The Impact of Influenza-Like Illness on the Winnipeg Health Care System: Is an Early Warning System Possible?

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Manitoba has one of the most complete, well-organized and useful data bases in North America. The data base provides a comprehensive, longitudinal, population-based administrative record of health care use in the province.

Members of MCHPE consult extensively with government officials, health care administrators, and clinicians to develop a research agenda that is topical and relevant. This strength, along with its rigorous academic standards and its exceptional data base, uniquely position MCHPE to contribute to improvements in the health policy process.

MCHPE undertakes several major research projects, such as this one, every year under contract to Manitoba Health. In addition, MCHPE researchers secure major funding through the competitive grants process. Widely published and internationally recognized, they collaborate with a number of highly respected scientists from Canada, the United States and Europe.

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EXECUTIVE SUMMARY

Introduction

Hospital overcrowding has been a problem in Winnipeg, and other Canadian cities, for many years. In 1999, the Manitoba Centre for Health Policy and Evaluation (MCHPE) examined the issue of overcrowding in Winnipeg hospitals by studying patterns of hospital use over eleven years (fiscal years 1987/88 to 1997/98) (Menec et al., 1999). Key findings of the report *Seasonal Patterns of Winnipeg Hospital Use* were that high-pressure periods occurred in nine of the eleven study years and that these high-pressure periods were driven by emergent/urgent medical patients. Moreover, high-pressure periods coincided with an increase in emergent/urgent medical patients with influenza-like illness, indicating that influenza outbreaks place a great deal of strain on the hospital system and were, to a large extent, responsible for high-pressure periods.

These findings were quite striking and raised a number of questions, such as: Who are the patients hospitalized for influenza-like illness? Is there any way to anticipate flu epidemics, which would help hospitals plan for an impending influx of patients with influenza-like illness? How many people are vaccinated for influenza in Manitoba and is there a need to improve vaccination rates? These questions suggested the need to further investigate the impact of influenza-like illness on Winnipeg hospitals, as well as on other parts of the health care system. The Manitoba Centre for Health Policy and Evaluation was therefore asked by Manitoba Health to conduct a follow-up to the *Seasonality* report, focusing on influenza-like illness.

Specifically, the present report has the following objectives:

- To provide an update of the impact of influenza-like illness on the Winnipeg hospital system by examining the most recent year of available data;

- To describe the patients hospitalized for influenza-like illness. For example, how old are they? Where do they live?

- To examine the impact of influenza-like illness more broadly by describing its effect on other sectors of the Winnipeg health care system (physician visits, emergency department visits), as well as on medication use and mortality;

- To investigate whether it is possible to identify early warning signals of impending influenza activity, which might help Winnipeg hospitals anticipate and prepare for an impending influx of patients with influenza-like illness.

- To examine whether it is possible to measure influenza vaccination coverage in Manitoba.

Methods

Data sources used in the present report included: hospital discharge abstracts, physician claims data, pharmaceutical data, and vital statistics data. We also obtained viral testing data from the Cadham provincial laboratory. We examined patterns of influenza-like illness over the most recent years. The time frame differed somewhat for the different analyses, given the data available at the time this report was prepared. For hospital data, physician claims data, and pharmaceutical data, we included a four-year period, extending from July 1, 1995 to March 31, 1999. Vital statistics data from which we derive number and cause of death were available only up to December 1997. We are therefore presenting vital statistics data from July 1994 to June 1997 to show patterns over three flu seasons.

For each study year, we tracked influenza-like illness on a weekly basis for: the average number of patients in hospital per day (we refer to this as the inpatient census), hospital admissions, ambulatory visits, emergency room visits, drug prescriptions (antibiotics and amantadine, a drug used for the prevention and treatment of influenza A), deaths, and viral tests for influenza A and B (both number and percent positive). Throughout the report, we describe patterns of influenza-like illness in relation to the hospital flu pressure period, defined according to two criteria: 1) the census had to rise to at least one standard deviation above the mean and 2) it also had to rise to two standard deviations above the mean for at least one week.

As the complications of influenza are predominately respiratory in nature (Nicholson, 1998), and similar to previous research (e.g., Fedson, 1992), we defined influenza-like illness in terms of three respiratory diagnostic categories: pneumonia and influenza (ICD-9-CM codes 480 – 487), acute respiratory diseases (codes 460 – 466; e.g., acute bronchiolitis and acute bronchitis) and chronic obstructive pulmonary disease and allied conditions (codes 490 – 496; e.g., asthma, chronic bronchitis).

Findings

The Impact of Influenza-Like Illness on the Hospital System

A seasonal increase in the number of patients in hospital with influenza-like illness emerged. Periods when the inpatient census for influenza-like illness was unusually high –we refer to these as the hospital flu pressure periods – occurred anytime between late December and April. The duration of flu pressure periods differed considerably across the four study years, lasting from five weeks (1998-99) to 15 weeks (1996-97).[1]

Increasingly higher peaks in the census for influenza-like illness were observed across the four study years. The average daily number of inpatients with influenza-like illness during the peak weeks rose from 156 in 1996-97 to 217 in 1997-98 to 258 in 1998-99. In 1998-99, for example, this represented a 155% increase over the average daily number of inpatients with influenza-like illness during the non-flu pressure period. The increasingly higher peak was driven by patients aged 75 and above.

While the large spike for influenza-like illness in 1997-98 can be explained in terms of a relatively poor match between the influenza vaccine and influenza strain, it is not clear why the peak in 1998-99 was even higher, particularly since the vaccine to strain match was good during that year. It cannot be solely attributed to the aging population, but may simply reflect an unusual year. Continued monitoring of influenza-like illness in the hospital system is necessary to determine whether this reflects a real trend.

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[1] Study years are defined here from July to June.

Who are the Patients Hospitalized for Influenza-Like Illness?

About half of individuals admitted for influenza-like illness were aged 65 or above (54% of admissions, as averaged across the four years). The proportion of seniors and, particularly, individuals aged 75 and above admitted for influenza-like illness increased steadily over the four study years. While 29.7% of patients admitted for influenza-like illness were 75 years and above in 1995-96, the proportion rose to 40.3% in 1998-99. The proportion of patients with influenza-like illness who had major comorbidity and complications also increased – from 13.3% in 1995-96 to 18.4% in 1998-99.

The majority of seniors (aged 65+) admitted for influenza-like illness lived at home (75% in 1998-99), followed by patients living in seniors' residences (18%) and PCH residents (7%). However, admission *rates* (age and sex standardized) were higher among seniors living in seniors' residences than among their counterparts living at home and were as high or even higher than admission rates among PCH residents.

The System-Wide Impact of Influenza-Like Illness

Seasonal patterns also emerged for ambulatory visits for influenza-like illness. For example, in 1998-99, the number of ambulatory visits for influenza-like illness per week peaked at 14,046 in January, markedly up from an average of 7,821 visits per week during the non-flu pressure period (an 80% increase). The *total* number of ambulatory visits did not increase systematically during the winter months, suggesting that the ambulatory care system is functioning at maximum capacity. Given that physicians can only see so many patients on a given day, what changes during the winter is the patient mix, with proportionally more patients with influenza-like illness being treated.

A marked decrease in the total number of ambulatory visits occurred over the Christmas/New Year's holidays. The total number of visits per week dropped by as much as 31,000 from the week prior to Christmas to the Christmas week. At the same time, a slight increase was observed in emergency room visits.

Emergency room visits and antibiotic and amantadine prescriptions for, as well as deaths due to, influenza-like illness also displayed seasonal variation. In 1998-99, for instance, the number of emergency room visits for influenza-like illness more than tripled during the peak week in December, as compared to the average weekly number of visits during the non-flu pressure period. Similarly, in 1998-99, the number of antibiotic prescriptions dispensed increased substantially, up from an average of 6,000 during the non-flu pressure period to 10,543 during the peak week (a 76% increase). A relatively large number of prescriptions was dispensed to children aged zero to 14 – 2,196 per week (as averaged across the four study years), compared to 3,616 per week dispensed to individuals aged 15-64 and 709 to persons aged 65 and above.

Is a Warning System Possible?

The percent positive viral tests for influenza A and B systematically preceded hospital flu pressure periods by one to 14 weeks. Similarly, increased activity in the ambulatory care system and emergency departments due to influenza-like illness, as well as increases in antibiotic prescriptions, occurred one to 13 weeks prior to flu pressure periods. These findings suggest that although a warning system that could help hospitals anticipate an influx of flu patients appears possible, a more active surveillance system than was in place would have to be developed (and tested) to provide a more precise estimate of impending influenza activity.

Influenza Vaccination

Our ability to determine vaccination coverage in Manitoba has declined over the years, as fewer influenza vaccinations are provided by physicians and, hence, recorded in the physician claims database. In 1993/94, 61% of influenza doses distributed in Manitoba were captured by physician claims, as compared to 42% in 1998/99. The decline in physician-administered flu vaccine has been offset by other programs, particularly public health. An information system that keeps track of influenza vaccinations outside the physician fee-for-service system was not available for the study years (i.e, 1995-96 to 1998-99). Such a system was implemented only recently in the fall of 2000.

Although there were no adequate administrative data available to determine vaccination coverage in Manitoba for the study years, National Population Health Survey data (a Statistics Canada survey involving a representative sample of Manitobans conducted in 1996-97) indicate that 52% of individuals aged 65 and above received a flu shot. This is well below the recommendations of the National Advisory Committee on Immunization (1999) that influenza vaccine programs should attain vaccination levels of at least 90% among high-risk groups.

Conclusions

- Influenza-like illness places considerable pressure on the hospital system each year. The impact of influenza-like illness should be continuously monitored to determine if pressures are increasing over time.

- A large proportion of patients admitted for influenza-like illness are 65 years old and above (54% on average). Moreover, the proportion (and number) of 75+ year olds admitted for influenza-like illness increased steadily from 1995-96 to 1998-99. Influenza vaccination is an effective method to reduce hospitalization for influenza-like illness. Numerous influenza vaccination initiatives were launched in 1999/2000 and 2000/2001 by the Regional Health Authorities (funded by the Communicable Disease Control Unit of Manitoba Health) including, for example, a comprehensive public education campaign (radio/television spots and advertisements in newspapers, bus shelters, and transit buses). Continued emphasis should be placed on enhancing/maintaining influenza vaccination coverage in Manitoba.

- This report further shows that hospital admission rates for influenza-like illness were much higher for seniors (aged 65+) living in seniors' apartments than for their counterparts living in the community. This suggests that particular emphasis should be placed on targeting seniors' residences for influenza vaccination clinics. As part of the enhanced vaccination initiatives launched in the fall of 1999, vaccination clinics are now being held in seniors' residences in Winnipeg. The effectiveness of these clinics will have to be evaluated.

- Continued emphasis should also be placed on targeting health care workers for influenza vaccination, such as those working with seniors, as influenza vaccination is less effective for the elderly, particularly the frail elderly, than young healthy individuals (Centers for Disease Control and Prevention, 2000). Influenza vaccination among health care workers has been shown to decrease mortality among elderly patients in long-term care hospitals (Carman et al., 2000).

- Wider use of influenza vaccination than is currently the case might also be useful. In the United States, immunization of all adults over 50 years of age is now recommended (Centers for Disease Control and Prevention, 2000). Given that young children are at increased risk of hospitalization during flu seasons (Izurieta et al., 2000; Neuzil et al., 2000), influenza vaccination might also be considered for children. In Ontario, influenza vaccine was, indeed, for the first time available to all residents (not only those at highest risk) in the fall of 2000.

- Appropriate outbreak control strategies in PCHs (and possibly seniors' apartments) are essential. For example, the correct dose of amantadine may be placed on each PCH resident's chart in the fall and administered by standing order after an outbreak has occurred.

- At the time this report was prepared, the data to describe influenza vaccination coverage in Manitoba were inadequate. Moreover, our capacity to determine vaccination rates had declined over the years, as the approach to providing influenza vaccination became increasingly fragmented. In order to enhance influenza vaccination coverage in Manitoba and monitor its effectiveness, Manitoba Health expanded the existing Manitoba Immunization Monitoring System (MIMS) as of 2000/2001. While MIMS was originally designed to track immunizations among children, the enhanced MIMS now also covers adults. As such, influenza (and pneumococcal) vaccine administered through public health will be captured. Physician-based immunization data for adults will also be transferred into MIMS to allow more comprehensive analysis of vaccine coverage. An important first step will be to evaluate how complete the new MIMS data are. Influenza vaccination coverage (and coverage of the newly introduced pneumococcal vaccination) in Manitoba can then be examined. The effectiveness of influenza (and pneumococcal) vaccination in preventing illness and hospitalization should also be investigated.

- Besides their impact on the hospital system, influenza-like illness also had a substantial effect on the ambulatory care system and emergency departments. Given that the number of ambulatory visits declines markedly over the Christmas/New Year's holiday season, the question of whether flexibility could be built into the ambulatory care system to increase capacity (or decrease capacity less than is currently the case) over the holiday season should be explored. The extent to which closure of physician offices places pressure on emergency rooms also warrants examination.

- The number of antibiotic prescriptions dispensed displayed substantial seasonal variation. The question of how appropriate antibiotic use is for certain respiratory illnesses has been raised in the research literature (Wang et al., 1999). This issue is an important one that should be systematically examined in future research.

- Is a warning system possible that could help hospitals anticipate impending influenza activity? Our data suggests yes. However, such a warning system would require more active influenza surveillance than was the case when this report was prepared. Since this report was prepared, the influenza surveillance system in Manitoba has been further enhanced, with additional sentinel physicians monitoring the incidence of influenza-like illness and taking swabs for viral testing. The role of sentinel physicians is clearly critical and continued involvement of physicians should be sought.

  School absenteeism, whereby public health nurses take samples from children once the absenteeism rate during the flu season reaches 10% or more, is now also systematically tracked on a weekly basis. The effectiveness of this school surveillance will have to be evaluated. Systematic surveillance of other non-specific indicators, such as emergency room activity might also be considered.

- In order to assess the impact of influenza-like illness on the entire hospital system, it is important to have complete data not only for hospital inpatients, but also for patients who visit emergency rooms. Current emergency room data are limited, however. Implementation of an information system that would capture all seven emergency departments in Winnipeg should be considered. Such as system would ideally provide individual-based information of all emergency room contacts, including diagnoses.

- Implementation of an effective surveillance system should help hospitals anticipate flu pressure periods. This could allow timely initiation of various management strategies, such as discharging patients who are no longer acute or enhancing home care services in order to prevent hospital overcrowding.

INTRODUCTION

Hospital overcrowding has been a problem in Winnipeg, and other Canadian cities, for many years. In 1999, the Manitoba Centre for Health Policy and Evaluation (MCHPE) examined the issue of overcrowding in Winnipeg hospitals by studying patterns of hospital use over eleven years (fiscal years 1987/88 to 1997/98) (Menec et al., 1999). Key findings of the report *Seasonal Patterns of Winnipeg Hospital Use* were that high-pressure periods occurred in nine of the eleven study years and that these high-pressure periods were driven by emergent/urgent medical patients. Moreover, high-pressure periods coincided with an increase of emergent/urgent medical patients with influenza-like illness, indicating that influenza outbreaks place a great deal of strain on the hospital system and were, to a large extent, responsible for high-pressure periods.

These findings were quite striking and raised a number of questions, such as: Who are the patients hospitalized for influenza-like illness? Is there any way to anticipate flu epidemics, which would help hospitals plan for an impending influx of patients with influenza-like illness? How many people are vaccinated for influenza in Manitoba and is there a need to improve vaccination rates? These questions suggested the need to further investigate the impact of influenza-like illness on Winnipeg hospitals, as well as on other parts of the health care system. The Manitoba Centre for Health Policy and Evaluation was therefore asked by Manitoba Health to conduct a follow-up to the *Seasonality* report that focuses specifically on influenza-like illness.

Influenza – A Brief Overview of the Literature

Influenza and its Consequences

Influenza is caused by influenza A and B viruses and spreads from person to person via virus-laden respiratory secretions (Nicholson, 1998). Symptoms of influenza are fever, cough, runny nose, muscle aches, and profound exhaustion. In children, influenza may be accompanied by nausea, vomiting or diarrhea. Influenza can give rise to a wide range of complications, most of which are respiratory in nature (Nicholson, 1998). They include, among others, pneumonia, acute bronchitis, croup, bronchiolitis, and exacerbation of chronic bronchitis and asthma. Besides respiratory complications, influenza has also been linked to cardiovascular diseases, such as congestive heart failure and myocardial infarction, as well as to a variety of other diseases such as otitis media in children (Nicholson, 1998).

Influenza is an important cause of morbidity and death. In Canada, 70,000 to 75,000 hospitalizations and approximately 6,700 deaths each year are attributed to influenza and pneumonia (Health Canada, 1993). Influenza and pneumonia are the sixth leading causes of death in Canada (Statistics Canada, 1997). The cost of treating patients with influenza and complications of influenza is substantial. A study conducted in the United States indicates that the cost of excess hospitalizations during the 1989-90 flu epidemic was over U.S. $1 billion (McBean et al., 1993).

Individuals aged 65 and above are at particular risk of experiencing complications of influenza. Studies indicate that about 90% of excess deaths due to influenza occur among this age group (Ashely et al., 1991; Lui & Kendal, 1987; Tillett et al., 1980). This is, in part, due to the fact that a large proportion of older adults have chronic medical conditions, which are a risk factor for death from and hospitalization for influenza and pneumonia. For example, the death rate was found to be 20 times higher among individuals aged 65 and above with high-risk conditions than among their counterparts with no high-risk conditions (Barker & Mullooly, 1982). Similarly, studies show that 70% to 90% of people aged 65 and above who were hospitalized for influenza and pneumonia had chronic conditions (Foster et al., 1992; Ohmit & Monto, 1995).

Influenza Vaccination

Influenza vaccination is the most effective preventive measure to attenuate influenza and the complications arising from it in high-risk populations, such as seniors. Studies focusing on seniors indicate that vaccination reduces hospitalization for pneumonia and influenza by 17% to 57% and hospitalizations for all respiratory conditions by 17% to 39% (see Gross et al., 1995 and Nichol, 1998 for reviews). Hospitalizations for congestive heart failure were reduced by 27% to 38%. Influenza vaccination also reduced influenza-related mortality by 41% and all cause mortality by 27% to 75% (Nichol, 1998). Cost-effectiveness studies show that influenza vaccination provides cost savings. For example, Nichol et al. (1994) showed that reduced hospitalizations for pneumonia and influenza due to influenza vaccination translated into savings of U.S. $117 per person per year.

The Canadian National Advisory Committee on Immunization (1999) recommends influenza vaccination for people at high risk. This includes:

- People aged 65 and above;
- Adults and children with certain chronic medical conditions, such as asthma, diabetes, and cancer;
- Nursing home residents;
- Health care workers who are in contact with people in the high-risk groups;
- Household contacts of people at risk who either cannot be vaccinated or may respond inadequately to vaccination.

In the United States, these target groups have been expanded to include persons aged 50 to 64 (Centers for Disease Control and Prevention, 2000). This age group was added because a substantial proportion of individuals between the ages of 50 and 64 have one or more chronic medical conditions. Research also shows that young children are at increased risk of hospitalization during flu seasons (Izurieta et al., 2000; Neuzil et al., 2000), suggesting that influenza vaccination might be considered for this age group as well.

Influenza vaccination is available free of charge in Manitoba for the target groups identified by the National Advisory Committee on Immunization. Vaccination coverage is high in personal care homes (PCHs) in Manitoba – 80% to 88%, according to studies conducted in rural Regional Health Authorities in 1993-94 and 1996-97, respectively (Buchan, 1998; Macdonald, 1994). Little current information is available in Manitoba on influenza vaccination coverage among other high-risk groups. One study, conducted during the fall/winter of 1990/91, showed a coverage of 39.9% among Manitobans aged 65 and above (Duclos & Hatcher, 1993). Another study carried out in Manitoba's Interlake region during the fall of 1994 showed a vaccination level of close to 50% for individuals aged 65 and above (Macdonald et al., 1996). These figures, while in the range of those for other provinces (Duclos & Hatcher, 1993), are low compared to the National Advisory Committee on Immunization (1999) recommendations that influenza vaccine programs should attain vaccination coverage of at least 90% among high-risk groups.

People may fail to receive influenza vaccination for a variety of reasons, ranging from fear of adverse reactions to believing that the vaccine is either ineffective or unnecessary (Frank et al., 1985; Nichol et al., 1996, 1992). To be effective, influenza vaccination programs have to address these fears and perceptions both among health care providers and the general public. A variety of approaches to increasing influenza vaccination levels have been assessed (see Gyorkos et al., 1994 for a review). Educational pamphlets (Bloom et al., 1988), reminder letters to eligible individuals (McDowell et al., 1986; Frank et al., 1985), chart reminders to physicians or nurses (Davidson et al., 1984; Chambers et al., 1991), and standing orders for nurses to vaccinate patients during a clinic visit or hospital stay (Margolis et al., 1988; Fedson et al., 1983) have all been shown to increase vaccination coverage.

Standing order programs for influenza vaccination are particularly effective in improving vaccination coverage. Standing order programs authorize nurses to administer influenza vaccination according to a pre-approved protocol without a physician's examination. In one study, for example, standing orders achieved a 40.3% vaccination level among high-risk hospitalized patients, compared to 17% with physician chart reminders and 9.6% with a physician education program (Crouse et al., 1994; see also Gyorkos et al., 1994 for a review). In the United States, the Advisory Committee on Immunization Practices (2000) now recommends implementation of standing order programs not only in long-term care facilities and hospitals, but also in other settings, such as home health-care agencies and adult workplaces.

In Winnipeg, a large influenza vaccination campaign was launched in the fall of 1999. Strategies used to increase influenza vaccination included a media campaign (e.g., posters, pamphlets, and newspaper ads) and increased vaccination clinics for seniors living in seniors' residences, home care workers, and hospital and PCH health care providers (Henteleff, 1999). The vaccination campaign was successful in improving coverage among target populations. For example, vaccination coverage among Winnipeg PCH health care workers increased by 50% and coverage of Winnipeg home care workers by 43%, as compared to the previous year. Public health vaccination clinics attracted 79% more seniors than in the previous year (Henteleff, 1999).

Influenza Surveillance

The purpose of influenza surveillance is to collect, analyze, and disseminate information on influenza activity. This information should help with the assessment, prevention, and control of morbidity and mortality associated with influenza and complications arising from it (Watson, 1998). Influenza activity is monitored in Canada by the provinces, as well as nationally by the Laboratory Centre for Disease Control (LCDC). World-wide, an international network established by the World Health Organization provides surveillance of influenza viruses.

Influenza surveillance typically involves general practitioners who act as sentinel physicians by reporting on influenza-like illness activity and taking samples for virus isolation. In Manitoba, as of the fall of 2000, 23 sentinel physicians report on influenza-like illness activity on a weekly basis between the months of October and May. As influenza tends to spread first among children and then among the general population (Glezen & Couch, 1978; Gruber, 1998), influenza surveillance in schools has also been implemented. Once schools have an absenteeism rate of 10% or more during the influenza season, public health nurses attempt to obtain six throat swabs from children who are still in school, but who are starting to feel unwell.

All samples are analyzed at the Cadham provincial laboratory. Influenza activity is compiled by the Communicable Disease Control Unit at Manitoba Health on a daily basis. Influenza information from across the country is published by LCDC on a weekly basis in the FluWatch report, which presents the number of and percentage of positive viral tests, rates of influenza-like illness reported, and extent of influenza activity in each province.

Besides surveillance of specific indicators of influenza activity, non-specific indicators are also being used in other countries, such as absenteeism of employees from work, drug consumption, hospital activity, and emergency room visits (Dab et al., 1991; Hutchinson et al., 1996; Quenel et al., 1994). Sales of nonprescription cold remedies (Welliver et al., 1979) and nurse hot line calls (Rodman et al., 1998) have also been proposed as potentially useful methods of influenza surveillance.

Objectives of Report

In sum, influenza represents a major health risk, particularly for high-risk individuals, such as people aged 65 and above or persons with certain chronic health conditions. It also places substantial pressure on the health care system each year. In the present report, we focused on influenza-like illness – respiratory illnesses that can arise as complications of influenza – and examine their impact on the Winnipeg hospital system, as well as other parts of the Winnipeg health care sector. We focused on Winnipeg, as pressures in the hospital system due to flu activity arise in the city, but not rural areas. A major theme of the report was to investigate whether it might be possible to develop a warning system that could help anticipate influenza activity and might, therefore, help prevent hospital overcrowding. For example, if physician visits due to influenza-like illness were to systematically increase prior to pressure periods in the hospital system, then monitoring of the ambulatory care system might be useful.

The issue of hospital bed shortages during the flu season is clearly a complex one. Temporarily opening more beds, one of the options that is frequently proposed to deal with seasonal bed shortages, is not as simple as it sounds. Beds cannot be opened on short notice unless nursing staff is also available. The problem with nursing shortages and ways to increase the number of nurses has been the topic of much discussion in recent months (Spurgeon, 2000).

Warning of impending influenza activity might allow other measures to be taken in anticipation of a pressure period, however, such as ensuring that non-acute patients are discharged to long-term care facilities or home care in a timely fashion to free up beds. Medical admissions might also be scrutinized to ensure that patients admitted prior to an impending pressure period indeed need to be in an acute care hospital or whether they might be cared for in alternative settings. Other strategies might also be used. Edmonton and

Saskatoon, for example, have home care available 24 hours a day during flu pressure periods. During the 1997-98 flu pressure period, scheduled surgery was cancelled where possible in Winnipeg as a crisis management procedure while, simultaneously, outpatient surgery was increased. To the extent that flu pressure periods can be anticipated, this might help in the planning of such shifts in surgical schedules.

Specifically, therefore, the present report has the following objectives:

- To provide an update of the impact of influenza-like illness on the Winnipeg hospital system by examining the most recent year of available data;

- To describe the patients hospitalized for influenza-like illness. For example, how old are they? Where do they live?

- To examine the impact of influenza-like illness more broadly by describing its effect on other sectors of the Winnipeg health care system (physician visits, emergency department visits), as well as on medication use and mortality;

- To investigate whether it is possible to identify early warning signals of impending influenza activity, which might help Winnipeg hospitals anticipate and prepare for an impending influx of patients with influenza-like illness.

- To examine whether it is possible to measure influenza vaccination coverage in Manitoba.

METHODS

Data Sources

We used several data sources in the present report, including: hospital discharge abstracts, physician claims data, pharmaceutical data, and vital statistics data. Data drawn from hospital discharge abstracts covered all Winnipeg acute care hospitals. For fiscal years 1995/96 to 1997/98 this included the Concordia Hospital, Grace General Hospital, Health Sciences Centre, Misericordia General Hospital, St. Boniface General Hospital, Seven Oaks General Hospital, and Victoria General Hospital. As the Misericordia General Hospital was transformed into a long-term care institution in the fall of 1998, hospital data for fiscal year 1998/99 are based on the remaining six acute care hospitals.

We also obtained viral testing data from the Cadham laboratory, the provincial laboratory where all testing is done (see below for details). Lastly, we used the 1996-97 phase of the National Population Health Survey (NPHS). The NPHS is a Statistics Canada survey involving a representative sample of participants from all provinces.

Viral Testing Data

Viral testing data were obtained from the Serology Virus Isolation sections of the Cadham Provincial Laboratory for the years 1992/93 to 1998/99. The data pertained to all specimens that had been tested for influenza A, B or Parainfluenza in the province. We focused here on specimens from Winnipeg residents only, as they are the most relevant in the context of the present report, which focuses on the Winnipeg health care system. Records for which the test results were “unclear” were excluded, as were tests for Parainfluenza.

Study Period

We examined patterns of influenza-like illness over the most recent years. The time frame differed somewhat for the different analyses, given the data that were available at the time this report was prepared. For hospital data, physician claims data, and pharmaceutical data, we included a four-year period, extending from July 1, 1995 to March 31, 1999. Vital statistics data from which we derive number and cause of death were available only up to

December 1997. We are therefore presenting vital statistics data from July 1994 to June 1997 to show patterns over three flu seasons.

We defined the study years from July 1 to June 30, in order to avoid including two flu seasons in the calculation of averages and standard deviations, as would be the case if they were based on the fiscal or calendar year. We use the notation 1995-96, 1996-97, 1997-98, and 1998-99 for our July-June study years.[2] Because fiscal year 1998/99 was the most recent year for which hospital discharge abstracts, physician claims data, and pharmaceutical data were available, 1998-99 ends on March 31. Calculations of means and standard deviations are therefore based on nine months of data only (July to March) for this year.

Definitions

Influenza-Like Illness

As the complications of influenza are predominately respiratory in nature (Nicholson, 1998), we defined influenza-like illness in terms of three respiratory diagnostic categories: pneumonia and influenza (ICD-9-CM codes 480 – 487), acute respiratory diseases (codes 460 - 466) and chronic obstructive pulmonary disease and allied conditions (codes 490 - 496).[3]

Note that, consistent with the *Seasonal Patterns of Winnipeg Hospital Use* report (Menec et al., 1999), hospital cases with influenza-like illness included only emergent/urgent medical patients. Medical cases were identified using the DRG (Diagnostic Related Group) classification system, with emergent/urgent further identified based on the admission status reported on the hospital discharge abstract. Among these emergent/urgent medical cases, patients were then identified whose most responsible diagnosis included one of the ICD-9-CM codes defining influenza-like illness. The most responsible diagnosis is the diagnosis that was deemed, upon discharge, as most responsible for the patient's hospital stay. Table 1

[2] This notation is used to differentiate our July to June study years from the fiscal year (April 1 to March 31), which we write with a forward slash (e.g., 1995/96).

[3] It should be noted that this definition differs somewhat from the one used in the *Seasonal Patterns of Winnipeg Hospital Use* report, where we included other respiratory disease diagnoses. The average daily census for influenza-like illness reported here will therefore differ slightly from that reported in the earlier report.

shows a list of specific diagnoses that fall into each of the three broad diagnostic categories and, for illustrative purposes, the number of hospital admissions for each category for 1998.

Table 1: Admission Diagnoses for Influenza-Like Illness, 1998

Pneumonia and Influenza (ICD-9-CM codes 480-487)	# of Admissions
Pneumonia, organism unspecified (486)	1392
Pneumococcal pneumonia (481)	116
Bronchopneumonia, organism unspecified (485)	83
Other bacterial pneumonia (482)	71
Viral pneumonia (480)	59
Influenza (487)	58
Other	9
Chronic Obstructive Pulmonary Disease and Allied Conditions (ICD-9-CM codes 490 – 496)	
Asthma (493)	735
Chronic bronchitis (491)	588
Chronic airway obstruction, not elsewhere defined (496)	334
Emphysema (492)	121
Bronchiectasis (494)	40
Bronchitis, not specified as acute or chronic (490)	32
Acute Respiratory Infections (ICD-9-CM codes 460-466)	
Acute bronchiolitis (466.1)	187
Acute bronchitis (466.0)	85
Acute upper respiratory infections with multiple and unspecified sites (465)	45
Acute laryngitis and tracheitis (464)	38
Acute tonsillitis (463)	24
Other	16

Hospital Flu Pressure Periods

For each study year, we determined when Winnipeg hospitals were experiencing a substantial increase in the average daily number of patients with influenza-like illness. A “substantial” increase was defined according to two criteria: 1) the census had to rise to at least one standard deviation above the mean and 2) it also had to rise to two standard deviations above the mean for at least one week. The time period during which the census remained above one standard deviation and at least once rose above two standard deviations we refer to as the flu pressure period.

For example, in 1998-99 the census rose above the mean plus two standard deviations the week of December 26th (see Figure 1). It remained above the mean plus two standard deviations for a total of four weeks and above the mean plus one standard deviation for one week. After that, the census dropped below our threshold (below mean plus one standard deviation). For that year, therefore, we describe the flu pressure period as lasting five weeks, starting the week of December 26th and lasting until January 29th. As noted above, standard deviations and means were calculated based on a July 1 to June 30 year throughout this report (except for 1998-99 which ends on March 31).

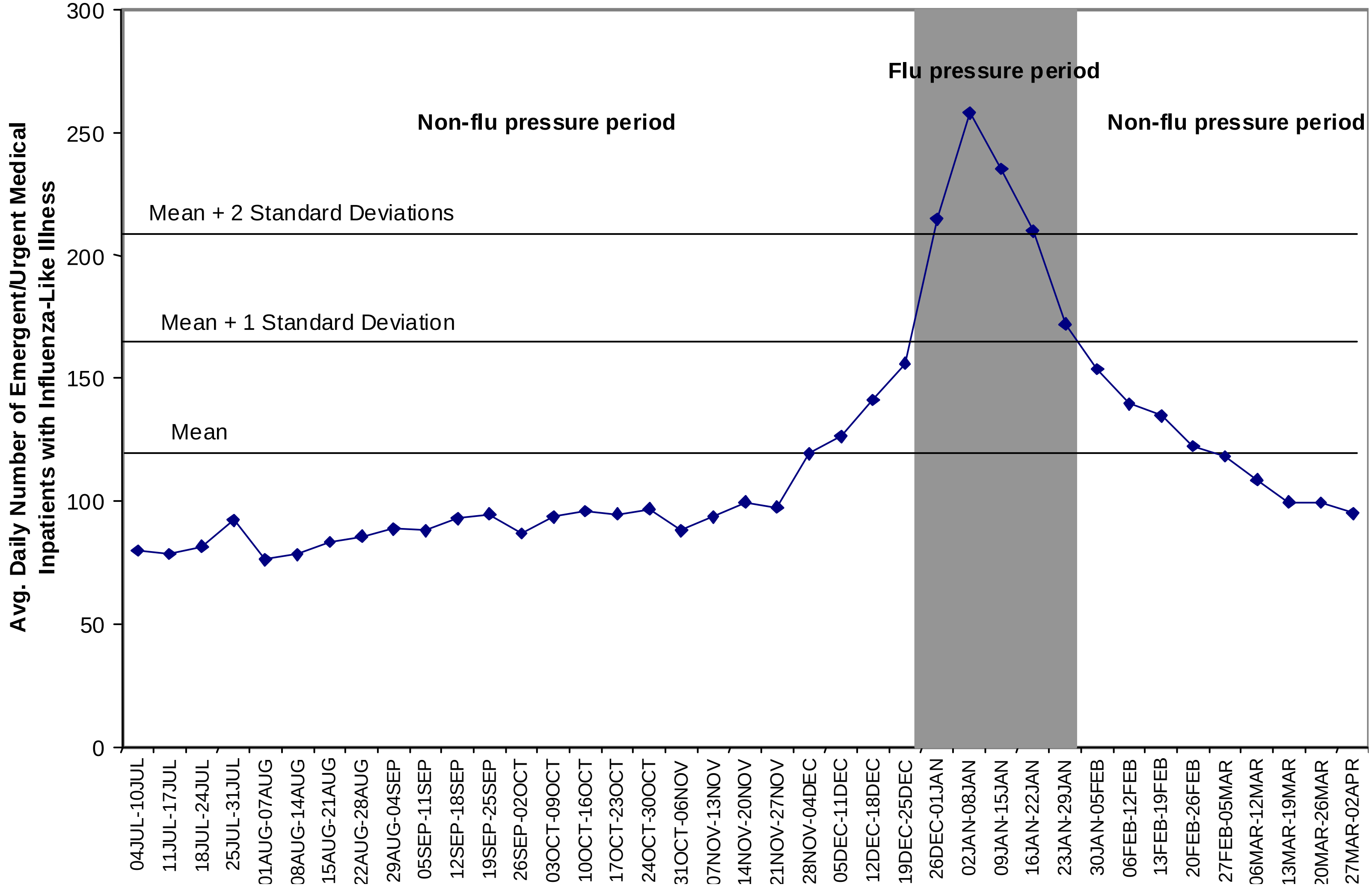
Non-Flu Pressure Periods

We defined the non-flu pressure periods as the weeks that fell outside the flu pressure period (as defined above). For example, in 1998-99, the 25 weeks prior to the hospital flu pressure period and the nine weeks following it were defined as non-flu pressure periods (see Figure 1). We used the non-flu pressure period as a baseline against which to compare patterns of health care use during the flu pressure period. In general, we are comparing mean figures during the non-flu pressure periods to either the peak week or the mean during the flu pressure period. It is important to emphasize that throughout this report, flu pressure and non-flu pressure periods are defined based on the hospital inpatient census.

Flu Season

In order to compare the patients admitted for influenza-like illness over the study years, we defined a standard flu season, a 13-week period spanning January 1 to March 31. In each year, the week closest to January 1 was defined as Week 1, the beginning of the flu season. We decided to use a standard flu season period, in order to allow easier comparisons across the years than if we were to use the hospital flu pressure periods, which varied in length quite dramatically over the four study years. January, February and March were chosen because they include the hospital flu pressure periods, which tended to fall between January and April. As 1998-99 data were available only up to March 31, defining the flu season up to March provided consistency across all years.

Figure 1: Defining Hospital Flu Pressure Periods vs. Non-Flu Pressure Periods, 1998-99



Weekly and Monthly Patterns

To examine patterns of health care use and mortality across each study year, we are presenting data for each week (or month in the case of deaths). Weeks were defined from Saturday to Friday so that weekends (and holiday weekends) would remain within the same week. Months were adjusted to correspond to 30 days to allow meaningful comparisons. Given that our study years were defined from July to June, we let the first week of each year begin on the Saturday closest to July 1st, with the last week being as close to June 30 as possible. This means that the first week of a particular study year may include the last one to three days of June, and the last week may extend a few days into July in the case of some years.

Study Measures

Number of Hospital Admissions counts the number of inpatient admissions to the seven (or six in 1998-99) Winnipeg acute care hospitals. The number of admissions are provided here for each week of the year.

Hospital Separation refers to the discharge or death of an inpatient.

Hospital Inpatient Census is a count of the number of patients in hospital on a given day. It was calculated based on admissions and separations data by counting the number of patients that had an admission date earlier than or equal to a chosen date *and* a separation date greater than that date. The average daily census in a given week was calculated by taking an average of the weekly inpatient census. The validity of this measure has been demonstrated in a previous report (see Menec et al., 1999).

Ambulatory Physician Visits included office visits, consultations, outpatient department visits, and visits to patients in personal care homes. Visits to hospital in-patients were excluded, and so were emergency room visits. Ambulatory care delivered as part of a global tariff, such as pre-natal and post-partum care visits, were also excluded, as we do not know how many such visits occurred.

Comorbidity and Complications

Comorbidity, together with complications of care affect the complexity of hospital care required to treat a given patient. In the present report, the RDRG (Refined Diagnostic Related Group) classification system was used to identify comorbidities and complications. The RDRG program (Fetter and Freeman, 1989, Version 9) classifies cases into levels of severity and complexity based on the impact they are likely to have on hospital resources use: 1) those where comorbidity and complications were likely to have no or little impact on hospital resource use; 2) those for which comorbidity and complications were likely to have a moderate impact; and 3) those where comorbidity and complications were likely to have a major impact.

Number of Comorbidities

Comorbidity refers to medical conditions that exist in addition to the main reason for hospitalization (usually recorded as the “most responsible diagnosis” on hospital discharge abstracts). The type and number of comorbid conditions provide an indication of the health status and risk of death of patients (Charlson et al., 1987). We used counts of comorbid conditions, with patients classified as having none, one, two, or three or more comorbid conditions known to increase the risk of death.

Drug Prescriptions Dispensed

We examined the number of antibiotic and amantadine (a drug used for the prevention and treatment of influenza A) prescriptions dispensed using the database of the Drug Program Information Network (DPIN). The DPIN database includes all prescriptions dispensed for out-of-hospital usage by Manitoba residents, including personal care home residents. It also includes most prescriptions for outpatient use dispensed by hospitals. Not included are drugs dispensed to Status First Nations through nursing stations, which are located primarily in the far north of the province.

“Drug prescriptions dispensed” counts the number of times prescriptions are obtained. For the present purposes, we examined prescriptions for individuals who had been diagnosed with influenza-like illness at any time during the year during an ambulatory visit, as determined from the physician claims data. It is important to note that we did not specifically link antibiotic and amantadine prescriptions to influenza-like illness diagnoses. Thus, it is possible that these drugs were prescribed for reasons other than influenza-like illness.

Antibiotic prescriptions were identified using the Anatomical Therapeutic Chemical (ATC) classification system, focusing on codes beginning with "J" (general antiinfectives for systemic use) administered via oral and intramuscular routes only. In 1998-99, seven drugs accounted for 71% of all antibiotics dispensed, including: amoxicillin (40%), erythromycin (14%), sulfamethoxazole and trimethoprim (8%), phenoxymethylpenicillin (5%), and clarithromycin (4%).

Emergency Room Visits were identified from the physician claims database. Visit patterns were examined for the Health Sciences Centre and St. Boniface General Hospital only, as emergency room physicians at the other hospitals are paid on a salary basis and, therefore, do not file claims. In the case of the Health Sciences Centre, both paediatric and adult emergency room visits were included. A report by Barer et al. (1994) showed that the Health Sciences Centre (adult and paediatric) and St. Boniface General Hospital treat close to half (48%) of the emergency cases in Winnipeg.

Influenza Vaccination was determined from the physician claims database. Influenza vaccine administered in other contexts (e.g., through employer programs) or by other health care providers (e.g., public health nurses) is not recorded on an individual basis and therefore not captured.

Length of Hospital Stay was calculated for patients admitted to hospital for influenza-like illness versus other reasons. Median lengths of stay are reported here, as the median, unlike the mean, is not influenced by a few very long stays. The median is the middle point. For example, if the median length of stay is eight days this means that 50% of patients had lengths of stay longer than or equal to eight days and 50% had shorter stays.

Winnipeg Seniors' Residences

Addresses (postal codes) of seniors' residences in Winnipeg were obtained from the 1997 Winnipeg Seniors Housing Directory published by Age & Opportunity. Using Manitoba Health Research Data Repository data for 1997 containing postal code and age of each Manitoba resident during 1997, we examined the age distribution of the residents at each of the postal codes identified as seniors' residences. If more than 15% of the population were less than 55 years old at a given postal code, we excluded it from the list of seniors' residences. Other possible seniors' residences were excluded because it was determined from Canada Post postal directories that the postal code pertained to a series of addresses. Thus, while these postal codes may have contained seniors' residences, we could not be sure about the neighbouring residences with the same postal code. Overall, 111 of 130 (85%) of senior residences listed in the Winnipeg Seniors Housing Directory were included in the present report.

FINDINGS

The Impact of Influenza-Like Illness on the Hospital System

Seasonal Census and Admission Patterns for Influenza-Like Illness

Figure 2 shows the average daily number of emergent/urgent patients in hospital for influenza-like illness, that is the patient census, for years 1995-96 to 1998-99. Clearly apparent is the seasonal increase in inpatients with influenza-like illness during the winter months. The shaded areas represent times when the inpatient census for influenza-like illness was unusually high – we refer to this period as the flu pressure period (see definition in Methods section). Flu pressure periods occurred between late December and April. The duration of these pressure periods differed quite substantially over the years, lasting anywhere from five weeks (1998-99) to 15 weeks (1996-97). See Table 2 for the specific weeks during which the flu pressure periods (and peak weeks) occurred.

A particularly large increase in the census occurred in February of 1998, when the average daily census rose to 217 inpatients, up by 141% from the average daily census of 90 during the 1997-98 non-flu pressure period – that is, the weeks outside the flu pressure period. An even higher peak occurred in January of 1999 when the average daily census peaked at 258 inpatients, up by 155% from the overall daily average of 101 patients with influenza-like illness during the non-flu pressure period.

Figure 3 shows that this increasingly higher peak in the census for influenza-like illness was driven by individuals aged 75 and older. In 1997-98, the number of inpatients with influenza-like illness in this age group rose from an average of 49 per day to 85, a 73% increase. In 1998-99, there was a 128% increase (up from an average of 54 patients per day to 123). The number of patients aged 65 to 74 remained relatively constant over the four years and the number of paediatric patients and inpatients aged 15-64 increased only slightly during the most recent two flu peaks as compared to 1995-96 and 1996-97.

Figure 2: Avg. Daily Census for Influenza-Like Illness, 1995-96 to 1998-99

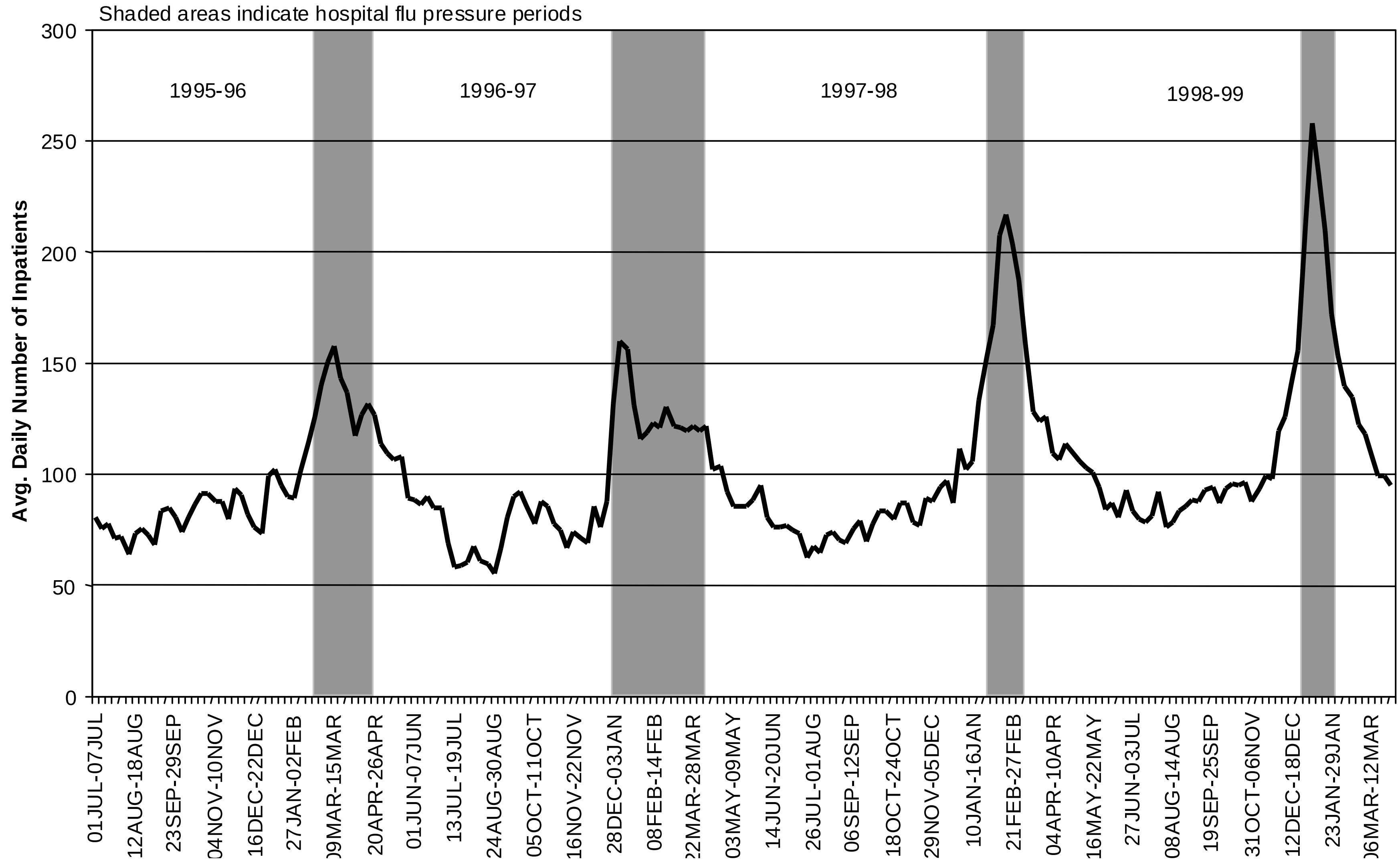


Table 2: Hospital Flu Pressure Periods and Peak Weeks

	Flu Pressure Period	Peak Week
1995-96	17 February - 26 April	9 March - 15 March
1996-97	28 December - 11 April	4 January - 10 January
1997-98	24 January - 13 March	14 February - 20 February
1998-99	26 December - 29 January	2 January - 8 January

The pattern for *admissions* for influenza-like illness closely mirrored that of the inpatient census, with substantial peaks during the winter months (see Figure 4). The number of admissions for influenza-like illness was particularly high during the last week of December of 1998, peaking at 216 admissions that week, compared to an average of 74 admissions per week during the non-flu pressure period (a 192% increase). This increase in admissions shows up in unusually high census levels during the subsequent week, as could be seen in Figure 2.

Figure 5 indicates that the seasonal peaks in patient census occurred for all three major diagnostic categories included in our definition of influenza-like illness: pneumonia and influenza, chronic pulmonary diseases, and acute respiratory diseases. For all three categories, the peaks occurred virtually during the same time period and for all three categories the peak was particularly high in 1998-99. Again, a similar pattern occurred for *admissions* (see Figure 6). Peaks are apparent for all three categories during the winter months and generally they coincided with each other. The exception is in 1996-97, when admissions for chronic pulmonary diseases and pneumonia and influenza peaked in January, but those for acute respiratory diseases in February.

Also readily apparent in Figure 6 is the increase in admissions for chronic pulmonary diseases that consistently occurred in September. A large proportion of these September admissions were children (ages 0 – 14) with asthma. In 1995-96, for example, 69% of all admissions for chronic pulmonary diseases during the September peak period were children with asthma. These seasonal patterns are likely due to a combination of children going back to school, which brings with it a greater probability of being exposed to various infectious agents, as well as increased levels of environmental irritants, such as dust from harvesting and smoke from stubble burning.

Figure 3: Avg. Daily Census for Influenza-Like Illness by Age Groups, 1995-96 to 1998-99

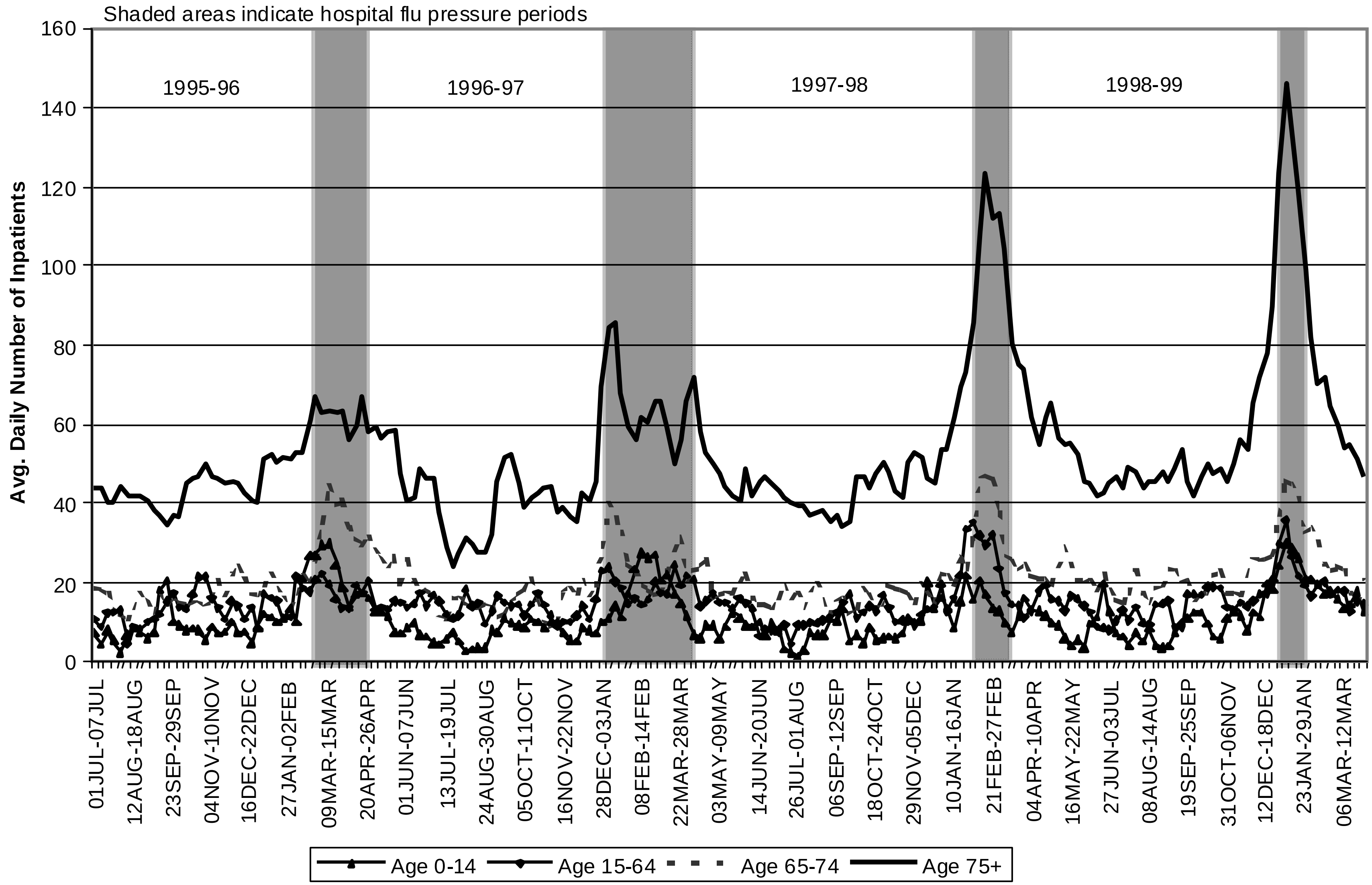


Figure 4: Weekly Admissions for Influenza-Like Illness, 1995-96 to 1998-99

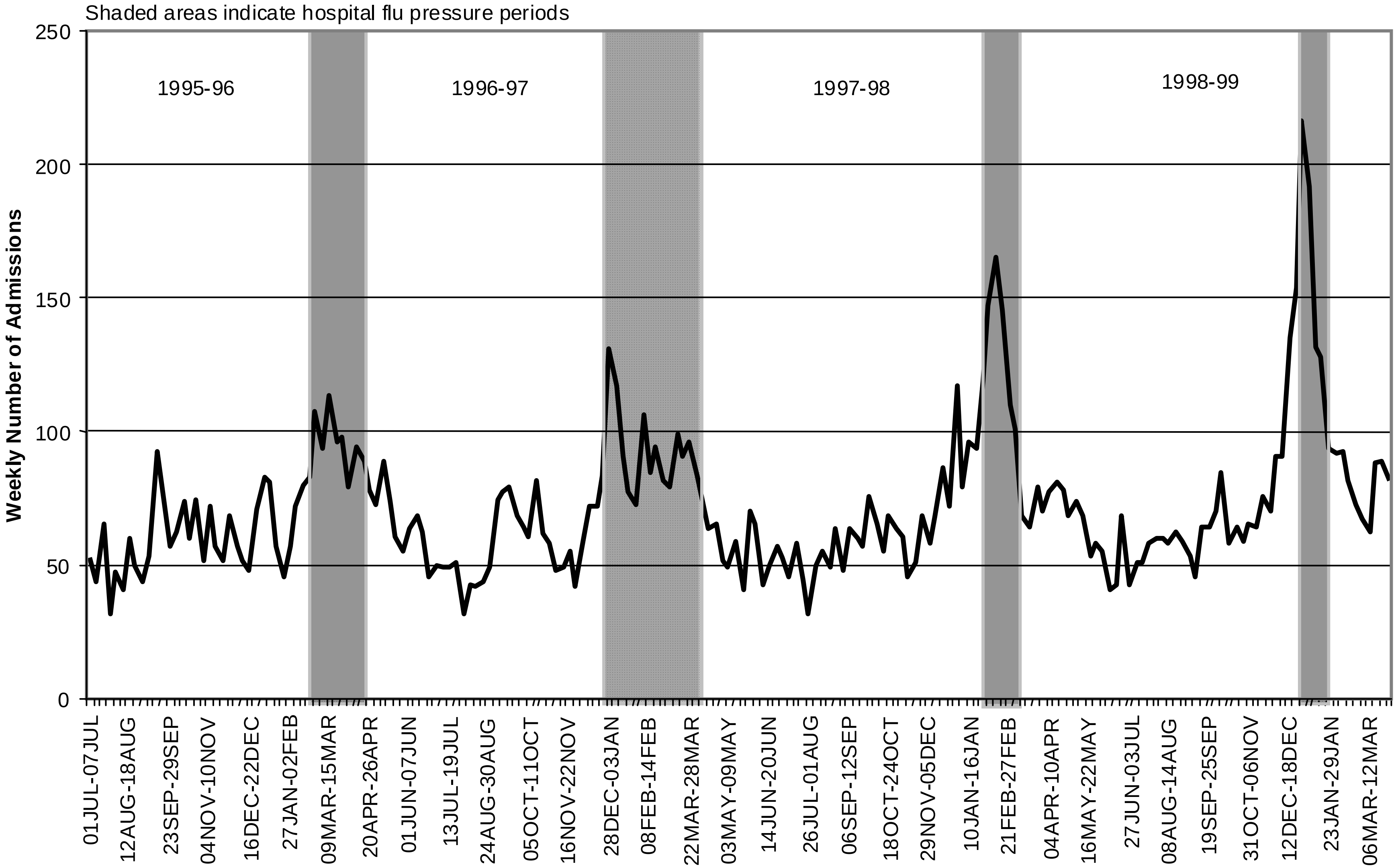


Figure 5: Avg. Daily Census for Three Diagnoses Groups, 1995-96 to 1998-99

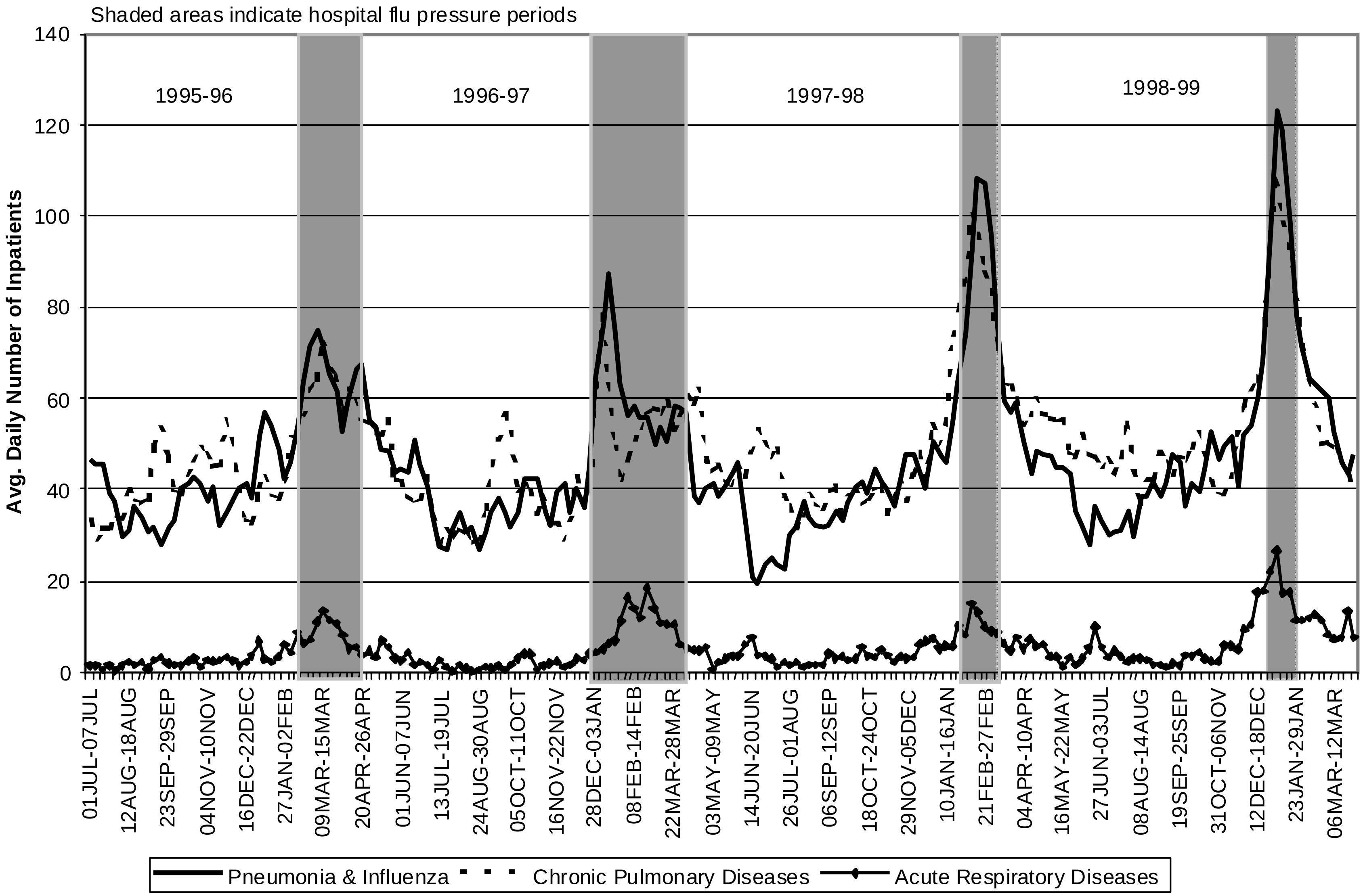
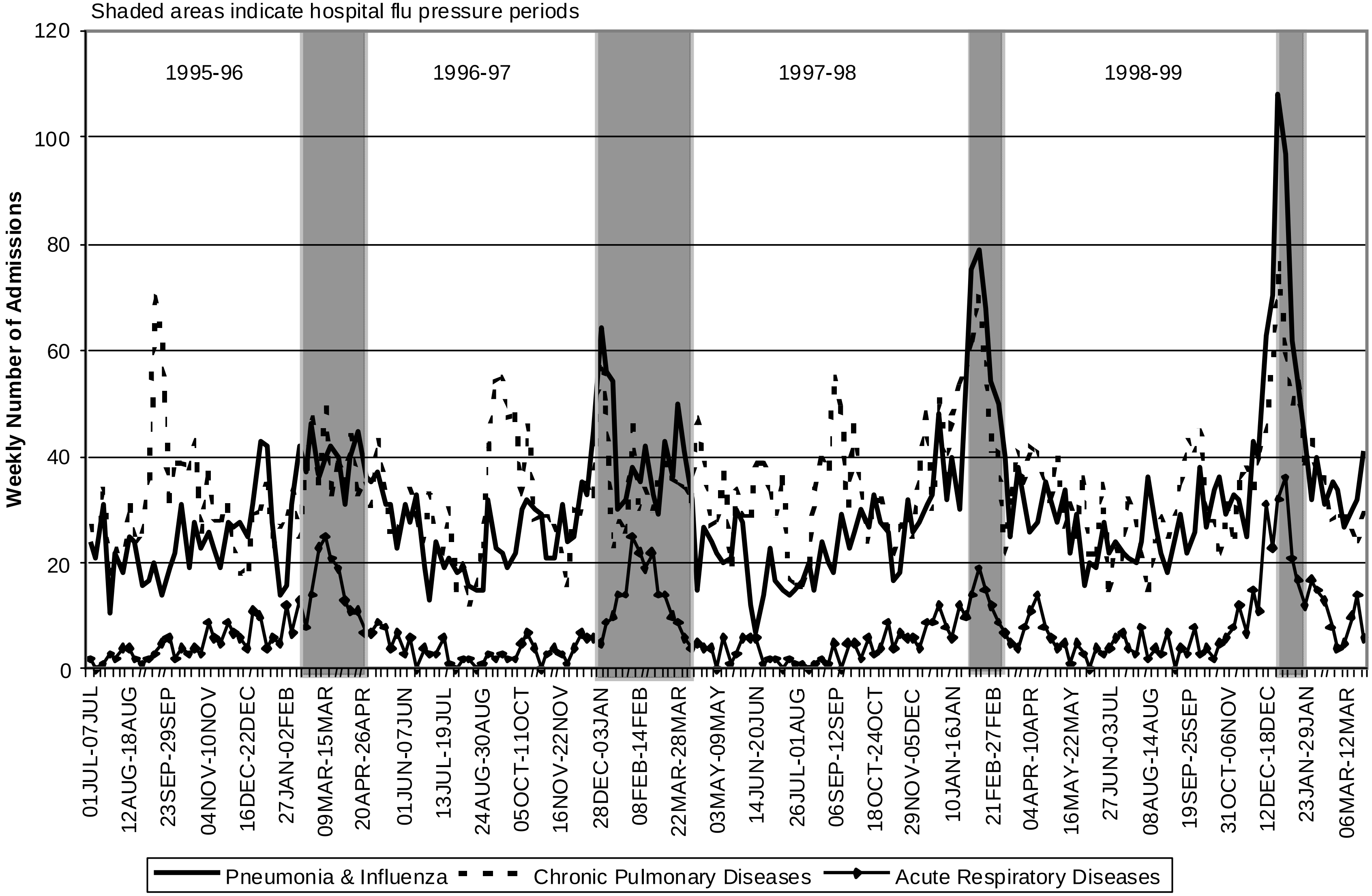


Figure 6: Weekly Admissions for Three Diagnoses Groups, 1995-96 to 1998-99



In sum, influenza-like illness displayed strong seasonal variation. The particularly high peaks in February of 1998 and January of 1999 warrant consideration. While the large 1998 spike can be explained in terms of a relatively poor match of the influenza vaccine to the influenza strain, it is not clear why the peak in January of 1999 was even higher, given that the vaccine was a good match to the influenza strain. It cannot be attributed solely to the aging population, as the proportion of the Winnipeg population aged 65 and older has remained virtually constant between 1995 and 1998. The proportion of individuals aged 75 and above among the Winnipeg population has increased by less than 1% during those four years.

Consistent with the present findings, the Laboratory Centre for Disease Control (LCDC) reported higher numbers of laboratory-confirmed influenza infections for the years 1997-98 and 1998-99, compared to any other influenza seasons during the years 1978 to 1997 (LCDC, 1999). They attribute this increase in part to enhanced surveillance activity and a small increase in the number of reporting laboratories. However, increased surveillance cannot explain the rise in the number of people hospitalized with influenza-like illness. It is possible that the unusually large spike simply represents a one-time phenomenon and that numbers will drop back to 1995-96 and 1996-97 levels in future years.

Moreover, it should be noted that the flu pressure period in 1999 was condensed into a shorter time period than in previous years – five weeks as compared to seven to 15 weeks. Indeed, there were fewer admissions for influenza-like illness during the 1998-99 pressure period - 762 admissions in total - than in the previous years. During the 1995-96, 1996-97, and 1997-98 pressure periods, there were 933, 1378, and 855 admissions, respectively, for influenza-like illness. That the total number of admissions for influenza-like illness was particularly high in 1996-97 is not surprising, given the 15-week duration of the flu pressure period. Undoubtedly, however, both intense albeit short-lived, as well as less intense, but longer flu pressure periods place a great deal of strain on the hospital system.

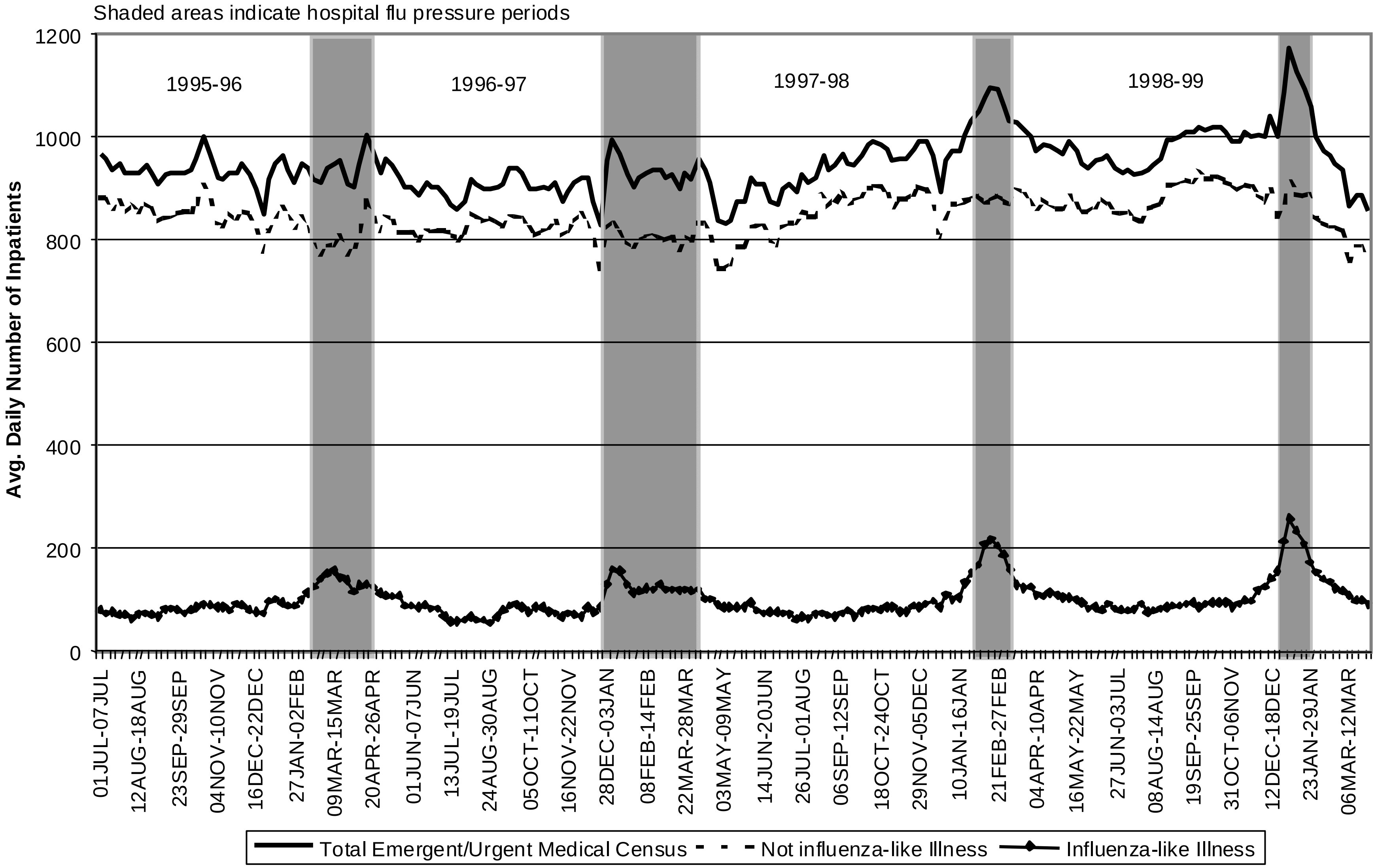
What About Other Conditions?

The previous figures showed that influenza-like illness, defined here in terms of respiratory illnesses, placed considerable pressure on the hospital system during the winter months. Although complications of influenza are predominantly respiratory in nature, other complications have also been described (Nicholson, 1998). Heart failure and myocardial infarction, for example, are widely thought to be complications of influenza (Nicholson, 1998).

We started out by comparing the census for influenza-like illness with that for other conditions, as well as the total emergent/urgent medical census (see Figure 7). As we saw earlier (see Figure 2), the census for influenza-like illness displayed seasonal variation. The peaks in influenza-like illness tended to correspond to an overall increase in the number of emergent/urgent patients. For example, in January of 1998-99, when we saw a large increase in the census for influenza-like illness, the total number of emergent/urgent medical patients rose from an average of 970 during the non-flu pressure period to 1,170 inpatients in hospital per day during the peak week in January (a 21% increase). The census for conditions other than influenza-like illness remained relatively constant across the year, with a slight increase in January.

Readily apparent in Figure 7 is also that, overall, patients with influenza-like illness constituted a relatively small proportion of the total emergent/urgent medical census (10.6% on average during the non-flu pressure periods). However, that proportion increased substantially during the flu pressure periods. For instance, in January of 1999, 22% of all emergent/urgent medical patients had influenza-like illness as their most responsible diagnosis. The proportion was lower in the previous three years when the percentage of patients in hospital per day with influenza-like illness ranged from 16% to 20% during the flu pressure periods.

Figure 7: Avg Daily Census for Patients with/without Influenza-like Illness, 1995-96 to 1998-99



We next took a closer look at the census for non-influenza like illnesses, focusing specifically on cardiovascular diseases. Figure 8 shows the average daily census for patients whose most responsible diagnosis was congestive heart failure. Evident is the clear seasonal pattern, with relatively high numbers during the winter and relatively low numbers in the summer. The hospital flu pressure periods are again indicated as shaded areas for comparison purposes. Generally, the peaks for congestive heart failure occurred simultaneously with those for influenza-like illness. In 1996-97, the census for congestive heart failure remained elevated slightly longer than that for influenza-like illness. On average, nearly three quarters of inpatients with congestive heart failure were 75 years of age or older.

We also examined patterns of acute myocardial infarction.[4] The seasonal variation was less apparent than for congestive heart failure and the number of patients in hospital for acute myocardial infarction was quite small – 27 on average per day. Only in 1995-96 did we observe a substantial increase in the number of patients in hospital for acute myocardial infarction, with the average number of patients in hospital per day peaking at 49. This peak occurred in April when the hospital system experienced a flu pressure period.

Who Are the Patients Hospitalized for Influenza-Like Illness?

The following description of admissions for influenza-like illness is based on a standard 13-week time period, spanning January 1 to March 31, for all four study years (see Methods section for details). We refer to this 13-week period as the flu season.

Diagnoses

Table 3 shows the number of admissions during the 1998-99 flu season by diagnostic code and age. During the 13-week flu season period, there were 1220 admissions for influenza-like illness; 34% were for pneumonia (organism unspecified) and 16% were for chronic bronchitis. A relatively large number of admissions were also for asthma and acute bronchitis and bronchiolitis, followed by chronic airway obstruction and viral pneumonia.

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[4] Data available upon request.

Figure 8: Avg. Daily Census for Congestive Heart Failure, 1995-96 to 1998-99

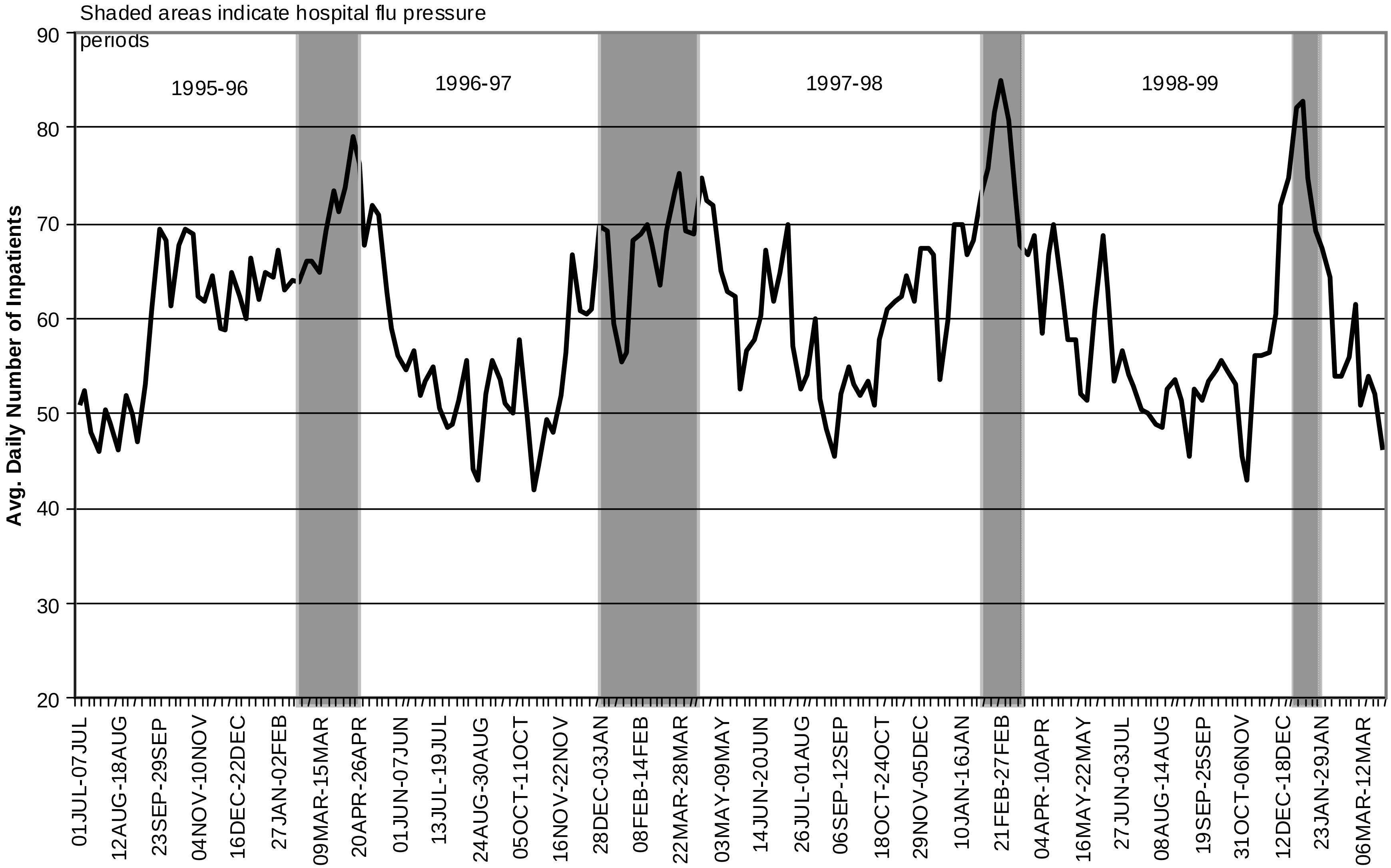


Table 3: Admissions for Influenza-Like Illness During Flu Season by Age Groups, 1998-99

	Age 0-4		**Age 5-14**		**Age 15-64**		**Age 65-74**		**Age 75+**		**Total**	
ICD-9-CM Code - Diagnosis	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
486 - Pneumonia, organism unspecified	36	14.3	13	36.1	75	32.9	78	36.7	216	43.9	418	34.2
491 - Chronic Bronchitis	0	0.0	0	0.0	23	10.1	57	26.9	115	23.4	195	15.9
493 - Asthma	24	9.5	15	41.7	53	23.2	18	8.5	31	6.3	141	11.6
466 - Acute Bronchitis and Bronchiolitis	115	45.7	0	0.0	4	1.8	6	2.8	15	3.0	140	11.5
496 - Chronic airway obstruction	0	0.0	0	0.0	19	8.3	22	10.4	48	9.8	89	7.3
480 - Viral Pneumonia	49	19.4	5	13.9	2	0.9	1	0.5	0	0.0	57	4.7
Other	28	11.1	3	8.3	52	22.8	30	14.2	67	13.6	180	14.8
Total	252	100.0	36	100.0	228	100.0	212	100.0	492	100.0	1220	100.0

The “other” category captures a wide range of diagnoses, none of which individually exceeded 27 admissions.

Systematic differences emerged among the different age groups. For example, pneumonia (organism unspecified) and chronic bronchitis occurred predominantly among individuals aged 65 and above, whereas acute bronchitis and bronchiolitis, not surprisingly, were primarily restricted to children between the ages of 0 and 4. Close to half (45.7%) of all zero to four year olds were admitted for these conditions. Admission for viral pneumonia also occurred mostly in children between the ages of zero and four. Of the 57 cases admitted, 49 (86%) were children aged zero to four.

Age

Table 4 shows the proportional distribution of admissions during the flu season by various patient characteristics. (The actual number of admissions are shown in Appendix A). A large proportion of individuals admitted for influenza-like illness were children between the ages of zero and four. In 1995-96, they constituted 26.8% of all admissions for influenza-like illness during the flu season. The proportion decreased slightly over the years. In 1998-99, 20.7% of all patients admitted for influenza-like illness were between zero and four years old. At the same time, the proportion of individuals aged 65 and, particularly the proportion of patients aged 75 and above increased steadily. In 1995-96, 29.6% of patients admitted for influenza-like illness were 75 and above, compared to 40.2% in 1998-99.

Table 4 also shows admissions for reasons other than influenza-like illness during the 13-week flu season periods. Note that these figures include only emergent/urgent medical admissions. Very noticeable is the marked drop in admissions of young children between the ages of zero and four in the most recent two years. In 1995-96, for instance 19.1% of admissions for non-influenza-like illness were children aged zero to four, compared to 5.5% in 1998-99, with the number of admissions dropping from 1239 to 329. Admissions started to drop at the beginning of fiscal year 1997/98. Reduced admissions are likely due to a shift toward treating certain conditions in observation units rather than admitting children to hospital (Brownell et al., 1999).

Figure 9 shows the age breakdown for *adult* admissions only. It shows the substantial increase in the proportion of individuals aged 75 and above admitted for influenza-like illness over the four years (left panel), as well as the slight increase in admissions for other reasons in this age group (right panel). Clearly evident is also that the proportion of 75+ year olds is considerably higher among patients with influenza-like illness than among patients admitted for other reasons (e.g., 52.8% vs. 35.5% in 1998-99).

Length of Hospital Stay

The median[5] length of hospital stay differed considerably across the different age groups (0-4, 5-14, 15-64, 65-74, and 75+). In 1998-99, for example, the median length of stay for children aged zero to four with influenza-like illness was three days, whereas that for the 65 to 74 year olds and 75+ year olds was six and seven days, respectively (see Figure 10). (Median lengths of stay were similar for individuals admitted for influenza-like versus non-influenza-like illness.) The median length of stay for each age group remained virtually the same across the four-year study period.

Comorbidities

A substantial proportion of patients admitted for influenza-like illness had no/minor comorbidity and complications (see Table 4). This proportion declined over the four years from 60.1% (1995-96) to 53.8% (1998-99). Correspondingly, the proportion of patients with major comorbidity and complications increased from 13.3% in 1995-96 to 18.4% in 1998-99. The proportion of patients with moderate levels of comorbidity and complications remained relatively stable over the four years. In comparison, the proportion of admissions with major comorbidity and complications among non-influenza-like illness cases remained relatively constant across the four years and was consistently lower than that for influenza-like illness admissions.

[5] The median is the mid-point. If the median length of stay is three days that means that 50% of patients stayed three days or less and 50% more than three days.

Table 4: Description of Patients Admitted for Influenza-Like Illness vs. Other Reasons During Standard, 13-Week Flu Seasons[a], 1995-96 to 1998-99

	Admissions for Influenza-like Illness				Admissions for Other Reasons			
	1995-96	1996-97	1997-98	1998-99	1995-96	1996-97	1997-98	1998-99
Total No.of Admissions	1068	1153	1343	1220	6486	6577	6118	6001
Age	%	%	%	%	%	%	%	%
0-4	26.8	25.7	16.3	20.7	19.1	16.8	5.1	5.5
5-14	3.6	2.9	4.0	3.0	2.7	2.9	3.5	4.0
15-64	21.0	20.5	19.7	18.7	35.2	36.2	40.7	41.6
65-74	19.0	16.7	18.8	17.4	17.3	16.4	18.3	16.7
75+	29.6	34.2	41.2	40.2	25.7	27.7	32.4	32.2
Male	52.6	49.0	45.4	48.1	48.8	49.6	48.0	48.0
Female	47.4	51.0	54.6	51.9	51.2	50.4	52.0	52.0
Level of Comorbidity and Complications								
None/Minor	60.1	54.5	51.1	53.8	55.6	53.5	51.6	52.0
Moderate	26.6	31.7	31.0	27.8	32.8	34.1	34.3	35.1
Major	13.3	13.8	17.9	18.4	11.6	12.4	14.1	12.9
Number of Comorbidities								
None	40.4	39.9	33.1	40.1	68.5	67.1	64.4	65.3
One	47.2	44.8	50.3	45.1	12.4	13.6	14.9	14.9
Two	8.2	9.2	11.5	10.2	9.2	9.7	10.5	9.3
Three or more	4.2	6.1	5.1	4.6	9.9	9.6	10.2	10.5
Residence								
Winnipeg	84.9	81.6	88.1	83.4	81.7	80.9	82.6	82.1
Elsewhere	15.1	18.4	11.9	16.6	18.3	19.1	17.4	17.9
Location of Residence - Winnipeg Residents								
Inner Core	11.6	9.0	8.5	8.7	7.4	7.6	7.4	6.8
Outer Core/Old St. B.	30.0	28.5	25.8	27.6	25.6	25.3	24.6	25.0
Other Winnipeg	58.4	62.5	65.7	63.7	67.0	67.1	68.0	68.2
Place of Residence - Winnipeg Seniors (65+)								
Home	76.7	73.0	75.3	75.8	80.7	78.6	79.9	80.2
Seniors Residence	16.2	17.2	17.0	17.6	15.7	15.9	15.8	15.3
PCH	7.1	9.8	7.7	6.6	3.6	5.5	4.3	4.5

[a] Flu Seasons are defined from the beginning of January to the end of March (see Methods section for details).

Figure 9: Adult Admissions for Influenza-Like and Other Illness During Flu Seasons, 1995-96 to 1998-99

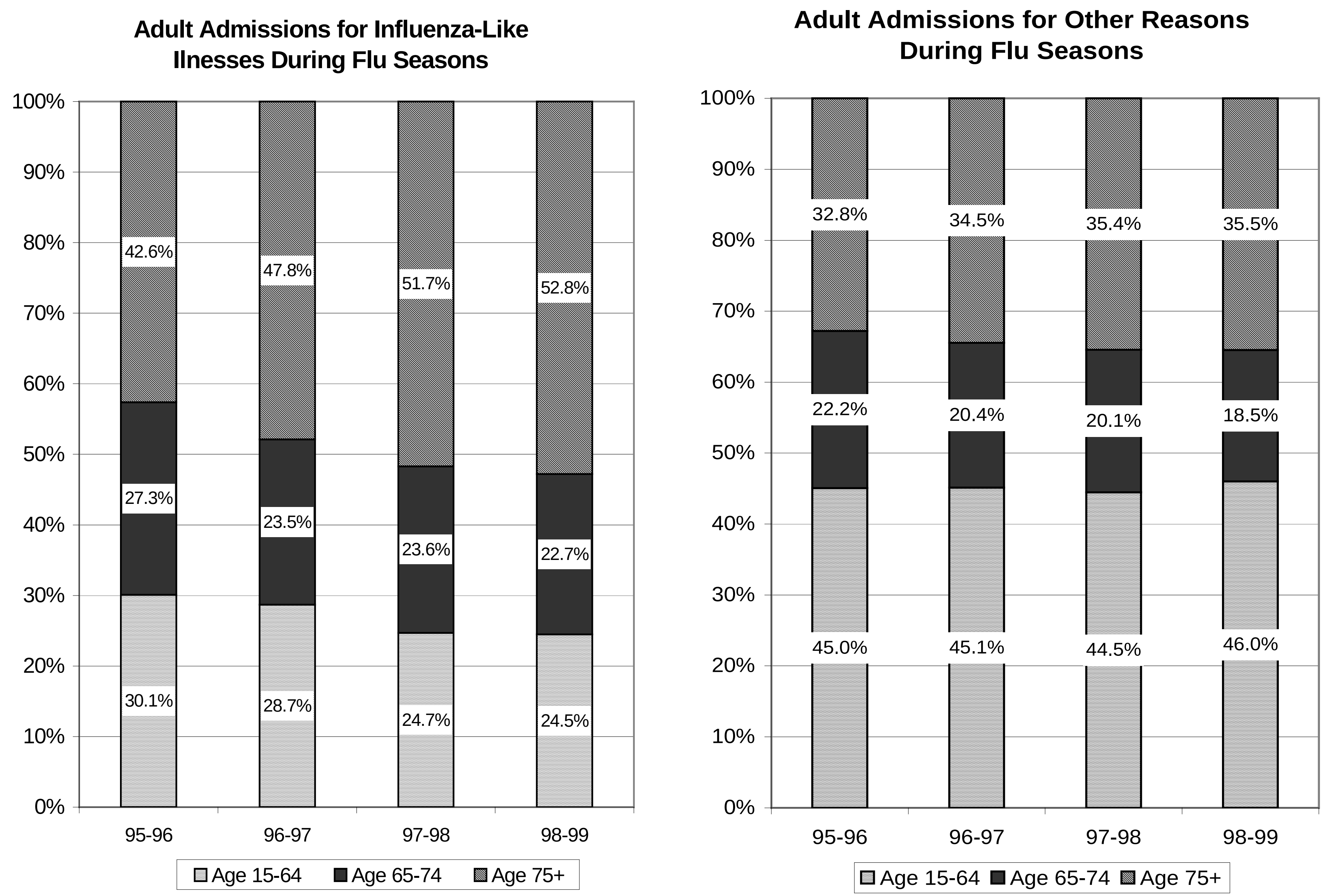
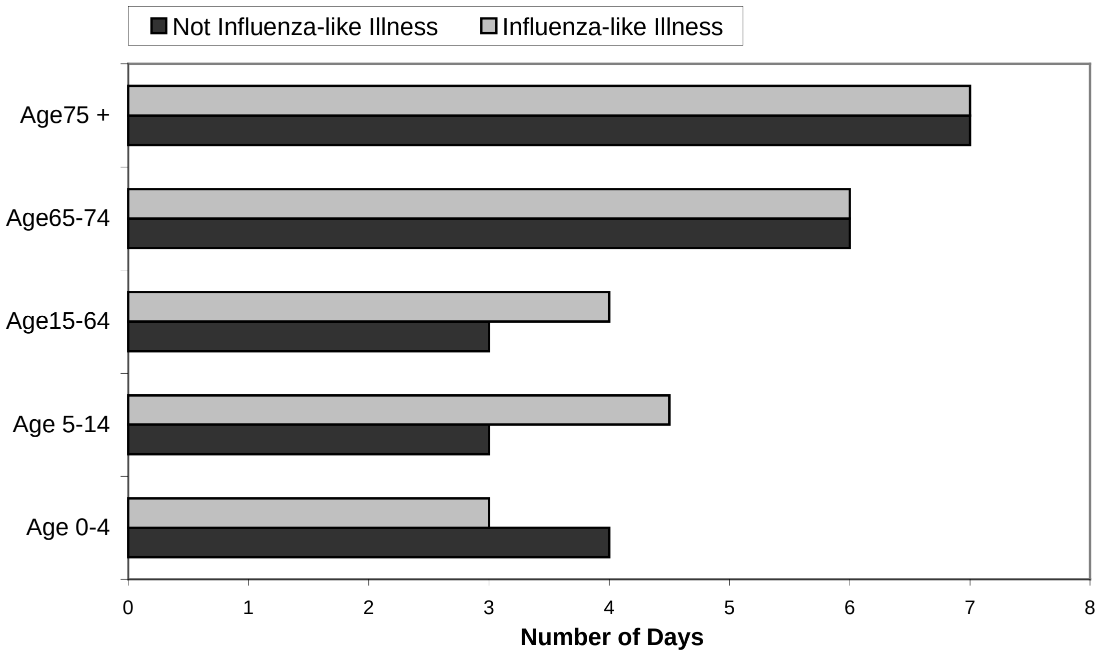


Figure 10: Median Lengths of Stay for Patients with/without Influenza-like Illness, 1998-99



Did the proportion of complex influenza-like illness cases (those with major comorbidity and complications) increase simply because the overall number of patients aged 75 and above, who would tend to be most likely to experience comorbidity and complications, has risen? If that were the case then one would expect an increase of complex cases primarily among 75+ year olds. However, the proportion of complex cases increased among all age groups. For example, among children, the percentage rose from 6.8% in 1995-96 to 11.8% in 1998-99; among 75+ year old patients, it increased from 16.1% in 1995-96 to 20.5% in 1998-99. Overall, however, there were clear age differences in the level of complexity, with over 80% of children (ages 0-14) having no/minor comorbidity and complications, as compared to approximately 40% among 75+ year olds.

In terms of the *number* of comorbidities (see Table 4), over half of patients admitted for influenza-like illness had one, two or more comorbidities, whereas only about a third of patients admitted for other reasons had one or more comorbidities. Thus, the majority of patients admitted for non-influenza like illnesses had no comorbidities, as compared to less than half among patients admitted for influenza-like illness.

Place of Residence

Most patients admitted to Winnipeg hospitals for influenza-like illness live, not surprisingly, in Winnipeg (see Table 4). The pattern was similar for admissions for reasons other than influenza-like illness. Nevertheless, a substantial number of patients were non-Winnipeg residents - 11.9% to 18.4% of admissions for influenza-like illness, which represent 160 to 212 admissions during the 13-week flu seasons (see Appendix A for the number of admissions in each year). Further analysis indicated that most of the non-Winnipeg residents were children (62% to 65%) who would likely have been treated at the Health Sciences Centre Children's Hospital. To further examine where the adults came from, we identified the Regional Health Authority (RHA) and, more specifically, the physician service area within the RHA, in which they lived. In 1998-99, 68% of adult non-Winnipeg patients with influenza-like illness came from adjacent RHAs (South Eastman, Central, North Eastman, and Interlake). Most of these individuals lived within commuting distance from Winnipeg. An additional 21% came from Northern RHAs (Burntwood and Norman), and the remaining 11% from other RHAs.

These findings mirror those found in a previous MCHPE report (Black et al., 1999). In this study, the proportion of hospital separations that occurred within the patient's RHA, in other RHAs, in Winnipeg, and out of province was examined. The proportion of Winnipeg hospital separations was particularly high for North Eastman, Interlake, and South Eastman residents.

Table 4 further shows in which area Winnipeg residents lived – inner core, outer core/old St. Boniface, and other Winnipeg. These areas have been used in previous MCHPE research (Roos et al., 1996). They have been found to differ systematically in terms of residents' health and need for health care. As Table 4 shows, the proportion of "flu" admissions in each of the Winnipeg areas remained relatively constant over the four-year study period: between 8.5% and 11.6% of patients admitted for influenza-like illness lived in the inner core and between 25.8% and 30.0% in the outer core/old St. Boniface. The remaining individuals lived in other Winnipeg areas. In comparison, there were slightly fewer patients from the inner core and outer core/old St. Boniface among admissions for non-influenza-like illnesses, but more admissions from other Winnipeg areas.

Lastly, we took a closer look at Winnipeg residents aged 65 and above and determined whether they lived in a PCH, a senior citizen residence, or at home. The proportion of seniors in each of these living environments remained quite constant over the four years, with the large majority of 65+ year old patients admitted for influenza-like illness, as well as those admitted for other reasons, living at home. This is not surprising as most seniors live at home. The proportion of seniors living in senior residences was slightly higher among admissions for influenza-like illness than admissions for other reasons. Similarly, the proportion of PCH residents was higher among admissions for influenza-like illness, as compared to admissions for other reasons.

Rates of Admission by Patient Characteristics (Winnipeg Residents)

Thus far, we simply examined the proportion of admissions given various patient characteristics. Table 5 shows *rates* of admission for influenza-like illness per 1000 Winnipeg population, given various patient characteristics, over the four flu seasons. Crude rates are shown when comparing age groups and men versus women, age and sex standardized rates in the case of location and place of residence.

Admission rates for both influenza-like illness and other reasons were highest for individuals aged 75 and above during all four flu seasons, followed, in general, by rates for patients aged 65 to 74 and rates for children between the ages of zero and four. Among the 65-74 and 75+ year olds, admission rates for influenza-like illness, as well as admissions for other reasons, were the highest during the 1997-98 flu season. That rates for influenza-like illness were higher that year may be explained by the relatively poor match between the influenza vaccine and virus strain. It is not clear, however, why admission rates for reasons other than influenza-like illness were also high in 1997-98, although it is possible that influenza also played a role here by causing non-respiratory complications, such as congestive heart failure.

Table 5: Rates of Admissions (per 1000 Population) for Influenza-Like Illness vs. Other Reasons During Standard, 13-Week Flu Seasons[a], Winnipeg Residents, 1995-96 to 1998-99

	Admission Rates for ILI				Admission Rates for Other Reasons			
	1995-96	1996-97	1997-98	1998-99	1995-96	1996-97	1997-98	1998-99
Age								
0-4	4.25	3.77	3.40	3.37	20.18	17.71	4.86	5.12
5-14	0.36	0.34	0.53	0.33	1.14	1.46	1.48	1.79
15-64	0.44	0.46	0.53	0.43	41.7	4.30	4.47	4.53
65-74	3.93	3.76	5.10	4.29	19.88	19.06	20.65	18.36
75+	7.75	9.24	12.64	10.95	38.64	41.20	43.60	41.04
Male	1.46	1.41	1.63	1.63	8.01	8.18	7.46	7.36
Female	1.31	1.48	1.99	1.99	8.16	8.16	8.06	7.86
Location of Residence								
Inner Core	3.22	2.75	3.20	2.84	12.44	12.7	12.28	10.77
Outer Core/Old St. B.	1.85	1.82	2.03	1.93	9.31	9.30	8.67	8.64
Other Winnipeg	1.18	1.31	1.71	1.39	7.85	7.80	7.43	7.16
Place of Residence - Winnipeg Seniors (65+)								
Home	5.45	5.99	8.58	6.99	30.06	30.30	32.82	30.26
Seniors Residence	8.35	10.96	11.88	12.35	40.80	42.03	44.59	37.31
PCH	7.16	9.96	15.24	12.94	24.12	33.62	23.80	36.50

[a] Flu Seasons are defined from the beginning of January to the end of March (see Methods section for details).
ILI = Influenza-like illness
Crude rates are presented for age and sex groups. Rates are age and sex standardized to the 1998 Manitoba population for location of residence and place of residence.

In terms of location of residence, admission rates for influenza-like illness for people living in the inner core were twice as high as those for people living in other areas of Winnipeg, with rates for the outer core/old St. Boniface falling in the middle. Admission rates for reasons other than influenza-like illness were also much higher among inner core residents than individuals living in the outer core/old St. Boniface or other Winnipeg areas. These findings are consistent with previous research. Roos et al. (1996) found that premature mortality rates - the mortality rates for individuals aged zero to 74 - were markedly higher in the Winnipeg inner core than in the outer core and old St. Boniface. Premature mortality rates in the outer core and old St. Boniface, in turn, were higher than in all other Winnipeg areas. Premature mortality is considered the best indicator of health status capturing the need for health care (Carstairs and Morris, 1991; Eyles et al., 1993).

Admission rates for influenza-like illness were higher for PCH residents and seniors living in seniors' residences than for seniors living at home (see Table 5). Note that these rates are age and sex standardized, which means that we take into account and adjust for differences in the age and sex structure among these three different groups of seniors. In other words, the rates take into account that PCH residents would tend to be older than seniors living at home or those living in seniors' residences. Admission rates for reasons other than influenza-like illness were consistently highest among people in seniors' residences.

That individuals in senior citizen apartments have high admission rates for influenza-like illness - in some years, rates were as high or even higher than those for PCH residents - is likely due to a combination of factors. Concerted efforts are being made to vaccinate PCH residents for influenza, with studies conducted in Manitoba indicating that vaccination rates are as high as 88% (Heise, 1994). As well, PCH residents with influenza-like illness would receive care in the PCH, which may prevent hospitalization. In contrast, influenza vaccination rates are much lower among non-PCH residents. This, coupled with the risk of exposure in seniors' residences due to congregate living could explain the high admission rates for seniors' apartment residents.

Moreover, individuals in living in senior citizen residences are a more vulnerable population than seniors living at home, as reflected in the finding that admission rates for both influenza-like illness and other reasons were consistently higher among seniors in seniors' residences than individuals living at home. This is consistent with previous research, which indicates that seniors in senior complexes use more health care services than their counterparts in the community (Roos & Shapiro, 1981). They are also at greater risk of being admitted to long-term care facilities (Shapiro & Tate, 1985; 1988).

The System-Wide Impact of Influenza-Like Illness

We next examined the impact of influenza-like illness outside the hospital system. Two issues were of interest: First, we were interested in the extent to which influenza-like illness affects the ambulatory care system, emergency rooms, drug prescriptions (antibiotic and amantadine), and mortality. Second, given that one aspect of this report was to assess whether a warning system could be implemented that would allow hospitals to anticipate impending influenza activity, we examined seasonal patterns in ambulatory visits, emergency room visits, drug prescriptions and deaths in relation to the hospital flu pressure periods. Thus, we continue to plot the flu pressure periods (as shaded areas), to allow comparison of peak times. Of particular interest is whether any indicator systematically preceded the hospital flu pressure periods and might therefore be used as an early warning signal for the hospital system.

Ambulatory Visits to Physicians

Figure 11 shows patterns of ambulatory visits for influenza-like illness over the four-year study years. Note that the analysis focuses exclusively on ambulatory visits to Winnipeg physicians by Winnipeg residents. As Figure 11 shows, peak periods for ambulatory visits tended to overlap with those in the hospital system. In 1995-96, the peak for ambulatory visits for influenza-like illness occurred in March. In 1996-97, visits peaked in December, two weeks prior to the beginning of the hospital flu pressure period. In 1997-98 and 1998-99, peaks occurred in January, which is also when the hospital system was experiencing a flu pressure period.

The increases in visits for influenza-like illness were substantial. In 1998-99, for example, the number of visits per week peaked at 14,046, up from an average of 7,821 visits per week during the non-flu pressure period (an 80% increase).[6] As in the case of hospital data, we again see a particularly high and narrow spike in the number of visits for influenza-like illness in 1998-99.

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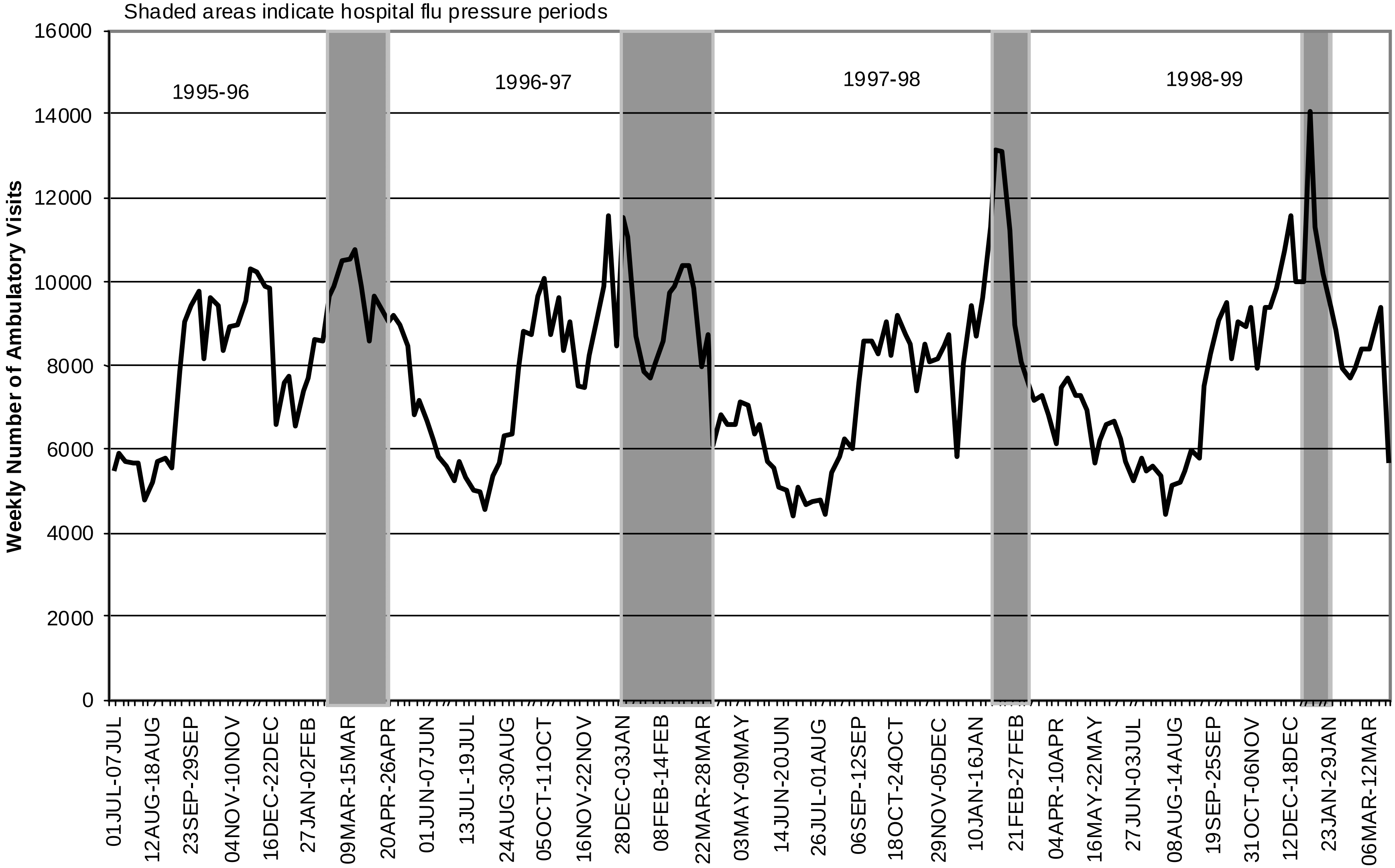
[6] Throughout this report, the non-flu pressure periods are defined as the weeks outside the hospital flu pressure period.

Figure 11: Ambulatory Visits to Winnipeg Physicians for Influenza-Like Illness, 1995-96 to 1998-99



Emergency room visits are excluded

In Figure 12, we plot the number of ambulatory visits for influenza-like illness and, in comparison, the total number of ambulatory visits each week. Striking is the dramatic drop in the total number of ambulatory visits over the Christmas holidays. For example, in 1995-96, 58,393 visits on average were made to Winnipeg physicians per week; during the week of the Christmas holidays, the number dropped to 31,995. Apart from this winter holiday drop, ambulatory visits decreased in July and August, the summer holiday season. Visits were consistently at a high point in October and also increased during the winter months (anywhere between January and March), although there are no marked peaks during the winter. This makes sense as there is a maximum number of visits physicians can deal with in a given week. What changes during the winter is the patient mix, with the proportion of patients with influenza-like illness increasing.

On average, ambulatory visits for influenza-like illness constituted 13% of all ambulatory visits during the non-flu pressure periods. This percentage increased substantially during the winter. In 1998-99, for instance, 27% of all visits during the peak week in December were for influenza-like illness. These percentages are comparable to those for the hospital census for influenza-like illness, where on average 11% of the average daily census was for influenza-like illness during non-flu pressure periods, with the percentage increasing to up to 22% during flu pressure periods.

Approximately two thirds of the ambulatory visits for influenza-like illness during the flu pressure periods were for acute respiratory illnesses (63% to 68% over the four years). Visits for chronic pulmonary diseases also constituted a substantial proportion (25% to 27%), whereas relatively few ambulatory visits were made for pneumonia and influenza (7% to 12%). The seasonal pattern in visits for influenza-like illness shown in Figure 11 was, therefore, to a large extent driven by acute respiratory illnesses. This is in contrast to the hospital census for influenza-like illness which was, as we saw earlier, composed mostly of patients with pneumonia and influenza and chronic pulmonary diseases.

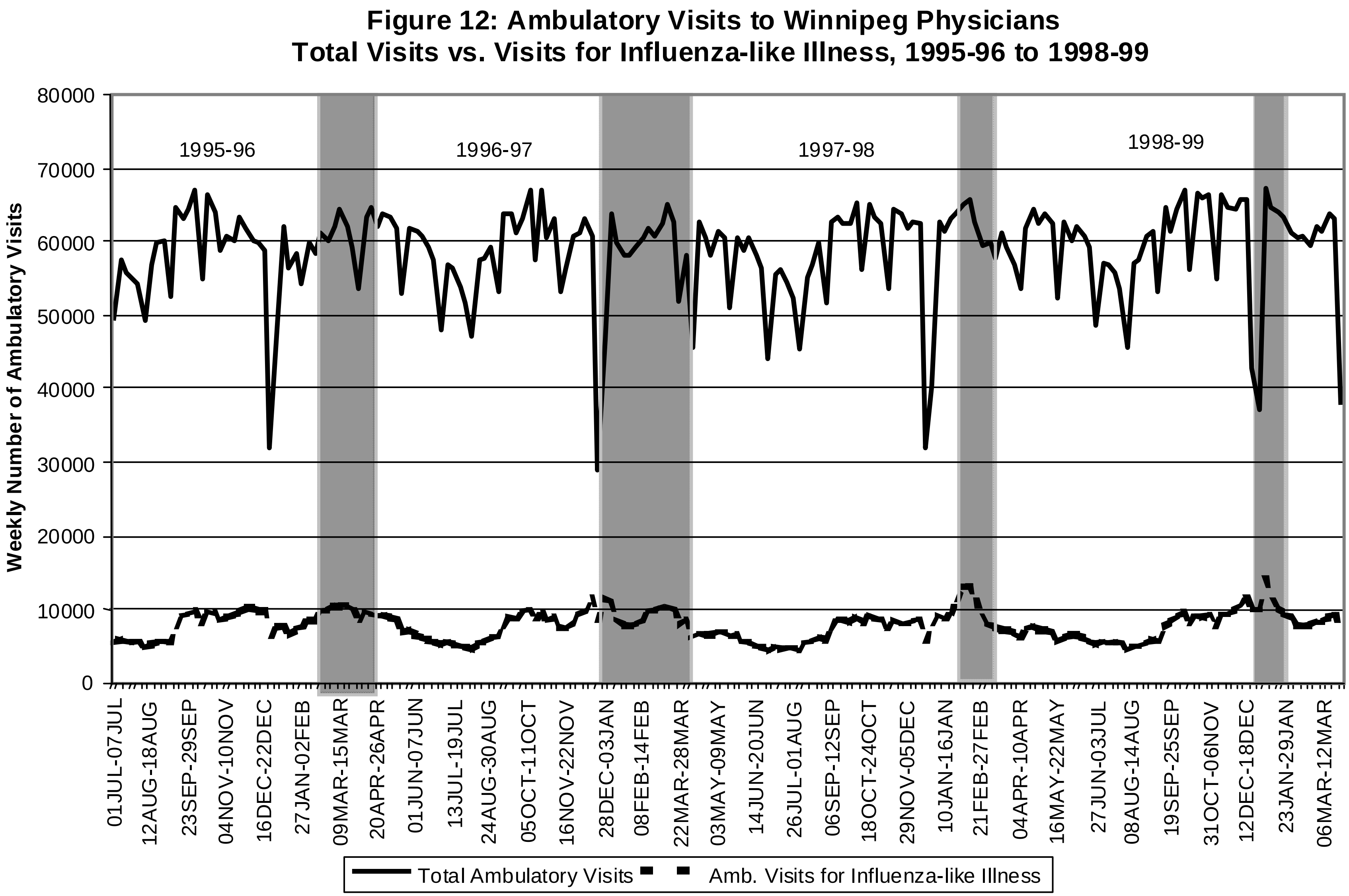
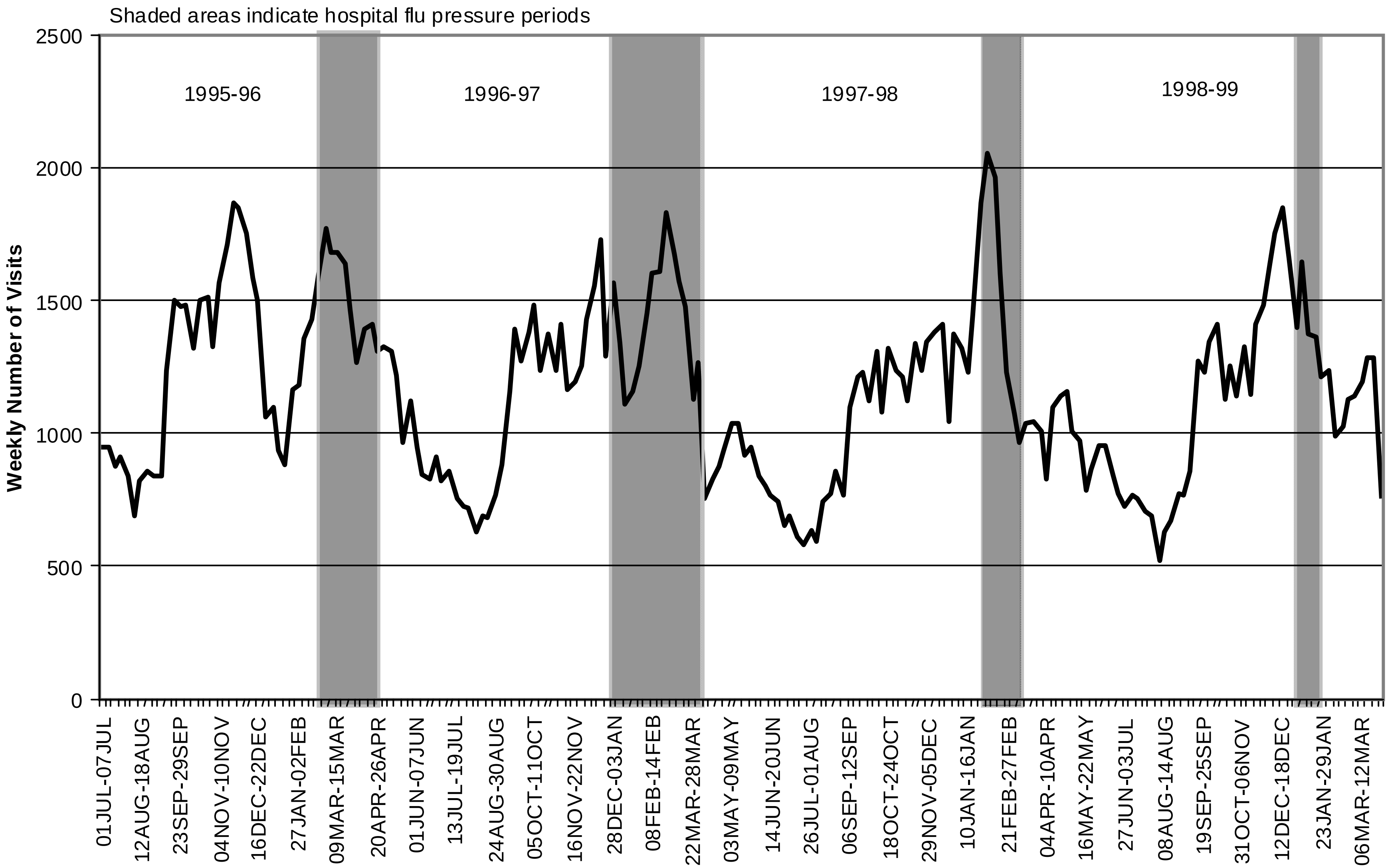


Figure 12: Ambulatory Visits to Winnipeg Physicians
Total Visits vs. Visits for Influenza-like Illness, 1995-96 to 1998-99
Weekly Number of Ambulatory Visits
80000
70000
60000
50000
40000
30000
20000
10000
0
1995-96
1996-97
1997-98
1998-99
01JUL-07JUL
12AUG-18AUG
23SEP-29SEP
04NOV-10NOV
16DEC-22DEC
27JAN-02FEB
09MAR-15MAR
20APR-26APR
01JUN-07JUN
13JUL-19JUL
24AUG-30AUG
05OCT-11OCT
16NOV-22NOV
28DEC-03JAN
08FEB-14FEB
22MAR-28MAR
03MAY-09MAY
14JUN-20JUN
26JUL-01AUG
06SEP-12SEP
18OCT-24OCT
29NOV-05DEC
10JAN-16JAN
21FEB-27FEB
04APR-10APR
16MAY-22MAY
27JUN-03JUL
08AUG-14AUG
19SEP-25SEP
31OCT-06NOV
12DEC-18DEC
23JAN-29JAN
06MAR-12MAR
Total Ambulatory Visits
Amb. Visits for Influenza-like Illness

The large majority of ambulatory visits for influenza-like illness were made by children and younger adults, with only a relatively small percentage of visits being made by individuals aged 65 and above. This fits with the above observation that most visits were for acute respiratory illnesses. For example, during the 1998-99 flu season, 30.6% of ambulatory visits for influenza-like illness were made by children (0-14 years old), 55.6% by individuals aged 15 to 65 years, and 13.8% by adults aged 65 and above. This contrasts with hospital admissions where, as described above, 57.6% of all admissions for influenza-like illness during that same time period were by patients aged 65 and above. These age differences in findings for ambulatory visits versus hospital admissions is not surprising, given the greater vulnerability of older individuals to experiencing health problems and, therefore, greater likelihood of being hospitalized.

Influenza tends to spread first among children and then among the general community, as reflected in the finding that the peak for influenza illness among children has been found to precede that of the community (Gruber, 1998). Similarly, school absenteeism in the winter has been shown to precede other indicators of influenza activity, such as hospital admissions (Glezen & Couch, 1978). One might therefore expect that peaks in ambulatory visits for influenza-like illness to paediatricians would occur prior to hospital flu pressure periods. Figure 13 shows that this was the case in some, but not all study years. For example, in 1995-96, visits to paediatricians were high in November and then again in February, during the hospital flu pressure period. A similar two-peak pattern occurred in 1996-97. In 1997-98, the peak in ambulatory visits fell in the flu pressure period, whereas in 1998-99 it preceded it. Thus, there was no systematic relation between ambulatory visits for influenza-like illness to paediatricians and hospital flu pressure periods.

Figure 13: Ambulatory Visits for Influenza-Like Illness to Paediatricians, 1995-96 to 1998-99



Emergency Room Visits

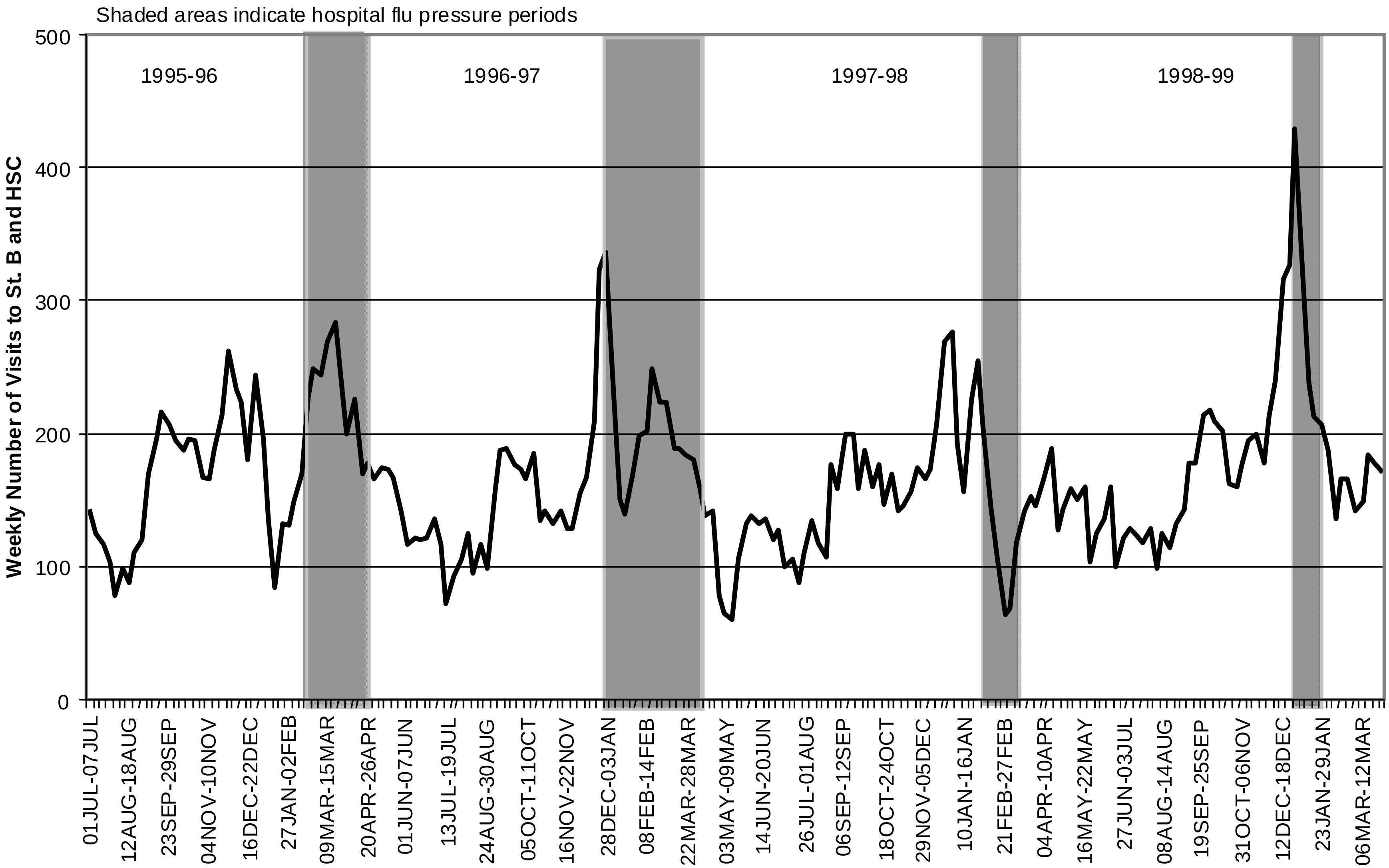
Patterns of emergency room (ER) visits for influenza-like illness are shown in Figure 14. It is important to note that these data are based only on the Health Sciences Centre and the St. Boniface General Hospital. By including the Health Sciences Centre, we are capturing the only paediatric emergency department in Winnipeg. Although we are only able to include two of seven ERs in Winnipeg, we know that they treat about half of all emergency cases in the city (Barer et al., 1994).

As for ambulatory visits, the peaks in ER visits tended to overlap the hospital flu pressure period. In 1996-97, ER visits for influenza-like illness rose markedly one week prior to the onset of the hospital flu pressure period. In 1997-98, the ER peak preceded the hospital flu pressure period by three weeks.

Similar to ambulatory visits, the *total* number of ER visits (including visits for influenza-like illness and other reasons) did not increase systematically during the winter. In fact, the total number of ER visits tended to be as high in the fall as in the winter. ER visits for influenza-like illness constituted on average 9% of *all* ER visits during non-flu pressure periods. This percentage increased to up to 22% during the flu pressure periods. These percentages are, again, similar to those for the hospital census and ambulatory visits. Thus, overall, influenza-like illness make up a sizable portion of health care use during the winter months, be it hospital use, ambulatory visits or ER visits.

As in the case of ambulatory visits, a large proportion of ER visits during the flu pressure periods were for acute respiratory illnesses (41% to 54% over the four years), followed by visits for chronic pulmonary diseases (24% to 39%) and pneumonia and influenza (17% to 23%). Visits for acute respiratory illnesses (the majority of which were made by children between the ages of zero and 14), exhibited an especially strong seasonal pattern with very

Figure 14: Emergency Room Visits to Health Sciences Centre and St. Boniface General Hospital for Influenza-Like Illness, 1995-96 to 1998-99



pronounced peaks.[7] The peak for acute respiratory illnesses was particularly high in December of 1998, when the number of visits per week rose from an average of 66 during the non-flu pressure period to 228 (a 245% increase). ER visits for chronic pulmonary diseases exhibited high peaks in September - indeed, the September peaks were higher than the winter ones. Increased exposure to irritants such as dust likely accounts for these findings.

The majority of ER visits for influenza-like illness during the flu season[8] were made by children between the ages of zero and 14 - 75% in 1998-99. In comparison, in 1998-99, 43% of ER visits for reasons other than influenza-like illness were incurred by children. The large proportion of ER visits by children is not surprising, as our data capture the only paediatric emergency department in Winnipeg, but only two of seven adult emergency rooms. We therefore miss a large proportion of adult visits. Accordingly, the proportion of visits by people aged 65 and above for influenza-like illness during that time period was relatively small (8.8%). Similarly, the proportion of visits by seniors for reasons other than influenza-like illness was quite small (10.3%).

A frequently heard comment is that emergency departments are under particular pressure during the flu season because many physician offices are closed for the Christmas and New Year holidays. Indeed, we saw earlier the dramatic drop in the number of ambulatory visits during the holiday season (see Figure 12). In Table 6 we show the number of ambulatory visits in comparison to the number of ER visits (total and for influenza-like illness only) over a four-week period – one week prior to Christmas and New Year, during the Christmas and New Year's weeks, and one week following these weeks. In 1995-96, for example, the total weekly number of ambulatory visits dropped from 58,875 the week prior to Christmas to 31,995 over Christmas. The number of ambulatory visits for influenza-like illness also dropped markedly.

[7] Data available upon request.
[8] It will be recalled that the flu season is defined here as a 13-week period extending from January 1 to March 31 (see Methods section for details).

Table 6: A Comparison of Ambulatory Visits and Emergency Room Visits to Health Sciences Centre and St. Boniface General Hospital During the Holiday Season

Year	Dates	Total Amb. Visits/Week	Amb. Visits for ILI/Week	Total ER Visits/Week	ER Visits for ILI/Week
1995-96	16 Dec - 22 Dec	58,875	9,856	1,733	181
	23 Dec - 29 Dec	31,995	6,595	1,771	243
	30 Dec - 5 Jan	48,853	7,580	1,709	196
	6 Jan - 12 Jan	61,985	7,741	1,605	136
1996-97	14 Dec - 20 Dec	60,772	11,569	1,616	209
	21 Dec - 27 Dec	28,850	8,454	1,811	323
	28 Dec - 3 Jan	46,571	11,506	1,854	337
	4 Jan - 10 Jan	59,961	11,027	1,597	152
1997-98	13 Dec - 19 Dec	62,289	8,709	1,762	207
	20 Dec - 26 Dec	31,884	5,817	1,871	270
	27 Dec - 2 Jan	40,581	8,014	1,788	277
	3 Jan - 9 Jan	62,913	9,411	1,646	193
1998-99	12 Dec - 18 Dec	65,592	11,549	1,852	317
	19 Dec - 25 Dec	42,925	10,018	1,743	327
	26 Dec - 1 Jan	37,098	10,031	1,974	429
	2 Jan - 8 Jan	67,297	14,046	1,762	321

ER visits = Emergency room visits
ILI = Influenza-like illness

Correspondingly, the total number of ER visits increased slightly that week from 1,733 to 1,771. The increase in ER visits was more substantial when we focus on visits for influenza-like illness only, with the number of visits in 1995-96, for instance, increasing from 181 pre-Christmas to 243 during the Christmas week (a 34% increase). While this increase in ER visits may not appear very large, particularly in comparison to the large drop in ambulatory visits, it does represent a considerable increase over the average weekly 160 visits during the non-flu pressure period (a 52% increase). Also, it should be remembered that our data only capture about half of all ER visits in Winnipeg.

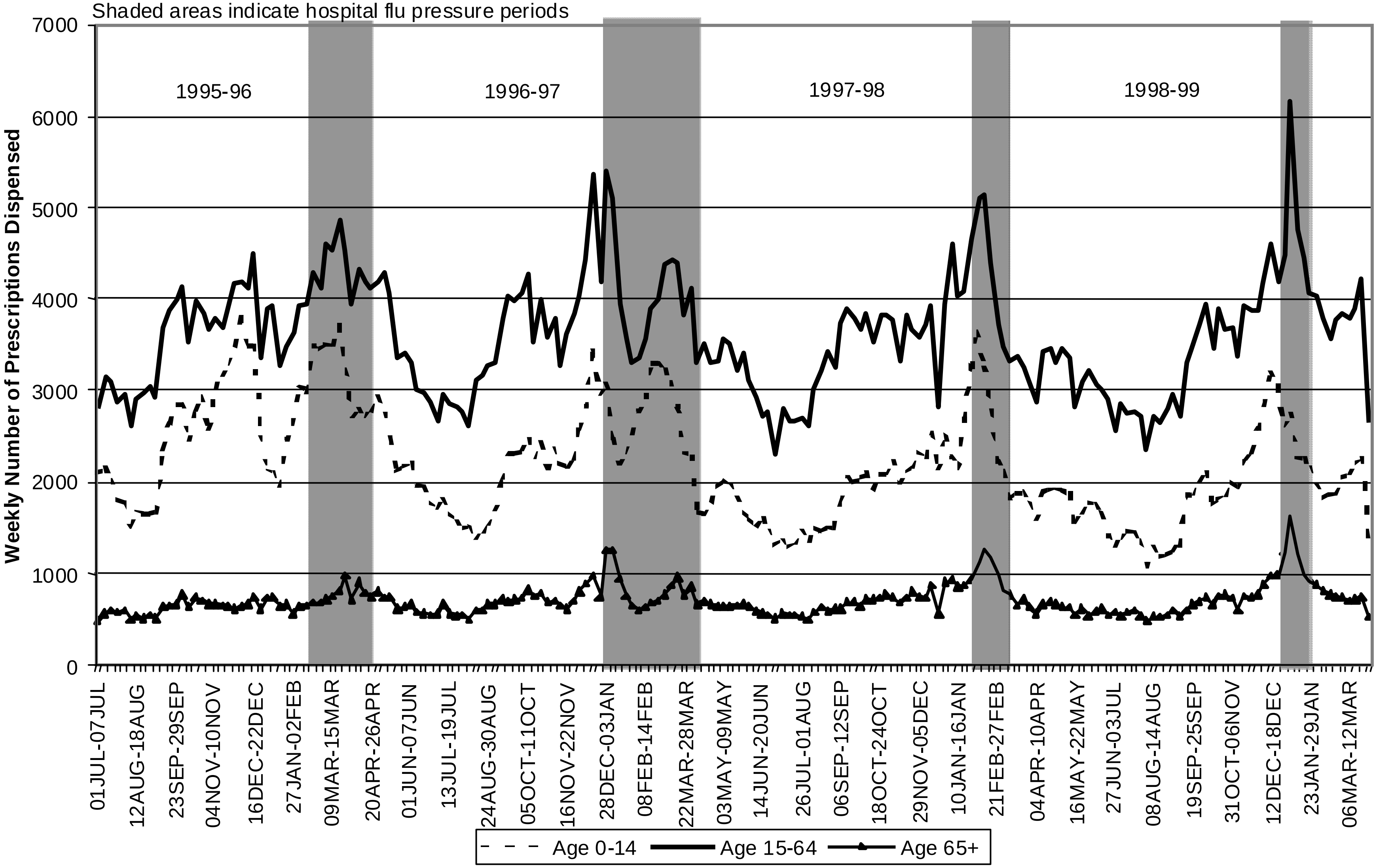
The pattern was similar across all four study years: The total number of ambulatory visits, as well as visits for influenza-like illness consistently dropped during the Christmas/New Year's season, while at the same time the number of ER visits, particularly those for influenza-like illness, increased. As the number of ambulatory visits increased again following the holiday season, the number of ER visits dropped. Although interesting, these findings cannot tell us whether emergency room visits increased *because* physician offices closed. Emergency room visits might have increased for other reasons. Nevertheless, the question of how much pressure is placed on ERs because of physician office closure is an important one that warrants systematic investigation by, for example, examining people's reasons for using emergency departments.

Drug Prescriptions Dispensed

Figure 15 shows antibiotic prescriptions dispensed to patients who were diagnosed with influenza-like illness at any time during the year, as determined from physician claims data. Because children aged zero to four and five to 14 displayed similar patterns, they have been combined into one age category. Clear seasonal patterns emerged for all age groups, with the number of antibiotic prescriptions dispensed being relatively high in the winter and lower in the summer. The peaks tended to correspond to hospital flu pressure periods, although in both 1995-96 and 1996-97 two distinct peaks emerged for children.

The number of antibiotics prescriptions dispensed to children was quite high, particularly during the winter months, much higher than for adults aged 65 and above. On average, 2,196 antibiotics per week were dispensed to children, compared to 709 per week to adults aged 65 and above. It is important to note here that we do not know why individuals were prescribed antibiotics, as we did not link prescriptions to diagnoses. Many of the children might have received antibiotics for reasons other than influenza-like illness, such as ear infections. That children, and particularly young children, are prescribed antibiotics more often than older age groups is consistent with previous research (McCaig & Hughes, 1995; Bergus et al., 1996).

Figure 15: Antibiotic Prescriptions Dispensed, 1995-96 to 1998-99



Data are provided for individuals who had been diagnosed with influenza-like illness during an ambulatory visit any time during the year.

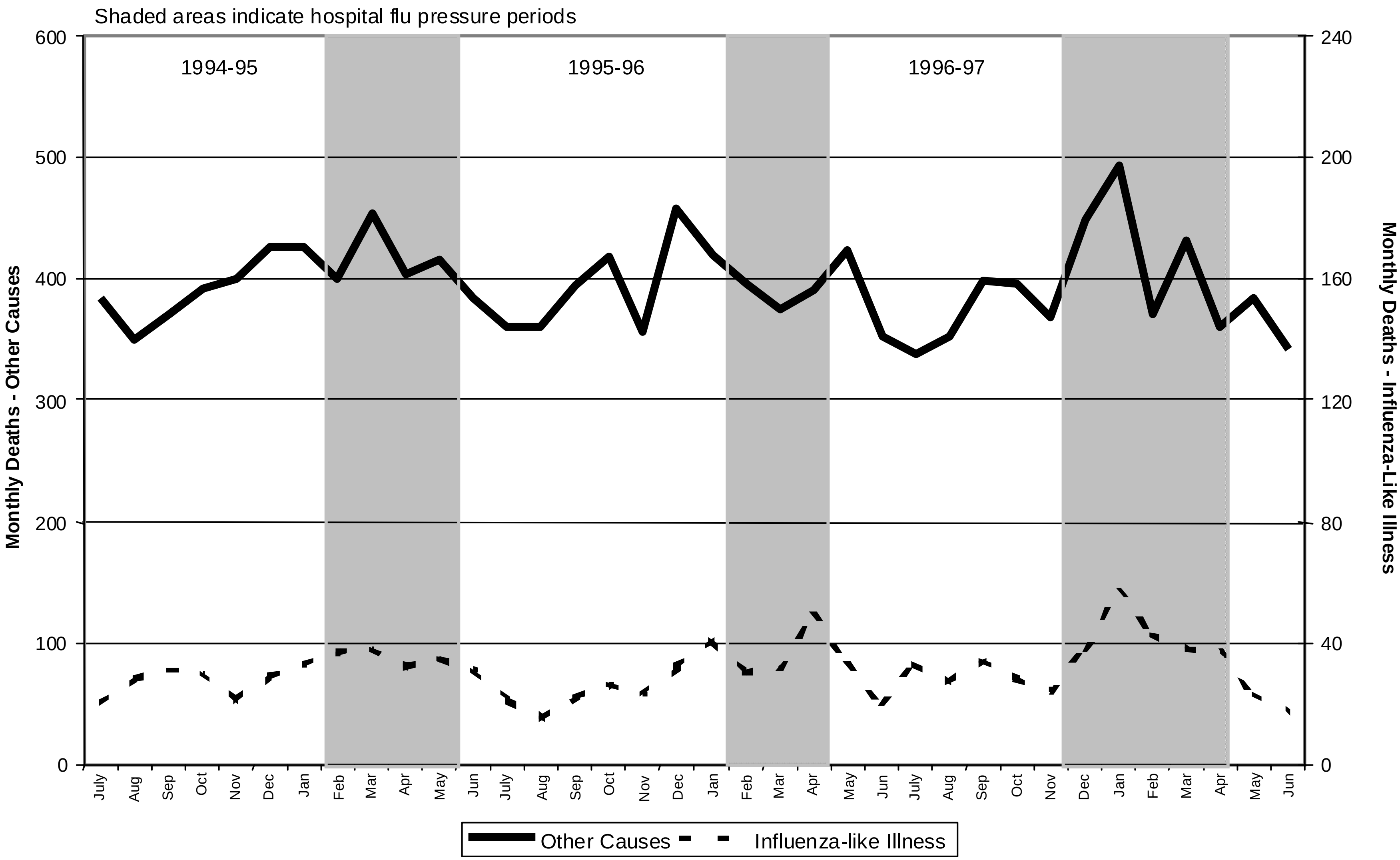
Amantadine is an effective antiviral drug used for the prophylaxis and treatment of influenza A (Aoki, 1998). It is often used for controlling influenza outbreaks among closed populations, such as in personal care homes. Although the number of amantadine prescriptions dispensed did display seasonal variation, peaking during the hospital flu pressure periods, the numbers were very low in 1995-96 and 1996-97 – 12 versus 13 amantadine prescriptions during peak weeks, respectively. During the 1997-98 flu pressure period, the number of prescriptions was substantially higher, peaking at 106 during the first week of March. In comparison, an average of nine prescriptions per week were dispensed during non-flu pressure weeks. The increase in March was driven by amantadine prescriptions dispensed to individuals aged 75, with 72 of the 106 prescriptions being dispensed to this age group. This dramatic increase in amantadine prescriptions is likely due to influenza outbreaks, including a major outbreak at the St. Boniface General Hospital.

That the number of amantadine prescriptions dispensed was unusually high in 1997-98 is supported by the finding that numbers were much lower in 1998-99, peaking at 25 during the flu pressure period. On average, seven prescriptions per week were dispensed during the non-flu pressure period, which is in the range of 1995-96 and 1996-97 figures, when there were six versus five dispensed on average per week, respectively.

Deaths – General Winnipeg Population

Figure 16 shows the number of deaths in a given month due to influenza-like illness from 1994 to 1997. Monthly patterns are plotted here, because weekly figures tended to fluctuate considerably from one week to the next, making it difficult to see seasonal patterns over the years. Deaths are presented only up to June of 1997, the most recent year for which vital statistics data were available when this report was produced. Note that the hospital flu pressure periods (shaded areas) are approximate, as they are shown for the months, rather than specific weeks during which the hospital census was unusually high.

Figure 16: Deaths from Influenza-Like Illness vs. Other Causes, Winnipeg Residents, 1994-95 to 1996-1997



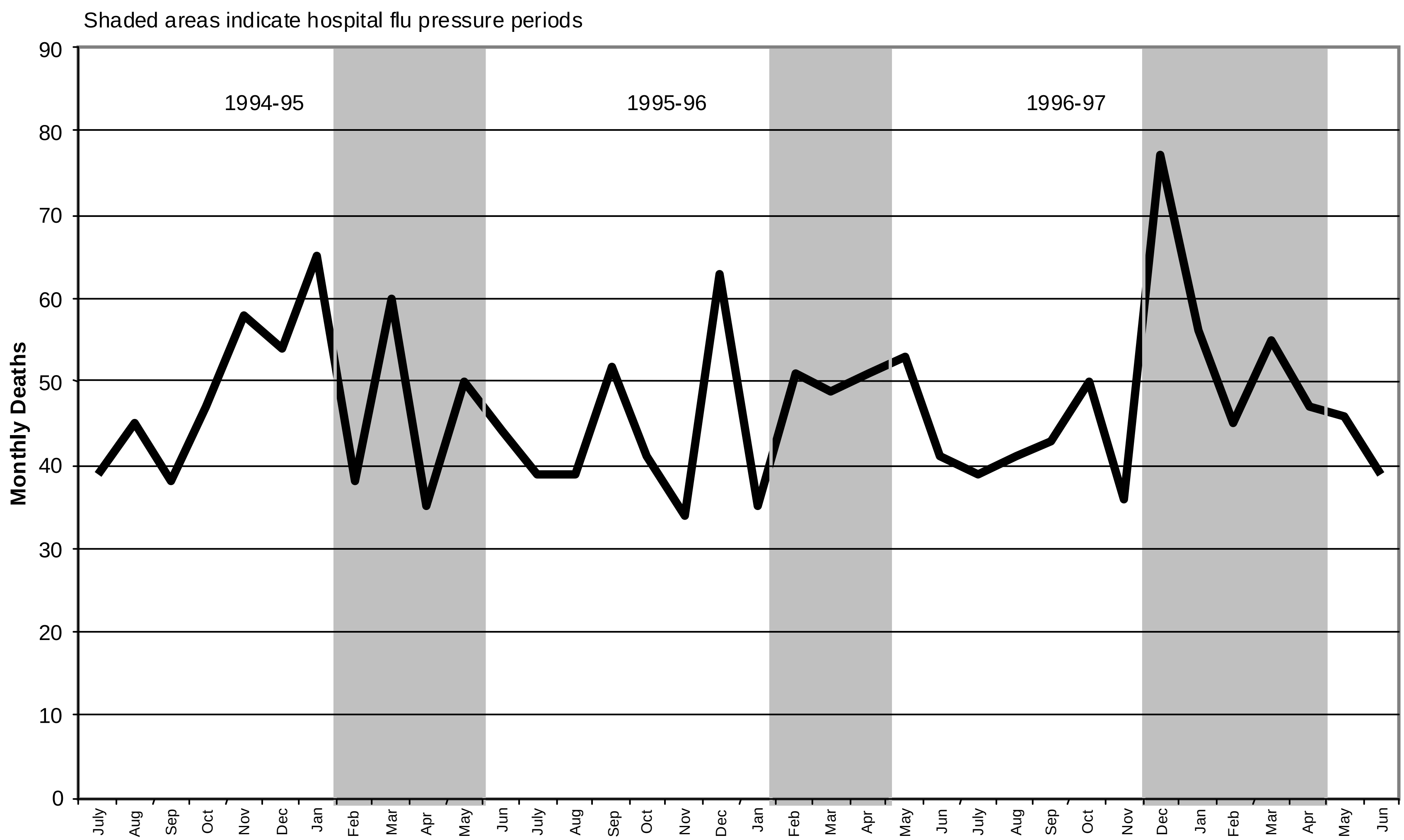
In general, the number of deaths due to influenza-like illness tended to be relatively high during the winter months and relatively lower in the summer. The peaks in deaths due to influenza-like illness corresponded to the hospital flu pressure periods during all three hospital flu pressure periods. A particularly high number of deaths due to influenza-like illness occurred in January of 1997, when they rose from an average of 27 deaths during the non-flu pressure period[9] to 57 deaths (a 111% increase). Thirty-two of these 57 deaths (56%) were, more specifically, due to pneumonia and influenza, with the remaining 25 deaths being due to chronic pulmonary diseases.

Deaths from causes other than influenza-like illness also displayed seasonal variation. However, in 1995-96 the peak occurred prior to that for influenza-like illness. In 1994-95 and 1997-98, the peaks coincided with those for influenza-like illness. As for influenza-like illness, the number of deaths due to other causes was highest in January of 1997. From an average of 368 per month during the non-flu pressure period, the number rose to 495 deaths in January (a 35% increase).

In Figure 17 we examine more specifically one other cause of death that may be related to influenza: acute myocardial infarction (Vullers et al., 1980). Evident is the clear seasonal pattern, with deaths caused by acute myocardial infarction being relatively high in the winter months and relatively lower during the summer. Peaks occurred in January of 1994-95, in December of 1995-96 and in December of 1996-97. The number of deaths due to myocardial infarction was especially high in December of 1996-97 (77 deaths). It was still quite high in January of 1996-97 (56 deaths). Overall, of the 552 deaths due to *all* causes that occurred in January of 1996-97, 57 (10%) were due to influenza-like illness, 56 (10%) were due to acute myocardial infarction, and an additional nine were due to congestive heart failure (2%).

[9] Consistent with previous calculations, this average was computed here based on a July 1996 to June 1997 time period (i.e. 1996-97).

Figure 17: Deaths from Acute Myocardial Infarction, Winnipeg Residents, 1994-95 to 1996-97



Deaths – Winnipeg PCH Residents

Figure 18 shows the number of deaths among Winnipeg PCH residents per month that were due to influenza-like illness versus other causes. Seasonal patterns can be seen for both deaths due to influenza-like illness, as well as those due to other causes, with the peaks generally falling into the hospital flu pressure periods (shaded areas). As we had seen for deaths among the general population, a particularly high number of deaths in January of 1997 also occurred among PCH residents. The number of deaths due to influenza-like illness peaked at 34 during that month - markedly up from an average of 14 deaths per month during the non-flu pressure period (a 143% increase); 23 of the 34 deaths (68%) were due to pneumonia and influenza, and 11 (32%) due to chronic pulmonary diseases.

We also examined deaths due to acute myocardial infarction and congestive heart failure among Winnipeg PCH residents. The number of deaths due to these causes was quite low throughout the year – ten per month due to myocardial infarction and four per month due to congestive heart failure, as averaged across the three years. Although deaths due to myocardial infarction displayed a seasonal pattern with peaks in the winter and valleys in the summer, the peaks did not always correspond to hospital flu pressure periods. For example, in 1995-96, the peak occurred in December (15 deaths), two months prior to the hospital flu pressure period.

Summary

As a summary of the previous findings, Table 7 shows a comparison of health care use and mortality during the hospital flu pressure versus non-flu pressure periods. For each indicator, we present the percent change from the mean of the baseline, non-flu pressure period to the mean for the flu pressure period.

The mean average daily census of influenza-like illness increased anywhere from 56.3% to 115.8% during the flu pressure weeks, as compared to the mean during the non-flu pressure weeks. Similarly, admissions increased substantially. The increase in ambulatory visits for influenza-like illness ranged from 26.4% to 48.1%. The increase in ER visits ranged from

Figure 18: Deaths among PCH Residents due to Influenza-Like Illness vs. Other Causes, 1994-95 to 1996-1997

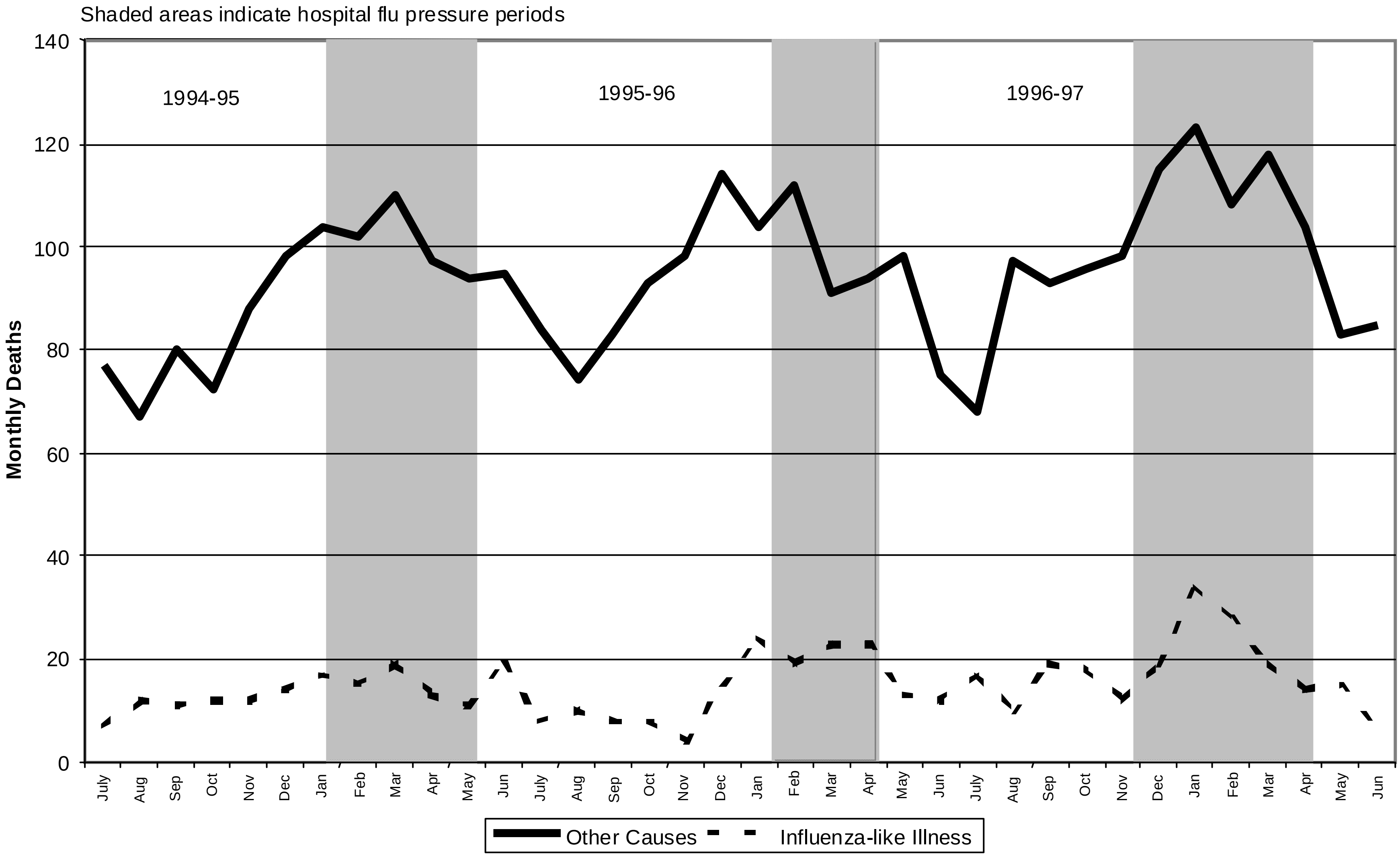


Table 7: A Comparison of Health Care Use Indicators During Hospital Flu Pressure Periods vs. Non-Flu Pressure Periods

	1995-96			**1996-97**			**1997-98**			**1998-99**		
Indicator	Non-Pressure Weeks	Pressure Weeks	Change	Non-Pressure Weeks	Pressure Weeks	Change	Non-Pressure Weeks	Pressure Weeks	Change	Non-Pressure Weeks	Pressure Weeks	Change
	Mean	Mean	%	Mean	Mean	%	Mean	Mean	%	Mean	Mean	%
Avg. Daily Inpatient Census for ILI	87	136	+56.3%*	78	128	+64.1%*	90	185	+105.6%*	101	218	+115.8%*
Weekly Admissions for ILI	62	93	+50.0%*	58	92	+58.6%*	64	122	+90.6%*	73	152	+108.2%*
Weekly Amb. Visits for ILI	7,629	9,781	+28.2%*	7,188	9,085	+26.4%*	7,073	10,475	+48.1%*	7,821	10,985	+40.0%*
Weekly ER Visits for ILI	160	229	+43.1%*	138	202	+46.4%*	156	138	-11.5%	176	282	+60.0%*
Weekly Antibiotic Prescriptions for ILI	6658	8322	+25.0%*	6157	7551	+22.6%*	5914	8008	+35.4%*	6000	8394	+39.9%*
Total Avg. Daily Census	2270	2303	+1.5%	2173	2211	+1.7%	2244	2348	+4.6%*	2198	2237	+1.8%
Weekly Total Admissions	571	599	+4.9%	554	593	+7.0%	540	590	+9.3%*	547	613	+12.1%*
Weekly Total Amb. Visits	58,393	61,290	+5.0%*	57,883	58,317	+.01%	58,167	62,049	+6.7%*	59,607	59,301	-.5%
Weekly Total ER Visits	1,746	1,782	+2.1%	1,649	1,674	+1.5%	1,701	1,066	-37.3%*	1,718	1,665	-3.1%

* Mean during flu pressure period is significantly different from that during the non-flu pressure period (p< .05, Poisson distribution).
ILI = Influenza-like illness

43.1% to 60%, the exception being 1997-98 where there were fewer visits during the flu pressure period than the non-flu pressure period. This decrease is due to the fact that during that year the number of visits for influenza-like illness peaked three weeks prior to the onset of the hospital flu pressure period, although visits were still high during the first two weeks of the flu pressure period (see also Figure 14). The increase in the average weekly number of antibiotic prescriptions dispensed ranged from 22.6% to 39.9%.

Compared to health care use for influenza-like illness, health care use for any condition did not increase as much during the flu pressure periods. Noticeable is the large decrease in emergency room visits in 1997-98. This is due to a significant decrease in emergency room visits for reasons other than influenza-like illness, which coincided with the flu pressure period. That overall health care use did not increase as much as use for influenza-like illness suggests that maximum capacity was reached. Thus, although the system has some capacity to accommodate additional patients (although in the case of the hospital system this sometimes means patients overflow into the hallways of emergency departments), in general the patient mix changes during the flu pressure period to include proportionally more individuals with influenza-like illness.

Table 8 shows the number of deaths during the 1995-96 and 1996-97 non-flu pressure periods versus flu pressure periods. The number of deaths per month due to influenza-like illness increased by 42.3% and 59.3% among the general population and by 100% and 64.3% among PCH residents. The increases in total number of deaths (deaths due to any cause) were not as large, although deaths due to any cause for PCH residents did show a 32% increase in 1996-97.

Thus, along with pressures due to influenza-like illness in the hospital system, there were systematic effects across the health care system. These increases were substantial when examining mean values during the hospital flu pressure periods. The increases were even greater during peak weeks.

Table 8: A Comparison of Deaths During Hospital Flu Pressure Periods vs. Non-Flu Pressure Periods, Winnipeg Residents

	1995-96			1996-97		
Indicator	Non-Pressure Weeks	Pressure Weeks	Change	Non-Pressure Weeks	Pressure Weeks	Change
	Mean	Mean	%	Mean	Mean	%
Monthly Deaths for ILI - General Wpg. Pop.	26	37	+42.3%	27	43	+59.3%
Monthly Deaths for ILI - Wpg. PCH Residents	11	22	+100%	14	23	+64.3%
Total Monthly Deaths - General Wpg. Pop.	420	425	+1.2%	395	464	+17.4%
Total Monthly Deaths - Wpg. PCH Residents	103	120	+16.5%	103	136	+32.0%

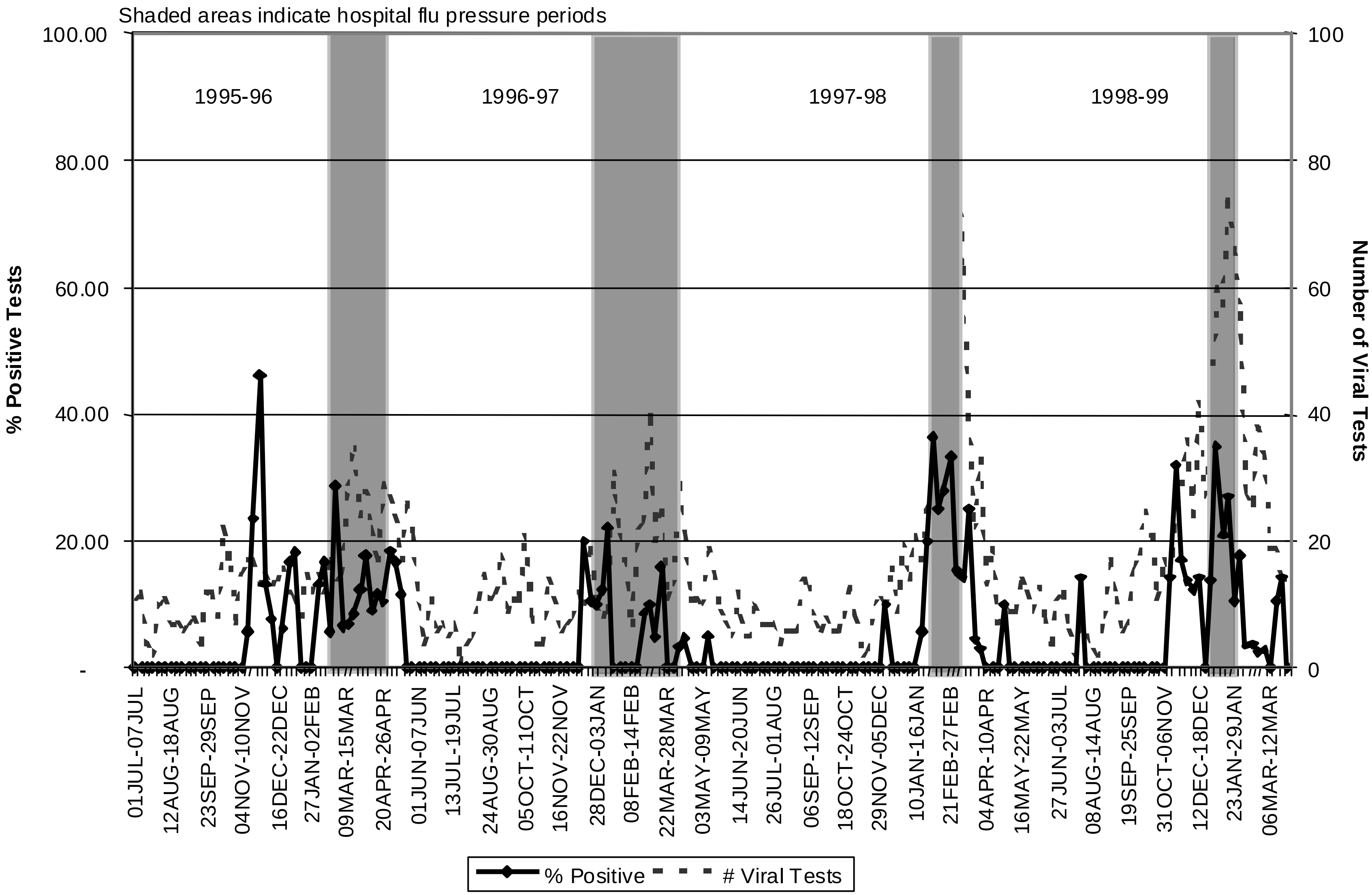
* Mean during flu pressure period is significantly different from that during the non-flu pressure period ($p< .05$, Poisson distribution). Wpg = Winnipeg

Is a Warning System Possible?

In this section we examine the relation between hospital flu pressure periods and specific versus non-specific indicators of influenza activity. The question addressed is whether it is possible to anticipate hospital flu pressure periods, thereby allowing hospitals to plan for and, presumably, minimize or prevent seasonal bed shortages.

We first examined laboratory data obtained from the Cadham laboratory, the provincial laboratory where viral isolates are analyzed. Figure 19 shows both the total number of viral tests for influenza A and B performed each week, as well as the percentage positive tests. Included are only tests for Winnipeg residents, as they are more relevant to potential health care use in Winnipeg than tests for residents from other parts of the province.

Figure 19: Viral Testing for Influenza A and B, Winnipeg Residents, 1995-96 to 1998-99



The number of viral tests increased substantially each winter, with the peaks corresponding to the hospital flu pressure periods during all four study-years. Thus, most of the testing was done when the hospital system was already under pressure. To be useful as a warning system, laboratory tests would have to precede hospital pressure periods. The percent positive tests are more promising in this respect. The first positive test preceded the start of the hospital flu pressure periods anywhere from one to 14 weeks (not counting the spring and summer positive tests). An alert period lasting 14 weeks, as was the case in 1995-96, is likely too long to be useful. We therefore examined next whether other, non-specific indicators systematically precede hospital flu pressures.

Table 9 shows physician visits, emergency department visits, and antibiotic prescriptions in relation to the hospital flu pressure periods. For each indicator, we identified periods of high activity, defined as periods when the weekly value of the indicator rose above the mean plus one standard deviation for at least two consecutive weeks and did not drop below the threshold for more than one week. Using this method, we determined for how many weeks high-activity periods preceded the hospital flu pressure period.

As can be seen in Table 9 (and as noted above) in 1995-96, the first positive laboratory tests for influenza were observed between November 11 and January 12 – 14 weeks prior to the hospital flu pressure period. After this, there were no positive tests for three weeks, with the next period of positive tests starting February 9 – two weeks prior to the hospital flu pressure period. Between 1996-97 and 1998-99, the first positive tests occurred one to seven weeks prior to the hospital flu pressure period.

For ambulatory visits for influenza-like illness (all Winnipeg physicians), there tended to be periods of high activity in September and October. Although these fall activity periods are shown for completeness sake, they do not provide useful information in the present context, as they occurred at a time when one would not expect a great deal of influenza activity. Nor would one expect a hospital flu pressure period in the early fall. Apart from this fall activity, increases in ambulatory visits for influenza-like illness occurred anywhere from three weeks (1996-97 and 1997-98) to 13 weeks (1995-96) prior to the hospital flu pressure periods.

Table 9: Is it Possible to Develop a System to Warn Hospitals of Impending Influenza Activity?

	1995-96		1996-97		1997-98		1998-99	
	Increased Activity	Weeks to Flu Pressure Period	Increased Activity	Weeks to Flu Pressure Period	Increased Activity	Weeks to Flu Pressure Period	Increased Activity	Weeks to Flu Pressure Period
% Positive Tests	11 Nov-12 Jan 9 Feb-17 May	-14 -2	14 Dec-17 Jan	-2	17 Jan-3 Apr	-1	7 Nov-19 Mar	-7
Amb Visits-ILI All MDs	23 Sep-27 Oct 18 Nov-22 Dec 17 Feb-19 Apr	-21 -13 0	28 Sep-11 Oct 7 Dec-10 Jan	-13 -3	13 Sep-31 Oct 3 Jan-27 Feb	-19 -3	28 Nov-22 Jan	-4
Amb Visits-ILI Paediatricians	4 Nov-15 Dec 17 Feb-22 Mar	-15 0	14 Sep-1 Nov 30 Nov-3 Jan	-15 -4	4 Oct-24 Oct 29 Nov-20 Feb	-16 -8	21 Nov-8 Jan	-5
ER Visits-ILI	16 Sep-29 Sep 18 Nov-15 Dec 17 Feb-12 Apr	-22 -13 0	7 Sep-20 Sep 14 Dec-10 Jan	-16 -2	6 Sep-19 Sep 13 Dec-2 Jan 17 Jan-6 Feb	-20 -6 -1	5 Dec-15 Jan	-3
Antibiotic Prescriptions-ILI	25 Nov-22 Dec 17 Feb-29 Mar	-12 0	5 Oct-11 Oct 30 Nov-10 Jan	-12 -4	13 Dec-27 Feb	-6	28 Nov-22 Jan	-4
Total Amb Visits All MDs	30 Sep-20 Oct	-20	5 Oct-25 Oct	-12	-		3 Oct-23 Oct	-12
Total Amb Visits Paediatricians	30 Sep-6 Oct 11 Nov-1 Dec 17 Feb-22 Mar	-20 -14 0	7 Sep-20 Sep 14 Dec-20 Dec	-16 -1	13 Sep-26 Sep 17 Jan-23 Jan	-19 -1	21 Nov-18 Dec	-5
Total ER Visits	2 Sep-6 Oct	-24	-		23 Aug-12 Sep	-22	29 Aug-2 Oct 5 Dec-1 Jan	-17 -3

Increased activity is defined as > mean+1SD (except for % positive viral tests). Weeks to flu pressure period shows how many weeks prior to the hospital flu pressure period this increased activity occurred, calculated from first week of increased activity up to first week of hospital pressure period. ILI=Influenza-like illness. A dash indicates that there was no increased activity during that year.

Similar findings emerged for the other health care use indicators, with (not counting the September and October activity periods) ambulatory visits to paediatricians, emergency department visits, and antibiotic prescriptions dispensed for influenza-like illness increasing anywhere from one to 13 weeks prior to the hospital flu pressure periods. Consistently longer time intervals emerged for 1995-96. This was the case because there was a high-activity period across all indicators in November/December followed by a second activity period in February. However, the hospital system only started to experience a major influx of patients with influenza-like illness in February. The hospital flu pressure period coincided with increased activity in ambulatory visits, ER visits, and antibiotic prescriptions dispensed. It should be noted that the second wave of positive laboratory influenza tests did indeed precede the hospital flu pressure period by two weeks.

Also evident in Table 9 is that ambulatory visits and emergency department visits for any reason (i.e., the total number of ambulatory and ER visits) were not sensitive to hospital flu pressure periods. Generally, increased activity occurred only during the fall (August to October). This supports the view that, given that there is a limit to how many patients a physician can see in a day and how many patients can be treated in emergency rooms, the flu season does not lead to a peak in the total number of visits, but rather is reflected in a change in the mix of patients.

What do these data suggest, then? First, laboratory-confirmed influenza tests, as well as increased activity across a range of health care use indicators systematically precede hospital flu pressure periods, although the time period can vary considerably, being as short as one week or as long as 14 weeks. Second, a warning system could benefit from both laboratory testing for influenza and monitoring of non-specific indicators, such as physician or emergency room activity. Third, although a warning system appears possible, current surveillance activities and tracking of non-specific indicators would have to be enhanced (and tested) to provide a more precise estimate of impending influenza activity.

Influenza Vaccination

Influenza vaccination is currently the single best method to prevent influenza and reduce hospitalizations and deaths due to complications of influenza. The question of the extent of vaccination coverage in Winnipeg, and Manitoba in general, and whether coverage meets recommended levels, therefore becomes a critical one. In trying to examine vaccination coverage, we were faced with the problem that at the time this report was prepared, no system was in place in Manitoba that systematically tracked influenza vaccination on an individual basis.[10] One data source we examined were physician claims, which cover influenza vaccination administered by physicians paid on a fee-for-service basis. However, we know that a considerable amount of influenza vaccination occurs outside physicians' offices. The biggest contributor is likely vaccination supplied through the public health system. Influenza vaccination is also provided in PCHs, through employee-related vaccination clinics, in hospitals, and through mass-vaccination clinics in salaried physician practices. No systematic individual records were kept for the study years (i.e., 1995-96 to 1998-99) that allowed us to identify who received a flu shot in these locals.

In order to determine the extent to which physician claims data underestimate influenza vaccinations, we examined the total, province-wide number of influenza vaccinations captured by physician claims. As Figure 20 shows, the number of vaccinations recorded declined steadily over the years. While there were 96,647 flu vaccinations recorded in fiscal year 1993/94, the number dropped to 68,987 in 1998/99. However, the actual number of flu vaccination doses distributed during that time period increased slightly. In 1993/94, 157,830 doses were distributed province-wide, in 1998/99 165,440. This means that in 1993/94, physician claims captured 61.2% of all doses distributed; in 1998/99 the percentage dropped to 41.7%. Clearly, physician claims substantially underestimate the number of flu vaccinations administered - and the problem got worse over the years.[11]

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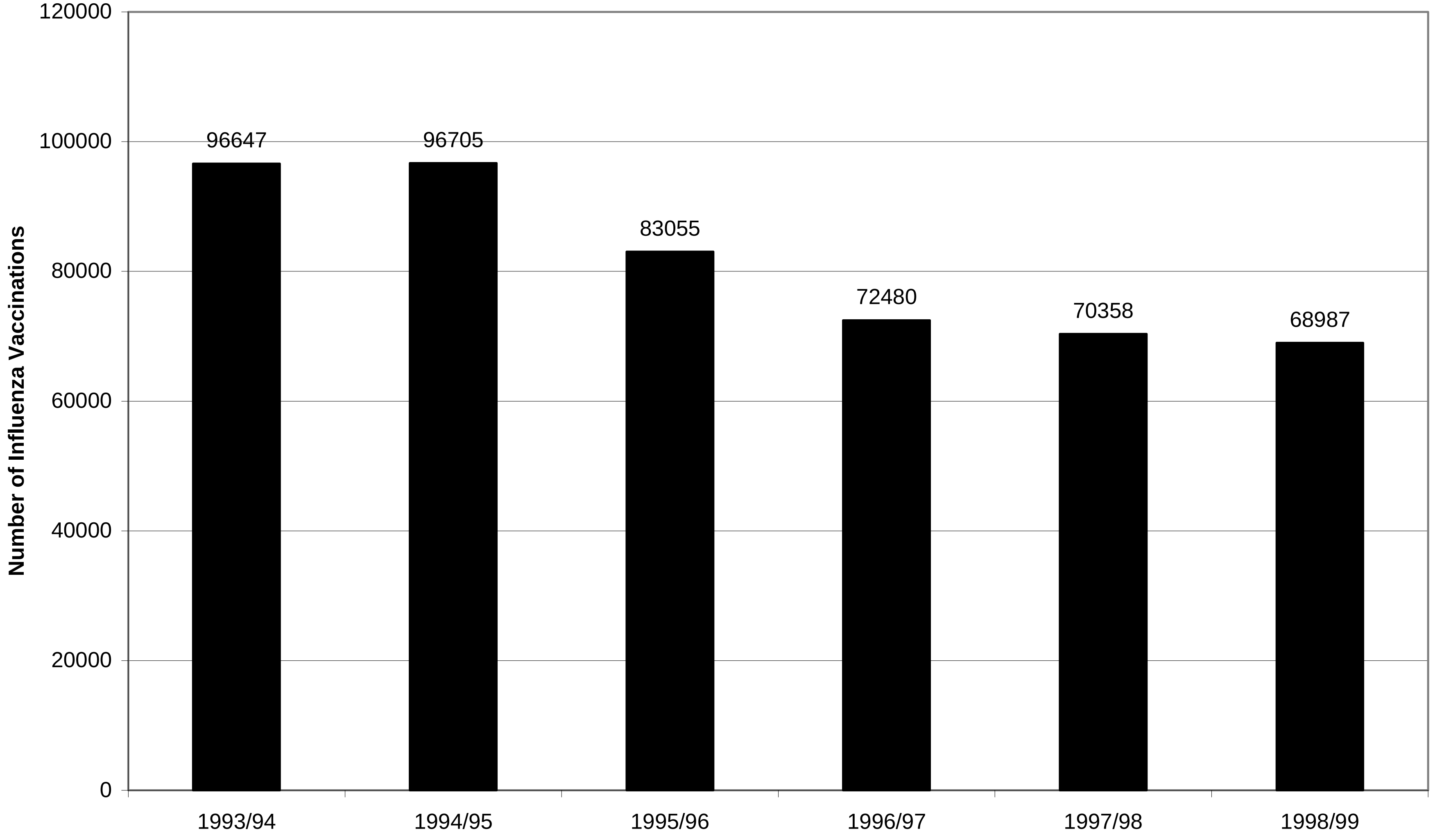
[10] An information system that tracks all vaccinations was implemented in the fall of 2000.
[11] Even if we estimate that 10% to 20% of influenza vaccine distributed is not used, the extent of underestimation is considerable.

Figure 20: Total Number of Influenza Vaccinations Reported in Physician Claim Database, Entire Province

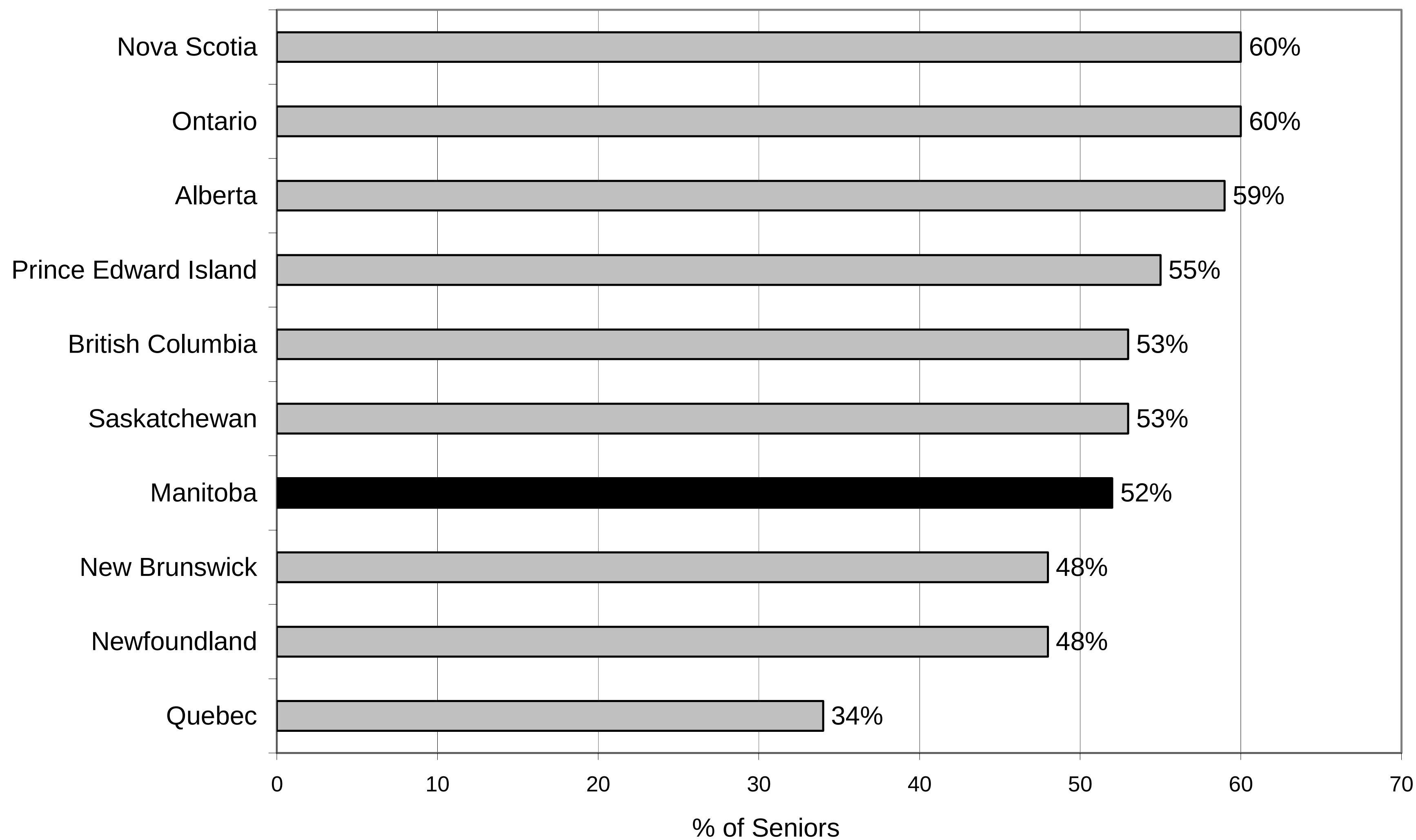


This under-reporting introduces two potential errors into data analyses: 1) Some individuals who received an influenza shot will be misclassified as not having been vaccinated. This will weaken the association found between influenza vaccination and outcome measures. 2) Non-uniform under-reporting can introduce biases. For example, by not being able to capture influenza vaccination administered by public health nurses, we may systematically miss certain populations that would tend to use nurses or salaried physicians, rather than physicians paid on a fee-for-service basis.

Both errors are at play here. Figure 21 shows influenza vaccination coverage among individuals aged 65 and above derived from the National Population Health Survey (NPHS). The NPHS is a survey conducted by Statistics Canada with a representative sample of participants drawn from each province. The most recent survey was conducted in 1996-97. Among many other questions, participants were asked about flu vaccination. As Figure 21 shows, survey results indicate that 52% of seniors aged 65 and above in Manitoba received a flu shot during the year prior to the survey. Vaccination coverage in Manitoba was similar to that in Saskatchewan and British Columbia, but lower than that in Nova Scotia, Ontario, Alberta, and Prince Edward Island. The lowest vaccination coverage was found in Quebec.

As a comparison, we calculated influenza vaccination using the physician claims data, focusing on Winnipeg residents aged 65 and above only (excluding PCH residents). This would tend to minimize the extent of under-reporting, as it eliminates vaccination in PCHs and employee clinics. In fiscal year 1997/98, 43% of seniors received a flu shot during the vaccination season (September to December), as reported in physician claims. This is 9% below the figures from the NPHS. Moreover, the extent of underestimation is not constant across different age brackets, with the smallest discrepancy emerging for individuals aged 75 to 79 (7% difference between NPHS and physician claims data) and the highest among the 80+ year olds (12% difference). Among people aged 65 to 69, the physician claims underestimated vaccinations by 8%, and among the 70 to 74 year olds by 9%. That the extent of underestimation is greatest among the old-old suggests that many of them receive influenza vaccination outside fee-for-service physician offices.

Figure 21: Percent Immunized against Influenza in the Past Year, by Province, Age 65+, Canada, 1996-97



Thus, it appears that even for non-PCH residents aged 65 and above, physician claims data underestimate influenza vaccination quite substantially, making it questionable to use the database to determine vaccination coverage. More substantively, however, the NPHS results indicate that vaccination coverage in Manitoba and, indeed, across the country is quite low. The 52% vaccination rate in 1996-97 falls clearly short of the recommendations of the National Advisory Committee on Immunization (1999) that influenza vaccine programs should attain vaccination levels of at least 90% among high-risk groups.

CONCLUSIONS

- Influenza-like illness places considerable pressure on the hospital system each year. The impact of influenza-like illness should be continuously monitored to determine if pressures are increasing over time.

- A large proportion of patients admitted for influenza-like illness are 65 years old and above (54% on average). Moreover, the proportion (and number) of 75+ year olds admitted for influenza-like illness increased steadily from 1995-96 to 1998-99. Influenza vaccination is an effective method to reduce hospitalization for influenza-like illness. Numerous influenza vaccination initiatives were launched in 1999/2000 and 2000/2001 by the Regional Health Authorities (funded by the Communicable Disease Control Unit of Manitoba Health) including, for example, a comprehensive public education campaign (radio/television spots and advertisements in newspapers, bus shelters, and transit buses). Continued emphasis should be placed on enhancing/maintaining influenza vaccination coverage in Manitoba.

- This report further shows that hospital admission rates for influenza-like illness were much higher for seniors (aged 65+) living in seniors' apartments than for their counterparts living in the community. This suggests that particular emphasis should be placed on targeting seniors' residences for influenza vaccination clinics. As part of the enhanced vaccination initiatives launched in the fall of 1999,vaccination clinics are now being held in seniors' residences in Winnipeg. The effectiveness of these clinics will have to be evaluated.

- Continued emphasis should also be placed on targeting health care workers for influenza vaccination, such as those working with seniors, as influenza vaccination is less effective for the elderly, particularly the frail elderly, than young healthy individuals (Centers for Disease Control and Prevention, 2000). Influenza vaccination among health care workers has been shown to decrease mortality among elderly patients in long-term care hospitals (Carman et al., 2000).

- Wider use of influenza vaccination than is currently the case might also be useful. In the United States, immunization of all adults over 50 years of age is now recommended (Centers for Disease Control and Prevention, 2000). Given that young children are at increased risk of hospitalization during flu seasons (Izurieta et al., 2000; Neuzil et al., 2000), influenza vaccination might also be considered for children. In Ontario, influenza vaccine was, indeed, for the first time available to all residents (not only those at highest risk) in the fall of 2000.

- Appropriate outbreak control strategies in PCHs (and possibly seniors' apartments) are essential. For example, the correct dose of amantadine may be placed on each PCH resident's chart in the fall and administered by standing order after an outbreak has occurred.

- At the time this report was prepared, the data to describe influenza vaccination coverage in Manitoba were inadequate. Moreover, our capacity to determine vaccination rates had declined over the years, as the approach to providing influenza vaccination became increasingly fragmented. In order to enhance influenza vaccination coverage in Manitoba and monitor its effectiveness, Manitoba Health expanded the existing Manitoba Immunization Monitoring System (MIMS) as of 2000/2001. While MIMS was originally designed to track immunizations among children, the enhanced MIMS now also covers adults. As such, influenza (and pneumococcal) vaccine administered through public health will be captured. Physician-based immunization data for adults will also be transferred into MIMS to allow more comprehensive analysis of vaccine coverage. An important first step will be to evaluate how complete the new MIMS data are. Influenza vaccination coverage (and coverage of the newly introduced pneumococcal vaccination) in Manitoba can then be examined. The effectiveness of influenza (and pneumococcal) vaccination in preventing illness and hospitalization should also be investigated.

- Besides their impact on the hospital system, influenza-like illness also had a substantial effect on the ambulatory care system and emergency departments. Given that the number of ambulatory visits declines markedly over the Christmas/New Year's holiday season, the question of whether flexibility could be built into the ambulatory care system to increase capacity (or decrease capacity less than is currently the case) over the holiday season should be explored. The extent to which closure of physician offices places pressure on emergency rooms also warrants examination.

- The number of antibiotic prescriptions dispensed displayed substantial seasonal variation. The question of how appropriate antibiotic use is for certain respiratory illnesses has been raised in the research literature (Wang et al., 1999). This issue is an important one that should be systematically examined in future research.

- Is a warning system possible that could help hospitals anticipate impending influenza activity? Our data suggests yes. However, such a warning system would require more active influenza surveillance than was the case when this report was prepared. Since this report was prepared, the influenza surveillance system in Manitoba has been further enhanced, with additional sentinel physicians monitoring the incidence of influenza-like illness and taking swabs for viral testing. The role of sentinel physicians is clearly critical and continued involvement of physicians should be sought.

  School absenteeism, whereby public health nurses take samples from children once the absenteeism rate during the flu season reaches 10% or more, is now also systematically tracked on a weekly basis. The effectiveness of this school surveillance will have to be evaluated. Systematic surveillance of other non-specific indicators, such as emergency room activity might also be considered.

- In order to assess the impact of influenza-like illness on the entire hospital system, it is important to have complete data not only for hospital inpatients, but also for patients who visit emergency rooms. Current emergency room data are limited, however. Implementation of an information system that would capture all seven emergency departments in Winnipeg should be considered. Such as system would ideally provide individual-based information of all emergency room contacts, including diagnoses.

- Implementation of an effective surveillance system should help hospitals anticipate flu pressure periods. This could allow timely initiation of various management strategies, such as discharging patients who are no longer acute or enhancing home care services in order to prevent hospital overcrowding.

LIMITATIONS OF THIS REPORT

In the present report we defined influenza-like illness on the basis of ICD-9-CM diagnostic codes for respiratory illnesses (pneumonia and influenza, chronic pulmonary diseases, and acute respiratory diseases). While respiratory illnesses have clearly been linked to influenza (Nicholson, 1998), we cannot determine whether individuals diagnosed with influenza-like illness indeed had influenza. Some respiratory problems might have been due to other causes, such as respiratory syncytial virus. In order to estimate how many patients admitted to hospital with influenza-like illness actually had influenza, it might be useful to conduct a study whereby samples would be analyzed from individuals hospitalized with influenza-like illness.

Our definition of influenza-like illness included only respiratory diseases. However, other illnesses are also thought to be complications of influenza, such as congestive heart failure. By focusing on respiratory diseases only, we therefore likely underestimate the true impact of influenza on the health care system.

We examined antibiotic and amantadine prescriptions for individuals identified as having influenza-like illness, as determined on the basis of physician claims data. We did not, however, specifically link drug use to diagnoses of influenza-like illness. It is therefore possible that some antibiotic and amantadine prescriptions were dispensed for conditions other than influenza-like illness.

A further limitation of the present report relates to emergency room data. We were only able to capture emergency departments at two hospitals (the Health Sciences Centre and the St. Boniface General Hospital), as emergency room physicians at other hospitals are salaried and their services are not captured in the physician claims database. Although the Health Sciences Centre and the St. Boniface General Hospital account for a large proportion of emergency room visits – previous research shows close to half (Barer et al, 1994) – we nevertheless miss a substantial number of visits. Moreover, as we include the only paediatric emergency department in Winnipeg, our data includes proportionally more children than would be the case if we had been able to use data from all seven hospitals.

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APPENDIX A
Description of Patients Admitted for Influenza-Like Illness vs. Other Reasons During Standard, 13-Week Flu Seasons[a], 1995-96 to 1998-99

	Admissions for Influenza-like Illnesses				Admissions for Other Reasons			
	1995-96	1996-97	1997-98	1998-99	1995-96	1996-97	1997-98	1998-99
Total No. of Admissions	1068	1153	1343	1220	6486	6577	6118	6001
Age								
0-4	286	296	219	252	1239	1105	311	329
5-14	38	34	54	36	174	188	216	241
15-64	224	236	264	228	2285	2384	2487	2499
65-74	203	193	253	212	1124	1079	1122	1005
75+	317	394	553	492	1664	1821	1982	1927
Male	562	565	610	587	3168	3264	2938	2878
Female	506	588	733	633	3318	3313	3180	3123
Level of Comorbidity and Complications								
None/Minor	642	629	685	657	3606	3517	3159	3122
Moderate	284	365	417	339	2125	2243	2097	2107
Major	142	159	241	224	755	817	862	772
Number of Comorbidities								
None	432	460	445	489	4443	4418	3938	3914
One	503	517	675	550	804	892	913	896
Two	88	106	154	125	594	635	644	561
Three or more	45	70	69	56	645	632	623	630
Residence								
Winnipeg	907	941	1183	1017	5298	5318	5056	4929
Elsewhere	161	212	160	203	1188	1259	1062	1072
Location of Residence - Winnipeg Residents								
Inner Core	105	85	100	88	390	406	376	333
Outer Core/Old St. B.	272	268	305	281	1357	1346	1246	1232
Other Winnipeg	530	588	778	648	3551	3566	3434	3364
Place of Residence - Winnipeg Seniors (65+)								
Home	380	403	577	507	2001	2020	2225	2096
Seniors Residence	80	95	130	118	389	409	441	399
PCH	35	54	59	44	90	141	119	118

Flu Seasons are defined from the beginning of January to the end of March (see Methods section for details).

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