



Gender and resilience in Gulf Coast communities: Risk and protective factors following a technological disaster

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ABSTRACT

In April of 2010 the Deepwater Horizon (DWH) oil spill poured an estimated five million barrels of oil into the Gulf of Mexico over a five-month period. This paper examines resilience by gender through a Conservation of Resources (COR) framework in three Gulf Coast communities impacted by the DWH oil spill. A total of 326 residents of three Gulf Coast communities participated in a 60-minute in-person survey to investigate the role of social networks, risk perceptions, preparedness measures, individual resilience, and demographics as predictors of preparedness and resilience for future hydrocarbon events. A hierarchical multiple regression analysis indicated that gender explained 5% of the variance in individual resilience. Furthermore, race explained an incremental 11% of the variance in individual resilience, above and beyond the variance in accounted for by gender. The number of exposures to disasters did not mediate the relationship between race, gender, and CD-RISC score. For men, speaking a language other than English at home was a resource loss factor, while worry about the physical health impact of the oil spill was a resource loss variable for women. Education was a resource gain factor for both men and women. For men in this study, disaster preparedness and openness to learning new skills to find a new job were both resource gain factors. This research highlights the need for practitioners to increase protective factors to improve resilience in females, as women in this study had the largest number of resource loss factors associated with individual resilience.

1. Introduction

In April of 2010, a short five years after Hurricane Katrina devastated communities on the U.S. Gulf Coast, the Deepwater Horizon (DWH) oil spill poured an estimated five million barrels of oil into the Gulf of Mexico over a five-month period [1]. A number of years later, people, communities, and the wildlife upon which many Gulf Coast residents rely for income are still struggling to recover from the effects of the oil spill and the chemical dispersants used to break up the oil slick. Disaster preparation, response, and recovery experiences vary widely among Gulf Coast residents, as do levels of post-disaster resilience.

Resilience among members of marginalized populations has gained scholarly attention in recent years, with evidence pointing to more negative consequences and more difficulty with recovery than for members of non-marginalized populations [2–4]. Most communities in the Gulf South closely resemble the rest of the nation in terms of gender,

in that approximately 50% of its residents identify as female [5]. This paper examines resilience by gender through a Conservation of Resources (COR) framework in three Gulf Coast communities impacted by the DWH oil spill.

1.1. Gender differences and disaster

Numerous studies have concluded that women experience more adverse effects and lower resilience than men after disasters (e.g. Ref. [2, 6]). Enarson [7] draws on disaster literature and feminist literature to argue that disasters are profoundly gendered, and that women experience unique disaster effects. She further argues that the intersections of gender with racial, economic, and other inequalities create varying degrees of risk. Enarson [8] calls for more research into how the expansion of women's caregiving roles during disaster might deplete their resources or foster resilience. Cutter [9] views women as forgotten

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casualties of disasters, and urges researchers to focus on how disasters affect women in the face of social transformations in areas of wealth, population movements, and gendered violence.

1.2. Purpose of the study

Disaster is known to be disruptive and have varying degrees of impact. This study intends to identify the gender differences of resilience among a sample of Gulf Coast residents impacted by the aftermath of disaster. This outcome was achieved by employing a series of multiple regression models, comparing resilience outcomes of females and males who experienced the impact of the DWH oil spill event. Awareness of differences between gender populations post-disaster can inform researchers, practitioners and policy makers on the needed measures to assist with disaster recovery measures. Therefore, our study aims to: (1) contribute to the existing but scarce literature on gender differences of resilience with a resource lens amongst post-disaster exposed populations; (2) test a conceptual model of resource conservation amongst Gulf Coast residents; and, (3) provide recommendations based on our findings for social service agencies to cultivate basic resources when working with individuals, families and communities impacted by an increasing amount of disaster. The main research question guiding the study was: *How much of the variance in individual resilience in gender can be explained by a post-disaster resilience model (resource loss and resource protection) between Gulf Coast residents?*

2. Theory

This study is grounded in Hobfoll's [10] *Conservation of Resources* (COR) theory. The COR, rather than applying a deficit lens, proposes that individuals build the potential for resilience when they are able to build resources. Conversely, those with fewer resources may experience a more difficult time recovering after adverse events. The COR approach is helpful in understanding and working within post-disaster settings, as it highlights the significance of resource loss while emphasizing the importance of the ability to invest, obtain, and maintain resources in loss mitigation. When applied to disaster situations, the theoretical principles of COR help to identify the predictors that impact survivor self-mastery, which translate to resilience and demonstrate that those with strong personal or social resources are better protected from the consequences of disasters [11,12].

Hobfoll [13] identifies major categories of resources as object resources (e.g., transportation, housing), condition resources (e.g. marriage, tenure), personal resources (e.g. skills, capabilities), and energy resources (e.g. knowledge, time). Individuals may rely on these resources to regulate the self and social relations, and ultimately to sustain physical and mental health and wellbeing [10]. The principles of COR theory are well established in the literature, and are supported across various studies on intimate partner violence, stress, and trauma (e.g. Ref. [10,14–20]). This framework is particularly salient when discussing such characteristics as gender in a post-disaster setting [8,21]. As populations that are subjected to marginalization and inequity on a global level, women, especially those who are people of the global majority, experience higher levels of social vulnerability and reduced access to resources [9,21]. "People of the global majority" (PGM) is a term that can be used in place of "minorities" or "people of color".

In a post-disaster setting, access to resources is central to resilience. Hobfoll et al. [22] propose that while resilience is determined by a variety of factors, a resource-rich environment enables resilience and a resource-poor environment undermines resilience. The COR framework helps to further our understanding of post-disaster loss among members of more socially vulnerable groups by highlighting the challenges related to procuring and sustaining resources. Cycles of resource loss and protection coexist in chronically stressful environments and situations, in which individuals with higher levels of social vulnerability tend to lose the resources required to overcome these situations and build

resilience [13]. This resource loss is compounded in post-disaster situations, in which an already present general lack of resources exacerbates individual resource loss [23]. In relation to energy resources in particular, it has been found that technological disasters such as oil spills can be corrosive to communities and cause a great deal of psychological distress [24]. The ongoing nature of litigation, worry about lasting health effects, and perceptions of governmental failure can delay timely recovery and affect resilience, leaving chronic social and psychological impacts in the forms of stress and interpersonal conflict [25–27].

2.1. Post-disaster resilience model

The current study is guided theoretically by COR. The conceptual model for post-disaster resilience created for this study consists of resource loss and resource protection. We use these two competing models to predict post-disaster resilience for female and male residents residing in the Gulf of Mexico during the DWH oil spill disaster. The first phase of the conceptual model focuses on resource loss, and is supported by a social vulnerability approach [21,23] and resource loss [13,14]. The social vulnerability model approach builds on past work conducted by Ferreira et al. [17]. Several of the indicators identified from the social vulnerability approach by Ferreira et al. [17] correlate with our current approach and are predictors of possible resource loss [22].

The second phase of the post-disaster resilience model is focused on resource protection. Resource loss, in the context of the model, is focused on predictors that result in current or future resource loss for individuals (e.g. livelihood) and which could possibly result in cascading events (e.g. employment loss). Access to resources provides the ability to overcome challenging moments. Resource protection provides a buffer from and lessens the impact of disaster stress and can create a sense of resilience [14,22].

3. Methods

The current study uses a cross-sectional design. Data used with this study was collected for a larger project that aimed to determine predictors of preparedness and resilience to future hydrocarbon (oil spill) events among households in the Gulf of Mexico. This was achieved through administering a 60-min in-person survey among individuals in the Galliano region (Lafourche Parish) and Port Sulphur region (Plaquemines Parish) in southeastern Louisiana, and the Bayou La Batre and south Mobile County region in Alabama. Surveys were administered by trained data collectors in these three communities between June 2017–October 2017.

3.1. Participants

The study sample consisted of individuals living in areas surrounding Port Sulphur and Galliano, Louisiana and Bayou La Batre, Alabama on the Gulf of Mexico in the Southern United States. Within each community the goal was to collect a minimum of 100 in-person surveys. Participants were recruited for participation in the study through a mixture of snowball sampling and the use of an existing database maintained by an outside research recruitment vendor. Recruitment packages for prospective participants included a recruitment letter, maintained by an outside recruitment vendor for probabilistic sampling, containing information on the study and contained both mail-in instructions and a weblink for scheduling an appointment to participate in the study.

In Alabama, the research team additionally partnered with Boat People SOS (BPSOS), a community group in Bayou La Batre and the Gulf of Mexico region working with the Vietnamese community. In addition to the original probabilistic recruitment plan, snowball recruitment was utilized by this community partner to inform participants about the study. Based on the participants' availabilities the community partner informed the prospective participant about a date and time for participating in the study.

The staff of BPSOS completed Collaborative Institutional Training Initiative (CITI) training and received the same training as the data collectors from the research team. BPSOS assisted the research team with scheduling and completion of surveys for respondents choosing to complete the survey in Vietnamese. Participants in Bayou La Batre, Alabama who took the survey in English were recruited following the same probabilistic sampling procedure as those participants in Port Sulphur and Galliano Louisiana. All adults 18 years or older, residing in Galliano and Port Sulphur, Louisiana and Bayou La Batre, Alabama were eligible to participate in the study.

All members of the data collection team completed Institutional Review Board (IRB) requirements for conducting research (e.g. CITI training). The data collectors also completed trainings in cultural sensitivity and data collection before data collection commenced.

Using a structured questionnaire, surveys were administered by the research team and trained data collectors. The survey was timed to last approximately 60 min, including provision of the consent script, administration of the survey, and completion of the survey. Surveys were conducted at community centers in each of the target community areas, in areas where confidentiality could be maintained. Data was collected through use of either a handheld tablet computer or a paper-based version depending on the preference of the participant. Following the completion of the survey, participants were asked if they had any questions for the research team and were provided with their gift card. IRB approval was obtained prior to initiating data collection. The final sample included 326 adult residents from three Gulf Coast towns. SPSS 25 was utilized to conduct the final data analysis.

3.2. Measures

3.2.1. Outcome variables

The outcome variable for this study was resilience. To this end, the 10-item Connor Davidson Resilience Scale (CD-RISC 10) was administered to study participants. The CD-RISC 10 is an abbreviated version of the original 25-item CD-RISC scale, which uses a 5-point Likert scale ranging from 1 for “not at all” to 5 for “nearly all the time” [28]. The CD-RISC 10 has demonstrated high internal consistency, construct validity, and test-retest reliability [28–30]. The 10-item scale has been shown have strong psychometric properties in general [31], as well as across various demographic indicators, including gender, age, and race [32–34]. The CD-RISC 10 asks respondents to rate their own resilience by responding to the following statements: (1) I am able to adapt when changes occur; (2) I can deal with whatever comes my way; (3) I try to see the humorous side of things when I am faced with problems; (4) Having to cope with stress can make me stronger; (5) I tend to bounce back after illness, injury, or other hardships; (6) I believe I can achieve my goals, even if there are obstacles; (7) Under pressure, I stay focused and think clearly; (8) I am not easily discouraged by failure; (9) I think of myself as a strong person when dealing with life’s challenges and difficulties; and (10) I am able to handle unpleasant or painful feelings like sadness, fear, and anger.

3.2.2. Predictor variables

3.2.2.1. Resource loss. Theoretically, we used elements from Hobfoll et al. [22], supplemented by Cutter et al.’s [21] Social Vulnerability Index and Cannon et al.’s [35] work on social vulnerability, to help identify the variables that would constitute the predictors of resource loss. The premise of the approach is that those who are under stress or who experienced a traumatic event, such as a disaster, are more prone to resource loss [23]. Resource loss was further guided by the work of Ferreira et al. [17], who employed a similar model to determine resource loss within a disaster context. The following predictor variables, derived from the existing literature captured in the manuscript, were included to assess resource loss: 1) presence in the region during

the oil spill (1=yes, 0=no); 2) oil spill exposure (1=yes, 0=no); 3) Person of global majority (PGM) (1=yes, 0=no); 4) age – older than 65 (1=yes, 0=no); 5) more than one job (1=yes, 0=no); 6) speak other language than English at home (1=yes, 0=no); 7) job loss as a result of oil spill (1=yes, 0=no); 8) worried about the physical health impact of the oil spill on self or family (1=yes, 0=no); 9) worried about impact of oil spill on economy (1=yes, 0=no); and 10) worried about the impact of the oil spill on relationships (1=yes, 0=no).

3.2.2.2. Resource protection. To guide the selection of the resource protection variables among the exposed population, we used theoretical elements from Hobfoll [10], Hobfoll & Lilly, (1993), Hobfoll et al., [22], Beeble et al. [14], Ersing and Kost [36], and Lauve-Moon and Ferreira [23]. The following predictor variables, derived from the existing literature, were included to assess resource protection: 1) additional education to advance career (1=yes; 0=no); 2) additional education to help find a new job (1=yes; 0=no); 3) open to learning new skills to find a new job (1=yes; 0=no); 4) moved to a new location to find a job (1=yes; 0=no); 5) open to moving to a new location to find a job (1=yes; 0=no); 6) preparations for a natural disaster (1=yes; 0=no); 7) effectiveness of preparations for a natural disaster (1=very ineffective, 2=ineffective, 3=effective, 4 very-effective); 8) preparations for an oil spill (1=yes; 0=no); 9) effectiveness of preparations for an oil spill (1=very ineffective, 2=ineffective, 3=effective, 4 very-effective); 10) education (1=greater than high school; 0= less than high school); 11) relationship status (1= in a relationship; 0=single or not in a relationship); and 12) employment (1=employed; 0=unemployed).

4. Results

The sample of 326 participants consisted of 61% females (n=199) and 39% males (n=127). Most of the participants identified as White at 49.1% (n=160), followed sequentially by Vietnamese 23.0% (n=75), Black or African American 17.8% (n=58), American Indian or Alaska Native 2.1% (n=7), Other 3% (n=10), Mixed Race 4.9% (n=16). Roughly 4% (n=13) of the sample identified as Hispanic or Latino. The mean age for the sample was 55.05 (SD=15.80), with males having a mean age of 55.06 (SD=16.9) years and females 55.04 (SD=15.10) years.

In terms of relationship status, the majority of participants were married, 50.6% (n=165), followed by divorced with 12.9% (n=42), never married 17.5% (n=57), widowed 9.5% (n=31), and separated 3.7% (n=12). The majority of participants had a high school diploma with 37.7% (n=123), followed by 23% (n=75) of respondents having less than high school, 21.8% (n=71) some college, 7.1% (n=23) bachelor’s degree, 6.1% (n=20) graduate degree, and 4.3% (n=14) with an associate’s degree. The majority of participants were employed with 39.3% (n=128), retired 27% (n=88), part-time 12.6% (n=41), on disability 9.2% (n=30), not employed and not looking 6.1% (n=20), and unemployed and looking 5.8% (n=19).

For the outcome variable, the Connor Davidson Resilience Scale, respondents who females had a mean score of for the 10-item scale 30.33 (SD=7.43), compared to males who had a mean reported score of 30.22 (SD=7.81). Table 1 provides a detailed description of the demographic variables for these two groups.

4.1. Resilience model testing

In order to answer the study question, “How much of the variance in individual resilience can be explained by a post-disaster resilience model (resource loss and resource protection) amongst Gulf Coast residents exposed to the DWH oil spill”, we ran two separate sets of regression models each for females and males. A total of four multiple regression models (resource loss and resource protection) were run, to ensure that variance was correctly attributed to the set of predictor variables within each

Table 1
Demographic characteristics.

Characteristic	Participants (n=27,680)		
	Female (n=199) 61% (n)	Male (n=127) 39%(n)	Total (n=326) % (n)
Race			
American Indian or Alaska Native	3.5 (7)	0 (0)	3.5 (7)
Vietnamese	23.6 (47)	22 (28)	23 (75)
Black or African American	22.1 (44)	11.0 (14)	17.8 (58)
Mixed Race	5.5 (11)	3.9 (5)	4.9 (16)
White	43.7 (87)	57.1 (73)	49.1 (160)
Other	1.5 (3)	5.5 (7)	3 (10)
Age			
Participant age	55.04 (SD=15.10)	55.6 (SD=16.9)	55.05 (SD=15.80)
Relationship:			
Married	45.7 (91)	58.3 (74)	50.6 (165)
Divorced	13.6 (27)	11.8 (15)	12.9 (42)
Widowed	13.6 (27)	3.1 (4)	9.5 (31)
Separated	3.5 (7)	3.9 (5)	3.7 (12)
Never married	4 (8)	8.7 (11)	5.8 (19)
A member of an unmarried couple	19.6 (39)	14.2 (18)	17.5 (57)
Education:			
Less than 12 years/No HS diploma	27.1 (54)	16.5 (21)	23.0 (75)
HS diploma/GED	30.2 (60)	49.6 (63)	37.7 (123)
Some college	24.1 (48)	18.1 (23)	21.8 (71)
Associate degree	5.5 (11)	2.4 (3)	4.3 (14)
Bachelor degree	5.5 (11)	9.4 (12)	7.1 (23)
Graduate degree	7.5 (15)	3.9 (5)	6.1 (20)
Connor Davidson Resilience:			
Resilience score (range 10–40)	30.33 (SD=7.43)	30.22 (SD=7.81)	30.28(SD=7.5)

group. The analyses were performed to investigate whether a COR conceptual approach could identify differences in predictors of resilience between females and males who experienced the DWH oil spill. IBM SPSS version 25 was used with the analysis.

4.2. Model 1 (resource loss)

The following predictor variables were included to assess resource loss: (1) presence in the region during the DWH oil spill; (2) oil spill exposure; (3) PGM; (4) age – older than 65; (5) more than one job; (6) speak other language than English at home; (7) job loss as a result of oil spill; (8) worried about the physical health impact of the oil spill on self or family; (9) worried about impact of oil spill on economy; and (10) worried about the impact of the oil spill on relationships. Two separate standard multiple regression models were performed to investigate if resource loss resulted in a decreased level of resilience among Females (Model 1a) and Males (Model 1b).

4.3. Model 1a: resource loss predictors of resilience among females

A standard multiple regression analysis was performed to investigate if resource loss predictors (*presence in the region during the DWH oil spill; oil spill exposure; PGM; age – older than 65; more than one job; speak other language than English at home; job loss as a result of DWH oil spill; worried about the physical health impact of the oil spill on self or family; worried about impact of oil spill on economy and worried about the impact of the oil spill on relationships*) resulted in a decreased level of resilience among females. The R^2 statistic was statistically significant $F(10,188) = 5.302$, $p = 0.0001$, R^2 adjusted = 0.178, indicating that 17.8% of the variance in resilience among females can be explained by resource loss predictors. A

summary of the regression coefficients is presented in Table 2a and indicates that PGM status, being worried about the physical health impact of the oil spill on self or family, and being worried about the impact of the oil spill on relationships contributed significantly to the prediction of the decrease in resilience in Model 1a for Females.

4.4. Model 1b: resource loss predictors of resilience among males

A standard multiple regression analysis was performed to investigate if resource loss predictors (*presence in the region during the DWH oil spill; oil spill exposure; PGM; age – older than 65; more than one job; speak other language than English at home; job loss as a result of DWH oil spill; worried about the physical health impact of the oil spill on self or family; worried about impact of oil spill on economy; and worried about the impact of the oil spill on relationships*) resulted in a decreased level of resilience among males. The R^2 statistic was statistically significant $F(10,116) = 5.106$, $p = 0.0001$, R^2 adjusted = 0.246 indicating that 24.6% of the variance in resilience among males can be explained by resource loss predictors. A summary of the regression coefficients is presented in Table 2b and indicates that PGM status, speaking a language other than English at home, and being worried about the impact of the oil spill on relationships contributed significantly to the prediction of the decrease in resilience in Model 1b for males.

4.5. Model 2 (resource protection)

The following predictor variables were included to assess resource protection: (1) additional education to advance career; (2) additional education to help find a new job; (3) open to learning new skills to find a new job; (4) moved to a new location to find a job; (5) open to moving to a new location to find a job; (6) prepared for natural disaster; (7) effectiveness of preparations for a natural disaster; (8) prepared for an oil spill; (9) effectiveness of preparations for an oil spill; (10) level of education; (11) relationship status; and (12) employment. The second model consisted of two separate standard multiple regression models to investigate if resource protection factors resulted in an increased level of resilience among females (Model 2a) and males (Model 2b).

4.6. Model 2a: resource protection predictors of resilience among females

A standard multiple regression analysis was performed to investigate if resource protection predictors (*additional education to advance career; additional education to help find a new job; open to learning new skills to find a new job; moved to a new location to find a job; open to moving to a new location to find a job; prepared for natural disaster; effectiveness of preparations for a natural disaster; prepared for an oil spill; effectiveness of preparations for an oil spill; level of education; relationship status; and employment*) resulted in an increased level of resilience among females. The R^2 statistic was statistically significant $F(12, 186) = 3.136$, $p = 0.001$, R^2 adjusted = 0.115, indicating that 11.5% of the variance in resilience can be explained by resource protection predictors. Table 3a indicates that level of education contributed significantly to the prediction of the increase in resilience in Model 2a for females.

4.7. Model 2b: resource protection predictors of resilience among males

A standard multiple regression analysis was performed to investigate if resource protection predictors (*additional education to advance career; additional education to help find a new job; open to learning new skills to find a new job; moved to a new location to find a job; open to moving to a new location to find a job; prepared for natural disaster; effectiveness of preparations for a natural disaster; prepared for an oil spill; effectiveness of preparations for an oil spill; level of education; relationship status; and employment*) resulted in an increased level of resilience among males. The R^2 statistic was statistically significant $F(12,114) = 2.731$, $p = 0.003$, R^2 adjusted = 0.142, indicating that 14.2% of the variance in

Table 2. a
Standard Multiple Regression Analysis for Resource Loss Predictors of Resilience Among Females.

	B	β	t	p	95% CI Lower Bound	95% CI Upper Bound
Age – Above 65	1.260	.076	1.152	.251	-.898	3.418
PGM status***	-3.586	-.240	-3.490	.001	-5.613	-1.559
Oil spill exposure	3.359	10.576	1.812	.072	-.298	7.016
Oil spill exposure severity	-.625	-1.953	-1.151	.251	-1.698	.447
In region during oil spill	-267.958	-8.596	-1.719	.087	-575.486	39.570
Job loss from oil spill	-.018	-.110	-1.646	.101	-.039	.004
English second language	1.832	.117	1.688	.093	-.308	3.972
Worried abt DWH impact on phys. health*	-.085	-.217	-2.570	.011	-.150	-.020
Worried about DWH impact on economy	.048	.107	1.305	.194	-.025	.121
Worried abt DWH impact on relationships*	-.059	-.168	-2.043	.042	-.116	-.002

Notes: n=188; df=10.

* $p < .05$. *** $p < .001$.

Table 2b
Standard Multiple Regression Analysis for Resource Loss Predictors of Resilience Among Males.

	B	β	t	p	95% CI Lower Bound	95% CI Upper Bound
Age – Above 65	.080	.005	.060	.952	-2.542	-2.702
PGM status***	-4.742	-.301	-3.482	.001	-7.439	-2.045
Oil spill exposure	-3.223	-.9274	-1.265	.208	-8.270	1.824
Oil spill exposure severity	.638	1.820	.814	.417	-.914	2.190
In region during oil spill	250.901	7.356	1.177	.242	-171.240	673.043
Job loss from oil spill	-.011	-.053	-.605	.547	-.045	.024
English second language*	-2.700	-.173	-2.125	.036	-5.218	-.183
Worried about DWH impact on physical health	-.041	-.108	-.984	.327	-.123	.041
Worried about DWH impact on economy	.015	.029	.199	.843	-.137	.168
Worried abt DWH impact on relationships **	-.133	-.323	-2.632	.010	-.233	-.033

Notes: n=116; df=10.

* $p < .05$. ** $p < .01$. *** $p < .001$.

resilience can be explained by resource protection predictors. Table 3b indicates that being prepared for a natural disaster, being open to learning new skills to find a new job, effectiveness in disaster preparedness, and level of education contributed significantly to the prediction of the increase in resilience in Model 2b for males.

5. Discussion

The objective of this study was to identify the predictors of resilience (both resource protective and resource loss factors) amongst females and males residing in the Gulf Coast region impacted by the DWH oil spill using a Conservation of Resources model. This study found that the variance in resilience as measured by the 10-item Connor Davidson

Resilience Scale could be explained by both resource loss and resource protection predictors. Thus, perhaps the most important finding from the study is that COR provides for a granular explanation of the relationship between resource protection and resource loss post-disaster.

Both females and males in this study had CD-RISC scores (30.33 and 30.22, respectively) lower than the mean psychological resilience score of 31.8 for the general population [37]. The population sampled in this study may be particularly vulnerable to disaster-related mental health impacts. Blackmon et al. [66] state that “Access to evidence-based behavioral health services that enhance psychological resilience may ... play a key role in long-term recovery” (p. 73). These results suggest that long term mental health care services are important for communities in recovery from major disasters such as the DWH oil spill.

Table 3a
Standard Multiple Regression Analysis for Resource Protection Predictors of Resilience Among Females. .

	B	β	t	p	95% CI Lower Bound	95% CI Upper Bound
Additional education to advance career	-.043	-.129	-1.189	.236	-.115	.028
Additional education for new job	-.003	-.008	-.088	.930	-.062	.057
Open to learning new skills	-.023	-.096	-1.098	.274	-.065	.019
Move to a new location	.028	.095	.884	.378	-.035	.093
Move to a new location for job	-.001	-.002	-.030	.976	-.041	.040
Prepared for natural disaster	-.034	-.093	-1.016	.311	-.100	.032
Effectiveness in natural disaster preparedness	-.041	-.177	-1.868	.063	-.085	.002
Prepared for an oil spill	-.003	-.010	-.111	.912	-.058	.052
Effectiveness in oil spill preparedness	-.012	-.031	-.457	.648	-.065	.040
Education level***	-3.202	-.213	-3.073	.002	-5.257	-1.146
Relationship status	-.608	-.041	-.588	.557	-2.648	1.433
Employment status	-.111	-.007	-.107	.915	-2.154	1.932

Notes: n=198; df=12.

*** $p < .01$.

Table 3b
Standard Multiple Regression Analysis for Resource Protection Predictors of Resilience Among Males

	B	β	t	p	95% CI Lower Bound	95% CI Upper Bound
Additional education to advance career	-.002	-.005	-.046	.963	-.095	-.090
Additional education for new job	-.013	-.041	-.359	.720	-.088	-.061
Open to learning new skills*	.069	.276	2.370	.019	.011	.127
Move to a new location	-.024	-.070	-.632	.529	-.101	.052
Move to a new location for job	-.048	-.197	-1.605	.111	-.107	.011
Prepared for natural disaster	-.022	-.063	-.523	.602	-.104	.061
Effectiveness in natural disaster preparedness*	-.062	-.247	-2.113	.037	-.121	-.004
Prepared for an oil spill	-.010	-.028	-.288	.774	-.076	.057
Effectiveness in oil spill preparedness	-.011	-.044	-.509	.612	-.055	.032
Education level**	-4.127	-.251	-2.928	.004	-6.920	-1.335
Relationship status	1.245	.075	.870	.386	-1.590	4.080
Employment status	-.702	-.045	-.504	.615	-3.456	2.053

Notes: n=126; df=12.

* $p < .05$. ** $p < .01$.

5.1. Resource loss predictors

5.1.1. Race, ethnicity, and language

For both males and females, PGM status was associated with a decrease in resilience (Tables 2a and 2b). Socioeconomic inequity disproportionately exposes PGM to the adverse effects of disasters caused by both natural and technological hazards [38]. People of global majorities are often less able to access government assistance and fear unequal treatment during response and recovery efforts [21]. Twenty two percent of the population sampled for this study were African American. Lesen et al. [38], in a study of COR and resilience in African Americans impacted by the DWH oil spill, suggest that financial instability and lack of sociopolitical representation decreases access to resources for African Americans that can affect the ability to prepare for and recover from disasters. It is also noteworthy that 23% of the population sampled in this study self-identified as Vietnamese. Some previous research has found that the Vietnamese community in New Orleans recovered from Hurricane Katrina relatively more robustly than other groups due to, in part, cultural characteristics such as collective perseverance and comfort with a stratified social structure, as well as the existence of extremely effective leadership within the community [39]. However, analysis of the same Gulf Coast post-DWH oil spill dataset that was analyzed in this present study found that the individuals identifying as Vietnamese—almost all of whom were residents of the Bayou La Batre area in rural coastal Alabama—were less resilient as measured by the CD-RISC 10 scale than other ethnic groups in the study [40]. Previous studies of Southeast Asian immigrants in Bayou La Batre following Hurricane Katrina identified several sociocultural barriers to recovery such as language, literacy, and communication; cultural differences in help-seeking; difficulty navigating the disaster recovery bureaucracy; and a lack of leadership [41]. These differences in resilience measures between Vietnamese immigrant communities from two disparate Gulf Coast locations highlights the importance of place-based factors in disaster recovery disparities, even amongst the same racial or ethnic groups.

Speaking a language other than English at home contributed significantly to a decrease in resilience for males in this study (Table 2b). As mentioned earlier, a large proportion of the participants in this study identified as Vietnamese, and in the Louisiana portion of the sample there were also a number of respondents who listed French as their first language spoken at home. Populations in the United States for whom English is a second language (or who do not speak English at all) have been found to be more vulnerable to the effects of disaster, and the percentage of the population that speaks English as a second language is a characteristic often used to construct disaster resilience indices [23]. Language barriers are amongst the factors that have been found to decrease disaster resilience in immigrant communities [40]. These

results highlight the need for communication, educational, and aid materials to be provided in appropriate languages for immigrant communities and other populations whose first language is not English.

5.1.2. Risk perception, relationships, and health

Worry about the impact of the oil spill on relationships contributed significantly to the prediction of the decrease in resilience for both females and males (Tables 2a and 2b). This finding is consistent with other work on disasters caused by technological hazards, indicating social conflict and a corrosive effect on communities [24]. These dynamics can be caused by factors including ongoing litigation, disparities in access to recovery resources, and erosion of trust in civic institutions [26]. While some studies have found that disasters can strengthen social relationships and civic engagement [42,43], previous work on the Exxon Valdez oil spill found that greater exposure to the spill was associated with decline in social relationships [44], and that, even several years after the spill, a deterioration of relationships with others was a predictor of symptoms of anxiety, depression, and posttraumatic stress disorder (PTSD) [45]. The results reported here suggest that anxiety about the effects of disasters on social relationships—particularly in the case of disasters caused by technological hazards—may endure for years after the event itself. This demonstrates the need for long term education, services, and policies that support the maintenance of close social relationships in disaster prone areas and communities that experience repeated disasters.

For females, worry about the physical health impact of the oil spill on self or family was associated with a decrease in resilience (Table 2a). Women are often major caretakers in their families and communities, are more likely than men to head households alone, to have higher rates of certain illnesses like hypertension, and to have lower paying jobs: such inequalities in health, education, and income often present women with increased burdens following disasters [46]. Following a disaster, women often have increased responsibilities in meeting household needs and protecting themselves and their families, and are at increased risk of anxiety about the health and safety of their families [47]. Women experience great stress during and after disasters, in needing to attend to the health of their children and other family members, and women are often of greater risk of injury or death during and after disasters due to their role as caregivers [48]. On the other hand, some scholars have argued that these increased burdens and responsibilities on women in disaster situations can actually serve to increase women's risk management skills, knowledge in disaster response, and their disaster resilience through experience and the necessity to cope with repeated adverse events [19,49]. In this vein, Reyes and Lu [50] suggest that "tapping into [women's] resourcefulness is crucial in disaster preparedness and mitigation" (p. 164). However, the results reported here suggest that for women, ongoing, chronic anxiety about health and

family following a disaster may degrade personal resilience and the ability to cope with future events. This suggests the need for disaster preparedness help, aid during disasters, and post-disaster support services—especially health-related services—geared specifically for women and their families.

5.2. Resource gain predictors

5.2.1. Education

For both females and males, level of education contributed significantly to the prediction of increase in resilience (Tables 3a and 3b). In the sample of respondents to this study, more females than males were had attained less than a high school diploma, although more females than males had attained an associates or graduate degree. A larger number of males than females listed a high school diploma or GED as their highest degree (Table 1). Based on meta-analyses, analyses of United States counties, and individual case studies, educational attainment and educational equality have been proposed as core resilience and disaster resilience indicators [51,52]. Frankenberg et al. [53], in a longitudinal study of people impacted by the 2004 tsunami in Southeast Asia, found that education was associated with higher levels of resilience in the long term, with the more highly educated faring better in finding stable housing, maintaining economic stability, and in maintaining better psycho-social health than those with lower educational attainment. Educational attainment and access to education have also been found to be strongly linked to disaster preparedness [54]. It is important to highlight that educational inequality often increases disaster vulnerability for women and the poor. These results indicate the need for policy on the U.S Gulf Coast that increases access to education for both women and men as part of a comprehensive disaster risk reduction strategy.

5.2.2. Disaster preparedness

For men, having prepared in the past for a natural disaster and feeling that their past preparations for disasters had been effective were both associated with increased resilience (Table 3b). These results are in agreement with other work indicating that having a sense of personal responsibility is an important psychological factor in disaster preparedness and that a perception of individual responsibility is key for climate change adaptation [55]. Some research has found men to be more likely than women to prepare for disasters in certain ways, including being more likely to have emergency plans and emergency supplies, and other studies found men to be more confident than women in their individual and household preparedness [56,57]. However, there are other studies that have found women to be more prepared for disasters or to have higher disaster risk perception, which may influence preparedness [57,58]. Factors that are known to be associated with disaster preparedness (such as demographics, socioeconomic factors, and socio-cognitive factors) are multifaceted, complex, and likely interact with each other. The results reported here corroborate those of other studies indicating that gender, along with other social and cultural factors, should be taken into consideration when developing risk communication and disaster preparedness education. More research is needed to tease apart the interactions between gender and other factors influencing disaster preparedness.

5.2.3. Employment

For males in this study, being open to learning new skills to find a new job was associated with increased resilience (Table 3b). The DWH oil spill had a negative impact on employment and economics in the Gulf Coast restaurant and tourism industries, the fishing industry, and the oil and gas industry [59]. Research on the Exxon Valdez oil spill showed mental health and other psycho-social impacts on fishers years after the spill had occurred [60]. Long term studies of the DWH oil spill also indicate long term, chronic mental and behavioral health issues, associated with disruptions including livelihood [61]. Cope et al. [62] found

particularly negative mental and physical health impacts of the DWH spill on people in the fishing industry in Louisiana, and that these effects worsened over time. Employment and reemployment was a major factor in resilience after the Hurricane Katrina disaster [63]. These studies evidence the great importance of employment in disaster resilience, especially in the case of the DWH oil spill. Long-term uncertainty about employment in the wake of the spill, especially in resource-dependent industries, such as the fishing industry, suggest that those people willing (and able) to train for new types of employment might experience fewer negative psychological impacts from the disaster, as compared to those without alternate employment options. Communities, such as those on the U.S. Gulf Coast, that experience repeated disasters, may develop what is known as “disaster subcultures:” “the perpetuation of successful patterns of adaptation to the disaster context through socialization,” [64] (p.1), especially if there are sufficient socio-cultural resources [65]. The results reported here suggest that the study areas, which have been affected by multiple disasters over a ten-to fifteen-year period, may have developed this “disaster subculture,” as evidenced by a willingness to seek new employment opportunities. However, in many communities affected by the DWH oil spill, employment options are limited, with much of the employment is resource-dependent, and therefore vulnerable to environmental damage caused by natural and technological disasters. Many of those resource-dependent industries (fishing, oil and gas) are male-dominated, thus the issue of post-disaster employment in those sectors may be especially significant for men. Policies that support communities in reemployment after disasters are extremely important, and those strategies should take the gendered nature of work into account.

6. Conclusion, strengths, and limitations

This study had several limitations that it is important to note. Data collection took place seven years after the DWH oil spill, and thus focuses on long term impacts of the disaster and may not reflect conditions immediately after the disaster. Another limitation is that this was a cross-sectional study, and therefore, does not reveal changes over time. Furthermore, the age concentration of the respondents sampled in this study (mean age 55.05) may not be representative of the overall population of the areas where research took place. However, there were several strengths of this research. The research team partnered with several local community partner organizations, who helped with recruitment of participants and with dissemination of results of this research to the communities involved [38]. Because of the long-term nature of the impacts of the DWH spill and other large oil spills such as the Exxon Valdez [61], the timing of this study can also be viewed as a strength, as it will be crucial to continue to study the people and regions affected by the DWH oil spill for years to come.

This study applied the Conservation of Resources model to investigate the relationship between gender and resilience in terms of both resource loss and resource gain after the DWH oil spill. The research highlighted the importance of relationships in resilience, as worry about the effect of the spill on relationships was a resource loss factor for both men and women in the region. Based on these results, it is important for policy to be developed that supports social relationships post-disaster. For men, speaking a language other than English at home was a resource loss factor, while worry about the physical health impact of the oil spill on self or family was a resource loss variable for women. Social support and resources should thus be provided to immigrant communities and other residents for whom English is a second language. These results suggest a need for focus in practice and research on the role of families in resource loss for females, and programs that support women and family health post-disaster. Education was a resource gain factor for both men and women, demonstrating the importance of educational attainment as a protective factor for disaster resilience, and the need for policies that increase access to education in disaster-prone areas. For

men in this study, disaster preparedness and openness to learning new skills to find a new job were both resource gain factors. Thus, education and support for disaster preparedness, job skills education and job re-training will help increase disaster resilience. This research highlights the need for practitioners to increase protective factors to improve resilience in females, as women in this study had the largest number of resource loss factors associated with individual resilience. The significance of ethnicity, language, and gender in decreased resilience in this study indicated the need for focus in practice and research on the role of intersectional identities in resource loss. Further research is needed to understand the ways gender and other demographic and psycho-social factors interact with each other to influence disaster resilience, in order to develop effective policies and services to better support communities facing repeated disasters with long-term impacts, such as on the Gulf Coast.

Declaration of competing interest

The authors report no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijdr.2020.101716>.

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