Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

EDITOR'S NOTE: The following article was first sent to *The Journal* as a contribution to the Notes from the Association of Medical School Pediatric Department Chairs (AMSPDC). Given the recent attention worldwide on viral pandemics such as influenza or avian flu, it was felt that a fuller discussion of the medical community's ability to handle children in a viral pandemic would be of great interest to our readers.

—Aaron Friedman, MD, Section Editor, AMSPDC

THE NEXT INFLUENZA PANDEMIC: WILL WE BE READY TO CARE FOR OUR CHILDREN?

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In October 2004, we were struck with another influenza surprise—almost half of the expected influenza vaccine supply for the United States was not available because of contamination during the manufacturing process. The Centers for Disease Control and Prevention (CDC) responded quickly to recommend that high-risk groups be given first priority for vaccine and to reroute existing vaccine stocks to areas experiencing short supplies.[1] This event occurred against the backdrop of a widespread avian influenza epidemic in Southeast Asia, described as the largest recognized to date, which re-emerged after a brief respite attributable in part to the culling of at least 100 million fowl in early 2004.[2-5]

The current H5N1 avian flu strain has spread among wild birds and also has evolved since 1997 to become more lethal to mice and more capable of spread among poultry.[6] The bird-to-human transmissions that have occurred resulted in a high mortality rate (42 deaths among 55 patients with confirmed infection in Cambodia, Vietnam, and Thailand from January 2004–January 2005).[7] Human-to-human spread of the H5N1 virus outside household contact has not been seen, but transmission within households has occurred.[8] There is concern that this strain of virus is just a point mutation—or more likely a single recombination event—away from causing the next pandemic.[9] If the worldwide influenza monitoring system of the World Health Organization (WHO) and CDC had an alert system similar to that for terrorism events in the United States, the color probably would be orange. The primary focus of this commentary is to explore our preparedness to care for children and to suggest what further steps need to be taken.

A REVIEW OF THE 2003–2004 INFLUENZA SEASON

The news of a vaccine shortage and rampant bird flu came on the heels of an annual epidemic in 2003–2004 that was moderately severe, especially among children. It began earlier than usual (October) and continued into January 2004, with widespread disease occurring in 45 states. To deal with the volume of queries and issues that arose, the CDC activated its Emergency Operating Center and reassigned staff on a 24-hour, 7-day-per-week basis. The CDC prospectively monitored mortality rates in U.S. children for the first time during this outbreak, and 152 deaths among U.S. residents <18 years of age were attributed to influenza and its known complications (particularly secondary bacterial infections).[10] Additionally, 50 children met the case definition for influenza-related encephalopathy (altered mental status lasting >1 day with onset of neurologic symptoms within 5 days of fever onset), with more than 40% having severe outcomes (death or neurologic sequelae).[11]

Influenza A viruses accounted for 99.0% of cases in the United States in 2003–2004. H3N2 strains accounted for 99.9% of the influenza A viruses, and 89% of these were antigenically similar to the drift variant A/Fujian/411/2002. Compared with the

CDC	Centers for Disease Control and Prevention	N-PIPP	National Pandemic Influenza Preparedness Plan
FDA	Food and Drug Administration	SARS	Severe acute respiratory syndrome
HCWs	Health care workers	WHO	World Health Organization

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A/Panama/2007/99 H3N2 strain (which accounted for 11% of influenza cases) that was included in the 2003–2004 vaccine, A/Fujian has 13 amino acid changes involving several antigenic sites.[10,12] Although early reports raised concerns that the 2003–2004 vaccine provided minimal, if any, effectiveness against the predominant A/Fujian strain, there was some protection: vaccine efficacy was estimated to be 25% and 49%, respectively, in 2 analyses among children, and 38% and 52%, respectively, among adults with and without an underlying high-risk condition in a case-control study.[13]

The CDC conducted a convenience survey of 221 hospitals throughout the U.S. and found that the following types of shortages occurred during the 2003–2004 influenza season: (1) 40% had inadequate vaccine supply, (2) 58% ran out of diagnostic influenza test kits, (3) 28% and 43% had too few general inpatient and intensive care beds, respectively, (4) 35% had insufficient numbers of health care workers (HCWs), and (5) 9% needed to divert patients because of bed or HCW shortages.[14] This survey did not ask about shortages of anti-influenza drugs or hospital supplies (eg, masks), but these types of shortages occurred at our hospital, as well as other health care centers.

PANDEMIC PREPARATIONS

The severity of the 2003–2004 flu season will pale in comparison with that of the next pandemic. There were 3 pandemics in the last century: the 1918 Spanish A/H1N1 influenza strain that killed at least 20 million and perhaps more than 50 million people worldwide, including many young adults, the 1957 Asian A/H2N2 influenza strain where ~70,000 persons died in the U.S. over a 2-year period, and the 1968 Hong Kong A/H3N2 influenza strain that caused the death of ~34,000 people in the U.S. in the first year.[15-17] The potential impact of the next influenza pandemic in the U.S. was modeled in 1999 by the CDC.[18] These estimates projected 89,000 to 207,000 deaths, 314,000 to 734,000 hospitalizations, 18,000,000 to 42,000,000 outpatient visits, and 20,000,000 to 47,000,000 additional illnesses. Estimates of medical costs, in 1999 dollars, ranged from $71 billion to $167 billion and did not include the indirect costs associated with disruptions to commerce and society.

On August 26, 2004, the U.S. Department of Health and Human Services, via the National Vaccine Program Office, put forth the first public draft of the National Pandemic Influenza Preparedness Plan (N-PIPP) for the beginning of a 60-day public comment period.[19] This planning and guidance is founded on efforts first undertaken in 1978 and then renewed in 1993.[16,20,21] This document, when finalized, will not be the completion of preparation (and was never intended to be such) but rather a major step forward in the process of (1) identifying issues that must be addressed at federal, state, and local levels—in both the public and private sectors and (2) providing guidance for planning and response to a pandemic.

The need for federal, state, and local public health preparation and involvement is well recognized, but public health planning efforts in the past few years, especially at the local level, have been distracted by issues surrounding bioterrorism (eg, smallpox) and emerging infections (eg, severe acute respiratory syndrome [SARS]). The N-PIPP recognizes that it is time to refocus public health efforts toward preparation for pandemic influenza and in some circumstances even to merge these efforts with those for bioterrorism and emerging infections. At the local level particularly, individuals from the multiple public agencies that will need to work together in response to each of these types of events are largely the same, and the types of issues they will be facing are highly similar, and in many instances identical (Figure).[21-24]

WHAT ABOUT PANDEMIC PLANS FOR CHILDREN?

The various problems that need to be addressed before arrival of a pandemic are broad in scope. The draft of the N-PIPP begins to address many of these issues, but as welcome and detailed as it is, there is little discussion or guidance for addressing the varying needs of infants and young children (or the very elderly). Table I provides a selected list of problems that are important for the care of children (and for adults in some cases) and potential solutions.

In terms of children's care issues, the N-PIPP does list the development of "regional surge capacity in providing care for children and adults including facilities and personnel, both in the hospital and in the community" as a priority area for upgrading the nation's health care system "to respond to bioterrorist and naturally occurring outbreaks of infectious diseases." Communities also are urged to develop real-time tracking of the number of available intensive care unit beds and medical beds for adults and children. Health care systems are encouraged to offer or expand hospital-sponsored sick care services for children of hospital staff to reduce absenteeism during pandemic conditions.[25]

The planning for specific needs of children currently is largely left to the local level. The CDC has developed 2 simple computer software modules for use as planning tools at local levels: FluAid 2.0 and FluSurge. FluAid uses population estimates for 0-18 years, 19-64 years, and 65+ years along with estimates of the percentage of high-risk patients in each age group and estimates of expected death, hospitalization, outpatient visit, and attack rates to estimate impact of influenza on a local health care system.[26] FluSurge uses population estimates for 0-17 years, 18-64 years, and 65+ years along with the number of staffed hospital beds, staffed ICU beds, and number of ventilators available to estimate total hospital demand and total deaths for specified attack rates and duration in weeks of the pandemic period.[27] These tools are works in progress but likely need to be refined at least in terms of the pediatric age ranges used (e.g., <2 yrs, 2-5 years, 5-12 yrs, and 13-18 years).

Even with "pediatric improvements" in these tools, it is not clear that many localities will have the necessary public health expertise to plan for or respond adequately to the variety

of health and social needs of young children that will arise during a pandemic, and expectations of such likely are unfair, given the relative paucity of resources in many small communities. It may be more appropriate to work on pediatric pandemic planning and response issues at regional and state levels in conjunction with pediatric hospitals and referral centers (Figure).

Under pandemic conditions, even with good planning, it will be more difficult to increase surge capacity for infants and young children than for adolescents and adults. The very young may require the presence of parents or other adults at all times, and especially when heart and pulse oximetry monitors (as well as the health care workers to respond to alarms) may be in short supply. This translates into more floor space rather than less for young patients. (Similar issues likely apply to the frail elderly.) Also, there is likely far less available "surge capacity" in terms of personnel able to care for young children than older children and adults. There also will be frequent occurrences where children have a parent(s) or guardian(s) too ill to provide care or oversight for them. In the current social structures of many families, extended family members often are not readily available to take over these responsibilities for either well or sick children.

The N-PIPP is hopeful that home health care programs may be able to fill in the gap for many "less ill" patients.[19] This may or may not be true for adults in terms of sustainable capacity at many local areas but is likely not true for infants and young children, where such resources often are minimal even under nonepidemic conditions. Many HCWs are not comfortable or lack the training or skills needed to provide basic care to young children (placing intravenous lines, assessing degree of illness, etc).

Earlier pandemic planning documents such as the "Nature's Terrorist Attack, Pandemic Influenza… Preparedness Planning for State Health Officials" guide prepared by the Association of State and Territorial Health Officials and released in November 2002[21] contains no mention of pediatric (or geriatric) health care needs. Initial state-level plans likely will mirror this and the N-PIPP, often as a matter of practicality. Indeed, the only references to children in the otherwise detailed North Carolina Pandemic Influenza Response Plan of the Division of Public Health of the North Carolina Department of Health and Human Services, released in October 2004, were those referring to determination of projections of case numbers (using FluAid 2.0) and need for hospital beds and ventilators (using FluSurge).[28]

Lastly, the medical literature also provides little guidance on influenza pandemic planning efforts for children. The results of a PubMed search are listed in Table II. Only 3 English-language articles published since 1990 have any information relevant to pandemic planning efforts for children. Two provide information about potential attack rates of among various age groups,[29,30] and one modeled effectiveness of antiviral agents by age groups.[31]

The above issues are in addition to the need for (1) more studies of vaccine efficacy in young children and perhaps development of additional influenza vaccine products (and producers of vaccine products—now standing at only 1 for children <4 years old), and (2) more studies of antiviral agents for infants. Neither the amantadine nor neuraminidase inhibitors are approved for use in infants by the Food and Drug Administration (FDA). It is past time for the pediatric community to begin to consider the needs that will likely arise and to advocate for the resources that will be required to address each of these issues (Table I).

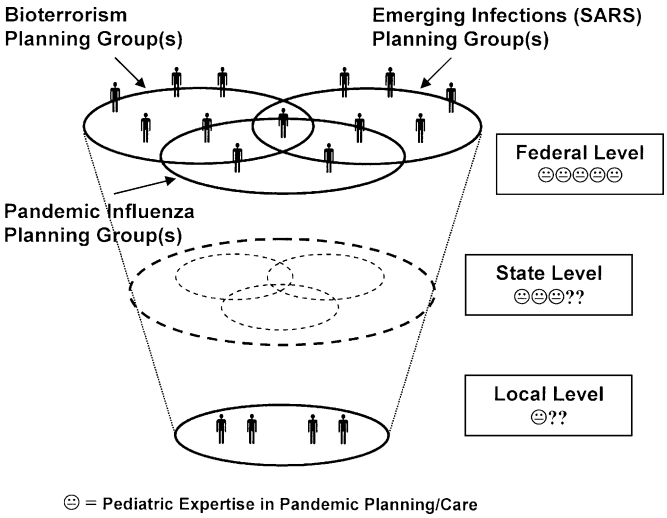

Figure. Configuration of working groups charged with planning for and oversight of responses to (1) bioterrorism events, (2) emerging infections such as SARS, and (3) pandemic influenza will, and likely must, vary from federal to state to local areas. At federal level, alignment of expertise and resources into dedicated groups that collaborate and have some overlap in membership at key agencies is likely most effective approach at this time. Configuration of state and large urban area working groups may vary depending on their specific population size and geographic characteristics, as well as expertise available in public and private sectors. At local level, those individuals from multiple public and private agencies who will need to work together in planning for and response to each of these types of events are largely the same, and types of issues they will be facing in each scenario would be highly similar, and, in many aspects, identical. Expertise in planning for and providing of care to children may not be readily available in many localities and may be unevenly distributed among states.

GENERAL ISSUES RELATED TO PANDEMIC PREPAREDNESS

A substantial further increase in funding is needed for the research and infrastructure required for an effective response to the next pandemic (Table I, Categories 1-5, 9). If insufficient new federal dollars are available to deal with influenza, then serious consideration should be given to reprioritizing the large infusions of dollars designated for other potential bioterrorism agents, where the risk of disease occurrence is far less certain. Indeed, many of the issues that must be addressed for influenza are relevant to responses to other potentially widespread emerging infections (eg, SARS) and bioterrorism agents (eg, smallpox virus).[32]

Table I. Issues that must be addressed before the next influenza pandemic[*]

Category	Problem	Potential solutions	Comments
1. Prediction and detection of the next pandemic	Difficulty in predicting which virus will cause the next pandemic	Increased research funding to better understand (1) which influenza virus genetic sequences and other factors predict virulence and (2) which virus strain(s) will circulate in a given year. See also the WHO Consultation on Priority Public Health Interventions Before and During an Influenza Pandemic.[†]	A large amount of funding currently is directed to the area of bioterrorism. Influenza causes many deaths due to natural disease and has the potential to be made into a bioterrorist weapon. Influenza research and planning should receive more funding even if it causes reprioritization of funding for other potential bioterrorism agents.[32]
2. Response coordination	Inadequate numbers of trained public health staff	Increased public health funding to hire, train, and retain additional staff at the national, state, and local levels	Additional personnel resources can be drawn from academic medical centers. Establishing networks among such persons and providing stable funding support for them for their efforts in ongoing planning efforts would be helpful. This is especially important for pediatric pandemic preparedness.
		Enhanced collaboration between bioterrorism defense, emerging infections work groups, and influenza pandemic planners.	The draft U.S. N-PIPP was released August 26, 2004, for 60 days of public comment.[19] This plan overall represents an excellent blueprint for the next stages of preparation. Greater collaboration between the various threat-response working groups is envisioned for adults, but there is little consideration of the specific needs of children in any of these arenas. Further development of the Incident Command System, or similar approaches, to facilitate interagency communications, is needed.[21]
3. Early control efforts	A. Isolation and quarantine of ill or exposed travelers from countries with initial outbreaks.	Development of protocols for travel industry, health care systems, public health departments, etc. Consideration of closing schools and limiting other places where large numbers of people congregate.[36]	Use of the precautionary principle with regard to the public health obligation to protect populations against foreseeable threats,[34] even under conditions of uncertainty, will be necessary. This application must be balanced by the principles of choosing the least restrictive/intrusive alternative, fairness and justice (both procedural and substantive).[35] Issues of child care for quarantined traveling families have received little discussion to date. Studies that assess the impact of school children on spread of influenza in the community are underway in the U.S. Additional epidemiologic studies assessing impact of other more crowded situations such as child care centers, shopping malls, and sports venues would be helpful.
	B. Prioritization plan to determine who should be the first to receive the vaccine because of the likelihood that only limited vaccine supplies will be available initially.	Rationale for vaccination prioritization plan that is transparent (eg, HCW and first responders receive high priority so that they can care for patients) Completion of a logistical plan for vaccine distribution, from sites of manufacture to sites of administration.	Federal legislation may be necessary to allow such prioritization plans to proceed unimpeded by legal challenges that might arise during the early stages of a pandemic with limited vaccine supply. Issues of children vs the elderly could arise and should be discussed. Legal provisions should be enacted before arrival of a pandemic to reduce appearances of favoritism during peak times of irrationality. A plan will need to involve all levels of public health infrastructure in collaboration with the private health sector at the local level.

Table I. (Continued)

Category	Problem	Potential solutions	Comments
4. Vaccine production	A. Current production methods requiring an egg-based system to grow virus, with a production time of about 4 months.	Use of tissue culture methods and other technology that allow for more rapid production of large quantities of influenza vaccine.	Research funding also should be provided for efforts toward (1) improved efficacy in young children, (2) vaccination of children <6 months old, and (3) new vaccines that do not need to be given on a yearly basis.
		Streamlining of the FDA process for influenza vaccine licensing and manufacturing.	This change would also help with other emerging infections with epidemic potential, such as the SARS coronavirus.
	B. Inadequate production capacity for pandemic needs.	Design and building of additional dedicated facilities.	This venture likely will require federal subsidization (eg, reimbursement for unused product) with collaboration from vaccine manufacturers and the academic medical community. The United Kingdom has drafted a business plan for a facility that can make vaccines rapidly. Canada has contracted with its private sector for capacity to produce 32 million doses in 4 months by 2006. Similar plans for the U.S. are included in the N-PIPP.[19]
	C. Concerns for potential risk to researchers working with virus strains to which they have no protective antibody.	Development of new Biosafety Level 3+ vaccine production facilities.	
5. Vaccination use and distribution	A. Logistical issues associated with attempting universal vaccination of everyone >6 mos of age.	Movement toward routine annual universal vaccination in the U.S.	Routine annual universal vaccination would provide a foundation to ensure that adequate manufacturing capacity exists to make the needed number of vaccine doses and that the logistics needed to vaccinate the entire population are in place.
			Further studies of "half-doses" for healthy adults, as well as high-risk groups as a means of extending supplies and increasing capacity should be initiated.
		Requirement for mandatory vaccination of everyone >6 mos of age during a pandemic.	A mandatory vaccination policy to be instituted during a pandemic will likely require federal legislation because of likely legal challenges and should be undertaken before the pandemic. Issues surrounding the swine flu vaccine effort in 1976 will need to be revisited and thought through.[37]
	B. Potential need for 2 doses for effective immunity against a pandemic strain.	Additional clinical studies of influenza vaccines in young children.	Much more needs to be learned about this issue. A second dose would be even more costly and logistically more difficult to accomplish.
6. Rapid diagnosis of influenza	Shortage of diagnostic kits.	Stockpiling and increased production capacity for diagnostic kits.	Shelf-life issues may require rotation of stocks. Stockpiling may require federal subsidy for manufacturers and reimbursement for expired products.
7. Antiviral agents	A. Lack of prioritization for distribution of limited supplies of antiviral agents.	Stockpiling and increased production capacity for antiviral agents.	Shelf-life and stock-rotation issues need to be determined. Stockpiling may require subsidy for manufacturers and reimbursement for expired product.
		Promotion of correct use (vs overuse) of antiviral agents (beginning in first 48 hrs of illness)	
	B. Lack of availability of antiviral agents for use in infants. (This problem is compounded by the lack of an effective influenza vaccine in infants <6 mos of age.)	Government-funded studies to determine pharmacokinetics, safety, and efficacy of anti-influenza agents in infants.	Efficacy of antiviral agents against potential pandemic strains should be ascertained, and new drugs may need to be developed.
			Under pandemic conditions, use of antibacterial agents for suspected or real secondary bacterial infections could lead to unanticipated shortages of some agents. Rapid production and stockpiling issues also may need to be considered for selected antibacterial agents.

Table I. (Continued)

Category	Problem	Potential solutions	Comments
8. Hospital resources	A. Shortage of hospital beds	Use of nontraditional in-house placements (short-stay suites, treatment rooms) as inpatient rooms.	Procedures to permit use of "non-approved" beds or facilities under emergency conditions may need to be developed, and potentially approved by legislative bodies, at state and local levels. Cooperation among local and regional institutions likely will be essential (see below).
		Plan for off-site care (eg, schools) for people requiring minimal intervention (eg, oxygen, fluids etc).	The national pandemic plan prefers use of nontraditional hospital beds and home health care first, but these resources could quickly be exhausted for adults and may not exist for young children. Protocols for temporary "wards" still need to be developed that address needs of young children, as well as adults and that include basic infection control procedures and mechanisms of handling medical waste.
		Postpone elective admissions.	
	B. Shortage of supplies and equipment	Stockpile of supplies (eg, masks, oxygen delivery materials, IV fluids) and equipment (ventilators, IV pumps).	Programs to store "retired" ventilators and other equipment in central locations would be helpful. Protocols for sterilization/reuse of normally disposed items such as face masks and plastic tubing may need to be developed. Pediatric ventilators likely would be in very short supply.
	C. Long waiting periods in emergency departments and difficulties in triage.	Develop protocols that facilitate collaboration between local health care providers and news media to provide instructions to the public as to when and where to seek help for varying degrees of illness. Those for children will differ from those for adults.	Involvement of institutional public relations and marketing personnel may be useful in development and implementation of local and regional triage plans. Points of triage may need to be moved to other sites (eg, private offices) in some communities, with expertise required for both pediatric and adult patients.
	D. Nosocomial outbreaks	Screening protocols for HCWs, family members and other visitors should be developed to help prevent nosocomial infections.	Hospital visitation policies have been greatly liberalized in recent years. Involvement of local news media may be essential to deal effectively with potential restrictions.
9. Public and private health care systems	A. Communication, coordination and collaboration between local and regional health care systems or institutions (even those competing in normal circumstances)[‡]	Establish or improve collaborations to coordinate private/public and private/private efforts, including plans to manage hospital beds and critical supplies in a collective manner.	Collaborative efforts in working with news media and responding to the public also will be critical in lessening impacts on societal functions. Tabletop exercises similar to those used in preparation for bioterrorism events may be useful planning exercises for pandemic influenza.[38,39] N-PIPP provides excellent initial guidance in this area.
	B. Shortage of staff to meet increased patient demands for health care	Development of strategies to call up retired or part-time health care workers and expand hours of care provided by existing staff.	Legislation or other administrative procedures may be required to allow for temporary circumvention of licensing requirements of various professional boards during emergency conditions.
		Development of mechanisms for sharing of employees across systems or from outpatient to inpatient facilities at the local level (which may need to be done at the regional or state level for children).	Off-service clinical faculty in medical schools, medical students, residents on nonessential rotations, nursing students, and students in other health care profession training programs represent an additional HCW resource pool.

Table I. (Continued)

Category	Problem	Potential solutions	Comments
10. Insurers	Increased patient volume stressing ability of office and insurer personnel to conduct "business as usual" and hinder efficient administrative responses‖	Suspension of approval processes to free up hospital and insurance company personnel to deal with the other administrative demands of a pandemic.	Federal indemnification of a proportion of pandemic-related costs may be necessary for financial survival of some health care systems, as well as for some insurers. Health insurers may need to explore how other insurers manage payments to those affected by large local natural disasters.

*This table includes a broad range of topics but is not considered all-inclusive by the authors. Established planning groups throughout the world have identified other problems, as well as many of the above, and are making progress toward delineation and implementation of solutions to these.
†WHO consultation on priority public health interventions before and during an influenza pandemic. April 27, 2004. *http://www.who.int/csr/disease/avian_influenza/consultation/en/*.
‡This was reasonably well accomplished in North Carolina during the 2003–2004 influenza epidemic, although the system stresses were far less than what would be present during pandemic conditions.
‖This was not a major problem in short-lived influenza epidemic of 2003–2004, but this is anticipated to be a major issue under pandemic conditions of longer duration.

Many of the influenza-induced deaths in children and adults occur in people for whom the vaccine is not routinely recommended, and this has led the Advisory Committee on Immunization Practices to begin consideration of a universal annual vaccination recommendation for everyone >6 months of age.[14] For a universal vaccination recommendation to be feasible, multiple obstacles will need to be overcome, including markedly enhancing the manufacturing infrastructure to increase the number of available vaccine doses, logistical issues related to mass vaccination within a few-month period each year, and acceptance of universal influenza vaccination by practitioners and the public (Table I, Categories 4 and 5).

Our ability to predict which strains of influenza virus will cause widespread severe disease needs improvement (Table I, category 1). There had been substantial debate about whether to include the Fujian or Panama strain in the 2003–2004 vaccine. The expert committee making recommendation to the FDA suggested that the Panama strain, rather than the Fujian strain, be included in the vaccine, mainly because of the uncertainty about which strain would predominate and whether the Fujian strain could be grown in time to be included in the vaccine.[14] Predicting whether an epizootic strain will cross the species barrier into human beings and initiate the next pandemic is even more difficult.[33] Genetic motifs that are associated with avian and mammalian virulence for some influenza strains are absent from other strains that cause severe human disease, such that inference of human virulence from animal models is not straightforward. An additional vaccine-related concern is that influenza A viruses of the H5 and H7 subtypes cannot be grown in eggs, the current standard method of vaccine production, because of the rapid lethality of these strains to chick embryos (Table I, problem 4A).[33]

A substantial international infrastructure to detect and hopefully interdict pandemic influenza has been put in place over the past 50 years. (Table III; available online at www.us.elsevierhealth.com/jpeds). The network of 110 National Influenza Centers in 83 countries allows for extensive monitoring capabilities that should provide at least several months warning of an impending influenza pandemic. The National Institute of Health has provided funding for a network of research laboratories for the study of emerging and reemerging infectious diseases.[34] It is hoped this will improve our understanding of the genetic factors and virulence characteristics of influenza viruses that will lead to improved vaccines for yearly epidemics and the next pandemic.

In the absence of a program capable of rapidly making vaccines that include the pandemic strain, the public health response will have to shift emphasis from prevention to treatment. Shortages of health care facilities, HCWs and supplies will put a tremendous strain on the ability to care for patients (Table I, Categories 6 - 9). Although stockpiling of supplies, including antiviral agents, would be helpful, it is unlikely that supply would meet the demand. Furthermore, amantadine and rimantadine are not active against some of the potential pandemic strains (eg, H5N1). This could leave us with only 1 antiviral class of drugs (ie, neuraminidase

Table II. PubMed, pandemic influenza, and children*

PubMed Search Terms and Limits	Number of articles retrieved
Influenza AND Pandemic (no limits)	644
Added limit: Human	490
Added limit: Publication Date: 1990-2004	414
Added limit: All Child: 0-18 years	52†
Added limit: All Infant: birth-23 months	19‡
Any relevance to pandemic planning for children	5

*PubMed, 1966 to present, as of October 20, 2004.
†If English language limit applied, N = 45.
‡If English language limit applied, N = 18.

inhibitors) and no treatment option for infants, because oseltamivir is contraindicated in children less than 1 year of age based on a study, done by the manufacturer, showing increased central nervous system drug concentrations in a juvenile animal model.

CONCLUSION

In the U.S. and elsewhere, we are not yet ready to respond in the ways necessary to provide medical care for the large numbers of children (and adults) who would have severe disease under pandemic conditions. As a scientific and medical community, we have been aware of some of the problems listed in Table I since the era of the 1918 pandemic (eg, Table I, problems 1, 2, 3A, 8A, 9B). Others have been under discussion since at least the era of the swine flu scare in 1976 (eg, Table I, problems 4A-C, 5A-B). Some of these we have finally recognized, or at least have had forced higher into our consciousness, by the A/Fujian epidemic of 2003-2004 (eg, Table I, problems 6, 7A-B, 8B-C, 9A).

We do have a plan on paper now, the N-PIPP, but it is a good beginning that needs to be expanded to better meet the needs of children. Do we also have the collective will to put the necessary scientific, logistical, medical, and legal preparations in place to minimize death and other individual and societal consequences of pandemic influenza when it comes? We fight a war on terrorism in part to diminish the risk of mass casualties from potential weapons of mass destruction. Pandemic influenza, poorly planned for and therefore poorly fought, would be a mass-casualty event worldwide. The key to effective intervention during a pandemic ultimately will be preparation at the local level, built on public and private sector collaboration, coordinated and supported by state and federal working groups. A wide range of pediatric expertise also must be brought to bear at the national and state levels in an effort to support response efforts for children at the local level. These planning efforts also will be useful for more effective management of other potential infectious and noninfectious scenarios causing serious widespread impact. Our time to prepare for the next influenza pandemic may well be short, for current events suggest that the pandemic clock is already ticking down.

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