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Behavioral Health in the Gulf Coast Region Following the Deepwater Horizon Oil Spill: Findings from Two Federal Surveys

Deborah W. Gould, PhD,

Division of Health Informatics and Surveillance, Centers for Disease Control and Prevention, Atlanta, Georgia. Phone: 404-498-0562

Judith L. Teich, MSW,

Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration, Rockville, MD, USA. Phone: 240-276-1967

Michael R. Pemberton, PhD,

RTI International, New Orleans, LA, USA. Phone: 919-485-5629

Carol Pierannunzi, PhD, and

Division of Health Informatics and Surveillance, Centers for Disease Control and Prevention, Atlanta, Georgia. Phone: 404-498-0501

Sharon Larson, PhD

Sharon Larson, PhD, Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration, Rockville, MD, USA. Phone: 240-276-0311

Deborah W. Gould: dgould@cdc.gov; Judith L. Teich: Judith.teich@samhsa.hhs.gov; Michael R. Pemberton: pemberton@rti.org; Carol Pierannunzi: CPierannunzi@cdc.gov; Sharon Larson: sharon.larson@samhsa.hhs.gov

Abstract

This article summarizes findings from two large-scale, population-based surveys conducted by Substance Abuse and Mental Health Services Administration (SAMHSA) and Centers for Disease Control and Prevention (CDC) in the Gulf Coast region following the 2010 Deepwater Horizon oil spill, to measure the prevalence of mental and substance use disorders, chronic health conditions, and utilization of behavioral health services. Although many area residents undoubtedly experienced increased levels of anxiety and stress following the spill, findings suggest only modest or minimal changes in behavioral health at the aggregate level before and after the spill. The studies do not address potential long-term effects of the spill on physical and behavioral health nor did they target subpopulations that might have been most affected by the spill. Resources mobilized to reduce the economic and behavioral health impacts of the spill on coastal residents—including compensation for lost income from BP and increases in available mental health services—may have resulted in a reduction in potential mental health problems.

Correspondence to: Judith L. Teich, Judith.teich@samhsa.hhs.gov.

Conflict of Interest The authors report no conflict of interest.

Introduction

In January 2013, the US Department of Health and Human Services (HHS) released a report titled *Behavioral Health in the Gulf Coast Region Following the Deepwater Horizon Oil Spill*, which summarized the findings of two separate surveys conducted by the Substance Abuse and Mental Health Services Administration (SAMHSA) and the Centers for Disease Control and Prevention (CDC) related to the behavioral health of Gulf Coast residents affected by the *Deepwater Horizon* oil spill in the Gulf of Mexico.¹ These data collection efforts, initiated in September 2010, focused on the residents of counties in Alabama, Florida, Louisiana, and Mississippi that were affected by the spill.* The surveys were funded through a memorandum of agreement with BP; however, BP was not involved in data collection, data analysis, or writing the report. The surveys measured the prevalence of mental health and substance use disorders and chronic health conditions, as well as utilization of behavioral health services in the areas affected by the oil spill.

The goal of these data collection efforts was to address several questions:

- What changes in behavioral health (mental health and substance use) and physical health occurred in the population before and after the oil spill in the affected counties?
- How did those changes in the affected counties from the pre-spill period to the post-spill period compare to changes between these time periods in other geographic regions?
- In the period after the oil spill, how did the behavioral and physical health of residents of affected counties in these four states compare with non-affected counties in those same states?

Behavioral health impacts of the Deepwater Horizon oil spill

When the BP Deepwater Horizon oil rig exploded in the Gulf of Mexico on April 20, 2010, it caused significant ecological and community damage. The proximity of the well to the shoreline placed fragile estuarine, marsh, and protected ecosystems in jeopardy of contamination and destruction. The spill disrupted the fishing, tourism, and petroleum industries, resulting in the loss of employment for many in the region. Issues related to seafood safety, water and air quality, and dispersant use raised concerns in the community over the long-term health effects of the spill, and increased calls to mental health and domestic violence hotlines suggested that residents were distressed about the loss of jobs and the perceived loss of the Gulf's culture and way of life.^{2,3}

Public health officials were concerned that several pre-existing vulnerabilities among residents of the Gulf Coast, including those experiencing prior trauma from Hurricanes Katrina and Rita,²⁻⁴ prior resource losses^{5,6} and the loss of confidence in authority,⁷⁻¹¹ might complicate the recovery following the Deepwater Horizon oil spill.

*In Louisiana, counties are called "parishes." In this paper, we use "counties" to refer to both counties and parishes.

The experience of prior trauma is a significant risk factor for developing negative behavioral health outcomes after a traumatic event.¹² Although the Deepwater Horizon oil spill occurred 5 years after Hurricanes Katrina and Rita, it is possible that individuals dually exposed to the hurricanes and the oil spill might be more likely to report negative behavioral health outcomes and a greater constellation of symptoms as past traumatic stress is “reactivated.”⁴ Moreover, resource loss is one of the most consistently demonstrated risk factors for negative behavioral health conditions following a technological disaster such as an oil spill. In a study evaluating mental health functioning 6 years after the *Exxon Valdez* oil spill, Arata and colleagues⁵ identified income loss as one of the most important predictors of depression, anxiety, and post-traumatic stress disorder (PTSD) among individuals affected by that disaster. The fishing and oil industry workers were both affected by the Deepwater Horizon oil spill not long after facing the disruption from hurricanes Katrina and Rita.

Another factor involved in the potential development of adverse behavioral health conditions after a technological disaster is general uncertainty and a loss of confidence in authorities,⁷⁻⁹ both of which were documented after the Deepwater Horizon oil spill.¹³ In a natural disaster, people generally agree that there is no person directly to blame (experiencing the disaster as an act of God or nature); however, in a technological disaster such as an oil spill (or the levee failures in New Orleans that occurred during Hurricane Katrina), conflict can arise about who is responsible (e.g., government, industry, and workers).^{7,8,13} This can lead to significant community division. Additionally, public health professionals were uncertain about the long-term health effects of the oil spill on community residents,^{11,14} and environmental experts were uncertain about the long-term ecological impacts,^{7,8,13} which could engender a further lack of confidence in authorities.¹⁵

Parallels were made between the psychological stress exhibited by Gulf Coast residents and those experienced by Alaskans in the wake of the Exxon Valdez oil spill more than 20 years earlier. The Exxon Valdez disaster severely threatened the way of life for nearby communities, particularly those with strong economic, social, and cultural ties to fisheries and other ecological resources damaged by the spill. Numerous research studies conducted since the Exxon Valdez spill have documented that this event had substantial mental health consequences for residents of affected communities and that these have persisted over time.⁷⁻⁹ Furthermore, the prolonged litigation following the spill created a “secondary trauma,” resulting in an additional source of stress for residents affected by the spill.⁶

As with the Exxon Valdez oil spill, the Deepwater Horizon oil spill was perceived by residents of the Gulf Coast as threatening their way of life. In addition, perceived inequities in opportunities to work in oil spill mitigation efforts and the bureaucracy of the financial claims process created an additional source of contention and stress for many Gulf Coast residents.⁶

Soon after the Deepwater Horizon spill, several researchers reported initial findings on the social and behavioral health problems generated by the spill based mainly on surveys with relatively small sample sizes. For example, Lee and Blanchard¹⁶ surveyed 925 adult coastal Louisiana residents between June 16 and July 2, 2010, finding self-rated stress more than

doubled after the oil spill compared to the previous year, and nearly 60% of the persons in the sample reported feeling worried almost constantly because of the oil spill during the week prior to the interview. Abramson and colleagues¹⁷ interviewed more than 1,200 adult coastal residents in Louisiana and Mississippi between July 19 and July 25, 2010. The key findings included parental reports of physical or mental health distress among children (33%) and income decrease among 20% of the households, all as a consequence of the oil spill. Osofsky and colleagues⁶ also examined factors related to psychological distress and PTSD symptoms in the Gulf Coast region. Among the 452 adults from four parishes in Louisiana who were interviewed between August and December 2010, 12% of respondents exceeded the cutoff for probable PTSD, and 15% had elevated levels of psychological distress. Psychological distress symptoms were significantly higher among those reporting disruption in life, work, and family as a result of the oil spill.

Five months after the start of the Deepwater Horizon oil spill, Gill and colleagues¹⁸ studied the level of event-specific psychological distress of 412 residents of southern Mobile County, Alabama, and compared their findings with distress levels observed in residents of Cordova, Alaska, following the Exxon Valdez oil spill in 1989. Analyses indicated that the distribution of event-specific psychological stress among mobile residents was similar to that found in Cordova in the year following the Exxon Valdez oil spill. In both samples, 37% of those surveyed reported mild levels of psychological distress, 25% of mobile residents reported moderate psychological distress, compared with 37% of Cordova residents, 20% of mobile residents reported subclinical levels of psychological distress, compared with 11% of Cordova residents, and 18% of mobile residents had clinical levels of psychological distress, which was similar to the 15% reported among Cordova residents.

Taken together, these studies suggest that the Deepwater Horizon oil spill did have some effect on the behavioral health of Gulf Coast residents in the immediate aftermath of the spill. These studies, however, do not address the issue of a broader, population-level impact on the region as a whole. As part of the Federal Government's recovery plan for the spill,¹² SAMHSA and CDC undertook separate population-based surveys to provide an initial look at the behavioral and physical health of the region affected by the spill. The following article provides a summary of the SAMHSA and CDC joint report and highlights key findings related to behavioral health. A detailed description of the background, survey methods, and additional findings is provided in the full joint report.¹

Data Sources and Methods

National Survey on Drug Use and Health

SAMHSA's data collection efforts included the National Survey on Drug Use and Health (NSDUH) Gulf Coast Oversample (GCO), conducted as part of the 2011 NSDUH. Conducted by the Federal Government since 1971, NSDUH is the primary source of statistical information on the use of illegal drugs, alcohol, and tobacco by the US civilian, non-institutionalized population aged 12 or older and also provides information on mental health problems and mental health service utilization. The survey collects data through face-to-face interviews with a representative sample of the population at the respondents' place of residence and includes residents of households and non-institutional group quarters (e.g.,

shelters, rooming houses, and dormitories) as well as civilians living on military bases. The survey is available in both English and Spanish. The annual nationwide survey involves interviews with approximately 70,000 randomly selected individuals and excludes homeless persons who do not use shelters, military personnel on active duty, and residents of institutional group quarters, such as jails or hospitals. For all persons aged 12 or older, the survey includes questions on past month use of illicit drugs, cigarettes, and alcohol: past month binge alcohol use (five or more drinks on the same occasion—at the same time or within a couple of hours of each other—on at least 1 day in the past 30 days), past month heavy alcohol use (binge drinking on five or more days in the past 30 days), and past year substance use disorder (defined as illicit drug or alcohol abuse or dependence). For adults aged 18 or older, the survey also asks questions that allow for classification of past year major depressive episode, any mental illness, serious mental illness, suicidality (serious thoughts about suicide, suicide plans, suicide attempts), and receipt of mental health treatment including outpatient treatment. Additional information on these measures is available at <http://www.samhsa.gov/data/NSDUH.aspx>.

The 2011 NSDUH GCO supplemented the survey with additional interviews in Alabama, Florida, Louisiana, and Mississippi, mostly in the 32 counties identified as those most likely to have been affected by the oil spill based on claims activity to BP for economic and related health needs, county and parish involvement with US Department of Education and Administration for Children and Families programming, and state assessment of impacted counties and parishes based on consultation with SAMHSA during the preparation of aid applications.[†] The GCO increased the total target sample size in these four states by approximately 2,000 completed interviews in 2011, with approximately 1,400 additional interviews in the 32 affected counties and 600 additional interviews in other counties within Alabama, Louisiana, and Mississippi. These additional interviews were included to facilitate comparisons between the group of 32 counties in the affected area versus the remainder of the Gulf Coast counties, remainder of the USA, and the total USA. Additional interviews were not conducted in Florida counties not affected by the oil spill because Florida, as one of the eight most populous states in the country that are oversampled in NSDUH, already had a sufficient sample size for these comparisons. The supplementary sample from the GCO resulted in 2,313 completed interviews in the 32 affected counties and 6,071 completed interviews in those four states (outside of the 32 counties). Detailed information on the NSDUH GCO methodology is available elsewhere.¹

Selected substance use and mental health measures from NSDUH were compared between the pre-oil spill period (2007 to 2009) and the post-oil spill period (2011) within each of the four geographic areas (the affected counties in the Gulf Coast states, remainder of the Gulf Coast states, remainder of the USA, and the total USA). Combined data from 2007 to 2009 were used for the pre-oil spill period to ensure that there were sufficient sample sizes in the

[†]Both the NSDUH GCO and the Gulf States Population Survey (GSPS) included Baldwin and mobile counties in Alabama; Escambia, Okaloosa, Santa Rosa, and Walton counties in Florida; Iberia, Jefferson, Lafourche, Orleans, Plaquemines, St. Bernard, St. Mary, St. Tammany, Terrebonne, and Vermilion parishes in Louisiana; and Hancock and Harrison counties in Mississippi. The GSPS also included Tangipahoa, Calcasieu, Jefferson Davis, Cameron, St. Charles, and Assumption parishes in Louisiana. The NSDUH GCO also included Clarke, Escambia, Monroe, and Washington counties in Alabama; Bay, Franklin, Gulf, and Wakulla counties in Florida; St. Martin and Lafayette parishes in Louisiana; and George, Pearl River, and Stone counties in Mississippi.

affected counties to support analyses, while also ensuring that data from the period immediately following hurricanes Katrina and Rita were not included. Additional analyses tested whether there was greater change in the affected counties than in the remainder of the Gulf Coast states, the remainder of the USA, or the total USA. Although there is less confidence in conclusions reached by performing tests with an alpha level between .05 and .10 than in those reached by performing tests with an alpha less than .05, differences are considered significant up to an alpha level of .10 in this report because of the relatively low level of statistical power for these tests due to the limited sample size in the affected counties in the Gulf Coast states.

Gulf states population survey

CDC's Gulf States Population Survey (GSPS) was a 12-month (December 2010 to December 2011) random-digit dial telephone survey of adults aged 18 or older in Alabama, Florida, Louisiana, and Mississippi, with the majority of interviews conducted in 25 coastal counties that lie within 32 mi of an area where fishing was closed due to the spill. The general methods used to develop and deploy the GSPS were based on previously tested methods used for the CDC's Behavioral Risk Factor Surveillance System (BRFSS).¹⁹ The GSPS included landline and cellular telephones (the latter were added in May 2011) and was available in English and Spanish (the Spanish version was added in May 2011). Interviews lasted approximately 20 min.

CDC developed the survey questionnaire in partnership with SAMHSA, subject matter experts within CDC, and state public health and mental health departments from the four states where the survey was conducted. Many of the questions were taken from the BRFSS including questions on life satisfaction and emotional support, quality of life, health status and chronic medical conditions, intimate partner violence, and health care access. Questions measuring depression and anxiety were taken from the eight-item Patient Health Questionnaire (PHQ-8) and the seven-item Generalized Anxiety Disorder (GAD-7) questionnaire.²⁰ Several questions were specific to the oil spill and measured contact with oil from the spill and changes in household income associated with the spill.

A total of 38,361 interviews were completed (27,947 in coastal counties and 10,414 in the remainder of counties in the Gulf Coast states). Data from the GSPS were used to compare responses from residents in the oil-affected coastal areas to those in the remainder of the Gulf Coast states. Selected measures were also compared with estimates taken from the 2004 to 2010 BRFSS to assess changes over time. The number of responses permitted the use of statistical techniques to determine whether differences existed among groups of respondents at the .05 level of significance. Detailed information on the GSPS questionnaire and methodology is available in the GSPS data user guide and manual.²¹

Results

National Survey on Drug Use and Health findings

Demographic and socioeconomic characteristics—In the period before the oil spill, approximately 3.1 million persons aged 12 or older lived in the oil spill area, 22.1

million lived in the remainder of the Gulf Coast states, and 224.7 million lived in the remainder of the USA (Table 1). The population in the oil spill area and in the remainder of the Gulf Coast states increased by about 4.5% from the pre-spill period to the post-spill period, whereas the population in the remainder of the USA increased by about 2.2% between these periods. Compared with persons in the remainder of the USA, persons living in the oil spill area were as follows:

- More likely to be non-Hispanic black and less likely to be Hispanic,
- More likely to have less than a high school education,
- More likely to have an annual household income of \$20,000 or less, and
- Similar in regard to age group, gender composition, and employment status.

Substance use—The prevalence of any illicit drug use in the past month and the prevalence of marijuana use in the past month increased from the pre-spill period to the post-spill period for persons aged 12 or older in the oil-affected areas. These differences were greater than the increase in past month illicit drug use and marijuana use in the remainder of the USA or in the total USA (Table 2). The prevalence of past month marijuana use in the affected counties increased from pre-spill to post-spill for adults aged 26 or older but was similar in those time periods for those aged 12 to 17 or 18 to 25. For persons aged 18 to 25, the rate of past month non-medical use of prescription-type pain relievers decreased from the pre-spill period to the post-spill period in the affected counties. This decrease in affected counties was greater than the decrease found in the remainder of the USA.

In the affected counties, the prevalence of any past month alcohol use increased from the pre-spill period to the post-spill period for all persons aged 12 or older as well as for those aged 26 or older. The rates of past month alcohol use in these age groups were similar in those time periods in the remainder of the USA and in the total USA. Among those aged 12 to 17, the rates of past month alcohol use decreased from the pre-spill period to the post-spill period in each of the geographic areas.

In the affected counties, rates were similar for past month non-medical use of prescription-type psychotherapeutics, past month cigarette use, past month binge alcohol use, past month heavy alcohol use, and past year substance use disorder in both the pre-spill and post-spill periods.

Mental health—Among all adults aged 18 or older, the only significant difference between the pre-spill and post-spill periods in affected counties was an increase in past year suicide plans (Table 3). There was no change during this time in the prevalence of past year suicide plans in the other geographic regions. When looking only at those aged 18 to 25, the prevalence of past year major depressive episode, serious thoughts of suicide, and suicide plans increased from pre-spill to post-spill in the affected counties. For each of these measures, there were no significant differences between these time periods for the other geographic regions among those aged 18 to 25. There were no significant changes from pre-

spill to post-spill in the rates of these mental health measures among adults aged 26 or older in the affected counties.

Among adults in the affected counties, past year rates of any mental illness, serious mental illness, and rates of mental health service utilization did not change significantly between the pre-spill and post-spill periods.

Gulf States Population Survey findings

Demographics and socioeconomic characteristics—GSPS respondents in coastal counties in the oil-affected area were similar in proportion by gender, percentage white, percentage black/African American (non-Hispanic), and percentage married (Table 4). Compared with coastal areas, those areas in the remainder of the Gulf Coast states had higher proportions of Hispanic respondents. Respondents in coastal areas were more likely to indicate that they had household incomes of \$75,000 or higher compared with respondents in non-coastal areas.

Substance use—Among residents of coastal counties, 18% reported everyday smoking, 15% reported binge drinking (defined as having five or more servings of alcohol on one occasion within the past 30 days for men or four or more servings of alcohol on a single occasion within the past 30 days for women), 4% reported heavy drinking (defined as having more than two servings of alcohol daily for men and more than one serving of alcohol daily for women), and 3% reported having increased use of prescription medication without their physicians' advice (Table 5). There were no significant differences between oil-affected coastal areas and the remainder of the Gulf Coast states. A comparison of everyday smoking and binge drinking rates, taken from CDC's 2004–2010 BRFSS and the GSPS, indicated no discernible differences.¹

Mental health—The GSPS contained questions from the PHQ-8 and the GAD-7 questionnaire, which can be used to screen for moderate to severe depression and generalized anxiety disorder, respectively. Overall, 16% of the coastal population suffered moderate to severe depression (PHQ-8 score of ≥ 10 on a scale from 0 to 24) in the 2 weeks before the interview, and 15% suffered moderate to severe anxiety (GAD-7 score ≥ 10 on a scale from 0 to 21) in the 2 weeks before the interview (Table 6). Prevalence estimates for current moderate to severe depression and moderate to severe generalized anxiety disorder were similar across states and between coastal counties and the remainder of the Gulf Coast states.

GSPS respondents were asked questions regarding suicide ideation and intimate partner violence. Among coastal residents, 5% reported having thoughts of suicide in the past year, and 3% reported physical abuse by an intimate partner (Table 6). Respondents were also asked whether they ever received counseling for their emotions, nerves, or mental health. Follow-up questions were asked to ascertain whether respondents had received counseling within the past year. Responses were consistent across states and between coastal counties and the remainder of the Gulf Coast states (Table 6).

Oil exposure and economic and environmental factors—Significant differences ($p < .05$) in direct contact with the oil and participation in cleanup activities were observed between coastal counties and the remainder of the Gulf Coast states. Findings indicated that 14% of residents of coastal counties reported having direct contact with the oil spill, and 8% reported participating in spill-related cleanup activities. The prevalence of households that reported decreased income (24%) and the prevalence of households that reported losing jobs (11%) due to the oil spill were significantly different ($p < .05$; Table 7). Prevalence estimates were similar in oil-affected coastal areas and the remainder of the Gulf Coast states for changes in employment status, numbers of those who were employed for wages prior to the oil spill, and numbers of those employed for wages at the time of the interview. Coastal residents and those living outside the areas affected by the oil spill provided similar responses when asked about stress related to having enough money to pay household mortgage or rent or to buy nutritious meals.

Discussion

Although many Gulf Coast residents undoubtedly experienced increased levels of anxiety and stress following the Deepwater Horizon oil spill, findings from NSDUH and the GSPS suggest only modest or minimal changes in behavioral health measures at the aggregate regional level in the oil-affected region before and after the spill. NSDUH data indicate that among those aged 12 or older, there were increases in the prevalence of past month illicit drug use, marijuana use, and alcohol use after the oil spill that were larger than any changes during that time in the rest of the nation. Furthermore, among young adults aged 18 to 25, there were increases in the prevalence of major depressive episodes, serious thoughts of suicide, and suicide plans in the oil-affected areas after the spill. Results of the GSPS indicated that people living in the coastal counties were more likely to report decreased income or lost jobs because of the oil spill; however, results did not indicate any significant differences in chronic physical or mental health conditions or health behaviors between coastal areas and the remainder of the Gulf Coast states.

The studies described here have several limitations. Both NSDUH and GSPS were geared toward identifying relatively short-term, acute effects; they do not address potential long-term effects of the oil spill on the physical and behavioral health of the population. Additionally, data from cross-sectional surveys such as NSDUH and GSPS can establish associations, such as changes in substance use or mental health indicators before and after the oil spill, but do not allow inferences to be made about whether the oil spill was the direct cause of these changes.

Both the NSDUH GCO and the GSPS targeted counties that were most likely to be affected by the oil spill; however, the surveys did not further target subpopulations in these geographic areas that could have been most affected by the oil spill such as individuals in the fishing, oil, or tourism industries. Therefore, lack of significant findings from the NSDUH and GSPS does not mean that there are not subgroups of the population in this region that have been affected more by the oil spill than the regional population as a whole.

Measures of substance use, mental health issues, and other topics in these studies are based on respondent self-reports and not on clinical diagnoses. Both surveys were conducted in English or Spanish; neither was available in other languages, such as Vietnamese, that are spoken by some Gulf Coast residents who were directly affected by the oil spill. Children younger than 12 are not interviewed for NSDUH, and GSPS data were collected only from adults aged 18 or older.

Factors other than the oil spill may have affected the comparisons over time in NSDUH and the comparisons between regions in the GSPS; for example, mental illness is associated with indicators of disadvantaged social and economic status, including unemployment, coverage by Medicaid or the Children's Health Insurance Program, and family income below the Federal Poverty Level. The analyses presented here are descriptive and do not account for the possible impact of these factors. Therefore, observed differences for the oil-affected area, the Gulf Coast region outside of the oil spill area, and the remainder of the USA could reflect demographic or socioeconomic differences across these regions rather than effects of the oil spill.

Although initial data suggested that the Deepwater Horizon oil spill might result in environmental and psychological impacts similar to those that resulted from the Exxon Valdez spill, important differences between the two spills have since been recognized. Unlike the Exxon Valdez oil spill, the Deepwater Horizon oil spill was more widely distributed and less intensively destructive.

Furthermore, resources mobilized to reduce the economic and behavioral health impacts of the oil spill on coastal residents—including compensation for lost income from BP and increases in available mental health services—may have resulted in a reduction in mental health problems relative to what would have occurred if those resources had not been mobilized.

Implications for Behavioral Health Services and Public Health Planning

There are multiple possible explanations for the lack of widespread increases in behavioral health problems in the period after the Deepwater Horizon spill compared to the pre-spill period. It may be that the oil spill truly did not lead to sufficient life disruption and stress to result in change at the regional level. It may be that the considerable resources (financial and otherwise) mobilized to address concerns about Gulf Coast residents following the oil spill helped to reduce any widespread impact. It could also be that there were widely felt impacts on behavioral health, but large-scale, population-level epidemiologic surveys such as NSDUH and the GSPS are not the best method of capturing such changes because they cast too wide a net, including both those individuals directly impacted as well as those not directly impacted. Additional studies are needed to provide guidance on how these data may help to inform future decisions about resources expended in disasters of this type, especially studies focusing on the effectiveness of specific programs and interventions mobilized by federal and state governments and private organizations following the oil spill.

Findings from large-scale epidemiologic studies such as NSDUH and the GSPS have some advantages as well as disadvantages relative to other forms of data collection that were used

after the oil spill. The main advantages are rigorous study methodology, tested procedures, and the ability to make comparisons from the pre-spill period to the post-spill period. The main disadvantages are that they require extensive resources to field and do not provide data in time to indicate if there is a need for additional resources, and as mentioned previously, they focus on the entire population, which may mask impacts on specific subpopulations. Smaller-scale surveys aimed at specific communities or specific occupation groups can be fielded more quickly and inexpensively, thus providing more timely information on the state of behavioral health and the need for additional resources. However, they do not always involve the level of methodological rigor of the larger surveys, and by focusing just on those most affected, they may not accurately reflect the state of behavioral health in communities or regions as a whole.

These strengths and weaknesses of both types of studies point toward the need for improved systems for conducting ongoing behavioral health surveillance at the community level. Data are a public health resource that can be used to assess the impacts of events such as the Deepwater Horizon oil spill and assist in planning for the day-to-day events that shape the health of communities. Surveys such as NSDUH and BRFSS can provide some targeted information regarding some communities, but available budget constraints do not allow for these national surveys to include the sample size required to provide community-level data on a consistent basis. Similarly, many communities do not have the resources (and in some cases the expertise) to conduct their own ongoing surveillance studies. It is important to pursue additional opportunities for federal, state, and local governments to continue working together to build additional data resources and to identify existing data (e.g., data related to criminal justice, emergency department visits, or domestic violence shelter admissions) that can serve as a point of reference on key measures. A promising move in this direction can be seen in the results from a 2013 disaster mental health surveillance needs assessment conducted at state agencies by the Council of State and Territorial Epidemiologist (CSTE) in collaboration with CDC.²² This assessment identified areas of collaboration between public health and mental health but also confirmed that much work is needed to increase surveillance for mental and behavioral health during disaster response and recovery. One broad goal reflected in the recommendations from the assessment is the development of state-level guidance for mental health surveillance that captures the needs of both individuals and communities in times of crisis. CSTE has convened a working group in conjunction with the CSTE Disaster Epidemiology Subcommittee to help implement the recommendations that came from needs assessment including the development of a tool kit for improved mental health surveillance following a disaster.

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Table 1
 Numbers in thousands and percent distribution of persons for geographic area and time period by demographic and socioeconomic characteristics: National Survey on Drug Use and Health (NSDUH), 2007–2009 and 2011

| Demographic/socioeconomic characteristic | Affected counties/parishes in Gulf Coast states | | Remainder of Gulf Coast states | | Remainder of USA | | Total USA |
|--|---|------------------|--------------------------------|------------------|----------------------|------------------|----------------------|
| | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 |
| Population estimate ^c | 3,069 | 3,207 | 22,065 | 23,038 | 224,691 | 231,353 | 249,825 |
| Age ^c | | | | | | | |
| 12–17 | 10.1 | 9.6 | 9.3 | 9.0 | 10.0 | 9.8 | 10.0 |
| 18 or older | 89.9 | 90.4 | 90.7 | 91.0 | 90.0 | 90.2 | 90.0 |
| 18–25 | 12.7 | 12.8 | 12.5 | 12.7 | 13.3 | 13.4 | 13.2 |
| 26 or older | 77.1 | 77.6 | 78.2 | 78.3 | 76.6 | 76.9 | 76.8 |
| Gender ^c | | | | | | | |
| Male | 47.5 | 47.8 | 48.0 | 47.9 | 48.6 | 48.4 | 48.5 |
| Female | 52.5 | 52.2 | 52.0 | 52.1 | 51.4 | 51.6 | 51.5 |
| Hispanic origin and race ^c | | | | | | | |
| Non-Hispanic White | 70.1 | 68.2 | 62.8 | 60.4 | 68.3 | 66.1 | 67.8 |
| Non-Hispanic Black | 23.3 | 23.1 | 19.7 | 19.8 | 10.9 | 10.8 | 11.9 |
| Non-Hispanic other | 3.0 | 4.2 | 2.7 | 3.4 | 6.7 | 7.7 | 6.3 |
| Hispanic or Latino | 3.6 | 4.5 | 14.8 | 16.4 | 14.1 | 15.3 | 14.0 |
| Education | | | | | | | |
| Less than high school | 21.2 ^a | 16.5 | 17.9 ^a | 15.6 | 15.5 ^a | 14.0 | 15.8 ^a |
| High school graduate | 35.4 | 35.7 | 33.9 ^b | 31.2 | 30.4 | 29.8 | 30.7 ^b |
| Some college | 25.0 | 27.5 | 26.1 | 26.7 | 25.5 ^a | 26.5 | 25.6 ^a |
| College graduate | 18.4 | 20.4 | 22.1 ^a | 26.5 | 28.6 ^a | 29.7 | 27.9 ^a |
| Current employment | | | | | | | |
| Full time | 52.6 ^a | 47.4 | 50.6 ^a | 46.2 | 53.4 ^a | 50.1 | 53.1 ^a |
| Part time | 11.1 | 13.2 | 11.6 ^a | 13.3 | 13.8 | 14.0 | 13.6 |
| Unemployed | 4.0 ^a | 6.8 | 4.7 ^a | 6.5 | 4.6 ^a | 5.8 | 4.6 ^a |

| Demographic/socioeconomic characteristic | Affected counties/parishes in Gulf Coast states | | Remainder of Gulf Coast states | | Remainder of USA | | Total USA | |
|--|---|------------------|--------------------------------|------------------|----------------------|------------------|----------------------|------------------|
| | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 |
| Other | 32.3 | 32.6 | 33.1 | 34.0 | 28.2 ^a | 30.1 | 28.7 ^a | 30.5 |
| Family income | | | | | | | | |
| Less than \$20,000 | 22.5 | 21.0 | 21.3 | 22.6 | 17.0 ^a | 18.8 | 17.5 ^a | 19.2 |
| \$20,000–\$49,999 | 36.9 | 37.5 | 36.5 | 37.1 | 32.1 | 31.8 | 32.6 | 32.4 |
| \$50,000–\$74,999 | 15.9 | 16.6 | 18.1 | 16.3 | 18.0 ^a | 17.1 | 18.0 ^a | 17.0 |
| \$75,000 or more | 24.7 | 24.9 | 24.1 | 24.0 | 32.8 | 32.2 | 31.9 | 31.4 |

Source: Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2007–2009 (revised March 2012) and 2011

^a Difference between pre-oil spill estimate and post-oil spill estimate is statistically significant at the .05 level

^b Difference between pre-oil spill estimate and post-oil spill estimate is statistically significant at the .10 level

^c The size of this domain is forced to match the US Census Bureau population estimate through the weight calibration process and so is free of sampling error. Therefore, statistically significant differences were not tested for this subpopulation

Table 2

Percentages of past month substance use among persons aged 12 or older, by geographic region and time period: National Survey on Drug Use and Health (NSDUH), 2007–2009 and 2011

| Past month substance use | Affected counties/parishes in Gulf Coast states | | | | Remainder of USA | | | | Total USA | |
|--------------------------|---|------------------|----------------------|------------------|----------------------|-------------------|----------------------|-------------------|----------------------|-------------------|
| | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 |
| Total aged 12 or older | | | | | | | | | | |
| Illicit drugs | 7.1 ^a | 9.7 | 7.7 | 8.2 | 8.3 ^b | 8.7 ^d | 8.3 ^a | 8.7 ^d | 8.3 ^a | 8.7 ^d |
| Marijuana | 4.7 ^a | 7.3 | 5.5 ^b | 6.3 | 6.3 ^a | 7.1 ^d | 6.2 ^a | 7.1 ^d | 6.2 ^a | 7.0 ^d |
| Prescription drugs | 3.4 | 3.5 | 2.8 | 2.3 | 2.7 ^a | 2.4 | 2.7 ^a | 2.4 | 2.7 ^a | 2.4 |
| Alcohol | 48.1 ^b | 53.1 | 48.8 | 49.2 | 51.9 | 52.0 ^d | 51.6 | 52.0 ^d | 51.6 | 51.8 ^d |
| Aged 12 to 17 | | | | | | | | | | |
| Illicit drugs | 7.4 | 8.5 | 8.8 | 8.4 | 9.8 | 10.3 | 9.7 | 10.3 | 9.7 | 10.1 |
| Marijuana | 5.4 | 4.7 | 5.5 | 6.4 | 7.1 ^a | 8.1 | 6.9 ^a | 8.1 | 6.9 ^a | 7.9 |
| Prescription drugs | 2.7 | 3.4 | 3.5 | 3.2 | 3.1 ^a | 2.7 | 3.1 ^a | 2.7 | 3.1 ^a | 2.8 |
| Alcohol | 18.7 ^b | 15.1 | 14.7 ^a | 11.8 | 15.2 ^a | 13.4 | 15.2 ^a | 13.4 | 15.2 ^a | 13.3 |
| Aged 18 to 25 | | | | | | | | | | |
| Illicit drugs | 16.6 | 18.1 | 18.3 | 19.8 | 20.5 ^a | 21.6 | 20.3 ^a | 21.6 | 20.3 ^a | 21.4 |
| Marijuana | 13.0 | 16.1 | 14.9 ^a | 17.5 | 17.4 ^a | 19.2 | 17.1 ^a | 19.2 | 17.1 ^a | 19.0 |
| Prescription drugs | 8.1 ^b | 5.5 | 6.2 ^a | 4.1 | 6.0 ^a | 5.1 | 6.1 ^a | 5.1 | 6.1 ^a | 5.0 |
| Pain relievers | 7.0 ^a | 3.5 | 4.6 ^a | 2.8 | 4.6 ^a | 3.6 ^c | 4.7 ^a | 3.6 ^c | 4.7 ^a | 3.6 ^d |
| Alcohol | 56.8 | 58.7 | 56.5 | 57.2 | 61.9 | 61.0 | 61.4 | 61.0 | 61.4 | 60.7 |
| Aged 26 or older | | | | | | | | | | |
| Illicit drugs | 5.5 ^b | 8.5 | 5.9 | 6.3 | 6.0 | 6.3 | 6.0 | 6.3 | 6.0 | 6.3 |
| Marijuana | 3.3 ^a | 6.2 | 4.0 | 4.5 ^d | 4.3 ^a | 4.8 ^d | 4.2 ^a | 4.8 ^d | 4.2 ^a | 4.8 ^d |
| Prescription drugs | 2.8 | 3.2 | 2.1 | 2.0 | 2.0 | 1.8 | 2.0 | 1.8 | 2.0 | 1.9 |
| Alcohol | 50.5 ^b | 56.9 | 51.6 | 52.2 | 55.0 | 55.3 ^d | 54.6 | 55.3 ^d | 54.6 | 55.1 ^d |

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There were no differences between pre-oil spill estimates and post-oil spill estimates of past month use of pain relievers, cigarettes, or past month binge or heavy drinking in the affected counties and parishes. Source: Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2007–2009 (revised March 2012) and 2011

^a Difference between pre-oil spill estimate and post-oil spill estimate is statistically significant at the .05 level

^b Difference between pre-oil spill estimate and post-oil spill estimate is statistically significant at the .10 level

^c Difference between area effect (post-oil spill period estimate minus pre-oil spill period estimate) for this geographic region and the area effect for the Gulf Coast oil spill disaster area is statistically significant at the .05 level

^d Difference between area effect (post-oil spill period estimate minus pre-oil spill period estimate) for this geographic region and the area effect for the Gulf Coast oil spill disaster area is statistically significant at the .10 level

Table 3

Percentages of past year mental health problems and treatment among persons aged 18 or older, by geographic region and time period: National Survey on Drug Use and Health (NSDUH), 2007–2009 and 2011

| Past year measure | Affected counties/parishes in Gulf Coast states | | | | | | Total USA | |
|---|---|------------------|----------------------|------------------|----------------------|------------------|----------------------|------------------|
| | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 |
| | Total aged 18 or older | | | | | | | |
| Major depressive episode | 6.8 | 6.9 | 6.2 | 5.7 | 6.6 | 6.6 | 6.6 | 6.6 |
| Serious mental illness | 5.1 | 4.2 | 4.7 | 4.9 | 4.6 ^b | 5.0 | 4.6 ^b | 5.0 |
| Any mental illness | 22.1 | 19.3 | 18.5 | 18.6 | 19.9 | 19.7 | 19.8 | 19.6 |
| Serious thoughts of suicide | 2.6 | 3.5 | 3.4 | 3.5 | 3.8 | 3.7 | 3.7 | 3.7 |
| Made any suicide plans | 0.5 ^a | 1.2 | 1.2 | 1.0 ^c | 1.0 | 1.0 ^d | 1.0 | 1.0 ^c |
| Attempted suicide | 0.4 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Received mental health treatment | 14.5 | 12.7 | 12.1 | 11.1 | 13.5 | 13.9 | 13.4 | 13.6 |
| Received outpatient mental health treatment | 6.2 | 5.3 | 5.9 ^b | 4.9 | 6.8 | 6.9 | 6.7 | 6.7 |
| | Aged 18 to 25 | | | | | | | |
| Major depressive episode | 6.7 ^a | 12.0 | 6.9 | 7.2 ^c | 8.3 | 8.4 ^c | 8.2 | 8.3 ^c |
| Serious mental illness | 8.8 | 8.4 | 6.4 | 7.2 | 7.5 | 7.7 | 7.4 | 7.6 |
| Any mental illness | 26.2 | 31.2 | 27.1 | 27.8 | 31.1 ^b | 29.9 | 30.7 ^b | 29.8 |
| Serious thoughts of suicide | 5.1 ^a | 9.4 | 6.2 | 7.6 ^d | 6.5 | 6.7 ^c | 6.4 | 6.8 ^c |
| Made any suicide plans | 1.8 ^a | 4.3 | 2.2 | 2.3 ^c | 1.9 | 1.9 ^c | 2.0 | 1.9 ^c |
| Attempted suicide | 1.2 | 1.8 | 1.2 | 1.7 | 1.2 | 1.2 | 1.2 | 1.2 |
| Received mental health treatment | 10.9 | 12.2 | 9.4 | 9.4 | 11.0 | 11.6 | 10.9 | 11.4 |
| Received outpatient mental health treatment | 5.9 | 6.0 | 4.9 | 5.0 | 6.0 | 6.3 | 5.9 | 6.2 |
| | Aged 26 or older | | | | | | | |
| Major depressive episode | 6.8 | 6.1 | 6.0 | 5.5 | 6.4 | 6.3 | 6.3 | 6.3 |
| Serious mental illness | 4.5 | 3.5 | 4.4 | 4.5 | 4.1 ^b | 4.5 | 4.1 ^b | 4.5 |

| Past year measure | Affected counties/parishes in Gulf Coast states | | Remainder of Gulf Coast states | | Remainder of USA | | Total USA | |
|---|---|------------------|--------------------------------|------------------|----------------------|------------------|----------------------|------------------|
| | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 | Pre-spill, 2007–2009 | Post-spill, 2011 |
| Any mental illness | 21.4 | 17.3 | 17.1 | 17.2 | 17.9 | 17.9 | 17.9 | 17.8 |
| Serious thoughts of suicide | 2.1 | 2.6 | 3.0 | 2.8 | 3.3 | 3.2 | 3.3 | 3.1 |
| Made any suicide plans | 0.3 | 0.7 | 1.0 | 0.7 | 0.8 | 0.9 | 0.8 | 0.9 |
| Attempted suicide | 0.2 | 0.4 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 |
| Received mental health treatment | 15.2 | 12.8 | 12.5 | 11.4 | 13.9 | 14.3 | 13.8 | 14.0 |
| Received outpatient mental health treatment | 6.2 | 5.2 | 6.0 ^b | 4.8 | 6.9 | 7.0 | 6.8 | 6.7 |

Source: Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2007–2009 (revised March 2012) and 2011

^a Difference between pre-oil spill estimate and post-oil spill estimate is statistically significant at the .05 level

^b Difference between pre-oil spill estimate and post-oil spill estimate is statistically significant at the .10 level

^c Difference between area effect (post-oil spill period estimate minus pre-oil spill period estimate) for this geographic region and the area effect for the Gulf Coast oil spill disaster area is statistically significant at the .05 level

^d Difference between area effect (post-oil spill period estimate minus pre-oil spill period estimate) for this geographic region and the area effect for the Gulf Coast oil spill disaster area is statistically significant at the .10 level

Percentages of demographic characteristics by state: Gulf States Population Survey (GSPS), December 2010–December 2011

Table 4

| Characteristic | 25 Coastal counties/parishes weighted % | | | | | | Remainder of Gulf Coast states % | |
|--|---|-------------------|-----------------------|----------------------|---------------------------------|---------------------------------|----------------------------------|---------------------------------|
| | Florida (n=5,177) | Alabama (n=4,533) | Mississippi (n=3,209) | Louisiana (n=15,028) | Four states combined (n=27,947) | Four states combined (n=10,414) | Four states combined (n=10,414) | Four states combined (n=10,414) |
| Female | 50.0 | 52.7 | 54.2 | 54.3 | 53.2 | 53.2 | 51.6 | 51.6 |
| White Non-Hispanic | 77.6 | 70.9 | 76.7 | 66.1 | 70.2 | 70.2 | 69.8 | 69.8 |
| Black/African American Non-Hispanic | 12.8 | 23.2 | 18.1 | 26.1 | 22.2 | 22.2 | 20.2 | 20.2 |
| Hispanic | 5.8 | 2.8 | 3.0 | 4.9 | 4.5 ^a | 4.5 ^a | 11.2 ^a | 11.2 ^a |
| Aged 65 years or older | 19.6 | 18.7 | 11.0 | 15.6 | 16.5 ^a | 16.5 ^a | 20.7 ^a | 20.7 ^a |
| Married | 56.9 | 56.2 | 57.2 | 49.5 | 52.8 | 52.8 | 52.0 | 52.0 |
| Income <\$10,000 | 4.9 | 6.0 | 7.4 | 7.7 | 6.8 | 6.8 | 6.2 | 6.2 |
| Income \$75,000 | 29.6 | 30.5 | 27.7 | 31.7 | 30.7 ^a | 30.7 ^a | 26.5 ^a | 26.5 ^a |

Number of responses may vary by question, as respondents may respond “do not know” or “not sure” or refuse to answer a question

^aDifferences between coastal counties/parishes and the remainder of the Gulf Coast states are statistically significant at the .05 level

Prevalence estimates for substance use: Gulf States Population Survey (GSPS), December 2010– December 2011

Table 5

| Characteristic | 25 Coastal counties/parishes weighted % | | | | Remainder of Gulf Coast states % | |
|--|---|-------------------|-----------------------|----------------------|----------------------------------|---------------------------------|
| | Florida (n=5,177) | Alabama (n=4,533) | Mississippi (n=3,209) | Louisiana (n=15,028) | Four states combined (n=27,947) | Four states combined (n=10,414) |
| Everyday smoking | 15.8 | 15.3 | 24.2 | 17.5 | 17.8 | 15.7 |
| Heavy drinking | 5.6 | 5.0 | 5.1 | 6.5 | 6.0 | 6.5 |
| Binge drinking | 13.4 | 13.5 | 14.9 | 16.2 | 15.1 | 14.7 |
| Increased prescription medication without physician advice | 2.6 | 3.7 | 1.8 | 3.0 | 2.9 | 2.8 |

Heavy drinking is defined by respondents indicating more than two servings of alcohol daily for males and more than one serving of alcohol each day for females. Binge drinking is defined as having five or more servings of alcohol on a single occasion within the past 30 days for men or four or more servings of alcohol on a single occasion within the past 30 days for women. The total number of responses may vary by question, as respondents may refuse to answer specific questions. Data are calculated from those who responded substantively to each of the questions

Prevalence estimates for mental health problems and treatment: Gulf States Population Survey (GSPS), December 2010–December 2011

Table 6

| Characteristic | 25 Coastal counties/parishes weighted % | | | | Remainder of Gulf Coast states % | |
|---|---|-------------------|-----------------------|----------------------|----------------------------------|---------------------------------|
| | Florida (n=5,177) | Alabama (n=4,533) | Mississippi (n=3,209) | Louisiana (n=15,028) | Four states combined (n=27,947) | Four states combined (n=10,414) |
| Current moderate/severe depression | 13.0 | 15.3 | 17.2 | 16.4 | 15.6 | 15.7 |
| Current moderate/severe anxiety | 12.8 | 13.3 | 18.6 | 16.6 | 15.5 | 14.7 |
| Ever received counseling for emotions, nerves, or mental health | 27.2 | 23.8 | 34.1 | 25.4 | 26.4 | 26.5 |
| Received counseling for emotions, nerves, or mental health within past year | 11.2 | 10.3 | 17.8 | 11.2 | 11.7 | 10.5 |
| In the past 12 months, serious thoughts of suicide | 3.5 | 4.8 | 7.2 | 5.0 | 4.9 | 5.0 |
| In the past 12 months, intimate partner slapped, pushed, kicked, or hurt | 2.4 | 4.1 | 4.1 | 2.6 | 3.0 | 2.7 |
| In the past 12 months, intimate partner put down, humiliated, or tried to control | 8.3 | 10.6 | 13.0 | 9.1 | 9.5 | 8.8 |

Scores for current depression and anxiety are based on the Patient Health Questionnaire (PHQ-8) and Generalized Anxiety Disorder (GAD-7), respectively. They were calculated based on the number of days respondents reported on each depression or anxiety symptoms in the past 14 days: 0 to 1 days="not at all," 2 to 6 days="several days," 7 to 11 days="more than half the days," and 12 to 14 days="nearly every day"; points 0 to 3 were assigned to each category, respectively. PHQ-8 and GAD-7 scores ranged from 0 to 24 and from 0 to 21, respectively. Current depression and current anxiety are defined as scores of 10 or higher on these scales. The total number of responses may vary by question, as respondents may refuse to answer specific questions

Prevalence estimates for oil exposure and economic impact: Gulf States Population Survey (GSPS), December 2010–December 2011

Table 7

| Characteristic | 25 Coastal counties/parishes weighted % | | | | | Remainder of Gulf Coast states % | |
|---|---|-------------------|-----------------------|----------------------|---------------------------------|----------------------------------|--|
| | Florida (n=5,177) | Alabama (n=4,533) | Mississippi (n=3,209) | Louisiana (n=15,028) | Four states combined (n=27,947) | Four states combined (n=10,414) | |
| Direct contact with oil spill | 19.3 | 19.7 | 20.2 | 9.8 | 14.3 ^a | 5.1 ^a | |
| Participated in cleanup activities | 7.3 | 9.8 | 10.0 | 6.5 | 7.5 ^a | 4.4 ^a | |
| Employment status changes since oil spill | 18.0 | 20.0 | 25.1 | 18.2 | 19.1 | 17.4 | |
| Currently employed for wages | 45.2 | 43.5 | 45.0 | 46.1 | 45.5 | 42.7 | |
| Employed for wages prior to oil spill | 46.5 | 44.9 | 48.2 | 47.5 | 47.0 | 44.5 | |
| Households indicating decreased household income due to oil spill | 25.9 | 22.8 | 28.4 | 21.9 | 23.5 ^a | 11.7 ^a | |
| Households indicating lost jobs due to oil spill | 9.5 | 12.8 | 13.7 | 10.3 | 10.9 ^a | 4.5 ^a | |
| “Usually” or “always” worried about rent or mortgage | 17.6 | 20.4 | 25.0 | 20.7 | 20.4 | 22.2 | |
| “Usually” or “always” worried/stressed about nutritious meals | 9.6 | 11.0 | 14.6 | 13.9 | 12.6 | 11.6 | |

Number of responses may vary by question, as respondents may respond “do not know” or “not sure” or refuse to answer a question

^aDifferences between coastal counties/parishes and the remainder of the Gulf Coast states are significant at the .05 level