ORIGINAL ARTICLE

A review of the winter Influenza strategy for hospitals within a major district health board in New Zealand following the 2012 Influenza season

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Abstract

Winter influenza planning is an integral part of a health services preparation for the annual increase in respiratory virus infections and associated hospital admissions in New Zealand.

A moderate to severe influenza A (H3N2) outbreak occurred in the winter of 2012 resulting in an unprecedented number of attendances at ED and admission of patients with influenza-like illness to the Canterbury District Health Board (CDHB) hospitals. A review of the hospital winter influenza management strategy following this outbreak, included the use of dedicated influenza wards, extensive diagnostic testing of patients, infection control advice, staff influenza vaccination and the use of Oseltamivir for treatment of patients and prophylaxis of their contacts. The review found that 534 patients were assessed and laboratory confirmed to have influenza, 347 patients were admitted and 40 nosocomial influenza infections recorded over an 11 weeks period. The strategy contributed to the management of the hospital admission of patients with influenza, a relatively low number of nosocomial influenza infections in the dedicated admission wards and low in-hospital mortality. The use of diagnostic testing for influenza with planned escalation of services supported the clinical decision to treat patients with confirmed influenza and prophylaxis of contacts with Oseltamivir probably facilitated appropriate discharge of patients.

Keywords: Influenza, human and epidemiology; Virus diseases and prevention and control; Patient admission – organization and administration; Immunization programmes

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Introduction

The epidemiology of influenza in New Zealand is that of a temperate climate with annual epidemics or outbreaks during the autumn and winter months.[1] These epidemics or outbreaks vary in intensity, and characteristically are associated with considerable morbidity resulting in the hospitalization and death of individuals, often the very young, elderly or chronically ill.[1] The overall burden of respiratory disease is also contributed to by other respiratory viruses which commonly co-circulate with influenza.[2] Planning for these annual increases in respiratory disease and for associated hospital admissions has become common practice by major health services globally. Preventive measures include community influenza awareness and immunisation programs and the vaccination of health care workers (HCW). Bed management is central to the hospital planning process, to optimise patient flow and minimise the occurrence of nosocomial infections.[3] However, the severity of the winter respiratory season, the influenza or other respiratory virus circulating, or the age groups affected cannot be predicted and during years when large winter epidemics occur, hospital services can be overwhelmed with admissions.

The objective of this study was to review the winter influenza management strategy following the influenza season of 2012 for the hospitals within a large New Zealand District Health Board. Outcome measures included patient admissions to hospital for influenza-like illness (ILI), laboratory confirmed influenza, treatment, mortality and the occurrence of nosocomial influenza infections.

Material and Methods

The health services

The Canterbury District Health Board (CDHB) in the South Island of New Zealand services a population of 501,425 people and is the second largest by population and by geographical area of the twenty New Zealand DHBs. The CDHB operates several hospitals, central to which is Christchurch Hospital (ChChH) an acute tertiary level university hospital with 650 beds servicing over 35,000 inpatients each year and a referral centre for other smaller District Health Boards in the South Island. The virology service is within Canterbury Health Laboratories (CHL), on the same hospital campus.

Several other hospitals provide services for women's health (CWH) including a Neonatal Intensive Care Unit, services to older person's health and rehabilitation (TPMH), a 150 bed hospital providing rehabilitation after spinal, arranged orthopaedic surgery and brain injury (BwdH) and a smaller rural 104 bed hospital south of Christchurch. The Christchurch region experienced major destruction to buildings and infrastructure during the February 2011 earthquake. As a result of the damage and subsequent building strength and evacuation assessments, three acute admitting medical wards were moved to TPMH. Clinical staff providing acute medical services were therefore required to work out of two separated sites.

Influenza Case definition

An influenza case was defined as a patient who had laboratory confirmed influenza during the influenza season (11 June – 26 August, weeks 24-34, 2012), and was either admitted to an hospital ward or discharged after clinical assessment in the Emergency Department (ED) or Children's Acute Assessment Unit (CAA) of CDHB.

Nosocomial influenza case definition

A nosocomial infection was defined as an influenza case with:

1. ILI symptoms > 4 days after admission and no respiratory symptoms on admission, or
2. Admitted with ILI symptoms and discharged from a previous admission within the previous 48 hours, or
3. Information in the discharge letter indicating that influenza developed during admission for other clinical reasons.

CDHB Winter Management Strategy for Hospitals

Documentation of the CDHB's winter management planning was searched for in all communications between the hospital management, senior and other hospital staff.

The key initiatives included:

- A free influenza immunization program for HCW's, actively promoted by the CDHB via

emails, newsletters and posters from March 2012 through the influenza season to August 2012.

- A bed management plan, involving designated influenza wards, advice on testing of all patients suspected of having influenza and, the prescribing of Oseltamivir to patients with ILI and confirmed influenza. Prophylactic prescription of Oseltamivir for patients with close contact with patients with influenza was promoted. Close contact was defined as admission to the same room as any patient with influenza. The designated influenza wards were two wards in ChChH and one of the transferred medical wards at TPMH.

- Infection Control Team involvement for advice on patient isolation precautions included droplet precautions. Single rooms were preferred, however these were limited and admission to multi-bed rooms was usually required. In multi-bedrooms the privacy curtains were to be pulled one meter from the level of the patient's head.

- Laboratory testing strategy was coordinated by the Virology Service, CHL during the winter influenza season, for influenza and other respiratory viruses with polymerase chain reaction (PCR) testing being performed routinely twice daily (between 0800 and 1700hrs), and with escalation, depending on patient admission numbers to once or more daily in the weekends.

Hospital electronic record systems

Four hospital electronic databases were accessed for the following data:

1. Concerto database: containing patients' electronic clinical notes:
   - Admission diagnosis and notes regarding influenza nosocomial infection
   - Days ILI symptoms present prior to influenza testing
   - Treatment with Oseltamivir
   - Mortality (date of death in relation to the influenza laboratory test)

2. Clinical Pharmacology Database: containing defined daily doses (DDD) of Oseltamivir used in all hospital wards for the period 11 June – 26 August 2012 (weeks 24-34)

3. Delphic Laboratory Information System: records of all patients who tested PCR positive for influenza were searched and the data cross-matched with the records from ICNet and information on further admissions. The day of sample receipt in the laboratory was used as the day of testing and influenza case confirmation. Data on other respiratory virus infections identified during the review period was also obtained.

4. ICNet Infection Control programme which communicated with other hospital information systems was available as a pilot programme during the period of the review. This system could provide reports on patient specific identification, admission and discharge data and clinical area of first presentation e. g. ED, CAA or inpatient wards

Other records

- The Infection Prevention and Control (IP&C) 2012 Influenza Guideline
- Reports from Community and Public Health, CDHB, and
- Internal CDHB Infection Control Reports from years prior to 2012 detailing the number of admitted patients with laboratory confirmed influenza, the number of patients with nosocomial influenza infections and number of HCWs receiving influenza vaccination.

Laboratory testing

Respiratory samples, which were largely nasopharyngeal/per nasal flocked swabs (Copan Diagnostics, Brescia, Italy), collected into 2.5 mL Universal Transport Media (UTM) (Copan Diagnostics, Brescia, Italy), were forwarded to the laboratory and stored at 4ºC until PCR testing, usually within a day of sample receipt, was performed. Respiratory virus diagnostic testing was performed using the Fast-track Diagnostics (FTD) respiratory pathogen (Fast-track, Luxembourg) multiplex PCR assay essentially as previously described.[4]

The primer sets included in the multiplex PCR allowed the detection of influenza type A (and sub-typing for (H1N1)pdm2009 and (H3N2) strains); influenza type B, parainfluenza types 1-4, respiratory syncytial virus (RSV), human metapneumovirus, adenovirus,

rhinovirus, enterovirus, and bocavirus. All results were entered into the laboratory Information System.

Ethics: This was a retrospective observational review carried out as both an Infection Control audit and a patient management audit following the 2012 winter Influenza season. This quality control exercise did not require patient contact or intervention, thus no specific ethical review was required.

Results

Influenza activity in Canterbury:

Annual sentinel general practice influenza surveillance during the months May to September, monitors influenza activity in the CDHB region. Fig 1 shows the 2012 Canterbury ILI rates in comparison with previous seasons from 2009. Peak ILI activity occurred during July and declined by the end of August. This reported activity was lower than that reported during the 2009 Pandemic, but higher than that reported in 2010.[5] The predominant virus identified was Influenza A/Victoria/361//2011(H3N2) while Influenza A(H1N1) pdm2009 and influenza B strains were also circulating.

Hospital Admissions

Historic data 2002-2012

The admission numbers of patients with confirmed influenza to CDHB hospitals over 10 years, varied from year to year. Clearly 2012 admission numbers were substantially higher than previous years including admissions during the 2009 H1N1 pandemic year (Table I). These data do not include patients with nosocomial influenza.

Patients clinically assessed or admitted in 2012

During the 2012 review period, 534 patients were clinically assessed and confirmed to have influenza in the CDHB's hospitals. The predominant influenza virus identified was influenza A (H3N2), however in five patients influenza A(H1N1)pdm2009, and in ten, Influenza type B virus was detected.

Of the 534 patients with confirmed influenza, 301 (56.4%) were initially assessed in the ED or the CAA, with 160 influenza cases being admitted and six tested in an outpatient clinic. A further 187 patients were admitted directly to inpatient wards without passing
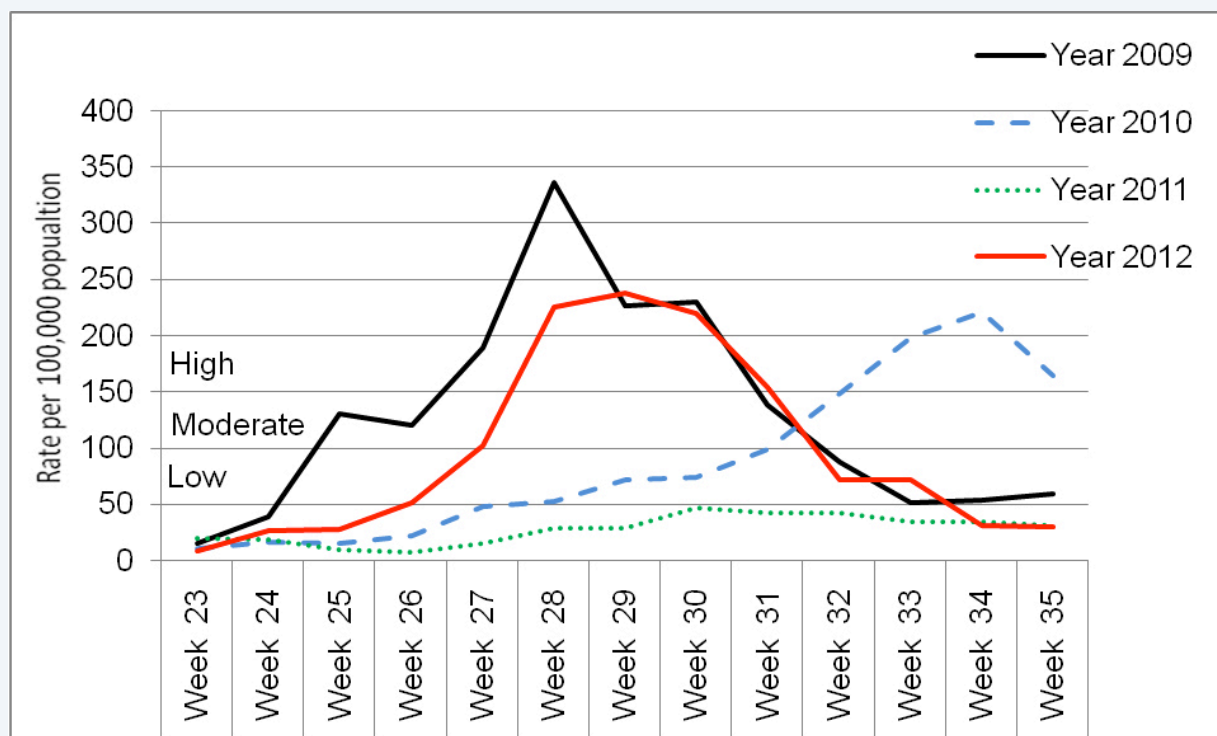

Figure 1. Canterbury Influenza-like Illness Rates per 100,000 populations 2009-2012 (Source: Community and Public Health, Christchurch Office, CDHB with permission)

Table I. Number of patients admitted with influenza in CDHB hospitals 2002 to 2012

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number patients admitted*	124	160	118	55	90	130	50	199	85	53	347

* These data does not include patients with nosocomial influenza.

through or being sampled in ED for diagnostic testing (Figure 2). A further 40 patients were diagnosed with hospital acquired influenza (HAI).

Day of influenza confirmation, number and ages of patients with nosocomial infections

All the patients assessed in ED or CAA were sampled for diagnostic testing on the day of presentation with the majority (110) admitted to designated influenza wards. Most of the 187 patients admitted directly to inpatient wards were also sampled on admission, however, with some, sample collection was delayed and an influenza diagnosis was not made for up to four days after admission. The number of days following
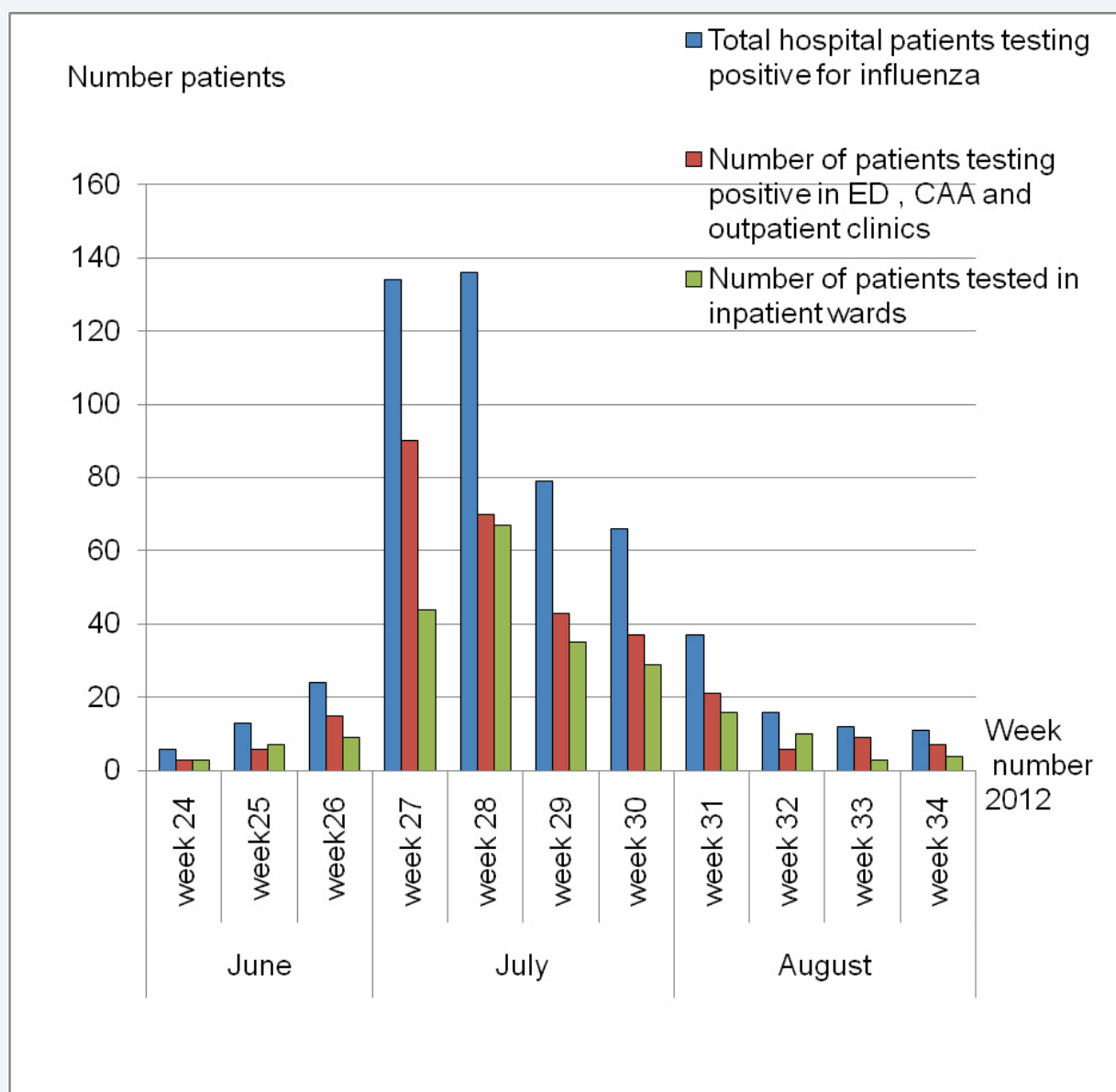

Figure 2. The number of patients by assessment areas with laboratory confirmed influenza in the CDHB hospitals during the weeks 24-34.

Table II. Total numbers of admitted patients with influenza and the number (percentage) of patients with nosocomial infections 2002-2012

Year	Total No admitted influenza patients*	No (%) Nosocomial infections
2002	143	19 (13.3)
2003	183	23 (12.6)
2004	130	21 (16.2)
2005	58	3 (5.2)
2006	102	12 (11.8)
2007	147	17 (11.6)
2008	54	4 (7.4)
2009	199	2 (1.0)
2010	80	3 (3.9)
2011	53	Not available
2012	387	40 (10.3)

includes patients with nosocomial infections

admission before influenza was confirmed in individual patients is shown in Figure 3. A total of 182 patients were admitted to designated influenza wards, either through ED or directly to the wards, 83 into other medical wards, 55 into speciality wards (including all surgical wards and ICU), 17 into rural hospitals and 10 patients into paediatric wards. Another 6 patients were sampled as outpatients, mainly in haematology clinics.

The 40 patients identified with nosocomial influenza, had been in hospital for varying lengths of time prior to infection. Eight patients had been in hospital for 3-4 days, 15 patients for 5-10 days, three patients for 16-20 days and seven had been in hospital for more than 20 days before their diagnosis. Of these patients, 15 were in hospital wards, eight were in a ward for elderly patients, while nine other wards had one to four patients each. The average age was 77 years, median 84 and age range 5-95 years.
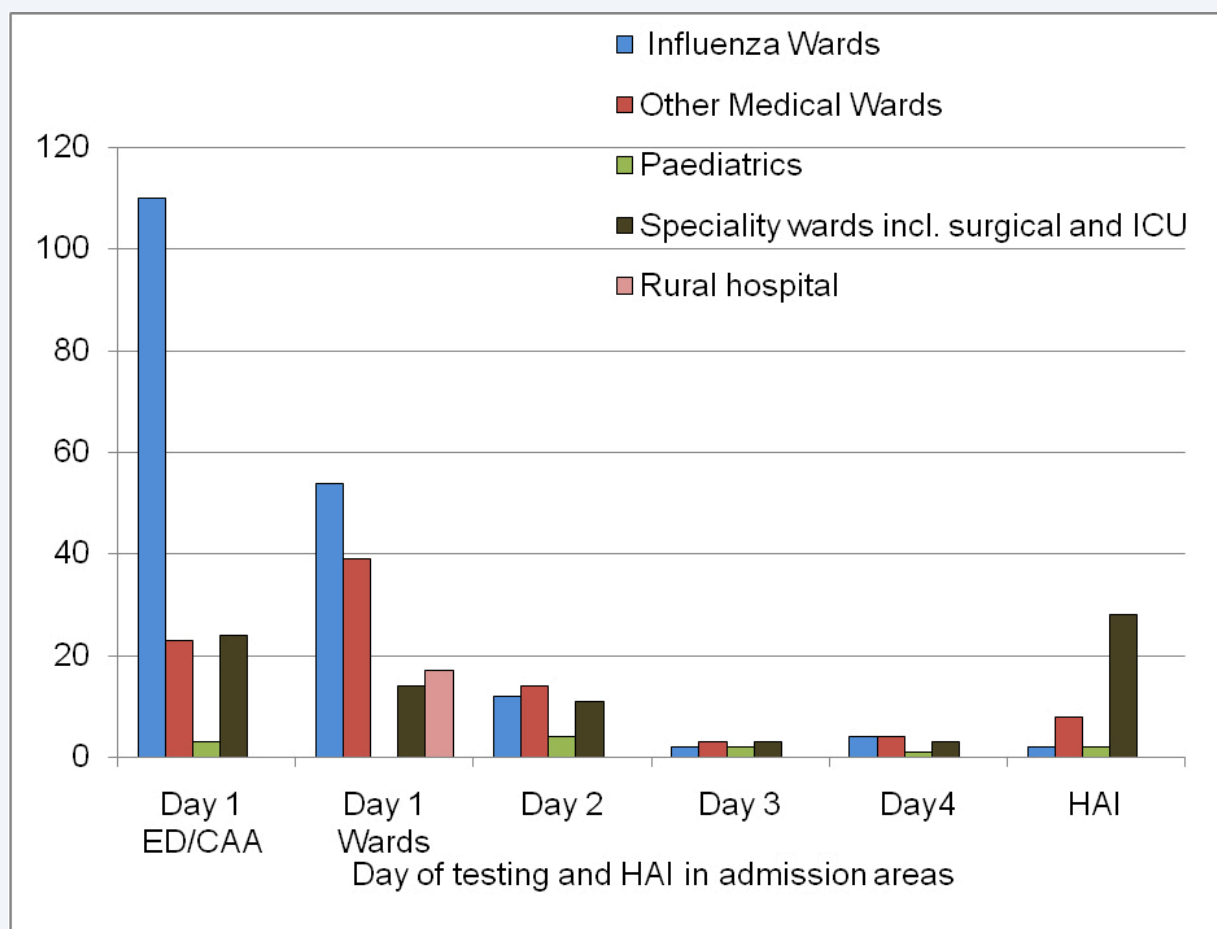

Figure 3. Day of influenza testing of patients admitted from ED/CAA or directly to a hospital ward, and areas recorded with Hospital Acquired Influenza infection (HAI)

The highest number of nosocomial infections occurred in wards for medical specialities which including surgical wards. The second highest number was in "other medical wards" (Figure 3). Only two nosocomial infections were identified in the designated influenza wards, both these patients were admitted to the influenza ward established in one of the medical wards transferred to TPMH.

Historical influenza admission and nosocomial infection case data

Data on the number of patients with confirmed influenza, admitted and number of nosocomial infections identified in the CDHB's hospitals from 2002 were available for comparison with data from this 2012 review (Table II). No detailed infection control data were available for 2011 as influenza activity in that year was low. The percentage of nosocomial infections identified in 2012 was lower than most previous seasons when 100 or more patients with confirmed influenza were admitted.

Age of patients admitted or discharged from ED and CAA

A total 141 of 301 (46.8%) patients with influenza were discharged following ED and CAA assessment. The majority were less than 60 years and those discharged from CAA were less than10 years of age.

Length of admission and age of patients

The length of hospital admission, in days, for different age bands of the 347 patients admitted and testing positive for influenza is shown in Figure 4. Those admitted for less than one day are included as 1 day. Overall 28% of patients with confirmed influenza had a length of stay of 1 day and with the majority (60%) being discharged within 3 days. Those considered to be nosocomial infections have not been included in the inpatient number in the figures.
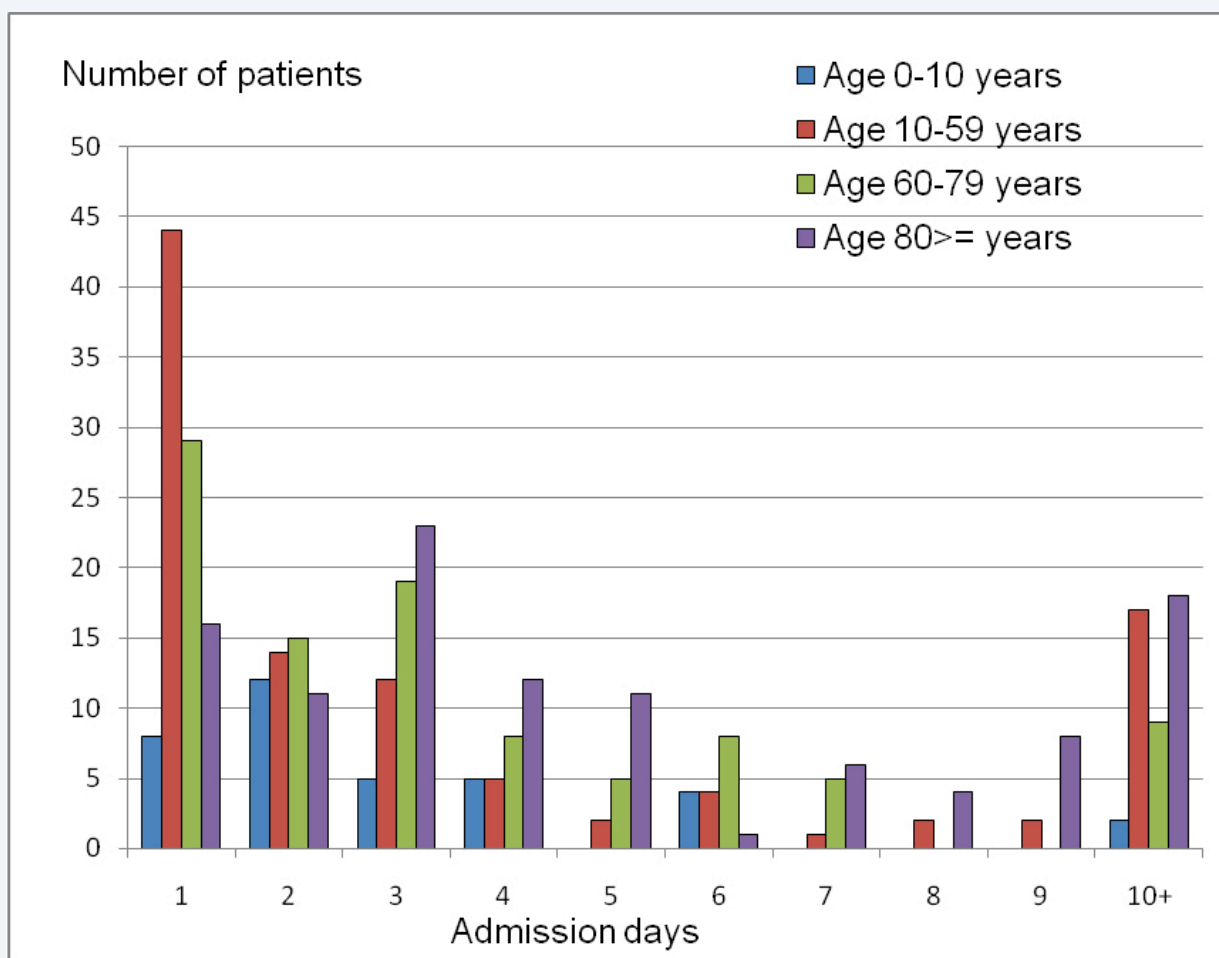

Figure 4. Length of admission (days) for each age groups of admitted patients with confirmed influenza (347 patients)

Table III. Number of Health Care Workers receiving influenza vaccination 2006 -2012

Year	2006	2007	2008	2009	2010*	2011	2012
Number of vaccinations	3403	3498	4233	4571	4151	5700	6154

*Approximately 6,800 doses of monovalent H1N1pdm vaccine given in 2010

Mortality and ICU admission:

Five deaths were recorded among hospitalised patients with confirmed influenza. One patient aged 71 years died in ICU five hours after admission of a suspected cardiac condition; one aged 66 with overwhelming sepsis caused by *Streptococcus pneumoniae*; one aged 81 had terminal metastatic malignancy and one patient aged 90 years with obstructive nephropathy. The latter two patients had a productive cough for a week. One further patient, aged 71 years had multiple co- morbidities and acquired a nosocomial influenza infection which progressed to pneumonia 72 days after initial admission. Overall, eleven patients required ICU admission.

Use of Oseltamivir

The number of Oseltamivir doses prescribed during the review period in four combined areas: ED, Influenza designated wards, other general medical wards and wards for medical specialities including all surgical wards and ICU is shown in Figure 5. Paediatric wards, CAA, the rural hospital and some miscellaneous areas with small number of patients have not been included as the usage was low and paediatric patients were treated with a different dosage than adult patients.

Detailed patient Oseltamivir prescribing data was not available and the time a patient had any respiratory symptoms prior to influenza confirmation, was only noted in the discharge letters of 35 patients. Two patients had symptoms for 1 day and seven for two days, while 12 for three-five days, six for six- seven days, and eight for eight days - two weeks. Only one patient with prolonged symptoms was under 50 years of age the rest were more than 70 years old.

The number of patients receiving Oseltamivir for treatment has been estimated by apportioning two 75 mg tablets twice a day for five days as treatment to all patients with confirmed influenza. By deducting the number of treatment doses from the total issued to each combined clinical area and allocating a prophylactic regime of one 75mg tablet daily for 10 days, the remaining number of tablets prescribed per area was used to calculate the number of patients on prophylaxis. It is assumed that patients were given the remaining medication to take home if discharged before 10 days. It is estimated that the influenza wards prescribed prophylaxis to 660 patients, other general medical wards prescribed prophylaxis to 156 and medical specialities including Surgery and ICU prescribed prophylaxis to 128.

Immunisation of Healthcare workers

The influenza immunisation coverage figures from 2006-2012 among the CDHBs approximately 8000 employees, are shown in Table III. Less than half of the employees accepted the offer of free seasonal trivalent vaccine in 2006 and 2007, however, the numbers increased following the 2009 (H1N1) pandemic. In January 2010, a monovalent A (H1N1) pdm2009 vaccine was offered, prior to the 2010 seasonal vaccine becoming available. The composition of the southern hemisphere 2012 vaccine available in New Zealand was: Influenza A/California/7/2009(H1N1); Influenza A/Perth/16/2009(H3N2); Influenza B/Brisbane/60/2008 (1).

Laboratory testing for Influenza and other respiratory viruses

A total of 2167 respiratory samples were received by the virology service from the CDHB hospitals for respiratory virus testing in 2012. Figure 6 show the percent of samples in which any respiratory virus was detected and an influenza A or B virus was detected during the 11 week review period. Overall, between 45-65 % of samples were positive for a respiratory virus with RSV being the most frequent other virus identified, with a peak activity coinciding with the circulation of influenza viruses, followed by rhinovirus and then parainfluenza virus type 3. Two patients had dual infections with an influenza virus and Parainfluenza
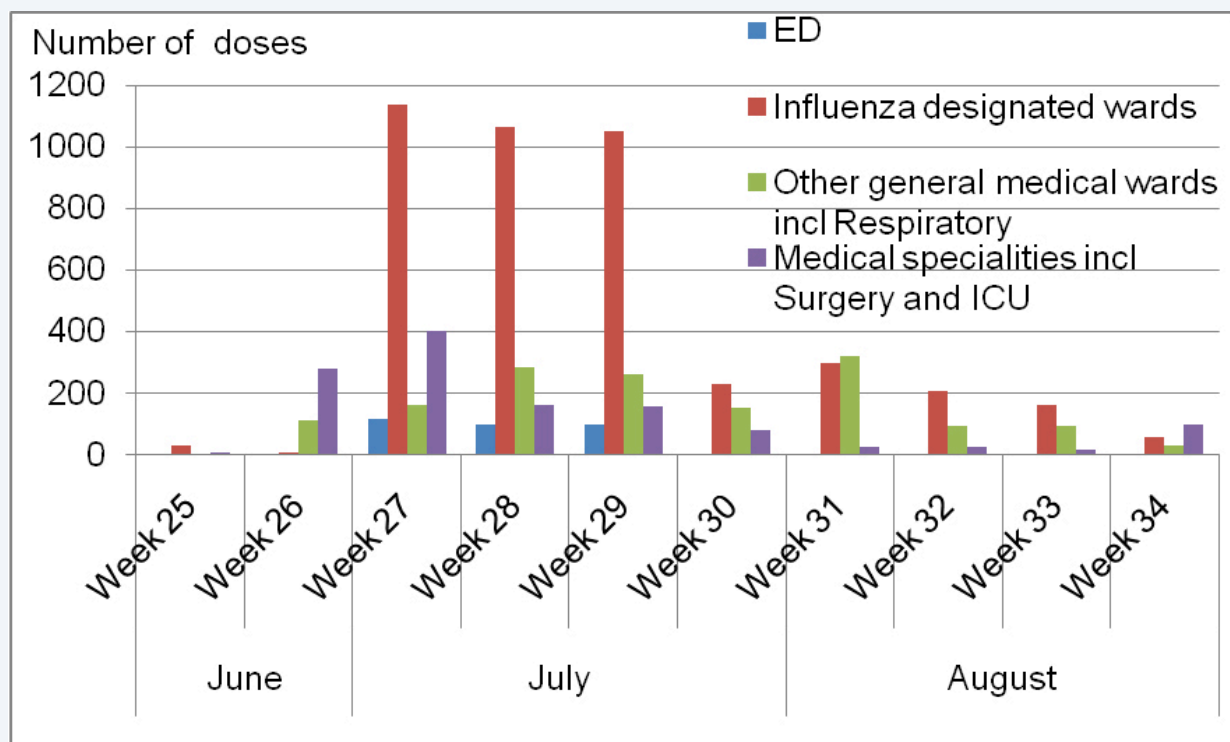
Figure 5. Number of Oseltamivir doses given to admitted patients during the influenza outbreak weeks 25-34

Type 3. The detection rate for influenza viruses was highest (48%) during the peak outbreak weeks in July.

Discussion

Winter influenza planning by the CDHB is an integral part of the preparation for the annual increased burden on health services due to respiratory virus activity. The management strategy influenced the initial placing of hospital ILI admissions, the laboratory confirmation of influenza in these cases, nosocomial influenza infections, and case mortality during a moderate to severe influenza A (H3N2) outbreak.

A national influenza control strategy endorsed and funded by Government has been in place in New Zealand since 1999. Recent versions of the influenza pandemic action plan have been used to respond to SARS in 2003 and the H1N1 pandemic in 2009.[5,6] The planning process has required DHBs to establish regional preparedness plans. The CDHB has been proactive in ensuring that annual winter influenza planning, both hospital and community, is important for the management of the winter increase in respiratory disease and associated hospital admissions. Influenza activity in Canterbury in 2012 approached

that recorded during the 2009 Pandemic.[7] During the 2009 pandemic, the focus of community planning was to keep people out of hospital by assessing ILI patients in community based influenza centres. Significantly, only 187 out of 595 confirmed cases of Influenza A(H1N1)pdm2009 required hospitalisation in 2009.[8] The 2009 pandemic was considered to be mild, affecting predominately the younger age groups, with some, especially those with underlying medical conditions suffering more severe outcomes.[9-11] Following a mild influenza season in 2011 and post-pandemic complacency, community planning was slow to respond to the explosive start of the 2012 influenza season. This may have resulted in the increased number of admissions, especially of elderly patients, to the CDHB's hospitals. The predominant influenza virus circulating was an Influenza A/Victoria/316/2011(H3N2) strain. This strain had drifted from the A (H3N2) strain included in the 2012 seasonal trivalent influenza vaccine used for preseason vaccination, thus it is possible that a diminished level of protection to the dominant circulating strain contributed to the increased morbidity. Further, influenza A(H3N2) virus circulation is often associated with more severe outcomes in the elderly.[12]
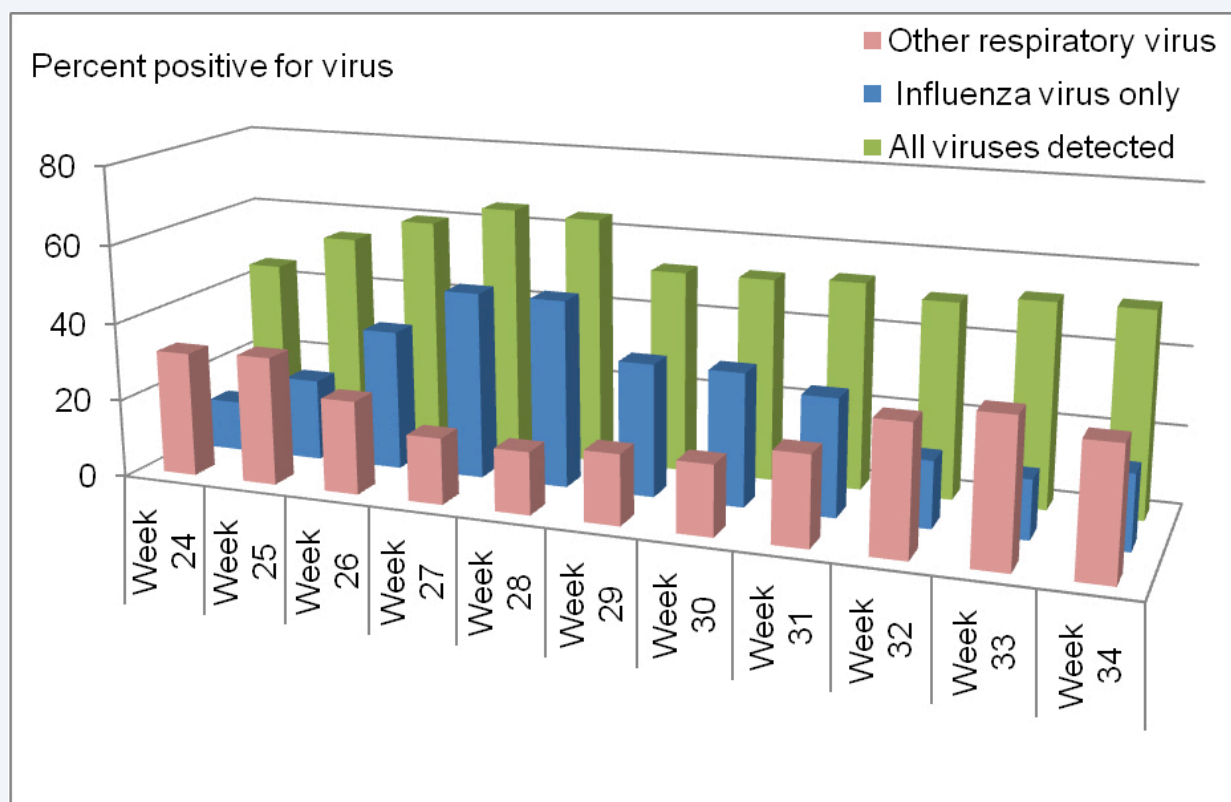
Figure 6. The percentage of laboratory confirmed respiratory viral infections in CDHB patients presenting with respiratory symptoms and tested during the influenza outbreak weeks 24-34

The admission management plan

The hospital admission management plan which included the designation of specific influenza wards was implemented the last week in June, when surveillance indicated increasing influenza activity in the community. However, within a week, the influenza wards were operating at capacity and patients with suspected influenza had to be admitted to other medical wards. The use of influenza wards was first instituted as part of the 2009 pandemic response with the aims of cohorting suspected cases of influenza, ensuring consistency of treatment and reducing the cross infection of staff and other patients. During the 2012 outbreak the majority of patients with ILI were admitted to the designated influenza wards.

The clinical diagnosis of influenza

The clinical assessment of patients with ILI was pivotal for patient admission to the influenza wards. A CDHB Infection, Prevention and Control Influenza guideline was available to assist clinicians. The definition of ILI included criteria of fever, at least one respiratory symptom and one systemic symptom with the caveat

that children and the elderly may not present with classical symptoms. However, the range of clinical signs and symptoms associated with ILI are broad and could apply to many other respiratory viral infections.

Fever and cough have been symptoms suggestive of influenza in healthy adolescents and adults when influenza is prevalent.[13] However in the elderly, especially those in long-term care facilities, the same obvious signs of influenza as younger adults may not occur.[14] For infection control practice, a history suggestive rather than the documented measurement of fever, cough and sore throat and age less than 65 years has been proposed as being reasonably sensitive and specific for influenza.[15] However, a contrary view is that these signs and symptoms are common and have low sensitivity and predictive values to identify cases of influenza and are insufficient to contain an institutional nosocomial outbreak, as many influenza cases would remain unidentified.[16] The combination of symptoms of cough and fever and fatigue or malaise in patients 60 years and older has also been proposed.[17,18] Overall, the clinical diagnosis of influenza remains problematic.

Antiviral treatment and prophylaxis

The use of Oseltamivir for both the treatment of confirmed influenza cases and prophylaxis of patients exposed to other patients with influenza was an essential part of the management strategy for influenza admissions during this outbreak. The lack of single rooms and the overall reduced hospital bed numbers following the February 2011 Christchurch Earthquake required additional measures to be taken. Oseltamivir has been used for the treatment of individual influenza cases within the CDHB for a number of years.

The use of antiviral agents, including Oseltamivir for influenza treatment and prophylaxis is advocated by The World health Organization (WHO) and the US Centers for Disease Control and Prevention (CDC).[19,20] Oseltamivir has been found useful for both prophylaxis and treatment of adults.[21,22] Oseltamivir has also been found safe and well tolerated in children for treatment of influenza within 48 hours of symptom onset, and during the 2009 pandemic, early treatment reduced the severity of disease in terms of ICU admission and death.[23,24] Large observational studies suggest better clinical and virological outcomes in hospitalized patients with seasonal influenza, treated with an antiviral, shortening viral shedding, reducing the length of hospital stay and reducing mortality.[25-27] These benefits were present even when treatment was initiated 48-96 hours after symptom onset.[25] There is also increasing data on outbreak management using antiviral drugs.[25,28] Oseltamivir prophylaxis was used successfully to contain an outbreak during the H1N1 pandemic in a large closed military setting in Singapore.[29]

Role of the laboratory in influenza diagnosis

The laboratory confirmation of ILI patients as having influenza contributed to the winter influenza management strategy in several ways. The confirmed diagnosis made it possible to treat influenza patients with Oseltamivir while the exposed patients could be given prophylactic doses only. The confirmed diagnosis of influenza or another respiratory viral infection was also important for the institution of infection control precautions. It was later shown that at the peak of the outbreak 48% of ILI cases were influenza and 20% were due to other respiratory viruses.

Discharge management

The majority of patients discharged from the emergency assessment areas were under 60 years of age. It is possible that these patients were clinically less complicated with symptoms of classical acute influenza infection. Of the patients admitted almost a third were admitted for only one day then discharged and again the majority of these patients were in the younger age groups. It is likely that their discharge was facilitated by the receipt of the laboratory confirmation of influenza. The length of admission was longest for patients 80 years or older, followed by those 60-79 years of age.

Nosocomial infection

Due to the size and rapid escalation of the Canterbury outbreak, patients were required to be admitted to multi-bed rooms rather than to the standard single rooms in the designated influenza wards and over-flow wards. The infection control advice was to pull the privacy curtains 1 meter down from the level of the patient's head towards their feet for droplet protection in addition to standard infection control precaution. The increased risk of patients acquiring influenza in multi bed rooms is widely recognised.[30] The recommendations of several infection control advisory groups are to draw privacy curtains as a precaution.[31,32] The reliance on the use of privacy curtains for aerosol protection has been challenged by Bischoff (2013) who has shown that small-particle aerosols containing influenza virus can be measured 1.829 m or 6 feet from an infected patient.[33]

It is difficult to assess the CDHB infection control approach for multi-bed rooms used in this review, as patients were also given either Oseltamivir treatment or prophylaxis. An interesting observation was the low number of nosocomial influenza infections in the designated influenza wards. The awareness of the clinical staff, early sampling and testing and initiation of Oseltamivir treatment or prophylaxis in all patients admitted to these areas may have contributed to this observation.

Other wards where clusters of nosocomial influenza were recorded also had a low use of Oseltamivir. It is possible that some patients admitted to these wards had more serious presenting medical issues as well as ILI symptoms, resulting in the delay in respiratory sample

collection for testing and influenza confirmation. The institution of isolation precautions may therefore have been delayed contributing to the higher number of nosocomial infections in these areas. These patients often had had ILI symptoms for one day to two weeks prior to admission as recorded in the patients discharge letters. Most with prolonged symptoms were in the older age groups. It is possible that these patients were shedding influenza virus, as it has been shown, in both studies of infection in healthy adult volunteers and in patients with severe influenza that the duration of viral shedding can be up to 8 days.[27,34]

Illness severity and mortality

The number of patients with confirmed influenza which progressed to more severe disease was low in this outbreak. Only eleven patients were admitted for respiratory support to ICU, with three of these ICU patients and two outside dying. The patients dying were all over 60 years of age. It is possible that this was the outcome of the CDHB hospitals' combined winter management strategy including early laboratory diagnosis and treatment with Oseltamivir irrespective of the duration of symptoms. Severe outcomes with higher mortality have frequently been reported in the past both during an Influenza A (H3N2) outbreak and during the A(H1N1)pdm2009 outbreak. In two studies, severe outcomes were reported in different age groups and in one, this was associated with the low use of Tamiflu.[25,26] Pregnant women have not been recorded separately in this review as only two were identified from the delivery suite records and they do not feature in the groups admitted to ICU or in the mortality list. This is in contrast to the morbidity and mortality recorded in other outbreaks.[35]

Laboratory management of Influenza testing

Prior to the 2009 pandemic the CHL virology service routinely diagnosed respiratory virus infections using direct Immunofluorescence (DFA) testing and viral culture. Each winter influenza season, a rapid influenza diagnostic test (RIDT) was added for out of hours testing. However, the emergence of the A(H1N1)pdm2009 virus, and need for a sensitive, high throughput assay, led to the introduction of a multiplex PCR assay for all respiratory virus detection and influenza virus confirmation.[36] DFA continued to be used for rapid testing for influenza as RIDT's

were demonstrated to have a low sensitivity for the detection of the A(H1N1)2009pdm virus.[36] In an attempt to improve the laboratory workflow, planning for the 2012 influenza season focused on the use of the multiplex PCR assay for respiratory viruses as the sole diagnostic test, along with an escalation pathway for increased testing during week days then additional testing during the weekends, as influenza activity increased. This lead to a greatly improved workflow during the 2012 influenza season compared to the 2009 pandemic in spite of the greatly increased number of hospital admissions while maintaining a 6 to <24 hour turn-around time for results.

Other respiratory viruses were in co-circulation with influenza during the review period with peak RSV and influenza activity coinciding. Zambon (2001) screened patients of all ages for influenza and RSV during the winter peak season and concluded that "In individuals diagnosed with influenza-like illness, there is a substantial potential for confusion between illnesses caused by influenza and those caused by RSV".[37] In another study, the respiratory virus results from patents seen in emergency rooms with ILI during the pandemic in 2009-10 were summarised. Of nearly 5000 patients tested 60% were negative for influenza virus.[38]

Influenza immunization of HCWs

Health care workers are frequently implicated as a source of influenza infection in health care settings, leading to nosocomial infections and staff absenteeism.[39] The vaccination of health care workers can reduce the risk to patients with associated reduced patient morbidity and mortality.[40-42] The CDHB influenza vaccination programme in 2012 resulted in 75% coverage of hospital staff. The Southern hemisphere 2012 trivalent influenza vaccine used may have provided suboptimal protection as the A/ Victoria/361/2011(H3N2) strain was not included in this vaccine. ILI in staff were not reviewed, however, it is possible that the patient influenza management strategy using confirmatory diagnosis and early treatment and prophylaxis of patients might have reduced both the patient- to-staff- to- patient influenza transmission cycle and the number of nosocomial infections occurring in the designated influenza wards.

Limitations

This winter influenza management strategy review used laboratory and other electronic data only. No attempt was made to document the ability of the hospital wards to cope with the large number of admissions apart from reviewing the patient discharge time. It is possible that not all nosocomial cases of influenza were identified as with patients admitted for a non-respiratory condition, their clinical discharge letters did not always record the presence of any respiratory symptoms on admission. Also, influenza-like illness among staff was not recorded during the study period, which despite the high influenza vaccination coverage, could have contributed to influenza virus transmission outside the designated influenza wards.

Conclusion

The most severe seasonal influenza outbreak in 11 years was experienced by the Canterbury region in 2012, with almost double the number of patients with confirmed influenza admitted to hospital compared to patients admitted during the 2009 pandemic.

The winter influenza management strategy used by the CDHB's hospitals included free influenza immunization for all health care workers, patient sampling on initial attendance and testing for influenza and other respiratory viruses by PCR, dedicated influenza admission wards, infection control protocols and the use of Oseltamivir for treatment of confirmed influenza cases and prophylaxis of their contacts. This strategy contributed to the overall management of the hospital admission of patients with influenza, resulting in a relatively low number of nosocomial influenza infections in the dedicated admission wards and low in-hospital mortality.

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