Improvements in State and Local Planning for Mass Dispensing of Medical Countermeasures: The Technical Assistance Review Program, United States, 2007–2014

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Objectives. To evaluate and describe outcomes of state and local medical countermeasure preparedness planning, which is critical to ensure rapid distribution and dispensing of a broad spectrum of life-saving medical assets during a public health emergency.

Methods. We used 2007 to 2014 state and local data collected from the Centers for Disease Control and Prevention's Technical Assistance Review. We calculated descriptive statistics from 50 states and 72 local Cities Readiness Initiative jurisdictions that participated in the Technical Assistance Review annually.

Results. From 2007 to 2014, the average overall Technical Assistance Review score increased by 13% for states and 41% for Cities Readiness Initiative jurisdictions. In 2014, nearly half of states achieved the maximum possible overall score (100), and 94% of local Cities Readiness Initiative jurisdictions achieved a score of 90 or more.

Conclusions. Despite challenges, effective and timely medical countermeasure distribution and dispensing is possible with appropriate planning, staff, and resources. However, vigilance in training, exercising, and improving plans from lessons learned in a sustained, coordinated way is critical to ensure continued public health preparedness success. (*Am J Public Health.* 2017;107: S200–S207. doi:10.2105/AJPH.2017.304037)

Securing the nation's health is a formidable task. Disaster readiness improves community preparedness, response, and recovery following outbreaks and incidents that threaten public health. Before 1990, increasing the nation's resiliency by building state public health departments' capacity to respond to catastrophic threats was not a component of public health planning. International and domestic terrorism incidents and large-scale natural disasters since the 1990s altered the course of public health[1] and cast a new perspective on the critical role public health planning and response plays in national biosecurity.

Potential vulnerabilities in national biosecurity were exposed by incidents such as the release of toxic sarin gas in a Tokyo subway in 1995 that killed 12 and injured many; the threat of bubonic plague from an unauthorized purchase by a lone potential extremist in 1995[1]; attempts to assassinate US president William J. Clinton with biological agents received from an extremist group in 1998[1]; and exposure to anthrax after September 11, 2001, that resulted in 5 deaths and 22 infected victims.[2] Before these events, state and local public health did not play the significant role in disaster preparedness it now assumes. Lessons learned from these incidents created momentum to further strengthen the public health system and increased focus on rapid distribution and dispensing of a broad spectrum of medical assets to affected populations.[3]

In 1998, Congress initiated annual appropriations to the Centers for Disease Control and Prevention (CDC) for pharmaceutical stockpiling. A year later, Congress appropriated and authorized $50 million dollars to the CDC to expand national public health preparedness for category A agents (i.e., *Bacillus anthracis*, *Clostridium botulinum*, viral agents of hemorrhagic fevers, *Yersinia pestis*, smallpox virus, and *Francisella tularensis*).[4] Today, the list of agents has been expanded using a tier designation; tier 1 select agents are under federal regulation by the select agents program.[5–8] The investment by Congress in 1999 supported the development of the national pharmaceutical stockpile, known as the Strategic National Stockpile (SNS) since 2002, and maintains a broad spectrum of medical assets.[9,10] The SNS initially was managed jointly by the US Department of Homeland Security and Department of Health and Human Services, and includes large quantities of antibiotics, chemical antidotes, antitoxins, life-support medications, medical supplies, respirators, and personal protective equipment to protect the US public in the event that local supplies cannot meet the immediate needs of the emergency response. These pharmaceuticals and ancillary medical supplies can be delivered within 12 hours of the federal decision to deploy in the United States or its territories.[11]

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The value of the SNS program was evident following the September 11, 2001, attack in New York City. The program successfully deployed a "push package"—a 50-ton, prepackaged container of broad spectrum medical assets[4,12] and additional supplies—to the affected area within 7 hours of the request from the New York City Department of Health and Mental Hygiene.[4,13] The Department of Health and Human Services also coordinated and sent assets to New York City and many additional jurisdictions a month later following exposure from anthrax-contaminated mail. This was done to support the public health response to provide medical countermeasures (MCM) to exposed mail handlers, congressional office employees, and personnel from affected media organizations.[4] However, after action analyses of these events identified challenges and revealed areas for improvement.

Recognition of these gaps increased awareness of the need for a national preparedness response effort that focused specifically on communities.[2,10,14] The Cities Readiness Initiative (CRI) began in 2004 in response to this national need and focused on improving communities' ability to dispense medications rapidly during emergencies. Public health departments use CRI funding to develop, test, and maintain plans to quickly receive and distribute MCM to local communities. Today, the CRI supports development and the sharing of plans, models, templates, and training tools to advance a coordinated response to a release of *Bacillus anthracis* spores or any other large-scale public health emergency event that would require dispensing MCM to the entire affected population within 48 hours.[14] In 2004, there were 21 participating CRI metropolitan statistical areas, but in 2006 this expanded to include 72 CRI metropolitan statistical areas, which increased national coverage of at least 1 CRI metropolitan statistical area in every state.[14] This represents more than 400 counties and cities nationwide and more than 57% of the US population covered today.[12]

The CDC has operational responsibility for the CRI and used the Technical Assistance Review (TAR) to assess state and local health departments' ability to rapidly distribute and dispense a broad spectrum of medical assets in the event of a public health emergency. The TAR was designed and implemented to objectively review documentation of planning efforts. Two versions of the TAR were developed. One assesses states' MCM planning by focusing on the assessment of receipt and distribution of federally supplied MCM. Another version assesses CRI jurisdictions' MCM planning by focusing on measuring the dispensing of MCM to an identified population after receipt of assets from the state.

We have described the progress made in state and local MCM planning using 2007 to 2014 data from the TAR.

METHODS

All 50 states and the 72 local CRI metropolitan statistical areas were required to participate in annual TAR from 2007 to 2014.

Materials

The TAR tool was used to quantify a score between 0 (min) and 100 (max) on 12 core functions required for MCM distribution and dispensing planning; the state TAR included "repackaging" a 13th core function (Table 1).[15] Each function received a weighted score. Weights ranged from 0.03 to 0.24 (sum of all weights = 1) and were determined by the CDC subject matter experts according to each function's relevance to MCM planning.[15] The sum of the weighted function scores resulted in an overall score for each state or local jurisdiction assessed. The function contributing the greatest weight to the overall score was MCM dispensing (state weight = 0.22; local weight = 0.24).

Each state participated in 1 TAR annually. The 72 CRI metropolitan statistical areas included as few as 1 and as many as 21 individual local CRI planning jurisdictions per CRI metropolitan statistical area as defined by the Office of Management and Budget.[16] Each jurisdiction within a CRI metropolitan statistical area participated in its own annual TAR. We aggregated the review scores from each jurisdiction within a CRI metropolitan statistical area by averaging across the defined jurisdictions to create a single, CRI metropolitan statistical area local score for each function and an overall local TAR score.

Procedures

To examine growth over time, we compared 2007 TAR scores with 2014 TAR scores. We conducted descriptive analyses, which included measuring minimum score, maximum score, mean, median, mode, and quartiles for state and local jurisdictions separately.

We conducted these descriptive statistics for both 2007 and 2014 for each TAR function and overall TAR score. We calculated percentage change in means from 2007 to 2014 scores for state and local jurisdictions separately for each function and for overall TAR scores. Finally, on the basis of the hypothesis that both function and overall scores would improve by 2014 (as compared with 2007), we tested scores by conducting a 1-tailed paired-samples *t* test to determine statistical significance between the means in 2007 versus 2014.

RESULTS

Nationwide, both state and local TAR scores showed improvement from 2007 to 2014.

Overall Scores

In 2007, the minimum for overall TAR scores among the 50 states was 51 and the mean was 86.6 (SD = 11.8; Table 2). By 2014, the minimum overall score increased 74.5% to 89 and the mean increased 13.2% ($P < .01$) to 98 (Table 2). Nearly half of the state scores (48%) achieved the maximum possible overall score of 100 in 2014 compared with 4 in 2007 (Figure A, available as a supplement to the online version of this article at http://www.ajph.org). The local TAR score distribution was more variable across jurisdictions than across states. In 2007, the lowest overall local TAR score was 18, and no local jurisdiction achieved an overall max score of 100 (Table 2).

By 2014, the range of scores narrowed significantly to a difference of 17 score points (range = 83–100) and the mean increased from 68.5 in 2007 to 96.3 in 2014 (Table 2). Ninety-four percent of local jurisdictions achieved an overall score of 90 or more in 2014 compared with 4 in 2007 (Figure B, available as a supplement to the online version of this article at http://www.ajph.org). At both the state and local levels, improvements in average overall TAR score from 2007 to

TABLE 1—Technical Assistance Review Core Functions: United States, 2007 and 2014

TAR Function	Description	Composite Score Weight %[a]
Developing a plan with SNS elements	A comprehensive, written plan is essential for facilitating the receipt, distribution, and dispensing of SNS assets quickly and efficiently. This plan should be incorporated as part of a state's comprehensive emergency operations plan.	3
Management of the SNS	The way a state, region, or community manages its response to a public health emergency is considered a program management and command and control function.	10
Requesting SNS	The decision to deploy SNS assets will be a collaborative effort among local, state, and federal officials. It will start at a local level when officials identify a potential or actual situation they believe has the potential to threaten the health of their community. SNS assets are requested from the CDC by the affected state's governor. Alternatively the state may request assets from HHS.	3
Communications plan (tactical)	The availability of robust and redundant communication systems is critical to coordinating response functions during an emergency. Effective and timely communications between emergency response staffs, operation centers, receiving sites, points of dispensing, and hospitals will be needed to meet and resolve the demands of a mass distribution and dispensing emergency.	3
Public information and communication	During an emergency when MCM assets are to be dispensed to the public, effective and timely public health communications are needed to ensure the public is informed and guided to appropriate locations to receive them.	7
Security	The security of MCM and safety involved in the receipt, distribution, and dispensing operations is essential. The arrival and transport of scarce resources will be newsworthy and may draw attention from persons unwilling to wait for the organized dispensing of prophylactic or treatment medicines.	10
Receipt, stage, and store (state)	The size, location, and characteristics of warehouse facilities used to receive, stage, and store MCM are important factors that will determine the effectiveness of an emergency response. The CDC has established minimum criteria for sites designated to receive, stage, and store federal assets from the SNS. The development of distribution strategies, site-specific plans, and the assignment and training of staff will determine the ability of jurisdictions to meet the demand for the distribution of assets to local populations.	14
Regional or local distribution site (local)	The size, location, and characteristics of warehouse facilities used to receive MCM from the state to distribute them to the identified local population are important factors that will determine the effectiveness of an emergency response. The CDC has established minimum criteria for regional and local sites designated to receive and distribute federal assets received from the state.	14
Inventory management	State and local jurisdictions must possess a robust inventory management system to monitor the receipt of MCM, track their distribution, and record dispensing during a public health emergency. SNS inventory must be properly apportioned and configured in the quantities necessary for the point of dispensing and health care facilities to successfully respond in an emergency.	8
Repackaging[b]	In the past, a significant amount of planning and preparation was required to repackage bulk oral drugs contained in the SNS before dispensing them to the public. Much of that effort is no longer necessary because the majority of oral medicines in the SNS now come in prepackaged unit of use regimens.	2
Distribution	Distribution is the physical delivery of SNS assets from the RSS facility to dispensing sites, treatment centers, and regional distribution sites. States are responsible for developing distribution networks that account for challenges and barriers unique to their areas.	10

Continued

TABLE 1—*Continued*

TAR Function	Description	Composite Score Weight %[a]
Medical countermeasure dispensing	Dispensing planning is designed to provide initial prophylaxis to 100% of the population within 48 h and should be flexible and scalable so that the infrastructure built for meeting this capability can be used for any incident as part of an all hazards plan.	24, 22[b]
Hospitals and treatment centers coordination	A large-scale emergency event can happen quickly and overwhelm available resources at hospitals and other acute care providers. This function stresses the need for and measures the degree of coordination among public health, emergency management, and hospitals or alternative care sites to manage and respond to materiel needs at health care facilities.	3
Training, exercise, and evaluation	This function serves to highlight and document the development of emergency response training and exercise and evaluation programs that are compliant with guidelines set forth by HSEEP. Emergency response exercises are intrinsic to the transition of plans to operational response.	10

Note. CDC = Centers for Disease Control and Prevention; HHS = Department of Health and Human Services; HSEEP = Homeland Security Exercise and Evaluation Program; MCM = medical countermeasure; RSS = receipt, stage, and store; SNS = Strategic National Stockpile; TAR = technical assistance review.
[a]TAR weights generated by SNS staff.
[b]Applies only to the state TAR; MCM dispensing weight adjusted by 2% to accommodate additional repackaging function.

2014 were statistically significant at $P < .01$ ($t_{state} = 7.036$; $t_{local} = 12.756$; Table 2). At the state level, 2007 scores were statistically significantly correlated to 2014 scores ($r = 0.316$; $P < .05$), but this correlation was not found at the local level ($r = -0.009$; $P = .941$).

Technical Assistance Review Function Scores

Average TAR function scores also improved from 2007 to 2014 on every function across states and locals.

State functions. Among the TAR functions, states demonstrated the greatest improvement (17.3%) in "dispensing" scores. "Treatment center coordination" was the second largest percentage increase (16.5%), followed by "repackaging" (16.3%). "Public information and communication" improved by 14.7% and "training, exercise, and evaluation" increased by 14.5%. The variation in scores within each function was much broader in 2007 and narrowed significantly by 2014 (Figure 1). For example, in 2007 the "dispensing" function score difference was 83 (range = 17–100) decreasing to a difference of 33 score points (range = 67–100) with a median of 100 by 2014. The remaining 8 TAR functions each improved, but by less than 14%, during the 7-year reporting period. All function score mean increases were statistically significant at $P < .05$ with the exception of "requesting SNS" ($t = 1.941$; $P = .06$). At the state level, most functions scores for 2007 and 2014 were not correlated with the exception of "repackaging" ($r = 0.381$; $P < .05$) and "treatment center coordination" ($r = 0.308$; $P < .05$).

Local functions. The largest improvement for local TAR scores was in "training, exercise, and evaluation" (60.1%), next by "distribution" (52.0%), followed by "security" (49.4%), and "dispensing" (43.6%). The range of local TAR function scores also significantly tightened from 2007 to 2014 (Figure 2). For "training, exercise, and evaluation" in 2007, the minimum TAR score was 5 but by 2014 the minimum score increased to 81. Within each function, 2007 scores were not statistically significantly correlated with 2014 scores at the local level.

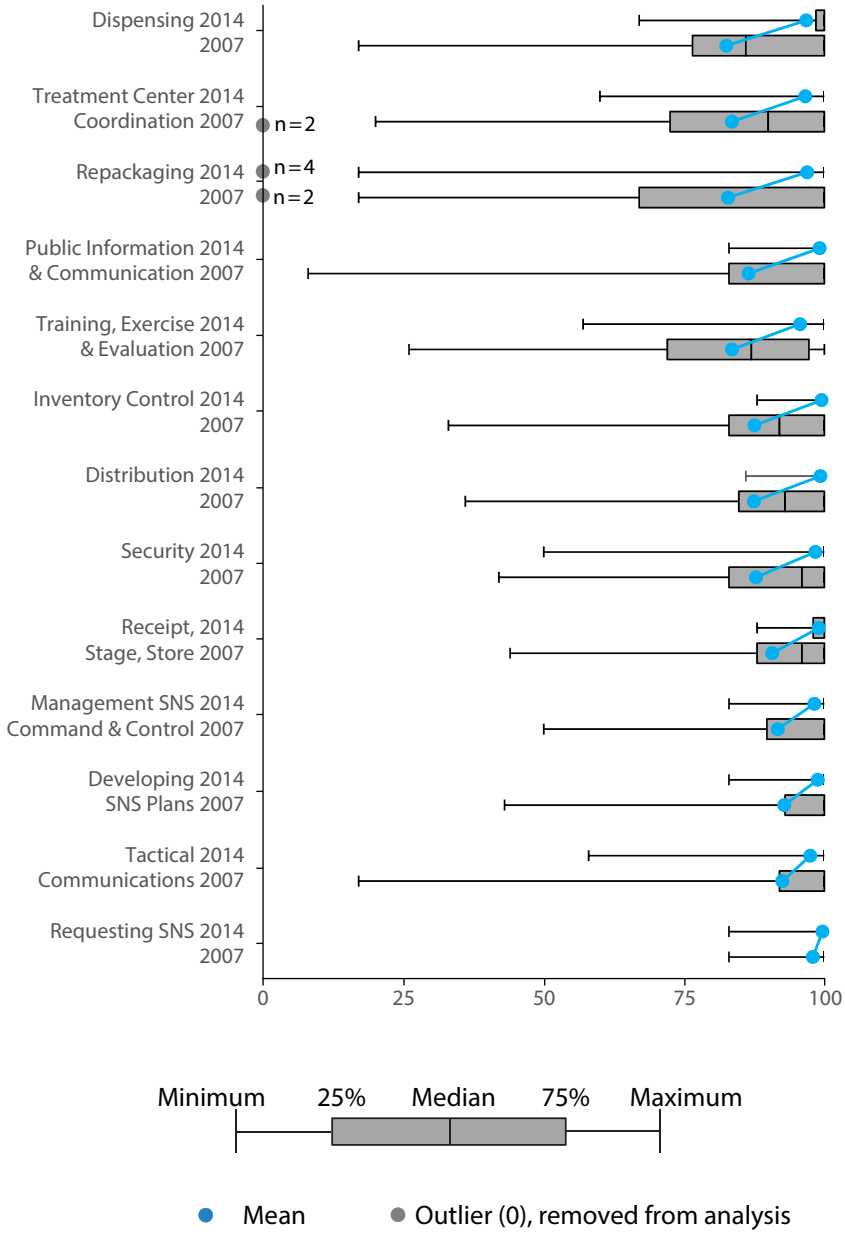
TABLE 2—Descriptive Statistics and Paired Samples *t* Tests of State and Local Technical Assistance Review Overall Scores: Unites States, 2007 and 2014

	State			Local		
Descriptive Statistics	2007	2014	Difference	2007	2014	Difference
No.	50	50		72	72	
Median	91	99		74	97	
Mode	93	100		79, 82[a]	99	
Min	51	89		18	83	
Max	100	100		97	100	
No. with maximum possible score (100)	2	24		0	7	
Mean ±SD	86.6 ±11.8	97.8 ±2.9		68.5 ±18.2	96.3 ±3.5	
Mean Difference (= $TAR_{2014} - TAR_{2007}$)			11.1			27.9
% change in mean (= [$TAR_{2014} - TAR_{2007}$]/ TAR_{2007})			+12.9			+40.7
t			7.04			12.76
P			< .01			< .01

Note. TAR = technical assistance review.
[a]Two modes exist for local 2007 overall score; both n = 4.

DISCUSSION

Delays in MCM processing increases the risk of morbidity and mortality.[17] Continued planning to efficiently distribute and dispense life-saving medical assets and



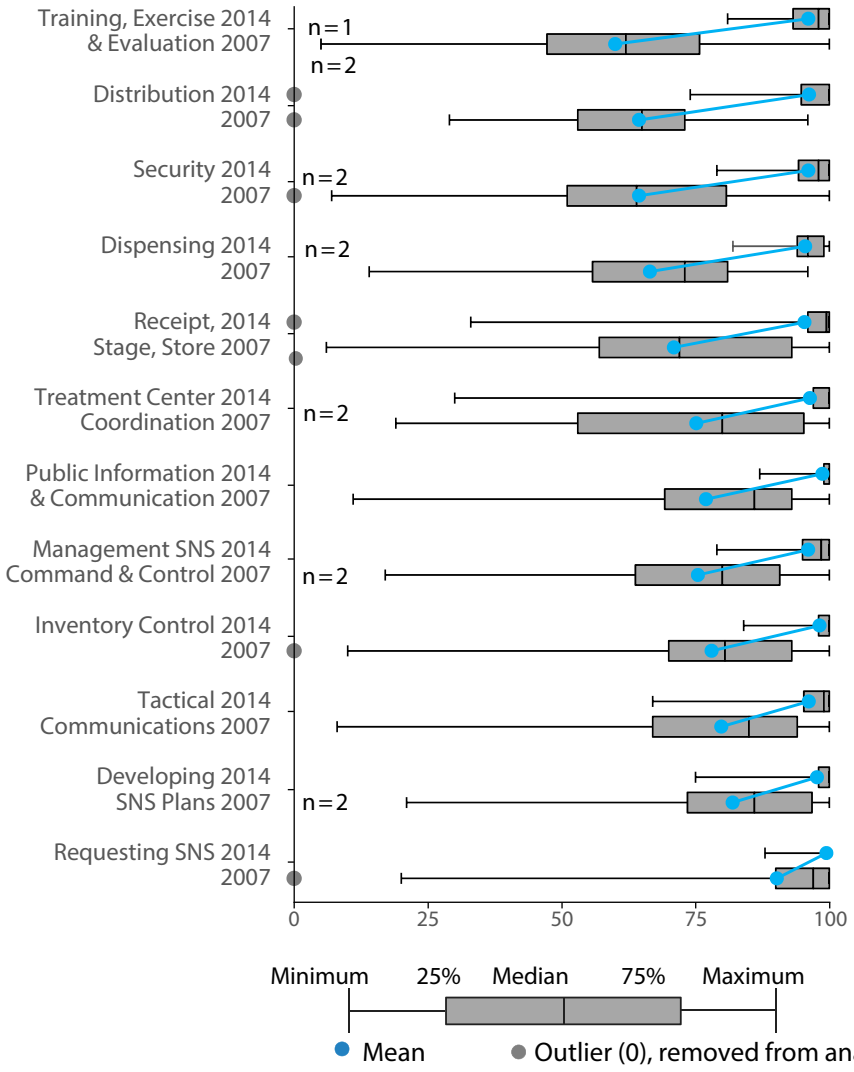
	No.	% TAR Change 2007 – 2014	Mean TAR diff. 2014 – 2007	*t*	*P*
Dispensing 2014	50	17.3%	14.24	5.652	<.01
2007	50				
Treatment Center 2014	50	16.5%	13.75	5.111	<.01
Coordination 2007	48				
Repackaging 2014	46	16.3%	13.47	4.183	<.01
2007	48				
Public Information 2014 & Communication 2007	50	14.7%	12.68	3.836	<.01
	50				
Training, Exercise 2014 & Evaluation 2007	50	14.5%	12.10	4.677	<.01
	50				
Inventory Control 2014	50	13.7%	11.98	5.093	<.01
2007	50				
Distribution 2014	50	13.6%	11.86	4.717	<.01
2007	50				
Security 2014	50	12.0%	10.58	4.450	<.01
2007	50				
Receipt, 2014	50	9.1%	8.28	4.437	<.01
Stage, Store 2007	50				
Management SNS 2014	50	7.1%	6.52	3.384	<.01
Command & Control 2007	50				
Developing 2014	50	6.4%	5.96	3.009	<.01
SNS Plans 2007	50				
Tactical 2014	50	5.4%	4.98	2.045	<.05
Communications 2007	50				
Requesting SNS 2014	50	1.7%	1.7	1.941	.06
2007	50				

Note. diff = difference; SNS = Strategic National Stockpile; TAR = technical assistance review.

FIGURE 1—Analysis of State Technical Assistance Review Scores by Function in 2007 Compared With 2014: United States

countermeasures to an affected community following a public health disaster is critical to decreasing that risk. In general, the increase across all TAR functions and overall state and local jurisdiction scores demonstrated continued planning improvements.[15]

Although the TAR scores increased over time, this analysis is subject to several limitations. TAR reviews were on the basis of self-reported data and therefore subject to recall bias. Furthermore, as TAR scores became the standard, some jurisdictions may have felt accountability pressure to achieve maximum scores or face implied funding reductions. Finally, suggesting TAR scores represent operational readiness (ability to appropriately react to an incident or event because of high TAR scores) is overstating the intent of the TAR, which



No.	% TAR Change 2007–2014	Mean TAR diff. (2014 – 2007)	*t*	*P*
72 72	60.1%	36.08	12.637	<.01
50[a] 31[a]	52.0%	33.53	10.021	<.01
72 70	49.4%	31.83	11.547	<.01
72 72	43.6%	29.00	12.033	<.01
44[a] 27[a]	37.6%	26.65	5.569	<.01
57[a] 70	29.1%	21.86	6.453	<.01
72 72	28.3%	21.75	8.183	<.01
72 72	27.3%	20.61	8.879	<.01
72 70	25.8%	20.11	8.496	<.01
72 72	20.5%	16.35	6.775	<.01
72 72	19.2%	15.76	6.827	<.01
72 70	10.2%	9.24	4.244	<.01

Note. diff = difference; SNS = Strategic National Stockpile; TAR = technical assistance review.

[a]Response rate is lower for Distribution, Treatment Center Coordination, and Receipt, Stage, Store because these functions were rated "Not Applicable" where appropriate for local jurisdiction.

FIGURE 2—Analysis of Local Cities Readiness Initiative Metropolitan Statistical Area Technical Assistance Review Scores by Function in 2007 Compared With 2014: United States

assessed planning components and requirements.

From 2007 to 2014, the average state TAR overall score increased by 13%, with a maximum score of 100 and the average local metropolitan statistical area TAR overall score significantly increased by 41% with a maximum score of 100. At the local level, all functional scores improved by at least 10% ("requesting SNS") and as much as 60% ("training, exercise, and evaluation"). The highest weighted functions were perceived as most critical and showed the highest percentage increase in mean scores. The following sections highlight critical functions and are discussed in more detail.

Distribution and Dispensing

Mass prophylaxis planning at the local level focus on the use of points of dispensing and

follow the distribution and dispensing strategy described by Stroud.[18] However, there are various challenges that local planners and health departments encounter; number, location, security, staffing, and throughput are just a few points of dispensing planning considerations. Public health planners moved toward innovative and out-of-the-box methods using existing community infrastructure (businesses, schools, etc.) to use rapid dispensing to address the CRI dispensing priority.

Applying creative methods (head of household, closed, drive-thru, mobile points of dispensing, etc.) likely contributed to the highest percentage increase in dispensing acuity at both the local (43.6%) and state (17.3%) levels. Similarly, the distribution function was found to have the second highest percentage increase (52.0%) at the local level.

Training, Exercise, Evaluation, and Treatment Center Coordination

Training, exercise, evaluation, and treatment center coordination depend on improved partnerships, coordination, and communication within jurisdictions. Collaboration across public health, emergency management, hospitals and alternative care site staff ameliorate gaps. By 2007, awardees relied on the Homeland Security Exercise and Evaluation Program principles[19] and some hired certified master exercise planners to plan, train, and conduct exercise evaluation.

As a result of these efforts, there was an increase in treatment center coordination (16.5% on the state TAR) and a significant increase in training, exercise, and evaluation (60.1% on the local TAR) functions from 2007 to 2014.

Security

A bioterrorism attack intensifies the limited surge capacity law enforcement faces on a daily basis. Any breakdown or breach in security during transportation (traffic-control, supply chain management, etc.) and transfer of medical material from federal to state and ultimately to local law enforcement can compromise the mission. The 49.4% improvement in security on the local TAR was likely a result of enhanced and specific MCM security plans that were understood and exercised to address security gaps.

Security plans and training met specific guidance and relied on collaboration between layers of law enforcement and security between federal, state, and local partners during the 2007 to 2014 reporting periods.

Repackaging

Before 2007, antiviral medications from the Division of SNS were delivered to the states in large bulk boxes or bottles containing 100 pills or more. This required awardees to repackage the pills into smaller doses for distribution and dispensing during an MCM campaign. The CDC fostered strong collaborations with the Federal Drug Administration, Public Health Emergency Preparedness awardees and pharmaceutical companies to create specific unit of use bottles sent straight from the vendor, thereby lessening the state and local burden of repackaging.

However, the requirement for plans to address repackaging was maintained and continued to be assessed on the state TAR from 2007 to 2014. Therefore, it is worth noting that repackaging showed improvement on the repackaging functional state TAR score (16.3%) over the period from 2007 to 2014.

Conclusions

Despite challenges, effective and timely medical assets and countermeasure distribution and dispensing is possible with appropriate planning, staff, and resources. However, vigilance to train, exercise, and improve plans from lessons learned in a sustained, coordinated way is critical for ensuring success. By 2014, TAR scores seem to plateau on the higher end of the scale, which suggests that all state and local programs were successfully planning. Future evaluation of medical asset attainment should focus on operational implementation of established planning practices. AJPH

CONTRIBUTORS

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HUMAN PARTICIPANT PROTECTION

No protocol approval was necessary because this article describes public health nonresearch.

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