ORIGINAL RESEARCH

An Evaluation of Community Assessment for Public Health Emergency Response (CASPER) in North Carolina, 2003-2010

Jennifer Horney, PhD, MPH, CPH;[1] Meredith K. Davis, MPH;[1] Sarah E.H. Davis, MPH;[1] Aaron Fleischauer, MSPH, PhD[2]

1. University of North Carolina Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina USA
2. Centers for Disease Control and Prevention – CEFO, North Carolina Division of Public Health, Raleigh, North Carolina USA

Correspondence:
Jennifer Horney, PhD, MPH, CPH
University of North Carolina at Chapel Hill
Gillings School of Global Public Health
Campus Box 8165, 400 Roberson
Chapel Hill, NC 27599 USA
E-mail: jen.horney@unc.edu

Conflicts of interest: The authors have no disclosures or conflicts of interest to report. This publication was supported by contract #02079-10 with the North Carolina Division of Public Health.

Keywords: CASPER; disaster epidemiology; evaluation

Abbreviations:
CASPER: Community Assessment for Public Health Emergency Response
CDC: Centers for Disease Control and Prevention
EPI: Expanded Program on Immunization
GPS: global positioning system
LHD: local health department
NC DPH: North Carolina Division of Public Health
UNC CPHP: University of North Carolina Center for Public Health Preparedness
WHO: World Health Organization

Received: May 19, 2011
Accepted: July 5, 2011
Revised: July 8, 2011

Online publication: January 29, 2013

doi:10.1017/S1049023X13000071

Abstract

Introduction: Community Assessment for Public Health Emergency Response (CASPER) is a group of tools and methods designed by the US Centers for Disease Control and Prevention (CDC) to provide rapid, reliable, and accurate population-based public health information. Since 2003, North Carolina public health professionals have used CASPERs to facilitate public health emergency responses and gather information on other topics including routine community health assessments.

Problem: To date, there has been no evaluation of CASPER use by public health agencies at the state or local level in the US.

Methods: Local health departments of North Carolina reported when and how CASPERs were used during the period 2003 to 2010 via an online survey. Data on barriers and future plans for using CASPERs also were collected.

Results: Fifty-two of North Carolina's 85 local health departments (61%) completed the survey. Twenty-eight departments reported 46 instances of CASPER use during 2003 to 2010. The majority of CASPERs were performed for community health assessments (n = 20, 43%) or exercises (n = 11, 24%). Fifty-six percent of respondents indicated they were "likely" or "very likely" to use CASPERs in the future; those who had prior experience with CASPERs were significantly more likely ($P = .02$) to report planned future use of CASPERs compared to those without prior experience with the tool. Lack of training, equipment, and time were the most frequently reported barriers to using CASPERs.

Conclusions: Local public health agencies with clear objectives and goals can effectively use CASPERs in both routine public health practice and disaster settings.

Horney J, Davis MK, Davis SEH, Fleischauer A. An evaluation of Community Assessment for Public Health Emergency Response (CASPER) in North Carolina, 2003-2010. *Prehosp Disaster Med.* **2013;28(2):94-98.**

Introduction

Community Assessment for Public Health Emergency Response (CASPER) is a set of tools and methods designed by the US Centers for Disease Control and Prevention (CDC) to rapidly collect reliable and accurate population-based public health information.[1] The CASPER methods and tools can be used to quickly measure the health status and basic needs of a community affected by a disaster by providing objective information required to direct resources and assets.[2] The methods originally were developed by the World Health Organization's (WHO's) Expanded Program on Immunization (EPI) for assessing vaccine coverage, and have been adapted for use in disaster-related rapid assessments by the CDC.[3,4] CASPER methods consist of a two-stage cluster sampling strategy with probability proportionate to population sampling of 30 clusters in the first stage, and a random selection of seven subjects per cluster in the second stage (30×7). CASPER tools include site selection tools, questionnaires, data analysis templates, and paper-based or electronic devices for data collection.

Community-based surveys have long been viewed as an important way to collect public health data from residents.[5] Two-stage cluster surveys, such as CASPERs, may be preferable to one-stage, simple random samples because they do not require an enumeration of all the eligible persons in the population prior to selection. They also

require relatively little formal epidemiologic or statistical training and may be performed by the staff with funds available to local health departments (LHDs).[6] Community-based surveys have been used regularly by LHDs to assess vaccination coverage, particularly among hard-to-reach populations,[6-8] and to determine disaster-related needs.[9] However, to date, there has been no systematic evaluation of the use of CASPERs at the state or local public health level in the United States.

Evaluations of CASPERs have been conducted in developing countries[10] and computer simulation evaluation studies of the 30×7 method have been undertaken by the WHO and the CDC.[11,12] These studies validated the method, with samples meeting the stated goal of estimating proportions within 10% of the true population proportion. Another computer simulation study found that while the 30×7 method was adequate for rapid assessment of morbidity prevalence or nutritional status, it may not be appropriate for measuring factors such as education or socio-economic status.[13] When electronic data collection instruments are used for the CASPERs, the methods have been found to save time and eliminate errors from double data entry, and are preferred by public health personnel, despite limited experience in using them.[14-16] Importantly, survey respondents and patients are comfortable with the use of the technology for data collection.[17,18]

North Carolina public health professionals have used CASPERs since 2003 to collect information to facilitate public health emergency responses, including the response to Hurricane Isabel in 2003.[19] CASPERs also have been used in North Carolina to collect community-based information for routine public health practices including Community Health Assessments. Since 2003, 17 of 85 local health departments in North Carolina received resources such as handheld computers, software, software licenses, and training to allow them to conduct CASPERs.[20] While no additional funds for CASPER tools have been provided since 2004, training and technical assistance has continued.

The purpose of this evaluation is to identify the reasons for and the barriers to the use of the CASPER in North Carolina, the value it provides, and recommendations for the use of this method in public health practice and during disasters.

Methods

Study Population

Preparedness Coordinators (or their designees) from all 85 LHDs in North Carolina were invited to participate in the study survey. Preparedness Coordinators are employed by LHDs to plan for public health disasters, train local health department staff on key preparedness topics, test preparedness plans through regular exercises, and serve as liaisons between the LHD and other agencies and partners. Because of their professional responsibilities, Preparedness Coordinators are more likely than other LHD staff to use CASPER tools and methods, and could, therefore, provide information on the use of CASPERs in LHDs in North Carolina.

Study Design and Questionnaire

A quantitative survey instrument was developed by the University of North Carolina Center for Public Health Preparedness (UNC CPHP) and piloted internally and with state partners from the North Carolina Division of Public Health (NC DPH). The revised survey was administered online via SurveyMonkey to LHD Preparedness Coordinators. Participants received an email invitation from the research team, and non-respondents received a reminder email three and six weeks after the initial invitation. Survey responses were collected from mid-April to mid-June 2010.

1.	Providing equipment (eg, handheld units)
2.	Implementing two-stage cluster sample—determining where to survey with GIS tool for ArcGIS
3.	Creating a survey/questionnaire
4.	Installing a custom form (survey) on handheld units
5.	Conducting training for interviewers
6.	Conducting interviews
7.	Downloading and cleaning data (survey results)
8.	Analyzing data
9.	Writing reports

Table 1. Community Assessment for Public Health Emergency Response (CASPER)—Related Tasks
Abbreviation: GIS, geographic information system

The questionnaire included a series of questions to determine when and how CASPERs were used during 2003-2010. First, respondents were asked whether their LHD had used CASPER methods (eg, two-stage cluster sampling by census tract), and whether their LHD had participated in an event where CASPER methods were used by another agency. Second, respondents were asked whether their LHD had used CASPER tools (eg, handheld electronic data collection units), and whether their LHD had participated in an event in which CASPER tools were used by another agency. Respondents who answered "yes" to any of these questions were asked to provide additional information about each instance, including the year, type of organization using the CASPER (eg, single county health department, multi-county health district, regional, other), and the reason for implementing the CASPER (eg, disaster-related rapid needs assessment, routine community health assessment, routine environmental health inspection, exercise, special topic survey, other routine surveillance, or other).

To assess the organizational capacity for CASPER use, respondents were provided with a scenario in which their agency would need to conduct a disaster-related rapid needs assessment in one month, and asked whether they would need assistance with nine CASPER-related tasks (Table 1). Next, respondents were asked which agency they would contact for technical assistance, whether they had received CASPER training and ArcGIS software training, and the total number of trained staff who were currently employed at the agency. The survey also inventoried equipment owned by the agency or available to the agency (eg, handheld global positioning system (GPS) units, tablet computers), and whether the agency maintained a software license for ArcGIS.

To assess potential barriers to CASPER use, all respondents were asked to choose from a list of reasons why their agency would not use a CASPER. A separate question asked whether the respondent believed a random sample could represent their jurisdiction. Finally, the survey examined key factors that may facilitate the use of CASPERs for public health preparedness and

https://doi.org/10.1017/S1049023X13000071 Published online by Cambridge University Press

routine public health practice. To determine the potential need for CASPERs, respondents were asked whether their agency collected data from the public on a variety of topics such as environmental health inspections, vaccination status, and infectious disease outbreaks. Respondents were asked to rate the likelihood that their agency would use CASPERs in the future on a four-point scale from "very likely" to "very unlikely." Those who answered "likely" or "very likely" were asked to specify the situation in which their agency would use a CASPER. Those who answered "unlikely" or "very unlikely" were asked to provide an open-ended comment about reasons for not using a CASPER.

Data Analysis

Data were downloaded from SurveyMonkey and imported into Excel (2007, Redmond, Washington USA) and SAS (9.1.2, Cary, North Carolina USA) for calculation of frequencies. A Student's *t*-test was conducted to determine if there was a significant difference in the mean likelihood of conducting a CASPER in the future depending on experience in conducting a CASPER in the past.

Results

Fifty-two of North Carolina's 85 LHDs (61%) responded to the survey. Of the LHDs that responded, 47 were from single-county health departments; the remainder were from multi-county health departments. Overall, 65 of North Carolina's 100 counties (65%) were represented in the study.

Use of CASPERs in North Carolina

Twenty-eight LHDs (54%) reported a total of 46 instances of CASPER use during the period 2003 to 2010 (Figure 1). The survey only allowed the LHD to report up to 7 separate instances of CASPER use. Twenty-four LHDs (46%) reported no instances of CASPER use during the specified time period.

The majority of 46 CASPERs conducted by the LHDs were for community health assessments (n = 20, 43%) or exercises (n = 11, 24%). Other reported reasons for the use of CASPERs were: hurricane response (n = 3, 7%); sampling private drinking water wells (n = 2, 4%); outbreak management (n = 2, 4%); an obesity study (n = 1, 2%); a Healthy Homes Survey (n = 1, 2%); a food product recall (n = 1, 2%); a survey about LHD services (n = 1, 2%); environmental shelter assessments (n = 2, 4%); a Legionnaire's Disease outbreak investigation (n = 1, 2%); and training (n = 1, 2%).

Twenty-three of the 46 instances (50%) of CASPER use were conducted by the LHDs alone, 14 (30%) were conducted by more than one agency acting together (such as an LHD and a regional public health support team), and three (seven percent) were conducted by some other agency (either the North Carolina Department of Public Health DPH or the CDC).

Thirty-one of the LHDs (67%) indicated they were "likely" or "very likely" to use CASPERs in the future, whereas 15 (33%) were "unlikely" or "very unlikely" (Table 2). Twenty-five of the 31 LHDs (81 with prior knowledge of CASPERs were 'very likely' or 'likely' to use CASPERs in the future, while only 6 of 15 (40%) of the LHDs without prior knowledge were "very likely" or "likely" to use CASPERs in the future ($P = .02$).

Situations in which a CASPER was reported "likely" to be used by LHDs are listed in Table 3. Among the 31 LHDs that reported that they were likely or very likely to use CASPERs in the future, the most commonly reported reasons were for routine community health assessments (n = 28, 90%), post-disaster rapid needs assessments (n = 27, 87%), and exercises (n = 25, 81%).

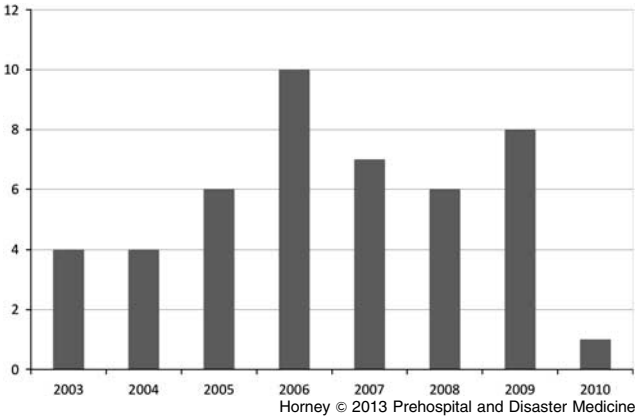

Figure 1. Number of Community Assessment for Public Health Emergency Response (CASPER) Uses Reported by North Carolina Local Health Departments (n = 28), 2003-2010

Capacity and Barriers

Concern regarding the representative quality of a 30×7 random sampling method was not perceived to be a barrier to CASPER use; 31 of 46 LHDs (67%) felt that 210 households could represent their jurisdiction. However, all LHDs indicated they would need help with at least one of the nine CASPER tasks, including installing a survey on handheld units (n = 44, 96%), downloading and cleaning data (n = 43, 93%), conducting random cluster sampling (n = 41, 89%), providing equipment (n = 39, 85%), and analyzing data (n = 39, 85%). Forty-five of 46 LHDs (98%) would contact a regional public health preparedness support team for help with CASPER tasks; 11 (24%) would ask UNC CPHP for help; seven (15%) would ask NC DPH; and five (11%) would ask another LHD for help.

The three most common barriers to using CASPERs by LHDs were lack of equipment (n = 32, 70%); lack of trained staff (n = 31, 67%); and lack of planning time (n = 26, 57%) (Figure 2). Twenty-three of the LHDs (50%) reported having access to equipment owned by others to conduct a CASPER, and 34 (74%) own such equipment themselves. Overall, 37 LHDs (80%) have access to some CASPER equipment, whether owned or borrowed. However, only 15 (33%) reported possessing a current ArcGIS software license.

Twenty-six LHDs (56%) reported having no staff trained in the use of CASPER tools or methodology; 13 LHDs reported having 1-3 trained staff members; six reported having 4-10 trained staff members; and one LHD reported having 11 trained staff members. Similar results were reported for the number of LHD staff trained in the use of GIS: 24 LHDs (52%) reported having no staff trained in GIS; 10 (22%) had 2-3 trained staff members; and one LHD had 7-10 trained staff members.

Discussion

Although CASPERs have been used widely by public health agencies in the US for assessment of immunization coverage, disaster-related assessments, and other public health research questions, there has been no prior evaluation of the use of CASPERs at the state or local level.[21-23] In North Carolina,

Likelihood of Future Use	All LHDs (n = 46) n (%)	LHDs with Prior Knowledge of CASPER n (%)	LHDs without Prior Knowledge of CASPER n (%)
Very likely	14 (30)	11 (35)	3 (20)
Likely	17 (37)	14 (45)	3 (20)
Unlikely	12 (26)	5 (16)	7 (47)
Very Unlikely	3 (7)	1 (3)	2 (13)

Table 2. Likelihood of Future Use of Community Assessment for Public Health Emergency Response (CASPER) by North Carolina Local Health Departments
Abbreviation: LHDs, local health departments

Data Collection Activity	n (%)
Routine community health assessment	28 (90)
Post-disaster rapid needs assessment	27 (87)
Exercise	25 (81)
Special topic survey	21 (68)
Routine environmental health inspection	12 (39)
Other routine surveillance	9 (29)

Table 3. Likelihood of Community Assessment for Public Health Emergency Response (CASPER) Use for Data Collection Activities by North Carolina Local Health Departments (n = 31)

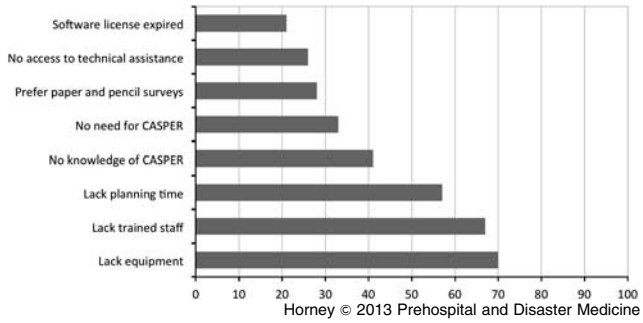

Figure 2. Barriers to using Community Assessment for Public Health Emergency Response (CASPER), North Carolina Local Health Departments

CASPERs have been used nearly 50 times during 2003-2010 for a wide variety of activities including emergencies, outbreaks, public health exercises, and routine public health functions such as regular community health assessments. More than half of the respondents who reported using CASPERs in the past indicated that they intended to use CASPERs again in the future.

The main barriers to conducting CASPERs were lack of trained staff and lack of equipment. Most LHDs indicated that they did not have enough staff sufficiently trained in CASPER tools and methodology. The lack of training is also apparent in the high percentage of LHDs that reported requiring assistance with essential CASPER tasks. Lack of equipment may also hamper the LHDs' ability to perform some CASPER tasks such as navigation and data collection.

Recommendations to address the identified barriers include: 1) the development of CASPER-specific training for LHD staff; 2) the enlistment of individuals at NC DPH or experts at other agencies to provide technical support to LHDs on specific topics such as how to download and clean data, and how to conduct random cluster sampling; and 3) the incorporation of CASPER methods and tools into regular training exercises conducted by LHDs or other recurrent events, such as community health assessments or special topic surveys. It is important to note however, that training is not a prerequisite for implementing CASPERs. Just-in-time training can be effective preparation, particularly for the interviewing and data collection components of the CASPER.

Lack of equipment need not be a deterrent for using CASPERs in the future. Using new technologies already in place in LHDs (eg, smart phones or personal digital assistants) to collect data can offset some of the costs and learning barriers associated with CASPER-specific data collection equipment. Simple paper-based data collection methods can be an effective means of collecting CASPER data. Moreover, in addition to paper maps, auto- or phone-based GPS units are inexpensive and widely available for navigating to interview locations.

The reported need for both training and equipment may be addressed by maintaining training among state public health staff or other outside agencies and increasing awareness among local public health agencies of the many uses of CASPERs, and the availability of other agencies for technical assistance. For example, UNC CPHP, in collaboration with NC DPH, is well-positioned to serve as a resource to provide direct technical assistance to LHDs, as well as to assist outside agencies in providing technical assistance to LHDs, particularly given that this activity is currently funded through the CDC's Preparedness and Emergency Response Learning Center.

Several key factors can facilitate the future use of CASPERs, not only as a part of preparedness, but for routine public health practice in North Carolina. For example, every four years, LHDs in North Carolina are required, as part of accreditation, to conduct a community health assessment to identify priorities that affect the health of the local population and to determine what resources are available within the community to address these identified priorities. Each assessment requires primary data collection from the community. CASPER methods and tools are ideal for this purpose.

https://doi.org/10.1017/S1049023X13000071 Published online by Cambridge University Press

This study has several limitations. Firstly, the overall local health department response rate was relatively low, and selection bias could have been introduced if a greater proportion of survey non-respondents were from counties unfamiliar with the CASPER. Secondly, given that many of the LHDs partnered with other LHDs to conduct the CASPER, there may be overlap in reporting a particular CASPER, which could have led to an overestimation of the overall use of CASPERs. However, the reported number of CASPER uses per agency may actually be an underestimate, since it is unlikely that survey respondents have been in their position since 2003, and they may not have knowledge of, or may not recall, each use of the CASPER. Lastly, respondents also may have had limited knowledge about available equipment and analytic and mapping software available in the health department given that they are public health staff rather than information technology staff.

Looking forward, the two most commonly identified barriers to the use of CASPERs for LHDs (ie, the lack of equipment and trained staff) can be overcome by resources and training, but the third most common barrier, lack of planning time, cannot. Forty-one percent of LHD staff reported lack of knowledge about the purpose of CASPERs as a barrier. This was not limited to LHDs who reported no prior knowledge of the existence of CASPERs. Not surprisingly, LHDs reporting no prior knowledge tended to report a lower likelihood of using CASPERs in the future than did LHDs with prior knowledge. However, more LHDs indicated that it was likely or very likely that they would use CASPERs in the future compared to those who had reported using CASPER in the past. This indicates that the LHD staff are aware of CASPER, and despite the barriers, plan to use it in the future.

Conclusion

CASPERs are perceived to be most beneficial in situations in which there are clear objectives and goals, and the specific survey questions have been validated in advance. These situations are more common in routine public health practice, such as in community health assessments and special topic surveys or research than during a disaster. Disaster-related rapid needs assessments commonly were listed as the reasons to use CASPERs in the future; however, the impact of CASPERs in these settings were not well described in this study and require further analysis. Future use of CASPERs in North Carolina should focus on applications for routine public health practice and research. CASPER use in the disaster setting must have clear objectives, goals, pre-identified stakeholders, and actionable data to justify its use.

North Carolina LHDs have used CASPER tools and methods, and intend to use them again, regardless of barriers due to training or lack of equipment. Local Health Departments are aware of the value of CASPERs, and with additional support from the state public health department and others, they can utilize CASPERs to collect community information to improve public health programs for all North Carolinians.

Acknowledgement

The authors would like to thank Shabbar Ranapurwala, MPH for assistance with data analysis.

References

1. US Centers for Disease Control and Prevention. *CASPER Toolkit*. http://www.bt.cdc.gov/disasters/surveillance/pdf/CASPER_toolkit_508%20COMPLIANT.pdf. Accessed August 16, 2010.
2. Zane DF, Bayleyegn TM, Haywood TL, et al. Community assessment for public health emergency response following Hurricane Ike-Texas, 25-30 September 2008. *Prehosp Disaster Med*. 2010;25(6):503-510.
3. Henderson RH, Sundaresan T. Cluster sampling to assess immunization coverage: a review of experience with a simplified sampling methodology. *B World Health Organ*. 1982;60(2):253-260.
4. Malilay J, Flanders WD, Brogan D. A modified cluster-sampling method for post disaster rapid assessment of needs. *B World Health Organ*. 1996;74(4):399-405.
5. Frerichs RR, Shaheen MA. Small community based surveys. *Annu Rev Publ Health*. 2001;(22):231-247.
6. Ewert DP, Thomas JC, Chun LY, Enguidanos RC, Waterman SH. Measles vaccination coverage among Latino children aged 12 months to 59 months in Los Angeles County: a household survey. *Am J Public Health*. 1991;81:1057-1059.
7. Goodman K, Wu JS, Frerichs RR. Compliance with childhood immunizations in Kern County, California. *J Immigrant Health*. 2000;2(4):213-222.
8. Shaheen M, Frerichs RR, Alexopolous N, Rainey JJ. Immunization coverage among predominantly Hispanic children, aged 2-3 years in Central Los Angeles. *Ann Epidemiol*. 2000;10(3):160-168.
9. Berg B, Grievink L, Gutschmidt K, Lang T, Palmer S, et al. The public health dimension of disasters: health outcome assessment of disasters. *Prehosp Disaster Med*. 2008;23(2):S55-S59.
10. Bennett S, Radalowicz A, Vella V, Tompkins A. A computer simulation of household sampling schemes for health surveys in developing countries. *Int J Epidemiology*. 1994;23:1282-1291.
11. Lemeshow S, Robinson D. Surveys to measure programme coverage and impact: a review of the methodology used by the expanded programme on immunization. *World Health Stat Q*. 1985;38:65-75.
12. Henderson RH, Sundaresan T. Cluster sampling to assess immunization coverage: a review of experience with a simplified sampling methodology. *B World Health Organ*. 1982;60(2):253-260.
13. Bennett S, Radalowicz A, Vella V, Tomkins A. A Computer simulation of household sampling schemes for health surveys in developing countries. *Int J Epidemiol*. 1994;23(6):1282-1291.
14. Fletcher LA, Erickson DJ, Toomey TL, Wagenaar AC. Handheld computers: a feasible alternative to paper forms for field data collection. *Eval Rev*. 2003;27(2):165-178.
15. Lal SO, Smith FW, Davis JP, et al. Palm computer demonstrates fast and accurate means of burn data collection. *J Burn Care Rehabil*. 2000;21(6):559-561.
16. Pace WD, Staton EW. Electronic data collection options for practice based research networks. *Ann Fam Med*. 2005;3(Supp 1):S21-S29.
17. Buck DS, Rochon D, Turley JP. Taking it to the streets: recording medical outreach data on personal digital assistants. *Comput Nurs*. 2005;23(5):250-255.
18. Greene PD. Handheld computers as tools for writing and managing field data. *Field Methods*. 2001;1(2):181-197.
19. North Carolina Office of Public Health Preparedness and Response. Community Assessment for Public Health Emergency Response. http://www.epi.state.nc.us/epi/phpr/casper.html. Accessed August 16, 2010.
20. Horney J, Ramsey S, Smith M, Johnson M, MacDonald PDM. Enhancing local health department preparedness in North Carolina with mobile GIS/GPS technology and training. *J Emerg Management*. 2011;9(5):47-55.
21. Horney J, Snider C, Gammons L, Ramsey S. Factors associated with hurricane preparedness: results of a pre-hurricane assessment. *J Nat Disasters*. 2008;3(2):143-149.
22. Horney J, Moore Z, Davis M, MacDonald PDM. Intent to receive pandemic influenza A (H1N1) vaccine, ability to comply with social distancing and sources of H1N1 information in North Carolina communities. *PLoS One*. 5(6). http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0011226. Published June 18, 2010. Accessed August 16, 2010.
23. Rosselli R, Bevc C, Simon M, Casani J, Horney JA, MacDonald PDM. Residential Household Knowledge and Receipt of Potassium Iodide within the 10-mile Emergency Planning Zone of a Nuclear Power Plant in North Carolina. *Int J Mass Emerg Disasters*. In press.