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Examining Successful Aging and Resilience After Disasters

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EXAMINING SUCCESSFUL AGING AND RESILIENCE AFTER DISASTERS

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Abstract

Resilience, a psychological adaptive process and outcome, is the ability to return to normal functioning after a traumatic event, such as a natural disaster. Successful aging entails biological, psychological, and social factors. The Great Flood of 2016 in the greater Baton Rouge area caused catastrophic structural damage to thousands of homes and businesses. Some of these individuals had previously moved to the Baton Rouge area after receiving catastrophic damage during Hurricane Katrina in 2005. In this study, I investigated the role that age group (younger, middle-aged, older) and disaster exposure group (control, single exposure, double exposure) had on post-disaster well-being. Specifically, the outcomes of resilience, physical health, and mental health were chosen to examine successful aging after disaster within a biopsychosocial framework. Additionally, I compared relationships among resilience and indicators of successful aging. Participants (n = 202) who ranged in age from 18-88 years represented three groups based upon disaster exposure. Results indicated that age group was positively associated with resilience and mental health scores, while negatively associated with physical health scores. For disaster exposure group, those with no structural damage reported significantly higher physical health than those who went through the 2016 flood and Katrina (double exposure group). However, for mental health, the double disaster group did not statistically differ from the control group, who scored significantly higher than those who only received structural damage during the 2016 flood. Lastly, a significant correlation was found for both resilience and mental health and resilience and physical health. These results indicate that resilience is an

important component of successful aging after disaster. Limitations of the present research and potential directions for future research are discussed.

Introduction

The construct of "successful aging" (SA) has undergone much transformation in the past 30 years, leading to debate about how SA should be operationally defined. Originating from quantitative, biomedical outcomes, 30 years of research has shown the importance of the inclusion of qualitative, self-report measures of well-being in older age to complement objective measures. In 2017, *The Journals of Gerontology: Series B* published a special issue entitled "Successful Aging" with an entire section devoted to defining meanings and measures of the concept. Within this subdomain, authors called for more consideration of cultural and social factors in SA research, as well as emphasis on pathways and trajectories of development affecting SA likelihood. In the opening editorial, Drs. Rachel Pruchno and Deborah Carr stated the importance of future research incorporating a lifespan approach to studying SA. Altogether, this special issue strongly suggested that SA could not be adequately defined through one domain alone, and multiple disciplines' perspectives are needed to continue to advance the field.

Heeding this call for interdisciplinary research, I conducted a synthesis of SA literature in order to build support for using the biopsychosocial (BPS) (Engel; 1980) framework to study SA (Stanko, 2018). The benefits of using a BPS framework to investigate factors of SA include social/societal comparisons alongside biomedical and psychological factors and outcomes. Through BPS one can also include consideration of lifespan influences, potential fruitful directions for further research, as discussed more fully later. In the sections that follow, I first describe the societal importance and history of SA, followed by the importance of including a middle-age group in SA research.

Next, I will discuss prior literature on SA after disaster. This section will conclude with an overview of resilience, an important variable to consider in a disaster context (Bonnano, Brewin, Kaniasty, & La Greca, 2010), and a possible proxy for SA.

Successful Aging

Current demographic trends. Determining the antecedent conditions that promote healthy and successful aging is a critical challenge for researchers. Importantly, there is also a societal urgency for doing so. By the year 2030, 20% of the United States population is expected to be age 65+, with 20% of that population being above age 85 as the Baby Boomers (those born between 1946-1964), the largest cohort the United States has seen, continue to reach retirement ages (Administration of Aging, 2015). By the year 2050, an estimated 83.7 million adults in the United States will be 65 years or older, nearly doubling its approximated 2012 population estimate. Specifically, the "oldest-old" (persons 85 years of age and older) are the fastest growing segment of the population while also being the most vulnerable to terminal age-related diseases (Administration of Aging, 2015).

Why successful aging is important. Given this demographic reality and impending costs of indirect and direct healthcare, basic research on the determinants of SA is a timely imperative (see: Pruchno & Carr, 2017; Rowe & Kahn, 2015). For those people who are in this aging cohort, SA is of personal relevance. By 2020, it is estimated that there will only be 3.5 working (age: 18-65) adults per one retired person. By 2060, this number is expected to drop to only 2.5 working age individuals per retired person (Administration of Aging, 2015). If a majority of these individuals do not engage in SA, a large burden will be placed upon public health; as a country, we will not

possess the manpower necessary to provide adequate care for the expected amount of older (65+ years) and oldest-old (85+ years). While the desired "Fountain of Youth" remains a myth, aging successfully can be a reality if healthcare practitioners and the general public are made aware of the components needed. Steps to promote SA include positive health behaviors across the lifespan, not just at the end of it (e.g., Pruchno & Wilson-Genderson, 2015). Next, I discuss the importance of using lifespan approaches to study SA.

Lifespan approaches to successful aging. While "successful aging" research is often conducted with those older than 65 years, studying both younger and middle-aged people alongside older adults can provide valuable information about the process of SA rather than outcomes (e.g., Pruchno et al., 2010; Pruchno & Wilson-Genderson, 2015). After all, in order to become a successfully aging older adult, an individual must be able to survive mid-life, typically defined as age 25 to 64 (ex., Woolf et al., 2018). Similar to the MacArthur Foundation's Research Network for Successful Aging, they also funded a Research Network on Successful Midlife Development, which created the Midlife Development in the United States (MIDUS) study. The main objective of the Research Network on Successful Midlife Development was to identify the major biomedical, psychological, and social factors that allow individuals to achieve good health, psychological well-being, and social responsibility during their adult years. Starting in 1995, the MIDUS study was one of the first longitudinal studies to focus on middle-age, and researchers continue to do follow-up in nine to ten year intervals (e.g., Radler & Ryff, 2010). At Time 1, MIDUS enrolled over 3,000 participants age 25 to 74 and tested them using a biological/biomedical, psychological, and cognitive battery.

The MIDUS dataset and its resulting studies have demonstrated that mid-life can be a stressful time, with many individuals providing the role of care-taker for both their children and their aging parents. These individuals are referred to as the "sandwich generation," referencing their support they provide to both the beginning (dependent children) and the end (dependent elderly relatives) of the lifespan (Chassin, Macy, Seo, Presson, & Sherman, 2010). Across the MIDUS studies, older adults (those 65 years or older) reported less daily stressors than younger and middle-aged adults, and older adults rated their life satisfaction with family, finances, and social situations significantly higher than the younger two groups (for discussion, see Brim, Ryff, & Kessler, 2004). From an epidemiological standpoint, it is important to recognize the stressors of midlife and how they can affect health and well-being. In a study using individuals belonging to the "sandwich generation," compared to non-caregivers and caregivers who only cared for one generation, multigeneration caregivers were more likely to engage in negative health behaviors; these included smoking, not wearing a seatbelt, not exercising, and not reading food labels (Chassin et al., 2010). In 2015, the highest rates of suicide were amongst those age 45-54; this age group also had the highest rate of drug-induced deaths (Murphy, Xu, Kochanek, Curtin, & Arias, 2017). The next age group, 55-64, had the greatest rate of alcohol-induced deaths and third-highest rate of suicide, behind those who are 85+. While cumulative stress can have negative long-term health consequences, in the case of suicide, the stressors may immediately culminate in death. By identifying protective and risk factors to well-being in middle-adulthood, social scientists endeavor to prevent disease and natural death exacerbated by negative health behaviors. Research on healthy aging may also be translated to interventions

which encourage individuals to take value in their life and develop resilience against these stressors that may threaten health and well-being. Understanding the role of resilience in successful aging requires a framework in which to encapsulate varying contributions. In this next section, I discuss the historical precedence of the biopsychosocial model and how it is appropriate for conducting SA research. Starting with its origins in the medical field nearly forty years ago, the biopsychosocial framework can readily be adapted for SA research, as discussed next.

Origin and History of the Biopsychosocial Framework

Before SA research began, the late George Engel (1980) proposed a new biopsychosocial framework for practicing psychiatrists and clinicians to treat mental disorders and illnesses. Engel, a medical doctor and professor of psychiatry at the University of Rochester, believed the current biomedical paradigm that dominated treatment of illness and disease was too reductionist and/or exclusivist. Too much focus, in his mind, was placed upon separation of body and mind, while his own research in psychosomatics demonstrated that emotions such as fear, rage, and attachment influenced physiological development (Borrell-Carrio, Suchman, & Epstein, 2004). According to the hierarchical biomedical model of disease, disorders can be reduced to clusters of symptoms, which is further narrowed to specific symptoms caused directly by deviations from normality at the cellular level. While Engel did not discuss aging specifically, he used the current state of diagnosis of schizophrenia as an example. In 1980, when Engel published his seminal article, “schizophrenia” as defined in the DSM-II was much more subjective and encapsulating than the operational definitions and criterion utilized today for diagnosis. At the time, schizophrenia did not

have a clear biomolecular cause. Proponents of reductionism supported the notion that if a biochemical/molecular defect was discovered, treatment of the defect alone would create a cascade of improvements across the hierarchy. In the exclusivist view, if a symptom cannot be rectified through treatment at the cellular level, then it is not a disease. However, the implications of adhering to only the reductionist or exclusivist view created a false dichotomy of treatment of disease, therefore stalling advancements in the field of biomedicine.

Engel then proposed a third group of scientists beyond the reductionists and exclusivists, the heretics, who rebelled against what they perceived to be the dogma of the biomedical paradigm. Engel self-identified as a heretic due to his desire to move psychiatry and medicine beyond the hierarchical biomedical model to a general systems theory. General systems theory (GST) also has hierarchical components, but, unlike the biomedical model, does not imply that all causes of disease and therefore treatment occur at the microcellular level. While the traditional biomedical model displays linearity across the hierarchy (i.e., cellular treatment leads to tissue functioning to organ functioning, etc.), GST goes beyond the strictly physiological systems by viewing the entire individual as a system as well as emphasizing the role of the society and larger environment. Thus, rather than proposing that treatment at the molecular level must occur in order for eradicate disease, GST postulates circular causality amongst the many systems in a person's life. That is, a person's social environment (including levels of social support and engagement) constantly synergizes with other physiological systems to maintain homeostasis. Modification of any system at any level will impact the surrounding systems and create changes in functioning.

Using GST as a basis, Engel called for a new biopsychosocial model of medical practice that could be utilized in both psychiatric and general health care. To illustrate his point, he uses diabetes and schizophrenia as examples. In both instances, adherence to medicine and positive outcomes are influenced by the relationship a person has with their doctor. This social influence effects how individuals choose to treat their disease. The biomedical model does not explain these "why's" or "how's" as much as the "what's" of disease– a conclusion also made by Rowe and Kahn (2015) with regard to their own biomedical model of SA. The biomedical model also does not help to explain why individuals may have a cellular defect but do not present as ill. It neglects all humanistic aspects of health, such as resilience, motivation, relationships, decision-making, etc. and treats the individual as mechanistic parts that can be modified and replaced (Engel, 1980). In essence, in order to study a human phenomenon, the approach must include investigation of multiple systems across varying levels to truly encapsulate the human experience. By using a BPS model to approach health and SA, the field is propelled by curious 'heretics' like Engel who do not support reductionist or exclusivist theories. Instead, using a general systems approach, the BPS framework considers all biological, psychological, and social factors, as discussed next.

Benefits of using BPS to study successful aging. As previously mentioned, SA does not solely depend upon physical functioning; rather, a combination of biological, psychological, and social factors must be considered in order to fully understand and measure the concept. Pruchno and Carr (2017) called for more interdisciplinary and cross-cultural work on SA in their opening editorial to the "Successful Aging" issue of *The Journals of Gerontology: Series B,* as noted earlier. In

that issue, articles tackled two core issues: a) what it truly means from an interdisciplinary perspective to successfully age, and b) engaging in SA in light of physical disability and/or adversity. When Rowe and Kahn (1987; 1997) first defined SA, their three tenets included avoiding disease and disability, engagement with life, and high cognitive and physical function. As the field developed, researchers began to realize how exclusive that definition truly was. For example, when Strawbridge et al. (2002) classified older adult participants in the Alameda County Study into Rowe and Kahn's model, only 18.8% met the criteria for SA. However, 50.3% rated themselves as aging successfully.

This disconnect between objectively defined versus subjectively perceived SA predominantly comes from Rowe and Kahn's (1997) first tenet: absence of disease and disability. Under Rowe and Kahn's definition, any person with a chronic illness would not be considered successfully aging. Bryant, Corbett, and Kutner (2001) interviewed 22 older adults who were enrolled in a larger quantitative study sponsored by the healthcare provider, Kaiser. To provide maximum variation in response, participants were recruited across four groups who had discordant self-rated SA scores versus what was predicted using regression modeling from the prior quantitative study. Two groups were under-raters (i.e., poor, fair, or good reported health compared to better predicted values) while the other two were over-raters (i.e., good, very good, or excellent scores reported to poorer predicted values). Across the sample, those who displayed positive attitudes, decisiveness, determination to remain active, and desire to take charge and control of their lives rated their health status more positively than those who did not. Overall, under-raters tended to view well-being as synonymous with physical health and

functioning, while over-raters embraced a more holistic perspective, including "goings and doings" as part of their definition. These results imply that perceptions of SA may vary amongst older adults: those that focus on physical health as their sole or major criterion (such as in a biomedical model of SA) self-report lower SA than those with physical limitations that choose to compensate for their losses through emotional and instrumental support resources (Bryant et al., 2001).

More recent qualitative studies have produced similar findings. Reichstadt, Sengupta, Depp, Palinkas, and Jeste (2010) interviewed 22 older adults (Range: 64-96 years, M = 80, SD = 9.1) about their definitions of SA, important factors of SA, life experiences' role in SA, and suggestions for others on how to age well. Two predominant themes emerged: self-acceptance/self-contentment and engagement with life. Self-acceptance included the subthemes of realistic self-appraisal, a (positive or complete) review of one's life, and focusing on the present. Under engagement with life, participants identified novel pursuits, giving to others, social interactions, and positive attitude as subthemes. Thus, older adults' self-perceptions of SA often focus on attributes outside physical functioning, providing further support for a biopsychosocial model of SA. A potential stressor in a person's life could be exposure to a natural disaster, which can disrupt all three BPS components (Cherry, 2009). Natural disasters include biologic events (e.g., Ebola outbreak), climate-related events (e.g., floods, wildfires, tornadoes, hurricanes), and geophysical events (e.g., volcanoes, earthquakes) (Leaning & Guha-Sapir, 2013).

Disaster Exposure and Successful Aging

Two longitudinal SA studies, the Louisiana Healthy Aging Study (LHAS) and the Ongoing Research on Aging in New Jersey: Bettering Opportunities for Wellness in Life (ORANJ BOWL), collected data after disaster using prospective designs, because pre-disaster data were available on these samples. Cherry, Galea et al. (2010) examined the immediate impact of Hurricanes Katrina and Rita on middle aged (age: 47-64 years, *n* = 20), older (age: 65-89 years, *n* = 20), and oldest-old (age: 90+ years, *n* = 26) adults' cognitive and psychosocial functioning. These adults were enrolled in the LHAS, a multidisciplinary and interinstitutional study of the determinants of healthy aging and longevity in the Louisiana population. Although these participants lived at least 85 miles from Katrina's devastation and did not directly experience the hurricanes directly, nearly everyone had family or knew someone who lost homes and property in the 2005 storm and flooding that followed. Thus, the stressors of the storm might be expected to impact this indirectly affected sample. Participants were initially tested on the same measures of cognitive and social functioning prior to Katrina (up to eight months before the first storm occurred, or pre-HKR), and post-test (Wave 1) occurred during the immediate aftermath, within five months of the storm. Compared to pre-storm assessment, middle-aged and older adults experienced decreases in size-judgement span (SJS) (Cherry, Elliott, & Reese, 2007), a task of working memory at Wave 1, but the oldest-old adults' performance remained the same as their pre-HKR performance. When a regression analysis was conducted on predictors of change in working memory for the middle-aged and older adults, housing evacuees in one's home, experiencing changes in job or workplace duties, and participating in clubs or activities explained

21% of the variance in forward digit span, a measure of short-term memory. When looking at differences in SJS performance, significant predictors included trouble communicating with others via telephone or email, age group, and education level which explained 17% of the variance. Cherry, Galea, et al. interpreted these results as providing support for the burden hypothesis (e.g., Thompson, Norris, & Haracek, 1993), indicating that middle-aged adults experience the most stress and therefore cognitive consequences of experiencing natural disaster. Approximately six months after Wave 1 assessments were completed, Cherry, Silva Brown, et al. (2011) followed up with Wave 2, which included 89% of those tested at Wave 1. By Wave 2, the declines in working memory demonstrated by middle-aged and older adults from pre-HKR to Wave 1 had returned to pre-HKR functioning. Thus, while the impact of a natural disaster may be associated with decreases in cognitive function at least initially for certain age groups, return to pre-hurricane levels of performance occurred in this sample with the passage of time.

In 2012, Hurricane Sandy struck the northern east coast, causing 147 deaths. In New Jersey, where the ORANJ BOWL is located, 65% of deaths associated with Sandy were older adults above the age of 60. In 2014, all living ORANJ BOWL participants were sent information for a fourth time point which included hurricane exposure, with 3,495 responding. Using multilevel mixed-effects models, Wilson-Genderson, Pruchno, and Heid (2017) found that subjective SA decreased linearly across the sample, but for those exposed to Sandy, they experienced a more severe drop between time point three (T3) and present (T4). More dramatic differences were seen for functional ability and pain, with Sandy survivors reporting stark decreases in functioning and large

increases in pain. However, when examining individual time lags (i.e., time between T3 and T4), these negative effects began to dissipate across time, with those who were tested further from the storm onset reporting higher scores. Interestingly, while declines in subjective SA were experienced by those exposed to Sandy, no effect was found on objective health, measured through chronic conditions. As the ORANJ BOWL began before Hurricane Sandy, Wilson-Genderson et al. had the same unique opportunity to use a prospective design as did the LHAS researchers, comparing pre- and post-storm functioning, which provided further evidence for the detrimental effects of environmental disruption on SA. Thus, even in the context of natural disaster, older adults can still engage in SA and appear to become more resilient to disaster stress with the passing of time. However, to date, no studies exist on the effects of exposure to more than one disaster in the context of SA research. A handful of studies have addressed exposure to more than one disaster in regards to psychosocial outcomes, which I discuss next.

Double disaster exposure. At least five studies have used adults exposed to both the World Trade Center terrorist attack on September 11, 2001 and Hurricane Sandy in 2012. Shira et al. (2014) retrospectively investigated the effect of age on post-disaster well-being. Shira et al. tested the maturation and inoculation hypotheses. The maturation hypothesis states that as we age, we gain emotional stability and become less affected by stressors (Knight et al., 2000). The inoculation hypothesis states that the more exposure one has to stressors, the more resilient they become to handle further stress and traumatic events (Ferrarro et al., 1999; Knight, Gatz, Heller, & Bengtson, 2000). Older adults with high 9/11 exposure reported less PTSD symptoms than younger adults with high exposure. However, older adults with low 9/11 exposure

showed *less* resiliency to PTSD symptoms than younger adults with low exposure, providing evidence for the inoculation over maturation hypothesis. Using individuals who experienced both a fire and flood in 1996 in Colorado, Benight (2004) also found support for the inoculation hypothesis. Those who experienced both disasters displayed higher collective self-efficacy than a control group who lived 20 miles away from the site of the flood.

A third hypothesis, stress-sensitization (Seery et al., 2010), proposes the opposite of the inoculation hypothesis. According to the stress-sensitization hypothesis, the more stressors a person experiences, the less likely they are to display resilience. The four remaining studies on the effects of exposure to Hurricane Sandy and the World Trade Center provide support for this idea. In a retrospective study using adults who lived near the World Trade Center at the time of the attack, Palgi et al. (2014) surveyed mental health one month after Sandy. Results indicated that exposure in Sandy related to PTSD symptoms, but only in those who had strong memories and recollections of the September 11 attacks and prior hurricanes. Using a prospective design, Caramanica et al. (2015) utilized the World Trade Center Health Registry, a longitudinal cohort study of over 70,000 people directly exposed to the 9/11 attacks in New York City. Five months after Sandy, surveys were sent to a select sub-sample, with half going to those in the hurricane inundation zone as defined by FEMA and the other half outside the zone. Results indicated that pre-Sandy 9/11 PTSD and degree of Sandy exposures highly associated with post-Sandy PTSD. Secondary disaster exposure can also trigger thoughts, memories, and even PTSD of prior exposures. Amongst first responders to the attacks, those with high 9/11 exposure and poor mental health status pre-Sandy had

a greater likelihood of post-Sandy 9/11-related PTSD (Bromet et al., 2017). Lastly, Gargano et al. (2019) used Wave 4 (2015-2016) data from the World Trade Center Health Registry to investigate the role of optimism in double disaster exposure. Those with lower optimism and higher Sandy exposure had a greater chance of developing post-Sandy 9/11-related PTSD. This strengthens support for considering prior traumatic exposures in post-disaster assessment.

The results just presented suggest that while disaster may negatively impact people's perceptions of health and well-being, post-disaster recovery is possible and common (Bonnano, Brewin, Kaniasty, & La Greca, 2010). While some research has been conducted on effects of double disaster exposure, the articles synthesized above have one common limitation. They did not separate or compare those who had only experienced one disaster to those who have double. Examining differences in these two groups may provide further insight into the inoculation versus stress-sensitization hypotheses. Additionally, no prior research exists on the number of disaster exposures and SA. A potential problem arises with researchers using different outcome measures of SA. In the next section, I will discuss traditional self-report measures of SA, including physical and mental health. I will also introduce resilience as a potential outcome measure of SA.

Proxies for Successful Aging – SF-36

When examining SA, researchers have used a variety of different outcomes. A popular measure of health-related quality of life is the Medical Outcomes Survey 36-Item Short Form Health Survey (SF-36). The SF-36 includes 36 questions that assess both physical and mental health-related quality of life. Eight subdomains comprise the

SF-36: physical functioning, role limitations due to physical problems, role limitations due to emotional problems, energy/vitality, mental health, social functioning, general health, and bodily pain. Utilizing these domains, the SF-36 provides a composite score for both physical (PCS) and mental health (MCS). The SF-36 is a well-validated rating scale (e.g., Lyons, Perry, & Littlepage, 1994) for physical and mental health and serves as an index of health-related quality of life as well. Health-related quality of life plays a crucial role in inferences concerning SA. In previous studies (e.g., Stanko, 2017) using the SF-36 (PCS scores only), age group differences were found for physical health, with younger adults (age 21-44) scoring higher than middle-aged (age 45-64), who scored higher than older adults (age 65-84), who scored higher than oldest-old adults (age 85+). The SF-36 has also been utilized in disaster research (Cherry, Sampson, et al., 2017; Silva Brown et al., 2010). For instance, Silva Brown et al. (2010) compared SF-36 PCS and MCS scores pre and post Hurricane Katrina using the LHAS sample described earlier. Compared to before Katrina, post scores showed significant increases in bodily pain and decreases in physical functioning. Women were more likely to report decreases in MCS scores. When using the MCS to examine mental health, a different trajectory emerges compared to physical health. In a study using three cohorts of Australian women, Mishra, Hockey, and Dobson (2014) found a steady decline in PCS across the lifespan (see also: Cherry, Silva Brown, Kim, & Jazwinski, 2016); however, MCS scores actually *increased* across the lifespan, up to age 70. After, there was a small decrease in MCS for those over the age of 70. Thomas et al. (2016) also demonstrated the mental health paradox in over 1,500 adults aged 21-100 years. Once again, SF-36 PCS scores decreased significantly across the lifespan.

However, similarly to Mishra et al.'s (2014) findings, MCS scores increased to about age 70, followed by a small decline from 70 to 100 years. Thomas et al. also found that happiness and satisfaction of life increased through age 100, while perceived stress, anxiety, and depression decreased. Thomas et al. termed this the "mental health paradox" due to the unexpected finding that although PCS substantially decreases, researchers actually document improvements in mental health as indexed by MCS scores across the lifespan. This paradox may occur due to older adults displaying more psychological resilience, which I discuss next.

Resilience

The concept of resilience has varying operation definitions, as does SA. Broadly, it can be defined as a measure of stress-coping ability, and it describes personal traits that give individuals the opportunity to grow and thrive in the face of adversity or trauma (Conner, 2006). Resilience is an individual difference trait that can be also be an outcome. For instance, those who display resilience in the aftermath of extreme stress and trauma have lower rates of developing stress-related disorders, such as post-traumatic stress disorder (Lamond et al., 2008). Resilient people often believe that stress can strengthen them, and that the world and/or God would not give them something they could not handle (Connor, 2006). It is important to note that resilience is not simply the lack of experience to stressful or traumatic events; one cannot be defined as resilient if they have never been exposed to adversity (Cherry & Galea, 2015). Resilience can occur and be modified at both the individual and community level.

Community Resilience

Disaster researchers have spent the past decades focusing on the individual's modifiable risk factors to promote resilience and recovery (e.g. Norris et al., 2002). Because the effects of disaster can and often impacts the entire community, a new emphasis has been placed on community interventions (Bonanno, Brewin, Kaniasty, & La Greca, 2010). These community interventions are designed to strengthen psychosocial bonds that may be loss or strained due to consequences of disaster. To do so, the needs of the community must be assessed using a phenomenological approach. In essence, community-based disaster interventions provide an excellent opportunity to incorporate community-based participatory research (CBPR). As the ecological validity of community interventions is limited to the culture and needs of specific communities, a "one size fits all" model of community-based interventions is not plausible. Thus, having individuals contribute their personal wants and needs to the interventions is imperative to promote resilience and recovery (Bonnano et al., 2010).

The concept of "psychological first aid" (PFA) (Vernberg et al., 2008) refers to guidelines and interventions appropriate for use for first responders in the immediate aftermath of a disaster. These include the categories of promoting sense of safety, promoting calming, promoting sense of self- and community efficacy, promoting connectedness, and instilling hope. Overall, these increase resiliency at the individual and community level. REACH NOLA (Rapid Evaluation and Action for Community Health in New Orleans) (Springgate et al., 2011) was a non-profit foundation formed one year after Hurricane Katrina. Post-disaster assessments one year after Katrina indicated a severe lack of mental health resources and infrastructure in disaster-

ravaged New Orleans and was especially exacerbated in those with low SES. REACH NOLA infiltrated the community in multiple avenues; the Mental Health Infrastructure and Training (MHIT) project trained hundreds of clinicians, many of them community members themselves, on how to best address the needs of the community.

In New Orleans, the hardest hit areas (the lower 9th ward) were predominantly African-American with low socioeconomic status. By providing specialized training to clinicians, thousands of Katrina survivors received mental health assistance, many of whom had never seen a mental health professional before or had preexisting stigmas about mental health. In addition to the MHIT, other projects such as the Talk-it-Out trailer and VideoVoice program gave survivors a direct opportunity to contribute to research and their own resiliency. The Talk-it-Out trailer provided a place for survivors to talk about their issues within the community and not a formal office. The VideoVoice program gave cameras to community members to document what they personally think needed most improvement in their community (Catalani et al., 2012). By creating and participating in their own research and recovery, REACH NOLA facilitated resiliency at both the individual and community-level. This, in turn, increased individual and community autonomy, which is also important for both resilience and SA.

Resilience and Its Relationship to Successful Aging

Like SA, resilience can be examined within a biopsychosocial framework. At the biological level, neuroscientists and geneticists have identified neural pathways and genetic markers that have shown associations with resilience (Charney, 2004); in a clinical setting using individuals with PTSD, after twelve weeks of treatment with fluoxetine, scores on the Connor Davidson Resilience Scale (CD-RISC, Connor &

Davidson, 2003) improved significantly from baseline. As mentioned more fully next (see Montross et al., 2006), the CD-RISC is a 25-item psychometrically-validated measure of resilience. Using the CD-RISC, Pietrzak et al. (2009) studied the relationships between protective factors, such as resilience and social support, and development of PTSD in veterans of the Iraq and Afghanistan wars. Results showed that lower unit support while deployed was related to increased PTSD and depressive symptoms; however, resilience was found to fully mediate this relationship via path analyses. Thus, in individuals with high resilience, low unit support did not affect their likelihood of developing PTSD or depression. As resilience has shown relationships with physical and mental health, determining correlating factors is of much interest to SA researchers. Jeste et al. (2013) investigated predictors of self-rated SA. The best-fitting model included resilience (CD-RISC), depression, physical functioning, and age as significant predictors of self-rated SA, with resilience contributing nearly as much as age in the final model.

The Jeste et al. (2013) findings can be interpreted to indicate that resilience may be acting as a proxy for SA. In order to determine whether resilience can serve as a proxy for SA, the present investigation will include a measure of resilience as an outcome variable. Thus, the presence findings will speak to the question of whether social scientists could replace these models with resilience as outcome instead of self-rated SA, physical health, or mental health and get the same results. Such a pattern of outcomes would signify the importance of resilience in SA research.

In another study, Montross and colleagues (2006) recruited 205 community-dwelling older adults (age: 60-99 years) across four sites: two assisted living/retirement

communities, a veterans' center, and an older-adult continuing education consortium sponsored by the University of California: San Diego. They included the Connor-Davidson Resilience Scale (CD-RISC) and the Medical Outcomes Study 36-item Short Form scale (SF-36) as measures of resilience and health-related quality of life, respectively. The CD-RISC contains 25 items related to overcoming adversity and fostering resilience, such as "I am able to adapt to change" and "I am not easily discouraged by failure" with each item self-rated from zero (not true at all) to four (true nearly all the time).

Table 1 displays significant correlations between outcome measures and self-rated SA, defined as reporting a seven or higher (out of ten) in regards to currently aging successfully. As seen in Table 1, all of the domains of the SF-36 had low to moderate correlations with self-rated SA. The domains that demonstrated the largest correlations related more to mental health than physical health, including scores on the Connor-Davidson Resilience Scale (CD-RISC). As the SF-36 measures health-related quality of life, these results imply self-ratings of SA correlated strongly with measures of well-being and quality of life. Out of the 92% (n = 188) of participants who rated themselves as SA, merely 16% met the criterion of absence of disease, and only 30% reported freedom from disability. When sorted by the three classic tenets of absence of disease, freedom from disability, and active engagement with life (Rowe & Kahn, 1987; 1997) only five percent of their sample classified as successfully aging. However, of the 188 self-rated SAers, at least 80% met the criterion of independent living, mastery/growth, positive adaptation, and life-satisfaction and well-being.

Table 1. Significant Correlations (Pearson's) of Self-Rated Successful Aging (Montross et al., 2006)

Variables Significantly Associated with Self-Rated Successful Aging (SRSA)		Non-Significant Associations with SRSA
SF-36 Domains General Health (r = 0.38) Energy/Vitality (r = 0.33) Emotional Health (r = 0.30) Mental Health Composite (r = 0.28) Physical Functioning (r = 0.27) Physical Health Composite (r =0.23) Role Limitations Due to Emotional Problems (r = 0.22) Role Limitations Due to Physical Problems (r = 0.18) Social Functioning (r = 0.18)	**Activities** Reading (r = 0.16) Listening to Radio (r = 0.24) Visiting Family (r = 0.17) **Other Measures** CD-RISC Score (r = 0.28) Number of Close Friends (r = 0.18)	• Age • Mother's Age at Death • Father's Age of Death • Gender • Ethnicity • Current Marital Status • Living Situation • Level of Education • Income

Thus, when constructing a definition of SA, over-emphasis on absence of disease and disability may eliminate many older adults who view themselves as successfully aging despite suffering from disease and disability.

In a meta-analysis of 28 quantitative SA articles with 29 varying definitions, Depp and Jeste (2006) found that 26 of these definitions included physical functioning and disability; however, life-satisfaction and well-being received only nine mentions, and self-rated subjective aging only two (i.e., Strawbridge et al., 2002 and Montross et al., 2006). Due to the wildly varying components of these SA definitions (as evidenced by reported proportion of SAers ranging from 0.4% to 95%) and large emphasis on

physical function and disease, age emerged as the strongest predictor of SA, with younger older-adults (i.e., those closer to 60) reporting better SA in 13 out of 15 studies. However, when studies have included mental health measures and were separated by age within older-adulthood, old-old adults (age: 75-99) often have significantly higher scores than young-old counterparts (age: 50-74) (Martin, Palmer, Rock, Gelston, & Jeste, 2015). In Martin et al.'s (2015) study, old-old adults (n = 641, M = 85.3, SD = 5.7) had lower SF-36 physical composite scores (PCS) compared to the young-old adult group (n = 365, M = 63.3, SD = 6.6), but provided higher SF-36 mental composite (MCS), satisfaction with life, and self-rated SA scores. Using multiple regression, Martin et al. (2015) explored associations of self-perceived SA in both groups. Contrary to their hypothesis, positive and negative psychological traits (i.e., resilience, optimism, depression, and perceived stress) did not associate with old-old adults' self-perceived SA, but SF-36 PCS scores did, albeit significantly less so than in young-old adults. They concluded that aging presents a paradox in which subjective ratings of SA increase in light of physical comorbidities increasing. Thus, empirical evidence exists for including multiple components of SA beyond solely physical health, in line with the biopsychosocial approach identified earlier. This evidence brings to light the need for further research to examine how these different domains might change across the adult lifespan and how disaster exposure might alter these expected trajectories. Consequently, the impacts of age and disaster exposure on SA will be the central focus of the present research, as discussed in better detail next.

Focus of the Present Research

Successfully aging does not occur in a vacuum—that is, throughout our lives, humans will be exposed to various stressors, and these stressors can impact the ability to successfully age. The Great Flood of 2016 in Louisiana served as an extreme stressor to individuals across 20 parishes (counties); those in the greater Baton Rouge metropolitan area (Ascension, Livingston, and East Baton Rouge parishes) received most of the damage with an estimated 92,400 houses flooded across the three parishes. As total state damage estimated over 100,000 houses, the three parishes received over 90% of total residential damage across the state (Terrell, 2016). The Great Flood was unique in that it was not a part of a larger named storm, thus giving people little preparation to prepare and evacuate their homes. Starting early on August 12, 2016, a storm system settled on the area, and across three days, relentless rain poured down across the state. The greater Baton Rouge area received over 20 inches of rain in those first 72 hours (NASA Earth Observatory, 2016). The nearby Amite and Comite rivers both reached record-breaking flood levels, thereby flooding local businesses and residences (United States Geological Survey, 2016). Seven days after the flooding began, experts stated the state of Louisiana received 600% more rain than an average week (National Weather Service, 2016).

Slowly the rain and the local rivers began to subside. Now in the aftermath of a natural disaster, hundreds of thousands of people had to begin to determine what contents, including their homes themselves, were salvageable. This recovery process, including choosing to rebuild or relocate, can place an extreme amount of stress on an individual. While the peak damage from the Great Flood of 2016 occurred within the first

week, affected persons of all ages would continue to experience its consequences for years to come.

The purpose of the present research is to expand upon prior work investigating the topic of SA by looking at disaster-exposed individuals (Cherry et al., 2015; 2016; Wilson-Genderson et al. 2017). Using a biopsychosocial and lifespan approach (Pruchno & Carr, 2017), the current study investigated age group differences in younger, middle-aged, and older adults using resilience (using the CD-RISC) and self-reported physical health and mental health (using the SF-36) as outcome measures. These individuals have been exposed to natural disaster, specifically the Great Flood of 2016. The primary questions that motivated the present research are as follows:

Research Question 1

How does age group relate to self-perceived resilience, physical health, and mental health after disaster? As resilience has some overlap with mental health (Connor & Davidson, 2003), it is expected that age will be a protective factor of resilience. Using the SF-36 Physical Composite Scores, Stanko et al. (2017) found support for decreasing physical health with increasing age. Contrary to decreasing PCS scores with age, Thomas et al. (2016) demonstrated evidence for the mental health paradox, with older adults reporting better SF-36 Mental Composite Scores (MCS) than younger. By comparing disaster-exposed older adults to controls, the present investigation allowed for a test of the maturation (Shira et al., 2014), inoculation (Knight et al., 2000), and stress-sensitization hypotheses in regards to resilience and mental health (Seery et al., 2010).

Research Question 2

How does disaster exposure impact SA, specifically resilience, physical health, and mental health? Does double disaster exposure (i.e., exposure to both the Great Flood of 2016 and Hurricane Katrina) impact these outcomes differently than only experiencing the Great Flood of 2016? Through this research question, I addressed the inoculation (Knight et al., 2000) and stress-sensitization (e.g., Seery et al., 2010) hypotheses. Specifically, does going through both disasters provide greater emotional health (as indexed by the SF-36 MCS scores), or conversely, could it start to contribute to low resilience and health quality of life?

Research Question 3

Do age group differences in resilience more closely resemble differences in self-perceived physical (which declines with age) or mental health (which may improve with age)? Will the hypothesized age group differences provide support for resilience being a proxy of SA, providing further support for the biopsychosocial model?

To summarize, the goals of the study are to examine age group and disaster exposure differences in three outcomes of SA: resilience, physical health, and mental health. By using two traditional outcomes of SA (physical and mental health), I compared if resilience more closely resembles physical or mental health, providing further support for resilience as a proxy of SA. If resilience does relate to SA, then that would show additional support for a biopsychosocial model of SA.

Method

Participants

Participants in this study were enrolled in the LSU Flood Study. This project, led by Drs. Katie Cherry, Matt Calamia, and Emily Elliott, investigated cognition and well-being after disaster. Participants ranged in age from 18 to 88, and they were also grouped by disaster status. In all, a total of 224 individuals participated in this project. Across three days of testing in the Wave 1 assessment, participants received a variety of cognitive tasks and measures of well-being. Approximately 9 (+/-3) months after the first visit of Wave 1 testing was completed, participants were contacted again for the follow-up assessment. For the purposes of this study, only a subset of the original data (n = 202) from the Wave 1 assessment was utilized. Excluded were the 22 participants who had catastrophic damage in the 2005 Hurricanes Katrina and Rita but did not flood in 2016.

Creation of Age Groups. In order to test the hypothesis that middle-aged adults may be more vulnerable to disaster stressors than their younger and older counterparts (Cherry et al., 2011), I aggregated these data by chronological age to compare younger, middle-aged, and older adults. To construct the age group variable, I first looked at the means of age groups within disaster group. Table 2 displays these means, standard deviations, sample size, and range of age. This analysis was performed to avoid any one age group from being over or under represented across the three disaster groups. I began with empirical age divisions of 18 to 39 for younger adults, 40 to 64 for middle-aged, and 65 to 88 for older adults (e.g., Cherry et al., 2011).

Table 2. Age Group* Means Within Disaster Exposure Group

		Mean Age	N	Std. Deviation	Min	Max
Group 1 - Control / No Structural Damage to Home	Younger Adults	28.23	26	6.64	18	39
	Middle-Aged Adults	53.37	19	5.39	42	59
	Older Adults	69.38	21	5.95	61	82
	Total	48.56	66	18.66	18	82
Group 2 - Single Disaster Exposure	Younger Adults	31.09	23	6.97	19	41
	Middle-Aged Adults	50.92	26	5.84	42	59
	Older Adults	69.68	22	6.97	60	88
	Total	50.31	71	16.78	19	88
Group 3 - Double Disaster Exposure	Younger Adults	30.88	26	7.33	18	41
	Middle-Aged Adults	52.28	18	5.06	43	59
	Older Adults	69.19	21	5.93	60	87
	Total	49.18	65	17.57	18	87
Total	Younger Adults	30.03	75	7.02	18	41
	Middle-Aged Adults	52.05	63	5.50	42	59
	Older Adults	69.42	64	6.22	60	88
	Grand Total	49.38	202	17.59	18	88

*Younger Adults = 18-41 years; Middle-Aged Adults = 42-59 years; Older Adults = 60 to 88 years

These age divisions were utilized by Cherry and colleagues in the Louisiana Healthy Aging Study (LHAS) as they were most appropriate for the LHAS sample. These arbitrary boundaries led to a larger proportion of middle-aged adults compared to younger and older, so I modified the age group boundaries until a closer distribution was

created. Thus, the younger adults in this study were 18 to 41 years, middle-aged were 42 to 59 years, and older adults were 60 to 88 years.

Disaster Exposure Groups. Group 1 (n = 66) was an indirectly affected comparison group who did not experience structural damage to their home in the 2016 flood. They served as the "control" group for disaster exposure. Group 2 (n = 71) experienced direct structural damage to homes and property owing to the intrusion of water, and Group 3 (n = 65) experienced catastrophic losses in Hurricanes Katrina and Rita in 2005 and had structural damage to homes and property in the 2016 flooding (doubly exposed disaster group). While many of these participants had experienced prior natural disasters other than the Great Flood, Group 3 was operationalized as individuals who relocated to the Baton Rouge area after losing their homes in Hurricane Katrina to permit comparisons with prior research utilizing former coastal residents who relocated permanently to the greater Baton Rouge Metropolitan area after Katrina and Rita (Cherry et al., 2015; 2017; 2018).

Design and Analyses

The design was a 3 (age group: young, middle-aged, older) x 3 (disaster status: control, flooded in 2016, and flooded in 2016 and in Katrina in 2005) between-group factorial. For each outcome, separate analyses of variance (ANOVAs) were carried out with age group and disaster status as between group variables. All significant main effects were followed up with Tukey post-hoc comparisons. Additionally, post-hoc comparisons were conducted for main effects with marginal significance (e.g., $p \leq .10$) based on a priori hypotheses concerning the direction of pairwise differences. For all

reported analyses, a conservative alpha level was employed to guard against inflated Type I error rates ($p < 0.01$).

Measures

CD-RISC (Resilience). The CD-RISC (Connor & Davidson, 2003) has 25 items such as “Even when things look hopeless, I don’t give up”; “I am not easily discouraged by failure”; and “I like challenges,” each rated on a 5-point scale (0 = *not true at all* to 4 = *true nearly all of the time*). Scores range from 0 to 100, with higher scores indicating greater perceived resilience. We selected the CD-RISC for use in this study based on established psychometric properties and prior work that documents excellent internal consistency reliability in a large sample of older women (Lamond et al., 2009). In addition, a methodological review of 19 resilience measurement scales found the CD-RISC to be one of the three strongest resilience measures due to high criterion and construct validity (Windle, Bennett, & Noyes, 2011).

SF-36 PCS (Physical Health) and MCS (Mental Health). Originally designed to meet the needs of the Medical Outcome Survey, a large-scale population-based study, the SF-36 contains 36 health-related quality of life items spread across eight subscales: physical functioning, role limitations due to physical problems, social problems, bodily pain, general mental health, role limitations due to emotional problems, vitality, and general health perceptions. For scoring, each scale is directly transformed into a 0-100 scale on the assumption that each question carries equal weight. The lower the score, the more disability one has. The higher the score, the less disability one has (i.e., a score of zero is equivalent to absolute disability and a score of 100 is equivalent to no disability). Using a scoring algorithm, these scores are then transformed for general

population norms. These norms are not adjusted for age or gender. The advantage of norm-based scoring includes simplified interpretation of results (Ware, 2000). Without using norms, one would have to remember the respective mean for each of the eight domains when doing comparisons. For example, when looking at people with asthma, 0-100 scoring showed asthma impacted vitality more than physical function. However, when compared to the norms of the population, it becomes apparent that physical function is more impacted in asthma than vitality, regardless of physical functioning having a higher score. Using norm-based scoring, each scale is scored in comparison to the population scores with a mean of 50 and standard deviation of 10. Thus, individual scores of 45 or below and group means of 47 for each scale are considered poorer health than the general population (Ware, 2000).

These eight scales can also be collapsed across one another to form a Mental Health Composite Score (MCS) and Physical Health Composite Score (PCS). MCS and PCS are two summary measures that reduce Type I error risk in running multiple comparisons in hypothesis testing (Ware et al., 1995). The MCS is comprised of the mental health, emotional role limitation, and social functioning subscales. The PCS contains the physical functioning, physical role limitation, and social functioning subscales. The remaining two subscales, vitality and general health, have correlations with both MCS and PCS components. Validity of the three-level taxonomy (36 individual items, 8 domains, and two composite scores) has been demonstrated by many researchers (c.f., Ware, 2000) as well as validity across diverse populations (e.g., McHorney, Ware, Lu, & Sherbourne, 1994).

In older adults, large population-based studies have demonstrated both internal consistency and validity for use amongst older adults (e.g., Lyons, Perry, & Littlepage, 1994; Walters, Munro, & Brazier, 2001). The ease of distribution and assessment in conjunction with high construct validity and test-retest reliability have made the SF-36 one of the most popular health-related quality of life psychometric tests, with over 25,000 publications utilizing it since 1988 (Google Scholar; Web of Science).

Results

Sociodemographic Characteristics of the Sample

Table 3 provides sociodemographic information about participants by age group. Chi-square goodness-of-fit analyses indicated the age groups differed on marital status, χ^2 (2, N = 202) = 14.31, p < .001. Younger adults were more likely to be single than middle-aged or older adults, while older adults were more likely to be widowed. For income, a Chi-square goodness-of-fit analysis revealed a significant difference of income across the age groups, χ^2 (6, N = 202) = 43.58, p < .001. 44% of younger participants reported their income being less than $2,000 per month, compared to 8% for middle-aged and 13% for older age. 40% of middle-aged adults reported an income of $6,000 or more per month, while only 16% of younger adults and 22% of older adults did. Lastly, there was a significant difference of income adequacy amongst the three age groups, χ^2 (2, N = 202) = 7.34, p = .03. A larger percentage of younger adults (26.7%) reported not at all adequate or can meet necessities only compared to middle-aged (12.7%) and older adults (10.9%). All other Chi-square analyses were non-significant.

Table 3: Sociodemographic and Individual Difference Characteristics (N = 202)

	Younger adults	Middle-aged adults	Older adults
		M (SD)	
Age	30.03 (7.01)	52.05 (5.50)	69.42 (6.22)
		N (%)	
Disaster Exposure Status			
Indirectly Affected / Control	26 (34.7%)	19 (30.2%)	21 (32.8%)
Structural Damage to Home in 2016 Flood	23 (30.7%)	26 (41.3%)	18 (28.6%)
Structural Damage in 2016 and Katrina	21 (32.8%)	22 (34.4%)	21 (32.8%)
Sex (female)	60 (80.0%)	46 (73.0%)	44 (68.8%)
Education			
High School	8 (10.7%)	5 (7.9%)	5 (7.8%)
Some college or training	25 (33.3%)	24 (38.1%)	25 (39.1%)
College Degree	30 (40.0%)	23 (36.5%)	20 (31.3%)
Master's Degree	8 (10.7%)	5 (7.9%)	11 (17.2%)
Graduate degree	4 (5.3%)	6 (9.5%)	3 (4.7%)
Marital Status			
Single/ Divorced / Widowed	42 (56.0%)	18 (28.6%)	19 (29.7%)
Married	33 (44.0%)	45 (71.4%)	45 (70.3%)
Income			
Less than $2,000 per month	33 (44.0%)	5 (7.9%)	8 (12.5%)
Between $2,000 to $4,000 per month	17 (22.7%)	26 (41.3%)	21 (32.8%)
Between $4,000 to $6,000 per month	13 (17.3%)	7 (11.1%)	21 (32.8%)
Over $6,000 per month	12 (16.0%)	25 (39.7%)	14 (21.9%)
Income Adequacy*			
Less than adequate	20 (26.7%)	8 (12.7%)	7 (10.9%)
Adequate or better	55 (73.3%)	55 (87.3%)	57 (89.1%)

Notes. "Less than adequate" income refers to "not at all adequate" and "can only meet necessities only."

Analyses of Resilience by Age and Disaster Group

A 3 (Age Group: Younger, Middle-Aged, Older) by 3 (Disaster Exposure Group: Control, Single, Double) factorial ANOVA was conducted for each outcome. Table 4 lists the means for each outcome by age and disaster group.

Table 4. Dimensions of Resilience, Physical Health, and Mental Health by Age and Disaster Group

	Control	Single Exposure	Double Exposure	Means by Age
CD-RISC[a]				
Younger	72.12 (13.31)	75.26 (13.54)	71.34 (14.64)	72.81 (13.77)+
Middle-aged	79.05 (9.35)	74.54 (16.73)	77.94 (11.52)	76.87 (13.37)
Older	80.20 (11.10)	78.55 (11.38)	75.00 (16.43)	77.92 (13.14)+
Means by Disaster Group	76.68 (12.01)	76.01 (14.12)	74.35 (14.52)	75.70 (13.57)
SF-36 PCS[b]				
Younger	56.00 (5.72)	50.93 (7.75)	50.59 (10.98)	52.62 (8.69)**
Middle-aged	45.67 (11.94)	46.03 (11.23)	48.12 (10.91)	46.53 (11.22)
Older	50.09 (8.36)	46.59 (9.31)	40.39 (13.78)	45.63 (11.31)
Means by Disaster Group	51.16 (9.62)*	47.77 (9.73)	46.55 (12.57)	48.49 (10.82)+
SF-36 MCS[c]				
Younger	43.68 (11.53)	42.55 (13.00)	40.03 (12.82)	42.09 (12.36)
Middle-aged	51.12 (9.01)	43.10 (12.03)	49.74 (12.18)	47.49 (11.65)*
Older	55.57 (7.43)	46.70 (12.41)	51.90 (11.24)	51.25 (11.11)**
Means by Disaster Group	49.51 (10.83)*	44.07 (12.42)	46.66 (13.12)	46.69 (12.30)**

+ $p > 0.05$ and ≤ 0.10 * $p \leq 0.05$ ** $p \leq 0.01$

Notes. Entries are means and standard deviations. [a] Connor-Davidson Resilience Scale (Connor & Davidson, 2003) [b] SF-36 physical health composite score (Ware et al., 2002). [c] SF-36 mental health composite score (Ware et al., 2002)

For resilience, there was a marginally significant effect of age group, F (2,193) = 2.81, p = .06. To determine whether these data were close to supporting the maturation hypothesis, post-hoc analyses were employed. Tukey post-hoc comparisons revealed a trend of an advantage of older age, with older adults reporting higher CD-RISC scores than younger adults (p = .07), but not middle-aged adults (p = .90). Younger and middle-aged adults also did not differ significantly in resilience scores (p = .15). These results provide mild support for the maturation theory in regard to resiliency. However, these differences are not clinically significant. Including a larger sample size in future research may clarify this finding (Tversky & Kahneman, 1971; see also Discussion).

Additionally, for resilience, there was no significant effect of disaster exposure group on CD-RISC scores, F (2,193) = 0.49, p = .61. There was also no significant interaction effect of age group and disaster group on CD-RISC, F (4,193) = 0.79, p = .53. These null results do not support inoculation nor stress-sensitization theory. Interestingly, the means displayed in Table 4 (M = 75.7) are lower than the general population (M = 80.3) used in the original validation study (Connor & Davidson, 2003). This may imply that disaster exposure does impact resilience, but it affected all participants the same way regardless of direct exposure.

Age and Disaster Group by Physical Health

For physical health, a main effect of age occurred in the analyses of SF-36 PCS scores, F (2,189) = 9.10, p < .001. Follow up analyses showed younger adults reported significantly higher SF-36 PCS than middle-aged (p < .002) and older adults (p < .001), who were not different between themselves (p < .88). Disaster exposure group status marginally affected SF-36 PCS, F (2,198) = 2.82, p = .06. Once again post-hoc

comparisons were utilized to see trends in the data. Those who did not flood in 2016 reported significantly higher scores than those who went through the flood and Hurricane Katrina (p = .03) but not those who only experienced the flood (p = .13). The two disaster-exposed groups did not differ from themselves (p = .77). The interaction between Age Group and Disaster Group was non-significant, F (4,189) = 2.04, p = .09. These results show support for stress-sensitization theory (Seery et al., 2010), as those who experienced both major disasters self-reported lower physical health than those who experienced neither.

Age and Disaster Group by Mental Health

Age group also had a significant effect on mental health, F (2, 189) = 11.38, p < .001. For the SF-36 MCS, younger adults were actually at a disadvantage, scoring lower than both middle-aged (p = .02) and older adults (p < .001), who did not differ amongst themselves (p = .16). Therefore, these results provide additional support for the maturation theory, as well as the mental health paradox of aging (Thomas et al., 2016). Lastly, mental health showed significant impact of disaster group, F (2,189) = 4.50, p = .01. Participants who experienced their first disaster in the flood of 2016 reported significantly lower mental health than those who did not flood (p = .02). However, the double-disaster group did not significantly differ from either the control (p =.34) nor single exposure (p = .40) groups. This demonstrates support for the inoculation theory, as those who were in both disasters had better mental health than those only in the most recent flood. There were no significant interactions for Age Group and Disaster Group, F (4,189) = 1.24, p = 0.30.

In summary, the results of these analyses just reported provide support for some of my hypotheses. For my first research question, age group was associated with resilience, a marginally significant effect. Older adults' scores were marginally significantly higher on CD-RISC than the younger adults. Age group was significantly associated with physical and mental health in the directions I predicted. For both mental health and resilience, evidence was found to support the maturation hypothesis (Knight et al., 2000). However, by treating chronological age as a grouping variable, power to detect significant age-related differences is necessarily lost. To provide a more definitive analysis of the age variable, I conducted multiple regression analyses treating age as a continuous variable, as discussed next.

Age as a Continuous Variable

In the analyses just reported, age was treated as a categorical (group) variable to allow comparisons among younger, middle-aged, and older adults in resilience, physical health, and mental health in order to test the hypothesis that middle-aged adults may be worse in these outcomes than younger and older adults based on the burden hypothesis (Thompson, Norris, Hanacek, 1993) However, dividing age, a continuous variable, into arbitrary age groups results in less statistical power to detect significant relationships. Consequently, multiple-regression models were run for each outcome to estimate the amount of variance accounted for by the age variable, treated continuously. Participants' marital status, income, and income adequacy were all entered as control variables prior to age and exposure, as these three sociodemographic measures differed in means across the three age groups (see Table 2).

For resilience (Table 5), age significantly contributed to the model, F (5,196) = 2.93, p = .014. As only age and income adequacy were the only significant predictors, this model predicted only 7% of the variance in resilience. Therefore, we can conclude that other factors may be more influential in predicting the variance in resilience than the sociodemographics listed, such as education, and that income adequacy may place a key role in individual's resilience.

Table 5. Age (Continuous) and Disaster Group for CD-RISC

	Unstandardized Coefficients		Standardized Coefficients		
Model (R^2 = .07)	B	Std. Error	Beta	t	Sig.
Marital Status	-3.67	2.35	-.13	-1.56	.12
Income	.769	1.14	.06	.68	.50
Income Adequacy	6.14	2.84	.17	2.16	.03
Age	.112	.06	.14	1.96	.05
Disaster Group	-1.10	1.17	-.06	-.94	.35
a. Dependent Variable: CD RISC total score					

Table 6. Age (Continuous) and Disaster Group for SF-36 PCS

	Unstandardized Coefficients		Standardized Coefficients		
Model (R^2 = .14)	B	Std. Error	Beta	t	Sig.
Marital Status	.33	1.82	.02	.18	.86
Income	.31	.87	.03	.36	.72
Income Adequacy	1.57	2.18	.06	.72	.47
Age	-.23	.04	-.37	-5.20	<.001
Disaster Group	-2.13	.90	-.16	-2.37	.02
a. Dependent Variable: Physical Composite Score					

For physical health (Table 6), both age and disaster group significantly contributed to the model F (5, 192) = 6.96, p = <.001. Together, these variables

accounted for 15% of the variance in SF-36 PCS scores. These results also support stress-sensitization theory, as disaster exposure negatively impacted the model (t = -2.37, p =.02).

For mental health (Table 7), the model surprisingly showed that age and income adequacy, rather than disaster exposure, predicted 16% of the variance in SF-36 MCS scores, F (5,192) = 7.38, p = <.001. When I compared age and disaster group earlier (p. 32), I found a main effect of disaster group, with the controls performing better than the single exposure group for mental health. However, by examining age as a continuous variable and using control variables, I discovered that disaster group is no longer significant after including income adequacy as a predictor in the model. These results imply that those who viewed their income as adequate or better reported higher SF-36 MCS scores compared to those who rated their income as not at all adequate or can meet necessities only (t = 2.56, p = .01).

Table 7. Age (Continuous) and Disaster Group for SF-36 MCS

	Unstandardized Coefficients		Standardized Coefficients		
Model (R^2 = .17)	B	Std. Error	Beta	t	Sig.
Marital Status	-2.88	2.06	-.11	-1.40	.16
Income	-.264	.99	-.02	-.27	.79
Income Adequacy	6.32	2.47	.20	2.56	.01
Age	.23	.05	.33	4.72	<.001
Disaster Group	-1.63	1.02	-.11	-.1.60	.11

a. Dependent Variable: Mental Composite Score

In summary, these models demonstrate support for the maturation hypotheses (Knight et al., 2000; Thomas et al., 2015) for resilience and mental health. Even after controlling for marital status, income, and income adequacy, age positively associated

with these two outcomes (*p*s = .05 and <.001). Even though there was a demonstrated decline physical health with age (*p* = .001), psychological well-being increased across the lifespan. Fascinatingly, disaster group only significantly contributed to the physical health model (*p* = .01), providing evidence for the stress-sensitization theory. However, for resilience and mental health, income adequacy mattered more than disaster group. This implies that exposure to multiple disasters negatively impacts physical health, but income adequacy matters more than exposure for resilience and mental health.

Comparing Resilience to Physical and Mental Health

The third research question was addressed by comparing relationships amongst resilience, physical health, and mental health. As income adequacy was a significant predictor of mental health, I controlled for this variable by conducting partial correlations. Table 8 shows results. As predicted, a partial correlation revealed a moderate relationship between mental health and resilience ($r = .399$, $p < .01$). Interestingly, a lesser, but still significant, correlation occurred between physical health and resilience ($r = .198$, $p < .01$). As resilience has been defined as the ability to handle and cope with stressors in life (Connor & Davidson, 2003), and levels of stress impact both physical and mental health (O'Donovan et al., 2012), resilience acts as a buffer for one's health. To answer the third research question, resilience and mental health had the strongest association; however, resilience and physical health also had a small relationship. These significant correlations imply resilience impacts subjective ratings of one's physical and mental health, thus providing evidence for using resilience as a proxy for SA.

Table 8. Partial Correlations of Resilience, Physical Health, and Mental Health Controlled for Income Adequacy

	1	2	3
1. CD-RISC	-		
2. SF-36 PCS	.198**	-	
3. SF-36 MCS	.399**	-.052	-
**Correlation significant at $p < 0.01$			

Table 8 provides evidence a small to moderate relationship exists between resilience and physical and mental health. To explore these relationships further, I then conducted another partial correlation between each of the eight scales of the SF-36 PCS and MCS, controlling for age, disaster group, and income inadequacy. These control variables were chosen so that relationships could be demonstrated regardless of age, disaster exposure group, or income adequacy, therefore making the results more generalizable. Table 9 displays these results. While Table 8 demonstrated no association between physical health and mental health, all eight of the domains had a positive correlation with resilience. The mental health (r = .396) and vitality (r = .376) domains showed the strongest associations; the weakest associations, physical functioning (r = .230) and bodily pain (r = .289), still significantly related to resilience. These analyses imply that resilience is a multi-faceted concept that both impacts and is impacted by physical and mental health, providing further support for it being a proxy of SA.

Table 9. Partial Correlations Between SF-36 Domains and CD-RISC Scores, Controlled for Age, Disaster Group, and Income Adequacy

SF-36 Domain	Correlation with CD-RISC
Physical Functioning	.230*
Role Limitations Due to Physical Problems	.322*
Bodily Pain	.289*
General Health	.372*
Vitality	.376*
Social Functioning	.333*
Role Limitations Due to Emotional Problems	.334*
Mental Health	.396*
Physical Component Score	.252*
Mental Component Score	.378*

* Correlation significant at $p \leq .001$.

Discussion

The primary objective of this study was to investigate SA after disaster using a biopsychosocial approach. To do so, I compared three groups of disaster-exposed individuals across the adult lifespan on one measure of resilience and two measures of health-related quality of life. Within disaster groups, three age groups were compared (younger, middle age, and older adults) to evaluate the maturation (Shira et al., 2014), inoculation (Ferrarro et al., 1999; Knight, Gatz, Heller, & Bengtson, 2000), and/or stress-sensitization (Seery et al., 2010) hypotheses. An additional objective was to evaluate resilience as a potential proxy for SA. As resilience has been defined as the ability to cope with stress and adversity in one's life, if physical and mental health indicators had strong associations with the resilience scores, such a result would provide validity for conceptualizing resilience as a proxy or component of SA.

To summarize, three research questions were addressed in this research. First, I investigated the role of age group on resilience, physical health, and mental health. Second, I explored disaster exposure group's influence on these three outcomes. Last, I conducted partial correlations of resilience, physical health, and mental health, controlling for income adequacy because it was significantly associated with the SF-36 MCS scores in earlier analyses.

Age Group Effects

For research question one, the resilience effect was marginally significant ($p = 0.06$). These null findings for resilience replicate other findings in the literature using resilience. Using community dwelling older adults aged 50-99, Jeste et al. (2013) found no differences in CD-RISC scores due to age. Thus, there is weak support for maturation

theory in regards to resilience as an outcome. However, as the sample size in this study was arguably small (N = 202), it may not accurately reflect the population's characteristics. According to the law of large numbers (Tversky & Kahneman, 1971), the larger the sampling size, the closer it will be to representing the population; the fallacy of the law of small numbers often leads researchers to believe replication can occur with similar sample sizes. Therefore, future research should use large sample sizes (e.g., 1,000 or more individuals) to accurately portray the population.

Although resilience scores may not change due to increasing age alone, it does correlate with physical and mental health (as demonstrated in Research Question 3). This suggests that it is a component of SA that taps into both biological and psychological factors.

I found a significant age effect for physical health and mental health. For physical health, younger adults reported higher scores than the middle-aged and older group. This is consistent with prior research using SF-36 PCS across the adult lifespan (Cherry et al., 2011; Stanko, 2017). Older adults had higher mental health than younger adults, providing support for the maturation hypothesis and mental health paradox of aging (Thomas et al., 2015). Interestingly, younger adults appeared to be at a disadvantage for mental health compared to their middle-aged and older adult counterparts. Originally, I had hypothesized that middle-aged adults may report lower mental health due to the burden hypothesis (Thompson, Norris, & Haracek, 1993). However, these data show that increasing age across the adult lifespan was associated with better mental health.

These results, in conjunction with the SF-36 PCS scores, demonstrate the need for a biopsychosocial approach to SA. For example, by only looking at physical health scores, older adults would not be considered successfully aging because of their decline from peak performance in young adulthood. We would not begin to appreciate the positive aspects of aging, such as increased mental well-being.

Disaster Group Effects

The second independent variable, disaster exposure groups, provided a novel contribution to the field of SA and resilience after disasters. As Louisiana is no stranger to disasters (e.g., Leaning & Guha-Sapir, 2013), we included a group of doubly exposed individuals who experienced catastrophic damage in both Hurricane Katrina in 2005 and the Great Flood of 2016. For resilience, unlike age group, I found no significant effect of disaster group. However, this does not imply individuals' resilience were not impacted by their disaster exposure. As our participants' scores were lower than the general population reported in Connor and Davidson (2003) (75.7 vs. 80.3), it may be that *all* participants' resilience received equal impact. In what may be the largest sample size utilizing the CD-RISC, Bezdijan et al. (2017) examined resilience in 53,692 United States Air Force members age 18-34 (99.9% between ages of 17 and 27); the assessment was given during the first days of Basic Training. After six months, Bezdijan and colleagues examined scores on CD-RISC between those members who left the service due to unsuitability attrition or any new mental health diagnosis. Those who ended up leaving the Air Force due to unsuitability (e.g., incorrigible behavior) scored significantly lower on resilience upon entry (baseline, M = 76.91) compared to those

who did not (M = 84.08, t = -35.63, p < .001). Mental illness diagnosis within the first six months was also predicted by CD-RISC scores, t = 16.11, p < .001.

For physical health, the control group reported higher SF-36 PCS scores than those who went through both disasters, providing support for stress-sensitization theory (Seery et al., 2010). After a disaster, living conditions can be very hazardous; many participants were rebuilding their flooded homes themselves for a variety of reasons, including financial cost. Thus, the danger and risk of a post-disaster environment may have negative physical health effects. Future research into physical functioning after disaster is warranted, as the literature lacks an examination of multiple exposures and physical health.

For mental health, while the control group demonstrated elevated SF-36 MCS scores compared to the single group, those who experienced both disasters did not significantly differ from either group. The double-disaster group showed a slightly higher mean score than the single exposure group, providing some support for inoculation theory (Ferraro et al., 1999; Knight et al., 2000). In spite of decreased physical health, those who went through Katrina and the flood did not have significantly different mental health or resilience scores. These null findings are unable to confirm nor deny support for inoculation and stress-sensitization theory.

Palgi et al. (2014) only found a relationship between disaster exposure (9/11 and Hurricane Sandy) and PTSD through the moderation of recollections. That is, those who had high self-reported recollections of 9/11 and Hurricane Sandy reported elevated PTSD symptoms compared to those with low recollections. Other studies using double-disaster exposed individuals have reported that higher degree of exposure was directly

related to number of post-traumatic stress symptoms (Shira et al., 2014; Caramanica et al., 2015; Gargano et al., 2019). In these studies that have utilized 9/11 and Hurricane Sandy exposure, post-traumatic stress after Sandy was moderated by degree of current stress and trauma from 9/11. However, Shira et al. (2014) found that for older adults, this relationship was lessened, providing support for the maturation protecting against stress-sensitization. In Caramanica et al.'s (2015) study, high Hurricane Sandy exposure and low social support were associated with greater likelihood of PTSD.

In essence, while people may experience disasters decades apart, if they are not fully healed from their prior trauma, new adversity and stressors many threaten mental health. In the current study, Hurricane Katrina and the Great Flood of 2016 took place approximately eleven years apart. Anecdotally, when conversing with the doubly-exposed disaster group, they mentioned that Katrina felt like it had happened the week before the flood. Many participants in this group shared stories of their harrowing tales of survival when the levees began to break in New Orleans. One participant mentioned that the most stressful part about the Great Flood of 2016 and its aftermath for her was trying to remember which items she lost during Hurricane Katrina versus ones she lost in the most recent disaster; in her mind, the two events seemed muddled once beginning post-disaster recovery. To further explore this finding, future research should include measures of cumulative adversity in additional areas besides disasters to see if support is found for these two theories (Pruchno and Wilson-Genderson, 2015).

Resilience as a Proxy for Successful Aging

For the third research question, resilience significantly associated with both physical and mental health (see Table 8), providing additional support for resilience

being a BPS component of SA (Pruchno, Heid, & Wilson-Genderson, 2015). This finding replicates other literature investigating these outcomes; in older American Indians, those with higher resilience reported less depressive symptomology, chronic pain, and overall physical and mental functioning problems compared to those who were low (Schure, Odden, & Goins, 2013). Indeed, in this study we found a small significant correlation (r = .289) bodily pain and resilience. Thus, it appears that those are more resilient also have better negative emotion regulation, leading to less reports of pain. Investigating further, all eight scales that comprise the SF-36, a health-related quality-of-life measure, significantly correlated with CD-RISC scores in this study. This provides evidence that resilience is related to SA and health-related quality of life. Moore et al. (2015) also demonstrated similar relationships between these three measures in a sample of older adults age 50+. In their study, resilience also showed a moderate relationship (r = .41) with self-rated SA. Montross et al. (2006), using a slightly older sample of 60-99, found this correlation to be smaller (r = .28). Since resilience has been shown to be a modifiable factor (Connor & Davidson, 2003), if we can find ways to increase resilience, we will thereby increase subjective views of SA, including physical and mental health. Additionally, while the eight scales of the SF-36 showed significant associations with CD-RISC, the strongest correlation was only a moderate .396 (Mental Health), suggesting that resilience is not adequately captured in the SF-36. Thus, when studying SA, particularly after a natural disaster, researchers should include a measure of resilience in addition to physical and mental health measures (Pruchno et al., 2015).

A sizeable problem in SA research is the lack of consensus on an operational definition of this construct (Pruchno & Carr, 2017). Thus, in this study, I sought to

determine if resilience could serve as a proxy of SA. These data indicated that older adults had higher levels of resilience than younger adults, and that resilience scores also correlated with physical and mental health. Therefore, it appears that the ability to overcome stress and adversity is also related to how we perceive our physical and mental health.

From the data in this study, I conclude that resilience is an important component of SA, but due to the low to moderate correlations with physical and mental health, it is not necessarily the perfect proxy or sole outcome (Pruchno et al., 2015). However, resiliency fits well within a biopsychosocial framework, as the BPS approach uses a variety of holistic measures to encapsulate biological, psychological, and social components of SA. To further demonstrate the link between resilience and the biological domain, it would be beneficial to study resilience and SA in adults with physical disabilities. Using a sample of older adults (age: 45-80) diagnosed with spincal cord injury, muscular dystrophy, or postpolio syndrome, Molton and Yorkston (2017) conducted focus groups. Specifically, they asked participants what it meant for them to successful age in light of a physical disability. Qualtitative analysis revealed the top theme to be resilience and adaptation, followed by adaptation. Learning to maximize gains and minimize losses (Baltes & Baltes, 1990; Carpentieri, Elliot, Brett, & Deary, 2017) is key to all older adults successfully aging but especially for those who face a deficit in a biopsychosocial domain. A person's subjective view of their capability to handle stress, resilience, may be the reason why some older adults report low physical health scores, but high mental health scores, and vice versa (Bryant et al., 2001; Carpentieri et al, 2017).

Disaster Exposure and Successful Aging

An additional objective of this research was to understand how disaster exposure impacts SA and resilience. In 2005, millions of coastal residents catastrophically lost their homes in Hurricane Katrina. Some survivors relocated to the greater Baton Rouge area, where unfortunately they again received catastrophic structural damage in the Great Flood of 2016. In between those times, the state of Louisiana experienced four additional hurricanes (Rita, Ike, Gustav, and Issac) and one technological disaster, the 2010 BP Oil Spill. Multiple exposure to traumas and adverse accounts in fewer than 15 years can cause serious health impacts (Seery et al., 2010). The present study provides new evidence for stress-sensitization theory, as those who experienced both 2005 and 2016 disasters reported lower physical health than the control group. However, this was not the case for mental health, as both disaster groups were not different from themselves, providing some evidence for inoculation theory (Ferraro et al., 1999; Knight et al., 2000).

These results echo findings of other studies that utilized individuals exposed to more than one natural disaster and traumatic event. For example, using BP fishermen and their families who also experienced Katrina, Lyon, Nezat, Cherry and Marks (2015) found that cumulative adversity was linked to feeling a “pile-up” of stressors after a decade of disaster. This result can be interpreted in multiple ways. If an individual is not fully functional or recovered after a traumatic event, they will not experience resilience when exposed a second time (Seery et al., 2010; Kessler et al., 2012). Rather, the looming consequences of the prior disaster begin to mesh with the current. However, the “healing time” for each individual varies, and there may be other factors that

contribute more to post-disaster well-being than disaster exposure itself, such as income adequacy, as demonstrated in the results of this study and other literature (Schure, Odden, & Goins, 2013). Future research should consider using participants' cumulative lifetime adversity to further explore the impacts on resilience, physical health, and mental health across the adult lifespan (Pruchno et al., 2015).

Successful Aging Through Biopsychosocial and Lifespan Frameworks

In this study I investigated SA through two frameworks, biopsychosocial and (adult) lifespan. As mentioned previously, in my general examination I performed a literature review to show support for the biopsychosocial model of SA. Using those findings, in the current study I included three outcomes of SA that would ideally tap into biopsychosocial components. Rather than solely utilizing older adults, two younger age groups were included to provide comparisons across the adult lifespan. This is crucial because SA is not only an outcome, it is also a lifelong process that can be modified at any time throughout life (Rowe & Kahn, 1997).

Similarly, adverse events across the lifespan may challenge resiliency in different biopsychosocial aspects. For example, experiencing a car accident as an adolescent draws upon the need for physical and some psychological resilience but not much social. In contrast, employment loss in middle-age or death of a spouse in older age require psychological and social resilience but little physical (Smith, Bergeron, McCord, Hochhalter, & Ory, 2018). In the current study, disaster exposure may challenge resiliency differently for younger, middle-aged, and older adults. Younger and middle-aged may be more physically challenged after a disaster as they attempt to rebuild their homes. Older adults may be more socially challenged if their lifelong

residence is destroyed and are forced to relocate with family elsewhere. Therefore, when studying SA, including resilience, in the aftermath of a disaster, a lifespan perspective provides the greatest insight.

Finally, disruptions in the wider social environment, such as surviving a natural disaster, impact likelihood of subjective SA (Wilson-Genderson et al., 2017). Declines in cognitive performance, especially in middle-aged to older adults, can also occur (Cherry, Galea, et al., 2010). Middle-age can also be associated with the beginning of the metabolic syndrome: a group of diseases that include high blood pressure and blood sugar, high cholesterol levels, and increased body fat. All of these diseases significantly contribute to a person's risk of having diabetes, a stroke, and even a terminal heart attack (Lanza et al., 2008). Reducing stress after environmental disruption through increased perceived and instrumental support promotes a trajectory of SA over normal aging and even mortality. Middle-aged adults can be especially susceptible to effects of loneliness and isolation thus, creating interventions specifically targeted for this age-group remains a crucial imperative of SA researchers (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015). While Engel (1980) stressed that the BPS model did not have hierarchical order amongst the components, by examining biological, psychological, and social components individually, researchers may find more severe impairments in one domain than another depending on factors such as age and level of disaster exposure. Similarly, Rowe and Kahn (1997; 2015) in their three-tenet model of SA (absence of disease/disability, high physical/cognitive functioning, and engagement with life) also did not place their components in a hierarchical fashion. Thus, emphasizing importance of one domain over another does

not benefit health nor SA, and the best outcomes occur when biological, psychological, and social influences are equally considered.

Overall, the biopsychosocial framework provides concrete domains for classification of factors of SA while acknowledging intraindividual variability within each area. In this study, support for resilience being a component of the BPS model of successful aging was found based on the demonstrated relationship between physical health and mental health scores. Empirical evidence is beginning to accumulate with demonstrated salient biopsychosocial risk and protective factors of SA. Gerontologists face a challenge in the next dozen years, when the last Baby Boomer (those born in the United States from 1946-1964) turns 65 years. As the Baby Boomers are the largest cohort in the US, we as a country will see the largest population of elders aged 65+ and 85+ than ever witnessed before (Administration of Aging, 2015). Biomedical interventions will not adequately target those who have high objective and low subjective SA, just as psychosocial interventions will not help those with low objective and high subjective SA. Engaging and sustaining a trajectory of SA only occurs when biological, psychological, and social factors all have equal importance and consideration. For future research, this includes creating interventions that target all three components. For example, an appropriate intervention may include getting a group of middle-aged or older adults together weekly for physical activity, team-building cognitive exercises such as puzzles, and social interaction with other group members. These interventions can also be employed in Senior Community Centers across the country; however, from a public health perspective, it is imperative to provide funding for these centers in order for them to provide the trajectory of SA for their clients.

Limitations and Future Directions

At least six limitations of the present study should be noted. First, there was no pre-flood measure of resilience, physical health, and mental health available for this sample. Comparing changes in pre- and post-flood functioning would have permitted more accurate disaster exposure effects; we would then be able to see differences in resilience and health-related quality of life directly attributable to the Great Flood of 2016.

As a second point, ideally, we would have at least three points of data to compare changes across time and their implications (Kaniasty & Norris, 2008). This would provide more information about the time course of these disaster exposure effects. Three or more measurement points allow for plotting trajectories of post-disaster recovery for participants (Bonnano et al., 2010).

As a third point, all three outcomes were self-report measures. While the biopsychosocial framework does allow for subjectivity, it also values the role objective measures play, such as fitness level and genetics (Engel, 1980). Future research would benefit from including biological measures of resilience, such as the neurochemicals cortisol and dehydroepiandrosterone (DHEA). High ratios of DHEA to cortisol may prevent a person who has experienced trauma from PTSD or depression (Charney, 2004).

Fourth, a selection bias may be in operation, as those who are less resilient or aging poorly may have moved out of the area after the flood or refused to participate. Therefore, the current sample may be aging more successfully than the general population. Fifth, the sample was recruited through convenience and snowball methods

of sampling. As we were recruiting individuals who had been exposed to a natural disaster, we could not randomly assign participants and relied on word-of-mouth recruiting, particularly for those who has experienced both the Great Flood and Katrina. Thus, amongst the current sample, we have couples, relatives, and friends as participants, which may lead to response bias; participants may have been more inclined to answer favorably if their friends and family also participated. Sixth, because of our use of convenience and snowball sampling, the sociodemographics (e.g., race, marital status, education, etc.) of the sample may not accurately represent the population. Future research should continue to investigate the role that multiple disaster exposures have on resilience, physical health, and mental health.

To summarize, the present research contributes to the growing literature that utilizes a biopsychosocial framework to study SA (Pruchno & Carr, 2017). Additionally, it allows for an exploration into the intersection of SA and natural disaster exposure (Cherry et al., 2015; 2011; Pruchno et al., 2010; Wilson-Genderson et al., 2017), and the role of positive psychological processes such as resilience during post-disaster recovery (Cherry et al., 2018; 2017). In Table 7, I demonstrated that perceived income adequacy mattered more to the variance in mental health scores than did disaster exposure itself. Applying these findings to public policy, post-disaster resilience and well-being may increase if financial aid and resources are deployed immediately after disaster. For example, after the Great Flood of 2016, anyone who had received a Small Business Administration (SBA) loan for repairs did not qualify for additional funds through LA Restore, a foundation designed to grant money to flood victims. On May 2, 2019, almost three years after the Great Flood occurred, Louisiana Governor John Bel

Edwards announced that SBA recipients would qualify for LA Restore, pending approval from the U.S. Department of Housing and Urban Development (Louisiana Governor Website, 2019). For SBA recipients, this means that three-years post-disaster, they are still not receiving adequate funds for recovery.

Our world is expected to have the largest aging population yet (Administration of Aging, 2015) alongside increases in natural disasters (Leaning & Guha-Sapir, 2013). By the year 2030, 20% of the world's population will be older than 65, with 20% of those older adults being older than 85 (Administration of Aging, 2015). Concurrently, the world is increasingly experiencing climate-related disasters, including floods, avalanches/landslides, severe storms, wildfires, and extreme temperatures (hot and cold). In 1950, the beginning of life for some older adults in this study, less than 25 climate-related disasters occurred. By 2012, this number had increased to over 350 climate-related disasters and over 25 geophysical disasters such as earthquakes and volcanoes (Leaning & Guha-Sapir, 2013). Thus, discovering factors and proxies of SA in times of adversity and trauma are crucial to getting older adults on the trajectory of SA. Now more than ever, it is imperative for gerontologists to embrace their "heretic" label as George Engel (1980) did and continue to embrace holistic, interdisciplinary approaches to SA.

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