H1N1 Influenza Incidence and Vaccination Rates in Nevada, 2009-2010

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Abstract

Background: *The 2009-2010 H1N1 influenza pandemic was a significant event in public health history. With increased awareness of H1N1 incidence and the need for vaccination, data that were recorded in state databases provided the perfect case study to determine the how influenza surveillance and vaccination documentation could be combined to inform an appropriate public health response. The purpose of this study was to: (1) investigate time trends of H1N1 disease occurrence and vaccination in Nevada; (2) calculate rates of disease incidence, hospitalizations, mortality, and vaccination coverage and determine whether these rates differ by age, gender, and county of residence; (3) examine how updated influenza and vaccination surveillance can inform public health approaches for preventing influenza morbidity and mortality; and (4) use the results to compare and contrast the strengths and weaknesses of Nevada's response to the H1N1 pandemic and make suggestions on how Nevada can be better prepared for possible impeding pandemics.*

Methods: *Data were analyzed from the Nevada incidence and surveillance data from NEDSS-Based System (NBS) and National Electronic Telecommunications System for Surveillance (NETSS) (n=4,264), along with Nevada's vaccination data from WebIZ (n=*358,844*). Time trends in H1N1 and vaccination incidence were assessed and crude and age-adjusted rates were calculated to determine demographic difference in disease and vaccination rates.*

Results: *Children had the highest rates of H1N1 influenza (374.6 per 100,000 persons); but those 0-1 and 2-4 years had the highest vaccination rate (26,979.6 and 26,780.2 per 100,000 persons, respectively). Compared to men, women had the highest rates of H1N1 (180.3 versus 142.9 per 100,000 persons) and vaccination (17,925.0 versus 11,999.0 per 100,000 persons). Out of all 17 counties, Carson City had the highest age-adjusted rate of disease and the second highest age-adjusted rate of vaccination (472.7 and 26,514.1 per 100,000 persons, respectively).*

Discussion: *The results from this study demonstrate the importance of monitoring, analyzing, and disseminating influenza incidence and vaccination data in Nevada. Surveillance data should be used to inform where vaccination efforts should be targeted in order to prevent any further spread, morbidity, or mortality associated with influenza infections.*

Background

Introduction

Influenza, often called “the flu,” is a respiratory tract infection caused from a negative strand RNA virus of the *Orthomyxoviridae* genus (Broadbent & Subbarao, 2011). The Centers for Disease Control and Prevention (CDC) estimates that in an average year, 5-20% of the United States (US) population will contract the virus, attributing to over 200,000 hospitalizations and 36,000 deaths in the U.S. annually (CDC-B, 2011; Sutton, 2009). Influenza contributes to significant indirect costs such as absenteeism from work and school, as well as loss of wages from ill employees. Furthermore, the direct cost of influenza infections attributed to doctor visits, costs for over-the-counter and prescription medications and hospitalizations place a significant financial burden on society (Bertino, 2002). Molinari et al. (2007) estimates that the economic burden, both direct and indirect cost, of influenza infections in the US exceeds $87.1 billion dollars annually.

The influenza A virus is known to infect humans, birds, pigs, horses, whales, and seals (Broadbent & Subbarao, 2011; Oxford, 2000). Influenza cases typically begin to appear in October, peak in January or February, and then begin to decline and end around May; this period (October-May) is known as the annual influenza season (Sutton, 2009). The influenza virus is transmitted when infected viral particles are aerosolized (usually through coughing, sneezing, or talking) and another person inhales these particles. Influenza is also transmitted via fomites that are infected with the virus. The virus affects the nose, throat, and lungs, and accompanies varied symptoms of high fever, sore throat, dry cough, headaches, body or muscle aches, and fatigue. Some children commonly have diarrhea and vomiting associated with the infection. While most people will recover within 2-14 days, specific populations may develop life-threatening complications from influenza (Blanton et al., 2011).

Particular populations may develop life-threatening complications from influenza including dehydration, bronchitis, secondary bacterial or viral infections, and pneumonia (Blanton et al., 2011).

These groups are most commonly children under 5 years of age (especially under 2 years), persons over 65 years of age, pregnant women, American Indian/Alaskan Natives, and persons with underlying health conditions such as asthma, diabetes, heart disease, cancer, neurological problems, or immunosuppressed persons (like those with HIV/AIDS). While infants under 6 months of age have the highest rate of infection, persons over the age of 65 years have the highest mortality rate (Influenza Surveillance; Centers for Disease Control and Prevention [CDC]-D, 2012; Sutton, 2009).

National Influenza Surveillance

The foundation of public health practice is surveillance, which includes the collection, analysis, interpretation, and dissemination of information gathered through its systems of data collection (Lee & Thacker, 2011). The primary purpose of surveillance systems is to monitor health conditions or health outcomes, and detect changes that are different from what is normally expected. Furthermore, surveillance systems provide statistical information that help health professionals intervene if needed, and prevent any unnecessary exposure, disease, or death from the disease or condition (Shire, Marsh, Talbott, & Sharma, 2011; Stoto, 2005).

Influenza surveillance systems in the US are based upon five categories: (1) viral surveillance; (2) outpatient illness; (3) pneumonia and influenza-associated mortality,; (4) influenza hospitalizations; and (5) geographical spread of influenza (Brammer et al, 2011). Each of these five components contribute essential information, that when combined, display a detailed overview of influenza activity in the nation (CDC-E, 2012). The information collected is compiled to produce a weekly report from the CDC called FluView, in which all states are divided into 10 regions of the country.

Viral Surveillance is monitored from World Health Organization (WHO) collaborating laboratories and National Respiratory and Enteric Virus Surveillance System (NREVSS) laboratories. These labs report the number of respiratory specimens tested and the number of specimens that are

positive for influenza. The WHO laboratories also test for the influenza A subtype (H1 or H3). Collected information allows for a determination of percent positive specimens for influenza (showing variability between weeks and detecting possible outbreaks) as well as commonly circulating strands (Brammer et al., 2011; CDC-E, 2012).

Outpatient Influenza-like Illness Surveillance Network (ILINET) monitors the weekly number of patients that come into 2,700 participating sentinel healthcare providers throughout the nation with influenza-like illness (ILI). A weekly percentage is calculated based upon patients seen with ILI compared to all patients seen during that time period. Regional percentage totals are monitored and compared to weekly regional baselines throughout the influenza season (Brammer et al, 2011; CDC-E, 2012; Simeonsson & Deyneka, 2007).

Mortality surveillance is monitored through two systems. The first is the Influenza-Associated Pediatric Mortality Surveillance System in which any laboratory-confirmed influenza-associated death in children under 18 years old is reported. The second, the Mortality Reporting System receives reports from 122 cities where pneumonia or influenza was reported as the cause of death in persons 18 years and older. Percentages of influenza-associated deaths are calculated and compared to seasonal baselines in order to determine fluctuations within influenza-associated mortalities (Brammer et al., 2011; CDC-E, 2012).

Hospital surveillance monitors anyone with laboratory-confirmed influenza that requires hospitalization though the Emerging Infections Program. Information is collected from 60 counties within 10 states, from patients of any age group that need to be hospitalized due to an influenza infection. Hospitalization rates are reported weekly to the CDC from each state (Brammer et al., 2011).

The fifth component of influenza surveillance is the system monitoring the geographic spread of influenza in the nation. Each state reports an estimated spread of influenza within regions of their state based upon five criteria: (1) no activity; (2) sporadic; (3) local; (4) regional; or (5) widespread

influenza activity (Brammer et al., 2011; CDC-E, 2012). Combined, these five components of influenza surveillance depict influenza incidence and mortality within the US on a weekly basis.

Monitoring influenza nationally with these five distinct surveillance systems allows for information gathered from each system to come together and display a very detailed picture of influenza on a weekly basis. Furthermore, information gathered collectively from these surveillance systems helps public health officials plan for the prevention and treatment of influenza for the upcoming year. Surveillance findings greatly contribute to annual influenza vaccine development, as well as antiviral treatment for influenza due to antiretroviral resistance that was identified from these surveillance systems. Information gathered from these systems also determines populations that are disproportionally affected by the disease and require targeted interventions strategies from public health officials to prevent influenza in these specific populations (CDC-E, 2012).

Nevada: State and Local Influenza Surveillance

The Nevada State Health Division (NSHD) is the statewide public health entity in Nevada. The NSHD receives information, data, and updates from the four jurisdictional health departments in the state; Washoe County Health Department, Southern Nevada Health District, Carson City Health and Human Services, and Public Health and Clinical Services (rural and frontier counties that do not have a local health jurisdiction). Influenza is not a nationally notifiable condition, except in the circumstance of influenza-associated hospitalization and influenza-associated mortality. Since January 24, 1992 in Nevada, any laboratory-confirmed influenza infection is reportable by law: Nevada Revised Statutes (NRS) 441A and Nevada Administrative Code (NAC) 441A. These laws require that any laboratory-confirmed influenza infection must be reported to the local health jurisdiction.

State and local influenza surveillance systems are very similar to national surveillance systems, where counts of ILI are reported from participating sentinel providers. This allows for a jurisdictional baseline of ILI to be depicted, thereby alerting public health officials to possible

outbreaks if changes from this baseline occur. Pneumonia and influenza-associated mortality is also recorded for the similar purpose of comparison (Blanton et al., 2011).

Lab-confirmed influenza infections within each health jurisdiction are also reported to the local health department. These samples are taken from ILI patients, hospitalizations, and case fatalities from anyone suspected of an influenza infection. All positive influenza specimens are entered into a database and are reported to NSHD. Public health officials monitor fluctuations in surveillance data and case-counts, and then initiate strong prevention campaigns during times of high disease incidence. Almost all state and local prevention campaigns are aimed at public education, which emphasizes influenza education, sanitation, and vaccination.

While statewide influenza systems are in place, NSHD does not routinely analyze the data received or report the findings to the public. However, recent descriptive analyses and report templates were developed by the student author in order to begin regular public reporting of influenza and other infectious diseases in the state of Nevada (CDC-A, 2012).

Influenza Prevention

Education is the best tool for public health officials to decrease influenza incidence. This includes informing the public of disease information, local disease patterns, and the need for improved sanitation and vaccination. Sanitation is extremely important in preventing the spread of influenza. This includes washing hands with soap and water frequently, covering the mouth when sneezing and coughing, staying home from work or school when feeling ill, and staying away from others who feel sick or are displaying symptoms of illness (Nichol & Treanor, 2006). While sanitation is very important for decreasing the spread of influenza, vaccination is the easiest and most effective way to prevent influenza infection (Grijalva, Zhu, Simonsen, Mitchel & Griffin, 2010; Nichol & Treanor, 2006; Sutton 2009).

Previous national publications on retrospective cohort studies, meta-analyses, and systematic reviews have been written determining the efficacy (reduction of laboratory-confirmed

cases) as a result of vaccination. These studies have determined that an increase in influenza vaccinations ultimately reduced influenza attributed morbidity (Grijalva, Zhu, Simonsen, Mitchel & Griffin, 2010), the number of laboratory-confirmed influenza cases, hospitalizations, and influenza-associated deaths (Glezen, 2006; Nichol & Treanor, 2006). Additionally, the more people that receive an annual influenza vaccination, decreases the incidence of influenza in people that cannot or do not receive the vaccine (Grijalva, Zhu, Simonsen, Mitchel & Griffin, 2010; Glezen, 2006). These studies have proven the idea of herd immunity and therefore, strongly recommend that all people receive the annual influenza vaccination not only to protect themselves, but to protect all others around them.

The CDC recommends that all persons over the age of six months should receive the influenza vaccination annually; however, emphasis is placed on persons at high-risk for influenza and influenza complications. These populations include children 6 months to 4 years, persons 65 years and older, pregnant women, American Indian/Alaskan Natives, all healthcare personnel, persons with chronic health conditions, and all household contacts and caregivers of infants less than six months of age.

Each year, the influenza vaccination coverage has fallen short compared to the national Healthy People (HP) 2020; even within the most recent, full influenza season (2011/2012). The HP 2020 objective was set at 80% vaccination coverage for children aged 6 months-4 years and all pregnant women. However, this objective fell short nationally with only 74.6% of 6 months-2 year olds being vaccinated, 63.3% of 2-4 year olds being vaccinated, and 47.0% of pregnant women being vaccinated in the 2011/2012 influenza season (CDC-A, 2012; CDC-C, 2012). Similarly, the HP 2020 objective was set at 90% for adults over 65 years of age, healthcare personnel, persons with chronic health conditions, and all other high-risk individuals. Again, this objective was not met with only 64.9% coverage in persons 65 and older, 66.9% coverage of healthcare personnel (CDC-C, 2012), 36.8% in adults with chronic health conditions, and 43.9% in American Indian/Alaskan Native populations. Overall, the CDC estimated that during the 2011/2012 influenza season, only 41.8% of

persons age 6 months and older received the influenza vaccination (CDC-A, 2012). These staggering statistics reveal the low vaccination rates within these high-risk populations and solidify the need for an improved approach from public health officials to increase influenza immunization.

Lastly, in the 2011/2012 influenza season, Nevada had only 32.6% of its residents vaccinated against the seasonal flu; Nevada has the lowest influenza vaccination coverage nationwide (CDC-A, 2012). This allows for extreme room for improvement in hopes of expanding vaccination coverage to more of Nevada's residents.

Collaboration of Influenza Surveillance and Vaccination Efforts

Influenza surveillance and influenza vaccination are two different entities with completely different purposes; however, these need work together in order to prevent influenza illness on both a local and national scale. One of the main functions of influenza surveillance systems is to detect changes in the expected norm. This allows for the detection of slight changes in influenza incidence, which may indicate an outbreak or even a possible pandemic situation arising. This is when public health officials investigate and intervene if necessary. When influenza surveillance systems detect an increase in influenza cases, public health officials respond by disseminating the information that was gathered through education. This is a comprehensive approach of describing disease incidence, detailing which populations are disproportionately affected by influenza, and a strong urge from public health officials for all people to receive the vaccination. Based upon CDC guidelines and research findings, persons at high risk for contracting influenza and developing complications for the infection, are the priority for receiving an influenza vaccination (Glezen, 2006). However, it is recommended that all adults and children receive vaccination and local health departments often hold vaccination clinics for the public in order to prevent further spread of the disease.

The earliest possible action from public health officials is obviously the most effective at preventing further spread of disease (Stoto, 2005). Glezen (2006) reflected on past mass vaccination campaigns in history in attempts to prevent further disease transmission, morbidity, or mortality.

Historically, this was done by taking information of increased disease incidence and enforced mass immunization campaigns on the national, and sometimes global, level. This technique has been successful for many diseases: smallpox, polio, and many other fatal childhood diseases. However, historically this technique had not been as successful at limiting influenza morbidity and mortality, or eradicating influenza all together (Glezen, 2006). This is due in part to multiple biological factors of a continually changing influenza virus, but it is significantly compounded by public stigma associated with influenza vaccination.

Like most public health campaigns, there is always room for improvement with the ability to learn from the most effective and least effective attributes of the current systems; this would be very effective in Nevada for influenza vaccination campaigns as well. Providing frequently updated reports on influenza incidence and surveillance information within Nevada, the Immunization Program at NSHD could monitor significant increases in cases, hospitalizations, and deaths in order to know when to enact strong influenza vaccination campaigns to its residents. This would allow influenza outbreaks, even possible pandemics, to be controlled in a timely fashion and greatly decrease any further transmission, morbidity, or mortality associated with the disease.

2009/2010 H1N1 Pandemic

On April 17, 2009, the CDC laboratory in Atlanta, Georgia confirmed the first two cases of a novel influenza A (H1N1) virus in the US (during MMWR week 15). In the weeks that followed, a significant increase in positive laboratory-confirmed cases of this novel influenza virus began being reported in several states. Disturbingly, this surge of new cases began to increase during a time when normal influenza seasons began to taper off and become nonexistent (Brammer et al., 2011; CDC-A, 2011; CDC-D, 2012; Dawood et al., 2009).

By May 5, 2009, three weeks after the first two initial cases of the virus, there were a total of 642 laboratory-confirmed cases of the emerging novel influenza strain throughout the US. On June 12, 2009, the World Health Organization (WHO) declared a global pandemic of the new influenza

virus (Dawood et al., 2009; Dimitrov, Goll, Hupert, Pourbohloul & Meyers, 2011; Kimmel, 2011). From there, historic efforts were made to control the pandemic virus in the US. This included strengthened influenza surveillance, health education, an emphasis on improved sanitation, controlled vaccination, and a targeted use of antiviral medications (Brammer et al., 2011; Dimitrov, Goll, Hupert, Pourbohloul & Meyers, 2011).

The most effective prevention tool against influenza is vaccination, and as the number of cases continued to increase in the nation, public health officials needed to slow the spread of the disease, specifically by interrupting the path of influenza transmission; this meant the rapid development of a new H1N1 vaccine. Each year, seasonal influenza vaccines contain three strains (trivalent vaccine) of the predicted causative virus for the upcoming season (Nichol & Treanor, 2006). However, during the 2009 H1N1 pandemic, a monovalent vaccine needed to be administered, along with the seasonal trivalent vaccine, to combat the H1N1 pandemic (Kimmel, 2011).

The Impact of 2009 H1N1 Pandemic in Nevada

Nevada began to receive reports of laboratory-confirmed H1N1 infections within the state beginning in MMWR week 17 of 2009. Once these initial cases began being reported, Nevada's four district health departments and NSHD requested that all positive laboratory-confirmed influenza specimens be subjected to influenza subtyping tests in order to detect the H1N1 virus. Almost all laboratory-confirmed influenza specimens in Nevada were subtyped, providing very accurate measures of true confirmed H1N1 cases during the 2009/2010 pandemic. Nationally, some states had a significant number of laboratory-confirmed H1N1 influenza cases during the spring wave of the pandemic; however, Nevada saw few cases during this time period, but experienced an enormous influx of cases during the second wave.

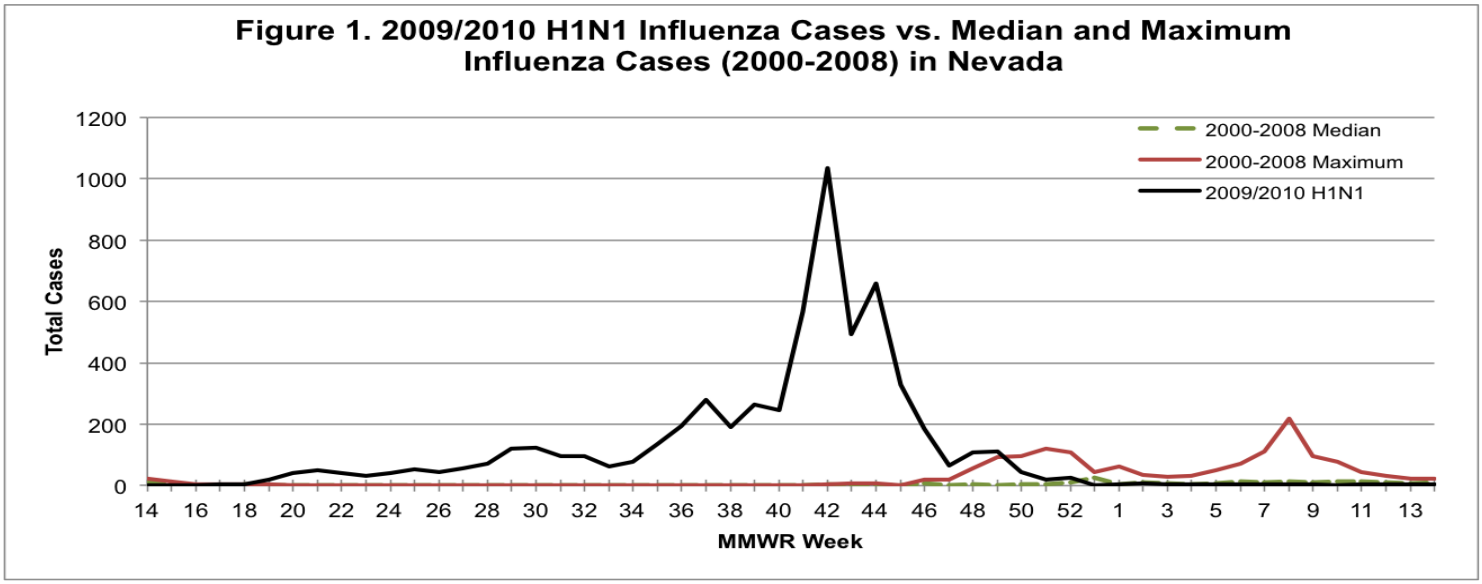

Figure 1: Data source for this analysis came from Nevada's NBS and NETSS records

In the Fall of 2009, data received from national surveillance systems indicated that the first wave of spring H1N1 had subsided; however, a second wave of H1N1 pandemic flu was beginning in September 2009 (week 36); weeks before the initial release of the new monovalent H1N1 vaccine (CDC-A, 2011). Additionally, the number of new H1N1 cases greatly surpassed that any of the previous eight years' maximum cases during influenza seasons. Due to this mounting evidence from national surveillance systems of a worsening H1N1 situation arising, combined with a not-yet-released vaccine, fear from the public, and strict government oversight of the H1N1 pandemic, the federal government mandated that all administered immunizations be documented and reported. In Nevada, the documentation of immunizations is done through a database called WebIZ. This system documents all administered vaccinations in Nevada that are reported to NSHD from all healthcare providers in the state and is required by state law via NRS 439.265. This system allows for the analysis of vaccine coverage within Nevada, which is essential in preventing great increases of vaccine-preventable diseases statewide by monitoring vaccination rates.

Once the vaccine was released in Nevada in October 2009, the initial demand from the public was extremely high but the number of vaccines available was very low. This created rigorous government supervision of vaccine supplies, and as a result, all vaccinations that were administered

were strictly monitored and reported to the WebIZ system. Information recorded from WebIZ during this time period provides a very accurate measure of H1N1 vaccination coverage within the state of Nevada and therefore creates the perfect opportunity for a study using the information collected from this time period through this system.

Overall Purpose

To date, no reports have comprehensively addressed the 2009/2010 H1N1 pandemic in Nevada. The few reports that were previously prepared were incomplete and were not made available to the public. Additionally, most of the data from Nevada's incidence and vaccination systems haven't yet been analyzed, and as a result, nothing has been learned or accomplished about how to prepare for future influenza epidemics based upon Nevada-specific data. Therefore, due to the high accuracy of administered vaccines reported to WebIZ, paired with precise reporting of disease incidence of laboratory-confirmed H1N1 infections in Nevada, an ideal situation was created for a first-ever case study in the state to analyze these systems and the relationship between vaccination and infection. From this analysis, public health officials in Nevada may better target specific populations for immunizations to prevent future influenza morbidity and mortality, and decrease the spread of disease through the proactive approach of influenza immunization. Ideally, by displaying accurate and relatable data to the public on the benefits of influenza immunization, the stigma associated with vaccination may decrease and consequently encourage immunization in all populations.

This paper intends to examine several impacts of the H1N1 pandemic in Nevada using statewide incidence information, surveillance data, and vaccination counts from the pandemic period. The objectives of this paper are:

- Investigate time trends of H1N1 disease occurrence and vaccination in Nevada;

- Calculate rates of disease incidence, hospitalizations, mortality, and vaccination coverage and determine whether these rates differ by age, gender, and county of residence;
- Examine how updated influenza and vaccination surveillance can inform public health approaches to preventing influenza morbidity and mortality; and
- Use the results to compare and contrast the strengths and weaknesses of Nevada's response to the H1N1 pandemic and make suggestions on how Nevada can be better prepared for possible impending pandemics.

Methods

Three data systems were used for analysis of this study. NEDSS-Based System (NBS) and National Electronic Telecommunications System for Surveillance (NETSS) were used to analyze H1N1 surveillance and incidence records in Nevada, while WebIZ was used to obtain data on H1N1 vaccination in Nevada. These three data systems were analyzed separately and the results were presented together in order to describe the whole picture of the 2009/2010 H1N1 pandemic in Nevada and access the relationship between incidence and vaccination.

Prior to 2009, influenza seasons were monitored from MMWR week 40 to week 26 of the following year. However, with the atypical H1N1 increase beginning in week 15 of 2009, it was determined that influenza seasons need to be monitored from week 40 to week 39 of the following year (Simeonsson & Deyneka, 2007).

Influenza

Cases

Nevada's influenza surveillance and incidence data came from two of Nevada's data systems: NBS and NETSS. The necessary information was extracted from both databases and was put into one line-listed spreadsheet used for the analysis of this study. The data that was received

came from every recorded laboratory-confirmed influenza specimens since 1992, the year that influenza became a reportable disease in Nevada (n=10,060).

The first step was to categorize and exclude all records where the MMWR year did not fall between 2009 and 2010. Consistent with the recommendation to begin influenza monitoring in week 40, cases before week 40 of 2009 were excluded. Furthermore, any records past MMWR week 17 of 2010 were excluded because it was the end of the pandemic and the influenza season (n=5,400).

Prior to the 2009/2010 H1N1 pandemic, subtyping on laboratory-confirmed influenza specimens was performed irregularly. Therefore, prior to 2009, all records of laboratory-confirmed influenza infections, whether influenza A, influenza B, or un-subtyped, were grouped together into seasonal flu for this analysis. Once the pandemic H1N1 influenza strain emerged, nearly all specimens were subtyped. However, in many cases, the specimen was only subjected to subtyping tests to distinguish influenza A from influenza B viruses; and because the novel H1N1 virus is a strain of influenza A, some records were only classified as "influenza A." If further subtyping was performed on many of these positive influenza A specimens, most would have actually been positive for H1N1 and therefore classified as such (there were very few laboratory-confirmed seasonal influenza cases that were determined not to be H1N1 during the pandemic). This analysis only included novel H1N1 laboratory-confirmed diagnosed cases because other influenza A cases couldn't be verified as H1N1 (n= 3,581).

County of residence for each patient of a laboratory-confirmed H1N1 influenza infection was very important to this study; however, for this dataset during the 2009/2010 pandemic influenza period, it was discovered that all Washoe County and Carson City H1N1 influenza cases were not recorded in the Nevada State Health Division (NSHD) database. Therefore, databases from these two counties were retrieved and analyzed separately and the results with the incidence and surveillance information presented in the results section. After these same inclusion/exclusion criteria were applied to these databases Carson City had additional records (n=217) and Washoe County had additional records (n=267).

The final H1N1 incidence sample size used for the study after inclusion/exclusion criteria was applied, and Carson City and Washoe Counties were added into the case counts, the final size was n=4,065.

Hospitalizations and Mortality

Cases

Data was extracted from NBS and NETSS used for the hospitalization and mortality calculations of this study. All records prior to week 40 of 2009 and after week 17 of 2010 were excluded from this analysis. The total H1N1 hospitalizations in Nevada during this time period were n=458. The total deaths in Nevada due to H1N1 was 38.

Vaccination

Cases

The data from WebIZ was taken from records of the 2009/2010 influenza season of any persons receiving an influenza vaccination, within the state of Nevada, who was 6 months of age and older. This data contained only records of the monovalent H1N1 vaccination that was administered during this influenza season. Prior to exclusion criteria, the database contained 17 possible variables (n=457,774). All date variables (age, week of vaccination) were calculated using the date of vaccination provided from the records.

The first step of the analysis was to categorize each record into MMWR week and year based upon the vaccination date in the dataset. All records where the date of vaccination did not lie between MMWR week 40 (of 2009) and week 17 (of 2010) were excluded because these records were considered errors in data entry and accuracy could not be confirmed (n=442,375).

Due to limited vaccination supplies during the initial release of the H1N1 vaccine in October 2009, many people travelled from other states into Nevada in hopes of getting immunized. This was

confirmed by the looking at the WebIZ data, where significant records of out of state residents received their vaccination in Nevada during this season. However, because this analysis is only on Nevada residents and it's inequalities of disease and vaccination, these records would not be necessary to examine. Therefore, it was determined that all persons not residing in Nevada at the time of vaccination would be excluded from this analysis (n=412,961).

High workload of H1N1 cases and vaccinations, along with job-related stressor during the 2009/2010 pandemic attributed to the possibility of data entry errors and duplicate records within the WebIZ system in Nevada. Records of individuals that had the same first name and/or last name and/or date of birth and/or date of vaccination were inspected to identify the possibility of duplicate records. Furthermore, infants and children might have needed a second H1N1 vaccination one month after the first; this is based upon specific guidelines and past vaccination histories of children (Blanton et al., 2011; Glezen 2006). However, limited and highly inaccurate reporting of vaccinations prior to 2009's NRS 439.265 legislation, made comparisons of which people needed a second vaccination, impossible. Therefore, one or more H1N1 vaccinations for one individual, during the 2009/2010 influenza season, constituted as a full vaccination for this study (n=358,844).

Measures

Each data set (H1N1 incidence, hospitalization, mortality, and vaccination) were analyzed using the same demographic variables of age, gender, and county. Race/ethnicity was very poorly recorded, with over 70% of H1N1 incidence records and over 72% of vaccination records reported as "missing" or "other". Due to this significant inaccuracy, race/ethnicity was not included or analyzed for this study. The age of each individual was categorized into age groups (0- 1 year, 2-4 years old, 5-17 years old, 18-49 years, 50-64 years, and 65+ years), which were based upon the age categories designed for influenza vaccination recommendations for the CDC. Gender was reported as male, female, or unknown. County of residency was determined by documentation of the

individual's county of residence at the time of illness of vaccination; any of Nevada's 17 counties within the state.

Statistical Analysis

Frequency and Percentage. Frequency totals and column percentages of all variables were calculated for H1N1 incidence and vaccination. This provided relevant information that is displayed in Tables 1, 2, and 3.

Rate calculation. Rates per 100,000 for both datasets were calculated based upon Nevada census information provided from the Nevada State Demographer. These totals excluded all persons residing in Nevada state prisons. Since annual influenza seasons fall between 2 years, the census data was averaged between the two years of reference for the influenza season in order to most accurately conclude rates per 100,000 within specific populations of Nevada. Furthermore, the rates of 2009/2010 H1N1 incidence and vaccination by gender and county were age-adjusted using the direct method. The standard age population was modeled from the 2000 U.S. Census in order to make the rates within each county relatable to each other. Age-adjusted rates for each defined group are presented in both Table 3 and Figure 3.

Results

H1N1 Incidence vs. Vaccination Trend

Figure 2 demonstrates 2009/2010 H1N1 incidence and vaccination in Nevada by week. In 2009 MMWR week 40, a significant increase in laboratory-confirmed influenza specimens began to be reported in Nevada during the second wave of the H1N1 epidemic. Week 40 is also when the state initially released the H1N1 vaccination. As confirmed H1N1 cases in Nevada increased quickly at week 40, so did the number of vaccinations administered within the state. Because immunizations take approximately 2 weeks to take full effect within the individual (Glenez, 2006) this gives a

window of 2 weeks after the vaccination to make an effect on influenza incidence. Therefore, to accurately measure the impact of H1N1 vaccination on H1N1 incidence in Nevada, one must compare the week of incidence (e.g. Week 42) to the week of vaccination, minus two weeks (e.g. Week 40). Using this comparison, it is evident that as the number of administered vaccinations began to increase, there was a subsequent decline in the number of laboratory-confirmed influenza infections.

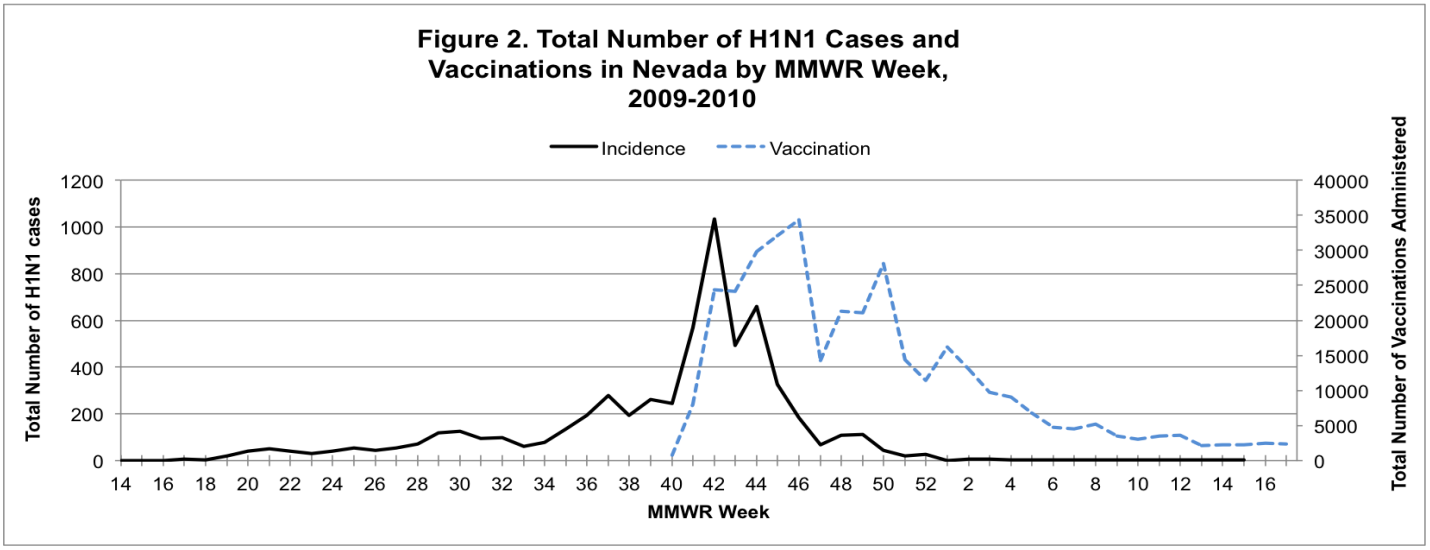

Figure 2: Data source for this analysis came from Nevada's NBS, NETSS, and WebIZ records

Rates of H1N1 Incidence, Vaccination, Hospitalization, and Mortality by Age Group

As shown in Table 1, crude rates of H1N1 influenza incidence show inequalities by age groups. Children aged 5-17 years, had the highest incidence rate (374.6 per 100,000 persons) of H1N1, followed by 2-4 year olds (358.4 per 100,000 persons), and 0-1 year olds (339.8 per 100,000 persons). Persons 65 years and older had the lowest incidence rate by far (25.6 per 100,000 persons).

Table 1. Crude H1N1 Incidence and Vaccination Rates by Age Group in Nevada, 2009-2010

	0-1 year	2-4 years	5-17 years	18-49 years	50-64 years	65+ years
Rate per 100,000 persons						
Incidence (n= 4,264)	339.8	358.4	374.6	113.0	66.9	25.6
Vaccination (n=357,874)	26,780.2	26,979.6	21,822.8	8,532.6	10,936.4	13,748.0

Additionally, Table 1 displayed that the crude vaccination rates by each age group varied greatly, with children having much higher vaccination rates than adults. Children aged 0-1 year and 2-4 years had the highest rates of vaccination (26,780.2 and 26,979.6 per 100,000 persons, respectively), while persons aged 18-49 years had a significantly lower rate of vaccination (8,532.6 per 100,000 persons).

Table 2 .Crude H1N1 Hospitalization and Mortality Rates by Age Group in Nevada, 2009-2010

	0-4 years	5-17 years	18-49 years	50-64 years	65+ years
Rate per 100,000 persons					
Hospitalizations (n=458)	34.5	10.5	15.7	21.3	14.1
Mortality (n=38)	0	0.6	1.5	2.7	1.3

Table 2. Note that 0-1 year and 2-4 years of age were combined into one age category (0-4 years). This was due to inconsistency of age versus age categorization reported by Nevada health departments. Therefore, it is was more appropriate to group these two age categories into one.

There were also important differences in hospitalization and mortality. Children aged 0-4 years old had a much higher rate of hospitalizations than any other group (34.5 per 100,000 persons), followed by 50-64 year olds (21.3 per 100,000). Surprisingly, persons 50-64 years of age had the highest mortality rate (2.7 per 100,000 persons) and mortality among those 65 years and older was relatively low (1.3 per 100,000 persons).

Age-Adjusted Rate of H1N1 Incidence and Vaccination

Table 3 demonstrates important demographic differences in age-adjusted rates of H1N1 incidence and vaccination. Compared to men, women had higher rates of H1N1 incidence (180.3 versus 142.9 per 100,000 persons, respectively) and vaccination (17,925.0 versus 11,999.0 per 100,000, respectively).

The age-adjusted incidence and vaccination rates varied greatly between counties. Nevada's two largest counties, Clark and Washoe, had relatively low incidence of disease compared to all other counties in Nevada (165.4 and 65.1 per 100,000 persons, respectively). Carson City and Douglas County had the highest age-adjusted rates (472.7 and 369.8 per 100,000 persons,

respectively). Storey County had the lowest vaccination rate in all of Nevada (4,179.3 per 100,000 persons), with the second lowest vaccination rate in Eureka County (10,015.8 per 100,000 persons). Lincoln County, Carson City, and Mineral County had the three highest vaccination rates in Nevada (26,688.0, 26,514.1, and 25,942.8 per 100,000 persons, respectively).

Table 3. Age-Adjusted Rates of 2009/2010 H1N1 Influenza Incidence and Vaccination

	Incidence (n=4,264)			**Vaccination** (n=358,844)		
	Count	Total Percentage (%) of Defined Population	Age-Adjusted Rate per 100,000	Count	Total Percentage (%) of Defined Population	Age-Adjusted Rate per 100,000
Gender	n=4,256			n=356,705		
Male	1,950	0.1	142.9	161,149	11.8	11,999.0
Female	2,306	0.2	180.3	195,556	14.6	17,925.0
Nevada County	n=4,263			n=356,471		
Clark	3,206	0.2	165.4	251,338	12.9	12,847.9
Washoe	264	0.1	65.1	51,714	12.4	12,268.4
Carson	217	0.4	472.7	14,192	26.9	26,514.1
Nye	94	0.2	251.6	5,138	11.1	11,482.6
Elko	107	0.2	211.4	8,486	16.5	16,519.1
Churchill	76	0.3	289.9	2,942	11.0	10,822.1
Humboldt	22	0.1	124.1	3,164	17.9	17,589.1
Douglas	144	0.3	369.8	7,509	14.6	16,477.5
White Pine	9	0.1	119.5	1,254	15.2	15,349.0
Lincoln	7	0.2	199.2	1,041	26.2	26,688.0
Mineral	4	0.1	113.1	1,135	25.3	25,942.8
Lander	9	0.2	151.9	966	16.0	15,766.4
Lyon	100	0.2	205.8	8,540	15.9	16,583.4
Pershing	4	0.1	81.1	711	12.8	13,397.6
Storey	0	0.0	0.0	198	4.6	4,179.3
Eureka	0	0.0	0.0	160	10.2	10,015.8
Esmeralda	***	0.1	146.0	121	10.1	13,491.1

Table 3. Note (***) is an identifiable case count under of 5.

H1N1 Incidence and Vaccination by Map of Nevada Counties

Figure 3 provides another view of geographic variation in H1N1 incidence and vaccination. The age-adjusted H1N1 incidence rate (indicated by the solid color) in each county is mapped along

with the age-adjusted vaccination rate (indicated by the circle). This map shows the 2009/2010 compiled incidence and vaccination rates for the entire influenza season. Because the timing of influenza incidence and vaccination cannot be determined, the map may reflect counties that initially had high rates of H1N1 followed by a response in vaccination, as well as counties that may have vaccinated early and did not see subsequent H1N1 infections.

Figure 3. Age-Adjusted H1N1 Influenza Incidence and Vaccination by County, 2009-2010

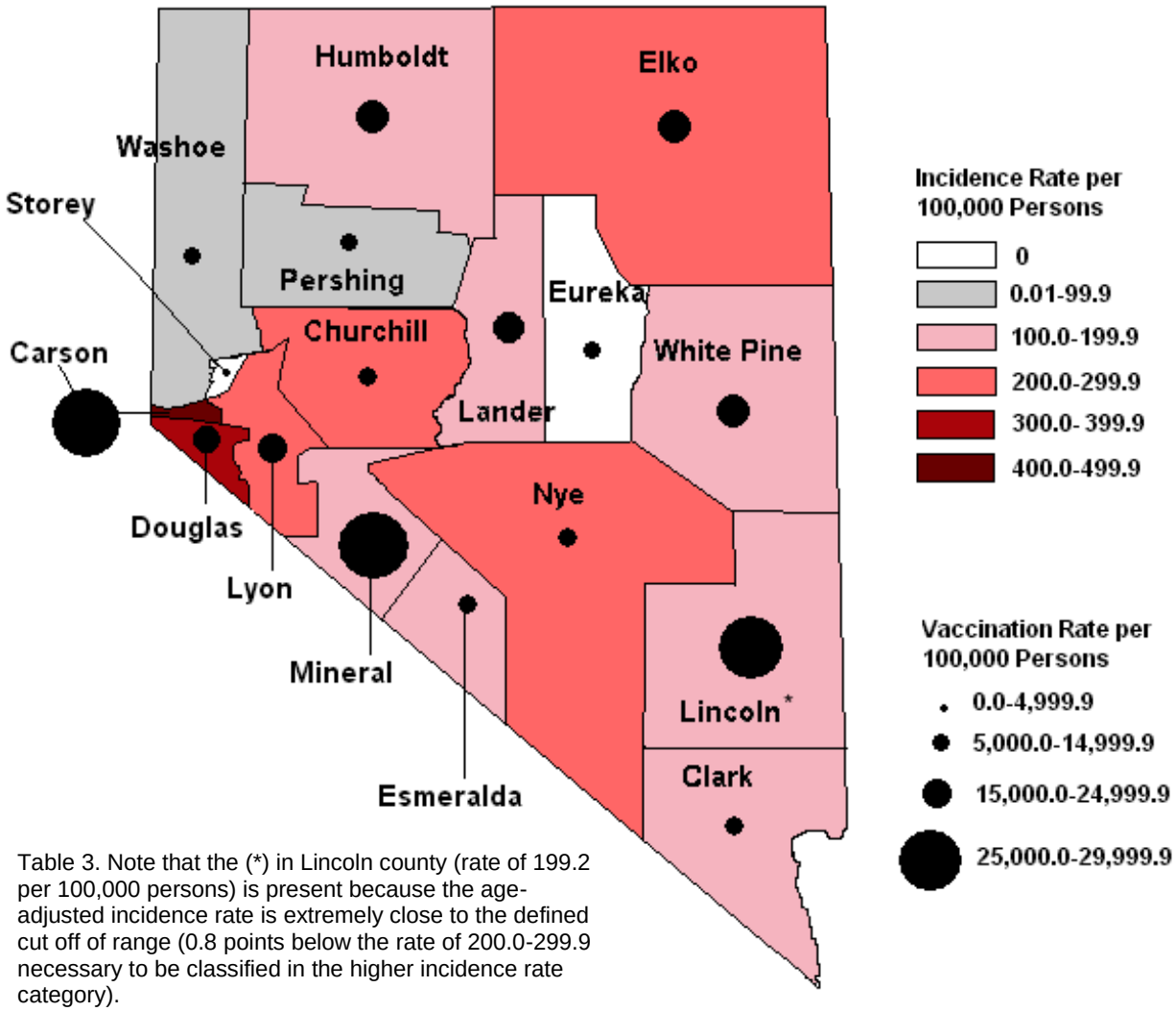

Table 3. Note that the (*) in Lincoln county (rate of 199.2 per 100,000 persons) is present because the age-adjusted incidence rate is extremely close to the defined cut off of range (0.8 points below the rate of 200.0-299.9 necessary to be classified in the higher incidence rate category).

Carson City had high disease incidence as well as high vaccination rates. Mineral County was noteworthy because although the county had low incidence of disease (113.1 per 100,000

persons), the immunization coverage was very high. Nye and Churchill Counties had relatively higher rates of disease (251.6 and 289.9 per 100,000 persons, respectively), but also had minimal vaccination coverage, even when compared to the rest of the state (11,482.6 and 10,822.1 per 100,000 persons, respectively).

Discussion

This is the first study to simultaneously assess both H1N1 influenza incidence and vaccination rates in Nevada. By combining multiple data sources related to H1N1 influenza information in Nevada (NBS, NETSS, and WebIZ), we were able to develop a more complete picture of this unique epidemic in the state. While this study only looked at H1N1 influenza from 2009-2010, the results of this study may be expanded to seasonal influenza as a whole.

The time trend of H1N1 influenza incidence versus vaccination suggests that influenza cases began to rise in Nevada in week 40 and vaccination efforts increased throughout the state. Once the vaccination was released (week 40) and Nevadans began being immunized, the H1N1 rates appear to have decreased. These results highlight the importance of coordinating disease surveillance and immunization efforts. NSHD and Nevada's four jurisdictional health departments need to monitor, analyze, and update influenza incidence and surveillance information in timely manner through weekly or monthly reports. The groups that could be targeted for data dissemination include: the general public, vaccination programs and organizations (and groups/departments focused on vaccination within the state), healthcare providers, hospitals, news and media groups, and childcare facilities. If these groups were informed about what to watch for in regards to high incidence populations, better and more effective prevention measures may be enacted earlier, before influenza cases become unmanageable.

A community approach to vaccination should be targeted towards groups disproportionately affected by influenza. While these suggestions for information regarding targeted immunization efforts came from 2009-2010, continued future surveillance information needs to be analyzed in

more “real-time” and disseminated for the purpose of determining the populations in need of influenza vaccination. The information gathered from these systems should be used to drive local health departments and NSHD to hold several free or low cost influenza immunization clinics in the community. If public outreach teams specifically went into the community and looked for these high-risk persons and administered the vaccination, influenza incidence, hospitalization, and mortality rates would decrease.

We found that while children had the highest rates of H1N1 incidence in Nevada, those 2-4 years of age had the highest vaccination rate followed by those aged 0-1 year. This suggests that Nevada is doing well at targeting children, along with reporting immunizations to WebIZ, compared to other age categories. Nevada’s public health officials should continue their efforts to maintain and increase influenza awareness and vaccination with pediatricians in the state. It is speculated that by vaccinating the group with the highest rate of disease incidence and efficient transmission behaviors (children), public health officials may have interrupted the path of influenza transmission and decreased further H1N1 influenza illness in all Nevada residents during the epidemic.

The results obtained from Nevada persons age 65 years and older during the epidemic were worrisome. While the incidence rate of H1N1 in this population was the lowest of any group, the disease outcomes (hospitalization, mortality) are typically much more severe of any other age category. This is why the CDC recommends that all persons 65 years and older receive the influenza vaccination; Healthy People 2020 set the objective at 90% vaccination coverage (CDC-A, 2012). However, our data suggest vaccination coverage for this age group was very poor and emphasizes significant need of improvement. This is difficult because persons aged 65 years and older that do receive the influenza vaccination still have low protection due to their age and immune systems response (Glezen, 2006). Therefore, while this population should still become vaccinated, emphasis should also be placed on persons in contact with adults over 65 years of age (healthcare providers, employees of long-term care facilities, children, and family members). This will promote herd immunity and there will ultimately be less transmission to adults over 65 years of age.

One of the most unexpected findings of the study was the H1N1 influenza-associated mortality by age group. The results were strikingly different than what is expected of normal seasonal influenza. Typically, persons over 65 years of age have the highest mortality rate of any age group (CDC-D, 2012; Sutton, 2009); however, in Nevada, adults 50-64 years and 18-49 years had higher mortality rates than persons 65 years and older. This may be attributed to the genetic make-up of the virus and exposure characteristics. Persons 18-64 years are the working class population of the state and nation, and therefore, have more exposure to diseases than older populations. With the significantly different genetic make-up of the novel H1N1 virus, minimal to no protection was achieved from previous exposure to other influenza viruses. Furthermore, these populations had the two of the lowest rates of vaccination for all age groups. Combined, these three factors created the prefect environment for persons in these age groups to become very ill and die from H1N1 infections.

Women had higher rates of H1N1 infection, and considerably higher rates of vaccination than men. This may be related to the fact that women are more likely than men to work in daycare facilities, schools, nursing positions, and long-term care facilities, and also more much more likely to be in stay-at-home parenting situations. Women may have been more exposed to H1N1 in these situations, explaining why they had higher rates of H1N1 infection. Typically, more exposure to diseases in these settings has the tendency to build the immune system over time, and allows for greater resiliency to disease. However, in the case of H1N1 infections, the genetic make-up of the virus was greatly different from any other influenza virus (Kimmel, 2011), and therefore minimal to no protection was available. Higher rates of vaccination among women may also be related to the fact that employees in schools, daycare facilities, and nursing facilities require vaccination for employment. The lower rate of vaccination for men may also be attributed to the fact that men are less likely to seek healthcare services (Bertakis, Azari, Helms, Callahan, and Robbins, 2000). Public health officials in Nevada should better target men though influenza vaccination campaigns. This could be done through informing and educating local primary care physicians on the risks of

influenza in order to push for vaccinations recommended for their male patients. There could also be greater effort to hold immunization clinics where there are higher rates of men employed or congregated.

While the findings of the comparison of age-adjusted H1N1 influenza incidence and vaccination rates by county provided interesting findings, there are a few inconsistencies with this comparison as well. Specifically, that vaccination efforts from each of the four jurisdictional health departments and the NSHD, varied. Each entity worked individually with minimal unified effort to target vaccinations to high-risk, high-incidence populations in Nevada. Therefore, it was difficult to ascertain which happened first; initially, high disease incidence followed by strong vaccination efforts and increase immunization, or, initially low vaccination efforts followed by low disease incidence. It may be that in places such as Carson City, the state capitol with a large population of state workers, a stronger effort to vaccinate state employees was emphasized. However, it is also possible that Carson City healthcare providers are far better at reporting administered vaccinations than any other county. Devoid of further investigation into county differences in disease and vaccination reporting, this difference may not ever be fully understood. Furthermore, without taking into account influenza incidence and vaccination by time, for each of the defined subpopulations, results cannot confirm which was a result of the other; H1N1 disease occurrence or vaccination efforts

Limitations

One of the biggest limitations to any analysis of reported disease occurrences is the number of laboratory-confirmed cases compared to the true number of cases that go unreported or unconfirmed. It is very common for infectious diseases, especially influenza, for the infected individual not to seek medical treatment if the illness isn't life-threatening or debilitating. If these true cases of H1N1 influenza did not seek medical attention, these individuals would not receive the necessary test to confirm H1N1 infection, and therefore would go unreported. Furthermore, all patients that visit the doctor for a possible influenza infection do not always receive the necessary

swab test to confirm an influenza infection. In most cases, the confirmation of influenza rarely changes the treatment approach because the laboratory confirmation takes days to diagnose, and by that time, the patient has usually recovered from the illness. This problem is compounded by the fact the many Nevada residents reside in rural towns with limited access to healthcare services or urban areas but lack a primary care provider or health insurance, and therefore would not as readily visit a physician if they were sick with the flu. All of these factors decrease the number of reported cases in comparison to the number of unreported cases.

This aspect of infectious disease reporting is a difficult issue to address because many people do not have the financial means or available time away from work or school to visit the doctor every time they are sick. And therefore, many true cases of disease go unreported. While this issue cannot be easily resolved, influenza education efforts should be targeted towards healthcare professionals, especially primary care physicians. Public health officials should emphasize the importance of collecting specimens on all patients of influenza-like illness. This would increase the true rates of disease and help NSHD and jurisdictional health departments better target these subpopulations in order to decrease influenza incidence.

The second limitation of this study is influenza subtyping on specimens collected from ill patients. Prior to the 2009 H1N1 pandemic, influenza subtyping was rarely, if ever performed on collected specimens. However, once the pandemic began, most of the collected specimens in Nevada were subjected to laboratory subtyping in order to access the spread of the novel virus. Still, some specimens were either not subtyped or were simply subtyped to distinguish between an influenza A or influenza B virus. This poses a problem because some reported cases of influenza in 2009 and 2010 were only reported as influenza A viruses, but didn't distinguish between seasonal influenza or H1N1 influenza. These reported cases of influenza A were excluded from this analysis and therefore may have possibly decreased the true rates of infection in persons of Nevada.

This limitation should be addressed to healthcare providers and diagnostic laboratories during high incidence periods. If healthcare providers knew to request specific subtyping on all of

patients with influenza-like illness, greater accuracy in H1N1 confirmed cases could have been achieved. Additionally, if diagnostic laboratories that tested influenza specimens during this time period were informed by NSHD of the need for specific subtyping (to distinguish seasonal influenza A from novel influenza A H1N1), then significantly more specimens would have been tested for H1N1, and a result, greater accuracy in true cases of disease. However, due to limited laboratory staffing and overwhelming requests for influenza subtyping on specimens, this recommendation may not be able to be fully achieved during times of large increases in influenza cases. Therefore, a better suggestion is recommended to help: sentinel sites across Nevada.

If NSHD set up sentinel sites to monitor influenza at primary care providers, clinics, hospitals, and urgent care facilities across the state, influenza surveillance may be more accurate and much more relatable to the state as a whole. These sites should be placed at strategic locations across Nevada, in both urban and rural locations throughout every county. The providers at the locations should be educated about the importance of accurately and rapidly reporting ILI and confirmed influenza cases, as well as requesting proper subtyping on all laboratory specimens. If these sentinel providers reported highly accurate ILI cases and laboratory-confirmed cases, this information could be expanded to Nevada as a whole, and information would be much more accurate, and prevention techniques aimed at the proper subpopulation be a lot more precise.

Thirdly, influenza surveillance from this time period was greatly lacking. H1N1 hospitalizations due to influenza infection were poorly reported and in many cases, were simply treated as a single case of H1N1, without the surveillance information provided. Additionally, Nevada does not collect information on ILI reports (this could be addressed from sentinel providers as previously described). Data collected from this analysis is not fully reliable since some counties reported influenza hospitalizations more than others. If public health officials at NSHD and all jurisdictional health departments educated healthcare providers and emphasized the importance of testing and reporting vaccinations and influenza cases, greater accuracy of rates of hospitalization could be made, and therefore more defined prevention techniques could be targeted.

Fourth, its quite possible that differences in vaccination reporting may have been inconsistent from healthcare providers across counties. This may have biased the results of this study and impacted the data obtained from WebIZ. However, without further investigation into the possibility and/or the reason for this, this question will go unanswered. Outreach teams from NSHD should educate healthcare providers on the importance of accurately reporting true vaccinations to WebIZ in a timely manner.

Significant inaccuracy in the race/ethnicity variables in both surveillance and vaccination databases needs to greatly improve. This demographic variable is extremely important and needs to be analyzed within both databases to decrease influenza incidence in Nevada. NSHD and all jurisdictional health departments across Nevada need to address these issues and amend current guidelines for the requirements of disease reporting from healthcare providers in the state. Public health outreach teams should educate healthcare providers in the state about the importance of reporting all cases of disease and vaccination in an accurate, complete, and timely manner. One big area of emphasis from outreach teams should be on the benefits of reporting (disease and vaccination) for healthcare providers. When providers report their influenza cases and vaccinations accurately, with all variables included, it allows for a better target for interventions (immunization) and ultimately means less influenza patients in their clinics and hospitals. Additionally, if stricter punishments or fines were enforced for lack of disease or vaccination reporting, significant and more reliable data would be available for analysis; and therefore, a greater accuracy of disease incidence and vaccination rates in the state.

In addition, an immunization question should be part of disease reporting requirements (yes/no, and approximate date of vaccination), as required by NSHD and all local health departments. This would allow for persons with a laboratory-confirmed influenza diagnoses to be examined as to whether they received an influenza vaccination. This would allow for future analysis into why people that received the influenza vaccination also contracted the flu.

The last recommendation is to improve the accuracy of WebIz's data reporting. While this study obtained accurate records of WebIZ recorded H1N1 vaccinations, due to the nature of the epidemic, this is not the case for other influenza seasons. NSHD should continue to perform statewide outreach of provider training and education about WebIZ, and the logistics and need for complete, accurate, and timely administered vaccinations in Nevada. This would greatly improve future data records of not only influenza vaccinations, but all immunizations administered within the state of Nevada.

Conclusion

Despite these limitations, this study significantly highlighted the importance of using influenza surveillance and immunization data to respond to current and future influenza pandemics in Nevada. This study emphasized groups with the highest disease incidence and lowest vaccination coverage; this information needs to be utilized and disseminated to public health officials and healthcare providers in Nevada in order to decrease morbidity and mortality in these high-risk, high-incidence, and low vaccinated subpopulations. Additionally, this demonstrated the need of timely collection, analysis, and dissemination of influenza surveillance information to guide influenza vaccination campaigns in the state. Lastly, this analysis could be used to promote changes in current public health policy in an effort to obtain more accurate data from influenza case patients and those receiving vaccinations to prevent influenza infections. Such changes may ultimately decrease the incidence of influenza in the state of Nevada and decrease the preventable costs associated with this illness.

Works Cited

Bertakis, K., Azari, R., Helms, J., Callahan, E., and Robbins, J., (2000). Utilization of Health Care Services. *The Journal of Family Practice.* 49(2): 147.

Bertino, J. S. (2002)., J. S. (2002). Cost burden of viral respiratory infections: issues for formulary decision makers. *American Journal of Medicine.* 112 Suppl 6A: 42S-49S.

Blanton, L., Brammer, L., Finelli, L., Grohskopf, L., Bresee, J., Klimov, A., Cox, N. (2011). VPD Surveillance Manual. 5th Edition. Retrieved from http://www.cdc.gov/vaccines/pubs/surv-manual/chpt06-influenza.pdf

Brammer, L., L. Blanton, S. Epperson, D. Mustaquim, A. Bishop, K. Kniss, R. Dhara, M. Nowell, L. Kamimoto and L. Finelli (2011). Surveillance for influenza during the 2009 influenza A (H1N1) pandemic-United States, April 2009-March 2010. *Clinical Infectious Diseases.* 52 Suppl 1: S27-35.

Broadbent, A. J. and K. Subbarao (2011). Influenza virus vaccines: lessons from the 2009 H1N1 pandemic. *Current Opinion in Virology.* 1(4): 254-262.

Centers for Disease Control and Prevention. (2011)-A. 2009-2010 Influenza Season. Retrieved from http://www.cdc.gov/flu/pastseasons/0910season.htm

Centers for Disease Control and Prevention. (2011)-B. Estimating Seasonal Influenza-Associated Deaths in the United States: CDC Study Confirms Variability of Flu. Retrieved from http://www.cdc.gov/flu/about/disease/us_flu-related_deaths.htm

Centers for Disease Control Prevention. (2012).-A. Flu Vaccination Coverage, United States, 2011-12 Influenza Season. Retrieved from http://www.cdc.gov/flu/professionals/vaccination/coverage_1112estimates.htm

Centers for Disease Control and Prevention. (2012)-B. Influenza Vaccination Coverage Among Health-Care Personnel-2011-12 Influenza Season, United States. *Morbidity and Mortality Weekly Report (MMWR).* Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6138a1.htm

Centers for Disease Control and Prevention. (2012)-C. Influenza Vaccination Coverage Among Pregnant Women-2011-12 Influenza Season, United States. *Morbidity and Mortality Weekly Report (MMWR).* Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6138a1.htm

Centers for Disease Control and Prevention. (2012)-D. Introduction and Biology of Influenza. Retrieved from http://www.cdc.gov/flu/professionals/acip/background.htm

Centers for Disease Control and Prevention. (2012)-E. Overview of Influenza Surveillance in the United States. Retrieved from http://www.cdc.gov/flu/weekly/overview.htm#viral.

Dawood, F., Jain, S., Finelli, L., Shaw, M., Lindstrom, S., Garten, R., Gubareva, L., Xu, X., Bridges, C., Uyeki, T. (2009). Emergence of a Novel Swine-Origin Influenza A (H1N1) Virus in Humans. *New England Journal of Medicine*. 360(25): 2605-2615.

Dimitrov, N. B., S. Goll, N. Hupert, B. Pourbohloul and L. A. Meyers (2011). Optimizing tactics for use of the U.S. antiviral strategic national stockpile for pandemic influenza. *PLoS One.* 6(1): e16094.

Glezen, W. P. (2006). Herd protection against influenza. *Journal of Clinical Virology.* 37(4): 237-243.

Grijalva, C. G., Y. Zhu, L. Simonsen, E. Mitchel and M. R. Griffin (2010). The population impact of a large school-based influenza vaccination campaign. *PLoS One.* 5(11): e15097.

Kimmel, S. R. (2011). The course and management of the 2009 H1N1 pandemic influenza. *Primary Care.* 38(4): 693-701, viii.

Lee, L. M. and S. B. Thacker (2011). Public health surveillance and knowing about health in the context of growing sources of health data. *American Journal of Preventive Medicine.* 41(6): 636-640.

Molinari, N. A., I. R. Ortega-Sanchez, M. L. Messonnier, W. W. Thompson, P. M. Wortley, E. Weintraub and C. B. Bridges (2007). The annual impact of seasonal influenza in the US: measuring disease burden and costs. *Vaccine* 25(27): 5086-5096.

Nichol, K. L. and J. J. Treanor (2006). Vaccines for seasonal and pandemic influenza. *Journal of Infectious Diseases.* 194 Suppl 2: S111-118.

Oxford, J. (2000). Influenza A pandemics of the 20th century with special reference to 1918: virology, pathology and epidemiology. *Reviews in Medical Virology.* 10: 119-133.

Shire, J., Marsh, G., Talbott, E., Sharma, R. (2011). Advances and Current Themes in Occupational Health and Environmental Public Health Surveillance. *Annual Review of Public Health.* 32: 109-132.

Simeonsson, K., Deyneka, L. (2007). Running the Numbers. *North Carolina Medical Journal*. 68(1): 74-76.

Stoto, M. (2005). Syndromic Surveillance. *Issues In Science & Technology*, 21(3): 49-56.

Sutton, S. (2009). Vaccination Recommendations for the 2008-2009 Influenza Season. *Drug Benefit Trends*. 21(1): 12.

Appendix

Nevada Administrative Code (NAC) and Nevada Revised Statute (NRS) Specific Laws

Surveillance and Disease Occurrence

NAC 441A.575 Influenza. (NRS 441A.120)

1. The health authority shall, for purposes of surveillance, obtain sufficient information of each case having influenza, as identified by confirmation by a medical laboratory of the presence of influenza viruses in clinical specimens, by demonstration of a specific serologic response in acute and convalescent sera or by a compatible clinical syndrome.

2. If a case having influenza is in a medical facility, the medical facility shall provide care to the case in accordance with the appropriate disease specific precautions.

(Added to NAC by Bd. of Health, eff. 1-24-92)

GENERAL PROVISIONS

NRS 441A.010 Definitions. As used in this chapter, unless the context otherwise requires, the words and terms defined in NRS 441A.020 to 441A.115, inclusive, have the meanings ascribed to them in those sections.

(Added to NRS by 1989, 294; A 2003, 2206; 2009, 557)

NRS 441A.020 "Board" defined. "Board" means the State Board of Health.

(Added to NRS by 1989, 294)

NRS 441A.030 "Child care facility" defined.

1. "Child care facility" means:

(a) An establishment operated and maintained for the purpose of furnishing care on a temporary or permanent basis, during the day or overnight, to five or more children under 18 years of age, if compensation is received for the care of any of those children;

(b) An on-site child care facility as defined in NRS 432A.0275;

(c) A child care institution as defined in NRS 432A.0245; or

(d) An outdoor youth program as defined in NRS 432A.028.

2. "Child care facility" does not include:

(a) The home of a natural parent or guardian, foster home as defined in NRS 424.014 or maternity home;

(b) A home in which the only children received, cared for and maintained are related within the third degree of consanguinity or affinity by blood, adoption or marriage to the person operating the facility; or

(c) A home in which a person provides care for the children of a friend or neighbor for not more than 4 weeks if the person who provides the care does not regularly engage in that activity.

(Added to NRS by 1989, 294; A 1991, 2310; 2011, 1998)

NRS 441A.040 "Communicable disease" defined. "Communicable disease" means a disease which is caused by a specific infectious agent or its toxic products, and which can be transmitted, either directly or indirectly, from a reservoir of infectious agents to a susceptible host organism.

(Added to NRS by 1989, 294)

NRS 441A.050 "Health authority" defined. "Health authority" means the district health officer in a district, or the district health officer's designee, or, if none, the State Health Officer, or the State Health Officer's designee.

(Added to NRS by 1989, 294)

NRS 441A.060 "Health Division" defined. "Health Division" means the Health Division of the Department of Health and Human Services.

(Added to NRS by 1989, 294)

NRS 441A.063 "Infectious disease" defined. "Infectious disease" means a disease which is caused by pathogenic microorganisms, including, without limitation, bacteria, viruses, parasites or fungi, which spread, either directly or indirectly, from one person to another. The term includes a communicable disease.

(Added to NRS by 2009, 554)

NRS 441A.065 "Isolation" defined. "Isolation" means the physical separation and confinement of a person or a group of persons infected or reasonably believed by a health authority to be infected with a communicable disease from persons who are not infected with and have not been exposed to the communicable disease, to limit the transmission of the communicable disease to persons who are not infected with and have not been exposed to the communicable disease.

(Added to NRS by 2003, 2196)

NRS 441A.070 "Laboratory director" defined. "Laboratory director" has the meaning ascribed to it in NRS 652.050.

(Added to NRS by 1989, 294)

NRS 441A.080 "Medical facility" defined. "Medical facility" has the meaning ascribed to it in NRS 449.0151.

(Added to NRS by 1989, 294)

NRS 441A.090 "Medical laboratory" defined. "Medical laboratory" has the meaning ascribed to it in NRS 652.060.

(Added to NRS by 1989, 294)

NRS 441A.100 "Physician" defined. "Physician" is limited to a person licensed to practice medicine pursuant to chapter 630 or 633 of NRS.

(Added to NRS by 1989, 294)

NRS 441A.110 "Provider of health care" defined. "Provider of health care" means a physician, nurse or veterinarian licensed in accordance with state law or a physician assistant licensed pursuant to chapter 630 or 633 of NRS.

(Added to NRS by 1989, 294; A 2001, 781; 2007, 1856)

NRS 441A.115 "Quarantine" defined. "Quarantine" means the physical separation and confinement of a person or a group of persons exposed to or reasonably believed by a health authority to have been exposed to a communicable disease who do not yet show any signs or symptoms of being infected with the communicable disease from persons who are not infected with and have not been exposed to the communicable disease, to limit the transmission of the communicable disease to persons who are not infected with and have not been exposed to the communicable disease.

(Added to NRS by 2003, 2196)

NRS 441A.120 Regulations of State Board of Health; performance of duties set forth in regulations.

1. The Board shall adopt regulations governing the control of communicable diseases in this State, including regulations specifically relating to the control of such diseases in educational, medical and correctional institutions. The regulations must specify:

(a) The diseases which are known to be communicable.

(b) The communicable diseases which are known to be sexually transmitted.

(c) The procedures for investigating and reporting cases or suspected cases of communicable diseases, including the time within which these actions must be taken.

(d) For each communicable disease, the procedures for testing, treating, isolating and quarantining a person or group of persons who have been exposed to or have or are suspected of having the disease.

(e) A method for ensuring that any testing, treatment, isolation or quarantine of a person or a group of persons pursuant to this chapter is carried out in the least restrictive manner or environment that is appropriate and acceptable under current medical and public health practices.

2. The duties set forth in the regulations adopted by the Board pursuant to this section must be performed by:

(a) In a district in which there is a district health officer, the district health officer or the district health officer's designee; or

(b) In any other area of the State, the State Health Officer or the State Health Officer's designee.

(Added to NRS by 1989, 294; A 2003, 2206; 2011, 2506)

NRS 441A.125 Use of syndromic reporting and active surveillance to monitor public health; regulations.

1. The Board shall develop a system which provides for syndromic reporting and active surveillance to monitor public health in this state during major events or when determined appropriate and necessary by a health authority.

2. The Board shall adopt regulations concerning the system it develops pursuant to this section, including, without limitation:

(a) The manner in which and situations during which the system actively gathers information;

(b) The persons who are required to report information to the system; and

(c) The procedures for reporting required information to the system.

(Added to NRS by 2003, 2205)

NRS 441A.130 State Health Officer to inform local health officers of regulations and procedures. The State Health Officer shall inform each local health officer of the regulations adopted by the Board and the procedures established for investigating and reporting cases or suspected cases of infectious diseases and cases or suspected cases of exposure to biological, radiological or chemical agents pursuant to this chapter.

(Added to NRS by 1989, 295; A 2009, 557)

NRS 441A.140 Authority of Health Division to receive and use financial aid. The Health Division may receive any financial aid made available by any grant or other source and shall use the aid, in cooperation with the health authority, to carry out the provisions of this chapter.

(Added to NRS by 1989, 299)

REPORTING OF OCCURRENCES; INVESTIGATIONS; ACTIONS TO PROTECT PUBLIC HEALTH AND SAFETY

NRS 441A.150 Reporting occurrences of communicable diseases to health authority.

1. A provider of health care who knows of, or provides services to, a person who has or is suspected of having a communicable disease shall report that fact to the health authority in the manner prescribed by the regulations of the Board. If no provider of health care is providing services, each person having knowledge that another person has a communicable disease shall report that fact to the health authority in the manner prescribed by the regulations of the Board.

2. A medical facility in which more than one provider of health care may know of, or provide services to, a person who has or is suspected of having a communicable disease shall establish administrative procedures to ensure that the health authority is notified.

3. A laboratory director shall, in the manner prescribed by the Board, notify the health authority of the identification by his or her medical laboratory of the presence of any communicable disease in the jurisdiction of that health authority. The health authority shall not presume a diagnosis of a communicable disease on the basis of the notification received from the laboratory director.

4. If more than one medical laboratory is involved in testing a specimen, the laboratory that is responsible for reporting the results of the testing directly to the provider of health care for the patient shall also be responsible for reporting to the health authority.

(Added to NRS by 1989, 295)

NRS 441A.160 Investigation: Powers of health authority to conduct investigation of communicable disease; order to require person to submit to examination; order of isolation, quarantine or treatment.

1. A health authority who knows, suspects or is informed of the existence within the jurisdiction of the health authority of any communicable disease shall immediately investigate the matter and all circumstances connected with it, and shall take such measures for the prevention, suppression and control of the disease as are required by the regulations of the Board or a local board of health.

2. A health authority may:

(a) Enter private property at reasonable hours to investigate any case or suspected case of a communicable disease.

(b) Order any person whom the health authority reasonably suspects has a communicable disease in an infectious state to submit to any medical examination or test which the health authority believes is necessary to verify the presence of the disease. The order must be in writing and specify the name of the person to be examined and the time and place of the examination and testing, and may include such terms and conditions as the health authority believes are necessary to protect the public health.

(c) Except as otherwise provided in subsection 5 and NRS 441A.210, issue an order requiring the isolation, quarantine or treatment of any person or group of persons if the health authority believes that such action is necessary to protect the public health. The order must be in writing and specify the person or group of persons to be isolated or quarantined, the time during which the order is effective, the place of isolation or quarantine and other terms and conditions which the health authority believes are necessary to protect the public health, except that no isolation or quarantine may take place if the health authority determines that such action may endanger the life of a person who is isolated or quarantined.

3. Each order issued pursuant to this section must be served upon each person named in the order by delivering a copy to him or her.

4. If a health authority issues an order to isolate or quarantine a person with a communicable or infectious disease in a medical facility, the health authority must isolate or quarantine the person in the manner set forth in NRS 441A.510 to 441A.720, inclusive.

5. Except as otherwise provided in NRS 441A.310 and 441A.380, a health authority may not issue an order requiring the involuntary treatment of a person without a court order requiring the person to submit to treatment.

(Added to NRS by 1989, 295; A 2003, 2206; 2011, 2507)

NRS 441A.163 Investigation: Powers of health authority to conduct investigation of infectious disease or exposure to biological, radiological or chemical agent; reports; regulations.

1. Except as otherwise required pursuant to NRS 441A.160, a health authority may conduct an investigation of a case or suspected case of:

(a) An infectious disease within its jurisdiction; or

(b) Exposure to a biological, radiological or chemical agent within its jurisdiction,

Ê which significantly impairs the health, safety or welfare of the public within its jurisdiction.

2. Each health authority shall:

(a) Except as otherwise required pursuant to NRS 441A.170, report each week to the State Health Officer the number and types of cases or suspected cases of infectious diseases or cases or suspected cases of exposure to biological, radiological or chemical agents which significantly impair the health, safety or welfare of the public reported to the health authority, and any other information required by the regulations of the Board.

(b) Report the results of an investigation conducted pursuant to subsection 1 to the State Health Officer within 30 days after concluding the investigation.

3. The Board may adopt regulations to carry out the provisions of NRS 441A.163 to 441A.169, inclusive.

(Added to NRS by 2009, 554)

NRS 441A.165 Investigation: Powers of health authority to access medical records, laboratory records and other information in possession of health care provider or medical facility; payment of certain costs related to investigation.

1. A health authority which conducts an investigation pursuant to NRS 441A.160 or 441A.163 shall, for the protection of the health, safety and welfare of the public, have access to all medical records, laboratory records and reports, books and papers relevant to the investigation which are in the possession of a provider of health care or medical facility being investigated or which are otherwise necessary to carry out the investigation. The determination of what information is necessary to carry out the investigation is at the discretion of the health authority.

2. If a health authority conducts an investigation pursuant to NRS 441A.160 or 441A.163, the health authority may require a provider of health care or medical facility being investigated to pay a proportionate share of the actual cost of carrying out the investigation, including, without limitation, the cost of notifying and testing patients who may have contracted an infectious disease, been exposed to a biological, radiological or chemical agent or otherwise been harmed.

(Added to NRS by 2009, 555)

NRS 441A.166 Investigation: Subpoena to compel production of medical records, laboratory records and other information; court order directing witness to appear for failure to produce.

1. Upon petition by a health authority to the district court for the county in which an investigation is being conducted by the health authority pursuant to NRS 441A.160 or 441A.163, the court may issue a subpoena to compel the production of medical records, laboratory records and reports, books and papers as set forth in NRS 441A.165.

2. If a witness refuses to produce any medical records, laboratory records and reports, books or papers required by a subpoena issued by a court pursuant to subsection 1, the court shall enter an order directing the witness to appear before the court at a time and place to be fixed by the court in its order, the time to be not more than 10 days after the date of the order, and then and there show cause why the witness has not produced the medical records, laboratory records and reports, books or papers before the health authority. A certified copy of the order must be served upon the witness. The court may enter an order that the witness appear before the health authority at the time and place fixed in the order and produce the required medical records, laboratory records and reports, books or papers, and upon failure to obey the order, the witness must be dealt with as for contempt of court.

(Added to NRS by 2009, 555)

NRS 441A.167 Investigation: Law enforcement agencies and political subdivisions authorized to share certain information and medical records with state and local health authorities.

1. A public agency, law enforcement agency or political subdivision of this State which has information that is relevant to an investigation relating to an infectious disease or exposure to a biological, radiological or chemical agent which significantly impairs the health, safety and welfare of the public shall share the information and any medical records and reports with the appropriate state and local health authorities if it is in the best interest of the public and as necessary to further the investigation of the requesting health authority.

2. The Board shall adopt regulations to carry out this section, including, without limitation:

(a) Identifying the public agencies and political subdivisions with which the information set forth in subsection 1 may be shared;

(b) Prescribing the circumstances and procedures by which the information may be shared with those identified public agencies and political subdivisions; and

(c) Ensuring the confidentiality of the information if it is protected health information.

(Added to NRS by 2009, 556)

NRS 441A.169 Investigation: Powers of health authority to issue cease and desist order to health care provider or medical facility; injunction.

1. During the course of or as a result of an investigation concerning the case or suspected case of an infectious disease or the case or suspected case of exposure to a biological, radiological or chemical agent pursuant to NRS 441A.160 or 441A.163, a health authority may, upon finding that a provider of health care or medical facility significantly contributed to a case of an infectious disease or to a case of exposure to a biological, radiological or chemical agent and that the public health imperatively requires:

(a) Issue a written order directing the provider of health care or medical facility to cease and desist any act or conduct which is harmful to the health, safety or welfare of the public; and

(b) Take any other action to reduce or eliminate the harm to the health, safety or welfare of the public.

2. A written order directing a provider of health care or medical facility to cease and desist issued pursuant to subsection 1 must contain a statement of the:

(a) Provision of law or regulation which the provider of health care or medical facility is violating; or

(b) Standard of care that the provider of health care or medical facility is violating which led to the case of the infectious disease or to the case of exposure to a biological, radiological or chemical agent.

3. An order to cease and desist must be served upon the person or an authorized representative of the facility directly or by certified or registered mail, return receipt requested. The order becomes effective upon service.

4. An order to cease and desist expires 30 days after the date of service unless the health authority institutes an action in a court of competent jurisdiction seeking an injunction.

5. Upon a showing by the health authority that a provider of health care or medical facility is committing or is about to commit an act which is harmful to the health, safety or welfare of the public, a court of competent jurisdiction may enjoin the provider of health care or medical facility from committing the act.

(Added to NRS by 2009, 556)

NRS 441A.170 Weekly reports to State Health Officer. Each health authority shall report each week to the State Health Officer the number and types of cases or suspected cases of communicable disease reported to the health authority, and any other information required by the regulations of the Board.

(Added to NRS by 1989, 299)

NRS 441A.180 Contagious person to prevent exposure to others; warning by health authority; penalty.

1. A person who has a communicable disease in an infectious state shall not conduct himself or herself in any manner likely to expose others to the disease or engage in any occupation in which it is likely that the disease will be transmitted to others.

2. A health authority who has reason to believe that a person is in violation of subsection 1 shall issue a warning to that person, in writing, informing the person of the behavior which constitutes the violation and of the precautions that the person must take to avoid exposing others to the disease. The warning must be served upon the person by delivering a copy to him or her.

3. A person who violates the provisions of subsection 1 after service upon him or her of a warning from a health authority is guilty of a misdemeanor.

(Added to NRS by 1989, 296)

NRS 441A.190 Control of disease within schools, child care facilities, medical facilities and correctional facilities.

1. Except as otherwise provided in this subsection, a health authority who knows of the presence of a communicable disease within a school, child care facility, medical facility or correctional facility shall notify the principal, director or other person in charge of the school, child care facility, medical facility or correctional facility of that fact and direct what action, if any, must be taken to prevent the spread of the disease. A health authority who knows of the presence of the human immunodeficiency virus within a school shall notify the superintendent of the school district of that fact and direct what action, if any, must be taken to prevent the spread of the virus.

2. Except as otherwise provided in this subsection, the principal, director or other person in charge of a school, child care facility, medical facility or correctional facility who knows of or suspects the presence of a communicable disease within the school, child care facility, medical facility or correctional facility, shall notify the health authority pursuant to the regulations of the Board. If a principal of a school knows of the presence of the human immunodeficiency virus within the school, the principal shall notify the superintendent of the school district of that fact. A superintendent of a school district who is notified of or knows of the presence of the human immunodeficiency virus within a school in the school district shall notify the health authority of that fact. The health authority shall investigate a report received pursuant to this subsection to determine whether a communicable disease or the human immunodeficiency virus is present and direct what action, if any, must be taken to prevent the spread of the disease or virus.

3. A parent, guardian or person having custody of a child who has a communicable disease shall not knowingly permit the child to attend school or a child care facility if the Board, by regulation, has determined that the disease requires exclusion from school or a child care facility.

(Added to NRS by 1989, 296; A 1991, 1340)

NRS 441A.195 Testing of person or decedent who may have exposed law enforcement officer, correctional officer, emergency medical attendant, firefighter, county coroner or medical examiner, person employed by agency of criminal justice or certain other public employees to contagious disease.

1. A law enforcement officer, correctional officer, emergency medical attendant, firefighter, county coroner or medical examiner or any of their employees, any other person who is employed by an agency of criminal justice or any other public employee whose duties may require him or her to come into contact with human blood or bodily fluids, who may have been exposed to a contagious disease while performing his or her official duties, or the employer of such a person, may petition a court for an order requiring the testing of a person or decedent for exposure to the human immunodeficiency virus, the hepatitis B surface antigen, hepatitis C and tuberculosis if the person or decedent may have exposed the officer, medical attendant, firefighter, county coroner or medical examiner or their employee, other person employed by an agency of criminal justice or other public employee whose duties may require him or her to come into contact with human blood or bodily fluids to a contagious disease.

2. When possible, before filing a petition pursuant to subsection 1, the person or employer petitioning shall submit information concerning the possible exposure to a contagious disease to the designated health care officer for the employer or, if there is no designated health care officer, the person designated by the employer to document and verify possible exposure to contagious diseases, for verification that there was substantial exposure. Each designated health care officer or person designated by an employer to document and verify possible exposure to contagious diseases shall establish guidelines based on current scientific information to determine substantial exposure.

3. A court shall promptly hear a petition filed pursuant to subsection 1 and determine whether there is probable cause to believe that a possible transfer of blood or other bodily fluids occurred between the person who filed the petition or on whose behalf the petition was filed and the person or decedent who possibly exposed him or her to a contagious disease. If the court determines that probable cause exists to believe that a possible transfer of blood or other bodily fluids occurred, the court shall:

(a) Order the person who possibly exposed the petitioner, or the person on whose behalf the petition was filed, to a contagious disease to submit two specimens of blood to a local hospital or medical laboratory for testing for exposure to the human immunodeficiency virus, the hepatitis B surface antigen, hepatitis C and tuberculosis; or

(b) Order that two specimens of blood be drawn from the decedent who possibly exposed the petitioner, or the person on whose behalf the petition was filed, to a contagious disease and be submitted to a local hospital or medical laboratory for testing for exposure to the human immunodeficiency virus, the hepatitis B surface antigen, hepatitis C and tuberculosis.

Ê The local hospital or medical laboratory shall perform the test in accordance with generally accepted medical practices and shall disclose the results of the test in the manner set forth in NRS 629.069.

4. The employer of a person who files a petition or on whose behalf a petition is filed pursuant to this section or the insurer of the employer shall pay the cost of performing the test pursuant to subsection 3.

5. As used in this section:

(a) “Agency of criminal justice” has the meaning ascribed to it in NRS 179A.030.

(b) “Emergency medical attendant” means a person licensed as an attendant or certified as an emergency medical technician, intermediate emergency medical technician or advanced emergency medical technician pursuant to chapter 450B of NRS.

(Added to NRS by 1999, 1122; A 2005, 328; 2007, 88)

NRS 441A.200 Right to receive treatment from physician or clinic of choice; Board may prescribe method of treatment. This chapter does not empower or authorize the health authority or any other person to interfere in any manner with the right of a person to receive approved treatment for a communicable disease from any physician, clinic or other person of his or her choice, but the Board has the power to prescribe the approved method of treatment to be used by the physician, clinic or other person.

(Added to NRS by 1989, 298)

NRS 441A.210 Rights and duties of person who depends exclusively on prayer for healing. A person who has a communicable disease and depends exclusively on prayer for healing in accordance with the tenets and precepts of any recognized religious sect, denomination or organization is not required to submit to any medical treatment required by the provisions of this chapter, but may be isolated or quarantined in the person’s home or other place of the person’s choice acceptable to the health authority, and shall comply with all applicable rules, regulations and orders issued by the health authority.

(Added to NRS by 1989, 298)

NRS 441A.220 Confidentiality of information; permissible disclosure. All information of a personal nature about any person provided by any other person reporting a case or suspected case of a communicable disease, or by any person who has a communicable disease, or as determined by investigation of the health authority, is confidential medical information and must not be disclosed to any person under any circumstances, including pursuant to any subpoena, search warrant or discovery proceeding, except:

1. As otherwise provided in NRS 439.538.
2. For statistical purposes, provided that the identity of the person is not discernible from the information disclosed.
3. In a prosecution for a violation of this chapter.
4. In a proceeding for an injunction brought pursuant to this chapter.

5. In reporting the actual or suspected abuse or neglect of a child or elderly person.

6. To any person who has a medical need to know the information for his or her own protection or for the well-being of a patient or dependent person, as determined by the health authority in accordance with regulations of the Board.

7. If the person who is the subject of the information consents in writing to the disclosure.

8. Pursuant to subsection 4 of NRS 441A.320 or NRS 629.069.

9. If the disclosure is made to the Department of Health and Human Services and the person about whom the disclosure is made has been diagnosed as having acquired immunodeficiency syndrome or an illness related to the human immunodeficiency virus and is a recipient of or an applicant for Medicaid.

10. To a firefighter, police officer or person providing emergency medical services if the Board has determined that the information relates to a communicable disease significantly related to that occupation. The information must be disclosed in the manner prescribed by the Board.

11. If the disclosure is authorized or required by NRS 239.0115 or another specific statute.

(Added to NRS by 1989, 299; A 1989, 1476; 1997, 1254; 1999, 1123, 2238, 2245; 2005, 329; 2007, 1277, 1977, 2109)

NRS 441A.230 Disclosure of personal information prohibited without consent. Except as otherwise provided in this chapter and NRS 439.538, a person shall not make public the name of, or other personal identifying information about, a person infected with a communicable disease who has been investigated by the health authority pursuant to this chapter without the consent of the person.

(Added to NRS by 1989, 300; A 2007, 1978)

ENFORCEMENT

NRS 441A.900 Injunction: Grounds; responsibility for prosecution; authority of court.

1. A person who refuses to:

(a) Comply with any regulation of the Board relating to the control of a communicable disease;

(b) Comply with any provision of this chapter;

(c) Submit to approved treatment or examination required or authorized by this chapter;

(d) Provide any information required by this chapter; or

(e) Perform any duty imposed by this chapter,

Ê may be enjoined by a court of competent jurisdiction.

2. An action for an injunction pursuant to this section must be prosecuted by the Attorney General, any district attorney or any private legal counsel retained by a local board of health in the name of and upon the complaint of the health authority.

3. The court in which an injunction is sought may make any order reasonably necessary to carry out the purpose or intent of any provision of this chapter or to compel compliance with any regulation of the Board or order of the health authority relating to the control of a communicable disease.

(Added to NRS by 1989, 299)—(Substituted in revision for NRS 441A.420)

NRS 441A.910 Criminal penalty for violation of chapter. Except as otherwise provided, every person who violates any provision of this chapter is guilty of a misdemeanor.

(Added to NRS by 1989, 300)—(Substituted in revision for NRS 441A.430)

NRS 441A.920 Criminal penalty and administrative fine for failure to comply with regulations or requirements of chapter. Every provider of health care, medical facility or medical laboratory that willfully fails, neglects or refuses to comply with any regulation of the Board relating to the reporting of a communicable disease or any requirement of this chapter is guilty of a misdemeanor and, in addition, may be subject to an administrative fine of $1,000 for each violation, as determined by the Board.

(Added to NRS by 1989, 300)—(Substituted in revision for NRS 441A.440)

NRS 441A.930 District attorney to prosecute violators. The district attorney of the county in which any violation of this chapter occurs shall prosecute the person responsible for the violation.

(Added to NRS by 1989, 300)—(Substituted in revision for NRS 441A.450)

Vaccination

NRS 439.265 Immunization Information System: Establishment and administration; duty to report information concerning immunization administered to child; contents and form of report; parent or guardian to be provided information concerning System; parent or guardian may decline inclusion of information in System; disclosure of information; regulations.

1. The Department shall establish an Immunization Information System to collect information concerning the immunization of children in this State. The Immunization Information System must be administered by the State Board of Health.

2. Except as otherwise provided in subsection 4, a person who administers any immunization to a child which is recommended and approved by the United States Public Health Service Advisory Committee on Immunization Practices, or its successor organization, on or after July 1, 2009, shall report information concerning the child and the immunization provided to the child to the Department for inclusion in the Immunization Information System. The information reported must include, without limitation:

(a) The immunization provided to the child;

(b) The name of the child;

(c) Demographic information concerning the child, including, without limitation, the age, gender and race of the child; and

(d) Any other information required by regulation of the State Board of Health, taking into consideration applicable requirements for information relating to the immunization of children of:

(1) The Centers for Disease Control and Prevention of the United States Department of Health and Human Services; and

(2) Any other governmental entity.

3. A person who reports information pursuant to subsection 2 may also report information concerning the history of the immunizations of the child if known to the Department for inclusion in the Immunization Information System.

4. The State Board of Health shall establish the form for reporting information to the Department for inclusion in the Immunization Information System and the form which the person administering the immunization must provide to the parent or guardian of the child receiving the immunization. The form provided to the parent or guardian must inform the parent or guardian about the Immunization Information System and must allow the parent or guardian to decline inclusion of the information concerning his or her child in the System.

5. The information in the Immunization Information System may only be disclosed to any person who administers immunizations to a child to determine the immunization status of the child and to the persons or governmental entities authorized pursuant to the regulations adopted by the State Board of Health.

6. The State Board of Health shall adopt regulations to carry out the provisions of this section.

(Added to NRS by 2007, 1515)