JEM

Community resilience: Measuring social and political vulnerability in the aftermath of the Deepwater Horizon oil spill

Tonya E. Thornton, PhD, MPPA
Celeste Murphy-Greene, PhD, MPA
Katherine M. Simon, MPA

ABSTRACT

The scope of policy issues surrounding emergency management remains inundated with several social and political challenges. There are specific events that cause added strain which make certain time periods for examining levels of resiliency relevant. The Deepwater Horizon oil spill represents a large-scale, technological disaster. Not only was there a loss of human life, but several community impacts also exist with the oil having spewed out into the water. Still, what impacts—ie, attitudes, beliefs, and behaviors—are associated with varying population groups that may be more vulnerable than others? Examining the connection between social capital and political trust is, thus, paramount as prior studies have documented that if resiliency networks are disrupted, there will be a lasting impact upon the community. This research extends the limited understanding of case-based perceptions of social and political vulnerability regarding disaster responsibility.

Key words: Community resiliency, vulnerability, oil spill, disaster policy

INTRODUCTION

Disaster planning and response is a complex process.[1] Examining the connection between social capital and political trust is paramount as a lessening of social capital undermines political trust and potentially leads to governmental alienation. If communal networks are disrupted, there will be a lasting impact on the social cohesion of the community, the political confidence among the individuals, and ultimately, the community resilience of the impacted area. Community resiliency is the capability for a community to effectively prepare for, respond to, as well as recover from an adverse event.[2,3] Given the limited opportunities for disaster-related experience, "decision-making, mental models, and situational awareness research on [crises] have highlighted a further need for effective emergency management."[4] Understanding the meaning, causality, severity, and incidence of disasters, both implied and actual, is essential to the problem-solving process.[5] Additionally, there are specific events that cause added strain which make certain time periods for examining levels of resiliency relevant.

The Deepwater Horizon (DwH) oil spill represents a large-scale, technological disaster with many socio-political impacts. Not only was there a loss of human life, but several crosscutting communal impacts existed with the oil having spewed out into the water.[6,7] For instance, residents living along the Northern Gulf Coast signify a heterogeneous population, which span across several geographical boundaries and represent a diverse range of demographic and cultural backgrounds. Would their impacts differ from that of the Exxon Valdez Oil Spill, which occurred 20 plus years prior and impacted a small geographic and tightknit or homogenous society? Additionally, the economic interests of impacted residents were also torn between the oil and gas industry and the fishing and seafood industry, given that many coastal residents were concurrently employed as oil rig workers and supplemented their financial income and/or quality of life as commercial anglers. This, too, is unlike that of the Exxon Valdez Oil Spill.

DOI:10.5055/jem.0511

Policymaking is described as "when faced with a problem, the decision-maker" follows a gradual process of identifying a problem, establishing goals, creating alternatives, noting consequences, weighing costs and benefits, and monitoring progress.[8-10] In actuality, however, policymaking is a complex translation of social and political issues into governmental regulation.[11,12] Still, given the realities of everyday life, the extent of social beliefs and political attitudes vary about policy.[13] Ideology, at its very core, is self-identification, and, as such, heeds a vested policy interest.[14] Nie et al.[15] maintain that the fabric of society changes, and in effect, changes "the public response to that change;" thus, the consistency of the public remaining the same on each issue is nearly impossible. First, ideologies differ among a range of social issues, and second, the length of time surrounding a particular issue automatically superimposes political importance. Wamsley[16] also suggests that ideologies "emerge in societies… to enhance coherence," and, thus, "simultaneously reveal and conceal something about the conditions which give birth to them, and, insofar as they conceal or obscure these conditions in thought, they tend to stabilize or perpetuate them in reality."[16]

The scope of policy issues surrounding emergency management remains inundated with several social and political challenges. What impacts—ie, attitudes, beliefs, and behaviors—are associated with varying population groups that may be more vulnerable than others during such focusing events as the DwH Oil Spill? Disaster planning, thus, needs to be investigated in terms of decisional premises so that a more comprehensive diagram of social and political resiliency can be developed.[17,18] This research extends the limited understanding of case-based perceptions of social and political vulnerability regarding disaster responsibility.[19,20]

Contextual background

The explosion of the Transocean owned and British Petroleum (BP) operated, DwH oil drilling platform opened a massive oil release in the Gulf of Mexico, just 50 miles south of Venice, Louisiana. The incident, notably referred to as the Macondo Blowout, occurred ironically late night on Earth Day, Tuesday, April 20, 2010. The Coast Guard immediately responded by evacuating rig workers.[21,22] Although eight workers were injured in the explosion, 11 remained missing until the rig sank two days later on April 22. The search was then called off and the missing workers were presumed dead.

In addition to the loss of human life, about 700,000 gallons of diesel fuel went down with the rig, and barrels of oil that had already been pumped went missing. Though at first, the Coast Guard said the initial oil slick was residual oil from the sunken rig, remotely operated vehicles revealed that the oil was probably a combination of residual oil and oil leaking from the well itself.[23] Disaster response teams and cleanup crews immediately mobilized and began utilizing several techniques to try and contain the growing oil spill.

Initial reports described efforts to clean up the oil and plug leaks brought about by the Macondo Blowout. First, Louisiana and Mississippi state authorities positioned oil booms around the spill site and coastline to prevent the oil from spreading. Some crews even tried burning some of the oil off the slick. Second, Transocean immediately began to ship additional rigs to the area to stop the release and inject a heavy fluid to stop oil or gas from flowing by creating a relief well in the case the blowout valve could not be turned on.[24,25] Third, BP tried utilizing robotic submarines to seal off the well and place a dome over it as to funnel the leaking oil on to boats for recovery and treatment.[26] Though a containment dome can ideally recover up to 125,000 barrels of oil; however, it soon failed after gas crystallized and began to build upon the dome. Therefore, a smaller dome was built to try and control the release.[27]

In continuing efforts, BP announced several new ideas for plugging the well, including pumping methanol through a smaller dome so the crystallized hydrates do not form again, pumping rubber scraps and other debris into the blowout preventer, installing a new blowout preventer on the well, and cutting the leaking pipe and installing a larger one to divert the oil flow to surface ships.[28] Finally, BP completed drilling a relief well into the outer casing of the bottom of the well, and the company began pumping cement into the well through a relief well.[29] This ultimately led to the sealing of the well which stopped the oil from further contaminating the water.

The DwH oil platform was praised for setting a world record of drilling 35,000 feet; yet, tactics to shut off the well releasing the oil proved difficult because it was stationed about 5,000 feet underneath the water's surface.[30,31] It was not until nearly 6 months later, on Sunday, September 19, 2010, when announcements confirmed that the oil well was effectively dead. When the plug was filled as a result of pumping cement into the well's annulus, the space between the well's steel casing and outer walls.[32] Upon its blast, the DwH oil rig issued a massive column of flame.[33] It has, therefore, been speculated that the explosion was caused due to the rig not having a blowout preventer.

A blowout is "an uncontrolled flow of gas, oil, or other well fluids into the atmosphere or into an underground formation. A blowout, or gusher, can occur when formation pressure exceeds the pressure applied to it by the column of drilling fluid."[34] In drilling, fluids buried in the earth under pressure push against the drilling fluid pressure. If the pressure of the buried fluids exceeds that of the drilling fluid pressure, the chance of a blowout increases. A blowout preventer consists of one or more valves attached to the wellhead to maintain pressure in the ring of space between the casing and the drill pipe or the empty hole. Blowout preventers come in two forms: annular and ram. Annular blowout preventers fill the ring of space between the pipe and well or the well itself. Rams cut off pressure on holes with or without pipes and can fit different drilling components. Regardless of each, if drilling fluids buried in the earth under pressure exceed that of the drilling fluid pressure, the chance of a blowout increases.[35] And, though it has been suggested that the massive oil spill was caused as a result of the residual oil from the sunken rig, remotely operated vehicles have revealed that the oil spill was probably a combination of residual oil from the impact as well as oil leaking from the well itself.[36]

After the initial response to the blowout, Transocean held a conference call with several industry experts, including Haliburton, Cameron International Corporation (CIC), and Smith International, for a technical and legal discussion on the incident in light of President Barack Obama holding BP responsible for the accident.[37,38] Transocean concluded that each should have limited financial liability in the oil release. This conclusion caused a debate between the companies.

Although BP had to pay its own money to fund the cleanup since outside insurance does not cover oil spills, one of the most contentious issues included whether or not Haliburton had installed the final cement plugs by the time of the explosion.[39,40] Halliburton provided many of the services on the rig including pressure control of the underground oil and gas, in which drilling contractors are particularly sensitive to three key clauses, and they write contracts in such a way that liability lies with the oil company for: (1) pollution due to oil coming from the well or blowout, (2) reservoir damage, and (3) loss of production; under this contract, the drilling contractor is likely, not liable.[41] Also, Transocean had CIC build the blowout preventer, but if the blowout preventer failure caused the incident, then Transocean would likely maintain liability. Experts say that the blowout preventer failure was likely a result of the explosion, which would also clear Transocean. This is possible because the cement plugs, installed by Haliburton, were not properly sealed. It is also possible that the cement mixture was executed improperly; however, that would be very difficult to prove. Regarding Smith International's role in the Macondo Blowout, there is a remote possibility that improper mud density caused a loss of hydrostatic pressure, and if this is the case, would still not likely bear any liability.[42]

Still, even with the infrastructural and environmental consequences associated with the DwH Oil Spill, many social and political challenges remained long after the well was effectively sealed off. Most notably, questions of liability—as it concerns with demographic and cultural vulnerability—were only beginning to surface. This is especially important since place has meaning, and variations in group belonging tend to influence policy values, particularly in the aftermath of disasters.

LITERATURE REVIEW

Place has meaning and many life factors allude to a sense of community concept, an occurrence in which people strongly identify with a particular geographical setting. Where "the linkages between space and representation" occur are key indicators of peoples' identities."[43-46] It has, therefore, become increasingly important for researchers to not only answer questions of *where* but also to attempt to answer questions of *why there*. Thus, to understand the basic functionalism of a society, individuals within it must be mindful of the demographic and cultural climate surrounding of the community, and how key policy issues interplay with and affect one another, which often is influenced by race, gender, and age, as well economic determinants as education and income.

Existing literature reflect trends connecting the level of political access and/or social standing on the part of communities, with the presence or implementation of policies that either benefit or neglect members of those communities, where "community" is defined flexibly to include a municipality, occupational group, geographical region, and/or online community.

For example, Murphy[47] conducted a case study of municipal government responsibilities and community-level initiatives as related to emergency management in the aftermath of two distinct disasters, the 2003 Northeast electricity outage and the 2000 Walkerton water-borne disease outbreak. The author found that in smaller, close-knit communities, there existed a higher degree of social capital in the form of a cohesiveness not experienced in larger areas where its members are more fluid. As such, the community is more likely to become engaged with local emergency management activities because they hold more of a vested political interest in seeing the resiliency of the area, their livelihoods. The author utilized household surveys for the larger population area associated with the electricity outage and focus groups for the smaller population group associated with the water-borne disease. However, this study was limited in that there was no pre/post establishment of "assessing and ameliorating resiliency prior to a crisis."[47] Still, this is likely with most case studies examining a specific event, such as a disaster, coupled with the fact that it is hard to establish baselines when disasters are fairly unpredictable. All in all, the author did a fairly well job in "assess[ing] emergency preparedness levels in the wake of [both events] and [evaluating] the impact and community response.[47]

This is also seen with Murphy[48] and Murphy-Greene and Leip's[49] work, where policies exist to protect vulnerable farmworkers, but due to sociopolitical factors relating to the workers' lack of agency, these policies are either not implemented or not effectively crafted. It is suggested that, where compliance is the responsibility of the farm owners, lack of accountability limits incentives for compliance. Additionally, the study of Gunningham, et al.[50] on over-compliance by private industry demonstrates both sides of this coin, where communities with positive social standing receive outreach by a manufacturer seeking economic benefit from a "social license," and corresponding policy compliance or over compliance. However, communities whose input is deemed less valuable receive little to no efforts for regulatory compliance, and community members experience adverse health outcomes relating to environmental outputs from the nearby factory.

METHODS

The impact of the effects of social distance is also manifested in factors of permanence, as in the case of Florida farm workers. This migrant population is poorly counted and even more poorly protected. The Social Distance Model illustrates the Social Distance Indictors used to determine one's social distance from the mainstream of society. The Social Distance Model illustrates how the negative outcome of Social Distance Indicators may result in a lack of protection from environmental pollution and exposure to environmental pollution. A negative outcome of the *race/ethnicity* variable would indicate minority status. It is important to express that this negative outcome is in no way an expression of the minorities as a negative factor in society. The negative outcome is used to better understand social standing. A negative outcome of the *income level* variable would be low-income. The negative outcome of the *dominant language* variable is that the individual does not speak the dominant language. The indictors used represent those factors that allow individuals to be socially engaged. This can be considered a variation on the *property ownership* aspect of the Social Distance Model, and in varying expectations of protection; if a population is not informed on their rights in a manner in which they can understand it (accounting for literacy and language barriers), their ability to exercise and advocate for those rights is diminished.

Additionally, this behavior can be contextualized by perceived political advantage, where the decision to declare an emergency may be informed by political desires rather than the actual needs of vulnerable communities. This may happen in the total absence of "traditional" emergencies (such as in the case of President Bush declaring an emergency to provide funds for President Obama's first inaugural).[51]

Conversely, positive social standing or nearness can facilitate beneficial aspects of individual and communal agency, as shown in Paton and Jackson[52] study of the TFWCH (Tassie Fires-We Can Help) Facebook community, and in Cunningham, et al., regarding overcompliance. In Paton's study, participants not only benefited from attaining or effectively sharing resources to combat the present disaster but also derived a sense of emotional well-being and connectedness, separate from disaster relief services rendered by government agencies. This study is significant in that it highlights the many forms that social standing (or nearness) can take, including more informal standing derived from participation in online communities.

"Disaster causality is only possible by understanding the ways in which social [and political] systems themselves generate unequal exposure to risk by making some groups of people, individuals, and some societies more prone to hazards than others."[53] Further research is needed to include the presence of glory-seeking behavior in decision-making by policy makers and implementers, with comparisons to communities of varying levels of social distance. See Figure 1.

Scientific approach

Research focused on disaster planning and response is based on how people perceive risk-related information. This process is strongly shaped by demographic and cultural factors.[54] Taken collectively, such measures can be derived as probabilistic risk assessments by conducting a series of systematically structured interviews that monitor the attitudes, beliefs, and practices across a population-based spectrum of needs as related to institutions that compose the everyday fabric of society in the form of distinctive case studies. Case studies are a distinctive form of empirical inquiry that can be either descriptive or explanatory in nature.[55,56] Essentially, it is the cumulative understanding or holistic examination of developmental factors of an individual unit of analysis in an attempt to build or expand an existing theoretical framework.[57-59]

Questionnaire development

Information for this research was drawn from *Enhancing the Coastal IQ Survey* (*ECIQS*). *ECIQS* was developed as a public opinion survey to investigate the social and political attitudes, policy beliefs, and behavioral practices of coastal residents in regard to disasters. The instrument underlying this study incorporated a number of questions and scales that were applied for the first time in examining the disconnect between social capital and political trust as specifically related to disaster responsibility. However, it would be remiss to not recognize prior scientific polls that were utilized as guides in the conceptual development of this particular questionnaire, including those conducted by *The Gallup Organization, Polling Report, USA Today, Newsweek Poll*, and *Pew Research Center*.

Survey protocol

ECIQS was administered by telephone to a representative sample of adults residing in coastal counties/parishes among the states of Alabama, Florida, Louisiana, Mississippi, and Texas. The approximately 144 counties/parishes were then subdivided into seven population-based clusters that also align with distinctive geographic cultural-based areas. See Figure 2.

For each of the identified survey population regions, a dual-frame sample was employed, whereby approximately 60 percent of the respondents were

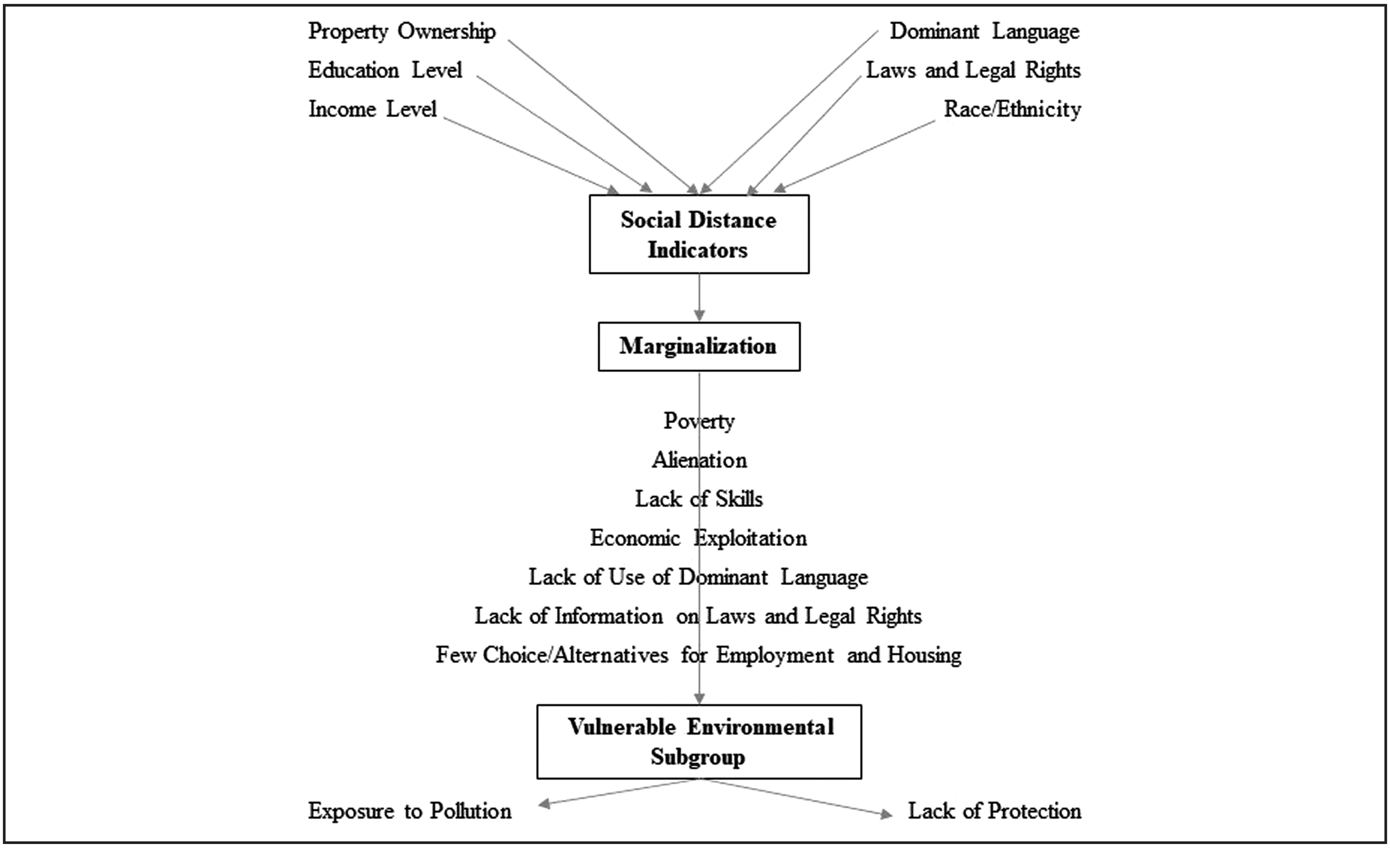

Figure 1. Social distance model for vulnerable environmental subgroup.

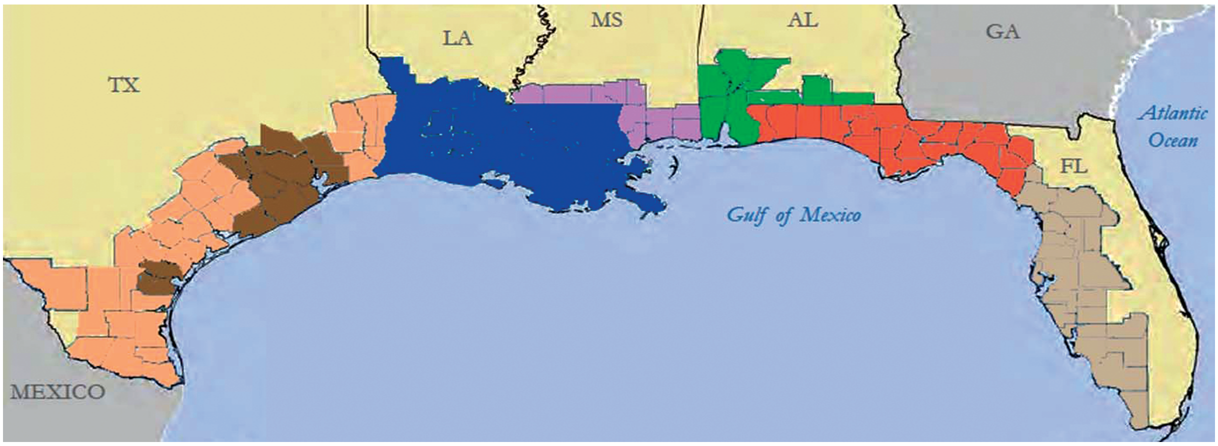

Figure 2. Survey population clusters.

contacted via landline phone and 40 percent via cellular phone. Individuals in these areas were interviewed between the second week of November 2011 and the first week of April 2012. Once a household was contacted, informed consent was obtained by asking to speak with a person 18 years of age or older and randomly who had either the last or next birthday. Attempts to contact households were made eight times before being retired and replaced. Each of the respondents was then told that should they participate, all of their responses would be kept confidential, after which any identifying information would be stripped away from the dataset as quickly as possible to maintain complete anonymity. A Computer-Assisted Telephone Interviewing System was used to collect the data.

Sample population

The respondent sample in *ECIQS* represents the civilian, noninstitutionalized adult population over the age of 18 in the targeted survey area. Households were selected using an enhanced stratified random digit dialing (RDD) sampling design that was obtained from Survey Sampling International, Inc., including those individuals with unlisted numbers. Of the 75,000 RDD-derived numbers dialed for the survey: disposition codes revealed that nearly 50 percent were determined inappropriate for the sampling frame as a result of disconnected numbers, business and unintended cellular phones or fax machines, respondent was under the age of 18 years, and/or respondent resides outside of targeted area while another 33 percent were not reached for an interview because of no answer, busy signal, and/or answering machine or voicemail after eight attempts. See Table 1.

Table 1. Survey disposition codes	
Total numbers	75,000
Completed	2,829
Refused	1,160
Hang ups	5,968
Bad numbers	37,436
Unknown	25,379
Incomplete callbacks	270
Communication or health problem	1,958
Total eligible	10,227
Total ineligible	39,394
Cooperation rate	70.9 percent
Response rate	18.30 percent

Cooperation and response rates

The cooperation and response rates serve as indicators for survey quality as a measure of demographic representativeness. Rates are calculated based on collapsed disposition codes to classify numbers. Of the eligible respondents successfully contacted for *ECIQS*, 2,829 respondents completed the survey, while 1,160 people refused to participate, for a cooperation rate of 70.9 percent. Response rates are based on the number of completed surveys and the amount of eligible numbers. Again, of the eligible respondents successfully contacted for *ECIQS*, 2,829 respondents completed the survey among 10,227 eligible numbers, for an overall response rate of 27.7 percent.

Data weighting, validity, and reliability

Sampling techniques employing random-digit dialing can often result in biased estimates since telephone coverage is a nonrandom event. That is, telephone responses may vary by demographic factors resulting in key differences between the study population parameter and its estimate that it is nonrandom. Often, this sample bias leads to an under-sampling of men, blacks, the elderly, and the young. To address this possible bias and achieve a representative sample of adults in *ECIQS*, the survey data were weighted according to the US Census Bureau's American Community Survey five-year estimates for 2005-2009 figures, the most readily available at the time, to adjust for deviations in race, gender, and age to obtain a representative sample. This resulted in a new number of completed surveys from the original N Size of 2,829 to the weighted N Size of 2,558. See Table 2.

It is also important to note response rates for telephone surveying techniques are on a downward trend in general, as many individuals, particularly the young, now only have cellular phones rather than landline phones.[60] Though this survey tried to combat this issue by incorporating a 60/40 percent mix of landline phones and cellular phones, the disposition codes that are used to calculate the response, refusal, and cooperation rates were collapsed altogether to provide a single set of rates, rather than separate rates. Therefore, if each of the set of rates had been separated, it may have likely increased both the response and cooperation rates, decreasing the refusal rate. See Table 3.

Table 2. Survey population characteristics				
Characteristics	**Original *N* size**	**Original percent**	**Weighted *N* size**	**Weighted percent**
State				
Alabama	403	14.2	285	11.1
Florida	813	28.7	645	25.2
Louisiana	403	14.2	323	12.6
Mississippi	403	14.2	277	10.8
Texas	807	28.5	1,028	40.2
Race				
White	2,075	75.6	1,322	53.5
Black	481	17.5	276	11.1
Other	188	6.9	875	35.4
Gender				
Male	1,162	41.1	1,205	47.2
Female	1,664	58.8	1,350	52.8
Age				
18-24 years	195	7.3	334	13.9
25-44 years	565	21.1	781	32.5
45-64 years	1076	40.3	879	36.6
65+years	837	31.3	408	17.0
Education				
Less than high school	302	10.8	325	12.9
High school graduate	874	31.4	770	30.6
Some college	615	22.1	570	22.7
College graduate and above	996	35.7	850	33.8

Further, the sampling error for the total data set, for dichotomous response options with a 50/50 split, is no larger than ±2 percent, a 95 percent confidence level. Additionally, the system missing codes within the dataset indicate that a question was not asked of a given respondent because it did not apply. Additionally, since the data underlying this study was collected as primary data with specific categorical responses, there was no need to eliminate outliers.

Variable operationalization

The study relies on one dependent variable and 14 independent variables. In order to condense response categories and have enough people to analyze, variables were recoded into sets of categorical information based on items from the survey questionnaire.[61] This typically included categories of a similar response being captured together, particularly those with a Likert Scale, while others were considered system missing codes, such as for low responses for do not know/not sure or refuse responses.

The dependent, nominal variable of disaster impact, according to Estimated Effects of Vulnerability from Oil Spill, was based on the survey question "On a scale of 1 to 5, with 1 being no impact and 5 being the highest impact, how much of an impact do you think the oil spill had on you," with the response category as the exact number. Since the scale began with one

Table 3. Variable descriptive statistics						
Variable	**N-size**	**Mode**	**Median**	**Mean**	**Range**	**Standard deviation**
Dependent						
Disaster impact	2,722	1	2	4	1.799	1.341
Independent						
Quality of life	2,814	1	1	1	0.148	0.384
Community recommendation	2,783	1	1	2	0.406	0.637
Trust in Government	2,736	2	2	2	0.596	0.772
Support for future drilling	2,663	1	2	2	0.589	0.768
Fault for oil spill	2,036	1	1	4	1.876	1.370
Oil spill as a result	2,430	1	2	4	1.848	1.360
Homeownership	2,791	1	1	2	0.227	0.477
Decisional influences	2,704	1	1	4	1.532	1.238
Education	2,787	2	3	4	1.517	1.232
Income	2,604	3	3	3	0.749	0.866
Age	2,069	1	2	4	2.035	1.426
Race	2,744	1	1	2	0.352	0.593
Gender	2,826	2	2	1	0.242	0.492

for no impact, the variable was recoded into: (1) one to three having a no or a low impact, (2) four having a medium impact, and (3) five having a high impact. The do not know/not sure and refused categories were dropped. A similar process was also completed for the other independent variables, according to social capital, political trust, disaster impacts, and demographics.

FINDINGS

Descriptive statistics

Population research is exploratory in nature. To summarize basic quantitative features of the sample, descriptive statistics were conducted to measure central tendency and dispersion among all variables.

For central tendency, the mode, median, and mean were calculated to, respectively, determine the category with the greatest number of cases, the category with the middle case, and the average score of all cases. For dispersion, the range, standard deviation, and variance were calculated to determine the distance or how divided or united the case scores were. The most notable results indicate that that there was no or a low disaster impact among respondents, that respondents trusted the government some of the time, that respondents were very supportive of future drilling, that respondents felt BP was at fault for oil spill, and that the oil spill was the result of a mechanical failure that can be corrected with better engineering.

Frequency distributions

To organize the interpretation of data, survey items are often gauged on the degree of societal attachment or cultural support among respondents. As such, the higher the percentage endorsement of a social climate item, the more likely that item will become part of the social fabric of the population segment surveyed. According to this model, the survey items were, therefore, classified as:

- Universal—when they are fully supported and accepted (85-100 percent of respondents).

- Predominant—when they are mostly supported but there is still a small number of people who reject them (65-84 percent of respondents).

- Contested—when the public is divided, and opinions and beliefs are very different (35-64 percent of respondents).

- Marginal—when they are supported by only a small share of people (0-34 percent of respondents).

Frequency distributions were, therefore, examined among the dependent and independent variables, according to the schemata. They revealed varied results among the many attitudes and beliefs respondents held. An overwhelming majority of respondents rated their quality of life as excellent or good but less than a third did not trust the government to do what is right most of the time. Not quite half of the respondents were supportive of offshore oil drilling in the future even though nearly three-quarters found BP at fault for the oil spill in the Gulf. Additionally, many of the respondents were white, middle-aged, and female who had low levels of both education and income. See Table 4.

Multivariate analysis

In model 1 of logistic regression, several factors influence disaster impact. These are most notable that the race, age, and gender, as well as perception of fault for the oil spill, are statistically significant with coefficients at the 0.01 level. Both income and somewhat that of quality of life also influence disaster impact, but with bare or close significance. The model has an Adjusted R^2 of 0.033 and an F-score of 7.32, demonstrating that this is a moderately weak model, statistically significant at the 0.05 level. In model 2, the same factors again influence disaster impact. Once the variables that were not significant were dropped, other than quality of life and income, altogether, the variables were statistically significant mixed with coefficients at the 0.05 and 0.01 levels. The model has an adjusted R^2 of 0.034 and an F-score of 15.55, demonstrating that this is also a moderately weak model, statistically significant at the 0.05 level. The same process was, again, repeated for model 3, dropping those variables with the lowest significance; that being, quality of life, and income. The remaining

Table 4. Heuristic frequency distributions

Social capital	
Quality of life	• Rate their quality of life as excellent or good (82 percent)
Community recommendation	• Are likely to recommend their place to live to a friend or associate (86 percent)
Political trust	
Trust in government	• Trust government, in general, to do what is right most of the time (26 percent)
Disaster impacts	
Support for future drilling	• Are supportive of offshore oil drilling in the future (43 percent)
Fault for oil spill	• Think BP is most at fault for the oil spill in the Gulf (68 percent)
Oil spill as a result	• Think that the oil spill was the result of a mechanical failure that can be corrected with better engineering (38 percent)
Demographics	
Homeownership	• Live in a residence that they own (81 percent)
Decisional influences	• Find that morals and values are what influences them the most when making (53 percent)
Education	• State that high school or the equivalent of a high school diploma was the last grade in school they completed (31 percent)
Income	• State that their income level was below $25,000 (28 percent)
Age	• State that their age was 45-64 years old (43 percent)
Race	• State that their race was white (76 percent)
Gender	• State that their gender was female (59 percent)
Estimated effects of vulnerability from oil spill	
Disaster impact	• Indicate that the oil spill had no or very little impact upon them—levels 1-2 (55 percent)

factors of race, age, and gender, as well as and perception of fault for the oil spill, were statistically significant with coefficients at the 0.01 level. The model has an adjusted R^2 of 0.031 and an F-score of 20.91, demonstrating that this is, too, a moderately weak model, statistically significant at the 0.05 level. See Table 5.

The stability of variables across all three models is not readily changing, reflective of a stable relationship. Put differently, as variables are being added or deleted, being controlled for different things, the stability of the model as whole remains fairly constant with only minimal changes from models 2 to 3.

Even by looking at the adjusted R^2, model 2, when controlling for the number of variables in the model, explains more of the variance in estimated effects of vulnerability from an oil spill than the other models. Although it is only slightly better than model 1, model 2 is the more stable model.

This study was designed to provide statistical estimates about how social capital and political trust impact environmental vulnerability from the DwH Oil Spill. There are a number of demographic and environmental factors, which influence vulnerability, and as an extension, their resiliency. These factors may change as based on time and location. They may also change based on the classification of the disaster as natural or manmade. In this particular study, an individual's demographics are the most statistically significant indicators that influence disaster impact—that being, race, gender, and age. In oil spills, blacks, females, and the elderly are the most susceptible followed by those with lower levels of income and state their quality of life as fair or poor. Additionally, those who found BP at fault for the oil spill also were impacted negatively. Clearly, individual, demographic factors affect resiliency followed by more environmental indicators. What is interesting is that education and homeownership were not found to be statistically significant variables despite their relationship to social and political stability.

Table 5. Estimated effects of vulnerability from oil spill

Independent variables	Model 1	Model 2	Model 3
Quality of life	0.112~ (0.077)	0.143* (0.071)	—
Community recommendation	0.036 (0.044)	—	—
Governmental trust	0.023 (0.036)	—	—
Support for future drilling	0.053 (0.033)	—	—
Fault for oil spill	–0.044** (0.013)	–0.044** (0.012)	–0.042** (0.012)
Oil spill as a result	0.025 (0.016)	—	—
Homeownership	–0.019 (0.063)	—	—
Decisional influences	0.016 (0.019)	—	—
Education	0.026 (0.023)	—	—
Income	–0.028~ (0.015)	–0.029* (0.014)	—
Age	–0.139** (0.033)	–0.150** (0.031)	–0.152** (0.031)
Race	0.201** (0.042)	0.190** (0.040)	0.208** (0.039)
Gender	0.171** (0.055)	0.182** (0.053)	0.192** (0.053)
Intercept	1.986	2.328	2.362
Adjusted R^2	0.033	0.034	0.031

N size is 2,558.
Significance * at the 0.05 level, ** at the 0.01 level and ~ represents close significance.
Standard errors are in parentheses.

CONCLUSION

It is axiomatic that the more advanced civilizations become, the more complex disasters become. Policymakers have attempted to reduce the impacts associated with disasters by anticipating the unexpected; however, it is easy to under analyze the complexities of emergency management activities.[62] First, disasters occur within narrow settings and a limited geographical scope, which prohibit policymakers from making sound solutions. Second, traditional disaster management models developed by policymakers have typically focused on post-crisis response and recovery lessons learned from terrorist attacks, diverting attentions away from evaluating current practices or adopting new procedures until there is an imminent crisis.[63] And, third, policymakers are unequipped to handle many of the economic, health, and environmental elements of disasters, as well as incapable of fully seizing many of its social and political attributes.[64,65]

Since disasters are typically dynamic and fluid in nature, there is a need for an improved means of understanding not only the governmental but also the communal response to disasters.[66,67]

This study was designed to provide statistical estimates about how social capital and political trust impact community resilience from the DwH Oil Spill. There are a number of demographics and cultural factors which influence vulnerability. Obviously, such factors change based on time and location. They may also change based on the classification of the disaster as natural or manmade. In this particular study, an individual's demographic are the most statistically significant indicators that influence disaster impact—that being, race, gender, and age. In oil spills, blacks, females, and the elderly are the most susceptible to negative impacts followed by those with lower levels of income and indicate their quality of life as fair or poor. Additionally, those who found BP at fault for the oil spill also were impacted negatively. Cleary, individual, demographic factors affect resiliency followed by more cultural indicators. What is interesting is that education and home ownership were not found to be statistically significant variables despite their relationship to social and political stability. These impacts, whether social or political were not as significant as those that had occurred in the Exxon Valdez Oil Spill. Why? Clearly, there are differences in the meaning of place and spatial and temporal elements affect levels of community resiliency both individually and collectively.

Inclination among policymakers should be to view emergency management as an integrated framework, taking into account all levels of governmental activity as well as consideration for communal attitudes, beliefs, and practices. Given the impact of social capital and political trust on democratic citizens and governance, it is essential to know what demographic and cultural factors influence disaster impact.[68-71] This is especially the case for the DwH oil spill, leaving, even to this day, a number of social and political impacts unanswered.[72]

ACKNOWLEDGMENT

This research was conducted under the auspices of The Social Climate of Disaster Preparedness at the Social Science Research Center of Mississippi State University.

Research protocols: *This research received approval from the Institutional Review Board for the Protection of Human Subjects at MSU, per Docket #10-150, in 2011.*

Autobiographical note: *Tonya E. Thornton (formerly Neaves) is the Assistant Professor and Director of the Centers on the Public Service at George Mason University's Schar School of Policy and Government. Tonya's research interests primarily focus on emergency management and community resiliency. Her research has appeared in the Journal of Emergency Management, Review of Policy Research, and the American Journal of Public Health. She is also an active member of the American Society for Public Administration and is the Treasurer for the Section on Emergency and Crisis Management.*

Celeste Murphy-Greene is Associate Professor and Program Director for the Graduate Certificates in Public Administration and Leadership in the School of Continuing and Professional Studies at the University of Virginia. Her research has focused on Environmental Justice and quality of life issues. Celeste's research has appeared in Public Administration Review, the International Journal of Public Administration, Review of Policy Research, and the Journal of Health and Human Services Administration.

Katherine M. Simon is a Graduate Research Assistant with the Centers on the Public Service at George Mason University's Schar School of Policy and Government. Katie's research interests primarily focus on community engagement and resiliency. She is a member of the American Society for Public Administration.

Presentations: *Neaves, T. T., Murphy-Greene, C., Simon, K. M. (2019). Communal Resiliency and Environmental Justice: Examining the Aftermath of the DeepWater Horizon Oil Spill. American Society for Public Administration Annual Meeting, March 8-12, in Washington, DC.*

Neaves, T. T., and Murphy-Brown, C. (2016). "Perspectives on Environmental Justice: Examining Communal Resiliency in the Aftermath of the Deepwater Horizon Oil Spill." Southeastern Conference for Public Administration, October 13-16, in Raleigh, NC.

Tonya E. Thornton, PhD, MPPA, Schar School Policy and Government, George Mason University, Arlington, Virginia.

Celeste Murphy-Greene, PhD, MPA, School of Continuing and Professional Studies, Tidewater Community College, University of Virginia, Virginia Beach, Virginia.

Katherine M. Simon, MPA, Schar School Policy and Government, George Mason University, Arlington, Virginia.

REFERENCES

1. Mushkatel A, Weschler L: Emergency management and the intergovernmental system. *Public Admin Rev*. 1985; SI: 49-56.
2. Neaves T, Feierabend N, Butts C, et al.: A portrait of the delta: Enduring hope and despair. *J Health Hum Services Admin.* 2008; 31(1): 10-29.
3. Patterson O, Weil F, Patel K: The role of community in disaster response: Conceptual models. *Popul Res Policy Rev*. 2010; 29: 127-141.
4. Paton D, Jackson D: Developing disaster management capability: An assessment centre approach. *Disaster Prev Manage*. 2002; 11(2): 115-122.
5. Birkland *T: Lessons of disaster: Policy change after catastrophic events*. Washington: Georgetown University Press, 2006.
6. Burdeau C: New discovery: Well beneath sunken rig off Louisiana has serious oil leak. *The Associated Press*. 2010. Available at *http://seattletimes.nwsource.com/html/nationworld/2011695704_rig25.html*. Accessed March 12, 2019.
7. Burdeau C: Oil cleanup at Gulf rig blast site delayed again. *The Associated Press*. 2010. Available at *http://www.google.com/hostednews/ap/article/ALeqM5g5gnWbqZ9SqBHvSYqJeE2AT5KebwD9FA6D0O0*. Accessed March 12, 2019.
8. White J: *Taking language seriously: The narrative foundations of public administration research.* Washington: Georgetown University Press, 1999.
9. Birkland T: *An introduction to the policy process: Theories, concepts, and models of public policy*. Armonk, NY: M. E. Sharpe, Inc., 2005.
10. Smith K, Larimer C: *The public policy theory primer*. Philadelphia, Pennsylvania: Westview Press, 2009.
11. Beierle T, Konisky D: Values, conflict, trust in participatory environmental planning. *J Policy Anal Manage*. 2000; 19(4): 587-602.
12. Dye T: *Understanding public policy*, 12th ed., Upper Saddle River, New Jersey: Pearson Education, Inc., 2008.
13. Erikson R, Tedin K: *American public opinion: Its origins, content, and impact*, 7th ed. New York: Pearson Education, Inc., 2007.
14. Etzioni A: Creating good communities and good societies. *Contemp Sociol*. 2000; 29(1): 188-195.
15. Nie N, Verba S, Petrocik J: *The changing American voter*. Cambridge, UK: Harvard University Press, 1979.
16. Wamsley G: A public philosophy and ontological disclosure as the basis for normatively grounded theorizing in public administration. In: Wamsley G, Wolf J, eds. *Refounding democratic public administration, modern paradoxes, postmodern challenges*. Thousand Oaks, California: Sage Publications, 1996.
17. Brandsen T, Boogers M, Tops P: Soft governance, hard consequences: The ambiguous status of unofficial guidelines. *Public Admin. Rev*. 2006; 66(4): 546-553.
18. Brewer, G: The policy sciences emerge: To nurture and structure a discipline. *Policy Sci*. 1974; 5(3): 239-244.
19. Rochefort D, Cobb R: *The politics of problem definition: Shaping the policy agenda*. Lawrence, Kansa: University Press of Kansas, 1994.
20. Bonser C, McGregor E, Jr., and Oster E, Jr.: *American public policy problems: An introductory guide*, 2nd ed. Upper Saddle River, New Jersey: Prentice Hall, 2000.
21. The Argus: Oil leaking from sunken US rig. *The Argus*. 2010. Available at *http://www.argus.ie/breaking-news/world-news/oil-platform-sinks-after-blast-2149136.html*. Accessed March 12, 2019.
22. The Associated Press: Evacuated workers sought after oil rig explosion. *The Seattle Times*. 2010. Available at *http://seattletimes.nwsource.com/html/nationworld/2011658472_apuslouisianaoilrigexplosion.html*. Accessed February 2, 2019.
23. Burdeau C: Oil cleanup at Gulf rig blast site delayed again. *The Associated Press*. 2010. Available at *http://www.google.com/hostednews/ap/article/ALeqM5g5gnWbqZ9SqBHvSYqJeE2AT5KebwD9FA6D0O0*. Accessed March 12, 2019.
24. Brennan P, Burke J: British Petroleum's oil well leak may take months to shut after rig sinks. *Bloomberg Businessweek*. 2010. Available at *http://www.businessweek.com/news/2010-04-25/BritishPetroleum-s-gulf-well-leaking-1-000-barrels-a-day-after-fire-update1-.html*. Accessed February 2, 2019.
25. Occupational Safety and Health Administration: #1. Deepwater Horizon response: Unified command. *Occupational Safety and Health Administration*. 2010. Available at *http://www.osha.gov/oilspills/index.html. 2010*. Accessed January 22, 2019.
26. Goddard J: Engineers build underwater dome to contain Gulf of Mexico oil spill. *TimeOnline*. Available at *http://www.timesonline.co.uk/tol/news/environment/article7108909.ece*. Accessed January 10, 2019.
27. Seba E: WRAPUP 7-British Petroleum tries a new US Gulf spill fix, as slick spreads. *Reuters*. 2010. Available at *http://www.reuters.com/article/idUSN1016775020100510?type=marketsNews*. Accessed January 3, 2019.
28. Bolstad E, Washburn M, Lebovich J: 3 companies expected to blame each other for Gulf oil spill. *Miami Herald*. 2010. Available at *http://www.miamiherald.com/2010/05/11/1623583/3-companies-expected-to-blame.html*. Accessed February 7, 2019.
29. Schmollinger C, Polson J: British Petroleum expects to finish sealing ill-fated Macondo well today. *Bloomberg Businessweek*. 2010. Available at *http://www.businessweek.com/news/2010-09-18/BritishPetroleum-expects-to-finish-sealing-ill-fated-macondo-well-today.html*. Accessed April 2, 2019.
30. Burdeau C: New discovery: Well beneath sunken rig off Louisiana has serious oil leak. *The Associated Press*. Available at *http://seattletimes.nwsource.com/html/nationworld/2011695704_rig25.html*. Accessed March 12, 2019.
31. Burdeau C: Oil cleanup at Gulf rig blast site delayed again. *The Associated Press*. 2010. Available at *http://www.google.com/hostednews/ap/article/ALeqM5g5gnWbqZ9SqBHvSYqJeE2AT5KebwD9FA6D0O0*. Accessed March 12, 2019.
32. CNN News: With Gulf oil well almost dead, what lies ahead. *CNN News*. 2000. Available at *http://articles.cnn.com/2010-09-18/us/gulf.oil.disaster_1_blowout-preventer-chief-executive-tony-hayward-gulf-of-mexico-oil?_s=PM:US*. Accessed March 29, 2019.
33. Murray M: Oil rig explosion injures workers and causes raging force off Louisiana coast. *ABC World News*. 2010. Available

at *http://abcnews.go.com/WN/oil-rigexplosion-drilling-rig-off-louisiana-coast/story?id=10437155*. Accessed March 22, 2019.
34. Oil Gas Glossary: Blowout. *Oil and Gas Field Technical Terms Glossary*. 2010. Available at *http://oilgasglossary.com/?s=blowout*. Accessed February 27, 2019.
35. Occupational Safety and Health Administration: Well control. *Occupational Safety and Health Administration*. 2010. Available at *http://www.osha.gov/SLTC/etools/oilandgas/drilling/wellcontrol.html*. Accessed January 28, 2019.
36. Goddard J: Engineers build underwater dome to contain Gulf of Mexico oil spill. *TimeOnline*. Available at *http://www.timesonline.co.uk/tol/news/environment/article7108909.ece*. Accessed January 10, 2019.
37. Smith V, Breed A: Giant box could be key to bottling spill. *The Associated Press*. 2010. Available at *http://www.2theadvocate.com/news/92838609.html?showAll=y&c=y*. Accessed January 13, 2019.
38. Bolstad E, Washburn M, Lebovich J: 3 companies expected to blame each other for Gulf oil spill. *Miami Herald*. 2010. Available at *http://www.miamiherald.com/2010/05/11/1623583/3-companies-expected-to-blame.html*. Accessed February 7, 2019.
39. Herron J: 2nd update: British Petroleum pursues many options to halt oil leak in US Gulf. *The Wall Street Journal*. 2010. Available at *http://online.wsj.com/article_email/BT-CO-20100426-711156-kIyVDAtMUMwTzAtNDIwMDQxWj.html*. Accessed January 20, 2019.
40. Morgan S: Oil services, drilling and equipment: Deep dive into the deepwater horizon incident. *Morgan Stanley Research North America*. 2010. Available at *http://thehinsons.net/wp-content/uploads/2010/05/Horizon3_Deep_Dive_into_Deepwater_Horizon_Incident.pdf*. Accessed March 12, 2019.
41. Urbina I: Conflict of interest worries raised in spill tests. *The New York Times*. 2010. Available at *http://www.nytimes.com/2010/05/21/science/earth/21conflict.html*. Accessed March 10, 2019.
42. Smith V, Breed A: Giant box could be key to bottling spill. *The Associated Press*. 2010. Available at *http://www.2theadvocate.com/news/92838609.html?showAll=y&c=y*. Accessed January 13, 2019.
43. Neaves T, Feierabend N, Butts C, et al.: A portrait of the delta: Enduring hope and despair. *J Health Hum Serv Admin.*. 2008; 31(1): 10-29.
44. de Blij H, Alexander A: *Culture, society, and space*, 7th ed. Hoboken, New Jersey: John Wiley and Sons, 2000.
45. Weeks J: *Population: An introduction to concepts and issues*, 8th Ed Belmont, California: Thomson Learning, 2002.
46. Stoneall L: *Country life, city life: Five theories of community.* New York: Praeger, 1983.
47. Murphy B: Locating social capital in resilient community-level emergency management. *Nat Hazards*. 2007; 41(2): 297-315.
48. Murphy C: The occupational safety and health of Florida farm workers: Environmental injustice in the fields? *J Health Hum Serv Admin.* 2002; 25(3): 281-314.
49. Murphy-Greene C, Leip L: Assessing the effectiveness of executive order 12898: Environmental justice for all? *Public Admin. Rev*. 2002; 62(6): 650-658.
50. Gunningham N, Kagan RA, Thornton D: Social license and environmental protection: Why businesses go beyond compliance. *Law Soc*. 2004; 29(2): 307-342.
51. Posner EA, Vermuele A: Crisis governance in the administrative state: 9/11and the financial meltdown of 2008. *John M. Olin Program in Law and Economics*, 2008, Working Paper No. 442.
52. Paton D, Jackson D: Developing disaster management capability: An assessment centre approach. *Disaster Prev Manage*. 2002; 11(2): 115-122.
53. Cannon T: Vulnerability analysis and the explanation of "natural" disasters. In: Varley A, ed., *Disasters, development and environment*. Chichester, New York, Brisbane, Toronto, Singapore: John Wiley & Sons, 1994.
54. Groves R: Theories and methods of telephone surveys. *Ann Rev Sociol.* 1990; 16: 221-240.
55. Lenson J, Rodgers R: Cumulating the intellectual gold of case study research. *Public Admin Rev*. 2001; 61(2): 235-246.
56. Yin R: *Case study research: Design and methods*. Thousand Oaks, California: Sage Publications, 2009.
57. Creswell JW: *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). Thousand Oaks, California: Sage Publications, 2007.
58. Stake R: *The art of case study research*. Thousand Oaks, California: Sage Publications, 1995.
59. de Vaus DA: *Research design in social research*. Thousand Oaks, California: Sage Publications, 2001.
60. Dillman DA, Phelps G, Tortora R, et al.: Response rate and measurement differences in mixed-mode surveys using mail, telephone, interactive voice response (IVR) and the Internet. *Soc Sci Res*. 2009; 38(1): 1-18.
61. Brick JM, Kalton G. Handling missing data in survey research. *Stat Methods Med Res*. 1996; 5(3): 215-238.
62. Petak W: Emergency management: A challenge for public administration. *Public Admin Rev*. 1985; SI: 3-7.
63. Wallace W, DeBalough F: Decision support systems for disaster management. *Public Admin Rev*. 1985; SI: 134-146.
64. Weichselgartner J: Disaster mitigation: the concept of vulnerability revisited. *Disaster Prev Manage*. 2001; 10(2): 85-95.
65. deLeon P: The stages approach to the policy process: What has it done? Where is it going? In: Sabatier PA, ed.: *Theories of the Policy Process*. Boulder, Colorado: Westview Press, 1999, pp. 19-32.
66. Gregory R, McDaniels T, Fields D: Decision-aiding, not dispute resolution: Creating insights through structured environmental decisions. *J Policy Anal Manage*. 2001; 20: 415-432.
67. Henstra D: Evaluating local government emergency management programs: What framework should public managers adopt," *Public Admin Rev*. 2010; 70(2): 236-246.
68. Vigoda E: From responsiveness to collaboration: Governance, citizens, and the next generation of public administration. *Public Admin Rev*. 2002; 62(5): 527-540.
69. Irvin R, Stansbury J: Citizen participation in decision making: Is it worth the effort? *Public Admin Rev*. 2004; 64(1): 55-65.
70. Page B, Shapiro R: Effects of public opinion on policy. *Am Political Sci Rev*. 1983; 77(1): 175-190.
71. Page B, Shapiro R, Dempsey G: What moves public opinion. *Am Political Sci Rev*. 1987; 81(1): 23-43.
72. Kurtz R: Coastal oil spill preparedness and response: The Morris J. Berman incident. *Rev Policy Res*. 2008; 25(5): 473-486.