Epidemic/Pandemic Influenza
Topic Collection
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Topic Collection: Epidemic/Pandemic Influenza

In 2009, the world watched as the pandemic influenza A (H1N1) virus circulated the globe. Many emergency departments, clinics, and physician offices were filled with symptomatic patients and the “worried well” as public health and emergency management agencies modified plans to respond to the evolving pandemic by delivering risk communications to the public, establishing mass vaccination clinics, and distributing personal protective equipment (PPE) and other supplies to protect worker safety. Since that time, the healthcare system has been incorporating lessons learned from the 2009 H1N1 response into continued pandemic influenza planning efforts. New technology in detection, advances in treatment, improved PPE and containment equipment, updated protocols on how to deal with highly infectious diseases, and experience responding to seasonal influenza outbreaks and other large-scale infectious disease outbreaks have all contributed to a more robust capability to respond to the next pandemic. The threats have also grown – an increasing number of novel influenza viruses have demonstrated the ability to occasionally infect humans. The resources included in this Topic Collection can help healthcare professionals and emergency medical planners prepare for the next influenza epidemic or pandemic. It is important to note how important strong healthcare coalitions with tiered response strategies and coordinated incident management are to an effective pandemic influenza response.

ASPR TRACIE has developed several additional Topic Collections with content relevant to specific aspects of epidemic and pandemic influenza planning; they are listed below.

Alternate Care Sites
Crisis Standards of Care
Disaster Ethics
Fatality Management
Healthcare-Related Disaster Legal/Regulatory/Federal Policy
Hospital Surge Capacity and Immediate Bed Availability
Medical Countermeasure
Non-Pharmaceutical Interventions
Pharmacy
Resource Management
Responder Safety and Health
Virtual Medical Care

Each resource in this Topic Collection is placed into one or more of the following categories (click on the category name to be taken directly to that set of resources). Resources marked with an asterisk (*) appear in more than one category.

Must Reads
Antiviral Treatment
Education and Training
Epidemiology and Surveillance
General Information
Guidance

This document provides an overview of clinical considerations for pandemic influenza, including sections on immunization, surveillance, reporting, prevention, diagnosis, testing indications and types, treatment, and isolation and quarantine. It also includes information on limiting transmission when managing patients at home.


The authors analyzed surveillance data of hospitalized patients from the 2010-11 through the 2014-15 influenza seasons to determine the use of antiviral treatment. They found that antiviral treatment of hospitalized influenza patients increased from 72% in the 2010-11 season to 89% in the 2014-15 season. They also found that 45% of patients admitted within two days of illness onset, when the clinical benefit of antiviral treatment is known to be greatest, did not receive antiviral treatment on their day of admission.


This document provides healthcare system and public health preparedness professionals, emergency managers, and other stakeholders with resources and information to consider when improving their readiness for potential human infections with avian influenza A viruses.
This playbook synthesizes multiple sources of information in a single planning document addressing the full spectrum of infectious agents to create a concise reference resource for emergency medical services (EMS) agencies developing their service policies. The information can be incorporated into agency standard operating procedures and reviewed by the EMS medical director.

This planning tool is intended to assist health care coalitions and their partners in assessing their preparedness for an influenza pandemic. It may also be used to orient the response as a pandemic begins.

This article describes a Department of Veterans Affairs feasibility study on the ability of personnel to safely disinfect respirators under pandemic conditions by following standard operating procedures.

The authors reviewed the epidemiology and emergence of all influenza A serotypes known to cause human infection. They found an increase in recent years in the emergence of avian influenza viruses causing infections in humans and suggest a variety of measures to prevent the emergence of zoonotic disease.

This tool was developed by the Centers for Disease Control and Prevention and other influenza experts to assess the risk of a human pandemic emerging from influenza A viruses currently circulating in animals. The IRAT uses 10 weighted evaluation criteria to assess the risk of both emergence and public health impact and to classify each virus as low, moderate, or high risk.
This appendix lists in table format diseases, the clinical syndromes or condition that may be associated with the disease, potential pathogens, and empiric precautions that should be taken to prevent disease transmission in healthcare settings.

Centers for Disease Control and Prevention. (2016). How is Pandemic Flu Different from Seasonal Flu?

This webpage lists commonly-asked questions about influenza and contrasts answers for seasonal influenza with pandemic influenza.


This toolkit consists of a Pandemic Influenza Triage Algorithm to triage patients with influenza-like illness, a Community Site-of Care Tool to determine the appropriate care site for patients based on the Pandemic Influenza Triage Algorithm, and the Community Healthcare Decision Pathway to assess resource and medical surge to determine appropriate care sites.


This supplement to Chest Journal includes several articles composing a consensus statement of the American College of Chest Physicians on the care of the critically ill and injured during pandemics and disasters. Individual articles focus on the following: Introduction and Executive Summary; Methodology; Surge Capacity Principles; Surge Capacity Logistics; Evacuation of the ICU; Triage; Special Populations; System-Level Planning, Coordination, and Communication; Business and Continuity of Operations; Engagement and Education; Legal Preparedness; Ethical Considerations; and Infrastructure and Capacity Building and Response, Recovery, and Research in Resource-Poor Settings.


This report summarizes a series of workshops on the public’s perception of how to facilitate access to antiviral medication and treatment during an influenza pandemic as well as discusses choices when not enough vaccine is available for all that need it.


This web page provides basic information on influenza, including what it is, what the symptoms are, how it is diagnosed and treated, and how epidemics and pandemics occur.

This article describes the Centers for Disease Control and Prevention’s revised framework for pandemic influenza preparedness and response. The authors describe the six intervals along the pandemic curve and eight domains used to organize efforts within each interval.

Infectious Diseases Society of America. (2016). *ID-Focused Hospital Efficiency Improvement Program*.

This guide for infectious disease physician executives identifies service lines and related metrics to mitigate infectious disease-related issues. The guide addresses four areas: infection prevention and control; antimicrobial stewardship; outpatient parenteral antimicrobial therapy hospital admission/readmission avoidance; and bio-security, bio-preparedness, and emerging infectious diseases.


The authors describe Taiwan’s Communicable Disease Control Medical Network, which was established after the 2003 SARS outbreak, and discuss its performance during the 2009 H1N1 influenza pandemic and the West African Ebola outbreak. They discuss similarities with the tiered response system established in the U.S. for Ebola, identify strengths as the establishment of a command system with well-prepared hospitals and trained personnel, and note the challenges of maintaining funding, clarifying the role of local public health authorities, and incentivizing the participation of frontline clinical staff.

Los Angeles County Emergency Medical Services Agency. (2010). *Recommended Actions for Hospitals to Prepare for and Respond to Pandemic Influenza*.

This document provides guidelines to hospitals to prepare for an influenza pandemic. It includes a summary of recommended actions and their triggers, checklists, sample response guides, general background information, and links to additional resources.


This toolkit is intended for use by hospital emergency departments, and tests how long it takes for a potential patient with a highly infectious disease to be identified and for staff to begin exposure mitigation procedures; how long it takes for a patient to be transferred to an isolation room; and the capability of the facility to make notifications internally and to the health department. The Toolkit includes scenarios for Ebola Virus Disease, Middle
East Respiratory Syndrome, and Measles, but may be modified to suit healthcare facilities of any nature and any type of disease outbreak.


The authors provide an overview of influenza and discuss epidemiology and surveillance, perspectives on vaccines and antivirals, and research opportunities related to universal vaccine, alternate vaccine production strategies, novel antiviral development, and continued transmission studies.


These guidelines update Centers for Disease Control and Prevention recommendations on the use of non-pharmaceutical interventions to slow the spread of infectious respiratory diseases, including influenza.


This article describes the Centers for Disease Control and Prevention’s framework for classifying pandemic severity. The authors describe the four-step process used to develop the framework and how it can be used for an initial assessment in the early stages of a pandemic and a refined assessment once additional data become available.


The authors review influenza pandemics throughout history to describe the changing knowledge of the virus and efforts to manage outbreaks. Given the unpredictable nature of when the next pandemic will occur, they encourage continued surveillance, coordination, and resource planning to mitigate risks.


The authors reviewed literature published through 2015 to identify factors influencing adherence to antivirals as prophylaxis or treatment for influenza, both seasonal and pandemic. The incidence of adverse side effects was the most common predictor of actual and intended adherence. Other predictive factors include knowledge about influenza risk factors, risk perceptions on the severity of and vulnerability to the outbreak, and beliefs about side effects or effectiveness of pharmaceuticals. These findings can inform both
conversations between providers and individual patients and the development of public risk communication campaigns.


This report examines early lessons learned by the healthcare system from the response to the 2009 H1N1 pandemic and highlights ongoing concerns about overall U.S. preparedness for potential outbreaks.


This updated plan builds upon the 2005 Pandemic Influenza Plan and its subsequent updates, focusing on the seven domains of: surveillance, epidemiology, and laboratory activities; community mitigation measures; medical countermeasures; health care system preparedness and response activities; communications and public outreach; scientific infrastructure and preparedness; and domestic and international response policy, incident management, and global partnerships and capacity building.

U.S. Department of Labor, Occupational Safety and Health Administration. (2014). Protecting Workers During a Pandemic.

This fact sheet provides guidance on workplace practices related to pandemic influenza.


These revised guidelines for healthcare workers, healthcare administrators, and policymakers offer recommendations and best practices on non-pharmacological infection prevention and control activities during outbreaks of acute respiratory infections.

Antiviral Treatment


The authors analyzed surveillance data of hospitalized patients from the 2010-11 through the 2014-15 influenza seasons to determine the use of antiviral treatment. They found that antiviral treatment of hospitalized influenza patients increased from 72% in the 2010-11 season to 89% in the 2014-15 season. They also found that 45% of patients admitted within two days of illness onset, when the clinical benefit of antiviral treatment is known to be greatest, did not receive antiviral treatment on their day of admission.

This document provides information on antiviral medications recommended for treatment and chemoprophylaxis of influenza, summarizes influenza antiviral treatment recommendations, identifies treatment considerations for patients hospitalized with suspected or confirmed influenza, describes diagnostic testing for influenza, lists recommended dosage and duration of various antiviral agents for pediatric and adult populations, discusses chemoprophylaxis, and highlights special considerations.


This report provides recommendations for treatment and chemoprophylaxis of influenza virus infection. The authors identify populations at greater risk of complications, identify major changes from previous recommendations, describe the mechanism of virus transmission and the clinical signs and symptoms of disease, outline the role of laboratory diagnostics, and provide information on the four approved influenza antiviral agents, including their usage, dosage, adverse events, drug interactions, and possible emergency use authorization.


The authors reviewed individual patient data from nine clinical trials comparing oseltamivir with a placebo as a treatment for seasonal influenza in adults. They found that oseltamivir reduced the time to symptom alleviation, the risk of lower respiratory tract complications, and risk of hospitalization, but increased the risk of nausea and vomiting.


This report summarizes a series of workshops on the public’s perception of how to facilitate access to antiviral medication and treatment during an influenza pandemic as well as discusses choices when not enough vaccine is available for all that need it.


The authors reviewed regulatory information from 46 trials of oseltamivir and zanamivir for influenza in adults and children. They found that oseltamivir and zanamivir reduce the
time to symptom improvement in adults with influenza-like illness. Neither oseltamivir nor zanamivir was found to reduce influenza complications, hospitalizations, or deaths. Oseltamivir increases the risk of nausea, vomiting, and psychiatric events in adults and vomiting in children, but may reduce the risk of diarrhea and cardiac events in adults. The authors found a minimal preventive effect of using oseltamivir or zanamivir as prophylaxis.


The authors discuss the debate about whether oseltamivir should be stockpiled for an influenza pandemic based on its performance in the treatment of relatively mild illness during seasonal influenza outbreaks.


The authors reviewed available data from randomized, placebo-controlled trials on adults and children with confirmed or suspected exposure to naturally-occurring influenza to determine the effects of neuraminidase inhibitors. They found that two commonly-stockpiled neuraminidase inhibitors – oseltamivir and zanamivir – reduce the time to alleviation of symptoms in adults and that prophylactic use of either drug reduces the risk of developing symptomatic influenza. Neither drug reduced the time to alleviation of symptoms in asthmatic children, and oseltamivir use increased the risk of nausea, vomiting, psychiatric effects, and renal events in adults and vomiting in children.


This systematic review of randomized and controlled trials and other relevant literature concludes that the benefits of antiviral drugs outweigh their risks. The article summarizes existing public health recommendations and examines research on antiviral prophylaxis and treatment. The authors encourage clinicians to consider the risk profile of patients in some at-risk populations and note the need for additional research on those populations and on the use of antivirals for highly pathogenic influenza viruses.


The authors reviewed literature published through 2015 to identify factors influencing adherence to antivirals as prophylaxis or treatment for influenza, both seasonal and pandemic. The incidence of adverse side effects was the most common predictor of actual and intended adherence. Other predictive factors include knowledge about influenza risk factors, risk perceptions on the severity of and vulnerability to the outbreak, and beliefs
about side effects or effectiveness of pharmaceuticals. These findings can inform both conversations between providers and individual patients and the development of public risk communication campaigns.


The authors review the literature on the use of peramivir for acute influenza treatment. They found that it is effective against a variety of influenza A and B subtypes and that its injectable form may be favorable for treating critically ill, hospitalized patients. While they found positive results in observational studies in pregnant women, pediatric patients, patients receiving continuous renal replacement therapy, and patients undergoing extracorporeal membrane oxygenation, there is a lack of clinical trials demonstrating the efficacy of peramivir in these populations.

**Education and Training**


This is a three-day course for emergency medical services, healthcare, and public health professionals who may triage, transport, and treat those with a highly infectious disease. Training includes guided discussions of best practices, demonstrations, practical experiences, and exercises.


This four-day course for healthcare leaders focuses on critical disaster emergency preparedness decision making. The course applies to any incident with multiple casualties requiring surge capacity implementation, including an epidemic or pandemic though this scenario is not specifically addressed.


These guidelines are intended as a quick reference for just-in-time training and set up of the types of mechanical ventilators included in the Strategic National Stockpile. The guidelines may be used by clinicians with a baseline knowledge of pulmonary physiology and the concepts of ventilation, but who may not be familiar with the stockpiled ventilators or who may not routinely care for children on ventilators.

The authors studied the feasibility and effectiveness of an interactive, computer-assisted training course designed to build resilience to the stresses of working during a pandemic. They measured confidence in support and training; pandemic-related self-efficacy; coping style; and interpersonal problems, before and after training, and found that the course was associated with improvement in each variable, with the “medium” duration course providing the greatest benefit. The course is free and may be accessed at https://www.msh-healthy minds.com/sv/.

**Epidemiology and Surveillance**


The authors describe a method for predicting the likely impact of an emerging influenza pandemic based on an analysis of data at the household level collected from the first few hundred cases.


The authors reviewed the epidemiology and emergence of all influenza A serotypes known to cause human infection. They found an increase in recent years in the emergence of avian influenza viruses causing infections in humans and suggest a variety of measures to prevent the emergence of zoonotic disease.


This tool was developed by the Centers for Disease Control and Prevention and other influenza experts to assess the risk of a human pandemic emerging from influenza A viruses currently circulating in animals. The IRAT uses 10 weighted evaluation criteria to assess the risk of both emergence and public health impact and to classify each virus as low, moderate, or high risk.


This article describes the Centers for Disease Control and Prevention’s revised framework for pandemic influenza preparedness and response. The authors describe the six intervals along the pandemic curve and eight domains used to organize efforts within each interval.

The authors provide an overview of influenza and discuss epidemiology and surveillance, perspectives on vaccines and antivirals, and research opportunities related to universal vaccine, alternate vaccine production strategies, novel antiviral development, and continued transmission studies.


The authors review influenza pandemics throughout history to describe the changing knowledge of the virus and efforts to manage outbreaks. Given the unpredictable nature of when the next pandemic will occur, they encourage continued surveillance, coordination, and resource planning to mitigate risks.


Using electronic medical claims data from 2003 to 2010, the authors found that influenza-like illness indicators accurately reflected weekly fluctuations in influenza activity. They suggest that electronic medical claims data can supplement surveillance systems and can be used to provide situational awareness, refine influenza transmission models, and support future pandemic responses.

**General Information**


This document provides an overview of clinical considerations for pandemic influenza, including sections on immunization, surveillance, reporting, prevention, diagnosis, testing indications and types, treatment, and isolation and quarantine. It also includes information on limiting transmission when managing patients at home.


This document provides healthcare system and public health preparedness professionals, emergency managers, and other stakeholders with resources and information to consider when improving their readiness for potential human infections with avian influenza A viruses.
Centers for Disease Control and Prevention. (2016). How is Pandemic Flu Different from Seasonal Flu?

This webpage lists commonly-asked questions about influenza and contrasts answers for seasonal influenza with pandemic influenza.


This webpage summarizes the four global pandemics occurred in the past century and includes links to additional resources on each.


This supplement to Chest Journal includes several articles composing a consensus statement of the American College of Chest Physicians on the care of the critically ill and injured during pandemics and disasters. Individual articles focus on the following: Introduction and Executive Summary; Methodology; Surge Capacity Principles; Surge Capacity Logistics; Evacuation of the ICU; Triage; Special Populations; System-Level Planning, Coordination, and Communication; Business and Continuity of Operations; Engagement and Education; Legal Preparedness; Ethical Considerations; and Infrastructure and Capacity Building and Response, Recovery, and Research in Resource-Poor Settings.


This web page provides basic information on influenza, including what it is, what the symptoms are, how it is diagnosed and treated, and how epidemics and pandemics occur.


This article provides a chronology and describes the evolution of pandemic planning since the 1970s.


The authors provide an overview of influenza and describe the viral, host, and bacterial factors that contribute to more severe illness, complications, and mortality.

The authors review influenza and respiratory bacterial co-infections, describing the historic understanding of such co-infections, disease dynamics and mechanisms, and prevention and treatment strategies.

National Academies of Sciences, Engineering, and Medicine. (2017). Preparing Airports for Communicable Diseases on Arriving Flights. The authors review current disease preparedness and response practices at airports in the U.S. and Canada with a focus on coordination with public health officers and partners. They emphasize that while larger (international) airports are more likely to face these challenges, the lessons in this document are applicable to the aviation sector as a whole, including smaller airports (which may be the final destination of some travelers with communicable diseases).


The authors provide an overview of influenza and discuss epidemiology and surveillance, perspectives on vaccines and antivirals, and research opportunities related to universal vaccine, alternate vaccine production strategies, novel antiviral development, and continued transmission studies.


This article describes the Centers for Disease Control and Prevention’s framework for classifying pandemic severity. The authors describe the four-step process used to develop the framework and how it can be used for an initial assessment in the early stages of a pandemic and a refined assessment once additional data become available.


The authors review influenza pandemics throughout history to describe the changing knowledge of the virus and efforts to manage outbreaks. Given the unpredictable nature of when the next pandemic will occur, they encourage continued surveillance, coordination, and resource planning to mitigate risks.
Guidance


This document provides guidance to nurses and other health professionals on the provision of care during extreme emergencies when usual resources are unavailable. It provides background information on policies and competencies, identifies expected challenges in extreme emergencies, and offers pre-, during, and post-event recommendations.


This document provides interim guidance for clinicians on how to identify, diagnose, report, and manage suspect cases of exposure to variant influenza viruses.


This webpage provides guidance on avian influenza A (H7N9), Asian H5N1, and newly detected avian influenza H5 viruses in the U.S.


This document provides guidance to long-term care facilities on preventing transmission of influenza through vaccination, testing, infection control, antiviral treatment, and antiviral chemoprophylaxis.


This document provides guidance for emergency departments and outpatient clinics to develop screening and isolation protocols for patients possibly infected with a highly communicable disease of public health concern. The document focuses on initial patient identification, initial infection control measures, notification and patient evaluation, and identification and management of exposed persons.
Guidelines


This report provides recommendations for treatment and chemoprophylaxis of influenza virus infection. The authors identify populations at greater risk of complications, identify major changes from previous recommendations, describe the mechanism of virus transmission and the clinical signs and symptoms of disease, outline the role of laboratory diagnostics, and provide information on the four approved influenza antiviral agents, including their usage, dosage, adverse events, drug interactions, and possible emergency use authorization.


These guidelines review data on handwashing and hand antisepsis in healthcare settings and provide recommendations for the promotion of hand hygiene practices and the reduction of pathogen transmission in healthcare settings.


This document provides infection control guidelines for healthcare settings across the continuum of care. Appendix A lists in table format diseases, the clinical syndromes or condition that may be associated with the disease, potential pathogens, and empiric precautions that should be taken to prevent disease transmission in healthcare settings.


This webpage defines healthcare settings and healthcare personnel, discusses modes of influenza transmission and fundamental elements of prevention; and outlines 13 recommended prevention strategies.


This webpage provides background information on the reliability and interpretation of rapid influenza diagnostic test results, guidance on how to minimize false results, lists details about available testing methods, and describes characteristics of rapid influenza diagnostic tests.

This webpage includes links to current and archived influenza vaccine recommendations from the Advisory Committee for Immunization Practices.


This report provides recommendations for treatment and chemoprophylaxis of influenza virus infection. The authors identify populations at greater risk of complications, identify major changes from previous recommendations, describe the mechanism of virus transmission and the clinical signs and symptoms of disease, outline the role of laboratory diagnostics, and provide information on the four approved influenza antiviral agents, including their usage, dosage, adverse events, drug interactions, and possible emergency use authorization.


These guidelines are intended as a quick reference for just-in-time training and set up of the types of mechanical ventilators included in the Strategic National Stockpile. The guidelines may be used by clinicians with a baseline knowledge of pulmonary physiology and the concepts of ventilation, but who may not be familiar with the stockpiled ventilators or who may not routinely care for children on ventilators.

Infectious Diseases Society of America. (2016). ID-Focused Hospital Efficiency Improvement Program.

This guide for infectious disease physician executives identifies service lines and related metrics to mitigate infectious disease-related issues. The guide addresses four areas: infection prevention and control; antimicrobial stewardship; outpatient parenteral antimicrobial therapy hospital admission/readmission avoidance; and bio-security, bio-preparedness, and emerging infectious diseases.


The authors review current evidence and indications for ECMO. They describe what it is, who could benefit, how to do it, and what the complications are. ECMO was used extensively during the H1N1 pandemic, and the guide has implications on decisions for its use during future influenza pandemics.

This protocol developed by an expert panel is based on a literature review and the experience of Polish treatment centers with extensive use of veno-venous extracorporeal membrane oxygenation (ECMO). The protocol is intended to improve treatment outcomes, expand access to ECMO where appropriate, and to avoid the use of ECMO in situations when it is unlikely to be beneficial.

* Los Angeles County Emergency Medical Services Agency. (2010). Recommended Actions for Hospitals to Prepare for and Respond to Pandemic Influenza.

This document provides guidelines to hospitals to prepare for an influenza pandemic. It includes a summary of recommended actions and their triggers, checklists, sample response guides, general background information, and links to additional resources.

* Los Angeles County Emergency Medical Services Agency. (2009). Recommended Actions for EMS Providers to Prepare For and Respond to Pandemic Influenza.

This document provides pandemic influenza guidelines for emergency medical services responders and management, recommended actions during each pandemic period, and additional resources, such as infection control information, employee health considerations, and patient assessment tools.


These guidelines update Centers for Disease Control and Prevention recommendations on the use of non-pharmaceutical interventions to slow the spread of infectious respiratory diseases, including influenza.


This articles describes the various approaches currently available to diagnose human influenza infections. The authors discuss advantages and limitations of the various approaches, such as sensitivity and specificity of the tests, cost-effectiveness, and ease to perform.

This report reviews gaps in influenza pandemic preparedness among emergency medical services and 911 systems and outlines five strategies to address these gaps.


These revised guidelines for healthcare workers, healthcare administrators, and policymakers offer recommendations and best practices on non-pharmacological infection prevention and control activities during outbreaks of acute respiratory infections.

Lessons Learned


The authors describe Taiwan’s Communicable Disease Control Medical Network, which was established after the 2003 SARS outbreak, and discuss its performance during the 2009 H1N1 influenza pandemic and the West African Ebola outbreak. They discuss similarities with the tiered response system established in the U.S. for Ebola, identify strengths as the establishment of a command system with well-prepared hospitals and trained personnel, and note the challenges of maintaining funding, clarifying the role of local public health authorities, and incentivizing the participation of frontline clinical staff.


The authors describe lessons learned from the 2009 H1N1 influenza pandemic and the 2014 Ebola virus epidemic related to the commercial supply chain of pharmaceutical and other healthcare products. They discuss how these lessons learned could inform readiness for future emergencies from a personal protective equipment supply chain and system perspective.


This report examines early lessons learned by the healthcare system from the response to the 2009 H1N1 pandemic and highlights ongoing concerns about overall U.S. preparedness for potential outbreaks.

The U.S. Government Accountability Office was charged with 1) determining how the Homeland Security Council and the responsible Federal agencies were monitoring the progress and completion of the Implementation Plan for the National Strategy for Pandemic Influenza, and 2) assessing the extent to which selected action items have been completed.

U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response. (2012). *An HHS Retrospective on the 2009 H1N1 Influenza Pandemic to Advance All Hazards Preparedness.*

The authors share lessons learned from the 2009 influenza pandemic, grouped into the following categories: surveillance, mitigation measures, vaccination, and communications and education.

**Non-Pharmaceutical Strategies**


The authors describe the development of guidance on non-pharmaceutical strategies to minimize the spread of the 2009 influenza A (H1N1) pandemic. They recommend a framework to be used by state and local health officials when collaborating with stakeholders including educational officials and large employers to select which non-pharmaceutical measures to use during a future pandemic.


The authors examined 19 categories of public health responses in 17 cities during the first 16 weeks of the 1918 influenza pandemic to determine their effectiveness. They found that early interventions were most effective in lowering peak death rates and that early closures of schools, churches, and theatres were associated with lower peak excess death rates.


The authors modeled various non-pharmaceutical interventions, social behaviors, and their interactions on outcome measures such as numbers of contacts, infections, and deaths to simulate the effects of the strategies on pandemic influenza outbreaks with varying levels of virus transmissibility.

The authors provide an overview of influenza and discuss epidemiology and surveillance, perspectives on vaccines and antivirals, and research opportunities related to universal vaccine, alternate vaccine production strategies, novel antiviral development, and continued transmission studies.


These guidelines update Centers for Disease Control and Prevention recommendations on the use of non-pharmaceutical interventions to slow the spread of infectious respiratory diseases, including influenza.

Modelling Community-Control Strategies to Protect Hospital Resources During An Influenza Pandemic in Ottawa, Canada. PLoS One. 12(6).

The authors modeled the effects on hospital capacity in one city of various strategies to control an influenza pandemic. They calculated ranges bounded by no interventions and all interventions for the attack rate, peak acute care hospital capacity, peak intensive care unit capacity, and mortality along with estimated economic burdens. They found vaccination, isolation, and personal protective measures to be the most effective strategies. However, all interventions decreased in effectiveness as transmissibility increased and as the outbreak progressed.


This study reviews existing systematic reviews and meta-analyses on pandemic influenza interventions including vaccines, antivirals, personal protective measures, school closures, and traditional Chinese medicine. Pandemic influenza vaccine was found to be protective against infection, but the authors found insufficient evidence for the effectiveness of each of the other interventions in isolation and hypothesized that a combination of interventions would be most effective.

Effectiveness of Non-Pharmaceutical Measures in Preventing Pediatric Influenza: A Case-Control Study. BMC Public Health. 15(543).

In this case-control study of illnesses during the 2009-10 and 2010-11 seasons, the authors evaluated the effectiveness of frequency of hand washing, alcohol-based hand
sanitizer use, and hand washing after touching contaminated surfaces. Hand washing more than five times per day was the only statistically significant protective factor. Among the school-age 5-17 year old group, both hand washing more than five times per day and hand washing after touching contaminated surfaces had a negative association for influenza infection.


The authors modeled the effect of voluntary self-isolation when distribution of antivirals is delayed and found that it reduced the transmission of pandemic influenza. Voluntary self-isolation is more effective the closer in time to symptom onset it is implemented and loses effectiveness as the proportion of asymptomatic infections increases.

**Pediatric Issues**


This kit allows pediatricians, public health leaders and other pediatric care providers to assess what is happening in their community or state, and help determine what needs to be done before an emergency or disaster (e.g., a pandemic). The kit also promotes collaborative discussions and decision making about pediatric preparedness planning.

* Centers for Disease Control and Prevention. (2010). Coordinating Pediatric Medical Care During an Influenza Pandemic: Hospital Workbook.

This workbook was designed to assist hospitals in coordinating the care of pediatric patients during an influenza pandemic. The workbook guides hospitals in thinking about needed actions to inform their preparedness planning.


These guidelines are intended as a quick reference for just-in-time training and set up of the types of mechanical ventilators included in the Strategic National Stockpile. The guidelines may be used by clinicians with a baseline knowledge of pulmonary physiology and the concepts of ventilation, but who may not be familiar with the stockpiled ventilators or who may not routinely care for children on ventilators.

This cohort study to compare influenza outcomes of infants less than 6 months of age born to vaccinated and unvaccinated women included more than 245,000 women who delivered nearly 250,000 infants in a single health system between December 2005 and March 2014. The authors found that while only 10% of pregnant women were vaccinated during the overall course of the study, the proportion steadily increased to 52% in the final season. They also found a 64% reduction in influenza-like illness health encounters, a 70% reduction in laboratory-confirmed influenza, and an 81% reduction in hospitalization with laboratory-confirmed influenza in infants born to women who reported being vaccinated during pregnancy and 97% of laboratory-confirmed influenza in infants less than 6 month occurred in those born to women who did not report being vaccinated during pregnancy.


In this case-control study of illnesses during the 2009-10 and 2010-11 seasons, the authors evaluated the effectiveness of frequency of hand washing, alcohol-based hand sanitizer use, and hand washing after touching contaminated surfaces. Hand washing more than five times per day was the only statistically significant protective factor. Among the school-age 5-17 year old group, both hand washing more than five times per day and hand washing after touching contaminated surfaces had a negative association for influenza infection.

**Personal Protective Equipment and Worker Safety**


This article describes a Department of Veterans Affairs feasibility study on the ability of personnel to safely disinfect respirators under pandemic conditions by following standard operating procedures.


This web page provides questions and answers to illustrate the importance of influenza vaccination among healthcare workers to not only protect vaccinated personnel but also to reduce transmission of influenza in healthcare settings.

This website compiles standards information for personal protective equipment from the U.S. government, American National Standards Institute-accredited standard development organizations, and the International Organization for Standardization. Users can search the database by fields including the category of personal protective equipment, hazard type, standard type, and standard organization.

Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. (2014). **Recommended Guidance for Extended Use and Limited Reuse of N95 Filtering Facepiece Respirators in Healthcare Settings.**

This guidance for professionals who manage respiratory protection programs for healthcare facilities provides recommendations on extended use and reuse of N95 filtering facepiece respirators. It also explains the risks associated with extended use and reuse.


The authors examined existing policies and guidelines from the Centers for Disease Control and Prevention, the World Health Organization, three high-income countries, and six low/middle-income countries on mask and respirator use for influenza, SARS, and tuberculosis. They found significant variation in choice of products, applications, and specifications. They encourage joint evaluation of evidence and development of a uniform policy to reduce confusion in healthcare settings.


This article reviews scientific findings on the extended use or reuse of filtering facepiece respirators in healthcare settings. The authors discuss considerations for routine events versus during public health emergencies. The authors express a preference for extended use over reuse and suggest that future recommendations consider new cautions and limitations.


The author provides an overview on occupational exposure to emerging infectious diseases in the healthcare industry and the history and use of isolation gowns as personal protective equipment (PPE). As the second-most used type of PPE, the author discusses properties affecting gown performance and factors influencing their design and development.

This report was updated following the 2009 H1N1 pandemic to assess current knowledge on personal protective equipment, research progress, and future efforts to protect healthcare personnel.


The authors exposed material coupons and straps from four models of N95 filtering facepiece respirators to a range of doses of ultraviolet germicidal irradiation to test particle penetration, flow resistance, bursting strengths of coupon layers, and breaking strength of straps. They found small effects on filtration performance and almost no effect on flow resistance, but a reduction in the strength of respirator materials of more than 90% in some models and a 20-51% reduction in breaking strength of straps. The authors suggest that ultraviolet germicidal irradiation is a possible method to disinfect respirators for reuse, but the respirator model used should first be tested to determine the maximum number of disinfection cycles and the dose required to inactivate the specific pathogen.


This report summarizes the proceedings of a workshop examining the current state of practice on the use of powered air purifying respirators in healthcare settings and research on their use and effectiveness.


The authors describe lessons learned from the 2009 H1N1 influenza pandemic and the 2014 Ebola virus epidemic related to the commercial supply chain of pharmaceutical and other healthcare products. They discuss how these lessons learned could inform readiness for future emergencies from a personal protective equipment supply chain and system perspective.

The authors described a survey of infectious disease physicians to learn their perspectives on influenza transmission, personal protective equipment preferences, respirator supplies, barriers to expanded use of respirators, and respirator conservation strategies. Among the findings, respondents widely agreed with recommendations to use surgical masks during seasonal influenza outbreaks. They slightly favored N95 respirators during mild severity pandemics, but two-thirds preferred N95 respirators over surgical masks during a high mortality pandemic. They also preferred extended use or reuse of disposable N95 respirators over elastomeric or powered air-purifying respirators in the event of a respirator shortage.


This meta-analysis examined the effectiveness of hand hygiene, respiratory etiquette, and use of facemasks in reducing the risk of pandemic influenza transmission. The authors did not find data on the effectiveness of respiratory etiquette, but found that hand hygiene was statistically significant and wearing a face mask was suggestive of preventing infection.


The authors conducted a meta-analysis of both clinical studies and surrogate exposure studies comparing N95 respirators to surgical masks to prevent transmission of acute respiratory infections. While the surrogate studies suggested a protective advantage of N95 respirators over surgical masks, the meta-analysis showed insufficient data to definitely determine whether N95 respirators are more protective.


This document provides an overview of infection control and other standards appropriate for pandemic influenza.

U.S. Department of Labor, Occupational Safety and Health Administration. (2014). Protecting Workers During a Pandemic.

This fact sheet provides guidance on workplace practices related to pandemic influenza.

This webpage contains standards on respirators, respiratory protection, and the medical evaluation program.

**Plans, Tools, and Templates: Modeling Tools**


This free, downloadable software allows users to simulate the effects of various interventions – including vaccination, school closure, facemasks, and patient isolation – on the spread of an influenza pandemic.


This free, downloadable software allows planners to estimate the effects of an influenza pandemic on their community in terms of hospitalizations, outpatient visits, and deaths.


This free, downloadable software allows laboratory directors and emergency planners to estimate the daily number of specimens expected to be received for testing and the laboratory’s testing capacity during each pandemic stage.


This free, downloadable spreadsheet allows hospital administrators and emergency planners to estimate hospitalizations and deaths during an influenza pandemic and to compare existing hospital capacity to expected numbers of patients needing hospitalization, intensive care, and ventilator support.


This free, downloadable spreadsheet allows emergency planners to estimate the number of days lost from work during an influenza pandemic.

**Plans, Tools, and Templates: EMS**


This playbook synthesizes multiple sources of information in a single planning document addressing the full spectrum of infectious agents to create a concise reference resource for emergency medical services (EMS) agencies developing their service policies. The information can be incorporated into agency standard operating procedures and reviewed by the EMS medical director.

This planning tool is intended to assist health care coalitions and their partners in assessing their preparedness for an influenza pandemic. It may also be used to orient the response as a pandemic begins.


This planning checklist is intended to assist emergency medical services and other transport providers assess and improve their influenza pandemic preparedness.

* Los Angeles County Emergency Medical Services Agency. (2009). Recommended Actions for EMS Providers to Prepare For and Respond to Pandemic Influenza.

This document provides pandemic influenza guidelines for emergency medical services responders and management, recommended actions during each pandemic period, and additional resources, such as infection control information, employee health considerations, and patient assessment tools.

**Plans, Tools, and Templates: Hospitals**


This plan can help healthcare providers manage an H1N1 outbreak or other large scale epidemic or pandemic. Developed during the 2009 H1N1 pandemic, it provides a checklist/template for hospital preparedness.

* Centers for Disease Control and Prevention. (2010). Coordinating Pediatric Medical Care During an Influenza Pandemic: Hospital Workbook.

This workbook was designed to assist hospitals in coordinating the care of pediatric patients during an influenza pandemic. The workbook guides hospitals in thinking about needed actions to inform their preparedness planning.


This checklist can help hospital staff with decision making and influenza flu plan development.

This guide is intended to assist community hospitals in identifying issues with response capabilities and resource availability during an influenza pandemic as well as to develop strategies to address them.


This checklist is intended to assist hospitals in evaluating current pandemic influenza plans or developing new ones.


This toolkit consists of a Pandemic Influenza Triage Algorithm to triage patients with influenza-like illness, a Community Site-of Care Tool to determine the appropriate care site for patients based on the Pandemic Influenza Triage Algorithm, and the Community Healthcare Decision Pathway to assess resource and medical surge to determine appropriate care sites.

* Los Angeles County Emergency Medical Services Agency. (2010). Recommended Actions for Hospitals to Prepare for and Respond to Pandemic Influenza.

This document provides guidelines to hospitals to prepare for an influenza pandemic. It includes a summary of recommended actions and their triggers, checklists, sample response guides, general background information, and links to additional resources.


This toolkit is intended for use by hospital emergency departments, and tests how long it takes for a potential patient with a highly infectious disease to be identified and for staff to begin exposure mitigation procedures; how long it takes for a patient to be transferred to an isolation room; and the capability of the facility to make notifications internally and to the health department. The Toolkit includes scenarios for Ebola Virus Disease, Middle East Respiratory Syndrome, and Measles, but may be modified to suit healthcare facilities of any nature and any type of disease outbreak.

Plans, Tools, and Templates: Long Term Care/Assisted Living/Home Health


This workbook provides guidance to long term care providers on why they need to be prepared for a pandemic, what they need to do to be prepared, and how they can make preparations.

This toolkit is intended to inform long-term care facilities and their owners about the importance of influenza vaccination among their workforce.


This checklist can help public and private healthcare organizations assess and better their pandemic influenza preparedness and planning.


This planning guide is geared towards long-term care, homecare, and hospice providers and is comprised of six sections: situational awareness, continuity of operations, facility or agency operations, crisis standards of care, staffing, and fatality management.


This resource identifies state statutes or regulations that require long term care facilities to assess the influenza vaccination status of personnel or patients, to offer or require influenza vaccination among personnel or patients, or require unvaccinated personnel to wear surgical masks during influenza season.


This toolkit is intended to assist healthcare facilities in developing pandemic influenza preparedness and response plans.

**Plans, Tools, and Templates: Physician Offices**


This checklist identifies universal early preparations, describes actions for areas with suspected or known pandemic influenza, outlines telephone and office triage, notes referral or transfer and waste disposal procedures, and lists required equipment and supplies for physician offices to consider when preparing for pandemic influenza.

This resource kit provides guidance on how pediatricians can work with the public health community and other pandemic planners to address the needs of children during a pandemic.

Centers for Disease Control and Prevention. (n.d.). *Abbreviated Pandemic Influenza Plan Template for Primary Care Provider Offices: Guidance from Stakeholders.* (Accessed 10/6/2017.)

The planning tool, based on discussion during an August 2009 CDC-sponsored stakeholder meeting, identifies considerations in a wide range of subject areas that primary care office staff should keep in mind when developing their office pandemic plans.


This planning tool – based on a meeting of primary care providers, office managers, hospital representatives, state and local health department and emergency management agency staff, professional association staff, and federal staff – offers a year-long planning timeline and key activities, a plan template checklist for primary care offices, and additional resources to support plan development.


This flowchart can aid medical staff in triaging calls. The tool may identify high-risk patients for consideration of initiation of antiviral treatment prior to an office visit.


This template can assist pediatric medical offices in identifying needed modifications to current office practices and developing a pandemic influenza plan.

**Plans, Tools, and Templates: Other**


This planning tool is intended to assist health care coalitions and their partners in assessing their preparedness for an influenza pandemic. It may also be used to orient the response as a pandemic begins.

The authors synthesized Federal guidance with promising practices and created this guide to help workplaces minimize infection and absenteeism.


This checklist identifies actions that businesses can take to plan for pandemic influenza.


This article describes the Centers for Disease Control and Prevention’s revised framework for pandemic influenza preparedness and response. The authors describe the six intervals along the pandemic curve and eight domains used to organize efforts within each interval.


The National Strategy for Pandemic Influenza provides strategies to stop, slow or limit the spread of a pandemic to the United States; limit the domestic spread of a pandemic, and mitigate disease, suffering and death; and sustain infrastructure and minimize economic and societal impacts. It aims to do so through preparedness and communication; surveillance and detection; and response and containment.


This plan contains the following sections: command, plans section (by unit), operations section, logistics, and finance. Four annexes that focus on different threats are included, as are sample forms and other appendices.


This guide can help people create a plan for and recognize the signs of influenza and care for themselves or others sick with the virus. It is available in several languages.
This updated plan builds upon the 2005 Pandemic Influenza Plan and its subsequent updates, focusing on the seven domains of: surveillance, epidemiology, and laboratory activities; community mitigation measures; medical countermeasures; health care system preparedness and response activities; communications and public outreach; scientific infrastructure and preparedness; and domestic and international response policy, incident management, and global partnerships and capacity building.

Research


The authors conducted a systematic review and meta-analysis of studies on willingness of healthcare workers to work during an influenza pandemic. 43 studies from 11 countries met the study’s inclusion criteria, but wide variation in settings, scenarios, and respondents contributed to an inability to complete a meta-analysis on the percentage willing to work. Factors associated with willingness included being male, a full-time worker, and a physician or nurse, while childcare obligation was associated with decreased willingness. The authors suggest that modifiable factors, such as risk perception, training, and knowledge level, could be addressed by additional education efforts and lead to increased willingness to work.


The authors estimated more than 200,000 respiratory deaths with more than 83,000 additional cardiovascular deaths worldwide associated with 2009 influenza A H1N1. This mortality estimate is 15 times higher than the number of reported laboratory-confirmed deaths.


The authors reviewed all 339 patients with a clinical diagnosis of influenza at a single hospital emergency department from May 2008 to December 2009 to compare patient management pre and during the H1N1 pandemic and to test adherence to H1N1 guidance from the CDC and the American College of Emergency Physicians. They found similar rates of hospital admission, but different clinical presentation patterns during the pandemic period. Diagnostic testing practices were very good or excellent in adherence to guidelines, but suboptimal in antiviral prescription guideline adherence.

The authors interviewed 65 primary care physicians in Australia, Israel, and England about their experiences during the 2009 influenza pandemic. Physicians in all three countries perceived difficulties in translating pandemic policies and guidelines into practice. The researchers attributed this to knowledge barriers (high volume of information and lack of time to keep pace, multiple sources of information, guidelines not oriented to primary care), primary care physician doubts about some guidelines, and operational difficulties associated with providing personalized consultations to patients hearing media reporting on policy changes before physicians received official updates from health authorities.


The authors conducted a nationally representative, cross-sectional survey of the pandemic influenza planning of 2,294 assisted living facilities and personal care homes. They found that more than half did not have a pandemic influenza plan. Facilities that were small, for-profit, and non-chain-affiliated were less likely to have a plan while those with higher staff vaccination rates were more likely to have a plan.


The authors conducted a case-control study to determine the association between body mass index and risk of hospitalization due to influenza. The researchers matched laboratory-confirmed hospitalized influenza patients with laboratory-confirmed outpatients and an outpatient control group during the 2009-10 and 2010-11 influenza seasons. They found an approximate five-fold increase in risk of hospitalization for those with a body mass index between 35 and 40 kg/m² compared to those of normal weight. They also found significantly increased risk of hospitalization for those with a body mass index between 30 and 34.9 kg/m² who are unvaccinated and under 65 years of age, underscoring the importance of influenza vaccination for these populations.


The authors used statistical modeling on time series data from two medical claims databases to estimate outpatient visits for respiratory diagnoses and otitis media attributable to influenza. For those under age 65, the model estimated approximately 14.5 million outpatient visits for respiratory diagnoses attributable to influenza, with
approximately 80% occurring in those age 5 to 49. They also found approximately 2.2 million outpatient visits for otitis media attributable to influenza, with 86% occurring in those under 18 years of age.


The authors analyzed vital statistics and emergency department visit data for cardiovascular deaths during non-pandemic influenza seasons from 2006 to 2012 in New York City. They found a 2.3% increase in cardiovascular disease mortality, a 2.4% increase in ischemic heart disease mortality, and a 5.5% increase in myocardial infarction mortality in those 65 years and older associated with an increase from the 25th to 75th percentiles in the number of influenza-related emergency department visits in the previous 21 days.


The authors reviewed 16 observational studies and found that corticosteroid therapy for presumed influenza-associated complications is associated with increased mortality. The authors also noted that they were unable to identify any clinical trials on the issue, not all studies specified the indications for corticosteroid therapy, and that when doses were specified they were a higher daily dose than typically recommended.


The authors modeled the number of cases, hospitalizations, and deaths due to 2009 H1N1 to address likely underreporting and compared these estimates to those for seasonal influenza. They found that the rates of hospitalizations and deaths among those under 65 were higher than for seasonal influenza while the rates of hospitalization were 75 percent lower and deaths 81 percent lower among those 65 and older in comparison to seasonal influenza.


This Norwegian study of general practice and primary care doctors on duty in out-of-hours services reviewed consultations for influenza-like illness during the 2009 pandemic in comparison to the 2008-2009 influenza season. In both seasons, the majority of consultations occurred in general practice, but there was a 5.5 fold increase in out-of-hours consultations during the pandemic year.
Resource Allocation and Management


This study models the number of additional ventilators that could be absorbed by hospitals during the peak of an influenza pandemic.


The authors convened an expert consensus panel representing health providers, administrators, emergency planners, and specialists, and asked them to review four disaster scenarios and prioritize 132 hospital resources. The number of hospital resources considered to be critical varied by scenario: 58 for the pandemic influenza scenario, 51 for radiation exposure, 41 for explosives, and 35 for nerve gas scenario.


The authors modeled demand for N95 filtering facepiece respirators and surgical masks during an influenza pandemic under base case, intermediate demand, and maximum demand scenarios. Because the billions of respirators and masks required under all three scenarios would likely exceed supply, the authors suggest the consideration of other strategies, including extended use and reuse of respirators and the use of other types of respirators.


This report summarizes a series of workshops on the public’s perception of how to facilitate access to antiviral medication and treatment during an influenza pandemic.


The authors developed a model to determine the optimal local versus central storage allocation of mechanical ventilators based on risk and stockpiling cost. Using data from Texas under mild, moderate, and severe scenarios, they found while central stockpiles may be more cost-effective, they are only advisable when there is little correlation in peak demand among local areas and deployment from a central location is highly reliable.

The authors describe an initiative of the Centers for Disease Control and Prevention to explore the acceptability and feasibility of establishing a coordinated and integrated network of poison control centers, nurse advice lines, 211 information lines, and other hotlines to triage calls and provide information during an influenza pandemic.


This commentary on Huang, H., Araz, O., Morton, D., et al.’s Stockpiling Ventilators for Influenza Pandemics offers context for the challenge of estimating surge demand for ventilators during a pandemic. The authors discuss the importance of models like the ones described in the article and identify its strengths and limitations.


The authors created a spreadsheet model to explore potential demand for invasive mechanical ventilation during an influenza pandemic. They used four standardized pandemic scenarios, each with a low and high clinical severity. They found that the number of deaths prevented varied greatly by scenario and was influenced by the shape of the epidemic curve and the effectiveness of ventilation as well as the distribution of ventilators throughout the healthcare system along with trained staff and resources to support their use.


Following the detection of a novel influenza strain A (H7N9), the authors modeled the use of antiviral treatment in the U.S. to mitigate severe disease across a range of hypothetical pandemic scenarios. The model included estimates of attack rate, healthcare-seeking behavior, prescription rates, and other related data. Based on these inputs, the total antiviral regimens estimated to be available in the U.S. (as of April 2013) were deemed sufficient to meet treatment needs for the scenarios considered.

The Minnesota Department of Public Health developed several tools to support healthcare providers during the 2009 H1N1 influenza pandemic, including MN FluLine, a nurse triage line that reached many rural and uninsured residents, and, according to the authors, may have prevented up to 11,000 in-person health-care encounters.


This document, developed by an expert workgroup, provides a conceptual framework for planning efforts related to allocation of mechanical ventilators during a severe influenza pandemic. It supplements a document released by CDC in 2007, Ethical Guidelines in Pandemic Influenza. The document outline key assumptions, describes routine versus emergency practice, and discusses principles guiding ventilator allocation, who should make allocation decisions, and other considerations.


The authors designed a decision model to determine whether the benefits of stockpiling antivirals for an influenza pandemic outweigh the negative consequences of not stockpiling. They estimated both the cost-effectiveness benefits as well as the health benefits, which were measured as deaths averted by stockpiling. While they found that the probability of not using a stockpile was greater than using it, stockpiling was justified due to the catastrophic losses that would occur from a severe pandemic without it.


The authors describe a conceptual framework for the distribution of ventilators stockpiled by the federal government during a large-scale emergency. They identify necessary planning steps to aid in the optimal allocation of ventilators to individual hospitals.
Vaccines


The authors modeled the effects of variables including the start time of a vaccination campaign, number of vaccine doses administered per week and allocation by age group, clinical attack rate, case hospitalization ratio, and case fatality ratio, on an influenza pandemic. The timing of the start of the vaccination campaign relative to the start of the pandemic had the greatest effect, with 141,000 to 2.2 million hospitalizations and 11,000 to 281,000 deaths prevented when the vaccination program started prior to the beginning of the pandemic.


This webpage includes links to current and archived influenza vaccine recommendations from the Advisory Committee for Immunization Practices.


The authors analyzed reporting data from immunization and public health preparedness programs to assess their pandemic planning with pharmacies. They found that most jurisdictions include pharmacies in their pandemic vaccine distribution plans, nearly half have a process to recruit pharmacists as vaccinators, and nearly a third have formal relationships established with pharmacies.


The authors completed an umbrella review and reanalyzed data from 15 previously published meta-analyses to determine how different analyses and study selection criteria could explain differences in findings or interpretations. They found statistically significant efficacy and effectiveness – high for laboratory-confirmed cases in children and adults and modest for clinically-confirmed cases and for the elderly – of seasonal influenza vaccines. They identified a scarcity of data on the efficacy of live-attenuated vaccine in those less than two years old, suboptimal quality of harms data, and a lack of meta-analysis on the effect of H1N1 vaccination on clinical outcomes.

The authors analyzed results from two surveys to assess readiness to vaccinate critical infrastructure personnel during an influenza pandemic. They found that less than half of responding public health preparedness programs had a plan to identify and vaccinate such workers and slightly more than a quarter of immunization programs knew the number of such personnel in their jurisdictions.


The authors provide an overview of influenza and discuss epidemiology and surveillance, perspectives on vaccines and antivirals, and research opportunities related to universal vaccine, alternate vaccine production strategies, novel antiviral development, and continued transmission studies.


The authors modeled the effects on hospital capacity in one city of various strategies to control an influenza pandemic. They calculated ranges bounded by no interventions and all interventions for the attack rate, peak acute care hospital capacity, peak intensive care unit capacity, and mortality along with estimated economic burdens. They found vaccination, isolation, and personal protective measures to be the most effective strategies. However, all interventions decreased in effectiveness as transmissibility increased and as the outbreak progressed.


This study reviews existing systematic reviews and meta-analyses on pandemic influenza interventions including vaccines, antivirals, personal protective measures, school closures, and traditional Chinese medicine. Pandemic influenza vaccine was found to be protective against infection, but the authors found insufficient evidence for the effectiveness of each of the other interventions in isolation and hypothesized that a combination of interventions would be most effective.


The authors developed a model to estimate the effects of vaccine administration in retail pharmacies. They estimated that nationwide capacity to administer vaccines would increase to 25 million doses per week when retail pharmacies were included and that the time to achieve 80% nationwide vaccination coverage could be reduced by seven weeks.
This document provides guidance on the allocation of influenza vaccine during the early stages of a pandemic when demand may exceed production capacity. It offers general principles on pandemic vaccination and a framework based on targeted groups and pandemic severity.

**Agencies and Organizations**

Association of State and Territorial Health Officials. [Pandemic Influenza](https://www.astho.org/)

Centers for Infectious Disease Research and Policy. [Influenza](https://www.cirdp.org/)

Centers for Infectious Disease Research and Policy. [Pandemic Influenza](https://www.cirdp.org/)

Infectious Diseases Society of America. [Animal Influenza Viruses of Zoonotic Concern](https://www.iais.org/)

Supplement of The Journal of Infectious Diseases.


U.S. Department of Agriculture, Animal and Plant Health Inspection Service. [Swine Influenza](https://www.aphis.usda.gov/)

U.S. Department of Health and Human Services:

- Office of the Assistant Secretary for Preparedness and Response. [Influenza and Outbreaks](https://www.phe.gov/crises/emergencytemps/pandemicinfluenza/)
- Centers for Disease Control and Prevention: [Influenza](https://www.cdc.gov/flu/) and [Pandemic Influenza](https://www.cdc.gov/pandemicinfluenza/)
- National Institute of Allergy and Infectious Diseases. [Influenza](https://www.niaid.nih.gov/)
- National Library of Medicine Disaster Information Management Research Center. [Influenza: Pandemic Preparedness and Response](https://www.nlm.nih.gov/detinfo/)

U.S. Department of Labor, Occupational Safety and Health Administration. [Avian Flu](https://www.osha.gov)

U.S. Department of Labor, Occupational Safety and Health Administration. [Pandemic Influenza](https://www.osha.gov)

U.S. Department of Labor, Occupational Safety and Health Administration. [Seasonal Influenza](https://www.osha.gov)

World Health Organization. [Influenza](https://www.who.int)

World Health Organization. [Pandemic Influenza Preparedness (PIP) Framework](https://www.who.int)

*This ASPR TRACIE Topic Collection was comprehensively reviewed in September 2017 by the following subject matter experts (listed in alphabetical order): Eric Alberts, Manager of Emergency Preparedness, Orlando Health; Julie Bulson, DNP, MPA, RN, NE-BC, Director,
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