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# Self-Assessed Emergency Readiness and Training Needs of Nurses in Rural Texas

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**ABSTRACT** ***Objective:*** Nurses, particularly public health nurses, play a key role in emergency preparedness and response in rural areas. To prepare rural jurisdictions for unforeseen disastrous events it is imperative to assess the public health emergency readiness and training needs of nurses. The objective of this study was to assess the self-reported terrorism preparedness and training needs of a nurse workforce. ***Design and Sample:*** Cross-sectional prevalence of practicing nurses in regions of North Texas. 3,508 rural nurses practicing in North Texas participated in the study. ***Measurements:*** Data were collected through a mailed survey; analyses included multinominal logistic regression and descriptive statistics. ***Results:*** A total of 941 (27%) nurses completed the survey. The majority of respondents reported limited bioterrorism-related training. Fewer than 10% were confident in their ability to diagnose or treat bioterrorism-related conditions. Although only 30% expressed a willingness to collaborate with state and local authorities during a bioterrorism event, more than 69% indicated interest in future training opportunities. Preferred training modalities included small group workshops with instructor-led training, and Internet-based training. ***Conclusions:*** Licensing agencies, professional organizations, and community constituencies may need to play a stronger role in improving the bioterrorism-related emergency preparedness of rural nurses.

Key words: bioterrorism, emergency preparedness, nurses, nurse public health education, rural communities.

Bioterrorism has recently become a central issue among health professionals, organizations, institutions, and agencies. Federal funding for domestic bioterrorism defense increased from US$576 million in 2001 to an estimated US$5,415 million in 2008, a 10-fold increase (Franco, 2008). This increase in funding has been instrumental in strengthening the preparedness infrastructure across a variety of federal, state, and local agencies. However, it still remains the responsibility of state and local health departments to create emergency plans that are specific to and reflect the unique characteristics of their communities. Health professionals who possess the knowledge and skills to act efficiently and effectively in the face of bioterrorism agents and potential attacks constitute the key component of any emergency plan (Agency for Healthcare Research and Quality, 2005). Therefore, maintaining a current inventory of local human and material resources to be implemented in emergency situations is absolutely essential. Health professionals should be competent in diagnosing and treating chemical-, biological-, radiological-, nuclear-, and explosive-related cases, regardless of their specialties or work settings (Hodkinson, 2005). Nurses, particularly public health nurses, figure significantly in emergency preparedness (Jakeway, LaRosa, Cary, & Schoenfisch, 2008).

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### *Background*

Nurses are the largest professional group in the health care workforce (Hassmiller & Cozine, 2006), and appropriate training of nurses constitutes a critical element in the national agenda for bioterrorism and biodefense. Research suggests that nurses play an integral role in the early detection and timely management of biological agents (Gershon, Gemson, Qureshi, & McCollum, 2004; Steed, Howe, Pruitt, & Sherrill, 2004; Veenema & Tõke, 2006; Wisniewski, Dennik-Champion, & Peltier, 2004). Although challenges and task priorities differ across practice settings (e.g., schools, hospitals, health departments), and patient populations (e.g., children, pregnant women), it is commonly agreed that nurses must be involved in advanced planning and education in order to successfully fulfill their expected role in the case of a bioterrorist event (Akins, Williams, Silenas, & Edwards, 2005; DNA Board of Directors, 2004; Evers & Puzniak, 2005; Ferguson, 2002; James, 2005; Mondy, Cardenas, & Avila, 2003; Veenema, 2003).

However, despite the general consensus regarding the role of nurses in bioterrorism response, the literature indicates that they lack both readiness to respond and confidence in responding effectively, possibly due to the absence of relevant content in their formal education curricula (Akins et al., 2005; Polivka et al., 2008; Weiner, Irwin, Trangenstein, & Gordon, 2005). All nurses, including public health nurses, are in need of competency-based training for emergency preparedness (Polivka et al., 2008). In response to the need for systematic efforts to prepare for mass casualty incidents, the Nursing Emergency Preparedness Education Coalition, formerly known as the International Nursing Coalition for Mass Casualty Education, has developed competencies for all nurses to be prepared for emergency and mass casualty events (Nursing Emergency Preparedness Education Coalition, 2003; Weiner et al., 2005). Although before September 2001 very few nurses received targeted education about weapons of mass destruction (Weiner et al., 2005), the National Council Licensure Examination currently includes disaster content (National Council of State Boards of Nursing, 2007). Despite these efforts, the literature indicates that nursing education does not properly address emergency planning and response (Polivka et al., 2008; Weiner et al., 2005). In addition, according to Akins et al. (2005), nurses lack both the readiness and the confidence to respond in as effective a manner as optimally envisioned (Akins et al., 2005). Although there have been recent efforts to integrate bioterrorism content into basic nursing curricula (Markenson, DiMaggio, & Redlener, 2005; Polivka et al., 2008), the lack of bioterrorism preparedness among nurses persists and must be addressed (Akins et al., 2005; DNA Board of Directors, 2004; Evers & Puzniak, 2005; Ferguson, 2002; James, 2005; Mondy et al., 2003; Veenema, 2003).

The need for emergency preparedness and response training is particularly notable in rural areas, which have unique organizational and geographic features demanding different approaches to bioterrorism preparedness training and response efforts. For example, studies have found that nurses' motivation for participating in terrorism preparedness training is largely dependent on their perception of the likelihood of an incident occurring in their regions, and that respondents in urban areas are usually more highly motivated than those in rural areas (Evers & Puzniak, 2005; Gershon et al., 2004; Markenson et al., 2005). The paucity of funding directed to rural agencies (National Opinion Research Center, 2008) places an additional burden of responsibility on local providers. Studies also suggest that health care providers in rural areas have different concerns and preferences in terms of training methods compared with their counterparts in metropolitan areas (Hsu et al., 2005, 2006; Manley et al., 2006; Soto Mas, Hsu, Jacobson, Zoretic, & Felán, 2006). Similarly, some studies indicate that nurses practicing in certain settings, such as in schools and emergency care, prefer Web-based education (Evers & Puzniak, 2005; Gershon et al., 2004; Wisniewski et al., 2004). It would be worthwhile to explore whether on-line resources are preferred by rural and public health nurses.

Rural areas also present specific emergency-related challenges due to the presence of populations representing different cultural and language needs. Although by 2020 U.S. providers will spend 40% of their total patient care hours with minority patients, minorities are underrepresented in the nurse workforce (U.S. Department of Health and Human Services, 2003). It is, therefore, important to anticipate whether the needs of patients with diverse cultural backgrounds and language needs can be met by current providers. Despite the changing demographics of the United States, data on the cultural background and language skills of the health care workforce are

scarce. For instance, the nurse database provided by the Texas State Board of Nurse Examiners did not include information on race/ethnicity or language.

Other relevant elements to consider in rural settings are resource availability and public health infrastructure, both key to emergency care. Since many rural counties do not have local health departments to coordinate emergency responses, it is essential to assess the type of facilities and personnel that would be available for emergency training and medical services.

### *Objectives*

The objective of this study was to assess the self-reported terrorism preparedness and training needs of a nurse workforce in North Texas. The purpose was to identify approaches for developing effective terrorism readiness training programs for nurses practicing in rural areas.

## Methods

### *Design and sample*

This study, conducted from 2005 to 2006, consisted of a cross-sectional prevalence design. The study was conducted in North Texas, specifically in Texas Department of State Health Services Public Health Regions 2/3 (hereafter referred to as PH Regions 2/3). Although there is no universally accepted definition of "rural" across federal agencies, the U.S. Department of Agriculture (USDA) classifies counties based on population, the size of any towns or cities in the county, and the county's proximity to a metropolitan area. In 1993 (the most recent figures available), USDA classified 196 of the 254 Texas counties as rural (Texas Controller, 2001). PH Regions 2/3 cover an area consisting of 49 counties, including large metropolitan areas such as Dallas, Arlington, and Fort Worth. However, this study only included counties referred to as "nonparticipating" because they do not receive state funding. Some do not have health departments and only provide environmental services, such as animal control, septic tank, and restaurant inspections (Texas Department of State Health Services, 2009). Health care is provided through small clinics and doctors' offices. The 38 "nonparticipating" counties represented in this study consist primarily of rural areas with a combined population of just over 1 million people. Thirty-two counties had $<50{,}000$ residents at the time of this study. Two minority groups constitute nearly 20% of the total population of these 32 counties: approximately 4% are African American and 16% Hispanic. More than 12% speak a language other than English at home (U.S. Census Bureau, 2008).

The effective sample included nurses practicing in 38 "nonparticipating" counties in Texas PH Regions 2/3. Survey population information was obtained from the 2005 Texas State Board of Nurse Examiners database. Inclusion criteria were (1) being employed full- or part-time and (2) holding a bachelor of nursing or higher degree (master's or doctoral degree). The database did not include demographic data. A total of 3,508 nurses qualified for the study.

A packet containing a cover letter, the survey, and a stamped, self-addressed return envelope was mailed to the 3,508 nurses who met the inclusion criteria. Approximately 8 weeks after the initial mailing of the survey packet, a second survey packet identical to the first was sent to 2,980 nurses from whom a completed survey had not yet been received.

The study was approved by the Institutional Review Board of the university where this research was conducted, and by the funding agency.

### *Measures*

The survey instrument used for data collection was developed previously for a larger project and employed in previous studies with rural providers (Hsu et al., 2005, 2008; Soto Mas et al., 2006). The instrument consists of 12 items divided into sections exploring employment and language use, experience with four biologic agents (anthrax, smallpox, botulism, and plague), experience with chemical and radiological exposure, participation in bioterrorism preparedness and response training, and willingness to collaborate with the state health agency in emergency response. The response options include Likert-type and categorical scales. The instrument is available on request from the corresponding author.

### *Analytic strategy*

Data were analyzed using SPSS 11.5.0 (1989–2002, SPSS Inc., Chicago, IL). Multivariate logistic regression was used to compare response and nonresponse. The variables included specialty or clinical area, educational level or degree, and employment status (full-time vs. part-time). Covariates included employment field and current employment position.

To determine the distribution of responses to the research questions, descriptive statistics (frequencies and percentages) of all sample characteristics were conducted.

## Results

The final database included 3,503 potential participants (5 were eliminated due to refusal to participate, wrong address, employment no longer in PH Regions 2/3, and death). A total of 941 completed surveys representing 92% ($n = 36$) of the 38 counties in the study area were returned and computed, which represents a 27% response rate. Full-time employment status ($F = 4.054$, $p = .044$) and 4-year college educational level ($F = 1{,}155.458$, $p < .005$) were found to be statistically significant potential determinants of response. Other factors examined did not seem to predict response status.

### *Education, employment, and language*

Most respondents (67.3%) had graduated from a 4-year undergraduate college nursing program (as opposed to receiving graduate degrees), and most had full-time jobs (74% were employed full-time). Table 1 summarizes respondents' characteristics. About half of respondents worked in the field of in-patient hospital care. Nearly one third indicated that they spoke a second language at work; one fourth spoke a second language at home. Spanish was the language most frequently spoken by those who reported using a language other than English in practice.

TABLE 1. *Respondents' Characteristics (N = 941)*

| Characteristic | *n* | % |
|---|---|---|
| Working status | | |
| Full-time | 695 | 73.9 |
| Part-time | 147 | 15.6 |
| Unemployed, retired, or inactive | 99 | 10.5 |
| Work setting | | |
| Inpatient hospital care | 433 | 46.0 |
| Physician or dentist/private practice | 65 | 6.9 |
| School/college health | 63 | 6.7 |
| Outpatient hospital care | 47 | 5.0 |
| Home health agency | 42 | 4.5 |
| School of nursing | 41 | 4.4 |
| Community/public health | 27 | 2.9 |
| Self-employed/private practice | 24 | 2.6 |
| Nursing home/extended care facility | 17 | 1.8 |
| Business/industry | 17 | 1.8 |
| Freestanding clinic | 17 | 1.8 |
| Rural health clinic | 7 | 0.7 |
| Temporary agency/pool | 4 | 0.4 |
| Other | 74 | 7.9 |
| None recorded | 63 | 6.7 |
| Language use | | |
| Other than English at work | 299 | 31.8 |
| Spanish | 149 | 15.8 |
| Tagalog/Filipino | 3 | 0.3 |
| American Sign Language | 4 | 0.4 |
| Other | 9 | 1.0 |
| Not specified | 134 | 14.2 |

### *Experience*

Regarding experience with the selected agents and exposures, "have seen" or "treated" chemical exposures were the answers most frequently selected. Only a small percentage of respondents reported having either seen or treated other types of agents, such as anthrax and plague (Table 2). More than half indicated that they had not participated in bioterrorism preparedness and response training. The majority of those who reported having received training indicated that it had taken place after September 11, 2001, and many indicated participation in more than one type of training (Table 3). The most common training dealt with anthrax, and included a broad range of areas, including diagnosis, treatment, emergency preparedness, and risk communication. Roughly 72% of those who reported receiving any training, or approximately 30% of all respondents, reported having had some training related to the agents or exposures listed.

### *Willingness and confidence*

More than one quarter of respondents ($n = 266$, 28.3%) reported being willing and available to collaborate with the state health agency in the diagnosis and treatment of bioterrorism cases, and being willing and available to participate in state response plans ($n = 308$, 32.7%). More than a quarter of respondents were "not sure" about collaborating with the state in

TABLE 2. *Experience with Bioterrorism-Related Agents/ Exposures (N = 941)*

| | *n* (%) | |
|---|---|---|
| Agent/exposure | Seen | Treated |
| Anthrax | 11 (1.2) | 4 (0.4) |
| Botulism | 23 (2.4) | 18 (1.9) |
| Smallpox | 28 (3.0) | 5 (0.5) |
| Plague | 8 (0.9) | 4 (0.4) |
| Chemical exposure | 135 (14.3) | 104 (11.1) |
| Radiological exposure | 42 (4.5) | 26 (2.8) |

TABLE 3. *Participation in Bioterrorism Preparedness and Response Training By Type (N = 941)*

| | *n* (%) | | | | |
|---|---|---|---|---|---|
| Agent/exposure | Diagnosis | Treatment | Emergency preparedness | Risk communication | Any |
| Anthrax | 254 (27.0) | 241 (25.6) | 297 (31.6) | 213 (22.6) | 335 (35.6) |
| Botulism | 213 (22.6) | 204 (21.7) | 249 (26.5) | 183 (19.4) | 285 (30.3) |
| Smallpox | 250 (26.6) | 234 (24.9) | 286 (30.4) | 211 (22.4) | 327 (34.8) |
| Plague | 200 (21.3) | 191 (20.3) | 233 (24.8) | 172 (18.3) | 263 (27.9) |
| Chemical exposure | 232 (24.7) | 230 (24.4) | 297 (31.6) | 205 (21.8) | 329 (35.0) |
| Radiological exposure | 178 (18.9) | 174 (18.5) | 233 (24.8) | 167 (17.7) | 256 (27.2) |

the diagnosis and treatment of cases ($n = 260$, 27.6%) or participating in a response plan for bioterrorism ($n = 245$, 26%). A majority of respondents ($n = 546$, 58%) were not confident in their ability to diagnose or treat a bioterrorism case, including responses of "not very confident" ($n = 347$, 36.9%), and "not confident at all" ($n = 199$, 21.1%).

### *Training needs*

Approximately two thirds of respondents indicated that they wished to receive additional information or materials on bioterrorism, and 69.4% wished to be informed of future training opportunities (Table 4). Of those who wanted to be informed of future training, most expressed a preference for instructor-led, small-group workshops. The Internet option was the most-preferred type of self-paced training.

## Discussion

Given the differences between respondents and nonrespondents, the results reported here represent mainly a particular subgroup of nurses: those with a 4-year undergraduate degree and employed full time.

Although the response rate (27%) was in the low range, it is consistent with previous studies with health professionals (Hsu et al., 2005, 2008; Soto Mas et al., 2006). Also consistent with previous findings, nurses represented in this study have had very limited prior participation in emergency and bioterrorism preparedness and response. Considering the national interest in emergency preparedness, this result suggests that current training strategies may need to be revised. The Texas Board of Nursing (2008) requires 20 contact hours of continuing education (CE) within the 2 years immediately preceding renewal of registration. However, bioterrorism training is not currently required in Texas. House Bill 1483 amended the Nursing Practice Act by adding the requirement that 2 hr of bioterrorism CE be obtained as part of the 20 hr of CE required for all LVNs, RNs, and APNs renewing their licenses between September 2003 and September 2007 (Texas Board of Nursing, n.d.). Given the results presented here, it is worth considering whether bioterrorism training should be reinstated as a requirement.

Another issue to consider is the responsibility for health care providers' emergency training. In the State of Texas, as in many states, emergency training is currently provided by a variety of agencies and entities at

TABLE 4. *Preferences for Future Information and Training Opportunities in Bioterrorism Preparedness and Response (N = 941)*

| | *n* (%) |
|---|---|
| Would like to receive additional information and/or materials | |
| Yes | 621 (66.0) |
| No | 186 (19.8) |
| Don't know | 109 (11.6) |
| No answer | 25 (2.7) |
| Total | 941 (100.0) |
| Would like to be informed of future training opportunities | |
| Yes | 653 (69.4) |
| No | 170 (18.1) |
| Don't know | 101 (10.7) |
| No answer | 17 (1.8) |
| Total | 941 (100.0) |
| Type of training preferred[a] | |
| Instructor-led training | |
| Small group workshop | 351 (53.8) |
| Large group presentations | 102 (15.6) |
| Self-paced training | |
| Audio-visual | 191 (29.2) |
| Internet-based | 296 (45.3) |
| CD ROM | 238 (36.4) |
| Type of training preferred[a] | |
| Curriculum-based reading materials | 217 (33.2) |
| Professional/scientific journals and publications | 163 (25.0) |

*Note.* [a]Multiple answers were allowed (% of 653).

the regional and local levels. These entities include Homeland Security, the Governor's Division of Emergency Management at the Texas Department of Public Safety, the Texas Association of Regional Councils, the Texas Emergency Nurses Association, in addition to several academic institutions across the state. Such a decentralized infrastructure is difficult to coordinate, with facilitates overlapping, and augments the difficulty of follow-up and evaluation.

Of the results related to experience with the various agents and exposures listed in the survey, the most surprising were the responses of those who had seen and/or treated smallpox, botulism, plague, and anthrax. Although the last case of smallpox in the United States was reported in 1949, it was not globally eradicated until 1977 (U.S. Food and Drug Administration, 2003). We suspect the respondents indicating experience with smallpox represent nurses with an international background. Regarding botulism and plague, although infrequent in the United States, they are still encountered in clinical settings, the latter particularly in the U.S. Southwest, including some areas of Texas (Centers for Disease Control and Prevention, 2005, 2008). As for anthrax, although 22 cases were reported in 2001 following an intentional release of spores (Centers for Disease Control and Prevention, 2001), it is very rare in the United States: two cases have been reported in Texas since 1990 (Texas Department of State Health Services, 2007). However, there have been human epidemics reported in other parts of the world (World Health Organization, 2009), which may explain the small number of respondents reporting experience with these agents (they may have international background and experience).

Although only about 30% of respondents reported a willingness to collaborate with local authorities in the diagnosis and treatment of bioterrorism cases, the majority of respondents indicated an interest in receiving additional information or materials on bioterrorism, and more than 69% wanted to be informed of future training opportunities. This may indicate that respondents are motivated to be informed and ready in the case of an emergency, even though they have yet to become more willing to collaborate with state agencies.

Regarding language use, the fact that nearly 32% of respondents reported speaking a second language at work comes as no surprise. In Texas, 33.5% of the population speaks a language other than English at home (U.S. Census Bureau, n.d). As indicated earlier, this is also true for more than 12% of the population living in the catchment area for this study (U.S. Census Bureau, 2008). Whether the level of language proficiency of the nurse workforce in the region is adequate to attend to the emergency needs of language-minority populations should be further explored.

In summary, this exploratory study points to the need for further research involving practicing nurses in rural areas to inform the development of programs aimed at increasing competence in bioterrorism response. Future studies should include national representation of the rural nurse workforce, and implement approaches to encourage nurses' participation in bioterrorism-related studies. Licensing agencies and professional organizations may more effectively collect bioterrorism-related data and assess workforce training needs, given that they have access to the workforce, and possess the infrastructure for data collection, analysis, and dissemination. In addition, nurses may be more motivated to participate in research studies conducted by professional agencies and organizations. With respect to training, it will be important to explore how other community constituencies (including local authorities, the police force, and emergency medical service systems) involved in bioterrorism preparedness and response can contribute to both assessment and training of the nurse workforce. Given the lack of public health infrastructure, these community systems may have the capacity to make a significant contribution to improving rural nurses' workforce competence in responding to bioterrorism.

The present study has several limitations that warrant mentioning. First, the database provided by the Texas Board of Nurse Examiners did not include demographic data related to gender and ethnicity. Thus, a complete demographic description of the population was not possible. The study presented here was part of a larger study that included physicians, veterinarians, and physician assistants (Hsu et al., 2006, 2008; Soto Mas et al., 2006). To maintain consistency, we followed the same procedures and methods across professional categories. While physician, veterinarian, and physician assistant databases provided demographic data, the nurse database did not provide similar demographics. Because of the fact that this research was integrated into a larger research project, we were unable to revise the survey to close this gap. Secondly, the study population only included nurses practicing in Texas PH Regions 2/3 (i.e., this was a nonprobabilistic survey), and only descriptive statis-

tics were used to describe the results. The results, therefore, present a snapshot of the preparedness and training needs of the participating population, and may not be applicable to those practicing in other regions. Finally, it is important to mention that the Occupational Safety & Health Administration health standards include safety training in chemicals (disinfectants, anesthetics, certain drugs, and other substances used in clinical practice) and physical agents (including ionizing, magnetic, and ultraviolet radiation). Although we specifically presented this as a bioterrorism-related study, some respondents may have reported nonbioterrorism-related experience and training. However, one of the aims of the study was to identify nurses who had previous experience diagnosing and treating particular agents (regardless of context), and who could potentially assist state agencies in a bioterrorism-related event.

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