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Final Report: The Rural H1N1 Experience: Lessons for Future Pandemics

WEST VIRGINIA RURAL HEALTH RESEARCH CENTER

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The Rural H1N1 Experience: Lessons Learned for Future Pandemics

Executive Summary

Background: Data have been collected and methods have been developed to estimate national trends in the incidence of the H1N1 influenza pandemic and prevention strategies. However, there has been little study of this pandemic for rural communities, where fewer resources for vaccination and care may exist. Caring for rural people impacted by H1N1 influenza in outpatient and hospital settings can further tax already burdened rural health care organizations. Rural needs relative to prevention of H1N1 disease (and in particular vaccination distribution) may not be considered during decision making about allocation of preventive resources at the state and national level. The results of this study can be used to guide policy recommendations for prevention for rural populations in future pandemics.

Study Aims: This study analyzed the rural experience with novel influenza A (H1N1, commonly known as “swine flu”) during the 2009-2010 flu season. The aims of this study were to:

1) determine the incidence of seasonal and H1N1 vaccination in rural versus urban people;
2) determine the incidence of diagnosed seasonal and H1N1 influenza illness reported by rural people;
3) describe point of service patterns for receipt of H1N1 and seasonal vaccination in rural communities; and
4) analyze the impact of rural concerns in decision making at the state and local health department relative to vaccine distribution.

Methods: This study incorporated survey approaches with analysis of existing secondary data sources to characterize the rural H1N1 experience. For the purpose of this study, the 2009-2010 H1N1 influenza season was defined as beginning August 30, 2009 through May 30, 2010. For aim 4, the Center surveyed each state Office of Rural Health. Online surveys were developed using Survey Monkey™ and email invitations for participation were sent to directors of each state Office of Rural Health. Standard internet survey methods were used, including email reminders sent every two weeks for eight weeks after survey release[13,14]. One additional email invitation was sent from the HRSA State Office of Rural Health Program Director.

Results:

- *Seasonal vaccination rates* are consistently higher than *H1N1 vaccination rates* across the urban-rural continuum.
- *Seasonal* and *H1N1 vaccination rates* are evenly distributed among all respondent categories, with no significant variation between urban, micropolitan, small rural, and remote rural areas.
- There were no significant differences across the urban-rural continuum for diagnosis of *seasonal* or *H1N1 influenza* during an illness

episode with fever and cough or sore throat in this sample.

- Rural respondents were significantly less likely than urban residents to receive their seasonal influenza vaccines at a doctor's office, hospital, pharmacy, or school, and more likely to receive their vaccine at a health department, clinic or health center.
- State Office of Rural Health directors were particularly insightful into the issues and barriers around H1N1 vaccination in their state. State Office of Rural Health directors provided neutral or disagreeing responses to survey questions about whether their state had effectively requested and used information from their organization in planning the state's H1N1 response.

Policy Implications: Rural policy makers can continue to address barriers related to access to and cost of immunizations. Policy makers can use the information from this study to plan the most appropriate sites for rural distribution of vaccines, deploying personnel to handle the need for increased manpower during times of peak vaccination, and for targeting outreach and education efforts in particular vaccination sites in rural areas, such as rural health clinics and federally qualified health centers. Because of the unique knowledge about rural health issues held by staff of the state Offices of Rural Health, a representative from the state Office of Rural Health could be an invaluable resource to serve on planning bodies for future pandemic response strategies to ensure that unique needs of rural residents are met. Further studies should analyze the most accessible places for immunization for rural residents, and can evaluate vaccination and incidence patterns among the highest risk populations in rural settings.

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Introduction

After the primary prevention methods of hand washing and hygiene, influenza vaccination is the most widely recommended public health prevention and protection method for seasonal flu. However, despite long standing public health messages about vaccination, self-reported influenza vaccination coverage rates vary by age group, risk group, and race/ethnicity. [1,2,3] A recent evaluation of immunization rates by the Centers for Disease Control (CDC) found that even those considered high-risk (other chronic disease) in the 18-49 age group reported only a 29.8 percent rate of influenza vaccination in the 12 months prior to the study (1998-2008).[1] Numerous studies have documented that rural residents are less likely to receive preventive services, such as physical exams, cholesterol checks, pap smears, breast exams, and mammograms. [2] A study conducted by the South Carolina Rural Health Research Center noted that while rural and urban residents over the age of 65 had similar annual influenza vaccination rates (67.2 percent vs. 67.7 percent), persons over 65 living in small adjacent rural counties (ie. Urban Influence Codes 4, 6, & 7 including areas with at least 2,500 residents that do not have a dense population and are adjacent to more densely populated areas) had lower influenza vaccination rates (64.9 percent) than residents in any other types of counties. Rural minorities across all rural counties were markedly less likely to have received an influenza vaccination, with African Americans having the lowest overall rate (47.4 percent).[3]

In April 2009, a novel influenza A (H1N1, commonly known as “swine flu”) virus was determined to be the cause of illness in two children in the United States and the cause of outbreaks of respiratory illness in Mexico.[4] The virus was transmitted in communities across North America and was identified in many areas of the world by May 2009.[4] On June 11, 2009, the World Health Organization (WHO) declared a worldwide pandemic.[5] Seasonal influenza vaccines were not likely to provide protection against novel influenza A (H1N1) virus in 2009.[6] Specific vaccines against the H1N1 virus became available in the US by October 2009.[6] The Centers for Disease Control and Prevention (CDC) Advisory Committee on Immunization Practices (ACIP) recommended that certain groups at highest risk for infection or influenza-related complications be the initial targets for vaccination. These recommendations included 1) the identification of five initial target groups for vaccination efforts (pregnant women, persons who live with or provide care for infants aged <6 months, health-care and emergency medical services personnel, children and young adults aged 6 month-24 years, and persons aged 25-64 years who have medical conditions that put them at higher risk for influenza-related complications), and 2) establishment of priority for a subset of persons within the initial target groups in the event that initial vaccine availability was unable to meet demand.[7] While no analyses of rural vs. urban vaccination rates for H1N1 exist for the 2009-2010 influenza season, previous studies [2,3] lead to concern relative to participation in vaccination for H1N1 by rural people.

Data have been collected and methods have been developed by federal organizations like CDC to estimate the impact of H1N1 prevalence and trends nationally. However, there has been little study of this pandemic for rural communities, where fewer resources for vaccination and care may exist. Caring for rural people infected by H1N1 influenza in outpatient and hospital settings can further tax already burdened rural health care organizations. It is important that rural needs relative to prevention of H1N1 disease (and in particular vaccination distribution) be considered during decision making about resource allocation at the state and national level. The results of this study can be used to guide policy considerations for prevention in rural populations in future pandemics.

Study Aims

This study analyzed the rural experience with novel influenza A (H1N1) during the 2009-2010 flu season. The aims of this study were to:

1. determine the incidence of seasonal and H1N1 vaccination in rural versus urban people;
2. determine the incidence of diagnosed seasonal and H1N1 influenza illness reported by rural versus urban people;
3. compare point of service patterns for receipt of H1N1 and seasonal vaccination for rural versus urban residents; and
4. analyze the impact of rural concerns in decision making at the state and local health department relative to vaccine distribution.

Design

This study incorporated survey approaches with analysis of existing secondary data sources to characterize the rural H1N1 experience. The existing data sets used to achieve study Aims 1 through 3 are described below in the data sources section. For the purpose of this study, the 2009-2010 H1N1 influenza **season** was defined as beginning August 30, 2009 through May 2010. *Data for each aim was available for this time period; however, due to differing data collection periods for the two data sets used in this study, each aim may not address the full 2009-2010 H1N1 influenza season.* In addition, two different methods of analyzing rural and urban residence in this study were necessitated by the two different data sets available. As described later, For Aim 1, Urban Influence Codes (UICs) were used, and for Aim 2 and 3, Metropolitan Statistical Areas (MSAs) were used. For Aim 4, the Center surveyed each state Office of Rural Health. Online surveys were developed using Survey Monkey™ and email invitations for participation were sent to directors of each state Office of Rural Health. Standard internet survey methods were used, including email reminders sent every two weeks for eight weeks after survey release.[8,9]

Data Sources

Aim 1: Determine the incidence of H1N1 vaccination in rural versus urban people.

The WV Rural Health Research Center worked collaboratively with the CDC to analyze rural vs. urban variations in vaccination rates for H1N1 using data from the Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is a state-based system of health surveys that collects information on health risk behaviors, preventive health practices, and health care access primarily related to chronic disease and injury. To help track influenza activity during the 2009-2010 influenza season, modules (an optional set of questions that are asked along with the standard set of BRFSS questions) related to influenza-like illness (defined as an illness with reported fever and a cough and/or sore throat for this survey), and seasonal and 2009 H1N1 vaccines were added to the survey. The 2009 H1N1 influenza vaccines modules for adults were accepted by 49 states and the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam. Questions in BRFSS's influenza vaccination module ask participants if they have received the seasonal and 2009 H1N1 vaccines. County code data were collected in the BFRSS system, which allowed ***Urban Influence Code comparisons*** (see Tables 1-2 for UIC definitions)[10]. Kaplan Meier Survival Analysis was used to estimate the proportion of people in the population who were vaccinated. Since members of the population could have been vaccinated after data were collected in the BFRSS survey and still during flu season, estimates of the total percent of the population likely to have been vaccinated were generated using Kaplan Meier analyses. Kaplan Meier Survival Analysis is useful when some subjects may not experience the event of interest (in this case vaccination) before the end of the study. Our Center worked collaboratively with CDC staff for these analyses, with CDC staff conducting the data analysis.

Aim 2: Determine the incidence of reported H1N1 influenza in rural people.
AND
Aim 3: Describe point of service patterns for receipt of seasonal and H1N1 vaccines as reported by people in rural communities.

The National 2009 H1N1 Flu Survey (NHFS) was used to answer aims 2 and 3. In order to monitor and evaluate flu vaccination efforts among adults and children, the CDC conducted the NHFS in 2009-2010. The NHFS was a list-assisted random-digit-dialing telephone survey of both landline and cell telephones. Interviews were conducted by telephone with households in all 50 states and the District of Columbia. A total of 70,944 households participated in the survey administered between October 2009 and April 2010. Interviews were primarily conducted in English, however Spanish and other languages were available depending on subject language preference. In addition to questions about H1N1 and seasonal flu vaccination status of adults and children, the survey also asked about flu-related behaviors, opinions about flu vaccine safety and effectiveness, recent respiratory illness, and pneumococcal vaccination status.

Our Center was notified by CDC that although they did not initially have plans to create a public use data file from the NHFS, the file would be released in fall 2011. The data set was released by CDC after cleaning and code book refinement in August 2012. *While county level and ZIP* *code data were collected in the original data set, these data were not released with the public use file. Alternatively,* ***Metropolitan Statistical Area (MSA) designations*** *were imputed by CDC from the data and released in the public use data file, and these MSA designations were used as a proxy for rural and urban comparisons by our Center.* Of note, in the sample for the NFHS, 28.8 percent were from MSA Principal City designated areas, 45.0 percent of the sample was from MSA Not Principal City designated areas, and 26.2 percent were from Non-MSA designated areas. The Office of Management and Budget defines a Metropolitan Statistical Area (MSA) as:

- one city with a population of 50,000 or more, or
- an urbanized area (as defined by the Bureau of the Census) with a population of at least 50,000 and a total MSA population of at least 100,000 (75,000 in New England).

Each MSA must include the county in which the central city is located and additional contiguous counties (fringe counties), if they are economically and socially integrated with the central county. Any county not included in an MSA is considered non-metro or "rural" .[11]

Aim 4: Analyze the impact of rural concerns in decision making at the state and local health department relative to vaccine distribution.

The Center surveyed the director of each State Office of Rural Health to analyze the impact of rural concerns in decision making at the state and local health department relative to vaccine distribution. Surveys were conducted online, and included questions on the topics of severity of H1N1 in rural areas of their state, responsible parties for decision making relative to vaccine distribution, most common points of rural distribution of H1N1 vaccines, barriers to rural distribution of H1N1 vaccines, and State Office of Rural Health participation in decision making relative to rural vaccine distribution. Because human subjects were involved in this portion of the study, IRB approval was sought and received prior to the survey. As no identifying data were collected in the survey, the study was deemed exempt. Record of this exemption is on file with the WVU/CAMC Institutional Review Board for the Protection of Human Subjects.

Results

Incidence of Seasonal and H1N1 Vaccination

Using 2009 BRFSS data, and in collaboration with CDC, we analyzed the reported incidence of both seasonal flu vaccination and H1N1 vaccination by Urban Influence Code (UIC). Respondents whose county code was missing, or the response was "do not know" or "refused" were excluded from analysis. Final samples included 300,105 respondents for seasonal flu vaccination, and 253,641 respondents for H1N1 flu vaccination. Kaplan Meier Survival Analysis was used to estimate the proportion of people vaccinated. The *seasonal flu vaccination* estimates by UIC are found in **Table 1**. Seasonal flu vaccination coverage estimates are for persons interviewed October 2009 through June 2010 and vaccinated August 2009 through May 2010. Seasonal vaccination rates for respondents range from a low of 35.3 percent in UIC

12, to a high of 42.8 percent in UIC 9. Both of these UICs constitute areas designated “remote rural”. However, there are no significant differences noted between UICs for *seasonal flu vaccination*.

Table 1: 2009-2010 BRFSS Kaplan Meier estimates of *Seasonal flu* vaccination rates by urban influence code (UIC) - adults ages 18+

Urban Influence Code	Number of Respondents (Seasonal)	Seasonal Vaccination %	Seasonal Vaccination 95% CI
UIC 1: Large-in a metro area with at least 1 million residents or more	93606	39.1	(38.3 , 39.9)
UIC 2: Small-in a metro area with fewer than 1 million residents	103841	40.8	(40.2 , 41.4)
UIC 3: Micropolitan area adjacent to a large metro area	5836	38.5	(35.8 , 41.2)
UIC 4: Noncore adjacent to a large metro area	3154	39.8	(35.9 , 43.7)
UIC 5: Micropolitan area adjacent to a small metro area	22076	39.5	(37.9 , 41.1)
UIC 6: Noncore adjacent to a small metro area with town of at least 2,500 residents	16753	39.8	(37.8 , 41.8)
UIC 7: Noncore adjacent to a small metro area and does not contain a town of at least 2,500 residents	6878	36.5	(33.2 , 39.8)
UIC 8: Micropolitan area not adjacent to a metro area	25195	40.8	(39.0 , 42.6)
UIC 9: Noncore adjacent to micro area and contains a town of at least 2,500 residents	6802	42.8	(39.5 , 46.1)
UIC 10: Noncore adjacent to micro area and does not contain a town of at least 2,500 residents	4459	36.7	(32.8 , 40.6)
UIC 11: Noncore not adjacent to a metro/micro area and contains a town of 2,500 or more residents	6995	39.0	(35.9 , 42.1)
UIC 12: Noncore not adjacent to a metro/micro area and does not contain a town of at least 2,500 residents	4510	35.3	(31.6 , 39.0)

H1N1 vaccination estimates by UIC are found in **Table 2**. H1N1 coverage estimates are for persons interviewed November 2009 through June 2010 and vaccinated October 2009 through May 2010. H1N1 vaccination rates for all UICs are lower than those for seasonal flu vaccination responses. H1N1 vaccination rates range from a low of 18.5 percent in UIC 7, to a high of only 23.5 percent in UIC 8. UIC 7 is typically designated "small rural adjacent to a metropolitan area", while UIC 8 is designated "micropolitan". However, there are no significant differences between UICs noted for *H1N1 flu vaccination rates.*

Table 2: 2009-2010 BRFSS Kaplan Meier estimates of *H1N1 flu vaccination* rates by urban influence code (UIC) - adults ages 18+

Urban Influence Code	Number of Respondents (H1N1)	H1N1 Vaccination %	H1N1 Vaccination 95% CI
UIC 1: Large-in a metro area with at least 1 million residents or more	79766	21.7	(21.1 , 22.3)
UIC 2: Small-in a metro area with fewer than 1 million residents	88327	22.1	(21.5 , 22.7)
UIC 3: Micropolitan area adjacent to a large metro area	5084	21.0	(18.5 , 23.5)
UIC 4: Noncore adjacent to a large metro area	2754	21.9	(18.2 , 25.6)
UIC 5: Micropolitan area adjacent to a small metro area	18404	20.2	(18.8 , 21.6)
UIC 6: Noncore adjacent to a small metro area with town of at least 2,500 residents	13522	21.2	(18.7 , 23.7)
UIC 7: Noncore adjacent to a small metro area and does not contain a town of at least 2,500 residents	5896	18.5	(15.2 , 21.8)
UIC 8: Micropolitan area not adjacent to a metro area	20698	23.5	(21.3 , 25.7)
UIC 9: Noncore adjacent to micro area and contains a town of at least 2,500 residents	5632	22.7	(19.2 , 26.2)
UIC 10: Noncore adjacent to micro area and does not contain a town of at least 2,500 residents	3906	19.8	(16.3 , 23.3)
UIC 11: Noncore not adjacent to a metro/micro area and contains a town of 2,500 or more residents	5752	21.8	(18.7 , 24.9)
UIC 12: Noncore not adjacent to a metro/micro area and does not contain a town of at least 2,500 residents	3900	23.1	(18.6 , 27.6)

To further assess whether there were urban and rural differences in reported vaccination rates, both for seasonal flu vaccine as well as for H1N1 vaccination rates, we collapsed UICs into four discrete urban/rural classifications. **Table 3** describes the four classifications and the corresponding UIC.

Table 3: Four Category Urban/Rural Classifications and corresponding UICs[15]

Category	UIC codes
Urban	1,2
Micropolitan rural	3,5,8
Small rural, adjacent to a metropolitan area	4,6,7
Remote rural	9,10,11,12

Tables 4 and 5 report the number and percentages of *seasonal* (**Table 4**) and *H1N1* (**Table 5) ***vaccination* among respondents by the four category urban/rural classification. Again, *seasonal vaccination rates* are consistently higher during the period of study than *H1N1 vaccination rates*. However, it is important to remember that the time period for data collection for seasonal vaccination (August 2009-May 2010) is longer than that for H1N1 vaccination (October 2009-May 2010) as the H1N1 vaccination only became available in October 2009. *Seasonal vaccination rates* are evenly distributed among all respondent categories, with no significant variation between urban, micropolitan, small rural, and remote rural areas.

Table 4: 2009-2010 *Seasonal Flu Vaccination* Kaplan Meier estimates by four category urban/rural classification

	n	**%**	**95% CI**
Urban	197447	39.8	(39.2 , 40.4)
Micropolitan rural	53107	39.7	(38.5 , 40.9)
Small rural adjacent to metropolitan area	26785	39.3	(37.7 , 40.9)
Remote rural	22766	39.5	(37.7 , 41.3)

For *H1N1 vaccination rates*, there is no significant variation by urban and rural category. However, it is important to note that while small rural areas reported the lowest overall percentage of H1N1 vaccination (20.9 percent), remote rural areas reported the highest (22.0 percent).

Table 5: 2009-2010 *H1N1 Flu Vaccination* Kaplan Meier estimates by Four category urban/rural classification

	n	%	95% CI
Urban	168,093	21.9	(21.5 , 22.3)
Micropolitan rural	44,186	21.3	(20.3 , 22.3)
Small rural adjacent to metropolitan area	22,172	20.9	(19.1 , 22.7)
Remote rural	19,190	22.0	(20.0 , 24.0)

Incidence of diagnosed seasonal and H1N1 influenza illness reported by rural versus urban people

To analyze the incidence of reported seasonal and H1N1 influenza illness diagnosed in rural people, our Center used data from the NHFS, available in a public data file. After responding to questions about whether the subject had in the last month had an illness that involved fever, cough or sore throat, a question related to diagnosis of influenza illness was included during NHFS interviews. The question was *"What did the doctor, nurse, or other health professional tell you: Did they say: 1. You had regular influenza or the flu, 2. You had swine flu, also known as H1N1 or novel H1N1, 3. You had some other illness, but not the flu."* Subjects could also respond that they didn't know, or refuse to respond. A small portion of the sample (7.8 percent, n=5505) reported illness with fever and cough or sore throat within the previous month. Of these, 5499 reported being treated for that cough or sore throat within the previous month. Of those who reported illness and were treated, 5404 answered that they were diagnosed with either regular influenza or the flu, or they were diagnosed with swine flu, also known as H1N1 or novel H1N1. 6.9 percent of respondents were diagnosed with seasonal influenza and 4.6 percent were diagnosed with H1N1. Results for this question are summarized in **Table 6** below:

Table 6: Self-reported diagnosis of *Seasonal* and *H1N1 influenza* illness when treated for cough or sore throat in total NHFS sample (n=5404

	Diagnosed with Seasonal influenza when treated for cough or sore throat	*Diagnosed with H1N1 influenza when treated for cough or sore throat*
No	2321 (42.9%)	2451 (45.4%)
Yes	381 (7.0%)	251 (4.6% %)

To analyze potential differences in documented diagnosis of *seasonal and H1N1 influenza* between rural and urban respondents, a Pearson chi square analysis was performed for the three MSA levels of MSA Principal City, MSA Not Principal City, and Non-MSA (proxy for rural in this study). There were no significant differences between MSA level for diagnosis of seasonal or H1N1 influenza during an illness episode with fever and cough or sore throat in this sample. However, the data trend toward rural residents being more likely to be diagnosed with seasonal influenza than their urban counterparts, and less likely than their urban counterparts to be diagnosed with H1N1. Results of these analyses are found in **Table 7 and 8**.

Table 7: Diagnosis of *seasonal influenza* when treated for fever with cough or sore throat by MSA

MSA	**Not diagnosed with seasonal influenza**	**Diagnosed with seasonal influenza**
MSA Principal city	595 (87.2%)	87 (12.8%)
MSA Not principal city	1077 (86.2%)	172 (13.8%)
Non MSA	649 (84.2%)	122 (15.8%)

(x^2 3.019 (2), p=0.221)

Table 8: Diagnosis of *H1N1 influenza* when treated for fever with cough or sore throat by MSA

MSA	**Not diagnosed with H1N1 influenza**	**Diagnosed with H1N1 influenza**
MSA Principal city	610 (89.4%)	72 (10.6%)
MSA Not principal city	1133 (90.7%)	116 (9.3%)
Non MSA	708 (91.8%)	63 (8.2%)

(x^2 2.445 (2), p=0.295)

Point of service patterns for receipt of H1N1 and seasonal vaccination in rural communities

The NHFS interviews asked participants to report the place where they received their most recent seasonal and H1N1 influenza vaccines. Specifically, the question asked: "*At what kind of place did you get your most recent (seasonal or H1N1) flu vaccination?"* Respondents could select from the following choices: *doctor's office, health department, clinic or health center, hospital, other medically related place, pharmacy, workplace, elementary/middle/high school, other non-medically related place, military, supermarket,* or *senior center*. In addition, they could refuse to respond or state that they did not know. Results for each site for the total sample are found in **Table 9** below. Percentages reflect the percent of the sample who reported receiving either the seasonal or H1N1 influenza vaccine at each site. For both *seasonal* and *H1N1 influenza vaccine*, doctors' offices and clinics or health centers are the most commonly reported sites of receipt in the total sample.

Table 9: Place of most recent *seasonal and H1N1 flu vaccine*, total sample

Site	Seasonal Influenza Vaccine	H1N1 Influenza Vaccine
Doctor's office	12182 (37.8%)	4541 (26.6%)
Health department	1287 (4.0%)	1588 (9.3%)
Clinic or health center	4793 (14.9%)	3083 (18.1%)
Hospital	2698 (8.4%)	1590 (9.3%)
Other medically related place	601 (1.9%)	339 (2.0%)
Pharmacy	3891 (12.1%)	1332 (7.8%)
Workplace	3860 (12.0%)	1360 (8.0%)
School	837 (2.6%)	2091 (12.2%)
Other non-medically related place	1928 (6.0%)	1071 (6.3%)
Military Facility	15 (0.1%)	17 (0.1%)
Senior Center	35 (0.11%)	11 (0.1%)
Supermarket	45 (0.14%)	17 (0.1%)
Total	**32232**	**17076**

To analyze rural and urban differences, comparisons of sites for vaccine receipt were undertaken by the three category MSA classification. Results for these analyses are found in **Tables 10** (seasonal) and **11** (H1N1) below.

Table 10: Site of *seasonal influenza vaccine* administration by MSA classification

Site	MSA Principal City (% of category)	MSA Non Principal City (% of category)	Non MSA (% of category)	Chi Square
Doctor's office	3430 (28.1%)	6051(49.7%)	2701(22.2%)	X^2 (2) 161.429 **p<.001**
Health department	217 (16.9%)	424 (33.0%)	646 (50.1%)	X^2 (2) 429.029 **p<.001**
Clinic or health center	1352(28.2%)	1734(36.2%)	1707(35.6%)	X^2 (2) 331.159 **p<.001**
Hospital	852 (31.6%)	1104 (40.9%)	742 (27.4%)	X^2 (2) 27.125 **p<.001**
Other medically related place	169 (28.1%)	268 (44.6%)	164 (27.3%)	X^2 (2) .895 p=.639
Pharmacy	1228 (31.6%)	2000 (51.4%)	663(17.0%)	X^2 (2) 171.518 **p<.001**
Workplace	1178 (30.5%)	1865(48.3%)	817 (21.2%)	X^2 (2) 45.687 **p<.001**
School	211 (25.2%)	322(38.5%)	304 (36.3%)	X^2 (2) 51.820 **p<.001**
Other non-medically related place	570 (29.6%)	881(45.7%)	477(24.7%)	X^2 (2) 1.148 p=.563
Military Facility	3 (20.0%)	10 (66.7%)	2 (13.3%)	X^2 not reported due to low n
Senior Center	9 (25.7%)	12(34.3%)	14(40.0%)	X^2 (2) 3.932 p=.140
Supermarket	11(25.0%)	26 (59.1%)	8(18.1%)	X^2 (2) 2.812 p=.245

Rural respondents were significantly less likely than both other MSA categories to receive their seasonal influenza vaccines at a doctor's office, hospital, pharmacy, or workplace, and more likely than both MSA categories to receive their vaccine at a health department.

Table 11: Site of *H1N1 influenza vaccine* administration by MSA classification

Site	MSA Principal City (percent of category)	MSA Non Principal City (percent of category)	Non MSA (percent of category)	Chi Square
Doctor's office	1379 (30.4%)	2248(49.5%)	914(20.1%)	X^2 (2)107.476 **p<.001**
Health department	323 (20.4%)	612(38.5%)	653(41.1%)	X^2 (2) 221.601 **p<.001**
Clinic or health center	918 (29.8%)	1187 (38.5%)	978(31.7%)	X^2 (2) 88.007, **p<.001**
Hospital	506(31.9%)	673(42.3%)	411(25.8%)	X^2 (2) 7.597 p=.022
Other medically related place	102(30.0%)	152(44.9%)	85(25.1%)	X^2 (2) .203 p=.904
Pharmacy	431 (32.4%)	711 (53.4%)	190(14.2%)	X^2 (2) 101.887 **p<.001**
Workplace	432(31.8%)	629 (46.2)%	299(22.0%)	X^2 (2) 12.504 **p=.002**
School	531(25.4%)	979(46.8%)	581(27.8%)	X^2 (2) 16.195 **p<.001**
Other non-medically related place	314 (29.3%)	475(44.4%)	282(26.3%)	X^2 (2) .291 p=.865
Military Facility	4 (23.5%)	11(64.7%)	2(11.8%)	X^2 not reported due to low n
Senior Center	2(18.2%)	4(36.4%)	5(45.4%)	X^2 not reported due to low n
Supermarket	6(35.3%)	8(47.1%)	3(17.6%)	X^2 (2) not reported due to low n

As with the seasonal influenza vaccine, rural respondents were significantly less likely than both other MSA categories to receive their H1N1 vaccines at a doctor's office, pharmacy, or workplace, and more likely to receive their vaccine at a health department.,

Impact of rural concerns in decision making relative to H1N1 vaccine distribution

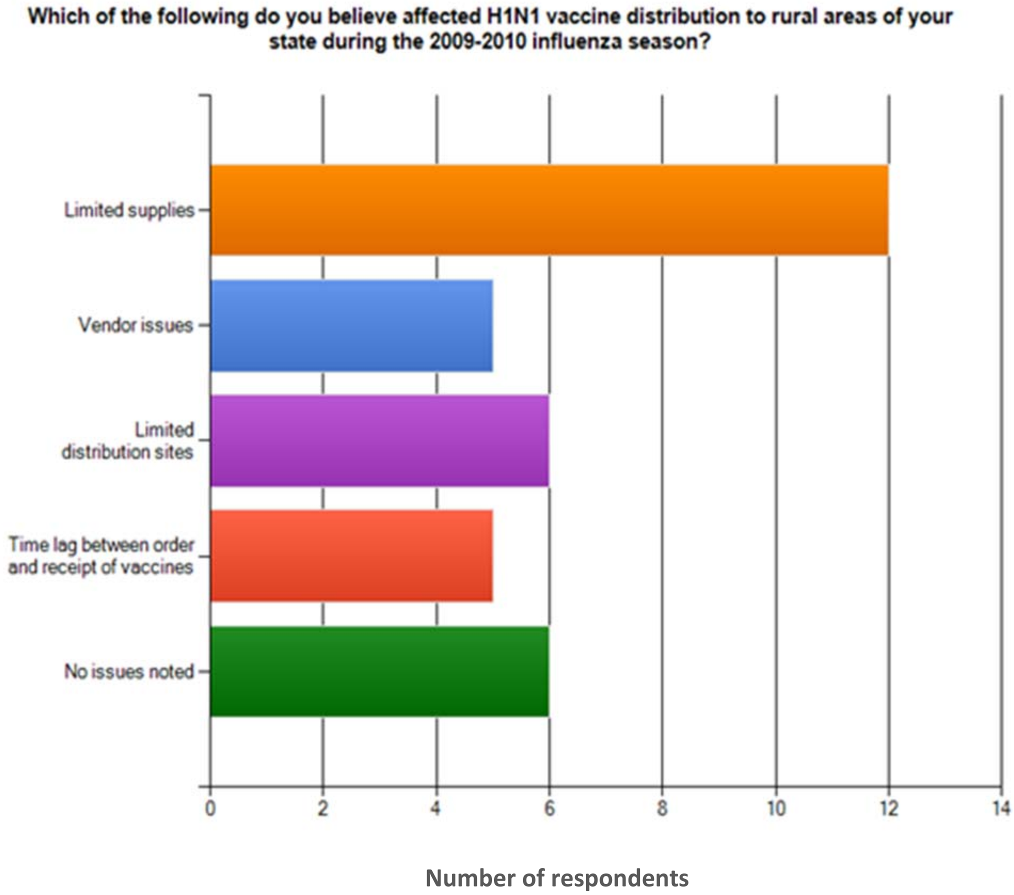
The survey of decision making related to H1N1 vaccine distribution was distributed online through an email invitation to participate sent to all State Office of Rural Health directors. Email reminders were sent every 2 weeks for an 8 week period. One additional email invitation was sent to all directors from HRSA State Office of Rural Health Program Director, indicating HRSA and the Office of Rural Health Policy's support of the study and interest in responses. Completed surveys were received from 25 state sponsored Offices of Rural Health*, out of a possible 34 state sponsored Offices for a response rate of 73.5 percent.[* †]

The first question asked on the survey was about the severity (mild, moderate, high) of H1N1 in the rural areas of respondent states during the 2009-2010 H1N1 season. Fifty two percent of respondents indicated mild severity, while 48 percent indicated moderate severity of H1N1 in the rural areas of their state. Next, respondents were asked to estimate the availability of H1N1 vaccines in rural areas of their state. No respondents reported that vaccines were unavailable. The majority (52.2 percent) of respondents reported vaccines were readily available in the rural areas of their state. However, 47.8 percent reported limited availability of H1N1 vaccines for rural areas. Respondents were asked the reasons for vaccine shortages in rural areas of their state, with the option to report that they knew of no issues. Respondents were able to choose more than one response. A total of 28 reasons were selected by 19 respondents, with 6 respondents indicating that there were no issues of availability of which they were aware. The most highly reported reason for vaccine shortages in rural areas was limited supplies, followed by limited distribution sites. Respondents were only asked to evaluate rural vaccine shortages, and did not report whether these shortages were specific to rural areas or state-wide. The figure below demonstrates the issues identified by respondents (**Figure 1**).

As not-for-profit and University model SORHs are not typically involved in issues of epidemics like H1N1, these SORHs were removed from the request and sample, resulting in a potential 34 SORHs to respond to the survey.

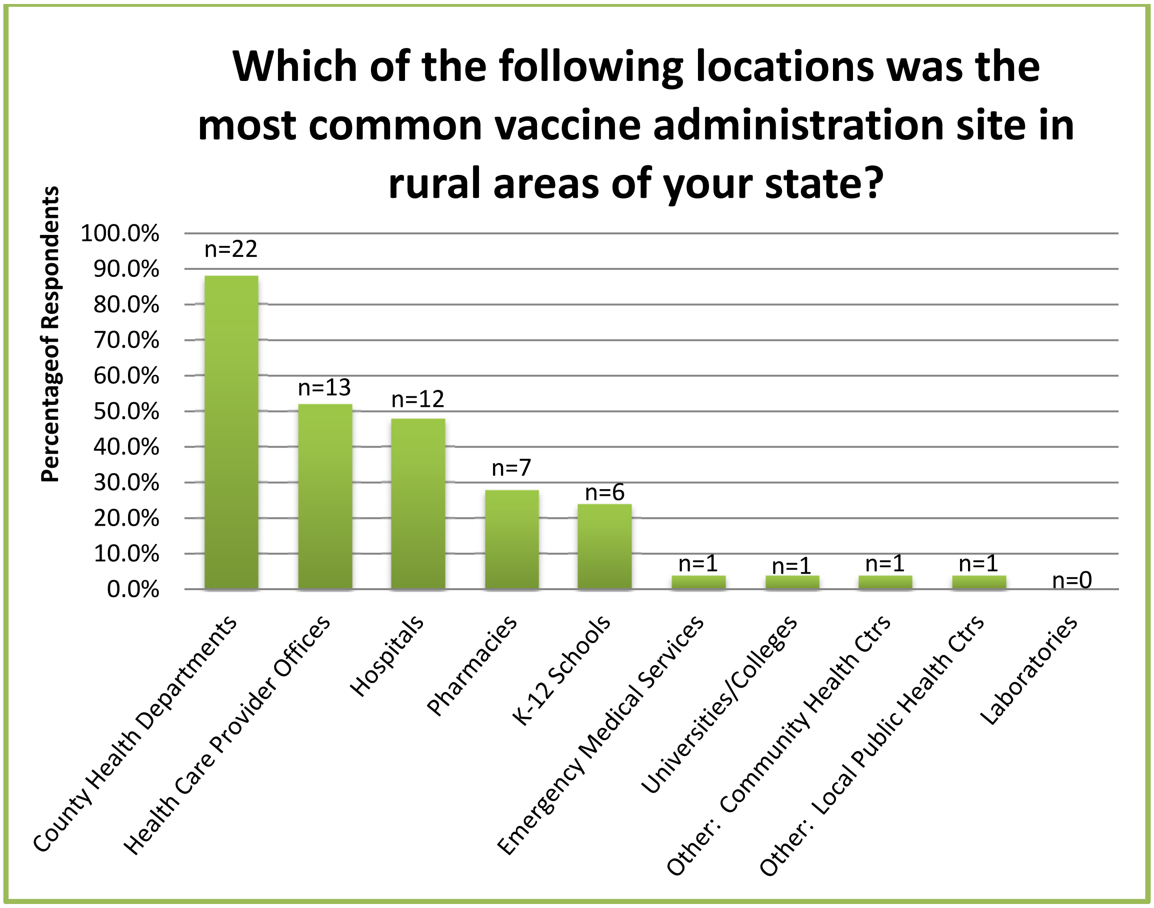
[†] Three Offices responded to the email indicating that they did not have the information to respond to the survey, with one indicating interest in sending the survey to their state public health office that deals with vaccines. Center staff responded to these directors, reiterating that we were specifically interested in the state Office of Rural Health involvement in vaccine decision making, and asked Center Directors to not forward the survey.

Figure 1: Factors affecting H1N1 vaccine distribution during 2009-2010 influenza season



Respondents were asked to report the most common distribution sites for H1N1 vaccine in rural areas of their state. Respondents could select more than one category. County health departments were the most common response, with 88 percent of respondents indicating that this was the most common site for H1N1 vaccination in rural areas of their state. Two respondents selected the "other" category, with one responding that "community health centers" were the most common distribution site, while another indicated "local public health centers" were the most common site in the rural areas of their state. Health care provider offices (52 percent) and hospitals (48 percent) were the next most common rural sites for distribution. Pharmacies (28 percent) and K-12 schools (24 percent) were also utilized frequently as sites for H1N1 vaccine administration in rural areas. Universities and colleges (4 percent), and emergency medical services (4 percent) sites were the least commonly noted rural sites for distribution of H1N1 vaccination. No respondents indicated that laboratories were a common site for H1N1 vaccine distribution in rural areas of their state (**Figure 2**).

Figure 2: Most common H1N1 vaccine administration sites in rural areas of states



The Center asked respondents to tell us which agency in their state was responsible for making decisions about H1N1 vaccine distribution to rural areas of their state. Respondents could select more than one response, indicating shared responsibility. State Health Departments were reported by 87.5 percent of respondents to be responsible for rural distribution decisions. Only 25.0 percent indicated local health department responsibility for decision making relative to rural vaccine distribution. One respondent indicated that the emergency management agency and the state department of health were responsible for decision making.

The survey also analyzed the extent of involvement of State Offices of Rural Health in rural H1N1 issues. **Table 12** details ratings of agreement with questions about responsiveness of state planning agencies to rural needs.

Table 12: State Office of Rural Health participation in H1N1 response

	Strongly Agree %(n)	**Agree % (n)**	**Neutral % (n)**	**Disagree % (n)**	**Strongly Disagree % (n)**
H1N1 information and guidance for rural planning and response provided **TO** my organization by state and local planning agencies was timely and helpful.	28% (7)	36% (9)	32% (8)	4% (1)	0% (0)
Information and planning and response requested **FROM** my organization by state and local planning agencies was used to improve care to rural areas in my state.	8% (2)	40% (10)	48% (12)	0% (0)	4% (1)
State and local planning agencies used my organization's input in making decisions regarding rural H1N1 vaccine distribution.	13% (3)	34.8% (8)	30.4% (7)	13% (3)	8.7% (2)
My organization was kept informed about H1N1 planning and response activities as those activities related to rural areas.	32% (8)	36% (9)	24% (6)	4% (1)	4% (1)
State and local planning agencies were responsive to my organization's question or requests for assistance related to rural H1N1 issues.	24% (6)	28% (7)	48% (12)	0% (0)	0% (0)

When asked about the most pressing unmet need for rural areas in the 2009-2010 influenza and H1N1 season, most respondents indicated that initial and continued delays in vaccine receipt and distribution significantly impacted their state's influenza prevention plan. Many indicated that this was not an issue specific to rural areas, but was a statewide issue. Delays from distributors, and then from the state for further distribution to local entities were commonly noted. One state indicated that "some rural county health departments who were the focal points for distribution were ill-equipped to administer vaccine, being staffed to a lesser degree than their urban counterparts". Problems with surveillance were also identified by one respondent, noting that a lack of participation with influenza surveillance in some rural regions impacted their state's response to H1N1. In considering special populations in rural areas, one respondent indicated that limited school participation with vaccine administration impacted rural areas. Another indicated an unmet concern relative to meeting the vaccine needs of farmers and very small towns. In terms of rural access, one respondent indicated "clinics that were community based, except for school based clinics, were not offered in all areas of the state equitably. Large communities received more opportunities for vaccination clinics". One respondent summed up thoughts about a solution to rural access issues and equitable distribution, stating "it is critical that a representative from the State Office of Rural Health serve on the planning body for H1N1 response strategies to ensure that unique needs of rural residents are met in this regard".

Limitations

This study used existing CDC data from 2009-2010 to examine patterns related to seasonal and H1N1 influenza vaccination in rural and urban areas. The data were self-reported by participants, and may not be representative of the entire population. The data available did not allow us to examine whether urban-rural disparities in vaccination receipt existed in the five critical populations initially identified by the CDC ACIP report. Data in this study are limited to adults only. For Aim 1, CDC analysts performed data analysis to our specifications using UI codes, but as we had no access to original data, we could not perform confirmatory analyses. For Aim 2 and 3, no ZIP code or county identifiers were released with the public use files. Therefore, comparisons of rural and urban vaccine patterns were limited to comparisons between Metropolitan Service Areas (MSA) imputed from original data by CDC. MSA comparisons only allowed three levels of comparison along the rural-urban continuum. Data from Aim 1 (UIC) were not able to be compared with Aim 2 and 3 (MSA) because of different categorizations of the urban-rural continuum due to data availability. Further research could reveal more differences in vaccine patterns among rural classifications if finer place residence data were to be made available for respondents. Finally, the survey portion of the study reported in Aim 4 is limited to the perceptions of the directors and/or their staff of the State Offices of Rural Health. Further analysis of local issues can be undertaken to illuminate additional rural issues related to vaccine distribution in a pandemic.

Discussion and Policy Implications

During a pandemic, rural resources for prevention and care may be stressed. Understanding participation in vaccine efforts, the reported incidence of influenza among citizens in rural and urban areas, and the most likely points of service in rural and urban areas for vaccine receipt can assist rural planners to develop targeted efforts for prevention and care in future pandemics. Utilization of existing agencies with specific knowledge of rural issues can be especially helpful in planning health care services during a pandemic.

Using existing data, we have been able to document relatively low participation in H1N1 vaccination efforts during the 2009-2010 H1N1 pandemic across the rural-urban continuum. H1N1 vaccination rates for all UICs were lower than those for seasonal flu vaccination. H1N1 vaccination rates ranged from 18.5 percent to 23.5percent in respondents to the 2009 BRFSS survey, with seasonal influenza vaccination rates ranging from 36.5 percent to 42.8 percent . The lowest rates of H1N1 influenza vaccination were found in areas designated as “small rural areas adjacent to a metropolitan area”. Immunization barriers may have played a role in lower H1N1 vaccination rates. Typical barriers to vaccination found in the literature include the cost of immunizations, lack of insurance coverage, and access to vaccine services[12]. In this pandemic, directors of State Offices of Rural Health noted that limited supplies and distribution sites contributed to lower H1N1 vaccination rates in their state. Rural policy makers can continue to address barriers related to access to and cost of immunizations, and equitable distribution of vaccines to rural areas.

While vaccination rates were relatively low, the reported incidence of diagnosed seasonal and H1N1 influenza in NHFS respondents were also relatively low, and there were no statistically significant differences in diagnosed rates of influenza across the rural-urban continuum. Of those who were seen by a health care provider for fever and cough or sore throat, reported diagnosis of seasonal influenza ranged from 12.8 to 15.8 percent in NHFS respondents, while H1N1 diagnosis reports ranged from 8.2-10.6 percent. Notably respondents from non MSAs reported the lowest rates of H1N1 influenza diagnosis and the highest rate of seasonal flu diagnosis During a pandemic with a new influenza virus, these lower rates of diagnosis in rural populations might be attributed to decreased opportunities for exposure due to low population densities and isolation. A recent historical study of the 1918 Spanish flu pandemic suggests that rural populations may also be protected from certain infectious diseases because older populations who typically reside in rural areas have increased immunity built up over their lifetime. [13] Our study only looked at the adult population, however no age analyses were possible to confirm if there were age differentials in H1N1 diagnosis. Lower diagnosis rates could also be attributed to limited access to health care professionals in rural areas to make the diagnosis of H1N1, or lower awareness of rural providers and the population of the unique symptoms of H1N1. These factors could contribute to lower reporting of symptoms and under-diagnosis H1N1 in rural areas. In future pandemics, rural policy makers may consider ways to maintain the physical isolation of rural dwellers for protective and preventive purposes, such as increased use of technology as opposed to face to face methods for teaching, working, and communicating during an outbreak. For instance, during the 2009-2010 pandemic, one health sciences program used technology for periodic clinical conferences as opposed to bringing students into the health sciences center from rural clinical sites, decreasing the chance of spreading influenza through close contact.[14] Other preventive solutions include the development of hand-washing stations in public gathering places in rural areas, development of social distancing policies related to closures of rural public institutions during flu outbreaks, and enforcement of absence policies that encourage those with flu like illnesses to stay home from schools and workplaces in rural areas[15].

Rural populations were significantly less likely to have received vaccines at doctor’s offices, hospitals, pharmacies, and workplaces than their more urban counterparts. They were more likely to have received their vaccines at the health department. State Office of Rural Health directors also reported similar observations, noting that the most common sites for distribution of vaccine in rural areas of their state were county health departments and health care provider offices. Policy makers can use this information to plan the most appropriate sites for rural distribution of vaccine, deploying personnel to handle the need for increased staffing during times of peak vaccination, and for targeting outreach and education efforts in particular vaccination sites in rural areas, such as rural Health Centers.

State Office of Rural Health directors were particularly insightful into the issues and barriers around H1N1 vaccination in their state. Of note, more than half provided neutral or disagreeing responses to statements about their perceptions of the request for and use of information from their organization in planning their state’s H1N1 response. Because of the unique knowledge about rural health issues held by staff of the state Offices of Rural Health, a representative from the State Office of Rural Health could be an invaluable resource for issues of allocation of preventive resources and to serve on planning bodies for future pandemic response strategies to ensure that unique needs of rural residents are met.

Conclusion

There has been little study of the impact of the H1N1 pandemic for rural communities.. Caring for rural people impacted by a pandemic in outpatient and hospital settings can further tax already burdened rural health care organizations. Rural needs relative to prevention of infectious disease (and in particular vaccination distribution) may not be considered during decision making at the state level. The results of this study can be used to guide policy recommendations for prevention and treatment of rural populations in future pandemics.

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