Saskatoon Health Region | Public Health Services

The H1N1 Pandemic

Medical Health Officer's Report on the Saskatoon Health Region's Response to the Global Influenza Pandemic 2009 - 2010

March, 2011

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Executive Summary

In June of 2009, the World Health Organization declared a full influenza pandemic of the newly emerged influenza virus H1N1. This report provides an account of Saskatoon Health Region's response to the H1N1 pandemic between May and December 2009. It highlights the planning process prior to and during the pandemic, provides a brief description of the outcomes, and identifies key lessons learned for addressing similar public health challenges in the future.

Planning

The pandemic created the need for a comprehensive Public Health Services (PHS) response, which was based on years of planning, practice and training by a host of workers from Saskatoon Health Region (SHR). Several SHR committees played key roles in planning for and addressing the pandemic, including: Health Emergency Operations Committee; SHR Outbreak Control Team; Public Health Services, Emergency Operations Committee; Mass Immunization Planning Committee; and Vaccine Allocation Approval Committee.

SHR used a model of the four stages of planning to meet medical surge capacity demands on the healthcare system. The model outlined key activities for each anticipated stage of demand from pre-surge through to the system at "overcapacity".

To inform planning, projected timeline estimates and approximate patient volumes were developed using data from the first wave, as well as data from Australia, who had just emerged from their winter experience with pH1N1. Specifically, Public Health Services produced a model to estimate anticipated pH1N1 ICU admissions and ventilator requirements for the tertiary hospitals. While the model underestimated the total number of hospitalizations, the number of critical care admissions and the mean and total length of critical care were accurate.

As part of the Pandemic Plan, the SHR outbreak control team (OCT) coordinated the Health Region's public health measures which focused on two main areas: infection control and social distancing to prevent disease. A variety of activities were undertaken by OCT to develop and distribute relevant material.

Another key action throughout the pandemic was communication. This was the first pandemic to occur with the new information age, so new approaches of communication such as Facebook, YouTube and Twitter were utilized in addition to traditional sources of information.

One of the major pieces of planning in the pH1N1 pandemic was the implementation of a mass vaccination campaign, which was a significant expansion of the usual seasonal influenza vaccine campaign for SHR. While plans were in place prior to the pandemic declaration, they needed to be modified throughout, as unanticipated challenges emerged in the fall of 2009 (e.g., initial shortages in vaccine supply during the first months of the campaign). Key aspects of the campaign included: vaccine allocation, vaccine distribution, mass immunization clinics, record keeping and antiviral allocation and distribution.

A key public health function during the pandemic was surveillance, which informed decision making prior to and throughout the pandemic. Routine surveillance activities were maintained, including: ER ILI surveillance, Sentinel Physician Surveillance, SHR employee illness absenteeism by site, Influenza and severe respiratory illness deaths surveillance, laboratory-confirmed influenza surveillance, weekly flu reports from the province and PHAC and school absenteeism surveillance. Enhanced surveillance activities during pH1N1 included: real time SHR employee illness absenteeism by unit, real time acute care surveillance, severe influenza outcomes surveillance and adverse events following immunization monitoring and reporting.

Outcomes

Key outcomes from the pH1N1 pandemic in SHR include:

- Between April 20 and Dec 15, 2009, the total number of all SHR resident lab confirmed pH1N1 cases was 909, including 87 hospitalized cases (in total there were 144 hospitalized cases in SHR, including SHR residents and non-residents transferred to a SHR facility).
- A large number (42%) of paediatric cases were hospitalized.
- In the adult cases, the mean age of 44.6 years was much younger than would be expected from influenza/pneumonia in a typical influenza season.
- Just over a quarter (26%) of hospitalized cases in SHR were admitted to ICU.
- The majority of hospitalized cases in SHR reported underlying conditions.
- SHR reported nine deaths (six lab confirmed pH1N1[a], and two SRI and one influenza A suspected pH1N1). Three of the deaths were in youth under eighteen. All deaths were in individuals that reported underlying health conditions.
- Overall, SHR successfully immunized 49% (149,103) of the population in SHR from October 26, 2009 to March 31, 2010.

Conclusions/Lessons Learned

A number of lessons learned emerged from the pH1N1 pandemic. Highlights include:

For Saskatoon Health Region:

- A mass immunization site appears to have worked well as an efficient method for immunizing a large proportion of the population.
- Other health care professionals could have been utilized to assist in streamlining and speeding up various processes (e.g., pharmacy or nursing students).
- Prioritizing vulnerable populations is important during an emergency response.
- An intensive coordinated communication approach was critical to the success of the immunization campaign.
- One central distribution site for antivirals worked well for tracking the antiviral stockpile.
- Having real time surveillance data available to the various planning committees was useful to support the approach in providing health care services.
- A pre-determined set of report parameters for surveillance would be useful for appropriate planning and staffing of surveillance information during a pandemic.

[a] One of these deaths was in a SHR resident, but was reported to First Nations and Inuit Health. As a result, they are not officially part of our count, but have still been included since they lived in our region.

For the Ministry of Health

- An ongoing universal influenza immunization program, with the needed infrastructure in place and an easier system to deal with the priority objectives of a new vaccine, would potentially provide a better basic approach and result in fewer opportunity costs.

For the Public Health Agency of Canada

- Collaboration and clear communication among all levels of government are essential as a first line of defence in a large scale health emergency.

- Investment in technology that would potentially make vaccine earlier is important for the future.

- In general, introducing new vaccine technology prior to a pandemic, rather than during it, would allow for a more thoughtful and evidence based approval process.

- Vaccine which has only a 24 hour shelf life once a vial is mixed leads to more wastage, and if there is a shortage, further limits distribution to the biggest agencies.

Introduction

The response by Public Health Services (PHS) to the H1N1 pandemic from May to December of 2009 was based on years of planning, practice and training by a host of workers from Saskatoon Health Region (SHR). Despite our best efforts, there were 144 hospitalized cases and 9 deaths in SHR as a result of pH1N1.[b]

This report provides an account of Saskatoon Health Region's response to the global H1N1 pandemic between May and December 2009. It highlights the planning process prior to and during the pandemic, provides a brief description of the outcomes and identifies key lessons learned for addressing similar public health challenges in the future.

Background

The H1N1 pandemic was characterized by the emergence of a new influenza virus to which most people had no immunity. It caused unusual and extensive outbreaks of disease in the summer of 2009 in many countries and very high levels of disease in winter months. It was also characterized by a dominance of the pandemic virus over other seasonal influenza viruses and other unusual clinical patterns, such as severe outcomes in some risk groups.

A chronology of the disease globally

Following the emergence of the pandemic strain in North America in April 2009, the first case in SHR was detected on May 6, 2009. Several interventions and surveillance responses were initiated to investigate the nature of the pandemic in SHR. Further development in international events prompted the region to implement its pandemic plan, as it was becoming clear that pH1N1 was a serious threat to public health. Globally, pH1N1 unfolded as follows:

- The World Health Organization (WHO) reported in late April a large number of Influenza Like Illness (ILI) and pneumonia cases in south and central Mexico. The high number of deaths, the geographical spread and the age groups affected (the majority healthy adults), made these events of high concern. At the same time, the United States government reported cases of mild swine influenza in California and Texas. [1] On further study, the Mexican and American sub-types were identical; however, the cases in the United States had not had any direct contact with pigs or history of travel to Mexico.

- On April 27th, 2009 the WHO moved the global pandemic alert level from 3 "Predominantly Animal Infections few human infections" to level 4 "Sustained human transmission (see Figure 1)."[2]

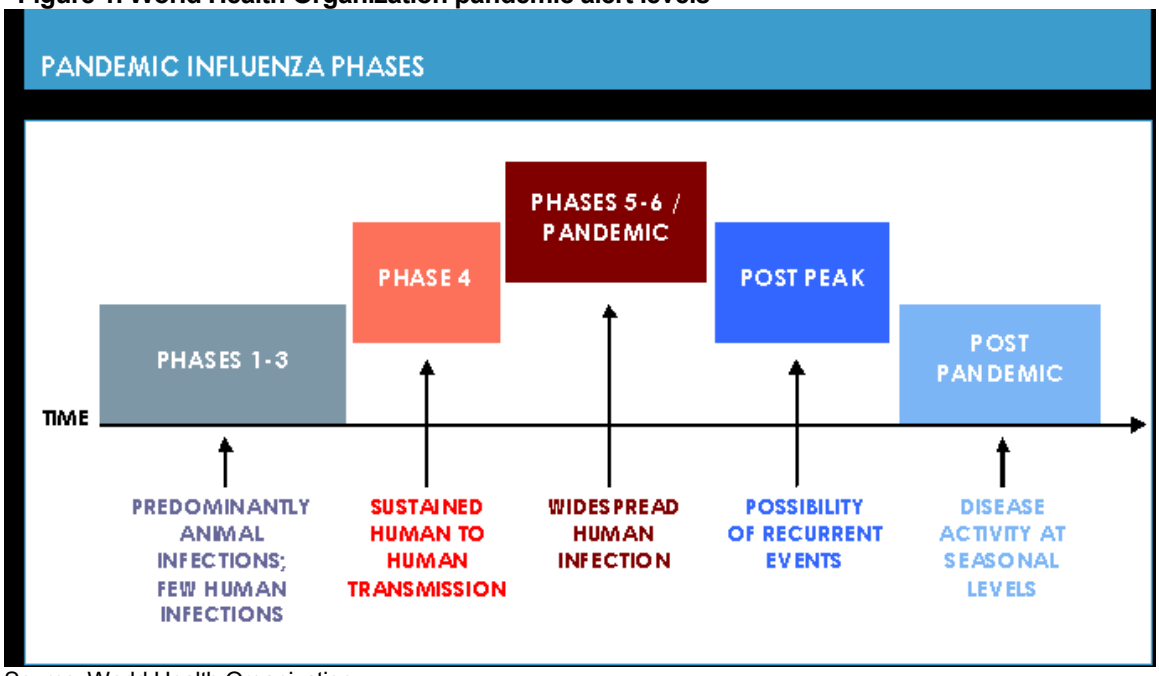
- By April 29th, 2009, the WHO declared a Phase 5 alert indicating "Widespread Human Infection." [3]

- On June 11th 2009, the WHO declared an influenza pandemic.[4] A total of 74 countries and territories had reported laboratory confirmed infections. To date, most countries in the world have confirmed infections from the new virus.

- On August 10, 2010, the WHO declared the end of the phase 6 influenza pandemic alert period, and the beginning of the post-pandemic period.[5]

[b] Eighty-seven of these 144 lab confirmed pH1N1 hospitalized cases were SHR residents. Six of the seven deaths were lab-confirmed pH1N1, while the other three were recorded in patients with Severe Respiratory Illness (SRI) or Influenza A, most likely due to H1N1.

Figure 1. World Health Organization pandemic alert levels[6]



Source: World Health Organization

pH1N1 in Canada and Saskatchewan

In Canada, the first wave (or intense flu period) of pH1N1 commenced in April 2009. The second wave was first witnessed in British Columbia and then spread eastwards. This activity lasted until December 2009, by which time many jurisdictions across the country had implemented mass vaccination campaigns.

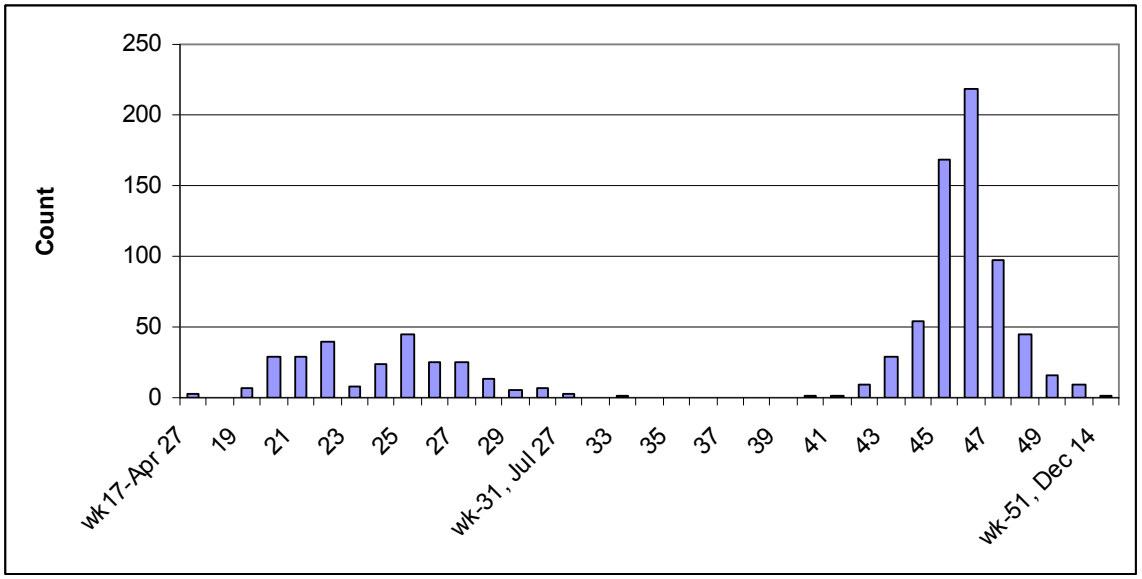
Saskatchewan experienced two distinct waves of intense influenza activity during the H1N1 pandemic, separated by the summer school adjournment. The first peaked in June / July 2009 while the second commenced in September and peaked in November / December 2009.

pH1N1 in Saskatoon Health Region

In SHR, the 2008/09 seasonal influenza season was drawing to a close when the first pH1N1 cases began to emerge. The first few cases emerged initially amongst vacationers who had just returned from Mexico, or their close contacts.

Between April 20 and Dec 15, 2009, the total number of all SHR resident lab confirmed pH1N1 cases was 909, including 87 hospitalized cases (in total there were 144 hospitalized cases including SHR residents and non-residents transferred to a SHR facility). Over 50% (498) of total SHR resident lab confirmed cases were paediatric patients (18 years or under). Lab confirmed cases peaked in mid-November, with 219 cases that week (Figure 2). As a comparator, the peak number of cases per week in the 2008 influenza A season was 45 cases.

Figure 2. Number of positive laboratory confirmed cases of pH1N1 in Saskatoon Health Region residents- first and second waves, 2009



Source: Saskatoon Health Region, Public Health Services

Planning

Work on the Saskatoon Health Region (SHR) pandemic plan began in 2004 following the Canadian SARS experience of 2003.[c] Details of the planning and preparations in 2004 are beyond the scope of this report; however, important planning assumptions developed in 2004 are referenced throughout this report. As in all emergency preparedness planning, the core of the SHR plan was to prepare for a possible worst case scenario global influenza pandemic, which would considerably tax both the health care and social services systems.

Within the incident command system used within SHR, "Code Orange" is the term used to describe a situation where an emergency/disaster has occurred which will result in a sudden influx of casualties or will require an expansion of services. A Code Orange in Public Health Services is a sudden influx of clients and/or an expansion of services (e.g. a mass public immunization effort or outbreaks such as in the case of a communicable disease(s), a waterborne or a food-borne outbreak). Outbreak response and mass immunization efforts may be concurrent. The H1N1 response is a good example of a Code Orange and this definition has been adopted by other Public Health Services' Directors in Saskatchewan (October, 2009).

SHR Planning Committees

There were several groups who played key roles in planning for and addressing the pandemic. These groups worked across the system in order to ensure a coordinated and systematic plan and response were in place. The Chief Medical Health Officer played a role at each table and ensured a feedback loop was in place. Committees included:

[c] The SHR Pandemic Plan is an internal document, so a reference is not available. Saskatoon Health Region employees can view the document on the SHR InfoNet at:
http://infonet.sktnhr.ca/emergencypreparedness/Pages/PandemicInfluenzaPlanUpdatedChapters.aspx

Health Emergency Operations Committee (HEOC): Responsible for SHR pandemic planning and central incident command for the health region; chaired by the CEO, with representation from across the region.

SHR Outbreak Control Team (OCT): A subcommittee of the HEOC, chaired by the Deputy Medical Health Officer responsible for disease control, with representation from: Communicable Disease Control, Public Health Services, Infection Prevention and Control, the regional Pandemic preparedness, and emergency measures coordinator, SHR Laboratory Services, SHR Pharmacy services and SHR Occupational Health and Safety.

Public Health Services, Emergency Operations Committee (EOC): Chaired by the Director of Public Health Services; responsible for Public Health's response to the pandemic, with cross representation at OCT.

Mass Immunization Planning Committee: Co-Chaired by the Deputy Medical Health Officer responsible for immunization and the Manager of Disease Control, Public Health Services; included liaison members from Workplace and Employee Wellness and primary health services.

Vaccine Allocation Approval Committee: Co-chaired by the Director of Primary Care Services and the Deputy Medical Health Officer responsible for Immunization Programs. Committee included representation from Public Health Services and Employee Wellness & Safety

In addition to the above noted teams, **routine surveillance activities and mechanisms** were in place as per usual practice, which informed the work of the committees throughout the process (for more detail, see the surveillance section below).

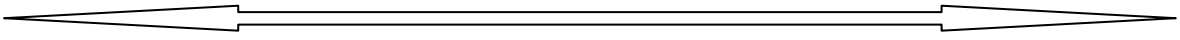
SHR Planning and Response

Four Stages of Planning to Meet Surge Capacity Demands on Health Care

Medical surge is the ability to provide adequate medical evaluation and care during events that exceed the limits of the normal medical infrastructure of an affected community.[7] The H1N1 pandemic is a prime example of the need for medical surge capacity. Figure 3 identifies the four stages of planning necessary to address increased demand during surge conditions, which SHR used in its planning (see table 3 on page 18 for SHR's experience through these stages).

Figure 3: Four stages of planning to meet surge capacity demands placed on healthcare systems[7]

Pre-Surge **Surging** **Capacity** **Over-Capacity**



Activities to keep people from seeking acute care services for mild ILI	**Preparations to support increased surge capacity in health care**	**Actions needed to keep health systems operating at the height of the pandemic wave**	**Actions needed to address over capacity**
• Public information • Education • Personal and family	• Address staffing and workforce preparedness • Increased demand	• Isolation and quarantine • Altered standards	• Altered standards of care (continued)

preparedness for in home care	for Personal Protective Equipment (PPE) • Pharmaceutical supplies • Medical supplies Hospital preparedness for critical care, the emergency department and paediatric care	of care • Alternate care systems • Influenza Assessment Sites (IAS)	• Alternate care systems (continued) • Mass fatality management

Source: U.S. Department of Health and Human Services

Projecting Capacity Demands

In order to determine the extent of interventions required by SHR, the 2004 pandemic plan called for an assessment of the severity and stage of the pandemic strain globally. With the first wave of pH1N1 activity occurring over the spring and summer of 2009, SHR continued to ramp up its preparations. After the June 11th WHO pandemic declaration, the need for modelling and triggers[d] to direct operations became crucial.[e]

Projected timeline estimates and approximate patient volumes were developed by public health officials and shared with surveillance stakeholders (including medical health officers, directors of acute care and paediatric services) and key health systems operations managers. Expected timelines for general pandemic activity were shared with a wider group of stakeholders across SHR, suggesting when to expect peak activity and when to expect decline. Regular weekly updates, including the projected timelines were sent by email throughout the pandemic. This piece of public health surveillance greatly informed planning in the Health Region as it enabled the system to ensure appropriate capacity for health care service needs in addition to pandemic. As such, the system's response to the pandemic was gradual as required. Public Health Services response was dedicated full time to this work given its lead role in health protection.

Predicted Cases of Hospitalizations

In September 2009, SHR Acute Care Departments were keen to anticipate intensive care equipment needs for the medical surge expected during the second wave of pH1N1. Public Health Services produced a model to estimate the anticipated pH1N1 ICU admissions and ventilator requirements for the tertiary hospitals, using the Australian experience. Australia had just emerged from their winter experience with pH1N1, in the absence of available pH1N1 specific influenza vaccination.

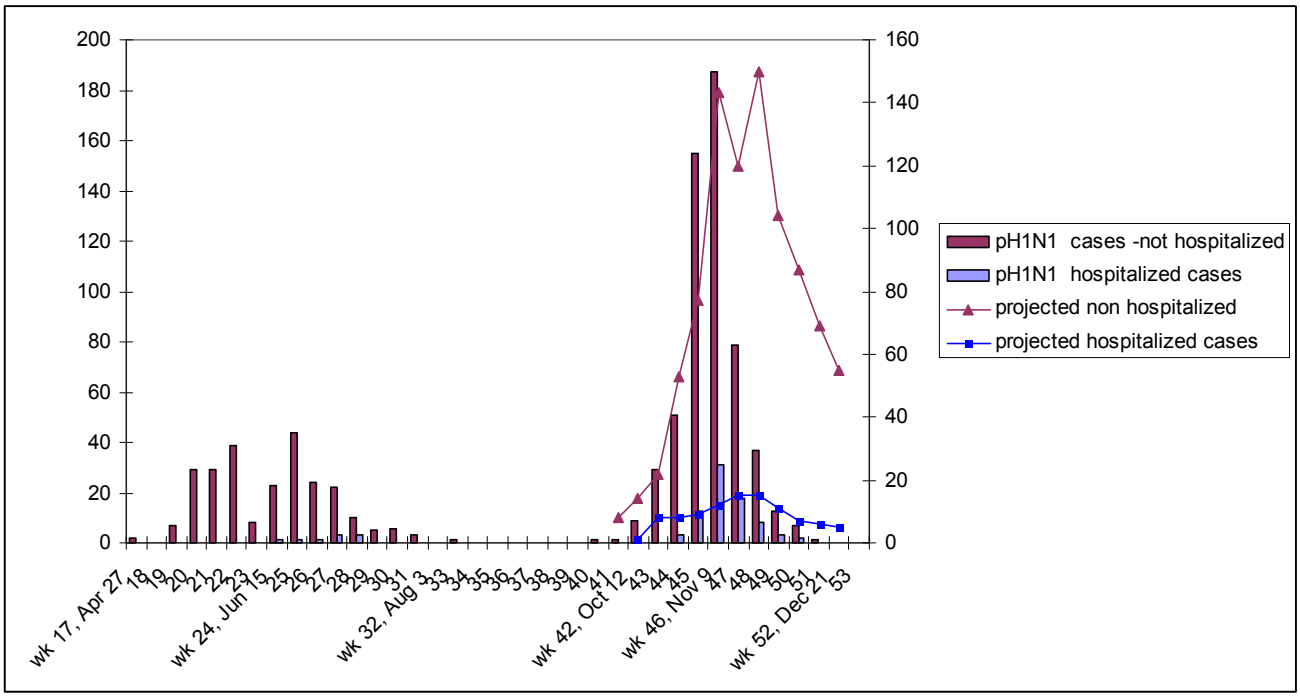
Using age-specific attack rates for lab confirmed influenza from the first wave, and the clinical attack rate, hospitalization and ICU percentage experienced in Australia, the model projected between 70-90 hospitalizations to be expected in SHR, including 18-36 ICU admissions. While the model underestimated the total number of hospitalizations (144), it accurately projected the number of lab-confirmed hospitalizations (87). The number of critical care admissions (38) and the mean length of critical care (8.2 days) and total length of critical care (337 days) were also accurate.

The Australia experience suggested a distribution of critical care patients over a six to ten week period, with peak ICU numbers in week six of the second wave. The projected estimate report was shared with SHR Acute Care Services in early October. Figure 4 shows the projected hospitalization

[d] A trigger is a set of pre-defined indicators that will set off a pre-determined action to address the recorded medial surge.
[e] The Australian pH1N1 experience in the summer of 2009, where they managed a full pH1N1 flu season in the absence of vaccine coupled with SHR's past experience with seasonal influenza, suggested that using timelines of duration of influenza activity, rather than the routine surveillance indicators might yield useful triggers or place-markers for operations

admissions by week compared to the actual numbers. In essence, the model predicted accurately, though it projected a longer duration of the pandemic than what actually occurred.

Figure 4. Lab confirmed pH1N1 by hospital status, Saskatoon Health Region, 2009



Source: Saskatoon Health Region, Public Health Services

Communications Approach

The H1N1 pandemic of 2009/10 was the first pandemic of the new information age with the Internet and 24 hour news from multiple sources of information. As such, SHRs pandemic communication strategy included: Internet Twitter updates, Facebook advertisements, YouTube, videos of clinic tours and news conferences. SHR also utilized traditional sources of information, including: print media; advertising; TV; radio; clinic location cards distributed to physician offices, pharmacies and other community locations; flyers delivered to families in the core neighbourhoods;[f] and a telephone help-line to get across the message of 'Stop the Spread of H1N1…get immunized'[g].

Public Health Measures

As part of the Pandemic Plan, the SHR outbreak control team (OCT) coordinated the Health Region's public health measures. These measures help to reduce the risk of transmission of a disease by decreasing the probability of contact between infected and uninfected people. They limit demands for hospital beds and lessen economic impact of the pandemic because fewer people would be ill at the same time. They **do not include** medical interventions to prevent or treat or cure disease such as **vaccines** or **antivirals.**

[f] The core neighbourhoods in Saskatoon consist of: Confederation Suburban Centre, Meadowgreen, Pleasant Hill, Riversdale, Westmount, and King George.

[g] The influenza help-line listed menu options regarding various topics, including: pH1N1 symptoms, when to visit your family physician, clinic locations and times, self-management of symptoms, and who was eligible for seasonal influenza immunization. The influenza help-line addressed client concerns, questions, and provided overall assistance in directing clients to mass immunization clinics or to seek medical assessment in relation to ILI illness. For four months following the mass immunization clinics, clients could call in to make an appointment for immunization.

In aiming to prevent the spread of pH1N1, SHR's public health measures[h] focused on two main areas:

- Infection control (e.g., hygiene and protective measures such as hand washing, cough etiquette, use of personal protective equipment and disinfection of shared surfaces); and
- Social distancing to prevent disease (i.e., measures that increase the space between people and decrease the frequency of contact among people).

Activities of the OCT included: creation of resource materials[i] and guidelines for health care practitioners and the general public, which were posted on the SHR website; distributing the Ministry of Health facts sheets and guidelines; writing recommendations and coordinating guidelines sent to health care professionals; producing Health Matters articles; developing key messages for pH1N1 prevention; and participation in OCT meetings. Schools, physicians and the public were informed where appropriate.

Immunization: SHR mass vaccination campaign background

In addition to public health measures listed above, immunization is a key strategy in reducing the potential for infection and was a key component in the SHR Pandemic Plan. Up until this point in Canada, there had been limited experience in conducting time-sensitive mass vaccination campaigns. The pandemic response in 2009 represented a significant expansion of the usual seasonal influenza vaccine campaign for Saskatoon Health Region across rural and urban areas. While plans were in place prior to the pandemic declaration, they needed to be modified throughout, as unanticipated challenges emerged in the fall of 2009, including:

- The need to deliver three to four times the usual number of vaccine doses compared to routine seasonal influenza campaigns.
- Significant disease in the province before vaccine was first available.
- Initial shortages in vaccine supply during the first months of the campaign.
- A need to adapt prioritization strategies in the absence of a clear national consensus.
- Use of a vaccine product that had only a 24 hour shelf life once the components were mixed together which prevented distribution to physicians initially.
- Using an adjuvant vaccine product not previously used in Canada, which created communication challenges.

Planning for and Implementing the Mass Immunization Campaign

Upon declaration of the pandemic by the WHO, the Mass Immunization Team initiated the planning process for mass immunization in the community.

Objective: to immunize the public as rapidly and safely as possible (as defined by the Canadian Influenza Plan)

Actions Included:

- Allocating, distributing and administering the vaccine to appropriate groups and monitoring the safety and effectiveness of the program.
- Establishing and operating immunization clinics for the immunization of the entire population, as vaccine availability and disease epidemiology dictated.

[h] There are many useful guidance documents, posters and brochures available regarding the use of public health measures at the SHR website: www.saskatoonhealthregion.ca. In addition, there are links to other websites that have other useful information regarding these topics.

[i] Materials included advice on preventing influenza transmission, release of the official testing, treatment guidelines

- Development of a Business Continuity Plan for Public Health Services using principles developed by the Saskatchewan Ministry of Health. The plan outlined public health services to be maintained, and which ones downsized or postponed during the immunization period (see Appendix A for a summary). This enabled the deployment of most nurses and other public health staff to operational requirements of immunization clinics in the community.

The strategy was based on vaccine availability from the federal government in the fall of 2009 and populations of priority groups, as determined by the Saskatchewan Ministry of Health (see Table 1). The Ministry requested that each health region identify the numbers in each population group to assist in provincial and local planning. With three months lead-time before the expected availability of the vaccine, initial planning assumptions were that 75% of the population (225,000 people) would need to be immunized within 4 weeks, and that a second dose would be needed.

Table 1. Priority groups for SHR vaccine allocation, starting October 26th, 2009

Week	Priority Group
1	– Health care workers, including Health Sciences students providing direct patient care
2	– Children 6 months to less than 5 years of age – Pregnant women over 20 weeks gestation – Women postpartum up to 4 weeks – Persons living in remote and isolated settings – Core community residents in urban centers – Medically at risk children up to age 12 (Grade 6)
3	– Children in kindergarten to grade 6 (ages 5-12) – Immunocompromised individuals of any age – Medically at risk individuals up to 35 years of age – Two caregivers of infants less than 6 months of age
4	– Children/young adults grades 7-12 (Ages 13-18) – Daycare operators – Community health care workers not yet immunized (such as day home/group home staff)
5 and after	– General public

Source: Saskatchewan Ministry of Health

Vaccine Allocation

As noted above, the immunization effort was initially limited by a lack of available vaccine. As such, the Vaccine Allocation Approval Committee (VAAC) provided consistency in distributing the available doses of vaccine among health care providers and the public in accordance with the provincial priority list and the weekly supply of vaccine available. Decisions were complicated by the availability of different vaccines over time, for example the availability of the non-adjuvant vaccine for pregnant women two weeks after the adjuvant vaccine program began.

Vaccine Distribution

SHR used a variety of methods to deliver vaccine in the community, including: mass immunization clinics, school-based clinics and rural health centres and halls, the Health Bus, physician offices, University of Saskatchewan and SIAST campuses, hospitals and special teams for home bound

residents. Some private nursing agencies also delivered vaccine to selected workplaces late in the campaign.

Mass immunization clinics

Mass immunization clinics operated ten hours per day, seven days a week. Urban sites (Saskatoon and area) were Prairieland Park, University of Saskatchewan, SIAST, locations in the core neighbourhoods, and schools. The Prairieland Park site had the largest capacity and remained open from November 1 to December 16th.

A small existing team was designated to provide immunization to those living in five core neighbourhoods in Saskatoon, which were known to have low coverage rates for routine childhood vaccines. Locations such as the Food Bank, Friendship Inn and drop-in satellite clinics were used as accessible public locations in these neighbourhoods.

Teams delivered immunizations at many schools in Saskatoon, targeting first schools in the inner city core and community schools that serve some of the most vulnerable populations. Some schools in affluent areas were invited to primary sites to be immunized. The School Divisions supported this approach through the provision of demographic information, space, distribution of consents, on site coordination and parent helpers. A Resource Guide for Schools outlined the process, roles and functions of team members.

The mass immunization sites in rural SHR consisted of town halls, civic centers, church/parish facilities, and some schools in various communities. Initially, there were three mass clinic sites, and then the staff moved to surrounding towns. All school-aged children, for the most part, were invited to primary sites in various communities.

The number of nurses who traditionally provide immunization were not adequate to immunize all residents of SHR. Therefore, it was necessary to recruit additional casual and part time nurses to supplement the immunizing team. The PHAC (2006) Immunization Competencies for Health Professionals was the foundational knowledge provided to nurses in a four to eight hour education session.

The clinic process was evaluated using a client comment card.[8] Adjustments were made to clinic setups and functioning in response to the feedback as the campaign rolled out.

Record Keeping

A record of immunization was entered into the Saskatchewan Immunization Management System (SIMS), a provincial electronic database, within 72 hours of immunization from a paper consent form. An average of 3300 SIMS entries per day was calculated over a 40 day period (Nov 9- Dec 18, 2009). An average number of 390 consents were entered per 8 hour period/person, with an average of 8 data enterers each day.

Antiviral Medication Allocation and Distribution

Antivirals are prescription medications that inhibit the growth and reproduction of influenza viruses. If given within 48 hours of exposure, antiviral medications may reduce the natural course of the disease by one or two days and prevent serious complications. The use of these medications as a prophylactic measure can confer protection from infection, but this benefit ceases once the medication has been discontinued. Antiviral medications are not the same as a vaccine and do not provide immunity to influenza. Table 2 compares properties of both antiviral medications and the influenza vaccine.

Table 2: Comparison of properties between antiviral medications and influenza vaccine

Property	Antiviral Medication	Influenza Vaccine
Treatment or Prevention	Used to treat influenza	Used to prevent influenza
Immunity	Does not provide immunity to influenza	Helps your body build immunity to influenza
Length of Protection	When taken as a prophylactic measure, protection is provided only as long as a person takes the medication	Once the body develops immunity, there is lasting protection
Availability	There is a finite amount of medication available in Saskatchewan (not enough to provide to everyone).	pH1N1 vaccine was initially produced in small quantities in Canada; however by December 2009 there were sufficient quantities to allow vaccination by all who requested it.

Source: Saskatoon Health Region, Public Health Services

Generally speaking there were sufficient quantities of antiviral medications available in Canada to address the H1N1 pandemic. In addition to the retail marketplace, the Ministry of Health had created an emergency antiviral stockpile composed of Osltamivir, Zanamivir and Amatadine to treat 25% of the Saskatchewan population, if needed. When the pandemic was declared on June 11, 2009, all health regions received 10% of their allocation of antiviral medications to be distributed only by prescription as a back-up for the retail antiviral supply.

In October 2009, the Ministry of Health advised regions that all three wholesalers in Saskatchewan who supply antivirals to the retail market were experiencing supply chain challenges. In order to address this issue, the Ministry released additional antivirals from the provincial stockpile to the central regional pharmacies. These pharmacies were previously determined as national antiviral stockpile (NAS) receiving pharmacies in the Regional Health Authorities for distribution to designated pharmacies.

The designated pharmacies within SHR were adequately stocked during the H1N1 pandemic with no further stockpiles distributed (except small quantities to the two 24 hour Shoppers Drug Marts in Saskatoon for use after midnight if needed). SHR pharmacy also pre-positioned stock in Humboldt, if needed, to distribute to designated pharmacies in the eastern portion of the region.

The antiviral stockpiles distributed to the designated pharmacies were for only those stores to dispense. They did not distribute to any other pharmacy. Non designated pharmacies sent their patients to their designated contact pharmacy. There was no intention to distribute stockpile antivirals to anyone else other than the designated pharmacies.

Surveillance Activities

A key public health function during the pandemic was surveillance. This activity informed decision making prior to and throughout the pandemic[8] and results were used to estimate the true burden of influenza in the community. Surveillance activities spanned a number of key areas across the system in SHR and in the community and results are summarized below. [j] These included:

[j] For a complete report of H1N1 surveillance findings contact the Public Health Observatory department, Public Health Services, SHR.

Routine Surveillance Activities

1. **Emergency Room Influenza-Like Illness (ILI) Surveillance**

   - Provides indication of seasonality and intensity of influenza activity
   - Three urban Emergency Rooms (ERs) and seven rural ERs provided counts of total number ER visits and total number of patients meeting an ILI definition. Rural ERs report one day per week, urban ERs report daily throughout the influenza season.
   - Reported as the number of ILI patients per 1000 ER patient visits.

2. **Sentinel Physician Surveillance Program**

   - Provides an indication of the seasonality, circulation of other viruses (if tested) and is used in addition to lab confirmed influenza to indicate the burden of illness on the community.
   - Throughout the influenza season, six to eight voluntary sentinel physicians submit counts for one clinic day per week, of the total patient visits and total number of patients meeting an ILI definition.
   - Reported as the number of ILI patients per 1000 patient visits.
   - The Saskatchewan Disease Control Lab (SDCL) staff recruit the physicians who participate in the provincial ILI sentinel physician's surveillance program and SHR recruits additional physicians from rural and urban practices.

3. **Influenza and Severe Respiratory Illness Deaths**

   - Nationally severe respiratory illness is identified by physicians with severe respiratory illness or death that is not explained by isolation of a organism. It is most often identified by Emergency Room physicians to the Medical Health Officer.
   - Reported as a count of influenza deaths, SRI cases or SRI deaths

4. **Laboratory-confirmed influenza**

   - Identifies onset of influenza season, location and diversity of respiratory strains that are circulating, and antiviral resistance.
   - Collated from clinical specimens submitted to RUH diagnostic lab and the Saskatchewan Disease Control Laboratory
   - Reported as influenza case counts or rates per 100,000

5. **Weekly Flu Reports from province and Public Health Agency of Canada**

   - Interjurisdictional summary of influenza activity, including: Flu Line calls, number of institutional outbreaks, collated ILI and ER ILI rates

6. **School Absenteeism Surveillance**

   - Used in tandem with lab confirmed influenza, indicates burden of influenza in the community

- Routinely, eight volunteer rural schools and all Saskatoon Public Schools report illness absenteeism for one sentinel day per week.

- Reported as the percent of children absent due to illness.

7. Adverse Events Following Immunization Monitoring and Reporting

- Conducted in addition to routine surveillance activities to track and report all adverse events that may occur as a result of an immunization.

- The region reports to the national Adverse Events Following Immunization system (AEFI), which is maintained and monitored by the Public health Agency of Canada (PHAC).

Enhanced Surveillance Activities during pH1N1

8. School Respiratory Outbreak Reporting

- All schools reported illness absenteeism greater than 10% to Public Health Services for assessment and follow-up if required.

- Respiratory outbreaks indicated intensity of influenza activity.

- Reported as number of newly reported outbreaks per week.

9. SHR Employee Illness Absenteeism

- Indicates the burden of illness in the service provider units, reported routinely during the influenza season one day per week by facility and union affiliation.

- Daily staff illness tracking (DSIT) implemented from October 19 to December 9, 2009 for approximately 35 key units considered high risk within SHR, based on their potential opportunity for exposure to patients/clients with respiratory illness (generally clinical areas and departments with high outpatient volumes).

- The main goal of DSIT was to inform staffing, scheduling and service delivery decisions during the height of pH1N1 activity. The second goal was to ensure that appropriate infection control measures were maintained within departments with high rates of staff absenteeism. A third goal was to learn from the observed levels of staff absenteeism and the surveillance experience for future emergency preparedness planning.

- Initial data collection occurred at the department level for all employees that reported illness and staff were asked to voluntarily report flu-like illness. Return to Work Services followed up with staff for further detail to be used for surveillance purposes and entered into a de-identified database.

- Percentages of total staff absent due to respiratory related illness was reported to HEOC and to the Public Health Surveillance team.[k]

[k] Public Health Services (PHS), one of the units monitored daily, relied on a slightly modified reporting form for the time period coinciding with the timing of the mass immunization clinics. PHS had central scheduling in place during this time period and surveillance results were very consistently reported for urban staff; however, it was unclear how often rural staff reported absences to central scheduling.

10. Real Time Acute Care Surveillance

- Daily situation textual updates provided to HEOC and the Ministry of Health during the pandemic of patients hospitalized with respiratory symptoms.

- Graphs of ER ILI, total patients, percentage patients with respiratory and/or ILI by unit were also provided, along with dashboard indicators such as number of infections, deaths, pediatric hospitalizations, etc.

11. Severe Influenza Outcomes and Severe Respiratory Illness (SRI) and Deaths

- Reportable only during this pH1N1 2009/10 season acute care facilities (infection control practitioners) to public health for provincial surveillance data.

- Case histories were conducted for hospitalized pH1N1 and severe respiratory infections (SRI) and reported to Ministry of Health through the provincial communicable disease reporting integrated public health information system (iPHIS).

- Communicable Disease Control (CDC) partnered with Infection Control Practitioners in Acute Care facilities to complete case investigations forms required for surveillance.[I] DC also worked with Medical Records who provided discharge summaries, and contacted patients and physicians to complete case history details.

- CDC collected information on the cases from out of region and then faxed to the appropriate health region for entry into the integrated public health information system (iPHIS)

SHR Experience: Response, Surveillance and Outcomes

Table 3 provides an overview of activities that took place during the 4 stages of medical surge. It indicates some of the key surveillance information that was used to make decisions during the pandemic. It also describes the impact of the activities on the health system.

Table 3. SHR Response with Medical Surge during pH1N1

Stages & Activities	Dates	Health System Utilization
Pre-Surge: – Based on the virulence of flu activity in other parts of North America, the province of Saskatchewan promoted self care at home with proper infection control practice in the home for mild presentations of ILI. Patients with moderate to severe symptoms or with underlying medical conditions were encouraged to seek medical advice, but to call their family physician's office to receive advice on when to come in and on infection control precautions to practice when they present.	**April 2009 to September 2009** (early stage of H1N1 pandemic and included the first wave	– People beginning to become ill with influenza-like illnesses, but not yet accessing the healthcare system in large numbers.

[I] Criteria for severe illness included that the patient had: Pneumonia diagnosed by chest x-ray or CT Scan, Diagnosed with Acute Respiratory Distress Syndrome (ARDS), On oxygen therapy during any of the hospital stay, Intubated/ventilated during any of hospital stay

Stages & Activities	Dates	Health System Utilization
– Combination of public information strategies to inform patients about when to seek access to healthcare and how to provide treatment at home. The goal was to enable more care at home and limit use of the healthcare system. – In the first wave of activity, school illness absenteeism did not increase significantly. In the summer of 2009, the Ministry of Education and the Ministry of Health recommended that all schools report illness absenteeism greater than 10% to regional health authorities. SHR worked with school divisions to adopt the new reporting protocol. When schools reached greater than 10% illness absenteeism, they were required to send a detailed report to Public Health Services. When the report was received, the Communicable Disease Control Department (CDC) determined whether further follow-up /investigation was warranted. Outbreak definition, for schools, was, "greater than 10% absenteeism due to respiratory illness". – In order to prepare for the second wave of the pandemic and possible questions from school divisions in SHR, letters were sent out to all the school divisions on October 26, 2009. The letters were designed to be sent out to parents in response to the disease's activity or impact on the school population and give the parents/guardians clear guidelines on how to manage illness occurring in the children. They focused on key public health measures and in the event that an incident such as severe illness causing hospitalization or death occurred as a result of pH1N1 in the school community, a letter would be sent which provided a summary of the current surveillance data on pandemic strain of influenza virus and reinforced the need to continue to use all the preventive health precautions.		
Healthcare System Surge: – Increased availability of supplies, Personal Protective Equipment (PPE), medications, and other treatment resources. – Materials management (SHR) joined the other health regions and the Ministry of Health in planning for large scale medical stockpiling. – Acute care managers began planning for routine service slow downs as additional demands were placed on the healthcare system. (Although ready to do so, we did not need to defer any non-essential services (e.g., postponing elective surgeries). – Critical care services in ICU and PICU were stretched and some out of province transfers were instituted. – Community-based physicians who needed assistance with some basic PPE supplies were provided with a medical kit that contained gloves, masks, gowns, eye protection and isogel from the provincial stockpile.	Late September 2009 until August 2010 (coincided with the opening of schools and institutions of higher learning for the fall 2009 school session)	– increase in the number of people seeking treatment at all levels of the healthcare system (e.g., physician's office, clinics, and hospital emergency departments).

Stages & Activities	Dates	Health System Utilization
– Thirty percent of SHR's allocation of antivirals were mobilised from the provincial stockpile to the central regional pharmacy at Royal University Hospital (RUH). This was subsequently broken down and pre-positioned in various 24-hour pharmacies throughout the health region (see antiviral section).		
Healthcare System at Capacity: – During the second wave, Sentinel Physician Surveillance data and lab –confirmed influenza data showed peaks in week 46. – The highest school illness absenteeism percentages were reported during week 44 and 45 (Oct 26 - Nov 5), when several schools reached absenteeism rates of 30%. The majority of schools saw greater than 10% illness absenteeism for approximately a week. Most schools reported illness absenteeism of less than 20% at any given time, meaning most schools did not experience absenteeism exceeding 20%. – ER surveillance data reported increased visits reaching a peak on November 5 at 277.5 ILI cases per 1000 patient visits – Lab-confirmed influenza hospitalization peaked in week 46 at 31 new hospitalizations (See section below on Influenza Hospitalization for details on the impact of H1N1 in hospitals). – Increased hours of service and alternate influenza assessment site (IAS) was opened at St. Paul's Hospital from November 14 – 23 (after ILI had peaked in Emergency Rooms). At this point ILI had been decreasing for about one week suggesting an earlier opening of the IAS might have been warranted. The IAS likely contributed to a further decrease in ILI presentations in the three urban hospital ERs. (On average, 16 patients per day were seen daily at the assessment center, ranging from 6 to 40 per day) – A roving emergency physician was instituted between the ER sites.	October 2009 to early December 2009	– Healthcare system experienced an excess of the normal number of patients treated per day. – Some physician offices experienced increased demand, but none reported that it was overwhelming. – In hospitals, critical care and the emergency departments bore the brunt of the medical surge. Most illness witnessed was characterised as either mild or moderate, so some bed capacity was retained throughout the H1N1 pandemic; however, some chronically ventilated patients were repatriated to their home health regions.
Healthcare System Over Capacity – Hospitals continued to admit persons who required care, and no alternate care systems were required. – Normal standards of care were maintained, and no elective procedures needed to be cancelled.		– The virulence of pH1N1 did not change at all during the second wave and patients who needed antivirals were able to get them. – SHR healthcare system **did not** exceed its capacity to provide care in the usual manner

pH1N1 Hospitalization

The extent of illness experienced with the first wave of pH1N1 suggested a fairly mild course of disease in the majority of cases; however, clinical evidence showed that the pH1N1 virus had a propensity to cause very severe illness in a small minority of cases. These cases quickly developed lower respiratory tract inflammation and alveolitis, often requiring urgent critical care. Other jurisdictions in Canada also reported the potential of pH1N1 to cause outbreaks of Severe Respiratory Illness (SRI) (e.g., in Manitoba during the summer of 2009, particularly among First Nations communities in the north), suggesting the seriousness of pH1N1 was not to be underestimated.

The Canadian Institute for Health Information (CIHI) reported that when compared to a typical influenza year, the H1N1 pandemic virus resulted in a higher proportion of patients requiring specialized hospital services in Canada in 2009. The pH1N1 virus affected a younger population more often than is seen in a typical flu season, where the majority of hospitalizations occur among the elderly, who often suffer from one or more chronic medical conditions.[9]

Data indicated that symptoms in individuals affected with pH1N1 were similar to seasonal flu. Therefore, investigation efforts changed to focus on severe hospitalizations (i.e., individuals in ICU) and deaths due to pH1N1.

Groups at increased risk of severe illness from the pandemic H1N1 virus included young children, pregnant women, and people with underlying respiratory or other chronic conditions, including asthma and diabetes.

Hospitalization in Saskatoon Health Region

A total of 144 hospitalized cases were reported through SHR's Strategic Health and Information Planning Service (SHIPS) department to PHS in 2009.[m] This includes:

- lab-confirmed pH1N1 cases,
- persons hospitalized with severe respiratory infection (SRI) where no influenza virus was detected by lab testing,
- persons hospitalized with respiratory symptoms likely related to pH1N1 where lab confirmation was missing,
- and persons hospitalized who were tested as influenza A:H1N1 positive in other health regions and later transferred to a SHR tertiary hospital.

In SHR, 42% of hospitalized cases were paediatric patients, a total of 61 patients (Table 4). In the adult cases, the mean age of 44.6 years was much younger than we would expect from influenza/pneumonia in a typical influenza season (Table 4).

Of the 144 hospitalized cases, Public Health Services reported 71 hospitalizations in residents of SHR, excluding out of region admissions.[n] The majority (49/71) reported underlying conditions. The most prominent conditions reported for hospitalized cases were chronic lung disease (23.9%), chronic heart disease (18.3%), asthma (18.3%) and immunosuppressed (18.3%).

Table 4. Hospitalized pH1N1 related cases, Saskatoon Health Region* 2009

Total Hospitalization	Reported Number	Predicted Number
Number of hospitalizations	144	70 - 90
Number adult female cases	80 (55%)	-

[m] CIHR uses clinical diagnosis of H1N1 without laboratory confirmation as j09 influenza due to identified influenza virus. Or j11.1 no lab test done or available at the time of coding

[n] Does not include First Nations individuals reported through First Nations and Inuit Health

Mean age of adult patients	44.6	-
Median length of stay for adults 18+ (days)	13.8	-
Number paediatric cases	61 (42%)	-
Mean age of paediatric patients	5.7	-
Median length of stay for children < 18 yrs (days)	3	-

Source: Saskatoon Health Region, Public Health Services
* denotes both resident and non resident cases seen in SHR hospitals. Approx 28% of hospitalized cases were residents from other RHA

Critical Care Hospitalizations

Approximately 18% of the hospitalized cases in Canada were admitted to ICU, compared to 22% (33/144) in SHR. The death percentage nationally was four percent compared to SHR's three percent.[o] It has been anecdotally reported that critical care admissions were particularly heavy for a short duration of time in October 2009. It was also observed that soon after pre-school age children were vaccinated early in the mass vaccination sequence paediatric admissions rapidly tailed off, suggesting that the mass immunization campaign may have had a disease prevention impact. The mean length of stay for paediatric cases in PICU, 3.4 days, was much less than the mean length of stay in adult ICU of 8.2 days. Table 5 shows the predicted and actual numbers and of critical care admissions.

The most intensive period of ICU response was between mid-November and mid-December. A total of 38 patients were admitted to critical care between June 9 and December 9, 2009; 9 in the first wave and 29 in the second wave. Five cases, or 13% of all intensive care patients reported over the two waves of activity, were admitted to the PICU. Table 5 shows the predicted and actual numbers of hospitalized. Asthma (46.2%), immunosuppressed (46.2%) and obesity (46.2%) were the predominant underlying conditions in patients admitted to ICU.

Table 5. Hospitalized Critical Care pH1N1 related cases, Saskatoon Health Region* 2009

Critical care	Reported Number	Predicted Number
Critical care admissions (includes ICU, PCU, PICU)	38	18-36
Percent ICU of total hospitalized	26%	26% - 40%
Mean age of adult critical care patients (years)	49	-
Total length of critical care stay (cumulative days)	337	324
Mean length of adult critical care admission	8.2	9
Number PICU admissions	5	10-20
Mean age of PICU patient (years)	1.8	-
Total length of PICU stay (cumulative days)	17	-
Mean length of PICU length of stay (days)	3.4	-
Deaths**	9	-

Source: Saskatoon Health Region, Public Health Services
* denotes both resident and non resident cases seen in SHR hospitals. Approx 28% of hospitalized cases were residents from other RHA
** Six lab confirmed pH1N1[p] and two SRI and one influenza A, suspected pH1N1.

[o] CIHI H1N1 Preliminary overview (July, 2010): contact Jennifer Frood (JFrood@cihi.ca). Note: SHR rates uses SHR covered population; however, 28% of admissions were residents in other regions.
[p] One of these deaths was in a SHR resident, but was reported to First Nations and Inuit Health. As a result, they are not officially part of our count, but have still been included since they lived in our region.

St Paul's hospital saw the greatest critical care response, although RUH ICU also saw an increased percentage of patients with respiratory symptoms in mid-November. St Paul's hospital ICU admissions peaked in late November with up to 90% of patients admitted for respiratory symptoms.

SHR hospitalized cases had similar characteristics to national cases. Table 6 shows the overall characteristics of hospitalized lab confirmed cases, nationally and regionally.

Cases admitted to ICU tended to be slightly older than those who did not require intensive care. The median age of SHR hospitalized cases was 32 years, compared to 29 years nationally; the median age was 52 years for ICU admitted patients, compared to 46 years nationally. A lower percentage of pregnant women were admitted in the SHR than at a national level (Table 6).

Table 6. Lab confirmed pH1N1 hospitalizations, ICU admissions and deaths, Canada and SHR, 2009[10±]

	Canada Hospitalized	SHR hospitalized	Canada ICU – admitted	SHR ICU admitted	Canada deaths	SHR deaths
	(n = 8227)	(n = 71)	(n = 1473)	(n=13)	(n = 423)	(n = 5)
Females, %	50	56.3	51	76.9	49.6	60
Median age	29	32	46	52	53	55
Aboriginal status*, %	7.4-10.0	4.2	7.8-10.4	0	7.1-10.4	20
Underlying medical	56.1	69.0	71.2	84.6	83	100
Conditions,** %	(2622/4673)	(49/71)	(849/1193)	(11/13)	(302/364)	(3/3)
Pregnancy,*** %	20.4	1.4	12.1	0	8	0
	(265/1299)	(1/71)	(31/256)		(4/50)	

Source: Public Health Agency of Canada and Saskatoon Health Region, Public Health Services

± All cases admitted to ICU are included in the hospitalization count; however, not all the fatal cases have been hospitalized before dying.

*Since Aboriginal status is not reported by two provinces (which comprise 23% of the Aboriginal population) two methods were used to calculate proportions: one proportion was calculated by including ON and NS cases in the denominator (which is an underestimate of the true proportion); while the other proportion was calculated by excluding ON and NS cases in the denominator (which is an overestimate).

**Proportion of cases with at least one underlying medical condition (excluding pregnancy) among those for whom the information was available. Please note that results may differ slightly compared to the previous weeks due to updates in the national database.

*** Percent of pregnant women among women 15 to 44 years of age.

Severe respiratory infection (SRI)

Cases of severe respiratory infection (SRI)[q] were also monitored in Saskatchewan during pandemic. The surveillance objective was to detect unusually severe morbidity and mortality caused by both known and unknown respiratory pathogens, including pandemic influenza. SHR reported 6 cases of SRI, 83% of which (5/6) were males and all but one case were adults. Two fatalities related to the six cases were reported. All cases with complete data indicated underlying conditions, most commonly obesity (3/5). The median age of adult SRI patients was 46.

[q] SRI is defined as fever, cough or breathing difficulty, radiographic evidence of pneumonia or acute respiratory distress syndrome (ARDS) with no identified organism, or post mortem history of unexplained acute respiratory illness and autopsy findings consistent with ARDS.

Mortality

Between three and five influenza certified deaths are recorded in SHR annually.[r] SHR reported six deaths in residents with lab confirmed pH1N1[s] and two deaths in individuals classified SRI which were suspected pH1N1 (noted above). Two of the seven deaths were in youth under eighteen. Another death was also reported in a child with lab confirmed influenza A where the specimen could not be typed; the specimen date was July, when the only influenza organism reportedly circulating in the province was pH1N1. The median age of pH1N1 deaths in adults was 55. All reported underlying health conditions.

Mass Immunization Campaign Results

SHR successfully immunized 49% of the population in SHR from October 26, 2009 to March 31, 2010 (149,103 immunizations). In the rural areas, coverage ranged from under 30% to over 60%, with the municipalities closest to Saskatoon achieving 40-50% and some of the more remote areas either achieving substantially higher or lower coverage.[t]

Urban coverage ranged by neighbourhood from 26% to over 70%. The lowest coverage rates were in some of the west side and northern neighbourhoods. The availability of mass immunization sites is likely a key factor which contributed to the region's ability to immunize a large proportion of the population over a short period of time.

A good deal of work has been done in the Health Region to minimize differences in access to services for subregional populations, particularly those in urban core neighbourhoods. The coverage rates in Table 7 below documents some success since the coverage rate for urban core neighbourhoods was only slightly below the average coverage rate for the region. Routine immunization coverage in the core neighbourhood often demonstrates a greater disparity in percent immunized compared to city or SHR wide coverage.

Table 7 pH1N1 Immunization Rates by Subregional Population – Saskatoon Health Region, 2009

Subregional population	Total Population	% Immunized
Affluent neighbourhoods	23024	**56.4**
Core neighbourhoods	16564	**40.2**
Middle income neighbourhoods	175109	**47.2**
Rural	85941	**46.2**
SHR Overall	**300638**	**48.4**

Source: Saskatoon Health Region, Public Health Services

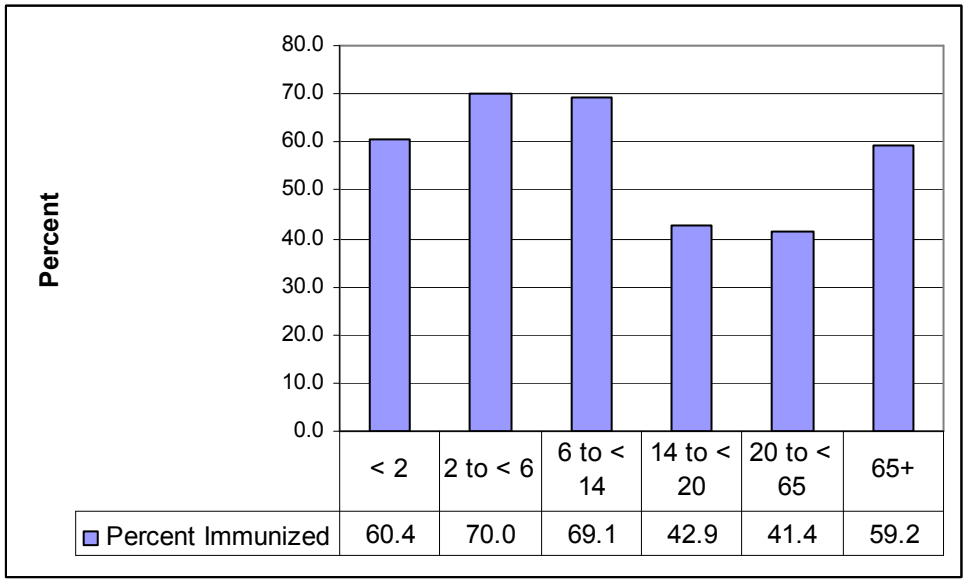
In addition, the region achieved very high levels of protection in children up to the age of 14, lower levels for older adolescents and young adults, and high rates of coverage for older adults (see Figure 5). These were particularly remarkable achievements for preschool and school-aged children who have typically not been covered by the provincial influenza vaccine program.

[r] Certified influenza deaths used. From query jm_deaths_influenza_ICD-10 in I PHO\Epidmeiologicy/Chronic Diease\Pandemic\Influenza deaths & hosp

[s] One of these deaths was in a SHR resident, but was reported to First Nations and Inuit Health. As a result, they are not officially part of our count, but have still been included.

[t] Children immunized on First Nations reserves may not be updated in SIMS. This may result in a slight underestimation of coverage in some neighbourhoods.

Figure 5. pH1N1 immunization percentage by age group, Saskatoon Health Region, 2009

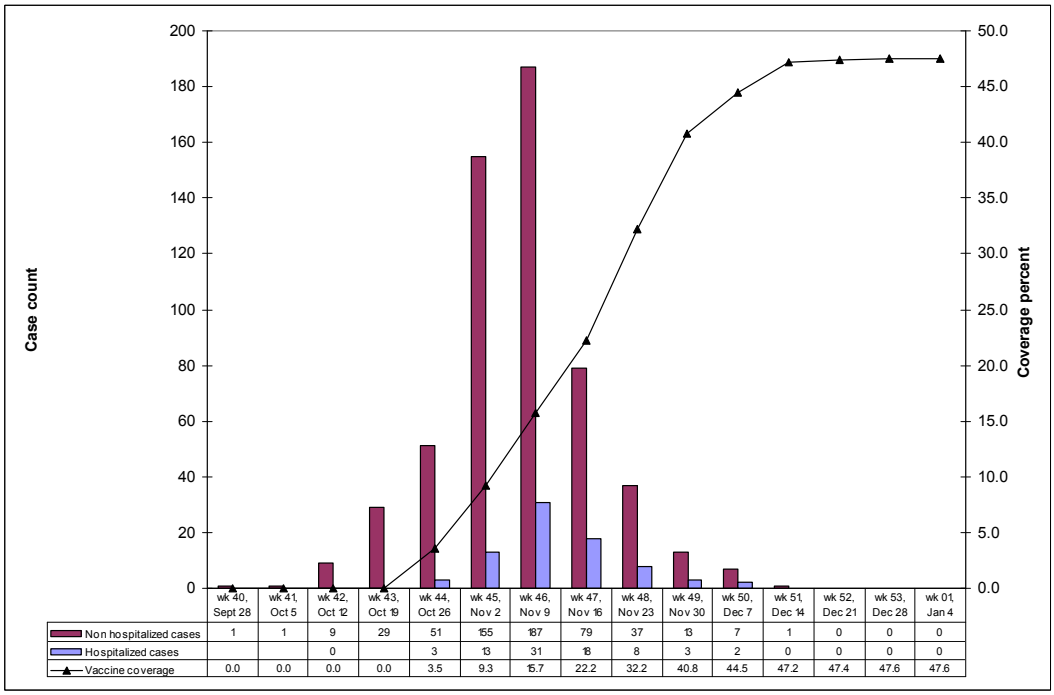


Source: Saskatchewan Information Management System

Impact of immunization on disease

By the time infections were starting to decline, the overall immunization coverage rate was still fairly low. In the peak week of infections (week 46) SHR had achieved a rate of 15% (Figure 6). However this overall coverage rate disguises the fact that coverage among health care workers and high risk groups, such as children between six months and five years, medically at risk and postpartum and pregnant women over 20 weeks had much higher coverage prior to week 46.

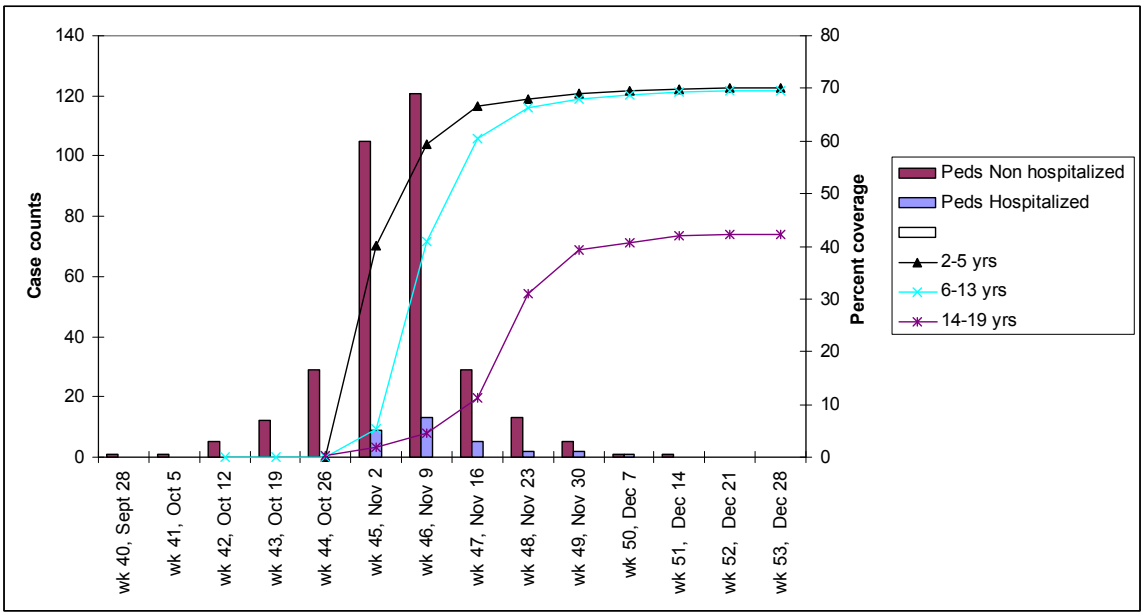
Figure 6. Confirmed cases of pH1N1 and coverage rates of pH1N1 vaccination, Saskatoon Health Region, 2009



Source: Saskatchewan Information Management System and Saskatoon Health Region, Public Health Services

Figure 7 shows that the coverage in the youngest age group was approximately 60% by week 46. In week 47, there was a dramatic reduction in pediatric cases, a much steeper decline than would be expected. The sharp decline in overall cases is also unusual (Figure 6) but less obvious than in pediatric cases (Figure 7), which are reduced three-fold in a single week. This may support a hypothesis that moderate to high coverage in specific risk groups may make an important impact on disease within those risk groups and have some effect disease in the general population. This evidence, without comparative data, is inconclusive however and must be explored further.

Figure 7. Confirmed pediatric cases of pH1N1 and coverage rates of pH1N1 vaccination among different age groups, Saskatoon Health Region, 2009



Source: Saskatchewan Information Management System and Saskatoon Health Region, Public Health Services

Although Figure 7 provides a strong suggestion of the impact on childhood disease rates, it is difficult without more sophisticated methodology than is available for this review to quantify the impact of immunization within the Saskatoon Health Region.

Estimating the number of cases that didn't occur involves either mathematical modelling or comparison to a similar population with different immunization rates. Ontario modelling data has been published which estimated the impact there. Overall, the model suggested that 22% of symptomatic cases, 22% of office and emergency department visits, 23% of hospitalizations, and 25% of deaths were prevented by the immunization program in Ontario.[11]

A crude analysis of the number of cases occurring after the peak week of disease in Saskatoon compared with other jurisdictions suggests that there are "missing cases" in the last half of the epidemic wave, likely in the same magnitude as the Ontario modelling study.[12]

So, for now, the best estimate of impact was that there was one, that it was likely greater for children than adults, and that until Saskatchewan specific modelling data is available, it is likely at least as great as the impact in Ontario, with roughly 22% of cases prevented. It will be important to do more rigorous analysis of the impact to guide future decision making in similar situations. Researchers at U of S are currently interested in pursuing this further.

Adverse Events following Immunization Outcomes

In SHR, 151 adverse events were reported among the 149,102 immunized. The majority of these events were minor and short lived. There was one likely anaphylactic reaction and five other allergic reactions for which people were given epinephrine. All recovered rapidly. None stayed in hospital for more than a brief observation period and there were no deaths.

Opportunity Cost of the Immunization campaign

The incremental cost of the response was estimated at a total cost of $3.1 million, with $1.7 million related to immunization.

The opportunity cost of the immunization campaign includes both the temporary disruption of most services normally delivered by Public Health staff, as well as the consequences of that disruption.

A large number of routine services provided by public health staff were deferred or discontinued. The list of routine services discontinued is included as Appendix A. Although this was done thoughtfully in conjunction with a provincially agreed upon list of essential Public Health Services, this will have had a long term impact. For example, among the most easily measurable adverse outcomes was a decrease in the percent of young infants being immunized on time, and a drop in the immunization coverage rates with seasonal influenza vaccine.

Administration of seasonal influenza vaccine was suspended from October 26 - December 28. The uptake of this vaccine was not significantly impacted except in the 6-23 month olds where we experienced a 46% drop from the 2008 coverage rate (Table 8).

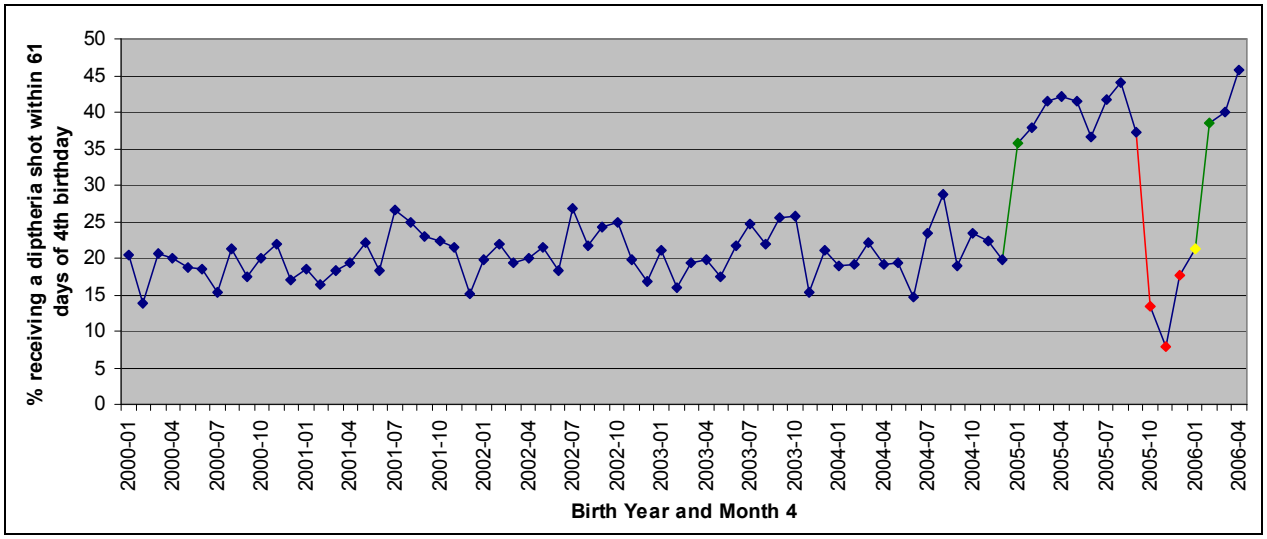
Table 8. Seasonal Influenza vaccine coverage by risk category, 2007-2009

	2009	2008	2007
6 – 23 months	1264 (15.8%)	2375 (41.2%)	2043 (39.4%)
SHR employees	8252 (71%)	7448 (63%)	7469 (64%)
65 years and older	23,145	22,278	22,221
Pregnant	296	287	314
LTC >65	1621 (87.6%)	1641 (85.3%)	1692 (88.8%)
LTC <65	237	230	216
Medical at risk	9934	10,598	11,315

Source: Saskatoon Health Region, Public Health Services and Saskatoon Health Region, People Strategies

The suspension of immunizations for children over twelve months of age during the mass immunization campaign and of the reminder system for four-year-olds also impacted the overall coverage rate of children within two months of their fourth birthday, as illustrated below. The graph in figure 8 shows both the impact of the implementation of a reminder system at the fourth birthday and what happens when it is removed temporarily.

Figure 8. Percent of children receiving a diphtheria vaccination within 2 months of their 4th birthday, Saskatoon Health Region, 2010



Source: Saskatchewan Information Management System

The opportunity cost of other service cessations, such as well baby examinations and sexual health centre clinical services are more difficult to quantify.

Conclusion / Lessons Learned

It is clear from this report that a great deal of planning and response activity was aimed at addressing the H1N1 pandemic. In any large scale process such as this, there are several lessons learned to be used for future consideration.

For Saskatoon Health Region:

Mass Immunization:

- A mass immunization site appears to have worked well as an efficient method for immunizing a large proportion of the population. Advantages over multiple smaller sites were seen in the region's ability to increase the number of individuals immunized per nurse per day and in simplifying staffing challenges.

- Other health care professionals could have been utilized to assist in streamlining and speeding up the processes. For example, other provinces utilized pharmacy or nursing students to draw up vaccine doses, and pharmacists or pharmacy technicians could have potentially played a role.

- Seasonal influenza immunization campaigns provide an opportunity to explore further involvement of other health care workers in the immunization process. This approach should be explored during seasonal influenza campaigns in the future. The disadvantage, of course, is the cost of the facility.

- It is important, but difficult, to prioritize delivery to vulnerable populations during an emergency response.

- An intensive coordinated communication approach was critical to the success of the immunization campaign. For example, the Health Region's website was an important method of communication, as was seen by the doubling of monthly visitors in October and this number then tripled in November.

Antiviral Medications:

- Feedback from SHR Pharmacy indicates that having a relatively closed distribution system within our region (i.e., one central distribution site) worked well for tracking the antiviral stockpile. Only hospitals, certain healthcare facilities and designated community pharmacies were able to dispense medications from the stockpile. Pre-positioning of the antiviral stockpile throughout the region at the designated sites allowed for quick access when an outbreak occurred outside Saskatoon.

Surveillance:

- Having real time surveillance data available to the various planning committees was useful to support the approach in providing health care services.

- Prior to pandemic it was anticipated that surveillance would ramp down as the containment phase passed. However, the demand for information escalated throughout pandemic. A pre-determined set of report parameters would help for appropriate planning and staffing of surveillance information.

- The DSIT established staff absenteeism information that might be useful in future pandemics. However, there were areas where the DSIT could be improved. Work should be done on planning and maintaining DSIT during non-pandemic times to ensure that the data will be ready and useful when needed.

Public Health Services Opportunity Costs:

- The opportunity cost of the immunization campaign includes both the temporary disruption of most services normally delivered by Public Health staff, as well as the consequences of that disruption. While it is important to consider this in planning and response, Public Health Services activities are crucial to the success and response during pandemic.

<u>For the Ministry of Health</u>

- An ongoing universal influenza immunization program, with the needed infrastructure in place and an easier system to deal with the priority objectives of a new vaccine, would potentially provide a better basic approach and result in fewer opportunity costs.

<u>For the Public Health Agency of Canada</u>

- In countries such as Canada that have shared responsibilities between many levels of government, collaboration and clear communication are essential as a first line of defence in a large scale health emergency. Reflecting back, pH1N1 clearly demonstrated that one of the biggest challenges we face in a large scale public health emergency is that of clear, concise, and timely communication. Some of the early

communication challenges with the public were communication around the adjuvanted vaccine (e.g., reasons for the Canadian choice and its benefits) and explaining the national decision on following a priority list when faced with potential vaccine shortages.

- Investment in technology that would potentially make vaccine earlier is important for the future. The immunization campaign was resource intensive but its effectiveness was seriously limited because there was significant disease already in the province before the vaccine became available.

- In general, introducing new vaccine technology prior to a pandemic, rather than during it, would allow for a more thoughtful and evidence based approval process.

- Vaccine which has only a 24 hour shelf life once a vial is mixed leads to more wastage, and if there is a shortage, further limits distribution to the biggest agencies.

- For future contracts consideration of having two companies participate could make the supply more secure. New technologies such as the use of live attenuated influenza vaccine (a nasal spray) should be considered.

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Appendix A: Temporary Changes to Public Health Services during Mass pH1N1 immunization

October 8, 2009– Saskatoon Health Region's Public Health Services announced adjustments to routine services provided to the public to allow staff to be available to mass immunize for pandemic H1N1 influenza.

The following services were reduced once mass pH1N1 immunization clinics began:

- fluoride varnish services except for vulnerable preschool children
- child health clinic appointments to be limited to immunization only – no screening or referrals by public health nurses
- routine immunization to be available only for children requiring their 2, 4, 6, 12 month immunization
- all early childhood psychology services
- breastfeeding, infant, and preschool nutrition support
- permitting, inspection and approval of plumbing installations and private, commercial or industrial sewage disposal systems
- approval and inspection of facilities regulated under the *Public Health Act, 1994* that do not require licensing
- education programs for operators of public food facilities such as restaurants
- Health Centres will not be open for clients to weigh infants
- routine International Travel Centre services with exception of services to clients who require vaccines for their travel visa and for clients travelling to destinations other than vacation resorts, low risk travel destinations were asked to consult with their family physician if the needed an travel related medical advice.

The following services were not offered by Public Health Services once mass pH1N1 immunization clinics begun:

- public health breastfeeding support
- community follow-up for children discharged from hospital
- dental health promotion and education
- Older Adult Wellness health promotion and education
- parenting support groups
- postnatal home visits
- postnatal phone calls
- Sexually Transmitted Infection (STI) clinic
- inspections for low risk facilities (e.g. facilities that are not regulated under the *Public Health Act, 1994*) that are under another federal, provincial or municipal agencies jurisdiction
- routine immunization for 18 months old, 4 years old and school-aged children and adults
- rural speech language pathology services.

During this time prenatal classes in Saskatoon continued as a Primary Health service. Clients with immediate concerns, were asked to contact their family physician or other Health Region services for assistance; and asked to visit the *Health-Care Services Guide* in telephone book or www.saskatoonhealthregion.ca for contact information, or contact to the Provincial Health Information Line at 1-877-800-0002.