Chapter 12
Planning and Managing Mass Prophylaxis Clinic Operations

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1 Introduction

Public health can be defined as "what we as a society do collectively to assure the conditions in which people can be healthy" [Institute of Medicine (IOM) 2003, p. xi]. Public health focuses not on the individual but on the population as a whole, setting it apart from the traditional healthcare system. The definition of a public health system is even more complex. It is a system that includes a network of individuals and organizations working together to create the conditions for health. It is the working together that enables them to act as a system (IOM 2003). This network can include government agencies, community organizations, healthcare providers, schools, businesses, and the media. Each network member, including local health departments, has a role to promote public health that may vary by community [National Association of County and City Health Officials (NACCHO) 2008].

An effective public health system includes the following core functions: preventing diseases, protecting against environmental hazards, preventing injuries, promoting and encouraging healthy behaviors, responding to disasters and assisting communities in recovery, and ensuring the quality and accessibility of health services (NACCHO 2003). Local health departments, the preferred term used by the NACCHO, are often the first line of defense within the public health system to support these core functions for many communities. Local health departments include all jurisdictional types and sizes. Throughout this chapter, the term "state

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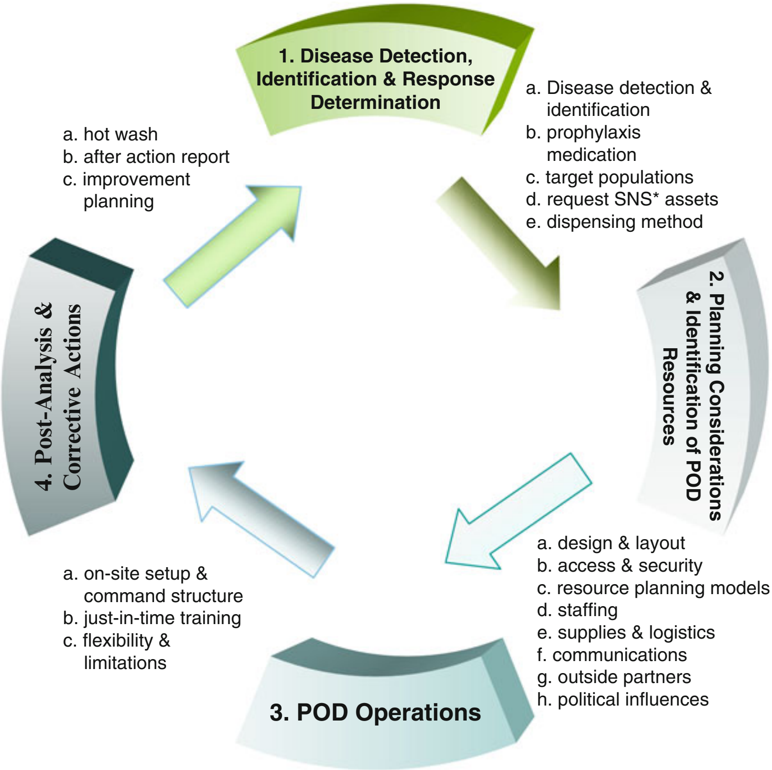

Fig. 12.1 Point of dispensing (POD) Operations Cycle. This figure outlines the four steps, along with specific processes, that public health planners work through when creating an effective efficient POD operation for a public health emergency or other public health activity. Step 1 begins at the *top* of the figure and continues clockwise through the specific processes (a–e) moving similarly through steps 2–4. (*Asterisk*) Strategic national stockpile

and local health departments or governments" is used to be inclusive of tribal health departments and governments.

This chapter will discuss the steps local health departments take to dispense medication to the public using PODs (points of dispensing) during a public health emergency or every day event, such as annual flu vaccination. The authors provide the POD Operations Cycle in Fig. 12.1 as a way to visually demonstrate the steps necessary to ensure an effective POD response. This chapter is intended to provide public health professionals an overview of the processes involved in planning and managing a POD operation from the perspective of a local public health department and local public health emergency planners (hereinafter known as "planners").

The chapter discussion applies to preparing for and responding to several public health emergency scenarios, including pandemic influenza, an aerosolized anthrax attack, a smallpox outbreak, as well as other smaller scale public health operations including annual influenza PODs. Although this chapter is written from a United

States (US) perspective, many of the concepts may apply to other countries. The authors recognize that PODs for public health emergencies and PODs for daily activities are different in scalability and urgency; however, some of the same steps can be applied to either situation. Throughout the chapter, the authors provide examples of the 2009–2010 H1N1 influenza pandemic as well as annual flu vaccine PODs to attempt to compare and contrast the two situations and the use of PODs. For more information on emergency preparedness and public health, visit the following web sites: Centers for Disease Control and Prevention (CDC) www.bt.cdc.gov and the Federal Emergency Management Agency (FEMA) www.fema.gov/areyouready.

The remainder of this chapter is organized as follows. Section 2 provides an overview of emergency preparedness and public health. Section 3 specifically addresses PODs and their role in emergency preparedness. Section 4 outlines and describes the specific steps and activities, shown in the POD Operations Cycle (Fig. 12.1), that local planners perform in POD planning and response. Section 5 discussed future research and practice challenges, including new and innovative solutions to increase the efficiency of PODs.

2 Background on Emergency Preparedness

As part of the public health system, local health departments, in collaboration with our state, tribal, and federal partners, have been charged with preparing for, responding to, and recovering from threats to public health. These threats can include acts of biological and chemical terrorism such as the dissemination of aerosolized anthrax spores or food product contamination and naturally occurring infectious disease threats such as pandemic influenza. Although predicting when and how such an event might occur is difficult, public health departments cannot ignore the possibility of events like the terrorist attacks on September 11, 2001, the anthrax attacks in 2001, the 2003 outbreak of severe acute respiratory syndrome (SARS), the 2004 earthquake and tsunami in Indonesia, Hurricane Katrina in 2005, the 2009–2010 novel H1N1 influenza pandemic, the 2010 Haitian earthquake, and the 2011 cascading disaster of an earthquake, tsunami, and nuclear event in Japan.

Preparing a nation to address these types of public health threats is a formidable challenge, but the consequences of being unprepared can be devastating. Today, with the increase in globalization, addressing health issues worldwide is critical. The ease and speed of transporting goods, services, and people across borders allows a small town or village to spread disease to the largest city in record time. The public health infrastructure must be prepared to prevent illness and injury that would result from a chemical, biological, radiological, and nuclear incident. As with emerging infectious diseases, the early detection and control of biological and chemical attacks depends upon a strong and flexible public health system at the local, state, federal, and international levels. In addition, primary healthcare providers must be vigilant to report and observe unusual illnesses or injuries.

In the USA, specific local state and federal laws and regulations provide guidance and authority to local health departments during an emergency. State laws grant powers to local governments in the form of police powers to quarantine, investigate disease outbreaks, and regulate facilities (Vinter et al. 2010). The federal Homeland Security Presidential Directive HSPD-21 names disease surveillance, caring for the sick and deceased, medical and nonmedical prevention strategies, and community resiliency critical to biodefense. The 2006 Pandemic All-Hazards Preparedness Act contains many functions of local health departments and emphasizes that local health departments and other medical first responders are critical to the response.

Local health departments undertake many roles and responsibilities during a public health emergency and are guided, in collaboration with many community and government partners, by specific federal frameworks to assure an organized and effective response. The National Response Framework (NRF) provides guiding principles for governments and their partners to provide a unified response to disasters and emergencies. Part of the NRF addresses the 15 emergency support functions (ESF) under which many local, state, and federal governments organize their resources and capabilities. ESF #8 is Public Health and Medical Services, which covers most of the functions of federal, state, and local health departments as well as other healthcare partners [U.S. Department of Homeland Security (DHS), FEMA 2011b]. Some of the core actions include assessment of public health/medical needs, health surveillance, managing mass fatalities, providing public health and medical information, managing behavioral healthcare, and protecting against environmental hazards (U.S. Department of Homeland Security 2008). In an effort to create a united response among agencies and organizations, local health departments follow the National Incident Management System (NIMS). NIMS can be applied across a full spectrum of potential all hazards regardless of size, location, and capacity of the incident (U.S. DHS, FEMA 2011a). For more information on NIMS, please visit www.fema.gov/emergency/nims/.

Federal program guidances such as the 2009 National Health Security Strategy, the 2010 Biennial Implementation Plan, and the 2011 Public Health Emergency Preparedness (PHEP) capabilities provide measures, benchmarks, and funding for local health departments to improve their PHEP capacity. In addition, CDC and state representatives conduct annual technical assistance reviews (TAR) to assess plans and to ensure readiness; these reviews use a 0–100 score system (U.S. CDC, October 14, 2011). However, since PHEP is relatively new to the field of public health, there is limited research and data regarding performance and program measures. Over the next few years, especially with the release of the new PHEP capabilities, additional data will be collected and analyzed to help inform future PHEP policies.

3 Purpose of PODs in Emergency Preparedness

If required, PODs, or points of dispensing, are a key function of local health departments in their mass prophylaxis and vaccination response to a public health and medical disaster or emergency. The goal of PODs is to medicate the population as quickly and accurately as possible to prevent morbidity and mortality. In emergency preparedness, PODs, or mass prophylaxis clinics, are the primary strategy used by local health departments to distribute medical countermeasures, such as medications (vaccine or antibiotics), to the public. PODs are also used in the everyday function of local health departments such as annual flu or routine immunization clinics. They vary in size, number, and location depending upon the jurisdiction, disease, and other factors. The annual TAR guidance requests localities to collect some baseline data which includes hourly estimated throughput, numbers of PODs, types of PODs, and levels of staffing. PODs are aimed at prophylaxis (prevention of illness), rather than at treatment (medical efforts to treat symptomatic individuals) (IOM 2008).

There are two primary POD models used by local health departments. The first is a centralized POD design in which the local health department and their partners set up several locations across a jurisdiction and ask the public to come to these PODs to pick up their medications; this is referred to as the “pull method” (Ablah et al. 2010). These could include traditional “walk-up” clinics where persons arrive one by one at multiple venues or “drive-through” clinics where cars drive up to receive medication. These clinics were popular during the H1N1 pandemic and often are used for annual flu or traditional vaccination clinics. The second design is a decentralized POD model, where the local health department and its partners would deliver directly to the public; this concept is referred to as the “push model” (Ablah et al. 2010). For example, if a target population were school children, as during annual flu season, then PODs in the schools might be the fastest method to dispense the vaccine. Local health departments may choose to use either one of these models or a combination.

In addition to using different POD models, local health departments may staff PODs using medical or nonmedical staff, or a combination. Depending on the type and scale of the incident or event, it may be necessary to use primarily nonmedical staff. For example, if the event or incident is small and manageable, primarily medical staff can provide accurate screening, triage, and exams, and could answer medical questions. If an incident is so large that it exceeds the local health department’s medical staff capacity, nonmedical personnel may be used to supplement medical staff. The nonmedical workers would be able to dispense medications and triage as appropriate but would not be able to provide medical consultation or assessments (IOM 2008).

4 The POD Operations Cycle

The POD Operations Cycle, illustrated in Fig. 12.1, demonstrates the processes necessary for an effective and efficient POD response. The first step of the cycle, which begins at the top of Fig. 12.1, is disease detection, situational awareness, and response determination. This includes an assessment of surveillance data and additional information, which will help to determine the affected population and a decision about the scope of the POD operation. The second step involves specific planning considerations that are necessary to clinic operations as well as the identification of resources necessary for the clinic. The third step is the setup and operation of the PODs. The fourth (and last) step is post-operation analysis and corrective actions, which involve capturing and analyzing the lessons learned during the clinics' operations in order to improve future operations.

4.1 Step 1: Disease Detection, Identification, and Response Determination

The first step of the POD Operations Cycle allows clinic planners to create a picture at a specific time and place to determine the type of disease (or biological agent) and to make critical decisions. The initial detection will likely occur at the local level. The detection and identification of the disease will determine the type of response which includes the type of prophylaxis medication necessary, identification of the target populations, the request for medical supplies, and the type of dispensing method(s). The order of when these processes occur may vary, and some may occur simultaneously, but the first step in the POD Operations Cycle always includes an assessment of the situation at hand and what immediate decisions need to be made in order to provide prophylaxis to the affected populations.

4.1.1 Disease Detection and Identification

Epidemiological data and information about the disease are critical when making an assessment of any outbreak, pandemic, or other biological event. Epidemiology is the study of the determinants and distribution of disease in the human population (Morton et al. 2001). Planners use epidemiological data to determine the type and size of the affected population to whom they will provide prophylaxis. During an emergency, understanding the epidemiological determinants and distribution of disease is important, and time sensitive, in order to save as many lives as possible. The populations that are of concern may be different and may change during the course of the event as more information develops about the disease or agent. In order to make the best-informed decisions about the disease and the affected populations, planners use many tools to gather and analyze information.

Disease surveillance systems at state and local health agencies must be in place and capable of detecting unusual patterns of disease or injury, including those caused by unusual or unknown biological agents. In the USA there are a number of disease surveillance systems used by states and localities to collect, report, and track reportable disease data. It goes beyond the scope of this chapter to discuss the different disease surveillance systems; however, they can differ from locality to locality, are often disease specific, and are fragmented (IOM 2003). This often makes it difficult to received timely and accurate data, particularly as it relates to a public health emergency.

Syndromic surveillance systems are of particular interest in the field of public health emergency response. They use health-related data such as symptoms which are often precursors to an actual diagnosis and may serve as a warning system. One particular system, Electronic Surveillance System for Early Notification of Community-based Epidemics (ESSENCE IV), which was designed by the Johns Hopkins University Applied Physics Laboratory and the US Department of Defense, is used by many local and state health departments. In practice, ESSENCE is an ongoing systematic collection of indicators of health status, grouped into health syndromes among a patient population. The application collects information from hospitals, healthcare providers, over-the-counter pharmaceutical sales, and school-based absenteeism reports. It applies statistical algorithms to detect unexpected changes in the data and provides the information to health officials in a web-based application [U.S. Department of Health and Human Services (DHHS), CDC 2011]. In particular, both exponentially weighted moving average (EWMA) models and autoregressive moving average (ARMA) models are used in ESSENCE.

The goals of ESSENCE are early detection of large-scale outbreaks, enhancement of traditional notifiable disease surveillance systems, monitoring the progress of recognized outbreaks, and ruling out existence of an emergency. The benefit of ESSENCE is that early detection accelerates response time; early response time reduces transmission, and reduced transmission limits incidence and mortality. During the H1N1 pandemic, ESSENCE provided planners a system to monitor the outbreak and information about the incident, including demographic characteristics of those who became ill and died from the disease.

In addition to syndromic surveillance, an additional system that planners use to identify an agent or disease is public health laboratories. The laboratory response network has been established to assist in a response to infectious diseases and bioterrorism. According to the association of public health laboratories, public health laboratories provide clinical diagnostic testing, disease surveillance, environmental and radiological testing, emergency response support, applied research, laboratory training, and other essential services to the community. There are central public health laboratories in every state, and the District of Columbia and many states have local public health laboratories as well that range in size and capacity.

Another system planners use in the USA is the Health Alert Network (HAN). HAN is a nationwide, integrated information and communication system whose goal is to strengthen state and local preparedness by serving as a platform for the distribution of health alerts, dissemination of prevention guidelines and other information, distance learning, national disease surveillance, and electronic laboratory reporting (U.S. DHHS, CDC 2001). In addition to HAN, many local health departments depend upon additional local and state systems to send and receive critical health information.

The US Department of Homeland Security's (DHS) BioWatch Program is also used by planners to help identify what is going on in the community. In 2003, the newly created DHS introduced the BioWatch Program. The program's objective is to swiftly detect specific biological agents that could be released in aerosolized form during a biological attack. BioWatch and infectious disease surveillance through the public health and healthcare systems are complementary. However, BioWatch has the potential to provide a timelier alert than the public health systems due to the quick turnaround time in reporting results. Also, the testing is focused on only select biological agents, unlike the wide range of infectious agents tested in the public health systems (Shea and Lister 2003).

Lastly the media (e.g., television, Internet, social media, and radio) serves as a tool to distribute timely information and should be monitored closely for analysis of any event. In addition, federal partners are also part of the information collection process. DHS and the U.S. DHHS are in constant communication during an incident of national importance. As one of the offices within the U.S. DHHS, the CDC plays an important role in communicating to state and local health departments the most current epidemiological data on the disease as well as providing guidance for prophylaxis medications. The CDC was critical in providing information on vaccine priority groups during the H1N1 pandemic.

In conclusion it is necessary for planners to collect and analyze data and information from many different sources in order to determine the type of event, the disease, and the affected population. This information will then be used by medical experts to determine the type of prophylaxis medication dispensed.

4.1.2 Prophylaxis Medication

As part of the assessment process, after determining the agent or disease, planners must determine the type of prophylaxis to dispense. Prophylaxis can be defined as "the prevention of or protection from disease." In public health, types of devices (e.g., condom), treatments, and medications can be referred to being prophylactic (Agnes 2005, p. 1150). Different types of diseases will require different types of prophylaxis, including vaccination and/or distribution of antibiotics. In addition to the type of prophylaxis, the route (e.g., oral, injection, and patch) and the number of doses are also important, particularly when planning for a mass prophylaxis operation.

The type, route, and dose of prophylaxis for even a common disease, like influenza, can vary. The primary prophylactic treatment for influenza is a vaccine (injection); however, since 2003 an influenza vaccine nasal spray has been available for those three years to 49 years of age (Fiore et al. 2010). In some cases, as during the early stages of the H1N1 pandemic, two doses of the influenza vaccine were initially recommended for individuals for full immunity (U.S. DHHS, CDC 2009); however, this was later reversed to only apply to children under age 10 (U.S. DHHS, CDC 2009). Another example is aerosolized anthrax, oral antibiotics, and/or a vaccine (injection) may be dispensed. Both methods include multiple doses to treat the affected population. It is important for planners to recognize that the type, route, and dose of prophylaxis, which is determined by scientific evidence from CDC, will affect the overall design, staffing, processing time, and throughput of the POD.

4.1.3 Target Populations

Planners must determine the size of the affected target population and identify subpopulations or priority groups that may be especially vulnerable or need special assistance. Local health departments often follow disease guidances developed by state and federal officials. The decisions made regarding the target populations, as well as any subpopulations or priority groups, are made based upon epidemiologic data of the disease as well as information collected from the various sources mentioned in Sect. 4.11.

An example scenario is influenza. The CDC's Advisory Committee on Immunization Practice (ACIP) meets regularly to update their annual flu guidance, which is based upon epidemiologic and clinical data and input from the general public (Fiore et al. 2009). This guidance is used to inform local and state public health officials as to the target population and priority groups for annual flu. It is important that there be a consistent message to the public about who is included in the priority groups and the reasons behind this decision. For routine annual influenza, the target populations have remained fairly constant. However, for the 2010–2011 influenza season, ACIP updated its guidance to include all persons aged 6 months and older. The previous guidance recommended annual vaccinations of adults aged 19–49 years, but the new recommendations were supported by evidence that annual flu vaccination is a safe and effective preventive strategy that could benefit all age groups (Fiore et al. 2010). The target population for annual flu is extremely large, and with enough vaccine to meet the demand, subpopulations or priority groups are not necessary.

During the H1N1 pandemic, the primary priority groups determined by ACIP were different than annual influenza. They included pregnant women, people who live with or provide care for infants, healthcare and emergency medical services personnel, people aged six months to 24 years, and those aged 25–64 who have medical conditions (Fiore et al. 2009). The epidemiological data showed that those groups were most at risk for the H1N1 virus. With limited vaccine at the time, these were the priority populations that local health departments were to target to limit morbidity and mortality.

There are challenges associated with outreach to target populations. Many populations may be resistant to receiving a vaccine. For example, despite the fact that Hispanics and African-Americans are more at risk for chronic illnesses (e.g., asthma, diabetes), influenza vaccination rates are still lower in these groups [Trust for America's Health (TFAH) 2010; U.S. DHHS, CDC, National Center for Chronic Disease and Health Promotion 2010]. Data from focus groups on the H1N1 pandemic found that some target populations felt that immunization or vaccine were not viewed as an important health issue, that the media exaggerated H1N1 as a pandemic, and that there was inadequate information on participants of clinical trials (Gist 2011). It is important for planners to be aware of cultural barriers, including concerns about receiving medication, and additional strategies may be required, i.e., public messages may need to target specific populations to inform them about the safety and importance of vaccination.

4.1.4 Request Strategic National Stockpile Assets

Once it is recognized that a significant public health incident has occurred, or is occurring, the need for supplies and resources, specifically medical, is urgent. The Strategic National Stockpile (SNS) is a national repository of medicine and other medical supplies used to supplement and resupply state and local resources. The decision to request and deploy SNS assets will be a collaborative decision made by local, state, and federal officials. The decision will begin most likely at the local level when officials first identify a potential or actual situation that they believe has the potential to threaten the health or safety of their community. The SNS supplies will be used as a supplement to state, local, and personal stockpiles (IOM 2011). The task associated with the delivery of federal SNS assets from their original warehouse location to the receiving, staging, and storing (RSS) warehouse sites and then to the dispensing sites is referred to as distribution (IOM 2008).

SNS stockpiles are strategically located in secure warehouses throughout the USA to ensure that once federal and local authorities agree that SNS deployment is needed, "12-hour push packs" of medications and/or supplies can be delivered to any designated RSS site within 12 h, while other managed inventory can be in place within 24 h of the decision to deploy. Once the SNS supplies arrive at the designated site, state and local authorities assume responsibility for the supplies and equipment and oversee storage, distribution, and dispensing (U.S. DHHS, CDC 2011).

4.1.5 Dispensing Method

After the target populations are identified and the request for supplies (either through the SNS or local or state stockpiles) and assistance has been sent, planners must select one or more methods for dispensing prophylactic medication. Dispensing involves providing prophylactic medication to the affected population in response to an incident or threat (IOM 2008). Ideally, those in the target population could obtain the prophylaxis from a web of entry points such as primary care providers, PODs, pharmacies, and other private healthcare providers. In some localities, prepositioning medications, or storing medications close to or in possession of those who need rapid access, is also being explored as another strategy in addition to PODs to rapidly distribute and dispense medication (IOM 2011). This variety of sources makes the prophylactic medication more accessible, thereby increasing the likelihood that people will decide to receive it to protect themselves.

Most local health departments have a mass prophylaxis plan that includes PODs. In an event requiring mass prophylaxis, the target population will be instructed to receive prophylactic medication using either one model or a combination of the POD models previously discussed in Sect. 3 of this chapter. The appropriate mass prophylaxis response for some disease agents, such as smallpox, may be accomplished over several days, because of the long incubation period. However, others, especially aerosolized anthrax, will require the target population to receive the first prophylactic medication within 48 h or less to minimize morbidity and mortality (Heymann 2004). The type of POD(s) and length of operation will vary depending upon the location site, the disease agent, and the size of the target population. Therefore, it is all the more important for planners to develop a scalable and flexible mass dispensing plan.

4.2 Step 2: Planning Considerations and Identification of POD Resources

After determining the type of disease and medications, requesting the SNS, targeting populations, and deciding on the dispensing method, planners move to the second step of the POD Operations Cycle. Planning considerations are made based upon information collected in the first step and include design and layout of PODs and access and security. Resource planning models can then assist to identify some of the resources necessary such as staffing and associated costs. Additional resources necessary for PODs include supplies and logistics, communications, outside partners, and political influences. Many of these planning considerations and identification of resources can be done pre-event, while others may occur during real time after the incident begins.

Throughout step 2, it is necessary to assess funding at each stage of the process. For example, during an annual influenza vaccination campaign, funding may be limited. To have the largest community impact, planners may decide to use limited resources for PODs at elementary schools to target young children, an at-risk population that can spread disease quickly within the community, along with a few selected small public PODs targeting other at-risk populations. In the case of a declared public health emergency, the Robert T. Stafford Disaster and Emergency Assistance Act states that incurred expenses may be reimbursed by the federal government; this may allow for more flexibility in providing increased outreach to the target population (U.S. DHS, FEMA 2007).

4.2.1 Design and Layout

The design and layout of the POD operation is critical. Design refers to conceptualizing the plan and purpose of the POD. Layout refers to the actual laying out (i.e., on paper or in a computer program) the design or plan to move people through the POD. See Figs. 12.2 and 12.3 as sample POD layouts. Ideally, much of the design and layout of the clinics is performed pre-event. However, in some cases, they may need to be created at the time of an event, if facilities are being occupied, renovated, or otherwise in use. The processes would be the same, but time will be a factor during real time.

There are some design elements that need to be considered. The size and dimensions of the facility must be well suited to handle large crowds and long lines

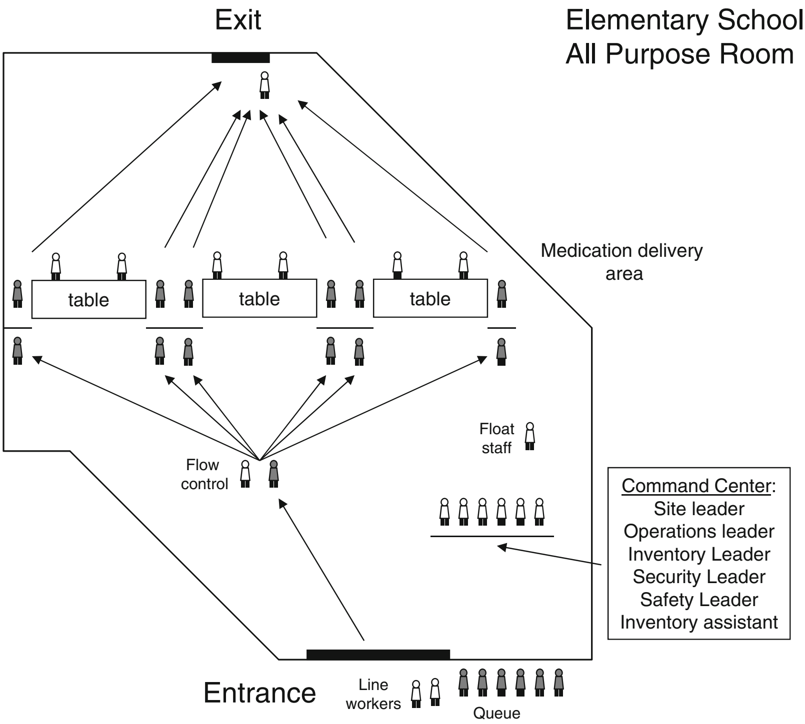

Fig. 12.2 Point of dispensing (POD) layout A. This is an example layout of a POD using an elementary school all-purpose room, with associated staff positions. The flow of the POD begins and the entrance and follows the *arrows* to the exit. This figure was created using Microsoft® PowerPoint®

of waiting people (including those with special needs, e.g., wheelchair bound and blind), preferably under cover and sheltered from the weather. Large areas inside the facility where people can receive handouts (e.g., disease and medication fact sheets and other information) will be needed. People receiving medications should enter from one area and exit from another without having to backtrack past others who are still waiting in line. Specific stations that clients visit during the process of receiving the medication will need to be designed. These stations can include greeting, triage, registration and forms completion, medical screening, education, and dispensing of medication. Some PODs have many stations, while others will have as few as two. The number of stations and staff needed may depend upon the amount of data collection or additional patient education required by local, state, and federal governments at the POD. This may not be determined until the event.

The time to serve the target populations must also be considered. When time is of the essence (i.e., it is critical to provide a target population with medication as quickly as possible due to the epidemiological characteristics of the disease), it may be better to have as few stations as possible in order to reduce the time in the

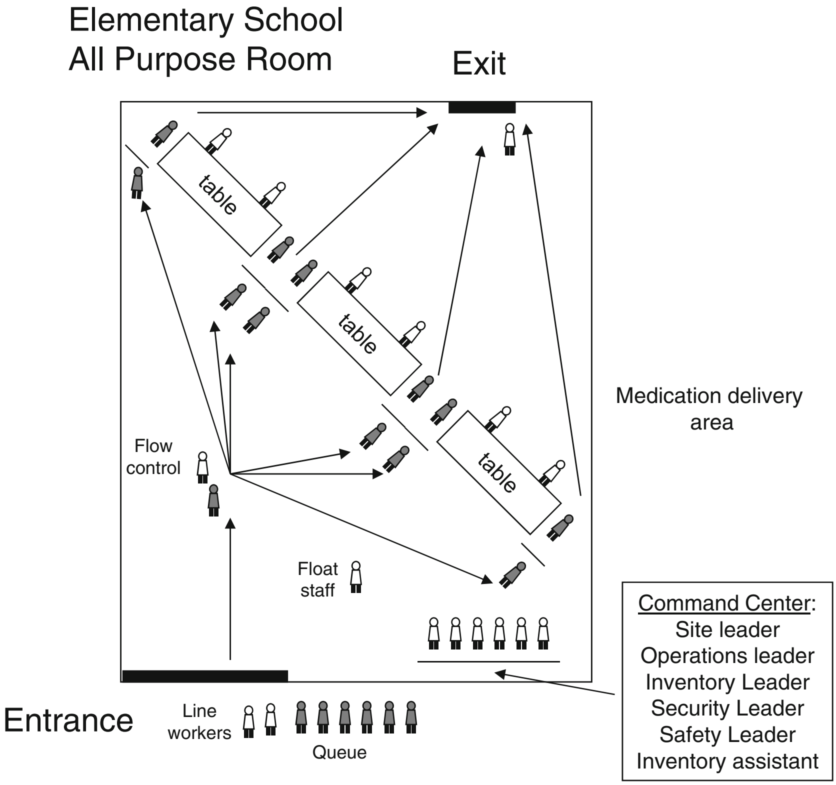

Fig. 12.3 Point of dispensing (POD) layout B. This is an example layout of a POD using an elementary school all-purpose room, with associated staff positions. The flow of the POD begins and the entrance and follows the *arrows* to the exit. This figure was created using Microsoft® PowerPoint®

POD. For an annual flu vaccination POD, it is necessary to collect paperwork and documentation on the client or resident receiving the medication; additional stations are necessary to process this paperwork, but time is not as critical as during an emergency.

Most local mass prophylaxis plans include a general POD layout which may need to be adjusted depending upon the event. This layout is intended to be flexible and may change, expand, or contract, depending upon the characteristics of the mass prophylaxis campaign (considered in the first step). This is particularly evident in the difference between annual flu vaccination POD operations and the H1N1 pandemic flu vaccination PODs, which was treated as a public health emergency. Since the volume of patients exceeded annual flu vaccination PODs, in some cases, layouts had to be reevaluated in order to accommodate additional staff and space for screening patients.

Planners should perform a site assessment, pre-event if possible, to determine each site's capacity to meet the design needs of the POD. Once the POD sites have been selected, a site-specific plan must be developed for each site. The following additional information should be collected:

- Equipment and furniture
- Staff accommodations
- Accommodations for people with disabilities or special needs
- Location of the EMS/ambulance/first aid staging area
- Number of restrooms
- Location of the medication receiving area (if necessary)
- Environmental health concerns
- Security arrangements
- The number and location of entrances and exits
- Space available for an incident command post
- Number of parking spots
- Potential traffic problems
- 24/7 contact information for the facility manager and procedures for accessing the site
- Other basic needs of the public (Phillips and Williamson 2005)

During the H1N1 pandemic, the demand for the vaccine was initially unknown. In the beginning the demand in some areas was so high that portable toilets had to be ordered and delivered in order to accommodate the people waiting in line outside the facility. An actual layout of the floor plan will need to be designed and can be created easily using paper, pencil, and measuring tape once a location for the POD operations is established.

4.2.2 Access and Security

Accessibility, time, and security are essential factors that affect the design of POD operations. Many of these decisions can be made pre-event, but again some may need to be changed or modified real time.

Flu vaccination strategies that create better access for the target population can increase vaccination rates (TFAH 2010). Issues such as providing adequate traffic flow and accommodating large numbers of people often lead local health departments to partner with local school systems to use their facilities. If the schools are in session, planners may need to consider nontraditional community venues such as community centers, convention centers, sports arenas, recreation centers, libraries, armories, churches, and private businesses. During the H1N1 pandemic, PODs were opened in schools, hospitals and large provider groups, public health departments, pharmacies, and occupational and institutional PODs (Rambhia et al. 2010). It is important to use existing places of congregation in the community that people already know and can easily access.

In order to maximize accessibility, it is important to have PODs at venues and times that best reach the target population. For example, if the target population is seniors, it may be advantageous to open PODs at senior centers or other gathering venues for seniors in the community. Working adults may prefer evening hours and drive-through PODs that they can visit on the way home from work.

Security for POD sites is a local law enforcement responsibility. It is critical for mass dispensing during a public health emergency, especially in controlling large crowds and/or in dealing with a shortage of the medications. Local planners must coordinate with local law enforcement to ensure that thorough security assessment is conducted by law enforcement on each designated POD site and that a security plan is written by law enforcement.

4.2.3 Resource Planning Models

After determining the scope and strategy of the response, planners must estimate the resources required for executing the response. Because of the scale of mass prophylaxis operations, tools such as planning models can help planners create estimates of resources, especially staffing requirements, and generate and evaluate plans for the logistics of distributing supplies. Many of the models discussed here can be used for pre-event as well as real-time planning and as an evaluation tool for POD plans. It is always important to keep in mind that models provide predictions (not guarantees), and their accuracy is limited by the quality and uncertainty of the information used to build the model. Also, in general, a key tradeoff in modeling is that models that are more accurate (i.e., they capture more details of the situation) usually require more information and more time to build and run.

Planning models are operations research models that are implemented as web sites, spreadsheets, and computer software. These models require inputs about the scope of the mass prophylaxis operation and the steps that will be performed. Many of these inputs are gathered from mass prophylaxis and POD plans or previous POD data collected. From this information, planning models estimate the staff required to operate the PODs. Some models can also estimate the congestion, which affects how long people will wait in line and how much space should be allocated for lines.

The Weill/Cornell Bioterrorism and Epidemic Outbreak Response Model (BERM) was the first widely available mass prophylaxis planning tool that performs capacity analysis to estimate staffing requirements (Hupert and Cuomo 2003). The model has been implemented as a spreadsheet and as an interactive web site. Version 2.0 is available online (http://www.ahrq.gov/research/biomodel.htm). This model simplifies the modeling process by limiting the analysis to a small number of options, which reduces the time required to build a model.

RealOPT (Lee et al. 2009) is another popular POD planning model. The RealOPT suite of models uses a combination of simulation and optimization to solve a variety of planning problems, including selecting locations for PODs, estimating staffing needs, and allocating staff to stations. RealOPT is a software application available upon request from the developers, who are based at Georgia

Tech (http://www2.isye.gatech.edu/~evakylee/medicalor/). The use of simulation and optimization requires additional computational resources but allows the tool to model many details and find automatically good staffing plans.

The Clinic Planning Model Generator (CPMG) (http://www.isr.umd.edu/Labs/CIM/projects/clinic/) is a spreadsheet-based tool that generates, for a specific POD configuration, a customized capacity-planning and queuing model spreadsheet (Aaby et al. 2006a, b; Herrmann 2008). The model allows planners to enter known population information and set time constraints specific to their applications. The immediate results include the minimum staff levels required, along with detailed POD information regarding waiting times, queue lengths, and cycle time. This approach can model a wide range of POD designs and avoids lengthy simulation runs by using queuing network approximations to estimate how long persons will wait.

Using the spreadsheet that CPMG creates, planners can easily adjust staffing levels and various inputs until they are satisfied with the efficiency of the PODs. Users can accept default values if they have little information about their PODs, or input more detailed information, such as routing probabilities and process times. Planners can use the model spreadsheets, which they have created using the CPMG, to determine the number of staff members they need to achieve the capacity they need and to design PODs that avoid unnecessary congestion. The CPMG uses data collected from POD exercises, and they have been validated by those exercises and by public health professionals.

Planning mass prophylaxis PODs also requires the close tracking of funds. This will assist local and state health departments when requesting for reimbursement from the federal government or if limited resources are available. A mass prophylaxis budgeting tool (Cho et al. 2011) allows planners to estimate the cost of operating a POD. The model includes setup costs, labor costs, supplies and materials, and facility costs. The model requires the user to enter data about the resources required and their value. Based on this data, the model aggregates everything to determine the overall cost of the POD, with costs by activity.

4.2.4 Staffing

Staffing is one of the largest challenges for local health departments when planning PODs. Considerable pre-event planning must be devoted to recruiting, training, and maintaining sufficient numbers of POD staff and volunteers to open and operate the PODs. Many local health departments will depend upon government employees, Medical Reserve Corps members, and other medical and nonmedical volunteers to serve as staff in PODs. As described above, planning models can be used to determine the number of direct service staff (i.e., those who provide the medication to the resident) to assure maximum capacity and to prevent unnecessary bottlenecks. The non-service-related staff (i.e., those who oversee the POD operations, assist with line direction, and serve as replacements) also need to be determined by planners.

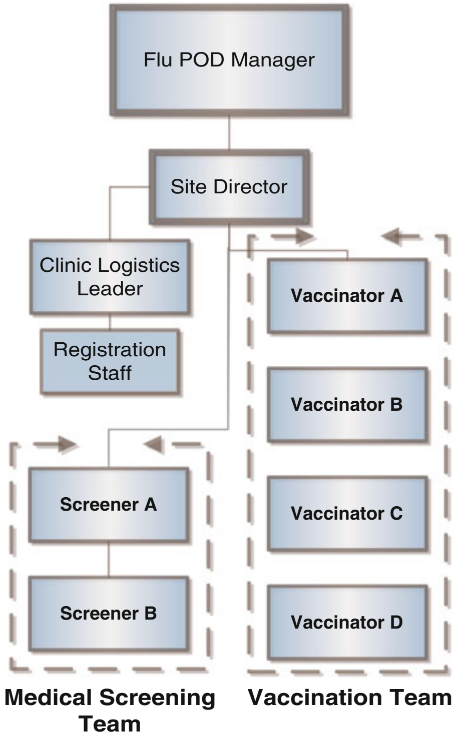

Fig. 12.4 Point of dispensing (POD) organizational chart small venue. It includes suggested staff for a flu clinic serving 300–500 clients. It might take place at a medical clinic or other small site

The NIMS or Incident Command System (ICS) provides a structure to assure a clear chain of command, communication, and supervision and includes the functional areas of finance, logistics, operations, and planning. ICS is the on-site structure used at the scene of an event (U.S. DHS, FEMA 2011c). Because the public health functions during an emergency are much more complex than they are during typical public health activities and require collaborating with many different agencies and disciplines, having a common structure like the ICS is key to the function of the response, which include PODs (Landesman 2001). POD plans should include detailed ICS organizational staffing charts for use in emergencies, and it may be necessary to include other agencies, such as law enforcement, to demonstrate a unified response. For annual flu vaccination PODs and other nonemergency PODs, a modified version of these organizational charts can be used. Nonemergency POD operations provide an ample opportunity to practice using the ICS structure and NIMS. A sample organization chart for a small venue (300–600 clients) flu vaccination POD is seen in Fig. 12.4; a large venue (5,000–7,000 clients) flu vaccination POD is seen in Fig. 12.5.

During a large public health emergency, once their staffing resources have been exhausted, local health departments may need additional staff from other organizations such as colleges, universities, and community-based organizations (e.g., Rotary Clubs, Lions Clubs, sororities and fraternities, professional associations,

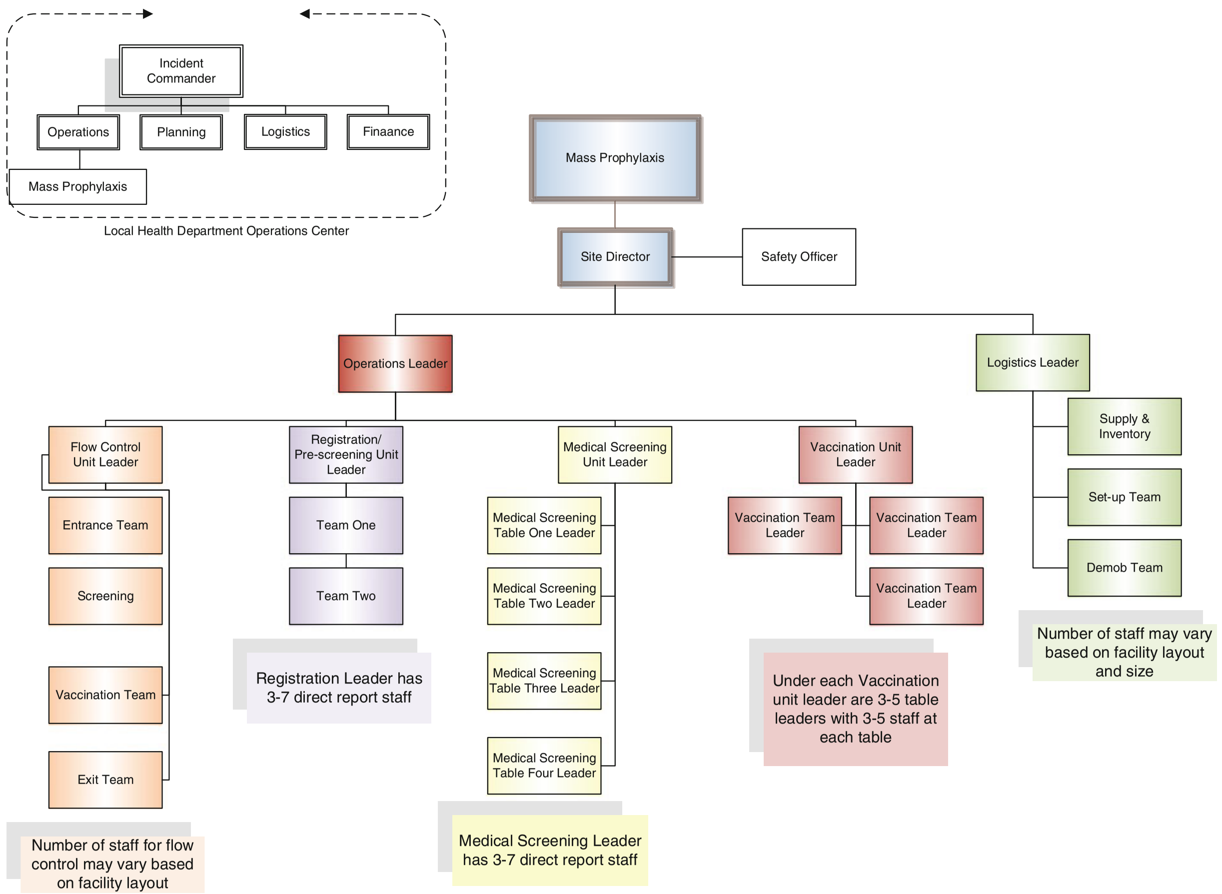

Fig. 12.5 Point of dispensing (POD) organizational chart large venue. It includes suggested staff for a flu clinic serving 5,000–7,000 clients. This might take place at a large school, university, or other large facility

faith-based groups, and private industry). Formal agreements (e.g., memoranda of understanding or agreement) should be in place in advance so that this type of mutual aid can be requested and provided promptly.

Once the positions and duties are determined, staff must be told where and when to report to duty. This can be accomplished through notification methods (e.g., phone trees and electronic alert systems) that contact staff at any time, including outside normal hours. Call down drills that test core leaders and workers should be conducted at least quarterly, and improvements should be made prior to the next test.

Finally, planners should create a detailed staffing schedule for multiple shifts if necessary. As part of their POD plan, the planners should be encouraged to develop procedures for the care and feeding of the POD staff and volunteers.

4.2.5 Supplies and Logistics

The demands placed upon a local health department to manage supplies and logistics can be overwhelming. Some of the supplies will arrive real time (e.g., vaccine); however, supplies may also be stockpiled (e.g., gloves, alcohol wipes, antibiotics) as part of the pre-event planning. Planners should determine how much medication to order or to request. During annual flu season, supplies and medication may be ordered using existing contractual services within the health departments. The actual amount of annual flu vaccine may be determined by the amount of funding available (i.e., federal, state, and local funds) to purchase vaccine and by the demand from the previous flu season.

The trucks that will move supplies from the RSS, which may be overseen by the state or local health department, to the PODs will follow routes determined by the planners or the trucking company (if one is used). Planners at the state or local level will want to create routes that are short and require little time to distribute the supplies while taking into account the capacity of the trucks (how much they can carry) and the requirements for supplies at each POD. CDC has made available the TourSolver software to assist with this planning task (C2Logix 2011).

During a pandemic influenza situation, where there is a declared emergency, the vaccine supply chain will require the federal government to deliver medications to state health departments which in turn distribute them to the local health departments. During H1N1, localities were solely dependent upon this vaccine supply chain. Vaccine deliveries were sporadic and limited, and challenges arose such as the wrong size needles and syringes were provided and the vaccine required refrigeration. These were real logistical challenges for local health departments.

In addition to medication, other medical supplies (e.g., needles, alcohol wipes, and gloves) need to be considered as well as the removal of hazardous waste. Supplies for staff such as vests for identification, directional signs, communication tools (e.g., walkie-talkies), printed materials for the public (e.g., screening forms, drug/vaccine information), and other event-specific materials should also be included. Local health departments should have an inventory system that is used to ensure that other supplies are easily accessible and on hand for the POD. These supplies may be stockpiled at a specified location and rotated on a regular basis after use.

4.2.6 Communications

Public messaging and risk communications, communicating to the public the true health benefits and health risks, is important in planning for a POD operation. In assessing resources, some messages may have been created prior to the event and are part of an overall risk communications plan. The primary communicators with the public are the public information officers at the state and/or local levels. They are charged with ensuring that messages address the target audience and utilize communication methods commonly used among that population. For example, during the H1N1 pandemic, some planners used bus advertisements, designed and field tested by the CDC, in specific county locations to encourage the African-American community to get vaccinated. It is important to communicate clear and concise messages to the public about who is at risk (i.e., target populations) and what preventive measures can be taken (i.e., flu vaccinations). Public information messages should be developed to inform the public that symptomatic persons should not go to a POD to receive prophylactic medication but to seek medical treatment at hospitals or other facilities or from their private physicians. During annual flu vaccine campaigns, the federal government provides public service announcements to encourage the public to get vaccinated; state and local efforts focus more on providing information on when and where to receive the vaccination (Rambhia et al. 2010).

In addition to risk communication, communication between staff and agencies is a critical function. In order to ensure that appropriate and accurate information is being shared with the public and/or internally between agencies and staff, the State and Local Emergency Operations Center or a Local Health Department Operations Center serves as the primary communicator of messages to operations staff during an emergency. During an annual flu event, using the ICS structure, the incident commander or operations section chief may serve as the primary communicator of messages. To ensure successful communication during normal and emergency operations, information technology support is important. To support an effective emergency response, the following items must be in place in all Operations Centers: primary power and back-up power, computers with controlled access and security policies, telephone (cell and landline) systems, radio systems, and information technology staff to support these devices.

4.2.7 Outside Partners

Planners must assess the resources and capabilities of outside partners. During pre-event planning, when no PODs are operational, local health departments should collaborate on some level with outside partners in the community on emergency preparedness activities. During a mass prophylaxis operation, these partners (e.g., the Medical Reserve Corps, Emergency System for Advance Registration of Volunteer Health Professionals, Community Emergency Response Teams, volunteers, community-based organizations, pharmacies, faith communities, healthcare organizations, the American Red Cross, and others) may be able to assist by providing resources for the response.

In some cases local health departments may partner with businesses (e.g., retail chains, large employers, banks, drive-through businesses) or healthcare organizations [e.g., Health Maintenance Organizations (HMO) and private PODs] to provide a POD operation. Most hospitals will not serve as public PODs because of the increase in the number of emergency room visits; PODs will hopefully divert those who are not ill. During the H1N1 pandemic, an increased number of state and local health departments used pharmacies to administer vaccine [Association of State and Territorial Health Officials (ASTHO) 2009]. That partnering with pharmacies during H1N1 opened the door for local and state health departments to continue the relationship for future emergencies. Outside businesses and organizations may assist with staffing, outreach to at-risk populations, physical facilities, security, storage of supplies, and other logistical support (IOM 2008).

4.2.8 Political Influences

Political influences are a factor during a POD operation. Sometimes these can be predicted, but sometimes they cannot, and political considerations may trump public health concerns. Politicians must make critical policy decisions with limited information and in a short amount of time in a public health emergency. During the H1N1 pandemic, many jurisdictions closed schools for days and weeks in attempting to contain the disease; however, there continues to be ongoing political and scientific debate over whether the effectiveness of this strategy outweighs the greater economic impact (Cauchemez et al. 2011; Lempel et al. 2009; Jackson et al. 2011; Gift et al. 2010). It is important to be aware that some decisions made prior to, during, and after the POD operations may be solely or partially based on political influences.

4.3 Step 3: POD Operations

POD operations begin in step 3 of the POD Operations Cycle. The POD operations will last for one or more days depending upon the scope of the mass prophylaxis campaign. Annual flu vaccination POD operations are approximately 1–3 months, depending upon public demand and the availability of vaccine and resources. During the H1N1 pandemic, POD operations began in September 2009 and continued beyond May 2010. The schedule of the PODs changed as public demand and the availability of vaccine changed. POD operations will generally flow more smoothly if sufficient time (pre-event) is allocated to the planning considerations and identification of resources discussed in the above section.

4.3.1 On-Site Setup and Command Structure

POD staff should arrive at the POD location several hours prior to the start of POD operations to set up the POD. If the POD is large and will be open for many hours, it may be useful to staff a setup team and a demobilization team to perform these tasks in order to prevent fatigue among the staff working the first and last shifts. The staff should utilize the detailed POD layout and design that was created from the site assessment and floor plan of the facility during step 2 of the POD Operations Cycle. Tables, chairs, directional signs, and supplies should be positioned correctly according to the POD layout.

Staff not participating in setup activities should arrive before the start of POD operations to sign in and receive just-in-time training for their POD duties and assignments. There may be last minute reassignments due to absences or other changes.

For most POD operations, the NIMS model is utilized in order to ensure clear leadership roles, delegation of duties, chain of command, personnel reporting system, identification of personnel, and record keeping (Phillips and Williamson 2005). On site the staff follow the ICS communications structure in that there is only one person who oversees the operation and no one supervises more than five direct staff. It is important to note that the ICS structure is flexible and is used for a variety of incidents across all levels of nongovernmental and governmental organizations and many different disciplines. Everyone who is part of the response effort should be trained in the basics of NIMS and the ICS structure (U.S. DHS, FEMA 2011a, c). Please refer back to Sect. 4.2.4 for sample POD organizational charts.

Off-site command personnel will depend upon the size of the entire POD operation. A command post will be set up on site at a predesignated location. The POD leaders will oversee operations from the command post.

4.3.2 Just-in-Time Training

Before the POD begins serving the public, it is important to provide just-in-time training to staff, usually led by the team leaders to the service staff. Ideally, all staff should have received training, participated in an exercise or previous PODs, or received information on POD operations prior to the event, but this may not happen. Therefore, it is important to plan for and implement just-in-time training immediately before a POD operation to ensure that all personnel, including those from outside organizations, are able to participate fully. Effective just-in-time training can help staff to:

- Increase their knowledge of the duties they are being asked to perform, which may be different from their normal tasks
- Feel more confident to perform these duties in an unfamiliar environment and under high-stress circumstances
- Work better with unfamiliar people and clients

Just-in-time training has been shown to be effective if it supports the responder, provides opportunity to practice, and takes into account the cultural environment (Cress et al. 2010).

4.3.3 Flexibility and Limitations

Once the POD is open to the public, there will be challenges. Planners should recognize this and realize that no one plan can address every possible challenge. The important thing is to be flexible when trying to solve problems. For example, if a queue of people has formed outside the POD, ask those in the line to fill out the paperwork while they are waiting (rather than when they arrive at registration).

Some challenges require solutions that cannot be implemented feasibly during operations. Planners should note such problems and analyze them thoroughly afterwards.

4.4 Step 4: Post-analysis and Corrective Actions

The fourth (and final) step of the POD Operations Cycle involves capturing lessons learned and identifying next steps. This includes the things that worked well during the POD operation and the challenges. This step is an important opportunity for local health departments to learn and to document how they will improve their mass prophylaxis plans in the future.

Many state and local governments are strongly encouraged to follow the Homeland Security Exercise and Evaluation Program (HSEEP) standards (https://hseep.dhs.gov). HSEEP is used to provide a standardized policy, methodology, and language for designing, developing, conducting, and evaluating all exercises. However, some of the templates can also be adapted for actual events (Montgomery County, Maryland Advanced Practice Center for Public Health Preparedness and Response 2007). After-action reports developed by state and local health departments for the H1N1 pandemic as well as annual flu vaccination PODs were created using HSEEP standards.

4.4.1 Hot Wash and After-Action Report

Although a hot wash is usually conducted after an operations-based exercise, many local health departments and other emergency responders also find it useful after a real event. A hot wash is a facilitated discussion that allows participants in the POD operations to engage in self-assessment of their roles and responsibilities and to help form an overall assessment of the response. Ideally, the hot wash is conducted soon after the POD operation is complete, preferably the same day while information is still fresh, and by a facilitator who was not part of the operation. The facilitator works to ensure that the discussion is constructive and brief and focuses on both the strengths of the operation and the areas for improvement. Some local health departments may develop evaluation forms that can be distributed to all participants, while others may choose to designate someone to take notes during the hot wash discussion. The HSEEP standards provide a template for the hot wash minutes. Whatever form this review may take, it is imperative to document this information in order to include it in the after-action report (AAR) (U.S. DHS 2007).

The AAR serves as the primary documentation of what happened during a POD operation. The AAR describes what happened, outlines best practices or strengths, identifies areas that need improvement, and suggests recommendations for improvement (U.S. DHS 2007). The HSEEP standards provide a template for an AAR and specific requirements including an improvement plan.

4.4.2 Improvement Planning

Improvement planning is the final piece of an effective POD operation. Planners should use the recommendations recorded in the improvement plan in the AAR and put them into action. A facilitated after-action conference can be used to bring together all the agencies and organizations involved in the real event to first identify the corrective actions and second who and by when they will be completed. Concrete corrective actions are then prioritized, tracked, and incorporated into a continuous quality improvement plan. Many of the actions may require changes in POD operations plans, fine-tuning policy and procedure manuals, or partnering with additional organizations to acquire additional staff. It is crucial to begin to implement these recommendations in order to improve POD operations in the future.

5 Future Research and Practice Challenges

Although PODs remain the primary means for local health departments to administer prophylactic medication to the population, there are additional modalities being studied. Other modalities, such as MedKits, the US Postal model, and stockpiling of pharmaceuticals, are critically important to explore, especially for other diseases or agents when time is of the essence. These modalities could be used by local jurisdictions to support POD operations by closing gaps and increasing access. In addition, there are new and innovative technologies that local health departments have developed in order to improve efficiency of PODs. In the remainder of this section, the authors discuss opportunities for future research, and practical challenges to be overcome, related to these additional modalities.

5.1 Additional Modalities to Support PODs

In 2006 the CDC partnered with the Missouri Department of Health and Senior Services to conduct an 8-month evaluation on the effectiveness of using MedKits as another means of providing timely medication to the public during a public health emergency. MedKits is a concept that prepositions medications, in this case antibiotics for anthrax, in individual households. The MedKit concept was developed in collaboration with the Food and Drug Administration (FDA) and met all federal and state regulatory requirements. For this research study, approximately 4,076 households participated, mainly from St. Louis City, St. Louis County, and St. Charles County. Each household was asked to maintain a MedKit in the home as directed and to reserve it for emergency use. Results found that 97% of the study respondents returned their MedKits upon completion of the study; 75% of the respondents reported that having the MedKit in their home increased their awareness to prepare for a public health emergency and the majority, 94% or more of each cohort, acknowledged that they would like to have a MedKit in their homes (U.S. DHHS, CDC 2007). The FDA and CDC continue to explore MedKits as one of the different modalities for increasing the nation's capacity to respond to a public health emergency requiring medical countermeasures.

In 2009 President Obama issued an Executive Order which directs DHHS, DHS, and the US Postal Service (USPS) to establish a model that allows postal workers to deliver medicine directly to residences. The Postal Model, as it is known, serves as another modality for states, cities, and counties to use to enhance their existing mass prophylaxis plans [U.S. DHHS, Office of the Assistant Secretary for Preparedness and Response (ASPR) 2011]. Funding was provided to localities in 2011 to test specific components of the model.

Currently, additional medical countermeasure modalities are being explored by federal government officials. The priority is to study strategies that can increase local access to lifesaving medications in a timelier manner. One strategy involves prepositioning medications. This could be caches of pharmaceuticals stored at or near where they will be dispensed such as workplaces, pharmacies, and other healthcare facilities (IOM 2011). Another strategy is prepositioning or predispensing of medications with first responders as a strategy to increase the response time to biological or chemical emergencies (U.S. DHHS, CDC 2007; IOM 2011). The September 2011 Institute of Medicine Report, *Prepositioning Antibiotics for Anthrax*, describes in detail the pros and cons of these strategies and encourages more research if the potential benefits outweigh the potentials risks and increased costs (IOM 2011).

It is important that local as well as federal and state health officials continue to research, evaluate, and share additional strategies that can be used to support POD efforts. PODs should be viewed as only one strategy state, local, and tribal jurisdictions can use to quickly and effectively dispense medical countermeasures to their populations.

5.2 Using Technology to Improve POD Functionality

Federal, state, and local health departments continue to create best practices and develop innovative ideas and solutions to improve the overall function of PODs. The following are examples of innovative ways local and state health departments are exploring technology to address POD functionality, specifically bottlenecks or congestion of people in PODs.

One innovative practice is the use of handheld devices to perform the screening. The Montgomery County, Maryland Advanced Practice Center, and the University of Maryland have studied this possibility using personal digital assistants (PDAs), Blackberry®, and iPhone® devices. They have developed a basic patient screening for both anthrax and hepatitis A scenarios. The PDA version was field tested in 2009 during an actual drive-through clinic in Tarrant County, TX, for a hepatitis A vaccine. The results found that screeners using the PDA screening were two times faster than those using the traditional paper screening (Tarrant County, Texas Advanced Practice Center 2009). More information about this project can be found at http://www.isr.umd.edu/Labs/CIM/projects/clinic/.

The Bay Area Mass Prophylaxis Working Group (BAMPWG) in California has created an online screening form for anthrax prophylaxis based on the concept that residents can easily prescreen themselves for medications prior to arrival at a POD (see http://www.bayareadisastermeds.org/). The residents answer a limited number of questions for up to 20 people then receive a printout of which resident should receive which drug, along with dosing instructions, if applicable. The site, pretested with 8,000 people per minute, was created in web-based software that can be modified easily by the BAMPWG. Some of the benefits in using an online screening form are that residents can go directly through an “express” route at the POD and that throughput increases at the POD by reducing the number of people who need to go to screening (Relucio and Pine 2010).

Another online screening form used during the H1N1 pandemic was developed by Yolo County Health Department, California. Created in order to ease the screening process for staff and to increase throughput at the POD, it was field tested in 2008 at three exercises and used real time during the H1N1 pandemic. The health department had anticipated approximately 10% of the population would arrive at PODs with printed screening forms including answers to questions as well as identifying the medication. In testing, it was found that 11.4% utilized this process. In the future Yolo County is considering having the screening tool available in other languages and compatible with smartphones (Carey 2010). Strategies that use technology and innovation are the future. As resources are reduced, it only makes sense to utilize these strategies to improve POD functionality.

6 Conclusion

Planning and managing a POD operation is an important function for local health departments in conjunction with local county government and community partners. The POD Operations Cycle represents the steps and activities associated with organizing a successful operation. However, it should be remembered that the Cycle is meant to act as a guide only and that it is important for plans and operations to be scalable and flexible. The importance of including lessons learned and follow-up on improvement plans for real events and exercises is vital to improving response efforts.

As the threats become more complex, the response effort by local health departments will continue to remain a challenge. The use of technology and innovative solutions to tackle these challenges will improve the planning and response to these threats.

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