in residential care homes for the elderly

TABLE 1. Underlying medical conditions of residents in residential care homes for the elderly

Condition	No. (%)
Hypertension	951 (59)
Stroke	500 (31)
Dementia	399 (25)
Diabetes mellitus	390 (24)
Heart disease	322 (20)
Chronic obstructive pulmonary disease	96 (6)
Malignancy	60 (4)
Chronic renal disease	32 (2)
Chronic liver disease	10 (1)

TABLE 2. Prevalence of different types of infections in the residents of residential care homes for the elderly

Types of infections	No. of cases	Prevalence	95% Confidence interval
Common cold or pharyngitis	31	1.9%	0.9-3.0%
Skin and soft-tissue infection (exclude scabies)	23	1.4%	0.5-2.4%
Symptomatic urinary tract infection	9	0.6%	0.2-0.9%
Lower respiratory tract infection	8	0.5%	0.1-0.9%
Conjunctivitis	7	0.4%	0.1-0.8%
Influenza-like illness	4	0.2%	0.0-0.6%
Tuberculosis	4	0.2%	0.0-0.5%
Gastroenteritis	3	0.2%	0.0-0.4%
All other infections*	3	0.2%	0.0-0.4%
Scabies	2	0.1%	0.0-0.4%

* Other infections were otitis externa, postoperative surgical site infection and vaginitis

association between recent discharge from hospital and infection (OR=3.2; 95% CI, 0.8-3.1%). More studies are needed to clarify this issue.

If residents with a common cold or pharyngitis,

influenza-like illness, and lower respiratory tract infections are regarded as a single group, respiratory tract infections were by far the most common (2.6%; 95% CI, 1.5-3.7%) in this RCHE survey. The prevalence reported depends on case-finding criteria, definitions of infection, and the intensity of surveillance. Infection-control measures to prevent the spread of respiratory virus are of paramount importance. Respiratory hygiene and cough etiquette should be implemented, whenever residents or visitors have symptoms of respiratory infection. The influenza vaccination coverage rate among these RCHE residents was reported to be over 90% for the year 2005-2006.¹⁷ However, coverage should also be monitored among the staff, as maintaining a high rate can help prevent the spread of influenza-like illness to residents.

In most surveys, the prevalence rate of lower respiratory infections was between 0.3 and 5.8%,⁸ and our survey findings (0.5%; 95% CI, 0.1-0.9%) are also comparable. Differentiation of bronchitis from pneumonia was not possible without radiological verification. It has been estimated that approximately 60% of lower respiratory tract infections represent pneumonia and 40% acute bronchitis.¹²

In most surveys of nursing homes, the prevalence of skin and soft-tissue infections is reported to be quite high (5.6-8.4%).¹² In our survey, these infections ranked second, but their prevalence (1.4%; 95% CI, 0.5%-2.4%) was low in comparison to published data. This discrepancy may be due to incomplete case identification, different case definitions, different characteristics of residents, or the skin care offered by our RCHE staff. As being 'bed-ridden' was a significant risk factor for skin and soft-tissue infection, the skin care of such patients is paramount.

The prevalence of asymptomatic bacteriuria in non-catheterized nursing homes residents ranges between 15 and 50%.⁸ It is recommended that such residents should not receive prophylactic antibiotics, as this strategy does not affect short-term or long-term morbidity or mortality, whilst predisposing to the development of antibiotic resistance in the nursing home setting.^{18,19} The prevalence of asymptomatic bacteriuria in catheterized patients (for which antibiotic treatment is not recommended) is 100%.¹⁸⁻²⁰

In this survey, only symptomatic urinary tract infections were counted, accounting for the third commonest type of infection (prevalence, 0.6%; 95% CI, 0.2-0.9%) and the urinary catheter was a significant risk factor. Some investigators reported that urinary tract infections are the most common infections in nursing homes, but they usually also included asymptomatic infections.^{7,8,21} Prevalence rates also vary depending on the criteria for diagnosis. Rates of urinary tract infection are higher in nursing homes in which a large proportion of residents have indwelling

urinary catheters¹²; in our survey population, 3.3% of residents had urinary catheters. To prevent urinary tract infection, visiting doctors should examine each resident critically to decide whether a urinary catheter is indicated, and if deemed necessary, advice should be given on the practice of caring for it.

Compared to overseas data, the prevalence of common infections among residents was low. Prevalence in overseas studies was reported to range between 1.6 and 32.7%.²⁻⁵ This difference may in part be due to the stringent infection control practices in most RCHE in Hong Kong. According to the Code of Practice for Residential Care Homes for Elderly Persons, each home needs to have an infection control officer (ICO) responsible for matters related to the control, prevention, and spread of infectious diseases.¹ Each home also needs to have an isolation area or room with proper ventilation and hand-washing facilities for residents who need isolation. Guidelines on the Prevention of Communicable Diseases in Residential Care Homes for the Elderly were drawn up by various branches of the Department of Health,²² and distributed to all such facilities. They can also be freely downloaded from the Centre for Health Protection website.²² Training courses for RCHE ICOs (and others) are organised annually by the Infection Control Branch of the Centre for Health Protection, which are well received (with over 1000 participants each year). Yearly infection control audits of all such homes (>760 at the time of writing) are conducted and cover areas of infection control knowledge and practice by the staff, as well as matters related to the environment, ventilation, and isolation facilities. After each audit, recommendations are made to individual facilities. In case of outbreaks, there is clear reporting system and the outbreak management team from the Surveillance and Epidemiology Branch of the Centre for Health Protection assist in the control of outbreaks. Doctors and nurses from Community Geriatric Assessment Team of the Hospital Authority provide out-reach out-patient care to residents in their homes, while the Visiting Health Team of the Elderly Health Service, Department of Health visits RCHE and provides health education to staff and residents. The Visiting Health Team also provides out-reach influenza vaccination programmes to residents and staff before each flu season. With the collaboration of RCHE staff and different government and non-government departments, there is a concerted effort to improve infection control practices in elderly care homes.

This is the first territory-wide study to describe the prevalence of infections among RCHE residents and the corresponding associated risk factors. Our study had several limitations. First, being a point prevalence survey, causal relationships between possible risk factors and infection cannot be established, and prevalence is affected by the mean duration of the disease in question. Infections of

short duration or those that are rapidly fatal would be missed. Seasonal variations may also result in infections being missed in a single point prevalence survey. Second, the generalisability of the result was affected by the low response rate. Among the 56 homes approached, only 44 agreed to participate in the study. Third, one selected home was excluded as it had a Norovirus outbreak and was still under quarantine on the survey day. This exclusion may have underestimated the prevalence of gastroenteritis. Outbreaks account for 10 to 20% of nursing home infections,^{8,12} and include clusters of upper or lower respiratory tract infections, gastroenteritis, diarrhoea, and catheter-associated urinary tract infections.¹² Fourth, inter-rater variation may exist, as the data were collected by different members of our group, though differences may have been minimised by our training workshop and standard protocol. Lastly, communication with residents with dementia poses a great problem. About 1 to 2% of data pertaining to demographic characteristics of the residents were missing, due to communication problems. Detection of acute symptoms was difficult, even with the help of relatives and RCHE staff.

Conclusions

This survey estimated the prevalence of residents with

infections in RCHE in Hong Kong to be about 5.7%. Potential risk factors for infection were identified. Such information helps prioritise infection control programmes. Targeted regular surveillance should monitor seasonal and secular trends. With the joint effort of health care workers, RCHE staff and various government and non-government departments, decreasing infections among the corresponding elderly residents can improve long-term health and quality of life.

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APPENDIX. Diagnostic criteria for various common infections among residents

The diagnosis of infection was based on modified long-term care facilities specific surveillance criteria developed by a Canadian consensus conference.¹⁴

Common cold or pharyngitis was diagnosed if the resident had at least two of the following complaints: (a) runny nose or sneezing, (b) stuffy nose, (c) sore throat or hoarseness or difficulty in swallowing, (d) dry cough, (e) swollen or tender cervical lymphadenopathy. Fever was not necessary.

A resident would be diagnosed as having an **influenza-like illness** if he/she had a fever ($\geq 38^{\circ}\text{C}$, taken at any site) and had at least three of the following complaints: (a) chills, (b) new headache or eye pain, (c) myalgias, (d) malaise or loss of appetite, (e) sore throat, (f) new or increased dry cough.

A resident must have had at least three of the following complaints to be diagnosed as having a **lower respiratory tract infection**: (a) new or increased cough, (b) new or increased sputum production, (c) fever, (d) pleuritic chest pain, (e) one feature indicating difficult breathing (shortness of breath or respiratory rate $>25/\text{minute}$ or worsening mental or functional status).

The diagnostic criteria for **symptomatic urinary tract infection** depended on whether the resident had a urinary catheter. If there was no catheter, urinary tract infection was diagnosed if at least three of the following features were present: (a) fever or chills, (b) new or increased burning pain on urination, frequency or urgency, (c) new flank or suprapubic pain or tenderness, (d) change in character of urine (eg new bloody urine, foul smell urine or increased amount of sediment), (e) worsening of mental or functional status. If the resident had a urinary catheter, two of the following complaints would be enough for the diagnosis of urinary tract infection: (a) fever or chills, (b) new flank or suprapubic pain or tenderness, (c) change in character of urine, (d) worsening of mental or functional status.

Skin and soft-tissue infection was diagnosed if the resident had either one of (a) presence of pus at wound, or (b) four or more of the following complaints: fever or worsening mental/functional status, the presence of a new or increasing area of (i) heat, (ii) redness, (iii) swelling, (iv) tenderness or pain, and (v) serous discharge at the affected site.

Conjunctivitis was diagnosed if the resident met one of the following criteria: (a) pus appearing from one or both eyes and lasting at least 24 hours, (b) new or increased conjunctival redness, present for at least 24 hours.

Gastroenteritis was diagnosed if one of the following criteria was met: (a) two or more loose or watery stools above what was normal for that resident within a 24-hour period, (b) two or more episodes of vomiting in a 24-hour period, (c) both of the following: (i) stool culture positive for a pathogen, and (ii) either one of these: nausea, vomiting, abdominal pain or tenderness, or diarrhoea.