

# Pandemic Influenza Planning in Nursing Homes: Are We Prepared?

Lona Mody, MD, MSc,<sup>\*†</sup> and Sandro Cinti, MD<sup>‡§</sup>

Avian influenza or Influenza A (H5N1) is caused by a viral strain that occurs naturally in wild birds, but to which humans are immunologically naïve. If an influenza pandemic occurs, it is expected to have dire consequences, including millions of deaths, social disruption, and enormous economic consequences. The Department of Health and Human Resources plan, released in November 2005, clearly affirms the threat of a pandemic. Anticipating a disruption in many factions of society, every segment of the healthcare industry, including nursing homes, will be affected and will need to be self-sufficient. Disruption of vaccine distribution during the seasonal influenza vaccine shortage during the 2004/05 influenza season is but one example of erratic emergency planning. Nursing homes will have to make vital decisions and provide care to older adults who will not be on the initial priority list for vaccine. At the same time, nursing homes will face an anticipated shortage of antiviral medications and be expected to provide surge capacity for overwhelmed hospitals. This article provides an overview of current recommendations for pandemic preparedness and the potential effect of a pandemic on the nursing home industry. It highlights the need for collaborative planning and dialogue between nursing homes and various stakeholders already heavily invested in pandemic preparedness. *J Am Geriatr Soc* 55:1431–1437, 2007.

**Key words:** pandemic preparedness; nursing homes; avian influenza

## EPIDEMIOLOGY AND CONSEQUENCES OF AVIAN INFLUENZA

Influenza is a communicable respiratory illness caused by a group of viruses: influenza types A, B, and C.<sup>1,2</sup> Most seasonal influenza outbreaks are due to types A and B; type C rarely infects humans. An influenza pandemic occurs when a new influenza virus subtype appears against which no one

has developed any immunity and for which no disease-specific vaccine initially exists. Only influenza A can cause pandemics. Influenza can be transmitted directly by large-droplet spread (e.g., when infected people cough or sneeze and their droplets come in contact with an uninfected person) or indirectly by contact spread (when uninfected people touch hands, surfaces, or objects contaminated with influenza virus) or airborne transmission (small-droplet nuclei 1–5 µm that remain suspended in air for long periods with a potential for infecting a large number of susceptible people).

Influenza A virus, occurring naturally in wild birds, causes the avian influenza (H5N1), more commonly known as “bird flu.” The current strain of H5N1 has several characteristics required for a pandemic; it can infect humans, the entire population is immunologically naïve (susceptible) to this virus, and it is deadly. The only missing characteristic is the lack of a sustained human-to-human transmission, although transient human-to-human transmission has been reported.<sup>3</sup> Direct sustained contact with infected birds is a requisite for avian influenza infection, although for efficient human-to-human transmission to occur, only a single genetic mutation is required.<sup>2</sup> Wild birds, which carry the virus asymptotically, have been spreading H5N1 to domestic birds (ducks and chickens) throughout Asia, Europe, and Africa. Domestic birds are highly susceptible to this virus, and mortality rates in these flocks can reach 100%.<sup>3–5</sup>

Descriptions of widespread and serious epidemics of respiratory diseases suggestive of influenza can be traced back for 300 years.<sup>6–8</sup> Based on historical reports, there have been 10 probable and three suspected influenza pandemics since 1590. There were four pandemics in the twentieth century, at 9- to 39-year intervals. Spanish influenza (H1N1) in 1918/19 was the most devastating pandemic, resulting in 25 million to 50 million deaths worldwide.<sup>9</sup> Other less-catastrophic pandemics occurred in 1957 (Asian influenza, H2N2), 1968 (Hong Kong influenza, H3N2), and 1977 (Russian influenza, H1N1).<sup>10,11</sup> These influenza pandemics caused millions of deaths and social disruption and had enormous economic consequences worldwide. Although experts agree that another pandemic is likely to occur, it is unclear when or how severe it will be. Furthermore, it is difficult to predict what age groups will be most affected.<sup>12–14</sup> Improved nutrition and health care, greater international travel, other simultaneous health threats, and level of preparedness will all influence the eventual morbidity and mortality from such a pandemic.

From the Divisions of <sup>\*</sup>Geriatric Medicine and <sup>†</sup>Infectious Disease, Department of Internal Medicine, University of Michigan Medical School, Ann Arbor, Michigan; and <sup>‡</sup>Geriatric Research, Education and Clinical Center and <sup>§</sup>Infectious Diseases Section, Veteran Affairs Ann Arbor Healthcare System, Ann Arbor, Michigan.

Address correspondence to Lona Mody, MD, MSc, 11-G GRECC, VA Ann Arbor Healthcare System, 2215 Fuller Rd, Ann Arbor, MI 48105.  
E-mail: lonamody@umich.edu

DOI: 10.1111/j.1532-5415.2007.01299.x

**Table 1. Pandemic Influenza Versus Seasonal Influenza Outbreak**

Seasonal Influenza	Pandemic Influenza
Typically occurs November–March	Seasonality unpredictable
Usually there is a known circulating strain	Caused by a new strain of Influenza A
Annual vaccines are available	May take 4–5 months after a pandemic strain is identified to develop an effective vaccine
Infects 10–20% of population	May infect 30–50% of population
Affects mainly very young and very old	May infect any age group
Does not usually affect other essential services; therefore does not disrupt a community's ability to provide essential services	Has potential to disrupt a community's ability to provide essential services

Are we, as a society, prepared to effectively handle another influenza pandemic? The Department of Health and Human Services (HHS) plan, released in November 2005, is clear about the threat of a pandemic. According to HHS, when a pandemic strain emerges, 25% to 35% (approximately 75–105 million) of the U.S. population would develop the disease, and a significant number (from 209,000 to 1,903,000) could die.<sup>15</sup> Current response to pandemic influenza relies on a decentralized approach, with individual states and countries mounting their own responses. Their responses must take into account the likely absence of an effective vaccine, an expected shortage and rationing of antiviral medications, a healthcare system that has not been designed to accommodate even a modest pandemic, and most worrisome, erratic planning in some regions.

Current influenza pandemic response plans do not include nursing home residents in their priority group for vaccine distribution.<sup>15–17</sup> Whether nursing home administrators are aware of the need to ration if faced with a pandemic and ensuing scarcity of vaccine, or have made contingency plans to sequester their patients in the event of an outbreak, is unknown. In fact, the extent of influenza pandemic preparedness in nursing homes is unknown, and research in this area is notably absent.

#### WHY THE HEALTHCARE INDUSTRY SHOULD BE PREPARED

An influenza pandemic differs from seasonal influenza epidemics in ways that directly influence the healthcare system's emergency preparedness (Table 1).<sup>18</sup> During a pandemic, there will be more sick patients to take care of and fewer healthcare and essential service workers to provide that care.

An influenza pandemic will likely occur simultaneously across every community in the nation and place a huge burden on the U.S. healthcare system. Published estimates based on extrapolations from the 1957 and 1968 pandemics suggest that there could be 865,000 hospitalizations, 45 million outpatient visits, 45 million additional illnesses, and 209,000 deaths. Estimates based on the 1918 pandemic are grimmer: 9.9 million hospital admissions and 1.9 million deaths globally in a short time span.<sup>19</sup> In addition to morbidity and mortality, pandemics can have enormous social and economic consequences.

Prepandemic planning by healthcare facilities is therefore critical to provide quality, uninterrupted care to the ill and to prevent further spread of the influenza virus. According to the HHS pandemic preparedness plan, the

participation of the entire healthcare industry, including federal, state, and local health departments, community stakeholders, acute care hospitals, nursing homes, and outpatient clinics, is crucial to pandemic readiness.<sup>6</sup> It would be reasonable to assume that a pandemic could disrupt all factions of society, requiring every level of the healthcare system to be self-sufficient. Developing a response plan to deal effectively with all phases of a pandemic ensures that measures are put into place before an emergency occurs. This will help contain the disease and reduce its transmission, decreasing the number of cases, reducing hospitalizations and mortality, maintaining essential services, minimizing the economic and social effects, and helping keep healthcare costs contained.

A pandemic response plan for healthcare facilities, including nursing homes, can be used as a road map for future emergencies, such as infection outbreaks, seasonal influenza vaccine shortages, and other natural disasters. Formal and informal professional ties established as a result of such planning can help healthcare facilities handle various natural and man-made disasters. Critical elements and considerations of a pandemic influenza response plan (put forward by the HHS) for healthcare facilities, including nursing homes, are described below.

#### PANDEMIC INFLUENZA RESPONSE PLAN: ASSUMPTIONS AND CONSIDERATIONS

To aid the pandemic response planning process and to make it consistent, the World Health Organization has defined distinct phases of a pandemic (Table 2), all of which require specific planning.<sup>20</sup> Currently, in the United States, per the Centers for Disease Control and Prevention (CDC) Website, we are in Phase 3 of the Pandemic Alert Period.<sup>21</sup> HHS has made several assumptions related to the epidemiology of influenza and its effect on the overall delivery of health care.<sup>6–8,18,19</sup> Recommendations for a pandemic influenza response plan are based on these assumptions.

##### Planning Assumptions

##### *Assumptions Related to the Epidemiology of Pandemic Influenza*

The pandemic will affect all phases of the healthcare industry and the community because of the universal susceptibility to the influenza subtype. The typical incubation period for pandemic influenza virus will be approximately 2 days; on average, two secondary infections will occur as a result of disease transmission. The attack rate in the United

**Table 2. WHO Pandemic Periods and Phases**

Period	Phase	Description
Interpandemic period	1	No new influenza virus subtypes have been identified in humans. An influenza virus subtype that has caused human infection may be present in animals. If present in animals, the risk of human infection is considered to be low
	2	No new influenza virus subtypes have been identified in humans, although a circulating animal influenza virus subtype poses a substantial risk of human disease
Pandemic alert period	3	Human infections with a new subtype, but no human-to-human spread or at most rare incidence of spread to a close human contact
	4	Small clusters with limited human-to-human transmission, but spread is highly localized, suggesting that the virus is not well-adapted to humans
	5	Larger cluster(s), but human-to-human spread still localized, suggesting that the virus is becoming increasingly better adapted to humans, but may not yet be fully transmissible
Pandemic period	6	Increased and sustained transmission in general human population
Postpandemic period		Return to interpandemic period

Source: World Health Organization, [www.who.int/csr/disease/influenza/inforesources/en](http://www.who.int/csr/disease/influenza/inforesources/en)

States may approach 40% (approximately 90 million people). Those at greatest risk will include infants, older people, and those with chronic conditions.

***Assumptions Related to the Effect of a Pandemic on the Delivery of Health Care***

Of those who become ill, 50% will seek outpatient medical care (45 million people in the United States). The number of hospitalizations will depend on the virulence of the virus. Hospitals and other local public health units will operate at a diminished capacity. The number of healthcare workers (HCWs) will be reduced by one-third or more because of concerns about infection transmission at a facility, personal illness, and family and care-giving responsibilities. Usual sources of essential supplies (medical and nonmedical) may be disrupted or unavailable. To meet community needs, resources, including staff, supplies, and equipment, may need to be reassigned or shifted to accommodate an overflow of patients from local hospitals; nursing home residents may need to be moved.

***Assumptions Underlying Preparedness Planning During a Pandemic***

It will take at least 4 to 5 months (after the pandemic strain is identified) for an effective vaccine to be available; when it does become available, it may reduce the effect of outbreak, although it is expected that vaccines will initially be in short supply and high demand. This may lead to rationing and chaotic, inequitable distribution. The United States will not have enough antiviral medications, and the CDC will have to prioritize the distribution of these drugs. Priority groups may change based on the epidemiology of the viral strain.

**Unique Assumptions and Challenges Facing Nursing Homes for Pandemic Preparedness**

It is assumed that preparedness plans developed by healthcare facilities, including nursing homes, will be coordinated with plans of other organizations in their communities and local or regional pandemic plans and be consistent with the respective state plan, although currently it appears that nursing homes are not actively involved in planning at a regional level.

Nursing home residents will not be in a high-priority group for receiving influenza vaccine.<sup>7</sup> The only specific drug treatment option for influenza during a pandemic will be antiviral medications, which must be started within 48 hours of the onset of symptoms. These antivirals will also be in short supply, and distribution may be chaotic.

Nursing homes may become sites for acute management of pandemic influenza patients if the hospitals are overwhelmed. Nursing homes will face the pressure to accept pandemic influenza patients for postacute care requiring immediate implementation of infection control practices, such as creating an isolation ward, to cohort residents and staff. Traditional infection control prevention and control practices will need to be in place, such as hand hygiene, appropriate personal protective equipment, and ability to cohort sick individuals. In addition, social activities such as dining and other recreational events and rehabilitation will have to be curtailed. Care protocols will need to be updated frequently. Plans to emergently transfer residents with their medical records to their homes (if well), another nursing home, or hospital (if sick) will need to be in place. Although not unique to nursing homes, they will need to be prepared to restrict visits by concerned family and friends, and staff will need to communicate with residents' families and friends, as well as the media.

Special considerations for HCWs must be taken into account in the planning stages. HCWs are at a similar risk of acquiring influenza as the general population. They have a duty to provide care to their patients; at the same time, society has an obligation to support HCWs, who will bear the greatest risk in fulfilling their care responsibilities. One of several ethical dilemmas that nursing homes face is determining whether vaccine should be distributed to save the "most number of lives" or the "most years of life."<sup>20</sup> Should policy makers give priority to individuals who are more likely to die if infected (e.g., an 89-year-old nursing home resident) or to individuals who are less likely to die if infected but stand to lose more if they did (e.g., a 41-year-old HCW with two children)? The HHS pandemic preparedness plan currently advocates saving "most years of life" by prioritizing immunization to HCWs.<sup>6</sup> Nursing homes, like other healthcare employers, are expected to maintain healthy work environments. Whether they have appropriate guidance to streamline their immunization

**Table 3. Elements of Pandemic Preparedness Plan: Focus on Nursing Homes**

<b>Surveillance</b>
<b>Interpandemic and pandemic alert periods</b>
Surveillance for suspected cases of novel strains of influenza
Ensure that procedures in place to facilitate laboratory surveillance
Ensure mechanism for reporting of unusual influenza isolates
<b>Pandemic period</b>
Conduct surveillance to detect increase in influenza-like illness
Monitor employee absenteeism
Track transfers to and from the facility
Update information on data to be reported to health departments
<b>Outbreak control, clinical evaluation, and admission procedures</b>
Identify, triage, diagnose, and isolate possible pandemic influenza patients
Develop protocol to limit access to the facility if pandemic detected in the community
<b>Communication plan</b>
Collaborate with public health officials, other government officials, neighboring healthcare facilities, the lay public, and the media to ensure rapid and ongoing information sharing during an influenza pandemic
Keep the facility personnel, patients, and visitors informed of the ongoing preparedness planning and the effect of the pandemic
<b>Education and training</b>
Develop a detailed educational plan for staff, patients, family members, and visitors
Develop educational material in different languages and directed at different educational levels and incorporate materials developed by HSS and state and local health departments
<b>Occupational health</b>
Plan for adequate staffing
Provide protection for healthcare workers from pandemic exposure
Evaluate and manage sick personnel
Prioritize distribution of vaccine and antiviral medications to healthcare workers
Provide psychosocial support
<b>Use and administration of vaccines and antiviral medications</b>
Frontline healthcare workers and key health decision-makers and emergency service providers are in the high-priority groups (nursing home residents are currently not considered high-priority older adults)
Monitor information and recommendations from the HHS on the development, distribution, and use of pandemic influenza vaccine
Work with local and state health departments on plans for distributing pandemic influenza vaccine
Implement updated protocols for the use of antiviral medications in the population, taking into account the potential for a shortage
<b>Evaluation of surge capacity</b>
Plan for emergency staffing needs and cohorting residents and develop checklists of emergency medical and durable supplies
Work with local hospitals to develop mutual aid agreements or memoranda of understanding to accept non-influenza patients who do not need critical care

Adapted from Department of Health and Human Services (HHS) Pandemic Preparedness Plan, [www.hhs.gov/pandemicflu/plan](http://www.hhs.gov/pandemicflu/plan)

programs during healthcare emergencies, be it seasonal influenza vaccine shortage or pandemic influenza response planning, needs to be examined further.

## ELEMENTS OF A PANDEMIC INFLUENZA RESPONSE PLAN

This section provides an overview of specific planning activities during various stages of a pandemic.

During interpandemic and pandemic alert periods, all healthcare facilities are responsible for:

- Developing response plans and decision-making structures, including chain of command
- Developing written plans that address disease surveillance, facility access, occupational health, distribution of vaccines and antiviral drugs, supply chain, access to critical inventory needs, and mortuary issues
- Participating in response exercises and drills, and incorporating lessons learned into response plans.<sup>6–8,18,19,22</sup>

During a pandemic alert period, if an influenza pandemic begins in another country, healthcare facilities are responsible for heightened institutional surveillance for influenza and preparing to activate institutional pandemic influenza plans, as necessary.

During a pandemic alert period, if an influenza epidemic begins or enters the United States, healthcare facilities are responsible for:

- Activation of institutional pandemic plans
- Identification and isolation of all patients with pandemic influenza
- Implementation of infection control practices to prevent influenza transmission

- Establishment of rapid and frequent communication within healthcare facilities and between healthcare facilities and healthcare departments
- Implementation of surge capacity plans to sustain healthcare delivery.<sup>6–8,18,19,22</sup>

To adequately respond during various alert periods, the HHS recommends that a healthcare facility's pandemic response plan include an internal multidisciplinary planning committee.<sup>15</sup> The committee should include technical experts, leadership personnel with decision-making authority, and representatives from a wide range of response partners. A response coordinator should directly command the facility's response. Various elements of pandemic response plan pertaining to nursing homes are briefly described in Table 3.<sup>15</sup> An in-depth review and guidance for the entire plan is available at [www.hhs.gov/pandemicflu/plan](http://www.hhs.gov/pandemicflu/plan).

### PANDEMIC PREPAREDNESS RESEARCH

Several opinion papers and review articles have been published recently on the political, social, economic, and health implications of a pandemic.<sup>5,10,13,23–34</sup> Empirical studies have been limited and have focused on airline travel,<sup>35,36</sup> emergency planning at an international level,<sup>37–39</sup> epidemic forecasting,<sup>40</sup> computer modeling to address an outbreak,<sup>41</sup> and public health lessons learned from Severe Acute Respiratory Syndrome,<sup>42,43</sup> although a significant void exists in research on pandemic preparedness in healthcare sectors.

A survey by the European Commission and the European Center for Disease Prevention and Control showed significant progress in development of a pandemic preparedness plan, with 46 of the 52 countries and reporting that they had a plan or a final draft by October 2005.<sup>38</sup> No studies evaluating pandemic preparedness plans within the United States exist, but there has been one in-depth qualitative study that evaluates 12 U.S. communities and their overall emergency response systems.<sup>44</sup> That study noted that, with flexible federal funding, communities have strengthened their ability to respond to public health emergencies.

As pandemic preparedness becomes reality, policy makers are identifying various key challenges. For example, in one meeting report, the following issues were brought to the forefront.<sup>30</sup> There is a lack of clear definition of hospital "preparedness." The HHS has formulated and disseminated a comprehensive checklist of pandemic preparedness tasks, but there is a lack of guidance in terms of priorities or metrics of implementation of the specific elements of the plan. Current regional-level planning does not bring nursing homes to the table. In a severe pandemic, traditional hospital care (as well as care provided in the community and nursing homes) will need to be altered significantly, and elective services would have to be deferred and acute services rationed. Although many experts recognize the need to ration care in these circumstances, no nationally recognized scientific, ethical, or legal framework exists for accomplishing this.

### ARE NURSING HOMES PREPARED?

Approximately 1.5 million people in the United States reside in more than 16,000 nursing homes.<sup>45</sup> A significant

proportion of these people have cognitive and functional impairments. Unlike other healthcare institutions, these facilities care for a highly vulnerable population at high risk of adverse outcomes from any emergency or disaster (e.g., hurricane Katrina). The objective of pandemic response planning in nursing homes is to enable them to recognize and manage a pandemic. Advanced planning may eventually help to reduce transmission of the pandemic virus, decrease the number of affected residents, reduce hospitalizations and deaths, maintain essential services, and reduce the socioeconomic effect of the pandemic. It is unrealistic for any facility to operate with the belief that it can adequately prepare and implement a comprehensive pandemic response plan in a matter of weeks.

The overarching questions are: What are the challenges that nursing homes face in planning for pandemic influenza? Are nursing homes capable of obtaining rapid testing for influenza when a majority of nursing homes contract with laboratories that are off-site? Will nursing homes be able to adjust case-definitions for pandemic influenza rapidly to screen their residents? Do they have protocols in place to screen their new admissions? Are nursing homes prepared to prevent or minimize their resident morbidity and mortality, to limit internal social disruption, and reduce the economic consequences caused by an influenza pandemic? Are these facilities able to establish effective collaborations with other community and state stakeholders? Thus far, there has been no published report or research focusing on the extent of, challenges to, barriers to, and opportunities for pandemic preparedness in nursing homes.<sup>46,47</sup>

A few articles have evaluated the effect of seasonal influenza vaccine scarcity during the 2004/05 influenza season and the adverse effect of ensuing vaccine rationing on immunization programs.<sup>47</sup> Nursing homes initially sought help from a variety of likely sources, such as local health departments, hospitals, and physician practices, and then moved on to unlikely sources, such as local prisons, schools and transportation authorities. A quarter of the facilities reported that they obtained vaccine from two or more sources. These results indicate the turmoil and uncertainty during the 2004/05 influenza vaccine shortage leading to an adverse effect on the facilities' immunization program.

To explain the decision-making process during an emergency, a qualitative study examined how medical and public health decision-makers navigated through the 2004/05 influenza vaccine shortage.<sup>46</sup> Although decision-makers initially relied on the scientific literature, professional judgment of experts, and patient information to make informed decisions, in a crisis, resources still needed to be allocated by relying on professional judgment. During their interviews, the investigators realized that clinical knowledge and perspectives, although crucial for making informed decisions, were not sufficient alone because of the social values at stake when protecting human lives.

Procedural rigor and transparency may reduce inequities in vaccine and antiviral medicine distribution during a shortage. An organizational framework of shared decision-making and collaboration with various stakeholders would assist in decision-making. Gaps in knowledge, pressure from the public sector, and logistic delays during the shortage suggest that the burden of responsibility and

**Table 4. Components of Pandemic Plan in Five Michigan Nursing Homes**

Pandemic Preparedness Planning	Number of Yes/Total
Incorporation of pandemic influenza planning into disaster planning	1/5
Creation of a multidisciplinary team to address pandemic preparedness	0/5
Point person assigned as a pandemic coordinator	1/5
Contact established with local and state health departments	1/5
Local, regional, or state emergency preparedness points of contact identified	1/5
Area hospitals' points of contact identified	0/5
Relevant Department of Health and Human Services Pandemic Plan copies obtained	3/5
Surveillance plan to detect pandemic influenza in residents, and staff in place	0/5
Facility communication plan developed	1/5
Education and training plan for all personnel, residents, and family members developed	2/5
Infection control plan to manage residents with pandemic influenza developed	4/5
Plan for cohorting the affected residents in place (in event of a pandemic)	3/5
Occupational health plan for addressing staff absences developed	2/5
Vaccine and antiviral use plan developed	2/5
Surge capacity concerns addressed	0/5

decision-making would fall at the local level (i.e., on local health agencies, hospitals, and nursing homes). As such, local acute care hospitals, nursing homes, and public health institutions would benefit from creating collaborations during pre-pandemic periods that would clarify the administrative structure and decision-making for coordinated, equitable vaccine and antiviral medication acquisition and distribution. Facilities without these connections and collaborations would be left on their own to handle the shortage.

Both of these studies evaluating the adverse outcomes of the 2004/05 influenza vaccine scarcity highlighted the practical and ethical challenges of rationing life-saving resources. The ensuing chaos led to reduced vaccinations in the CDC-defined high-priority groups, including nursing home residents and their HCWs. Although vaccine and antiviral medication allocation during a seasonal influenza season and a pandemic will differ, nursing homes are susceptible to disarray and suboptimal healthcare delivery, eventually leading to poor health outcomes.

#### PILOT SURVEY OF FIVE SOUTHEASTERN MICHIGAN NURSING HOMES

A pilot survey was conducted to evaluate the status of pandemic preparedness in five local nursing homes. Only one government-owned facility had a well-developed pandemic preparedness plan. Three nonprofit facilities had just started their planning process, and one for-profit facility had not begun planning (Table 4). All four facilities with some pandemic planning had a complete or in-progress infection control plan to manage residents with pandemic influenza. This finding reflected the involvement of a pre-established infection-control committee in the planning process. Alternatively, only one facility had established contact with a state health department, and none had established any communication with other emergency preparedness point people, reflecting a lack of collaborative relationships between nursing homes and other stakeholders such as local hospitals and community planners.

The pilot data of five local nursing homes suggest that, although they are aware of the need to initiate a pandemic response, their planning is only in the early stages.

Further research in a diverse group of nationally representative nursing homes is required to examine the level of pandemic preparedness in these facilities and their involvement in overall pandemic influenza planning as an integral part of the community. This research should then be applied to public policy in prioritizing resources and suggesting sequential guidelines to increase level of preparedness in nursing homes.

#### CONCLUSIONS

In conclusion, pandemic influenza outbreaks have the potential to cause millions of deaths, lead to social disruption, and create enormous economic consequences worldwide. Although experts agree that another pandemic is likely to occur, it is unclear when or what its epidemiology will be, in terms of the likely target age groups, or what the virulence will be. Nevertheless, pandemic preparedness is critical to reduce the adverse effect of this potentially devastating outbreak. Nursing homes, serving the frailest, most-vulnerable populations, will have to make vital decisions and provide care to older adults who will not be on the initial priority list for vaccine. At the same time, nursing homes will face an anticipated shortage of antiviral medications and be expected to provide surge capacity for overwhelmed hospitals. Further research is crucial to assess pandemic preparedness in nursing homes.

Dialogue between healthcare personnel providing care to seniors (including nursing homes, short-term rehabilitation facilities, and assisted living facilities) and local, state, and national pandemic preparedness planners is critical to providing the best possible care to older adults during a pandemic. Collaborative planning between acute care hospitals and nursing homes is urgently needed to adequately prepare for a pandemic. A pandemic response plan for nursing homes can then be used as a road map for future

emergencies, such as infection outbreaks, seasonal influenza vaccine shortages, and other natural disasters.

## ACKNOWLEDGMENTS

The authors wish to thank Drs. Carol A. Kauffman and Suzanne F. Bradley for their critical and thoughtful review of this manuscript.

**Financial Disclosure:** Funding was received from National Institute on Aging Grant K23 AG028943 and an Association of Specialty Professors/American Geriatrics Society T. Franklin Williams Research Scholarship.

**Author Contributions:** Mody and Cinti: Background research, manuscript preparation.

**Sponsor's Role:** The funding sources had no role in the manuscript preparation, or decision to publish this study.

## REFERENCES

- Cox NJ, Subbarao K. Influenza. *Lancet* 1999;354:1277–1282.
- Webster RG, Bean WJ, Gorman OT et al. Evolution and ecology of influenza A viruses. *Microbiol Rev* 1992;56:152–179.
- American College of Physicians. The Health Care Response to Pandemic Influenza. Philadelphia, American College of Physicians, Position Paper, 2006.
- Webster RG, Peiris M, Chen H et al. H5N1 outbreaks and enzootic influenza. *Emerg Infect Dis* 2006;12:3–8.
- Bartlett JG. Planning for avian influenza. *Ann Intern Med* 2006;145:141–144.
- McKibbin WJ, Sidorenko AA. Global Macroeconomic Consequences of Pandemic Influenza, Analysis [on-line]. Available at [www.lowyinstitute.org](http://www.lowyinstitute.org) Accessed July 1, 2006.
- Kilbourne ED. Influenza pandemics: Can we prepare for the unpredictable? *Viral Immunol* 2004;17:350–357.
- Horimoto T, Kawaoka Y. Pandemic threat posed by avian influenza A viruses. *Clin Microbiol Rev* 2001;14:129–149.
- Killingray D, Phillips H. The Spanish Influenza Pandemic of 1918–19: New Perspectives. London, UK: Routledge Press, 2001.
- Potter CW. A history of influenza. *J Appl Microbiol* 2001;91:572–579.
- Palese P. Influenza: Old and new threats. *Nat Med* 2004;10:S82–S87.
- Skelton AG. Private sector planning, preparedness, and response activities to reduce impact of pandemic influenza. *J Public Health Manag Pract* 2006;12:381–387.
- Osterholm MT. Preparing for the next pandemic. *N Engl J Med* 2005;352:1839–1842.
- Meltzer MI, Cox NJ, Fukuda K. The economic impact of pandemic influenza in the United States: Implications for setting priorities for interventions. *Emerg Infect Dis* 1999;5:659–671.
- HHS Pandemic Influenza Plan, U.S. Department of Health and Human Services. November 2, 2005 [on-line]. Available at [www.hhs.gov/pandemicflu/plan](http://www.hhs.gov/pandemicflu/plan) Accessed January 26, 2007.
- HHS Pandemic Influenza Plan, U.S. Department of Health and Human Services, Supplement 6. Vaccine distribution and use, November 8, 2005 [on-line]. Available at [www.hhs.gov/pandemicflu/plan/sup6.html#summary](http://www.hhs.gov/pandemicflu/plan/sup6.html#summary) Accessed on December 15, 2006.
- Avian Influenza, including Influenza A (H5N1), in humans: WHO interim infection control guideline for healthcare facilities, 2006 [on-line]. Available at [www.wpro.who.int](http://www.wpro.who.int) Accessed September 1, 2006.
- A guide to influenza pandemic preparedness and response in long-term care homes. Emergency management unit, Ministry of Health and Long-term care, Canada [on-line]. Available at [www.health.gov.on.ca](http://www.health.gov.on.ca) Accessed February 1, 2007.
- HHS Pandemic Influenza Plan, U.S. Department of Health and Human Services [on-line]. Available at <http://www.hhs.gov/pandemicflu/plan/part1.html#2> Accessed April 6, 2007.
- World Health Organization Epidemic and Pandemic Alert and Response [on-line]. Available at [www.who.int/csr/disease/influenza/inforesources/en](http://www.who.int/csr/disease/influenza/inforesources/en) Accessed January 31, 2007.
- Centers for Disease Control and Prevention. Pandemic Flu Home [on-line]. Available at [www.cdc.gov](http://www.cdc.gov) Accessed January 31, 2007.
- Committee on Environmental Health; Committee on Infectious Diseases; Michael WS, Julia AM. Chemical-biological terrorism and its impact on children. *Pediatrics* 2006;118:1267–1278.
- Belshe RB. The origins of pandemic influenza—lessons from the 1918 virus. *N Engl J Med* 2005;353:2209–2211.
- Weber CJ. Update on preparing for the next influenza pandemic. *Dermatol Nurs* 2006;18:362–366.
- Oshitani H. Potential benefits and limitations of various strategies to mitigate the impact of an influenza pandemic. *J Infect Chemother* 2006;12:167–171.
- Cinti S, Chenoweth C, Monto AS. Preparing for the next pandemic influenza: Should hospitals stockpile oseltamivir? *Infect Control Hosp Epidemiol* 2005;26:852–854.
- Cinti S. Pandemic influenza: Are we ready? *Disaster Manag Response* 2005;3:61–67.
- Goh LG, Cheong PY. The pandemic influenza threat: A review from the primary care perspective. *Prim Care Respir J* 2006;15:222–227.
- Karwa M, Currie B, Kvetan V. Bioterrorism: Preparing for the impossible or the improbable. *Crit Care Med* 2005;33:S75–S95.
- Toner E, Waldhorn R, Maldin B et al. Hospital preparedness for pandemic influenza. *Biosecur Bioterror* 2006;4:207–217.
- Paget WJ. Commentary: Europe's preparedness for an influenza pandemic. *Eur J Public Health* 2006;16:121.
- Weber CJ. Update on avian influenza pandemic threat. *Urol Nurs* 2006;26:67–68.
- Fauci AS. Pandemic influenza threat and preparedness. *Emerg Infect Dis* 2006;12:73–77.
- Monto AS. Vaccines and antiviral drugs in pandemic preparedness. *Emerg Infect Dis* 2006;12:55–60.
- Brownstein JS, Wolfe CJ, Mandl KD. Empirical evidence for the effect of airline travel on inter-regional influenza spread in the United States. *PLoS Med* 2006;3:e401.
- Evans A, Finkelstein S, Singh J et al. Pandemic influenza: A note on international planning to reduce the risk from air transport. *Aviat Space Environ Med* 2006;77:974–976.
- Coker R, Mounier-Jack S. Pandemic influenza preparedness in the Asia-Pacific region. *Lancet* 2006;368:886–889.
- Horstick O, Kaiser R, Ciotti M et al. Europe makes progress in preparing for influenza pandemic, but further work needed. *Euro Surveill* 2005;10:E051117.1.
- Mounier-Jack S, Coker RJ. How prepared is Europe for pandemic influenza? Analysis of national plans. *Lancet* 2006;367:1405–1411.
- Hall IM, Gani R, Hughes HE, Leach S. Real-time epidemic forecasting for pandemic influenza. *Epidemiol Infect* 2006;135:1–14.
- Doyle A, Bonmarin I, Levy-Bruhl D et al. Influenza pandemic preparedness in France: Modelling the impact of interventions. *J Epidemiol Community Health* 2006;60:399–404.
- Schull MJ, Stukel TA, Vermeulan MJ et al. Surge capacity associated with restrictions on nonurgent hospital utilization and expected admissions during an influenza pandemic: Lesson from the Toronto Severe Acute Respiratory Syndrome Outbreak. *Acad Emerg Med* 2006;13:1228–1231.
- Lim MK. ird flu: Pandemic flu preparation: An unheeded lesson from SARS. *BMJ* 2006;332:913.
- Katz A, Staiti AB, McKenzie KL. Preparing for the unknown, responding to the known: Communities and public health preparedness. *Health Aff (Millwood)* 2006;25:946–957.
- Gabrel C. Characteristics of elderly nursing home current residents and discharges: Data from the 1997 National Nursing Home Survey. *Adv Data* 2000;(312):1–15.
- Schoch-Spana M, Fitzgerald J, Kramer BR et al. Influenza vaccine scarcity 2004–05: Implications for biosecurity and public health preparedness. *Biosecur Bioterror* 2005;3:224–234.
- Mody L, Langa K, Malani P. Impact of 2004–2005 influenza vaccine shortage on immunization practices in long-term care facilities. *Infect Control Hosp Epidemiol* 2006;27:383–387.