
Local Variation In Public Health Preparedness: Lessons From California

Even in California—one of the best-prepared states—much work remains to ensure preparedness for a public health emergency.

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ABSTRACT: Since September 2001 Congress has allocated approximately \$3 billion to strengthen the public health infrastructure. To achieve this goal, the U.S. Centers for Disease Control and Prevention (CDC) allocates funding to states, which distribute funds to local jurisdictions. Evidence-based measures to assess public health preparedness are lacking. We used an expert-panel process to develop performance measures, based on the ten essential public health services. We developed and conducted tabletop exercises in California to evaluate preparedness to detect and respond to a hypothetical smallpox outbreak based on those measures. There was wide variation of readiness in California. While the sources of variation are often different, common infrastructure gaps need to be addressed.

SINCE THE 1988 INSTITUTE OF MEDICINE REPORT, *The Future of Public Health*, the “disarray” of the U.S. public health system has been broadly acknowledged.¹ The impressive achievements of public health during the past century and their accompanying improvements in longevity created a sense of complacency about the underlying public health infrastructure, which has deteriorated markedly during the past twenty-five years. The U.S. Centers for Disease Control and Prevention (CDC) declared in 2001 that the U.S. public health infrastructure remains “structurally weak in nearly every area.”² Not until the 11 September 2001 terrorist attacks and the subsequent anthrax attacks were any large-scale investments made in the public health infrastructure.

Since then Congress has allocated approximately \$3 billion over a three-year period to strengthen the infrastructure, largely through programs administered

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by the CDC that are focused on public health agencies.³ A companion program, administered by the Health Resources and Services Administration (HRSA), addresses hospitals' preparedness. Although these programs were intended to improve public health preparedness, especially the ability to detect and respond to a bioterrorist attack, an additional goal was to improve public health systems' ability to address other threats to health more generally, particularly those related to infectious diseases. The CDC's Bioterrorism Supplemental Funding Cooperative Agreement was developed to "ensure that all state and local public health organizations have a strong infrastructure and are prepared to respond to bioterrorism, outbreaks of infectious diseases, and other public health threats and emergencies through comprehensive planning, training, and evaluation."⁴ Funds from this program are allocated to states, which in turn are responsible for passing funds along to local jurisdictions.

In the first two years of this investment, in response to a set of mandates (critical benchmarks) from the CDC that are intended to strengthen public health preparedness, state and local public health agencies have developed preparedness plans. Assessing their progress has been hampered by several factors, including the different ways that public health is organized. There are approximately 3,000 local health departments, with varying size, structure, relationship to their state agencies, scope of responsibility, and constituent population.

Although there is broad agreement about some functional responsibilities of public health, there are widespread differences in the specific roles played by individual state and local public health departments. Nearly all would agree that public health agencies should be prepared to deal with a large-scale infectious disease outbreak or a bioterrorist event. However, there is little agreement regarding key elements of preparedness or how to measure them. Many elements in previously proposed measures are not easily measurable, and the evidence base underpinning most of the elements is weak.

The absence of well-established measures of performance for public health systems is not unique to preparedness. Although limited performance measurement for local public health departments dates back to the 1940s, it has not been as widely accepted in public health as in personal health.⁵ The field of measurement in the quality of medical care has been growing since the 1960s; despite its shortcomings, it is still more firmly established than performance measurement in public health.⁶

The Trust for America's Health (TFAH), a not-for-profit public health advocacy group, used an expert-panel process to identify an initial set of key indicators with which to judge the preparedness of state public health departments. TFAH recently published its first statewide rankings based on these indicators and found wide state-to-state variation in the status of the public health infrastructure.⁷ California was one of four states in these rankings' top tier.

In late 2002 RAND was asked to identify gaps in California's public health in-

frastructure, focusing first on public health preparedness against infectious disease outbreaks. Because there are no standards for what the public health infrastructure should look like or established methods for its assessment, we developed and applied a combination of methods to examine public health preparedness in California. We chose the framework of the ten essential public health services (EPHS) for our work because these were developed by the public health community (Public Health Functions Steering Committee, 1994) and endorsed in the recent IOM report, *The Future of the Public's Health in the Twenty-first Century*.⁸ This framework does not specify programmatic activities; rather, a given public health program is likely to have activities associated with each EPHS. In this paper we briefly describe how we tried to measure performance on each of the essential public health services and the methods we developed and used to assess local public health agencies' preparedness. We also report our key findings.

Study Methods

■ **Identifying an interim set of measures.** The study protocol was approved by RAND's Human Subjects Protection Committee. First, we reviewed existing measures of public health preparedness. This review documented both the lack of consensus regarding how to measure public health preparedness and the lack of evidence to support most of the performance measures.⁹ We identified the measures common to more than one instrument and added to them the Critical Benchmarks for preparedness developed by the CDC and HRSA. We organized these measures according to the EPHS to which they were most related. We used an expert-panel process to assess the importance and feasibility of measurement for each item. The nine-member panel comprised content experts in public health measurement, organization and finance, community relationships, media, occupational health, and emergency response, and it included representatives from the medical and public health practice communities. Panelists rated both importance and feasibility of measurement on a 1-10 scale, with 10 being the most important. We eliminated measures scoring 7 or below on importance and retained measures scoring 5 or greater for feasibility, because these cutoffs represented natural break points in the scoring for each component. We used these as an "interim" set of measures, designated as such because widespread agreement about a final set of measures will require a more robust evidence base. These measures helped guide the site visits and exercises described below. Representative measures appear in the first column of Exhibit 1.

■ **Study sample.** We focused our assessments on the local level.¹⁰ We requested participation from eight jurisdictions covering the spectrum along several dimensions: geography (urban, rural, and border status), population size (large, medium, and small), demographics (especially ethnicity and socioeconomic status), and organizational status (independent, contracts public health functions back to the state, and receives funding directly from the CDC). Seven agreed to participate. Together these seven jurisdictions contained 39 percent of the state population.

EXHIBIT 1
Examples Of Key Essential Public Health Service (EPHS) Performance Indicators And
Of Differences And Similarities Across Seven California Jurisdictions, 2003

Key EPHS performance indicators	Differences across sites	Similarities across sites
<p>EPHS 1: Monitor health status to identify community health problems</p> <p>Number of hours per week that a public health professional is available to receive emergency calls</p> <p>Ability to receive reports of reportable diseases electronically</p> <p>Availability of baseline data to compare new diseases to baseline rates</p> <p>Conducting of regular community health assessments</p>	<p>One site would take several days for cases to be noticed and come to attention of health department</p> <p>One site is so small that it seems unlikely that any case would escape knowledge of the health department for very long</p> <p>Only two sites have done recent community health assessments and have good knowledge of where their vulnerable populations are</p> <p>Two sites have set up syndromic surveillance capacity of some kind</p>	<p>All sites report ability to receive case reports around the clock; no system has been tested</p> <p>In all sites, outreach to physicians and hospitals to increase surveillance is under way</p>
<p>EPHS 2: Diagnose and investigate health problems and health hazards in the community</p> <p>Capacity to contact community hospitals and physicians to initiate active surveillance</p> <p>Adequate numbers of trained staff to investigate a serious infectious disease outbreak</p> <p>Capacity to begin investigating a report of a possible infectious disease outbreak within 12 hours</p>	<p>One site can reach more than 90 percent of community physicians via e-mail to begin active surveillance</p> <p>Three sites can use blast fax to contact local hospitals and emergency departments but have limited capacity to reach practicing physicians</p> <p>One county seems to lack basic knowledge of how to begin an investigation</p>	<p>All could begin an investigation within 12 hours and are confident in their ability to investigate a small number of cases; all but one are limited in their ability to handle larger numbers; most would rely on "just in time" training of other staff for investigation</p> <p>All but one reported significant lab equipment and personnel shortages</p>
<p>EPHS 3: Inform, educate, and empower people about health issues</p> <p>Availability of designated local public information officer (PIO)</p> <p>Presence of contacts with the local media</p> <p>Presence of robust channels of communication to minority groups in the community that can be used in a public health emergency</p>	<p>Four sites would notify the public as soon as a suspicious case was taken seriously; three would only notify the public after a diagnosis was confirmed</p> <p>Two sites have strong relationships with media, and two have weak relationships</p> <p>One site has strong relations with a large number of minority-serving community organizations</p> <p>One site provides public messages and information in nine languages; one provides information in English only</p>	<p>All sites have access to a PIO, but most are not in the health department</p> <p>Five sites are limited in their capacity to reach minority groups, especially non-English-speaking populations</p>
<p>EPHS 4: Mobilize community partnerships to identify and solve health problems</p> <p>Presence of an effective system for getting information to and from health care providers and law enforcement officials</p> <p>Evidence of community-based organization in preparedness planning</p>	<p>Two sites do substantial outreach to physicians and infection control practitioners</p> <p>In one site, disaster agencies are uncertain about their role; in a second, disaster agencies are prepared to provide clergy and mental health support; disaster agencies are not expressly involved in other sites</p>	<p>In no site have minority-serving community organizations been involved in preparedness planning; with one exception, other community partners, including schools, businesses, and the Red Cross, have been minimally, if at all, involved In most jurisdictions, and there is a good command of roles played by institutions and individuals in a health emergency; there are strong ties with emergency/fire/police; all but one have a high level of comfort with simultaneous criminal and epidemiological investigations</p>

EXHIBIT 1
Examples Of Key Essential Public Health Service (EPHS) Performance Indicators And
Of Differences And Similarities Across Seven California Jurisdictions, 2003 (cont.)

Key EPHS performance indicators	Differences across sites	Similarities across sites
<p>EPHS 5: Develop policies and plans that support individual and community health efforts</p> <p>Local health department formally incorporated in the community's emergency response incident command structure</p> <p>Existing emergency response plan that establishes roles of individuals and community organizations</p> <p>Plans that explicitly cover quarantine and isolation and mass vaccination</p> <p>Plans that address vaccination of public health and emergency first responders, as necessary, against smallpox</p>	<p>Two sites have written plans regarding vaccination and transportation of specimens in place</p> <p>One site, among the most prepared, has no written plan or protocol in place</p>	<p>There are no public health mutual aid agreements with neighboring county health departments; formal mutual aid agreements for firefighters and first responders are in place in most sites</p>
<p>EPHS 6: Enforce laws and regulations that protect health and ensure safety</p> <p>Relevant public health laws that are widely understood and accepted by law enforcement/first responders and local governance leadership</p> <p>Legal counsel knowledgeable about public health law, available to local authorities around the clock</p> <p>Plan for enforcing a quarantine that involves both public health and law enforcement, in which roles and responsibilities are clear</p>	<p>Two sites assert that health officer has authority to mandate whatever necessary to resolve an outbreak; in one site, police question this authority</p> <p>One site has legal counsel available around the clock; in three sites, legal counsel is unfamiliar with public health law</p> <p>In three sites, protocols are in place for law enforcement to support a quarantine, although guidelines regarding use of force have not been finalized; in two sites, law enforcement personnel question whether they have authority to enforce a quarantine</p>	<p>Most sites have a limited supply of security personnel; many work for the police department and moonlight as hospital security guards and are often in the National Guard</p>
<p>EPHS 7: Link people to needed personal health services and assure the provision of health care when otherwise unavailable</p> <p>Identification of surge capacity during a public health emergency in hospital beds, ICUs, isolation, patient transport, and key personnel</p> <p>Contingency plans to ensure provision of vaccine, isolation, and quarantine, and treatment of members of vulnerable populations in an infectious disease outbreak</p>	<p>Two sites have clear protocols for mass vaccination and quarantine</p> <p>One site has comprehensively assessed surge capacity</p> <p>One site has well-developed plans to handle "worried well"</p>	<p>Nurse shortage is serious impediment to adequate surge capacity</p> <p>No site has clear plans for how to vaccinate or care for disenfranchised populations</p> <p>Quarantine and vaccination sites have been tentatively designated in each jurisdiction</p>

■ **Site visits.** We conducted two-day site visits in each jurisdiction. On the first day we interviewed key informants, including the public health director; health officer; bioterrorism coordinator (if one existed); director of public health nursing; senior epidemiologist (if one existed); fiscal manager; local political official; representatives of the clinical community; as well as senior officials from police, fire, and emergency medical services (EMS) departments. These interviews provided infor-

EXHIBIT 1
Examples Of Key Essential Public Health Service (EPHS) Performance Indicators And Of Differences And Similarities Across Seven California Jurisdictions, 2003 (cont.)

Key EPHS performance indicators	Differences across sites	Similarities across sites
<p>EPHS 8: Assure a competent public health and personal health care workforce</p> <p>Ability of public health workforce to operate in a command-and-control environment</p> <p>Back-up capacity/redundancy for key public health staff (such as health officer)</p> <p>Mechanisms to ensure that public health staff can be quickly retrained and reassigned in a public health emergency</p> <p>Plans in place to ensure that nurses and other staff who may have multiple employment arrangements are assigned to where they are needed most in a public health emergency</p>	<p>One site has invested heavily in leadership training for senior personnel</p> <p>One site is training nonepidemiologists for investigation and contact tracing; three are developing their own plans for such training</p> <p>One site has child care provisions in place to support personnel in working during an emergency</p>	<p>All sites have sizable training needs with regard to vaccination, contact investigation, relevant laws, use of force, and lab procedures</p> <p>All sites need processes for credentialing volunteers and for licensing out-of-state workers</p> <p>Key functions in each site hinge on a single person who is often near retirement</p> <p>No site has addressed staffing for staff with multiple employment arrangements</p>
<p>EPHS 9 and 10: Conduct evaluations of services and research on solutions to public health problems (these functions were not a major focus of the site visits and exercises)</p> <p>None</p>	<p>None</p>	<p>Funds to conduct evaluations were not included in the CDC grants for preparedness planning</p> <p>Most local sites devote few resources to evaluation</p> <p>Very few sites conducted frequent or extensive community health assessments; preparedness evaluations are even more rare</p>

SOURCE: Site visits and tabletop exercises in seven California communities.

NOTES: ICU is intensive care unit. CDC is U.S. Centers for Disease Control and Prevention. "Sites" in this exhibit refer to "jurisdictions" in the text.

mation about how the system was organized and financed, preparedness plans and their progress to date, and the challenges involved in developing a public health preparedness plan amid other health department responsibilities. Interviews were semistructured using a standardized protocol, and interviewees were assured confidential handling of their responses.

■ **Exercises.** We developed and pretested tabletop exercises that were specifically designed to assess how jurisdictions were able to fulfill the EPHS, focusing on the measures endorsed by our expert panel. We conducted the exercises on the second day of the site visit.

In each jurisdiction, exercises were facilitated by two people, who followed a semistructured protocol. A third person took detailed notes. Public health directors in jurisdictions were asked to participate in the exercises and to invite other participants, based on the nature of their communities. They received guidelines regarding the types of people to be invited (health officer; bioterrorism coordinator; public health nurse; lab director; representatives from local hospitals, doctors, and local disaster relief agencies; minority-serving community organizations;

elected local officials; school administrators; and representatives from fire, police, and EMS), but individual invitations were left to their discretion. Participants were assured that neither they nor their jurisdictions would be individually identified without permission.

The exercises consisted of three steps. In the first step, participants were confronted by three unrelated case reports that might be consistent with smallpox, in the context of a heightened national terrorism alert. They were asked how they would respond to the case reports, begin an investigation, collect and transport biologic samples from patients to the appropriate laboratories, involve other partners as they deemed necessary, activate an emergency operations center, and communicate with the public and political authorities. In the second step, participants were confronted with confirmed cases, increasing numbers of sick people, up to 2,000 exposed people, and a panicked population. They were asked about isolation, quarantine and its enforcement, legal authority to act, plans for vaccination, delivering care to those in need, crowd control, and ongoing public communication. In each step, after participants responded to the specific problems posed by the scenario, they were asked to discuss how the scenario related to their infrastructure more broadly.

In step three, participants were asked to assess (on a 1–10 scale) the group’s response to the exercise events and the state of their current public health infrastructure, using questions that addressed the EPHS. They were then asked to rate “where they are” and “where they want to be” for each dimension. The difference, or gap, between exercise and desired performance was used as a springboard for discussion about what resources would be required to fill the gap and the obstacles to filling it. The director of the health department received a written after-action report that documented the group’s responses during the exercise and included an assessment of strengths and areas for improvement.

■ **Analysis.** At the completion of all of the exercises, three members of the study team reviewed each after-action report and rated the level of preparedness of each jurisdiction on a 1–10 scale for each EPHS, using the interim set of performance measures as a guide. Rater agreement was high; raters never disagreed with one another by more than one point for any EPHS. Raters then identified which of the interim performance measures seemed most relevant to assessing performance, and a “short set” of indicators was developed. Two additional raters then reviewed the after-action reports again and scored them using this short set. They again agreed within one point on all but one EPHS; the disagreement was related to a measure about syndromic surveillance and was not directly used in evaluating performance.

Results

Site visits yielded information about the organization of public health activities in the jurisdiction and how they are financed, and they highlighted areas for further exploration that came up during the exercises. Conversely, exercises yielded

information that was not apparent during the site visits, particularly with regard to how the system and its key participants would respond to a specific threat. Both exercise performance and information gleaned from site visits were used in our assessments of preparedness.

■ **Variations.** We found that each jurisdiction has done considerable planning since receipt of the CDC and HRSA grants; interviewees and exercise participants could point to progress made in increasing preparedness or in strengthening particular aspects of their infrastructure, or both. Despite this, the exercises revealed wide variation in the level of preparedness. Raters judged two of the seven counties to be well prepared to respond to a scenario of the magnitude described in the exercise and one to be particularly poorly prepared. Several factors seemed to account for the high ratings in two counties. Both had strong leadership and had worked to develop the leadership potential of others in their departments, including incident-command training. Both had confidence and experience in communicating with the public and the media and in working with the law enforcement community, and both had participated in multiple exercises over the past several years. Neither size nor urban-rural status clearly differentiated one jurisdiction's performance from that of another, although larger counties clearly have more flexibility and personnel to commit to preparedness activities. The sample size is too small to draw other conclusions about which attributes are associated with better preparedness. Columns 2 and 3 of Exhibit 1 provide examples of local public health agencies' responses on a sample of performance measures associated with each EPHS.

With regard to monitoring health status in a community (EPHS 1), we were struck by the general lack of recent community health assessment and relatively incomplete information about the distribution and demographics of potentially vulnerable or underserved populations. In some jurisdictions, representatives from police and fire departments appeared to have better knowledge of vulnerable populations than the health department had; in some, these entities also had stronger relationships with community leaders from various racial/ethnic groups. Various efforts are under way to improve disease surveillance in most jurisdictions, but most were limited to increased outreach to health care providers. No jurisdiction has implemented a comprehensive surveillance system. As revealed in the exercises, the jurisdictions varied in how long it would take for three suspicious cases to come to the attention of public health officers and for their health departments to realize that the cases were related.

Health departments varied dramatically in their ability to rapidly alert the physician and hospital community to a potential outbreak (EPHS 2). There was much variation in modalities for beginning active surveillance, with methods ranging from blast fax and e-mail for reaching local hospitals quickly to relying on informal relationships between the public health director or health officer and hospital medical leadership to facilitate communication. Only one jurisdiction had the ability to rapidly contact most practicing physicians outside of a hospital context.

Another jurisdiction seemed fundamentally uncertain about the basics of beginning an investigation.

In the area of communication and education (EPHS 3), jurisdictions were split regarding when they would first communicate with the public about a potential outbreak. Some would notify the public as soon as they began to investigate a suspicious case; others would wait until a diagnosis was confirmed (days later) to hold a press conference. One health department can communicate health information in nine languages, while another is not prepared to communicate in any language except English.

There was wide variation in understanding of public health legal authority, especially with regard to quarantine and its enforcement. Many health departments reported that they did not have access to legal counsel with public health knowledge (EPHS 6).

Specific to smallpox, there was considerable variation in the fundamental approach to beginning an epidemiological investigation, beliefs about whom to vaccinate and when, vaccine efficacy, whether epidemiologists or vaccinators had to wait until their vaccination “took” before they could contact potential cases, and whether healthy people should stay home or go about normal activities once one or more smallpox cases were confirmed in the community. There was wide variation in understanding which lab could perform which type of test to diagnose smallpox. There was similar variation in knowledge about where to locate information that could be used to communicate about smallpox to the public and the medical practice community, and there were large differences of opinion regarding when, either legally or practically, the jurisdiction would hand over responsibility for managing the public health crisis to the state health department or the CDC.

■ **Similarities.** There were also some similarities across the jurisdictions we studied. The implications of the current nurse shortage are substantial when it came to staffing in a public health emergency. Participants noted that many public health nurses also worked at one or more local hospitals or nursing homes and could only be in one place (if they came to work at all) in an emergency. A similar situation existed for law enforcement personnel; in some jurisdictions, most hospital security guards are off-duty police officers. In addition, many police officers are also part of National Guard units. It seems likely that these jurisdictions would have a serious shortage of law enforcement personnel during an emergency (EPHS 6, 7, and 8). Additionally, in all but one health department, a key public health function was dependent on a single person who was very close to retirement. Hiring freezes imposed by state and local budget crises and bureaucratic hiring processes compound staff shortages in every site. Finally, the lack of a pipeline for epidemiologists, lab personnel, and public health nurses means that even if funding were adequate, there are not sufficient numbers of qualified people available to be hired (EPHS 8).

Most jurisdictions had similar types of needs. Many were allocating scarce resources, often working on their own, to fill needs that are likely common to most

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jurisdictions. Examples include developing programs to train nurses assigned to other functions to help with an epidemiological investigation; rewriting of laboratory procedures for processing samples or conducting diagnostic tests; and developing emergency response plans, policies, and procedures. An overarching need was a statewide information system that could be used to receive automated reports from hospital and commercial laboratories; manage a public health emergency, including mapping, managing, and monitoring the status of contact tracing and other investigative activities; and administration and monitoring of vaccination or prophylaxis.

■ **Costs.** Preparedness efforts appeared to be associated with sizable unintended costs. In nearly all cases, public health directors described needing to reassign staff with responsibilities for other key functions (such as teen pregnancy prevention or sexually transmitted disease [STD] contact tracing) to preparedness activities, particularly in preparing the smallpox plan. Several health directors reported that they are contemplating curtailing or suspending key public health activities—including tuberculosis (TB) control, STD contact tracing, childhood immunization, and pregnancy prevention activities—or have already done so. Directors reported that these decisions were made in part because of the higher priority accorded the CDC’s bioterrorism mandates but also because of state and local budget cuts and overall workforce shortages. It is not clear when the downstream consequences of these programmatic changes will be manifest as population health problems.

Discussion

We found wide variation in the level of public health preparedness across a representative sample of local public health jurisdictions in California. These findings are consistent with those of TFAH, which indicated much state-to-state variation in preparedness. They are cause for concern, for several reasons. First, they describe much unevenness in preparedness in a state that some consider to be in the top tier for preparedness. In addition, they indicate that the degree of protection afforded by the public health system is highly dependent on where one lives, and not merely on whether one chooses an urban or rural lifestyle. Variations can indicate poor agreement on the standards for quality performance.

■ **Local variation.** Variation in medical care has been documented at statewide, regional, and local levels. Large regional variations in care are thought to indicate waste and inefficiency and suggest ample room for improvement in the cost, efficiency, and quality of medical care. Our findings suggest a similar phenomenon in public health. Although we found evidence of progress in preparedness as a result of the recent investment, the infrastructure in local public health jurisdictions varied

widely—with regard to not only preparedness but also basic elements such as strategic planning, community health assessment, environmental control, communicable disease surveillance, workforce development, and emphasis on chronic diseases versus other public health threats.

In the medical care delivery system, recognition of variation was a major impetus in the development of consensus measures of health system performance, including sophisticated methods for case-mix adjustment and the development and use of solid indicators of quality of care. We believe that public health is ripe for a similar movement. Whether at the local or state level, the public is entitled to know how well their public health system is performing. Absent such information, it is difficult to know how much to invest, and whom to hold accountable for results. We are a long way from that goal in public health, but the lessons from the quality improvement movement, whether in personal health care, airline safety, or automobile manufacturing, suggest that tools exist with which to get started.

■ **Inefficiency.** Two other findings from our study deserve mention. First, we were repeatedly struck during our site visits and exercises by tremendous inefficiencies. Often each local jurisdiction was spending scarce resources to fill a need, such as developing training programs for public health nurses to learn how to investigate an outbreak, that was common to all jurisdictions in the state. In light of the high fixed costs associated with many public health functions, small health jurisdictions are particularly disadvantaged in this regard. As a result, it is probably not realistic to expect small counties to ever be sufficiently prepared for a major bioterrorist event, absent more regional approaches. For many functions, not just those related to preparedness, it was apparent that some sort of regionalization and sharing of resources could increase efficiency.

Local health officials reported varying levels of support from state health officials in developing their preparedness programs. The state adapted the guidance it received from the CDC (benchmarks and “critical capacities”) into a local guidance document. Health jurisdictions were required to apply to the state to receive funds, with funds awarded based on a fixed amount plus a population-based increment. In addition to this “formal guidance,” some local stakeholders reported a fair amount of informal communication with knowledgeable state staff and with the work groups they assembled to implement the CDC grants. Others indicated that they did not receive adequate technical assistance.

Strong leadership at national, state, and local levels will be required to bring about needed transformation of the public health system. In most jurisdictions, there is opportunity for great improvement within reasonable resource constraints. For example, staffing to conduct an outbreak investigation could be done the way it has been done for years or could take advantage of new technologies (such as Web-supported call centers) and even use personnel other than public health nurses (such as community members or first responders) to obtain basic information from the affected population. Such redesign could ultimately free up

needed resources that could be reinvested in other critical areas of public health.

■ **Undermining other priorities.** Second, we were disturbed by repeated reports from local health departments that the combination of local budget cuts and the need to shift key personnel from other areas to preparedness efforts has meant that they have had to curtail or eliminate important public health programs. Although these reports are only anecdotal at this point, similar situations have been noted in other states.¹¹ This underlines both potential unintended consequences of the recent investments and the need to study this in more detail and remain vigilant for problems associated with developing only one area of the system. It will likely take several years before the consequences of these programmatic changes create public health emergencies themselves.

■ **Study limitations.** Our study has obvious limitations. There are no agreed-upon, evidence-based standards or measures for public health preparedness, so we used an expert-panel methodology to guide us toward those standards. This methodology has not been validated for use in public health.¹² The use of tabletop exercises to measure public health preparedness is new, and the methods have not been validated. Participants in our exercises were limited to those invited by the public health director and may not reflect the true array of stakeholders in the communities' preparedness efforts.

Because we conducted our exercises in only seven jurisdictions, we cannot ascertain the generalizability of our findings. However, we have several reasons to believe that it is quite high. The jurisdictions were broadly representative of all state health jurisdictions, in terms of size, location, minority populations, and per capita public health spending. The sampled jurisdictions cover nearly two-fifths of the state's population. The ways in which California's public health system is organized and financed suggests that the state, by and large, treats local health jurisdictions equally. Finally, and perhaps most importantly, we found that the marginal information added by the last two site visits and exercises was low, which suggests that we were unlikely to learn much more from conducting additional exercises in many other jurisdictions. We remain uncertain about what the appropriate number of exercises might be.

We expect that our findings are broadly applicable beyond California. Although California is the most populous state, it is not alone in its need to deal with border issues, vulnerable populations, language diversity, or multiple organizational structures for public health, as well as the panoply of public health threats faced by all Americans.¹³

WE FOUND WIDE VARIATION in the public health infrastructure and the level of preparedness across California's local public health jurisdictions. Variation of this magnitude suggests important opportunities for improved performance, greater efficiency, and clearer standards. Our finding that two jurisdictions seemed highly prepared by most measures suggests that

there may be exemplary practices that could be shared with other jurisdictions and other states.

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