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The Impact of Federal Bioterrorism Funding Programs on Local Health Department Preparedness Activities

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Using the 2005 National Association of County and City Health Officers Profile of Local Health Departments data set, bivariate probit and Heckman selection models were used to test the hypothesis that the level of federal funding received for bioterrorism preparedness is related to the preparedness activities undertaken by local health departments. Overall budget, leadership, and crisis experience are found to be the most important determinants of local preparedness activity, but Centers for Disease Control and Prevention preparedness funding plays a mediating role by building capacity through the hiring of one key leadership position, the emergency preparedness coordinator. Additional research is needed to determine the potential impact of these funds on other aspects of the local public health system, such as the scope of services delivered, to determine secondary effects of the program.

Keywords: *public health preparedness; local health departments; public health finance; bioterrorism; federalism*

Introduction

With the national policy focus on the area of homeland security over the past decade, questions about the shape of US federalism are once again of

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significant interest (Kettl, 2003), and preparedness programs offer a new ground for studying the mechanics of intergovernmental policy (Caruson, McManus, Cohen, & Watson, 2005). Federal public health preparedness programs, for example, offer a case for reexamining the leverage that financial transfers provide in stimulating local program activity.

Funding for public health preparedness programs was nonexistent until 1996 but has increased dramatically in the past 11 years (Hebert, Anderson, & Gursky, 2007). Following the events of September 11, 2001, federal funding to states and local health departments for preparedness programs grew from US$50 million in 2000 to US$1 billion in 2002, primarily through the Health Resources and Services Administration's (HRSA) National Bioterrorism Hospital Preparedness Program and the Public Health Emergency Preparedness Program managed by the Centers for Disease Control and Prevention (CDC; Boulton, Abellera, Lemmings, & Robinson, 2005). These programs transfer federal funds to state health departments, and through them to local departments, for the purpose of improving the ability of the public health system to respond to a public health emergency, particularly the use of biological weapons, and are the primary source of federal assistance to the public health system in this area. However, concern exists over whether these funds are being used appropriately. In 2001, a White House study noted that the Federal government " . . . has little idea of the actual effects of the billions of social service dollars it spends directly or sends to state or local governments" (White House, 2001). Such concerns also apply to grants for federal preparedness programs. Significant concerns remain over whether funding for preparedness activities has in fact resulted in increased preparedness (Fraser, 2007). The Office of Management and Budget (OMB), for example, found that the National Bioterrorism Hospital Preparedness Program was not performing, particularly in terms of program management and accountability (OMB, 2007).

Historically, Federal Emergency Management Agency (FEMA) and other federal agencies have had little success in developing sufficient incentives for local authorities to prepare for emergencies that have low salience in local communities (Mushkatel & Weschler, 1985). In US politics, disasters have a high political salience after they occur, but preparedness is generally a low priority because of discounting due to a perception of a low probability of occurrence (Wamsley & Schroeder, 1996). Mixed evidence exists over whether federal expenditures have an impact on the performance of local public health systems and agencies. A 2004 survey by the National Association of County and City Health Officers (NACCHO) regarding federal grants to support bioterrorism activities concluded that federal bioterrorism

funds had supported the improvement of preparedness levels, but the study was based on a small sample and did not directly link funding to the level of preparedness activities (Bashir, Lafronza, Fraser, Brown, & Cope, 2003). As a cautionary contrast, Scutchfield and colleagues found little impact of budget level on local public health system performance in general (Scutchfield, Knight, Kelly, Bhandari, & Vasilescu, 2004). Similarly, Honore and Schlechte observed that for the most part, the amount of resources allocated to a particular essential health service was not related to performance in that area (Mays et al., 2004).

One potential problem with the public health preparedness programs is a lack of state and/or local stakeholder involvement in the development of the national strategy for Homeland Security (Krane, 2002). At the same time, the federal government lacks the ability to implement the program without these stakeholders, meaning that their compliance is critical for success (Krane, 2003). The US federal structure contains institutional arrangements, which make a centralized and coordinated program difficult to implement, as local priorities shape how local agencies implement programs. These activities are often shaped as much by the agency's view of internal capacity as by threat perception (Clarke & Chenoweth, 2006). According to both donor-recipient and jurisdictional models of federalism, intergovernmental programs are dependent on the implementation ability of the local level and implementation is shaped by local capabilities and needs. Compliance with the goals of programs developed at the national level can become an issue as local managers seek to use federal funds without regard to the granting agency's intent (Agranoff & McGuire, 2001; Goodrich, 1980). Hence, it should not be assumed that the provision of intergovernmental grants alone will provide sufficient incentive for local health departments to conduct preparedness activities.

The CDC and HRSA preparedness programs function under a donor-recipient model. In this model, the donor units offer incentives for recipient governments to undertake certain activities, which are coupled with specific requirements as conditions of aid. Both structure and management have been found to be important in obtaining program success under this model (O'Toole & Meier, 2004). Effective emergency preparedness programs require local leadership that has the resources, training, and experience necessary to manage such programs (Schneider, 1992).

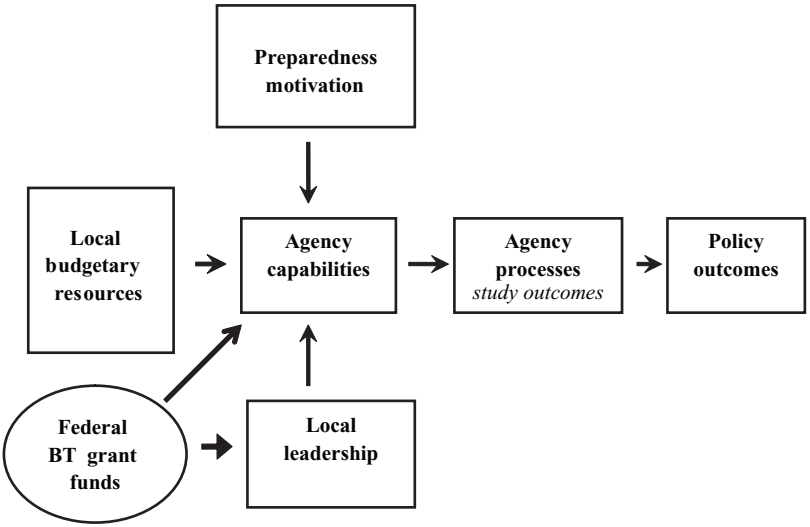
The importance of local leadership and administrative capacity is well noted in the literature of intergovernmental relations. Orland suggests that subordinate agencies require a knowledge of superordinate agency expectations, administrative capacity to meet expectations, and an organizational

commitment to compliance (Orland & Goettel, 1982). Some studies have suggested implementation is largely shaped by the perception of the dominant local political actor, whether a generalist official, specialist administrator, or outside interest group, with significant differences between the type of leader (Fossett, 1986; Nathan, 1983). In the case of the federal Safe Drinking Water Act Program, for example, program directors at state primacy agencies have been shown to shape program implementation to meet local political demands even in the presence of a strong national mandate (Avery, 1995). Local policy champions can to some extent even overcome resource limitations (Scheberle, 1997). It has been suggested that the incorporation of mechanisms into intergovernmental grants to develop this leadership capacity can improve subordinate agency compliance (May & Burby, 1996). The consequences of failure to do so can be catastrophic in the area of preparedness policy, as was seen in the Hurricane Katrina Disaster.

The federal public health preparedness programs in particular have been plagued by coordination problems, complicated by historically weak leadership in all levels of the public health system (Avery, 2006). The Association of State and Territorial Health Officers found at the state level that competing priorities, workforce issues, and institutional practices formed significant barriers to the effective use of federal bioterrorism preparedness funds (NACCHO, 2005). Turnock (2004), in a study of preparedness programs in Illinois, notes that the lack of coordination between federal agencies and a perceived overselling of what local officials view as low-risk events (such as a smallpox epidemic) have damaged the credibility of federal agencies in the eyes of local public health officials. This can result in further discounting of the importance of the issue. Kydland and Prescott (1977), for example, have shown that suboptimal policy decisions can arise because there is no mechanism that can induce *future* policy makers to take into consideration the effects of their decisions on the current expectations of implementing agents. In this case, lack of confidence in the credibility of federal donors may erode confidence in the sustainability of federal support, leading to increased discounting.

This study uses a secondary data analysis to test the relationship between federal preparedness funding and preparedness activities at local health departments using the conceptual framework of Handler, Issel, and Turnock (2001), where public health system inputs define agency capacity, which determines agency activities and hence public health outcomes (Figure 1). This study uses this framework as a theoretical model to examine the role of budgetary and leadership inputs, controlling for jurisdictional size and

Figure 1
Conceptual Model for Health Department Operations



NOTE: BT = Bioterrorism.

racial/ethnic composition, as well as department size, the existence of departmental capabilities (presence of an epidemiologist or public health laboratory), state preparedness levels, and the occurrence of a public health emergency, which may have raised awareness of the need for emergency planning. These inputs represent the resource and administrative capacities identified as critical for successful intergovernmental program implementation (Orland & Goettel, 1982).

From this model, this study evaluates eight hypotheses, presented in Table 1. These can be generally classified into four domains as follows: resources, leadership, saliency, and interdependence.

Four hypotheses relate to resource levels. First (H_1), it is anticipated that a positive, direct relationship between the level of funding received from CDC and HRSA preparedness programs and preparedness activity exists. This hypothesis is a restatement of the fundamental justification for the program, to whit that additional federal resources targeted at preparedness create a sufficient incentive for local health departments to implement such activities. Second (H_2), organizations serving larger jurisdictions are likely

Table 1
Hypotheses Tested

Domain	Hypothesis	Description
Resources	1	Increased CDC and HRSA funding is correlated with increased preparedness activity
	2	Departments serving larger populations have greater preparedness activity
	3	Greater per capita expenditures on public health are correlated with greater preparedness activity
	4	Higher levels of federal preparedness funding increase the probability of hiring a preparedness coordinator
Leadership	5	Employment of a preparedness coordinator is associated with greater preparedness activity
	6	Full-time department directors are associated with greater preparedness activity
Saliency	7	Departments that have experienced and actual emergency will have greater preparedness activity
Interdependence	8	Greater levels of state preparedness activity are related to greater levels of local public health preparedness activity

NOTE: CDC = Centers for Disease Control and Prevention; HRSA = Health Services Resource Agency.

to have greater resources available and thus are more likely to afford to implement these activities. Third (H_3), agencies in jurisdictions with a greater willingness to pay for public health, as evidenced by the level of per capita expenditures, are more likely to implement public health preparedness activities. Fourth (H_4), because it is anticipated that federal preparedness funds will encourage the hiring of dedicated preparedness staff, a positive, indirect relationship should exist between preparedness funding levels and the employment of a preparedness coordinator.

Local leadership and administrative capacity have been identified as critical to the implementation of intergovernmental programs; hence, two hypotheses are tested related to the role of leadership. First (H_5), it is believed that the existence of a full-time, as opposed to part-time, agency executive will result in greater efforts to implement the preparedness activities. Beyond the basic agency leadership role, preparedness may require a dedicated leader or advocate. Emergency preparedness is a function requiring what James Q. Wilson calls a "procedural" organization, that is, it is a task where outputs (such as preparedness activities) are measurable, but the outcome (actual preparedness) is generally not. Managing such tasks requires oversight to ensure that specialized procedures are implemented as more

ambiguous goals cannot be measured (Wilson, 1989). As a result, the hypothesis (H_6), that the availability of focused leadership resources in the form of an emergency preparedness coordinator, is positively related to the performance of preparedness activities is tested.

The saliency of emergency preparedness may well determine the priority a local health department places on the issue. The experience of an actual emergency is anticipated to move the issue of preparedness from the theoretical to concrete level, raising the importance of preparedness as a policy issue and increasing the motivation to conducted activities to improve preparedness. A hypothesis (H_7), therefore, is tested that the saliency of the preparedness issue to the department, as indicated by the experience of an actual public health emergency, is likely to be positively correlated with the performance of preparedness activities.

Because these federal funds, with the exception of the cities of New York and Los Angeles, are dispersed through the states, the program is structured on a sequential interdependence model, with the federal policy dependent on implementation by state agencies, which are further dependent on the local departments. This relationship model is susceptible to failure at multiple points, as the performance of one level in the model can effect the operations of another (O'Toole & Montjoy, 1984). Therefore, a final hypothesis (H_8) is that, *ceteris paribus*, higher levels of state performance will be linked to greater local preparedness activity.

Methods

This study uses data from the 2005 NACCHO National Profile Data Set (core module) to build regression models testing the relationship of organizational capacity, leadership, and environmental factors on the performance of bioterrorism preparedness activities. The profile is a periodic survey of local health departments conducted by the NACCHO for the purpose of informing public policy and identifying infrastructure needs in local health departments. Data were collected through paper and Web questionnaires, and consists of a core questionnaire sent to all local health departments and three modules collecting more detailed data from samples of local departments. Data were self-reported and not verified. This data set contains completed core module responses from 2,300 local health departments (80% response). After excluding cases with missing data, 798 departments remained in the analytical data set. These departments are described in

Table 2
Descriptive Statistics (Continuous Variables) for Included and Excluded Cases

	Sample LHDs		Excluded LHDs		Statistics	
Variable	Mean	*SD*	Mean	*SD*	*t*	Significance
Population served[a]	167797	482704	101822	334058	3.401	.001
% Caucasian	80.39	17.51	85.89	15.94	7.283	<.001
% Hispanic	7.05	11.34	5.74	10.05	2.683	.007
Annual budget (×US$100,000)	87.63	410.21	36.38	145.55	3.348	.001
Log (per capita budget)	1.47	0.37	1.41	0.41	3.541	<.001
Percent of departmental budget—local sources	30.58	27.41	36.30	31.55	4.307	<.001
Percent of departmental budget—state sources	22.14	19.12	19.51	20.63	2.871	.004
CDC bioterrorism funds (×US$1,000)	225.77	1163.90	120.32	308.35	2.460	.006
HRSA bioterrorism Funds (×US$1,000)	73.05	659.39	24.81	126.51	1.955	.051
Director's tenure (years)	8.56	7.81	8.06	7.55	1.440	.150
FTEs hired with federal BT funds	1.76	5.36	1.10	2.82	3.155	.002
State preparedness score	4.25	1.42	4.06	1.30	3.042	.002
Local preparedness score	4.12	1.22	3.99	1.30	2.312	.021

NOTE: BT = Bioterrorism; CDC = Centers for Disease Control and Prevention; FTE = Full-time equivalents; HRSA = Health Services Resource Agency; LHD = Local Health Department.
[a] In models, the log10 of the population is used to obtain a normal distribution.

Table 2. Data were missing from excluded cases largely because of nonresponse on the questions producing the predictor variables.

Models are built to examine the determinants of a number of indicators of local public health department preparedness activities. Because, in the absence of an evaluation of response to an actual public health emergency, the actual preparedness of a department cannot be directly measured, this study focuses on examining the activities that are conducted by the department as a means of building the capacity to respond to an emergency. These include variables representing five specific local health department emergency preparedness activities (development of a written preparedness plan, review of legal authority, participation in drills, assessment of staff preparedness competencies, and conducting staff preparedness training) and the employment of a local emergency preparedness coordinator. These activities are consistent with requirements as outlined in the CDC-provided

Table 3
Descriptive Statistics (Discrete Variables) for Included and Excluded Cases

Variable	Sample LHDs	Excluded LHDs	Statistics	
			Odds Ratio	Significance
Existence of a local board of health	75.7	73.6	1.115	.311
Local department is part of a state agency	23.7	21.9	1.105	.370
The department has a full-time director	87.0	85.3	1.150	.315
The director has a public health degree	21.5	16.9	1.347	.009
The director has a medical degree	21.4	14.1	1.656	<.001
The director has a nursing degree	32.9	34.3	0.940	.539
Local department employs an epidemiologist	27.7	22.7	1.306	.017
Local department employs an emergency preparedness coodinator	53.8	60.4	0.763	.005
Local department operates a syndromic surveillence system	32.4	31.0	1.067	.525
Local department has a public health laboratory	29.3	22.3	1.446	<.001
Local department has an emergency preparedness plan	92.0	89.0	1.422	.029
Local department has reviewed legal authority for emergencies	66.4	63.6	1.129	.210
Local department has participated in drills or exercises	92.7	90.9	1.257	.190
Local department has experienced an actual emergency	39.9	34.4	1.268	.011
Local department has assessed staff preparedness competencies	70.9	70.4	1.027	.826
Local department has conducted staff preparedness training	89.8	84.8	1.587	.001
Local department has conducted no preparedness activity	1.9	2.3	0.824	.642

NOTE: LHD = Local Health Department.

guidance for the preparedness program funding announcement for fiscal year 2004 (CDC, 2004). These are binary coded (1 = *yes*, 0 = *no*). These variables are derived from questions that asked departments if they have developed or updated an emergency plan, reviewed legal authorities, participated in exercises, participated in an actual emergency, assessed staff emergency competencies, or provided staff emergency preparedness training. These responses are analyzed individually and as an overall score

calculated as the total number of preparedness activities performed, ranging from 0 to 5. Each activity is weighted equally because of the crudeness of the measures for individual activities, which only reported whether an activity was conducted, with no indication of how often or comprehensive the activity was, nor any indication of the quality of the activity. In addition, this is consistent with the way the overall preparedness activity score is constructed for states by The Trust for America's Health (Hearne, Segal, Earls, & Unruh, 2004).

In addition, a binary coded variable indicating the presence of a syndromic surveillance system operated by the local health department is used, as such a system is a widely advocated tool for the early detection of a public health emergency. These systems use patient symptoms from electronic medical records to obtain rapid epidemiological information to identify potential disease outbreaks. Because the crude yes/no measures reflect a wide range of activity levels within the group, a significant part of the unexplained variance in the statistical models is likely to represent the measurement error and uncertainty inherent in these variables. Finally, a continuous variable reflecting the number of FTEs added as a result of federal bioterrorism funding is used.

Independent variables described agency funding, the population of the jurisdiction served, agency leadership, and other resources. These variables are identified in Tables 2 and 3. For yes or no questions, variables were binary coded with values of $1 = yes$, $0 = no$. Funding variables included the level of federal bioterrorism funding (in thousands of dollars) received from the CDC and the Health Resources and Services Administration (HRSA). The per capita budget and the total population, normalized by a logarithmic transformation, are used to control for overall budgetary resources, with the population variable representing resource differences deriving from the size of the jurisdiction (larger jurisdictions, all other things being equal, would be expected to have greater resources than smaller ones) and the per capita budget variable accounting for differences in resources deriving from factors other than size, such as the willingness of the local population to pay for public health programs. This formulation is used to avoid collinearity between budgetary variables, and it should be noted that the population size variable may be connected to nonresource factors, such as risk perception, that can motivate preparedness activities. Larger jurisdictions, for example, may be perceived as being at greater risk for the occurrence of a terrorist attack. The percentages of the local department budget deriving from local and state sources are also included in the model to account for the potential policy impacts of the sources of departmental revenue streams.

A number of variables are used to represent the governance structure and leadership of the local health department. Governance is represented by variables representing the governance institutions of the local health department, such as the presence of a local board of health, whether a local department is organizationally part of a larger state health department, and whether the department has a full-time director (vs. part-time leadership). Leadership indicators include the tenure in office of the director and indicators of the director's professional training and orientation, as indicated by holding medical, nursing, or public health degrees. These variables are available whether the director is employed full time or part-time. In addition, the employment of an emergency preparedness coordinator is included to indicate leadership resources dedicated to preparedness activities.

Because local governmental units in the United States are not sovereign entities and exist as creatures of the state government, the score representing state-level preparedness activities obtained from the Trust for America's Health was used (Hearne et al., 2004). This scale is constructed by totaling ten preparedness measures, representing funding; basic legal, workforce, and epidemiological capacities; local concurrence with state bioterror preparedness plans; and pandemic influenza preparedness, to represent the state preparedness environment.

Power calculations, based on an uncorrected probit model, were performed prior to analysis using the technique of Hsieh, Bloch, and Larsen (1998). Because of the possibility of collinearity between the large number of independent variables, sample sizes were calculated using a variance inflation factor based on the multiple correlation coefficients of similar models predicting performance of the ten essential public health services observed in a study performed by Scutchfield et al. (2004). These ranged from 0.24–0.45. Using 798 observations, significance levels of 0.05 and a power of 0.8 can be obtained for logits (logistic regression coefficients) of 0.02–0.03. Taylor and colleagues have demonstrated that the sample size required to identify the same underlying effect with a probit model, with the same specificity and power, is the same as for the logistic model (Taylor, West, & Aiken, 2006). The models, therefore, have at least the ability to detect probit coefficients in the approximate range of 0.01–0.02.

Statistical models were constructed and evaluated using the NLOGIT 3.0 software package. For all models, standard errors were corrected for groupwise autocorrelation based on state-level clustering using a robust covariance matrix.

According to our theoretical model, the employment of a preparedness coordinator is likely to be endogenous, that is, determined in part by other

factors in the model, which violates the assumptions of the standard regression models, resulting in inconsistent and inefficient estimation (Avery, 2005). As a result, simultaneous equations instrumental variables estimation is used, where employment of a preparedness coordinator is modeled using the employment of an epidemiologist and the presence of a public health laboratory as instruments. Because of a CDC focus on epidemiological capacity (CDC, 2004), these were believed likely to be correlated with the employment of a coordinator, and tested as exogenous with the Durbin-Wu-Hausman test, meeting the criteria for an instrumental variable (Kennedy, 1998). The employment of an epidemiologist fully met this requirement, and the use of these two variables allowed for the full specification of the econometric models while correcting for the endogeneity problem.

The basic form of the model is as follows:

$$\text{Prob(EP coordinator)} = F(X_i, \text{epidemiologist}, \text{laboratory}) + \varepsilon_1 \quad (1)$$

$$\text{Preparedness activity} = F(X_i, \text{Prob}_{\text{Pred}}(\text{EP coordinator})) + \varepsilon_2 \quad (2)$$

$$\text{EP} = \text{Emergency preparedness}$$

where Prob (EP coordinator) is the probability of employing an emergency preparedness coordinator, X_i is the matrix of exogenous independent variables, epidemiologist is the employment of an epidemiologist, laboratory is the existence of a local public health laboratory, and $\text{Prob}_{\text{Pred}}$(EP coordinator) is the predicted probability, from Model (1) of employing an emergency preparedness coordinator.

For the first stage (Model 1), the employment of an emergency preparedness coordinator was modeled using a univariate probit model. Variables were tested for endogeneity using the Durbin-Wu-Hausman test (Hausman, 1978). None demonstrated significant endogeneity within this model.

For the second stage (Model 2), two approaches were used, depending on the nature of the variable. For the two continuous measures (the preparedness scale score and the number of FTEs hired as a result of preparedness funds), data were analyzed using a Heckman two-step estimation procedure to address the endogeneity of the emergency preparedness coordinator, with all results from the probit estimation of the endogenous variable used to estimate the second stage least squares regression model (Heckman, 1979). This method uses the results of the first stage bivariate probit to calculate the Inverse Mill's Ratio, which is used to calculate consistent standard errors for second stage model estimates. For binary preparedness measures,

simultaneous bivariate probit models were estimated, using the preparedness coordinator estimation equation as the second probit model in the system of equations. These methods control for the problem of endogeneity in predictor variables, producing consistent estimators, that is, accurate estimates of standard errors (Ashford & Snowden, 1970).

It should be noted that significant differences exist between departments used in the sample and those that could not be used because of incomplete responses (Tables 2 and 3). Departments used in the study tend to be larger, with correspondingly greater resources. Leadership does not appear to differ significantly between the two groups with the exception of employment of a local emergency coordinator, and the performance of most, but not all, emergency activities are not significantly different between study and nonstudy departments (Tables 2–3). This suggests using caution in assuming that the results are generalizable to the larger population of local health departments. Population density and urbanization, however, are considered to increase the risk from a public health disaster by increasing the consequences of an incident (Arnold, 2002); thus, the sample may reflect those jurisdictions at greatest risk.

For the sake of clarity, the meaning of the effect defined by a probit coefficient should be discussed. Where effect sizes in percentage change are noted in this article, it should be observed that the change refers to a percentage of a base probability, not a percentage point change in the probability. Hence, if a 30% increase in probability for a unit change in a predictor is noted, it means that the change results in probability that is 30% higher (1.3 times p for a single unit change, or 1.3^2 times p for a two unit change), not a 30% point increase in probability ($0.30 + p$).

Results

Results from the statistical models are presented in Tables 4–7. Table 4 presents a univariate probit model addressing the predictors of hiring an emergency preparedness coordinator. Tables 5 and 6 represent results from models with least squares regression used in the second stage, examining predictors of the number of full-time equivalent staff hired for the preparedness program (Table 5) and overall preparedness (Table 6). Table 7 represents models with the second stage estimated using bivariate probit that examine factors related to the performance of individual preparedness activities.

With respect to the first hypothesis, that federal preparedness funds will have a direct impact on local preparedness activities, such an effect is observed

Table 4
Factors Predicting Employment of an Emergency Preparedness Coordinator—Univariate Probit Model

Variable	Coefficient	Significance
Constant	−4.061	<.001
Population served		
% ***Caucasion***	***0.014***	***.002***
% Hispanic	0.005	.379
Resources		
Log10 (population)	***0.480***	***.002***
Log10 (per capita budget)	***0.567***	***<.001***
Percent from local appropriations	0.004	.559
Percent from state direct sources	0.005	.222
CDC bioterrorism funds (US$100K)	***0.304***	***.028***
HRSA bioterrorism funds (US$100K)	0.018	.580
Leadership and management		
Local board of health	−0.052	.725
Part of state agency	0.230	.472
Full-time director	−0.004	.999
Director tenure	−0.009	.231
Director—public health degree?	−0.090	.615
Director—medical degree?	−0.007	.968
Director—nursing degree?	−0.006	.960
Other factors		
Employs epidemiologist?	***0.880***	***<.001***
Experienced actual PH emergency?	−0.065	.514
State preparedness scale	−0.026	.654
Log likelihood	−375.160	
Positive predictive value	88.2%	
Negative predictive value	72.2%	
% correctly predicted	79.2%	

NOTES: CDC = Centers for Disease Control and Prevention; HRSA = Health Services Resource Agency; PH = Public Health; ***bold italic*** variables are significant at $\alpha = .05$.

for only two outcome measures: the hiring of a preparedness coordinator and the number of full-time equivalents hired, and only as a result of the level of CDC funding (Tables 4 and 5). HRSA funding levels demonstrate no impact on any measure. For each additional US$100,000 in CDC preparedness funding, a department is approximately 30% more likely to hire a preparedness coordinator and hires approximately 0.43 FTEs for preparedness positions.

Although no direct impact is seen on preparedness activities, there is an indirect impact, as the employment of a preparedness coordinator is a

Table 5
Factors Predicting Hiring of Bioterrorism Personnel (Heckman Sample Selection Model)

	Direct Effects		Indirect Effects		Total Effects	
Variable	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance
Constant	−2.462	.091	−2.4126	.006		
Population served						
% Caucasion	−0.003	.627	0.007	.908	0.004	.944
% Hispanic	***0.032***	***<.001***	0.003	.968	0.035	.586
Budget						
Log10 (population)	***0.561***	***.036***	0.252	.131	***0.813***	***.010***
Log10 (per capita budget)	*−0.499*	*.095*	*0.297*	*.090*	−0.202	.559
Percent from local appropriations	−0.005	.216	0.002	.976	−0.003	.956
Percent from state direct sources	−0.0007	.892	0.0029	.963	0.0022	.972
CDC bioterrorism funds (US$100K)	***0.428***	***<.001***	***0.159***	***.023***	***0.587***	***<.001***
HRSA bioterrorism funds (US$100K)	***−0.093***	***.002***	0.009	.857	−0.084	.162
Leadership and management						
Local board of health	0.133	.523	−0.027	.820	0.106	.659
Part of state agency	−0.107	.662	0.120	.392	0.013	.962
Full-time director	0.026	.926	−0.0002	.999	0.026	.933
Director tenure	0.001	.896	−0.005	.939	−0.003	.958
Director—public health degree?	−0.124	.541	−0.047	.710	−0.171	.475
Director—medical degree?	0.263	.233	−0.003	.969	0.260	.275
Director—nursing degree?	0.252	.180	−0.003	.949	0.248	.198

(continued)

Table 5 (continued)

Variable	Direct Effects		Indirect Effects		Total Effects	
	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance
Other factors						
Employs emergency preparedness coordinator?	***2.258***	***.002***				
Employs epidemiologist?			***0.460***	***.032***		
Experienced actual PH emergency?	0.195	.229	−0.034	.725	0.161	.394
Has public health laboratory?			0.077	.349		
State preparedness scale	0.016	.805	−0.014	.832	0.002	.981
λ	−1.096	.0156				
N	769					
R^2	0.868					

NOTES: CDC = Centers for Disease Control and Prevention; HRSA = Health Services Resource Agency; PH = Public Health; ***bold italic*** variables are significant at $\alpha = .05$; *italic only* trend at $\alpha = .10$.

Table 6
Factors Predicting Overall Preparedness Activity (Heckman Sample Selection Model)

Variable	Direct Effects		Indirect Effects		Total Effects	
	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance
Constant	0.441	.509	−0.468	.219		
Population served						
% Caucasion	***0.007***	***.008***	0.001	.908	0.008	.500
% Hispanic	0.003	.412	0.0005	.968	0.004	.779
Budget						
Log10 (population)	***0.234***	***.043***	0.049	.285	***0.283***	***.023***
Log10 (per capita budget)	***0.327***	***.015***	0.058	.259	***0.385***	***.008***
Percent from local appropriations	0.001	.573	0.0004	.976	0.001	.909
Percent from state direct sources	*0.004*	*.059*	0.0006	.963	0.005	.683
CDC bioterrorism funds (US$100K)	−0.005	.578	0.031	.208	0.026	.317
HRSA bioterrorism funds (US$100K)	0.003	.816	0.002	.858	0.005	.770
Leadership and management						
Local board of health	0.142	.158	−0.005	.822	0.137	.185
Part of state agency	***−0.363***	***<.001***	0.023	.456	***−0.340***	***.002***
Full-time director	***0.773***	***<.001***	−0.0004	.999	***0.773***	***<.001***
Director tenure	0.007	.153	−0.001	.939	0.006	.636
Director—public health degree?	−0.009	.927	−0.009	.710	−0.018	.857
Director—medical degree?	0.020	.853	−0.0007	.969	0.019	.859
Director—nursing degree?	***0.200***	***.027***	−0.0006	.949	***0.200***	***.028***

(continued)

Table 6 (continued)

	Direct Effects		Indirect Effects		Total Effects	
Variable	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance
Other factors						
Employs emergency preparedness coordinator?	***0.885***	***<.001***				
Employs epidemiologist?			0.089	.217		
Experienced actual PH emergency?	***0.412***	***<.001***	−0.007	.731	***0.405***	***<.001***
Has public health laboratory?			0.015	.426		
State preparedness scale	−0.018	.556	−0.003	.834	−0.020	.533
λ	−0.213	.200				
N	777					
R^2	0.318					

NOTES: CDC = Centers for Disease Control and Prevention; HRSA = Health Services Resource Agency; PH = Public Health; ***bold italic*** variables are significant at $\alpha = .05$; *italic only* trend at $\alpha = .10$.

Table 7
Results for Individual Preparedness Activities

	Prepared or Updated a Written Emergency Plan				Reviewed Legal Authorities			
	Index Preparedness		Index Coordinator		Index Preparedness		Index Coordinator	
Variable	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance
Constant	−0.042	.982	***−4.4983***	***<.001***	***−2.504***	***.016***	***−4.5549***	***<.001***
Population served								
% Caucasion	−0.002	.740	***0.013***	***.025***	0.006	.633	***0.013***	***.009***
% Hispanic	0.008	.642	0.005	.460	0.006	.417	0.004	.654
Budget								
Log10 (population)	0.091	.765	***0.476***	***.001***	0.069	.633	***0.481***	***.001***
Log10 (per capita budget)	−0.105	.698	***0.569***	***<.001***	0.184	.366	***0.562***	***<.001***
Percent from local appropriations	−0.001	.748	0.004	.551	0.005	.210	0.003	.668
Percent from state direct sources	−0.003	.748	0.006	.218	0.004	.410	0.005	.325
CDC bioterrorism funds (US$100K)	−0.043	.537	***0.330***	***<.001***	0.059	.177	***0.313***	***<.001***
HRSA bioterrorism funds (US$100K)	0.085	.816	0.017	.747	0.010	.916	0.018	.705
Leadership and management								
Local board of health	0.149	.556	−0.067	.716	0.177	.167	−0.057	.720
Part of state agency	*−0.633*	*.065*	0.194	.650	−0.509	.001	0.206	.624
Full-time director	***0.425***	***.019***	−0.015	.950	0.699	.002	−0.098	.968
Director tenure	0.005	.688	−0.015	.259	−0.005	.342	−0.008	.355
Director—public health degree?	−0.026	.948	−0.086	.654	0.066	.651	−0.095	.658
Director—medical degree?	−0.064	.712	0.308	.876	−0.038	.806	−0.014	.947
Director—nursing degree?	0.080	.677	0.034	.773	0.126	.176	0.006	.956

(continued)

Table 7 (continued)

	Prepared or Updated a Written Emergency Plan				Reviewed Legal Authorities			
	Index Preparedness		Index Coordinator		Index Preparedness		Index Coordinator	
Variable	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance
Other factors								
Employs emergency Preparedness coordinator?	***2.028***	***<.001***			***1.123***	***.003***		
Employs epidemiologist?			***0.867***	***<.001***			***0.864***	***<.001***
Experienced actual PH emergency?	*0.295*	*.084*	−0.062	.674	***0.528***	***<.001***	−0.064	.655
Has public health laboratory?			0.178	.240			0.118	.489
State preparedness scale	−0.018	.890	−0.043	.584	0.033	.632	−0.022	.760
r	−0.944	<.001			−0.370	.2003		
N	777.000				777			
Log likelihood	−530.956				−751.513			

	Participated in Drills or Exercises				Assessed Staff Emergency Preparedness Competencies			
	Index Preparedness		Index Coordinator		Index Preparedness		Index Coordinator	
Variable	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance
Constant	***−3.338***	***.023***	***−4.7866***	***<.001***	−1.359	.166	***−4.548***	***<.001***
Population served								
% Caucasion	0.008	.206	***0.014***	***.002***	0.004	.554	***0.014***	***.005***
% Hispanic	−0.002	.908	0.005	.399	0.0007	.860	0.004	.600
Resources								
Log10 (population)	***0.725***	***.018***	***0.498***	***.002***	0.103	.484	**0.466**	**<.001**
Log10 (per capita budget)	***0.696***	***.024***	***0.605***	***<.001***	0.137	.326	**0.552**	**<.001**
Percent from local appropriations	−0.003	.117	0.004	.568	0.0002	.928	0.004	.638
Percent from state direct sources	0.004	.627	0.006	.262	0.003	.262	0.005	.302
CDC bioterrorism funds (US$100K)	0.523	.204	***0.306***	***<.001***	−0.005	.753	***0.315***	***<.001***
HRSA bioterrorism funds (US$100K)	1.216	.787	0.017	.734	0.003	.892	0.018	.690
Leadership and management								
Local board of health	−0.234	.428	−0.031	.858	0.047	.826	−0.048	.758
Part of state agency	−0.667	.107	0.257	.561	−0.014	.942	0.229	.581
Full-time director	0.345	.329	0.002	.992	0.304	.061	0.006	.980
Director tenure	0.007	.460	−0.009	.369	0.011	.128	−0.009	.355
Director—public health degree?	−0.099	.825	−0.091	.669	−0.084	.652	−0.092	.369
Director—medical degree?	−0.289	.384	−0.010	.967	−0.173	.418	0.018	.925
Director—nursing degree?	0.189	.581	−0.005	.969	0.130	.092	−0.0003	.999

(continued)

Table 7 (continued)

	Prepared or Updated a Written Emergency Plan				Reviewed Legal Authorities			
	Index Preparedness		Index Coordinator		Index Preparedness		Index Coordinator	
Variable	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance
Other factors								
Employs emergency preparedness coordinator?	−0.262	.768			*0.813*	*.060*		
Employs epidemiologist?			***0.853***	***<.001***			***0.852***	***<.001***
Experienced actual PH emergency?	0.276	.263	−0.007	.603	***0.519***	***<.001***	−0.073	.593
Has public health laboratory?			0.134	.384			0.192	.194
State preparedness scale	−0.020	.892	−0.032	.677	−0.024	.630	−0.020	.787
ρ	0.437	.3965			−0.257	.3413		
N	777				777			
Log likelihood	−523.902				−792.232			

	Conducted Staff Preparedness Training				Has a Local Syndromic Surveillence System			
	Index Preparedness		Index Coordinator		Index Preparedness		Index Coordinator	
Variable	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance
Constant	*−4.019*	*.084*	***−4.6004***	***<.001***	−0.259	.793	***−4.568***	***<.001***
Population served								
% Caucasion	0.005	.437	***0.014***	***.018***	0.004	.273	***0.014***	***.013***
% Hispanic	0.006	.660	0.005	.491	0.003	0.615	0.002	.710
Resources								
Log10 (population)	0.565	.292	***0.477***	***<.001***	−0.259	.162	***0.493***	***<.001***
Log10 (per capita budget)	0.502	.205	***0.559***	***<.001***	−0.232	.217	***0.569***	***<.001***
Percent from local appropriations	0.001	.763	0.004	.629	−0.004	.101	0.003	.670
Percent from state direct sources	0.005	.434	0.005	.299	***−0.009***	***.007***	0.005	.335
CDC bioterrorism funds (US$100K)	0.352	.158	***0.304***	***<.001***	*0.031*	*.078*	***0.258***	***<.001***
HRSA bioterrorism funds (US$100K)	1.057	.786	0.018	.719	0.021	.581	0.011	.775
Leadership and management								
Local board of health	0.353	.105	−0.052	.743	−0.154	.388	−0.081	.641
Part of state agency	−0.015	.949	0.229	.598	−0.021	.911	0.193	.646
Full-time director	***0.567***	***.018***	0.001	.996	*0.366*	*.089*	−0.030	.903
Director tenure	***0.023***	***.007***	−0.009	.375	−0.0008	.908	−0.009	.384
Director—public health degree?	0.013	.957	−0.090	.624	0.042	.688	−0.006	.974
Director—medical degree?	0.283	.226	−0.005	.981	0.318	.068	−0.050	.814

(continued)

Table 7 (continued)

	Conducted Staff Preparedness Training				Has a Local Syndromic Surveillence System			
	Index Preparedness		Index Coordinator		Index Preparedness		Index Coordinator	
Variable	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance
Director—nursing degree?	***0.812***	***<.001***	−0.006	.961	0.145	.207	0.021	.872
Other factors								
Employs emergency preparedness coordinator?	0.737	.602			***1.254***	***<.001***		
Employs epidemiologist?			***0.882***	***<.001***			***1.000***	***<.001***
Experienced actual PH emergency?	***0.447***	***.010***	−0.065	.627	***0.548***	***<.001***	−0.072	.579
Has public health laboratory?			0.150	.281			0.166	.231
State preparedness scale	−0.057	.681	−0.025	.739	−0.005	0947	−0.021	.787
ρ	−0.129	.8838			−0.626	<.001		
N	777				772			
Log likelihood	548.810				778.716			

NOTES: CDC = Centers for Disease Control and Prevention; HRSA = Health Services Resource Agency; PH = Public Health; ***bold Italic*** variables are significant at $\alpha = .05$; *italic only* trend at $\alpha = .10$.

significant predictor of such activities, as noted below. Hence, the hypothesis (H_1) of a direct relationship between federal preparedness funds and activities is largely rejected, but evidence exists of an indirect role for the CDC program in developing planning capacity. This supports the hypothesis (H_4) that federal funds play an indirect role by developing leadership.

For the second hypothesis, that overall resource levels will be significantly linked to preparedness activities, the relationship between the jurisdictional population and activities are used, on the assumption that larger jurisdictions will have, ceteris paribus, greater available resources. Results indicate a positive relationship between the population and the employment of a preparedness coordinator, program FTEs hired, and overall preparedness activity (Tables 4–6). For individual activities, a relationship is seen only in the likelihood to hold drills and exercises (Table 7). Hence, the hypothesis is confirmed, subject to the caution that population size is an imperfect surrogate and may also represent concepts of risk perception. As with CDC funding levels, an indirect relationship through the role of this variable in enabling the hiring of the preparedness coordinator also exists.

For the third hypothesis, that local willingness to pay for public health had a positive relationship on public health activity, the per capita budget for public health has a significant positive relationship to the hiring of the coordinator and overall preparedness activity, as well as on the conduct of drills and exercises (Tables 4, 6–7). A negative trend at the 90% confidence level is observed between per capita funding and the number of preparedness personnel hired (Table 5). No impact is seen on the budget percentage generated through local revenue and activity. As a result, it is imprudent to conclude that willingness to pay at the local level is a predictor of activity. The results, rather, suggest that preparedness activities may be funded by available resources over and above what are needed for the department's baseline services.

The models provide confirmation of both hypotheses (H_5, H_6) related to departmental management and leadership. The characteristics of the local health department director are directly related to the activities conducted by the department. At the 95% confidence level, local health departments with a full-time director carry out on average 0.77 more activities than those without (Table 6). Those with full-time directors are 42.5% more likely to have a current emergency plan and 56.7% more likely to have conducted staff training in the areas of preparedness (Table 7). Expanded to the 90% confidence level, full-time directors are also associated with implementation of syndromic surveillance. Those led by directors with nursing backgrounds have higher overall activity scores and are 81.2% more likely

to have conducted staff preparedness training. Directors with longer tenure are also associated with the conduct of staff training. As a result, the models support the hypothesis that the characteristics of the department director are related to preparedness efforts.

The sixth hypothesis, that the existence of dedicated preparedness leadership is positively related to program activity, is strongly supported by the models. Employment of a coordinator is related to an average of 2.28 additional FTEs (Table 5), and the performance of approximately 0.9 additional activities (Table 6). In particular, coordinators are more than three times as likely to have a current written emergency plan and more than twice as likely to operate a syndromic surveillance system (Table 7).

The seventh hypothesis, that the experience of an actual emergency is related to preparedness activity, is supported by significant positive relationships between such experience and overall activity. Departments that experienced a public health emergency are 52.8% more likely to have reviewed their legal authority, 51.9% more likely to have assessed staff competencies, 44.7% more likely to have conducted training, and 54.8% more likely to have a syndromic surveillance system (Table 7). At the 90% confidence level, these departments are 29.5% more likely to have a current emergency plan. No significant relationship, however, is seen between experience and the hiring of preparedness staff (Table 5).

The final hypothesis (H_8), that the state preparedness level predicts local preparedness activity, is not supported. Such a relationship was not observed in any model. Local preparedness activity appears to be independent of state efforts.

Discussion

These results should be tempered with the realization that the analysis is conducted on relatively crude measures of activity, a limitation imposed by the nature of the secondary data set used for the study, as well as the fact that the data are self-reported and unverified. Given those limitations, however, the observed results are consistent with the theory that local leadership is the important driver determining how federal transfer funds are spent and whether the goals of intergovernmental programs are implemented. These findings suggest that federal preparedness funding does enhance preparedness activities for local health departments, but indirectly through enabling hiring of specialized program leadership. Federal funding does not exert a

direct effect on preparedness, but does enable the local health department to hire dedicated emergency preparedness leadership in the form of an emergency preparedness coordinator. The leadership provided by the preparedness coordinator then facilitates the implementation of a preparedness program.

In direct terms, these results are consistent with the Handler model, suggesting that the overall budget and leadership resources available to the department, as well as the motivation provided by having experienced a public health emergency, are related to determining whether preparedness activities are conducted.

These findings are consistent with those reported from a 2002 NACCHO survey of local health departments regarding preparedness efforts 1 year after the terrorist attacks of September 11, 2001. This study found that agency preparedness was hampered by a lack of staff resources for planning and coordinating preparedness, and that these agencies were reluctant to add staff due to a lack of permanent funding (Brown, Brown, Cope, Randall, & Rauf, 2002). Similar results, particularly regarding the issue of sustainable funding, were found in a study of preparedness and public health nurses (Akins, Williams, Silenas, & Edwards, 2005). Likewise, the implementation of homeland security initiatives in US cities with populations greater than 30,000 found that overall funding levels, administrative capacity, and leadership are critical to success, and that federal efforts might best be focused on developing local administrative and leadership capacity to sustain such programs (Gerber, Cohen, & Stewart, 2007). The current study provides further confirmation for some of these conclusions, finding that overall resources and leadership, particularly leadership focused on preparedness efforts but including full-time departmental direction and a departmental director with a nursing background, remain a determining factor for local agency preparedness activity. Federal bioterrorism funding appears to spur preparedness activities by enabling the department to hire the specialized preparedness leadership needed to initiate activities rather than by directly funding those activities.

The finding that overall preparedness activity is related to having a director with a nursing background raises questions. Why is a nursing background related to more preparedness activity? One suggestion is that this results from a professional focus by public health nurses on a process of assessment and planning (Jakeway, LaRosa, & Schoenfisch, 2008; Moody, Cardenas, & Avila, 2003). The results of models for individual preparedness activities are equivocal in their support for this idea, however. Although the results for planning and workforce assessment activities do produce positive coefficients, these are statistically insignificant. The only significant activity

finding is for workforce training. Departments with a nurse director are 80% more likely than the reference (nonphysician, nonpublic health trained, nonnurse directed) group to conduct preparedness training. Although this may reflect a professional focus on assessment and planning, concluding that it does in the absence of a strong relationship between professional background and explicit planning measures would stretch the evidence beyond what can be prudently supported. These results thus suggest a new question for future research.

This study lacks data on the perception of funding stability; hence, this concept was not completely testable in the study. Likewise, the cross-sectional nature of the available data limits the ability to address this question by examining the impact of funding dynamics on activities. For example, the concept might be tested by answering the question of whether the consistency of funding levels in lagged years have a relationship to preparedness activity. Current efforts by NACCHO to create a new profile data set using the same core questions will create opportunities for further work in this area. Results indicating that per capita expenditures, but not the level of local funding, predict activities potentially suggests that activities may depend on the level of resources in excess of the requirements to implement baseline services. This may support a suggestion that intergovernmental funding stability plays a role in program implementation and that further longitudinal work is warranted. Because the study is cross sectional, it is also difficult to establish a temporal relationship that would provide stronger support for determining the causal nature of the observed relationships.

These results offer insight into how an intergovernmental transfer program can successfully obtain desired program outcomes. Pressman and Wildavsky, in their classic study of intergovernmental program implementation, note that few officials at donor levels can visualize the steps needed at the local level to successfully implement a program, and that the behavior of recipients is "strongly influenced by their organizational problems with giving and receiving money"(Pressman & Wildavsky, 1973). In the case of CDC bioterrorism funds, the donor agency is successful in influencing local health departments to conduct preparedness planning activities through the development of local, specialized leadership in the form of emergency preparedness coordinators that can overcome these problems. The role of the CDC program in encouraging the development of specialist leadership in the area of emergency preparedness is identified as more important in terms of obtaining program goals than its direct role in paying for local preparedness planning and program activity. This is consistent with models that suggest that local leadership is critical to the success of intergovernmental

grants in obtaining subordinate agency compliance and that incorporating capacity building measures into such programs can improve program outcomes (May & Burby, 1996; Nathan, 1983; Orland & Goettel, 1982). Neither donor nor recipient agencies can assume that the specification of technical aspects of a program, without an assurance of adequate administrative capacity for proper implementation, will ensure that policy goals are met.

It is worth noting that there appears to be no linkage between state-level preparedness ratings and local preparedness activity. Likewise, little evidence was found to indicate that either variable reflective of state influence on local departments (dependence on state funding, administrative control by the state health department) has much impact on local preparedness. The lack of such a link may indicate a low level of coordination between state public health and preparedness agencies and local health departments. It has been argued that no actor in the US intergovernmental system has the complete capacity or expertise to smoothly and effectively implement emergency management programs (Mushkatel & Weschler, 1985), which means that the lack of such a link should be an issue of concern to program managers at all levels. Significant efforts need to be made to address ongoing issues in intergovernmental and interagency coordination.

This study leaves unanswered the further question of whether federal preparedness funds can spur *systemic* improvements in public health, rather than just the conduct of emergency planning activities. Advocates of the federal preparedness program have argued that it is essential to build a dual infrastructure, one that incorporates bioterrorism preparedness into the existing public health infrastructure, improving both (Avery, 2004; Fraser & Brown, 2000; Hoffman & Norton, 2000; May, 2005; McCann, 1999; McDade, 1999). Concern exists that this is not happening. Historically, development of public health policies in response to short-term crisis has resulted in a focus on the momentary crisis to the exclusion of sustained support for broader public health goals (Fee & Brown, 2002). Concern exists that the current patterns of preparedness policy repeat this pattern. In some cases, narrowly tailored preparedness programs are replacing core public health activities such as communicable disease programs (Geiger, 2001; Hebert et al., 2007). As federal funding for the bioterrorism program has increased, some states have reduced local public health funding by similar amounts (Eban, 2002). If federal preparedness efforts are displacing broader public health efforts, the programs may be having an adverse impact despite achieving their primary goals.

The finding that the mechanism for spurring preparedness activity, the primary policy goal of the bioterrorism funding program, is the development of

a specialized leadership in the form of the emergency preparedness coordinator indicates that this issue of the mechanics of how intergovernmental funding programs obtain results remains relevant. Whether a program that largely depends on leadership focused on a specific problem area can result in significant improvements in areas outside the targeted focus has yet to be resolved. Evidence exists that targeted public health funding inhibits planning and integration of public health activities (Smith, Minyard, Parker, Van Valkenburg, & Shoemaker, 2007). The finding in this study that the mechanism that spurs successful targeted funding is the development of focused leadership is consistent with this evidence and indicates that further work is needed before accepting the open-ended assertion that targeted funding transfers such as the federal bioterrorism programs lead to general public health system improvements.

References

Agranoff, R., & McGuire, M. (2001). American Federalism and the Search for Models of Management. *Public Administration Review*, *61*, 671-681.

Akins, R. B., Williams, J. R., Silenas, R., & Edwards, J. C. (2005). The role of public health nurses in bioterrrorism preparedness. *Disaster Management and Response*, *3*, 98-105.

Arnold, J. L. (2002). Disaster medicine in the 21st century: Future hazards, vulnerabilities, and risk. *Prehospital and Disaster Medicine*, *17*, 3-11.

Ashford, J. R., & Snowden, R. R. (1970). Multi-variate probit analysis. *Biometrics*, *26*, 535-546.

Avery, G. (1995). *Out of the tap, into the garbage-can: Ambiguity, resource scarcity, and the implementation of the safe drinking water act.* Unpublished MPA thesis, University of Arkansas at Little Rock, Little Rock, AR.

Avery, G. (2004). Bioterrorism, fear, and public health reform: Matching a policy solution to the wrong window. *Public Administration Review*, *64*, 275-288.

Avery, G. (2005). Endogeneity in logistic regression models. *Emerging Infectious Diseases*, *11*, 503-504.

Avery, G. (2006). Infectious diseases: A resurgent problem: Developing effective public health responses. In W. Charney (Ed.), *Emerging infectious diseases and the threat to occupational health in the U.S. and Canada* (pp. 221-237). Boca Raton, FL: CRC Press.

Bashir, Z., Lafronza, V., Fraser, M. R., Brown, C. K., & Cope, J. R. (2003). Local and state collaboration for effective preparedness planning. *Journal of Public Health Management Practice*, *9*, 344-351.

Boulton, M. L., Abellera, J., Lemmings, J., & Robinson, L. (2005). Brief report terrorism and emergency preparedness in state and territorial public health departments—United States, 2004. *Morbidity and Mortality Weekly Report*, *54*, 459-460.

Brown, C., Brown, D., Cope, J., Randall, T., & Rauf, Z. (2002). *One year later: Improvements in local public health preparedness since september 11, 2001 (Issue Brief: Bioterrorism and Emergency Preparedness).* Washington, DC: National Association of County and City Health Officials.

Caruson, K., McManus, S., Cohen, M., & Watson, T. A. (2005). Homeland security preparedness: The rebirth of regionalism. *Publius: The Journal of Federalism*, *35*, 143-168.

Centers for Disease Control and Prevention. (2004). *Continuation guidance for cooperative agreement on public health preparedness and response for bioterrorism—Budget year five program announcement 99051.* Atlanta, GA: Author.

Clarke, S. E., & Chenoweth, E. (2006). The politics of vulnerability: Constructing local performance regimes for homeland security. *Review of Policy Research*, *23*, 95-114.

Eban, K. (2002). Waiting for bioterror: Is our publich health system ready? *Nation*, *275*, 11-18.

Fee, E., & Brown, T. M. (2002). The unfulfilled promise of public health: Deja Vu all over again. *Health Affairs*, *21*, 31-43.

Fossett, J. W. (1986). Assessing city responses to federal subventions. *Environment and Planning C: Government and Policy*, *4*, 289-298.

Fraser, M. R. (2007). After 5 years of public health preparedness, are we ready yet? *Journal of Public Health Management and Practice*, *13*, 3-6.

Fraser, M. R., & Brown, D. L. (2000). Bioterrorism preparedness and local public health agencies: Building response capacity. *Public Health Rep*, *115*, 326-330.

Geiger, H. J. (2001). Terrorism, biological weapons, and bonanzas: Assessing the real threat to public health. *American Journal of Public Health*, *91*, 708-709.

Gerber, B. J., Cohen, D. B., & Stewart, K. B. (2007). US cities and homeland security: Examining the role of financial conditions and administrative capacity in municipal preparedness efforts. *Public Finance and Management*, *7*, 153-190.

Goodrich, J. A. (1980). Optimizing under CETA: Program design, implementation problems, and local agencies. *Policy Studies Journal*, *8*(Spec 3), 1119-1126.

Handler, A., Issel, M., & Turnock, B. (2001). Conceptual framework to measure performance of the public health system. *American Journal of Public Health*, *91*, 1235-1239.

Hausman, J. A. (1978). Specification tests in economics. *Econometrica*, *46*, 1251-1272.

Hearne, S. A., Segal, L. M., Earls, M. J., & Unruh, P. J. (2004). *Ready or not? Protecting the public's health in the age of bioterrorism (Issue Report).* Washington, DC: Trust for America's Health.

Hebert, K., Anderson, N., & Gursky, E. A. (2007). Building preparedness by improving accountability. *Journal of Public Health Management and Practice*, *13*, 200-201.

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica*, *47*, 153-161.

Hoffman, R. E., & Norton, J. E. (2000). Lessons learned from a full-scale bioterrorism exercise. *Emerging Infectious Diseases*, *6*, 652-653.

Hsieh, F. Y., Bloch, D. A., & Larsen, M. D. (1998). A simple method of sample size calculation for linear and logistic regression. *Statistics in Medicine*, *17*, 1623-1634.

Jakeway, C. C., LaRosa, G., & Schoenfisch, S. (2008). The role of public health nurses in emergency preparedness and response: A position paper of the association of state and territorial directors of nursing. *Public Health Nursing*, *25*, 353-361.

Kennedy, P. (1998). *A guide to econometrics* (4th ed.). Cambridge, MA: The MIT Press.

Kettl, D. F. (2003). Contingent coordination: Practical and theoretical puzzles for homeland security. *The American Review of Public Administration*, *33*, 253-277.

Krane, D. (2003). The state of American Federalism, 2002-2003: Division replaces unity. *Publius: The Journal of Federalism*, *33*, 1-44.

Krane, D. A. (2002). The state of American Federalism, 2001-2002: Resilience in the response to crisis. *Publius: The Journal of Federalism*, *32*, 1-28.

Kydland, F. E., & Prescott, E. C. (1977). Rules rather than discretion: The inconsistency of optimal plans. *The Journal of Political Economy*, *85*, 473-492.

May, P. J., & Burby, R. J. (1996). Coercive versus cooperative policies: Comparing intergovernmental mandate performance. *Journal of Policy Analysis and Management*, *15*, 171-201.

May, T. (2005). Funding agendas: Has bioterror defense been over-prioritized? *American Journal of Bioethics*, *5*, 34-44.

Mays, G. P., McHugh, M. C., Shim, K., Lenaway, D., Halverson, P. K., Moonesinghe, R., et al. (2004). Getting what you pay for: Public health spending and the performance of essential public health services. *Journal of Public Health Management and Practice*, *10*, 435-443.

McCann, S. A. (1999). View from the hill: Congressional efforts to address bioterrorism. *Emerging Infectious Diseases*, *5*, 496.

McDade, J. E. (1999). Addressing the potential threat of bioterrorism—Value added to an improved public health infrastructure. *Emerging Infectious Diseases*, *5*, 591-592.

Moody, C., Cardenas, D., & Avila, M. (2003). The role of the advanced practice public health nurse in bioterrorism preparedness. *Public Health Nursing*, *20*, 422-431.

Mushkatel, A. H., & Weschler, L. F. (1985). Emergency management and the intergovernmental system. *Public Administration Review*, *44*(Special Issue: Emergency Management: A Challenge for Public Administration), 49-56.

Nathan, R. P. (1983). State and local governments under federal grants: Toward a predictive theory. *Political Science Quarterly*, *98*, 47-57.

National Association of City and County Health Officers. (2005). *Operational definition of a functional local health department.* Washington, DC: Author.

O'Toole, L., & Meier, K. J. (2004). Public management in intergovernmental networks: Matching structural networks and managerial networking. *Journal of Public Administation Research and Theory*, *14*, 469-494.

O'Toole, L. J., & Montjoy, R. S. (1984). Interorganizational policy implementation: A theoretical perspective. *Public Administration Review*, *44*, 491-503.

Office of Management and Budget. (2007). *Program Assessment: National Bioterrorism Hospital Preparedness Program* [Electronic Version]. Retrieved March 3, 2008, from http://www.whitehouse.gov/omb.expectmore/summary/10001053.2003.html

Orland, M. E., & Goettel, R. J. (1982). States and the implementation of federal categorical programs in education: A hueristic framework. *Educational Evaluation and Policy Analysis*, *4*, 141-155.

Pressman, J. L., & Wildavsky, A. B. (1973). *Implementation: How great expectations in Washington are dashed in Oakland; or, why it's amazing that Federal programs work at all, this being a saga of the Economic Development Administration as told by two sympathetic observers who seek to build morals on a foundation of ruined hopes.* Berkeley, CA: University of California Press.

Scheberle, D. (1997). *Federalism and environmental policy: Trust and the politics of implementation.* Washington, DC: Georgetown University Press.

Schneider, S. K. (1992). Governmental response to disasters: The conflict between bureaucratic procedures and emergent norms. *Public Administration Review*, *52*, 135-145.

Scutchfield, F. D., Knight, E. A., Kelly, A. V., Bhandari, M. W., & Vasilescu, I. P. (2004). Local public health agency capacity and its relationship to public health system performance. *Journal of Public Health Management Practice*, *10*, 204-215.

Smith, T. A., Minyard, K. J., Parker, C. A., Van Valkenburg, R. F., & Shoemaker, J. A. (2007). From theory to practice: What drives the core business of public health? *Journal of Public Health Management and Practice*, *13*, 169-172.

Taylor, A. B., West, S. G., & Aiken, L. S. (2006). Loss of power in logistic, ordinal logistic, and probit regression when an outcome variable is coarsely categorized. *Educational and Psychological Measurement*, *66*, 228-239.

Turnock, B. J. (2004). *Public health preparedness at a price: Illinois.* New York: The Century Foundation.

Wamsley, G. L., & Schroeder, A. D. (1996). Escalating in a quagmire: The changing dynamics of the emergency management policy subsystem. *Public Administration Review*, *56*, 235-244.

White, House. (2001). *Barriers: A Federal system inhospitable to faith-based and community organizations.* Washington, DC: Executive Office of the President.

Wilson, J. Q. (1989). *Bureaucracy: What government agencies do and why they do it.* New York: Basic Books.

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