AGE DIFFERENCES IN PREPARING FOR, RESPONDING TO, AND RECOVERING FROM THE COVID-19 PANDEMIC: THE STRENGTHS OF OLDER ADULTS

by
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Dedication

To my parents, Qian Huang and Weihua Chen, for their endless love and encouragement throughout my life. They provided unconditional support for me to reach for stars and chase dreams.

To my aunt, Fang Huang, for guiding me to be an independent woman. She taught me that women can have ambition, career, as well as just beauty.

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Abstract

This dissertation consists of three independent articles, investigating the age differences in preparing for the continuation of COVID-19 pandemic, experiencing negative COVID-19 impacts across multiple domains, and psychologically recovering from cumulative disaster exposures during the COVID-19 pandemic, with an emphasis on the strengths of older adults.

Data used were from the longitudinal research project "Vulnerability and Resilience to Disasters" conducted in Texas, Tennessee, and Alabama, USA. Multiple linear regressions from Article 1 (N = 450) showed that compared to those aged 65+, people aged 18-44 perceived a lower level of preparedness for the ongoing COVID-19; and there was no significant difference in perceived preparedness between people age 65+ and those aged 45-64. In Article 2, latent class analysis (N = 1,080) yielded three classes of multidimensional COVID-19 impacts: class 1 "low overall impacts", class 2 "moderate overall impacts with high emotional distress", and class 3 "severe overall impacts". Subsequent multinomial logistic regressions revealed that compared to those aged 65-74, people aged 18-34, 35-49, and 50-64 had higher odds of being in "severe overall impacts" class versus "low overall impacts" class. In Article 3, negative binomial regressions (N = 554) indicated that individuals aged 65+ reported lower psychological distress relative to those aged 18-34, 35-49, and 50-64 after experiencing tornadoes and the COVID-19 pandemic, and their advantages in mental health over people under 50 can be maintained over time.

Taken together, this dissertation highlighted the unique strengths of older adults in disaster management with regard to COVID-19. Based on the findings, disaster-related practice and future research should consider age differences in disaster contexts and develop new disaster management frameworks for public health disasters.

Chapter 1: Introduction

Problem Statement

A disaster refers to a severe disruption of the functioning of a society, leading to a wide range of adverse losses and impacts that exceed the ability of the affected society to cope using its own resources (United Nations International Strategy for Disaster Reduction, 2009). The novel coronavirus disease 2019 (COVID-19) pandemic satisfies this definition, since it has resulted in an unprecedented disruption in human society and become a global health, economic, and social crisis that affects our everyday life (Abrams & Szefler, 2020). Originated at the Wuhan city of China in late 2019, COVID-19 has now spread internationally, with more than 630 million confirmed cases and 6.58 million confirmed deaths as of November 9, 2022 (World Health Organization, 2022). Distinct from disasters caused by natural hazards or man-made events, the COVID-19 pandemic is ongoing for a longer time, changes nearly every aspect of personal life, and disproportionately affects older adults aged over 65 in terms of COVID-19 related hospitalization and mortality, which presents some unique challenges for disaster management (Mueller et al., 2020; Peleg et al., 2021).

Disaster management is a process of organizing and managing resources and responsibilities in preparedness, response, and recovery phases (Coppola, 2015). In normal disaster types (e.g., earthquake, hurricane), preparedness involves preparation and mitigation efforts before a disaster occurs, response includes actions taken to prevent or mitigate damage during and in the immediate aftermath of a disaster, and recovery aims to help victims return to a normal life after the emergency phase has ended (United Nations International Strategy for Disaster Reduction, 2009). In the context of the COVID-19 pandemic, however, there is no such a clear distinction between each disaster management phase (Peleg et al., 2021). To be specific,

COVID-19 has been ongoing for nearly three years and many countries have experienced multiple waves with new coronavirus variants (e.g., Delta, Omicron), which forces people to simultaneously prepare for, respond to, and recover from the continuing COVID-19 disaster. In addition, disaster management for COVID-19 is much more complicated than other disaster types, as the global pandemic not only affects health and well-being, but also causes a plethora of problems with finances, employment, transportation, housing, Internet access, caregiving, etc. (Harvard T.H. Chan School of Public Health, 2020). Furthermore, COVID-19 highlights the vulnerability of older adults aged 65 and older, since they are at significantly higher risk of negative COVID-19 outcomes and consequences compared to younger adults (Shahid et al., 2020), which leads to a disproportionate focus on the weaknesses in older age when examining the age differences in disaster management.

Older adults often have some age-related vulnerabilities that may prevent them from preparing for, responding to, and recovering from disasters, such as declined health, functional impairment, and social isolation (Astill & Miller, 2018; Dostal, 2015; Tuohy et al., 2014). The COVID-19 pandemic amplifies these vulnerabilities, and risk-reduction measures are usually implemented based on how to best protect older people from pandemic-related consequences (Kornadt et al., 2021). As a result, older adults tend to be viewed as a homogenously weak group and a burden to society during the COVID-19 pandemic (Cohn-Schwartz & Ayalon, 2021), with their strengths in disaster management overlooked. Failure to shift from a negative perspective to focus on the strengths of aging populations will contribute to the ageist portrayals of older adults and exclude their wisdom, experience, and coping strategies from disaster management with regard to the pandemic (Finlay et al., 2021). Therefore, the objective of this dissertation is to examine the age differences in preparing for the continuation of COVID-19 pandemic,

experiencing multiple negative impacts during the COVID-19 response phase, and psychologically recovering from cumulative disaster exposures during the global pandemic, guided by balanced view and theoretical frameworks of vulnerabilities and strengths of older adults.

Significance

The world's population is aging rapidly. Between 2020 and 2050, the global number of persons aged over 65 is projected to increase from 727 million to more than 1.5 billion (United Nations, 2020). The COVID-19 pandemic is a public health disaster for aging societies, as older adults are experiencing increased health vulnerabilities (i.e., higher rates of hospital and ICU admission, mechanical ventilation, and mortality once infected with COVID-19), disruption in health and social services, mental health problems resulting from isolation and inadequate support, financial hardship due to unemployment and loss of retirement savings, barriers in technological literacy, and stronger internal and external ageism (Clarfield & Dwolatzky, 2021; Morrow-Howell et al., 2020). Given these disproportionate consequences, disaster management that help people prepare for, respond to, and recover from adversities is critical during the ongoing pandemic especially for aging populations (Pendergrast, 2021). Delving into the characteristics, special needs, and heterogeneity of older persons in disaster management can facilitate age-responsible policy and intervention efforts to promote healthy aging in the continuation of COVID-19. In addition, highlighting the strengths in older age may effectively combat COVID-19 ageism that frequently portrays older people as a homogenous and vulnerable group (Kessler & Bowen, 2020), and incorporate the important lessons, experience, and wisdom of older adults into disaster preparedness, response, and recovery for people of all age groups (Vahia, Blazer, et al., 2020; Verhage et al., 2021).

Disaster-related social work is deeply rooted in the profession's history of disaster relief, social work values of social justice and human dignity, and the profession's expertise in understanding and addressing the adverse impacts of disasters on individuals, families, and communities (Fahrudin, 2012; Findley et al., 2017; Zakour, 1996). Research and practice evidence has identified the important role of social work in disaster management with regard to natural hazards, war, terrorism, and pandemic outbreak (Adamson, 2014). In particular, gerontological social workers are experts in assessing the special needs and strengths of older persons, providing crisis response and psychosocial interventions, and coordinating diverse resources and groups, which can make unique contributions to older adults' disaster preparedness, response, and recovery (Kusmaul et al., 2018). The COVID-19 pandemic has led to an unprecedented rise in demand for social work services. Research into age differences in COVID-related disaster management can provide some important implications for social work clinicians, managers, and policy practitioners to develop and implement age-specific interventions in the current pandemic and for future public health disasters. In addition, disaster research in social work profession has predominantly focused on post-disaster practice with limited literature reporting social work involvement in pre-disaster mitigation and preparedness, and the majority of them are qualitative studies with small sample sizes (Harms et al., 2020). This dissertation will address these research gaps by covering different phases of COVID-19 disaster management and using quantitative approaches based on a large sample, which can provide some comprehensive and generalizable insights for future social work research and practice in terms of disaster management.

Theoretical Foundations

Life course perspective. The interest in life course research was generated by maturation of early child development samples, rapidity of social change, changes in the composition of the U.S. and other populations, changes in age structure of society, and growth of longitudinal research in the 20th century (Elder et al., 2003). As a relatively young but popular theoretical orientation, life course perspective provides a framework for studying how chronological age, relationships, life transitions, and social change shape individual's life course and its developmental consequences (Hutchison, 2010). According to the life course perspective, the life course is the interweave of age-related trajectories and early life experiences can influence the events and choices in later years (Elder & Johnson, 2003). When applied in disaster contexts, this perspective allows us to examine individuals' disaster experiences within the context of their life stage, memories, values, and views; and to understand how past experiences influence individuals' coping with disastrous events later in life (Shenk et al., 2009). There are six major principles of the life course perspective, and four of them could be particularly useful to examine age differences in disaster management, including linkage between early life experiences and later experiences, timing of lives, diversity in life course, and interdependence of human lives (Hutchison, 2010).

Linkage between early life experiences and later experiences. The historical events and life transitions at one point of the life journey can significantly influence what happens at later points (Elder, 1994). It is noted that previous life experiences can either positively protect human development in subsequent transitions and events, or negatively put later life course trajectory at risk (Hutchison, 2005), which may explain the complexity of age differences in disaster management. In the phase of disaster preparedness, for example, some older adults are more likely to get prepared than younger people as they have learnt the importance of preparedness

and how to perform preparatory tasks from life experiences (i.e., older adults' strengths) (Tuohy et al., 2014); but some other older adults may develop optimism and normalization bias from prior experiences and see no need to take precautionary actions (Becker et al., 2017).

Timing of lives. Age is a key variable in bringing order and predictability to the understanding of human behavior (Hutchison, 2005). Social roles, behaviors, life transitions, and events should be examined based on their timing in an individual's life (Elder, 1994). Age differences in disaster management should also be viewed in terms of the specific timing of life course. People at the stage of late adulthood often have several age-related differences from their younger counterparts, such as vulnerabilities in health and functional conditions and strengths in more disaster experiences and a greater sense of personal responsibility to maintain independence, which could significantly affect their behaviors in disaster contexts (Tuohy & Stephens, 2012).

Diversity in life course trajectories. There is much variability or diversity in life course pathways between cohort groups or within cohorts, which is due to a plethora of factors, such as social class, culture, gender, and individual agency (Hutchison, 2010). This principle informs that we should not only highlight the differences between younger and older cohorts, but also examine the heterogeneity among older populations in disaster management. In addition, instead of simply focusing on age per se, the impacts of other risk and protective factors in disaster contexts can also be considered in the relationship between age and disaster management behaviors.

Linked or interdependent lives. Individuals' lives are interdependent with family, friends, coworkers across the life span and these social relationships can regulate and support human behaviors (Elder, 1994). As a result, macro-level events could affect individuals and their social

networks; and individual-level changes can also be linked to family members and the wider world (Hutchison, 2005). Such an interdependence is important in coping with disasters. People at different life stages can have different sizes of social networks, varied preferences for social relationships, and different needs for social support, which may further affect their behaviors in disaster management.

Socioemotional selectivity theory. Socioemotional selectivity theory is a life-span theory of social motivation in which the perception of time plays a fundamental role in the selection and pursuit of social goals (Carstensen, 1995; Carstensen et al., 1999). In this theory, social goals are divided into two distinct categories: goals related to knowledge acquisition and those associated with emotional regulation; These two goals are intertwined to form the central goals that motivate social behavior through life cycle (Carstensen et al., 1999). When people prioritize knowledge-related goals, they are motivated to acquire new information and skills that will be useful in the future; If people regard emotion-related goals as primacy, they tend to pursue emotional satisfaction and meaning (Carstensen et al., 2000). Many factors could influence individuals' prioritization of these two types of social goals through life, and socioemotional selectivity theory posits that people's view of time is the key factor.

Different from the life course perspective that highlights the influence of past time, socioemotional selectivity theory focuses on the remaining time in the future. As people move through life, they are always aware that time is passing and "running out", so pursuing the right goals to avoid wasting time is important (Carstensen et al., 1999). When the time left is perceived as expansive or open-ended, the most salient goals will be those that help individuals prepare for future and focus on collecting information, experiencing novelty, and expanding breadth of knowledge (Carstensen, 2006). In contrast, when future is viewed as limited or

constrained, attention shifts to the present and the prioritized goals tend to be those that emphasize feeling states, particularly regulating emotions and finding meanings to optimize psychological well-being (Carstensen, 1995, 2006).

Chronological age is inextricably correlated with the perception of time left in life, which may explain the age-related differences in social goals and subsequent social behaviors (Carstensen, 2006; Carstensen et al., 1999). Older adults are often reminded how time flies when they experience some events, such as seeing children graduate or get married; They would also perceive that time is limited when they have more medical conditions or experience the death of family members or friends (Carstensen et al., 2003). As a result, older people tend to have increased preferences for and commitment to emotionally meaning goals, focusing on here and now, meaning in life, intimate relationships, and emotional quality (Carstensen et al., 1999). In contrast, younger people from late adolescent to middle adulthood are more likely to be future-oriented and pursue knowledge-related social goals (Carstensen et al., 1999). In addition to goals selection, older adults are also different from their younger counterparts in regulating emotions (Carstensen, 2006). Socioemotional selectivity theory claims that due to the awareness of limited time and emphasis on emotion-based goals, older adults are more skilled at emotion-focused coping strategies and are more likely to develop a sense of "this may be the last time", which can help them avoid experiencing negative emotions even in stressful life events and strengthen their appreciation of positive aspects of life (Carstensen et al., 2003; Carstensen et al., 1999).

Although socioemotional selectivity theory has rarely been used in disaster contexts, it may offer some insights into explaining the age differences in disaster management, especially the strengths of older adults in disaster response and recovery (Cong & Liang, 2022). For instance, older adults are more likely to stay calm in response to disasters, because their emotion-

focused coping strategies enable them to timely regulate emotional states and find meanings in catastrophic events (Brockie & Miller, 2017b; Tuohy & Stephens, 2012). Moreover, older adults may have unique strengths in mental health recovery, as they are adept at focusing on positive emotion, acceptance, and ongoing life and survival than disaster-related loss (Henderson et al., 2010; Rafiey et al., 2016). It is noteworthy that older adults with an advanced age are often closer to death than young-old adults, which may account for some differences within older cohorts in disaster contexts.

Strengths perspective. The development of the strengths perspective was driven by the awareness that U.S. culture and helping professionals were saturated with deficits, problems, and victimization (Saleebey, 1996) and based on the philosophical principles concerning liberation and empowerment (Saleebey, 2006). Over the decades, strengths perspective has evolved into an important value orientation in social work practice. As an alternative to a preoccupation with weakness and pathology, strengths perspective is committed to a resilience framework, appreciating the belief that people possess positive attributes, capabilities, and resources that enable them to effectively cope with life challenges (Brun & Rapp, 2001; Weick et al., 1989). Strengths perspective does not ignore or downplay real problems; Instead, it emphasizes the assessment and evaluation of problems and guides social workers to build on clients' talents and strengths to address these problems (Saleebey, 1996). Strengths perspective has been applied to gerontological social work, with a basic assumption that older adults, while often facing age-related losses and physical, emotional, and social vulnerabilities, possess underutilized or untapped capacity for resilience, wisdom, and strengths even in the context of stressful life events (Chapin & Cox, 2002; Langer, 2004), such as disasters. In the real world, however, frontline practice and public policy with respect to disaster management has been pathologizing

aging populations, predominantly focusing on their vulnerabilities and excluding them from disaster planning and response activities (Hrostowski & Rehner, 2012; Kusmaul et al., 2018). To shift from such a negative perspective to exploiting the strengths and resilience of older adults in disaster contexts, three key principles of strengths perspective may provide some insights for gerontological social work practice and research.

All individuals have strengths at every stage of life and under all conditions. Strengths perspective appreciates the resources, knowledge, and assets that older adults obtain from life experience, such as a broad network of social relationships, the wisdom developed through years of confronting and overcoming challenges, and accumulated material and socioemotional assets (Nelson-Becker et al., 2006), and respects the potentials that these strengths may have for achieving goals and attaining aspirations (Rapp & Goscha, 2011). Social work practitioners do not merely focus on older adults' problems and barriers, but assume that they have learned lessons from past experience and have capacities to cope with challenges (Saleebey, 2006). In disaster contexts, older adults' strengths may be obscured by the stresses of disastrous events and age-related vulnerabilities, but they still abide.

All experiences, even negative or unexpected ones, may present opportunities for growth. People may suffer from adversities, but they may also gain life-affirming capacities and become more resilient and resourceful (Saleebey, 2006). Despite suffering, older adults are continuously motivated to address basic and self-actualization needs, and they are more likely to maximize their ability when their strengths are supported (Langer, 2004; Nelson-Becker et al., 2006). This principle suggests that current intervention and policy efforts that focus on weaknesses of older people in disaster contexts may discourage their resilience and growth, which calls for strengths-based approaches.

Advocacy of the strengths of older adults can motivate them to achieve aspirations. For social work practitioners and researchers, it is important not only to listen to older adults' stories and affirm their possibilities (Chapin & Cox, 2002), but also to communicate the stories and views of older people to the macro system, i.e., the bureaucracies and organizations of helping that are often against the strengths perspective (Saleebey, 1996, 2006). Such advocacy is especially needed in disaster contexts where the strengths of aging populations are submerged under the weight of disaster crisis and age-related barriers in preparedness, response, and recovery.

Overview of Important Literature

All the attempts to reduce people's exposure to disaster consequences have the same goal: disaster management. Comprehensive disaster management is based on four distinct components: mitigation, preparedness, response, and recovery, which are performed before, during, and after disasters (Coppola, 2015). For traditional disasters that are one-off events occurring within a limited period (e.g., earthquake, hurricane), the four-phase disaster management is typically linear, as shown in Figure 1.

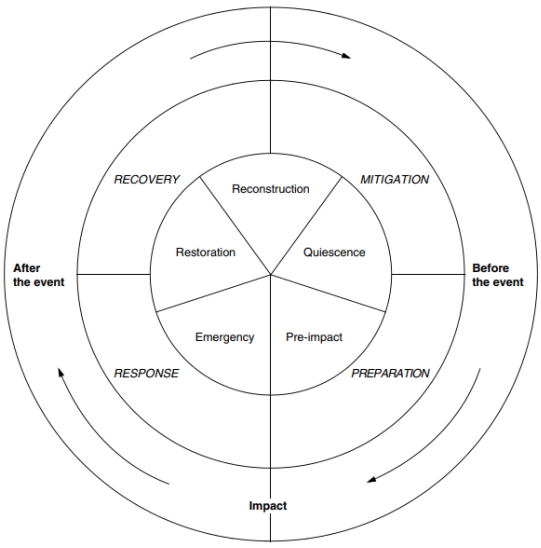

Figure 1. Disaster management cycle (Alexander, 2002)

While the COVID-19 pandemic is undoubtedly a disaster, its distinctions from traditional disaster types force us to think outside the typical disaster management cycle. To be specific, COVID-19 has been ongoing worldwide over an extended period, so the phases of COVID-19 disaster management tend to be non-linear (Fakhruddin et al., 2020). As illustrated in Figure 2, there is no sequence between each phase, and individuals have to simultaneously prepare for, respond to, and recover from the ongoing pandemic. Moreover, with no definitive disaster strike or end of emergency, there are no clear boundaries between the content of each disaster management phase. For example, some precautionary measures in the preparedness phase, such as social distancing and vaccination, can also be seen as responsive behaviors to the pandemic. Therefore, it is important not only to draw on previous disaster research, but also to consider the uniqueness of pandemic disaster management, when examining the age differences in COVID-19 preparedness, response, and recovery.

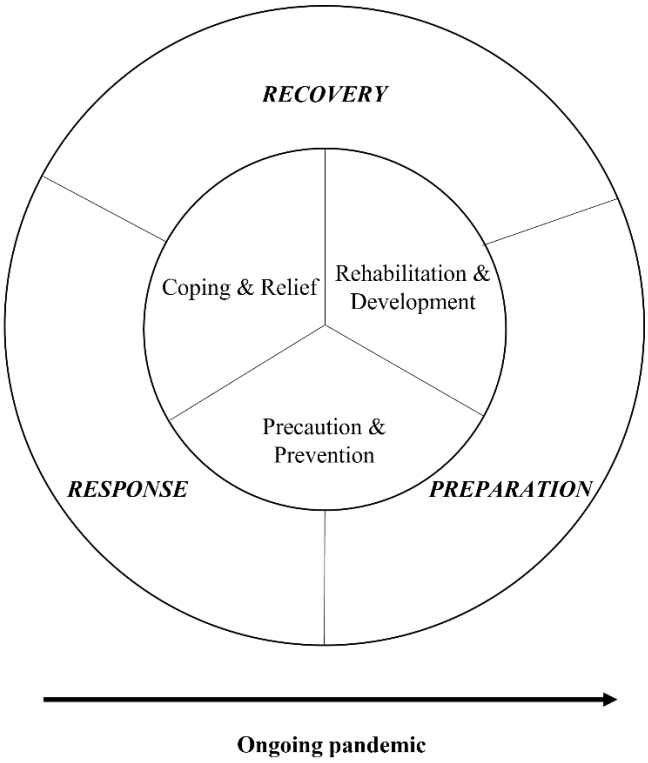

Figure 2. Disaster management model for the pandemic

Disaster preparedness refers to the measures taken in advance to effectively predict disasters, prevent or mitigate their impacts, and respond to the consequences of disasters (United Nations International Strategy for Disaster Reduction, 2009). Empirical studies on the relationship between age and disaster preparedness have not yielded consistent results. On the one hand, some studies suggested that older adults are less likely to take preparatory actions for disasters, largely due to their age-related declines in physical health and functional capacity that limit their ability to prepare and add to the complexity of preparedness plans (Dostal, 2015). In addition, older adults' optimism bias stemmed from previous disaster experiences (Heller et al., 2005) and less fear of death (Gershon et al., 2017) can also contribute to a lower level of preparedness relative to younger populations. On the other hand, older people can have unique strengths in getting prepared for disasters. Generally speaking, older adults have more disaster experiences than their younger counterparts, from which they can clearly realize the potential consequences of disasters, inadequacy of current preparedness, and the effectiveness of precautionary actions (Tuohy et al., 2014). Furthermore, people at the stage of late adulthood usually perceive a high level of individual responsibility and a strong sense of independence, so they are more likely to follow public disaster preparedness advice and take preparatory actions in order to avoid being a burden on others during future disasters (Tuohy & Stephens, 2016; Tuohy et al., 2015).

In the context of COVID-19 pandemic, preparedness activities include some precautionary measures that help prevent the spread of COVID-19 and respond to pandemic-related consequences, such as frequent handwashing, respiratory etiquette, self-quarantine, vaccination, developing household care plan, and storing groceries, supplies, and prescription medication, etc. (Johns Hopkins Medicine, 2021). Consistent with prior disaster literature,

despite the age-related vulnerabilities in physical and functional health, older people have been found to be more likely to take precautionary actions against COVID-19 than younger adults, such as practicing social distancing and avoiding gathering (Muto et al., 2020; Pearman et al., 2021). Such a higher level of COVID-19 preparedness may be related to older adults' advantages in risk perception, knowledge accumulation, and better mental health during the pandemic (Al-Hanawi et al., 2020; Bechard et al., 2021; Bruine de Bruin, 2021).

Disaster response involves a series of decisions and actions taken to save lives and prevent or mitigate negative impacts during the emergency phase of a disaster (United Nations International Strategy for Disaster Reduction, 2009). In the response phase, it is common to focus on the vulnerabilities of older adults and subconsciously treat them as people in need, since older people often face more barriers in reacting timely and correctly to a disaster due to age-related sensory, functional, and health impairments (Al-Rousan et al., 2014; Dostal, 2015). Moreover, older adults tend to lack necessary resources to help them respond to an emergency, such as accessible transportation (Shih et al., 2018) and immediate support from close family members and friends (Astill & Miller, 2018). Under the pressure of these weaknesses, the strengths of older persons in disaster response are often ignored. However, older adults typically have more disaster experiences and a stronger sense of independence than their younger counterparts, so they know the "right things" to do during a disaster and are proud of being responsible for these responsive actions (Brockie & Miller, 2017a; Tuohy & Stephens, 2012). In addition, lifetime experiences allow older people to see disaster as a normal part of living and to find meaning in catastrophic events (e.g., "just another experience", "go through something bad to appreciate life"), so they are often better at regulating emotional states and remaining calm in

response to the negative impacts of disasters (Brockie & Miller, 2017b; Tuohy & Stephens, 2012).

Unlike other disasters with a clear end, there is no definitive end to COVID-19, which results in a prolonged response phase for individuals to cope with a wide range of negative impacts. In line with previous disaster research, the physical health of older adults is a major weakness and the most affected in response to the global pandemic, in terms of their morbidity, comorbidities, and mortality (D'cruz & Banerjee, 2020). Government actions have been taken to shield older people from the virus and protect their health (e.g., shelter-in-place), but these responses also bring some adverse side effects to older populations, including increased loneliness and social isolation, lack of necessary resources and services, ageism and marginalization (Heid et al., 2021; Miller, 2020). As a result, older adults have been widely described as the most vulnerable population in need of protection and assistance during the COVID-19 pandemic. In fact, older people tend to develop mature coping capacity and perceive high coping efficacy that allow them to effectively respond to the threats and stressors associated with COVID-19 (Klaiber et al., 2021). Particularly, the emotion-focused coping strategies of older adults can enable them to be more resilient to mental health disorders than younger populations (Vahia, Jeste, et al., 2020) and derive joy and comfort from close relationships and social contact even during difficult times (Whitehead & Torossian, 2021). In addition to coping mechanisms, older adults have advantages regarding social roles across the adult life span, because some challenges are more common among younger and middle-aged adults (e.g., employment and family stressors) during the pandemic (Klaiber et al., 2021).

Disaster recovery is defined as a multidimensional and long-term process, including actions to restore sustainable living conditions for populations that have been severely affected

as a result of pre-existing vulnerabilities and disaster exposure (Contreras, 2016). After experiencing disasters, older people tend to report higher risks of morbidity and physical incapacity (Lome-Hurtado et al., 2021), increased all-cause hospitalization rates (Bell et al., 2018), and the highest mortality rate (Brunkard et al., 2008). They are also more vulnerable in economic recovery because most of them are on fixed income from social assistance or retirement funds and have limited savings to help them recover (Acierno et al., 2006; Mavhura & Mucherera, 2020). As a result of social isolation, older adults often lack social support in the ongoing turmoil and incomplete post-disaster recovery (Astill & Miller, 2018). Despite these weaknesses, older people have unique strengths in mental health recovery (Barusch, 2011). Previous experiences with disasters or other life stressful events (e.g., war, economic crisis, bereavement) may enable older adults to take a comparative and long-range view of their current situation, believing that they had experienced similar or tougher times before and they are capable to get it through this time (Adams et al., 2011; Brockie & Miller, 2017b). Furthermore, older persons are often more skilled at the coping strategies associated with emotional regulation than younger adults, and therefore they would be more satisfied with the support they received (Cherry et al., 2010) and find a new sense of interest, meaning, and appreciation for life in recovery phase (Hrostowski & Rehner, 2012; Tuohy & Stephens, 2012). In addition, compared to younger adults, especially those in the "sandwich" generation, people in late adulthood usually do not face multiple responsibilities in post-disaster recovery process, such as rebuilding, finding jobs, caring for children and parents simultaneously, which can help older adults reduce or minimize the fear, stress, and frustrations of failed recovery (Adams et al., 2011).

Since the COVID-19 pandemic has been ongoing globally for years with multiple waves, people have to go through a long journey to recovery while continuing to cope with the threat of

COVID-19. In comparison to younger adults, older persons have a harder time recovering from the long-term effects of COVID-19 and multiple complications (Morley, 2020; Xiong et al., 2021), suffer more economic setbacks due to limited savings and barriers for reemployment, and remain isolated as they have to continually avoid infection (Morrow-Howell et al., 2020). These vulnerabilities can lead to a challenging road to recovery for older adults, but reassuringly, they have evident strengths in mental health recovery. Although people from all age groups can experience some increases in mental health problems in the early phase of the pandemic relative to pre-pandemic, older adults have been found to develop fewer mental health problems than their younger counterparts at the beginning (Daly et al., 2020). During the recovery process, older persons can gradually recover from those initial problems and maintain good mental health (Pierce et al., 2021); while younger people are more likely to experience psychological distress and related symptoms over time (Fernández et al., 2022; McPherson et al., 2021). Even though some younger adults can have faster improvements than older people in certain mental health issues (e.g., depressive symptoms and anxiety), the age differences in mental health recovery still persist (Fancourt et al., 2021).

Rationale for Dissertation

This dissertation consists of three articles that examine the age differences in the preparedness, response, and recovery phases of disaster management with regard to COVID-19 pandemic. When investigating the age differences in the context of COVID-19 pandemic, current literature has mainly studied COVID-19 as a public health crisis and focused on health-related issues, with limited research from a disaster management perspective. The three articles will fill this gap by innovatively putting COVID-19 into a disaster framework and considering its uniqueness to develop a specific model (Figure 2) that differs from typical disaster management

cycle. In addition, the strengths of older adults in preparedness, response, and recovery will be highlighted, which can powerfully combat the prevailing "vulnerability" discourse about older people during the pandemic and provide some imperative implications for disaster-related practitioners and policymakers in different disaster management phases.

Article 1

The first article will examine the age differences in preparedness for the continuation of COVID-19 pandemic. The difference between older and younger adults in disaster preparedness is a result of many counterbalancing factors from the life course perspective. Previous studies are primarily focused on natural disasters, whereas the COVID-19 pandemic provides a relatively different context for disaster preparedness. To be specific, COVID-19 has come in multiple waves across the globe, so individuals have to continuously prepare for the ongoing pandemic. Moreover, older adults aged over 65, a particularly high-risk group for COVID-19, may endorse greater pandemic worry than their younger counterparts (Maxfield & Pituch, 2021) and therefore be more willing to implement precautionary measures to mitigate risks (Barber & Kim, 2021). However, the literature on age differences in preparing for COVID-19 is quite limited. Most studies treated age as a continuous variable and did not include samples aged over 65, so their findings tend to focus on "being older" rather than truly comparing older and younger adults in COVID-related preparedness. Moreover, there is a need to consider other imperative factors in coping with pandemic when delving into the complexity of age differences in preparedness, among which social support is a critical but understudied factor in the context of COVID-19 preparedness.

With only a few exceptions, prior disaster research has identified the significant influence of social support in elevating disaster preparedness level (Lai et al., 2018; Strine et al., 2013).

The positive impact of social support may primarily result from the exchange of resources within social networks, which can facilitate information flow that reiterates the potential risks of disasters, the need for and effectiveness of preparedness, and how to get prepared (Gargano et al., 2015; Hausman et al., 2007). Nevertheless, some studies suggested that social support is not a significant predictor to disaster preparedness (Heller et al., 2005; Story et al., 2020), since the quality of those resources within social networks is not always reliable and social relationships can have conflicting views on disaster preparedness (Messias et al., 2012). Especially in the case of COVID-19 pandemic, individuals' social networks tend to be full of competing attitudes toward precautionary measures (e.g., wearing a mask, vaccination), which calls for empirical research to determine the relationship between social support and COVID-19 preparedness. In addition, little is known about how social support affects age differences in preparing for the COVID-19 pandemic. Older people usually rely more on social support than their younger counterparts in buffering against vulnerability (e.g., declined health, functional problems, fixed financial resources) and promoting disaster preparedness and resilience (Heid et al., 2017). Moreover, older adults' emotional closeness to a reliable network of supportive contacts may be another reason for their elevated preparedness when receiving social support (Tuohy et al., 2014). To address the above research gaps, three specific research questions are developed:

RQ1: What are the age differences in preparing for the continuation of COVID-19 pandemic?

RQ2: How do different types of social support affect individuals' preparedness for the ongoing COVID-19 pandemic?

RQ3: How do different types of social support affect the age differences in preparing for the ongoing pandemic?

The data used come from a sample of tornado victims in Dallas County, TX, collected from October 2020 to January 2021. Address-based random sampling was adopted and about 25,000 addresses were chosen from selected zip codes affected by the Dallas tornado of October 2019. The recruiting mails were sent to the selected addresses, with options to participate the study via online platform, mail-in-survey, and telephone interview platform. Participants were asked about their experiences with the Dallas tornado and COVID-19 pandemic. It is noted that the survey block with a group of COVID-related questions was presented to respondents with planned missing data design, i.e., some sections including COVID-related questions were only randomly assigned to a subsample. Among the 792 adults recruited in this survey, 521 respondents randomly received the COVID-19 survey block and 489 of them reported valid answers regarding perceived preparedness for the continuation of COVID-19. Thirty-nine respondents with missing values in analytical variables are further excluded, so the working sample in this study consists of 450 adults. The dependent variable, preparedness for the ongoing pandemic, is measured by the question "what is your current level of preparedness for the continuation of COVID-19?" and the answer is ranged from 1 = "none" to 5 = "very high". Age is coded as 0 = "65 years or older" (reference), 1 = "18-44 years", 2 = "45-64 years". Moderators include three types of social support, i.e., emotional, financial, and instrumental support (0 = not received, 1 = received). Control variables include participants' gender, race, educational level, marital status, income, risk perception, preparedness level before COVID-19, and transportation and information barriers. Multiple linear regressions with four models are performed using Stata 15. Model 1 includes the key variables and control variables. The two-way interaction between age and emotional support is added in Model 2. Likewise, the interactions between age and

financial support as well as between age and instrumental support are included in Model 3 and Model 4 respectively.

Article 2

The second article focuses on disaster response phase and examines the age differences in patterns of experiencing negative impacts of COVID-19 pandemic. COVID-19 has affected nearly every aspect of human life, and people may cope effectively with some aspects but be more negatively affected in other areas. Furthermore, older and younger adults may respond differently in different aspects. Existing research tends to focus on how people cope with the impacts of one particular area and where older adults are most vulnerable (e.g., financial hardship, social isolation), without a comprehensive understanding of responses to COVID-19 impacts. To fill this gap, it is needed to identify the underlying patterns of various negative COVID-19 impacts and examine the age differences in those identified patterns.

In addition to affecting individuals themselves, the COVID-19 pandemic has impacts on people's relationships with family, friends, coworkers, and community. It is noted that not all of those impacts are negative; some people have experienced positive changes in social relationships during the pandemic, e.g., increased emotional support and more social contacts through digital technologies (Ammar et al., 2020; Philpot et al., 2021). According to the interdependent lives principle of life course perspective, individuals' social relationships across the life span can regulate and support human behaviors (Elder, 1994). In the context of disaster response, these social relationships are important for healthy coping with the negative COVID-19 impacts (Moore & March, 2022). However, it is unclear how the COVID-19 influences on social relationships affect the patterns of different negative COVID-19 impacts. As older adults are particularly reliant on social connections in response to the pandemic (Fuller & Huseth-

Zosel, 2021; Macdonald & Hülür, 2021) and have preferences for intimate relationships (Carstensen et al., 1999), there is also a need to examine how the age differences in experiencing COVID-19 impacts patterns are contextualized by the COVID-19 influences on different social relationships. To address these gaps, four research questions are developed.

RQ1: What are the patterns of a wide variety of negative COVID-19 impacts?

RQ2: What are the age differences in those identified patterns?

RQ3: How do the influences of COVID-19 on social relationships affect those identified patterns?

RQ4: How do the influences of COVID-19 on social relationships affect the age differences in those identified patterns?

Data used come from the cross-sectional surveys conducted from October 2020 to August 2021 in Texas, Tennessee, and Alabama, USA. The sampling strategy in Texas is mentioned in Article 1. Because Tennessee (Nashville-Cookeville) tornado and Alabama tornadoes are in relatively population-sparse areas, tornado tracks are identified, with about 10,000 addresses selected for each event centering on the tornado tracks. Among the 1,496 respondents in the surveys, the working sample include 1,080 adults who provide valid answers in analytical variables. The indicators of COVID-related impacts include 17 binary items from economic, health, social, and emotional aspects. Age is categorized into five groups: 65-74 (reference), 18-34, 35-49, 50-64, and 75 years and older. The COVID-19 influences on the relationships with family, friends/colleagues, and community were separately measured from "1 = a lot of negative influence" to "5 = a lot of positive influence". Control variables include participants' gender, race, ethnicity, educational level, marital status, and tornado damage to home. First, latent class analysis is performed using Mplus 8.3 to obtain (1) fit indices based on which the optimal

number of classes is determined, and (2) latent class membership probabilities that are used to assign respondents into different classes. Second, multinomial logistic regressions with four models are conducted using Stata 15. Model 1 will include all the key variables and control variables. The interactions between age and the COVID-19 influences on the relationships with family, friends/colleagues, and community are respectively added in Model 2-4.

Article 3

The third article will focus on mental health recovery after cumulative exposures to tornadoes and the COVID-19 pandemic. Due to fears of infection, economic recession, conflicting information from authorities, and extensive public health measures that violate personal freedom and disrupt daily routines, people are experiencing worsening mental health and widespread psychological distress associated with COVID-19 (Pfefferbaum & North, 2020). Besides, the persistence of COVID-19 increases the frequency of multi-disaster scenarios, i.e., the overlap between the pandemic and other disasters (e.g., climate hazards), which could greatly hinder public health response and post-disaster recovery (Phillips et al., 2020). Following disasters, the experience of mental health recovery can vary by age, and older adults often have unique strengths in emotion-focused coping and psychological resilience (Adams et al., 2011; Tuohy & Stephens, 2012). In the distinct disaster context of COVID-19, older adults have also been found to have better psychological health than their younger counterparts at the initial stage of pandemic response (Klaiber et al., 2021). Nevertheless, it is unclear whether the age-related advantages are maintained after multiple exposures to COVID-19 and other disaster types.

As described in Article 2, the COVID-19 pandemic has resulted in profound impacts on multiple life domains (Harvard T.H. Chan School of Public Health, 2020) and there should be underlying typologies of those negative COVID-19 impacts. The multidimensional COVID-19

impacts tend to continuously jeopardize disaster recovery and increase the risk for negative psychological outcomes as a result of massive and abrupt resource loss and disruptions in daily routine (Frounfelker et al., 2022; Goldstein et al., 2022). Particularly, older adults may experience greater difficulties and prolonged psychological distress in response to those chronic and complex COVID-19 impacts (Grasso et al., 2021; Wrzus et al., 2013). Although theoretical frameworks and existing studies have suggested the diminished age-related advantages in coping with negative COVID-19 impacts, the differences between older adults and their younger counterparts in experiencing multiple COVID-19 impacts and associated long-term mental health effects remain unclear. To address the above research gaps, four research questions are developed:

RQ1: What are the age differences in psychological distress after experiencing tornadoes and the COVID-19 pandemic?

RQ2: What are the latent classes of a range of negative COVID-19 impacts?

RQ3: What are the associations between the identified latent classes and psychological distress after exposures to tornadoes and the COVID-19 pandemic?

RQ4: How do the identified latent classes moderate the age differences in psychological distress after experiencing tornadoes and the COVID-19 pandemic?

Data used come from a two-wave panel study that examines participants' vulnerability and resilience to multiple disaster exposures (i.e., tornadoes and the COVID-19 pandemic) in Texas, Tennessee, and Alabama. USA. The first wave of data collection took place between October 2020 and August 2021 (T1). The data collection methods are described in Article 1 and Article 2. A total of 1,496 participants completed the baseline survey and were compensated for their time. Participants who agreed to be contacted again for follow-up surveys were sent an

email between May and August 2022 (T2), resulting in 655 respondents who completed the baseline and follow-up surveys with an attrition rate of 56.22%. In the present study, the working sample include 554 respondents with no missing values in analytical variables. Respondents to Texas survey contributed to the major missingness (N = 100), as the planned missing was used at T1 to avoid overburdening respondents. Psychological distress is measured by the Kessler Psychology Distress Scale (K6). This scale has 6 items drawing from depressive and anxiety related symptomology (e.g., "nervous", "hopeless"), each of which is answered by a 5-point Liker scale from 0 = "none of the time" to 4 = "all of the time". An additive score is calculated, ranging from 0 to 24. A higher score indicates a higher level of psychological distress. Age is categorized into four groups: 65+ (reference), 18-34, 35-49, 50-64. Control variables include respondents' gender, educational level, marital status, ethnicity, race, tornado-related home damage, and survey location. First, latent class analysis is conducted using Mplus 8.3 to explore the typologies of negative COVID-19 impacts. Subsequently, negative binomial regressions are performed using Stata 15 to examine the age differences in T2 psychological distress, as well as the moderating effect of the identified latent classes, with baseline psychological distress and covariates controlled.

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Chapter 2: Age differences in perceived preparedness for the continuation of COVID-19 pandemic: Important role of social support

Abstract

This study examined the age differences in perceived preparedness for the continuation of COVID-19 pandemic; and tested the moderating effects of three types of social support, i.e., emotional, financial, and instrumental support. Using a sample of 450 adults in Texas, U.S. from the research project "Vulnerability and Resilience to Disasters" (October 2020 to January 2021), results of multiple linear regressions showed that compared to people aged over 65, those aged 18-44 perceived a lower level of preparedness for the ongoing COVID-19; and there was no significant difference in perceived preparedness between individuals aged 65+ and those aged 45-64. Receiving emotional and instrumental support were respectively more important for people aged 65+ to perceive a better level of preparedness than for those aged 18-44 and 45-64. The findings highlighted the unique strengths of older adults in COVID-19 preparedness from the life course perspective and the importance of social support in their preparedness and resilience. Based on these findings, social workers could incorporate the wisdom and experience of older adults into disaster management and develop age-specific interventions to promote preventive behaviors during the ongoing COVID-19 pandemic and future public health disasters.

Keywords: Disaster preparedness, life course perspective, older adults, social support, socioemotional selectivity theory

Teaser text

This study examined how older adults (aged 65+) differed from younger people (aged 18-44) and middle-aged adults (aged 45-64) in perceived preparedness for the ongoing COVID-19 pandemic; and tested how emotional, financial, and instrumental support affected the above age differences. Results of multiple linear regressions showed:

- Older adults perceived a higher level of preparedness for the ongoing COVID-19 than younger people, and their preparedness level was not significantly different from that of middle-aged adults;
- Receiving emotional and instrumental support were respectively more pronounced for older adults to get prepared than for younger and middle-aged adults.

These findings highlighted the strengths of older adults and the importance of social support in COVID-19 preparedness, which provided some important implications for social work services and programs during the ongoing pandemic and future public health disasters:

- Social workers should appreciate the resources and assets that older adults obtain from life experience and actively incorporate their important lessons and wisdom into disaster preparedness and prevention campaigns;
- The concept of social support can be incorporated into disaster preparedness education and training programs especially for older adults.

Introduction

Disaster social work is rooted in the profession's history of disaster relief, social work pursuits of human rights and environmental justice, and social worker's expertise in understanding and addressing the adverse influences of disasters on individuals, families, and communities (Dominelli, 2013; Zakour, 1997). Although social workers are primarily engaged in post-disaster response and recovery, they are increasingly contributing to pre-disaster preparedness (Boetto et al., 2021). Disaster preparedness refers to the measures taken in advance to effectively prevent and cope with the consequences of disasters (United Nations International Strategy for Disaster Reduction, 2009). This area of practice for social work is critical and requires social workers to undertake preparedness-promoting interventions at micro-, meso-, and macro-levels to protect marginalized and vulnerable populations (Alston et al., 2019).

The COVID-19 pandemic has resulted in an unprecedented disaster to human society. Distinct from regular disaster types, the global pandemic is ongoing for a longer time without a definitive end and disproportionately affects older adults aged over 65, which presents some unique challenges for continuous disaster preparedness and gerontological social work. On the one hand, older adults are susceptible to disasters because of age-related vulnerabilities, such as declined health and social isolation (Dostal, 2015; Tuohy et al., 2014). The COVID-19 pandemic amplifies these vulnerabilities, and older adults tend to be viewed as a homogenously weak group and a burden to society during the pandemic (Cohn-Schwartz & Ayalon, 2021). On the other hand, however, older adults can obtain disaster-related lessons and coping strategies from life experience, and their strengths in disaster preparedness relative to younger people have been well documented in prior literature regarding natural disasters (Cong et al., 2021; Tuohy et al.,

2014). It is unclear whether the age-related advantage in preparedness can be maintained in the context of persistent public health disaster.

To address the research gap and provide implications for social workers in promoting preparedness and counter ageism during the pandemic, this study examined the differences among three age groups (i.e., 18-44, 45-64, 65 and older) in perceived preparedness for the continuation of COVID-19 from the life course perspective. Besides, given that social support networks are key social capital in coping with the pandemic and play an important role in disaster-related social work practice (Hay & Pascoe, 2021), this study further investigated how three types of social support, namely, emotional, financial, and instrumental support, moderated the above age differences.

Literature Review

Age differences in disaster preparedness: A life course perspective

According to the life course perspective, life course is the interweave of age-related trajectories, and early life experiences can influence the events and choices in later years (Elder & Johnson, 2003). When applied in disaster contexts, this perspective allows us to examine individuals' disaster experience within the context of their life stage, memories, values, and views (Shenk et al., 2009). Three of the six major principles of life course perspective can provide some insights into the age differences in disaster preparedness.

Principle 1: Linkage between early life experiences and later experiences. This principle posits that the historical events at one point of the life journey can significantly influence what happens at later points (Elder, 1994). It is noted that previous life experiences could either positively protect human development in subsequent transitions and events, or negatively put later life course trajectory at risk (Hutchison, 2005), which may explain the complexity of age

differences in disaster preparedness. For example, previous experience can enable older adults to realize the potential consequences of disasters and effectiveness of precautionary actions, which could motivate them to get better prepared (Tuohy et al., 2014). In contrast, older adults who lived through more previous disasters may believe that they can survive a disaster again without injury or household damage (i.e., optimism bias) and are therefore less likely to prepare than their younger counterparts (Heller et al., 2005).

Principle 2: Timing of lives. Social roles, behaviors, life transitions, and events should be examined based on their timing in an individual's life course (Elder, 1994). People at the stage of late adulthood have several age-related differences from younger adults. For instance, older adults often perceive a higher level of responsibility and a stronger sense of independence, so they tend to take preparatory actions to avoid being a burden on others during future disasters (Tuohy & Stephens, 2016; Tuohy et al., 2015). However, older people could have limited ability to prepare because of age-specific vulnerabilities in health and functioning (Dostal, 2015) and a lack of necessary resources to get prepared (Gershon et al., 2017). In addition, social roles and responsibilities vary across the adult life span, which can further affect human behaviors in disaster contexts (Adams et al., 2011).

Principle 3: Linked or interdependent lives. Individuals' lives are interdependent with family, friends, coworkers across the life span and these social relationships can regulate and support human behaviors (Elder, 1994). Such an interdependence is important in coping with disasters. People at different life stages often have different sizes of social networks, varied needs for social support, and different preferences for social relationships, which may affect their perceptions and behaviors of disaster preparedness.

Age differences in COVID-19 preparedness

COVID-19 preparedness includes some precautionary measures that help prevent the spread of COVID-19 and respond to pandemic-related consequences. In line with previous disaster research, older adults are generally more likely to engage in preventive behaviors against COVID-19 than younger adults, such as hand hygiene, social distancing measures, avoiding touching the eyes, nose and mouth (Machida et al., 2020; Varghese et al., 2021). From the life course perspective, such age-related advantages may be because older adults perceive higher risk of negative COVID-19 outcomes and consequences (Kim & Crimmins, 2020b), their life experience allow them to accumulate preparedness knowledge and obtain information from reliable sources (Pearman et al., 2021), and social roles in late adulthood protect them from some barriers to getting prepared (e.g., employment, multiple challenges) (Keyworth et al., 2021). However, some studies have suggested that older adults are less likely to take certain protective measures than younger people, such as wearing a mask and storing medical supplies (Barber & Kim, 2021; Kim & Crimmins, 2020a), which demonstrates a diversity of preparedness behaviors within older populations and calls for a measure of overall COVID-19 preparedness level. Furthermore, unlike rapid-onset disasters with a clear end, COVID-19 has been ongoing for nearly three years and thus forced individuals to continuously cope with the COVID-19 threats and risks. Nevertheless, existing studies have mainly examined preparedness during the early phase of COVID-19, with limited research on age differences in preparing for the continuation of the global pandemic.

Social support and disaster preparedness

Social support refers to the support that individuals receive through their social relationships with other individuals, groups, and the larger community (Lin et al., 1979). It consists of different dimensions, such as emotional support (the expression of caring and positive affect),

financial support (the provision of financial aid or advice), and instrumental support (tangible support or behavior assistance), with sources of informal systems (e.g., family members) and formal groups (e.g., local government) (Hwang et al., 2009). Social support plays a key role in various phases of disaster management (Heid et al., 2017), and it is also an essential resource for social workers engaged in disaster work (Hay & Pascoe, 2021).

Existing studies have identified the significant influence of social support in elevating preparedness level. For example, Strine et al. (2013) found that individuals who reported adequate social and emotional support were more likely to prepare food and prescription medications than those with inadequate social and emotional support. Kim and Kim (2020) also suggested that greater social support was associated with more preventive behaviors against COVID-19, such as wearing a mask and performing social distancing. Such a positive impact may primarily result from the exchange of resources within social support networks (Kim & Zakour, 2017). To be specific, receiving different types of social support means that individuals are in contact with and influenced by their social networks, which can facilitate information flow that reiterates the potential risk of disasters, the need for and effectiveness of preparedness, and how to get prepared (Gargano et al., 2015; Hausman et al., 2007). In addition, the materials provided by social support networks could also help people build emergency kit and develop plans for future disasters (Karunarathne & Lee, 2020).

However, some studies have suggested that social support is not a significant predictor to disaster preparedness. For instance, Heller et al. (2005) found that receiving instrumental and emotional support were not significantly correlated with perceived preparedness or actual preparedness steps taken for an earthquake. Lee and You (2020) also reported that receiving support while in isolation was not associated with precautionary behaviors in response to

COVID-19. As mentioned earlier, social networks can facilitate the sharing of disaster-related information and materials; Nevertheless, the quality of these resources is not always reliable and social relationships can have conflicting views on disaster preparedness (Messias et al., 2012). Especially in the case of COVID-19 pandemic, individuals' social support networks are full of competing attitudes toward some preventive measures (e.g., wearing a mask, vaccination), which is even linked to political divide in the United States. Based on previous disaster research and the specific context of the pandemic, a tentative hypothesis will be developed to test the real relationship between social support and preparedness for the continuation of COVID-19.

Social support at different age stages

At the stage of late adulthood, people are often more suspectable to disasters due to age-related vulnerabilities including declined physical health and functional capacity, fixed financial resources, and shrinking social networks (World Health Organization, 2008). Social support can counteract these vulnerabilities by assisting in preparedness activities that many older adults would like to do but cannot (e.g., shift heavy items), providing access to economic resources, and sharing information and knowledge that some isolated older adults are not familiar with (Howard et al., 2018; Meyer, 2017; Tuohy et al., 2015). Accordingly, older people tend to rely more on social support than their younger counterparts in buffering against vulnerability and promoting disaster preparedness and resilience (Heid et al., 2017).

In addition, older adults' emotional closeness to a reliable network of supportive contacts may be another reason for their elevated preparedness when receiving social support. According to the socioemotional selectivity theory, as people age, they often perceive future time as constrained and have increased preference for emotionally meaningful goals and close relationships (Carstensen, 1995). As a result, older adults are more likely to maintain high-

quality relationships than their younger counterparts and cherish the support from these relationships in disaster contexts. For example, it is suggested that older adults prefer to identify high-quality social relationships (e.g., family, friends) as their emergency support resources, which could increase older adults' confidence in response to disasters and thus contribute to a higher level of perceived preparedness (Ashida et al., 2017; Brockie & Miller, 2017). Moreover, social support can improve the emotional well-being of older adults and motivate them to get prepared, as reported by Cheng and Lo (2022) that family/peer support may help older persons alleviate distress during the COVID-19 pandemic and promote caring about the health of others and themselves, ultimately leading to more preventive behaviors.

Hypotheses

Based on the above discussions, three hypotheses were developed:

Hypothesis 1: Compared to people aged 65+, those aged 18-44 and aged 45-64 perceive a lower level of preparedness for the continuation of COVID-19 pandemic.

Hypothesis 2: Receiving social support increases individuals' perceived preparedness for the ongoing COVID-19 pandemic.

Hypothesis 3: Receiving social support is more important for individuals aged 65+ in perceiving a higher level of COVID-19 preparedness than for those aged 18-44 and 45-64.

Methods

Data source and study sample

The data used came from a sample of tornado victims in Dallas County, Texas, U.S., as a part of the research project "Vulnerability and Resilience to Disasters" conducted from October 2020 to January 2021. Address-based random sampling was adopted and about 25,000 addresses were chosen from selected zip codes affected by the Dallas tornado of October 2019. The recruiting

mails were sent to the selected addresses, with options to participate the study via online platform, mail-in-survey, and telephone interview platform. Participants were asked about their experiences with the Dallas tornado and COVID-19 pandemic. Since the planned missing design was adopted to avoid overburdening respondents which conforms to the assumption of missing completely at random, the missing data were handled by using listwise deletion (Little & Rhemtulla, 2013). All study protocols were approved by the authors' university Institutional Review Board. Among the 792 adults recruited in this survey, 521 respondents randomly received the COVID-19-related questions and 489 of them reported valid answers regarding perceived preparedness for the continuation of COVID-19. Thirty-nine respondents with missing values in analytical variables were further excluded, so the working sample consisted of 450 adults. The variable of income contributed to the major missingness of 6.34%.

Measurement

Dependent variable

Participants' perceived preparedness for the continuation of COVID-19 was measured by the question "what is your current level of preparedness for the continuation of COVID-19?" and the answer was ranged on a 5-point Likert scale from 1 = none, 2 = low, 3 = moderate, 4 = high, to 5 = very high. Higher score means a better level of perceived preparedness.

Independent variable

Age was coded as 0 = "65 years or older" (older adults, reference), 1 = "18-44 years old" (younger adults), 2 = "45-64 years old" (middle-aged adults).

Moderators

Moderators included three types of social support. Emotional support was obtained from the question "Did you receive any COVID-19-related emotional support from the following

entities?" The list of entities included parents, adult children, extended family/relatives, friends, community, religious institutions/organizations, charity, other non-profit agencies/local organizations/volunteers, government agencies, insurance, and others. If respondents reported receiving emotional support from any of those 11 entities, they were deemed to have received emotional support; If not, they were considered to have not received emotional support (0 = no, 1 = yes). Similarly, financial support and instrumental support were both binary variables (0 = no, 1 = yes).

Control variables

Control variables included participants' gender, race, educational level, marital status, income, risk perception, perceived preparedness level before COVID-19, and transportation and information barriers. Gender was a binary variable (0 = male, 1 = female). Race was coded as 0 = "others" and 1 = "white". Educational level was measured as 0 = "some college or below" (reference), 1 = "undergraduate degree", and 2 = "graduate or professional degree". Marital status was a dichotomous variable (0 = non-married, 1 = married). Income was an ordinal variable from 1 = "$49,999 or below" to 5 = "$150,000 or above". Risk perception was measured by asking "How likely do you think it is that you will experience another pandemic like COVID-19 in the future?" from 1 = "very unlikely" to 5 = "very likely". Participants were asked about their perceived preparedness level for an epidemic before COVID-19 outbreak on a 5-point Likert scale from 1 = "none" to 5 = "very high". They were also asked to rate their difficulties in disrupted transportation and inadequate information from authorities due to COVID-19 from 1 = "none" to 5 = "extreme".

Data Analyses

First, univariate analyses were used to describe participants' perceived preparedness for the ongoing COVID-19, age, three forms of social support, and all control variables. Second, multiple linear regressions with four models were performed. Model 1 included the key variables and control variables. The two-way interaction between age and emotional support was added in Model 2. Likewise, the interactions between age and financial support as well as between age and instrumental support were included in Model 3 and Model 4 respectively. All analyses were conducted using Stata 15.

Results

Table 1 detailed the sample characteristics. Participants had a moderate level of perceived preparedness for the ongoing COVID-19 (M = 3.51, SD = 0.92). 18-44 age group accounted for 53.11%, followed by the 45-64 age group (25.11%) and 65 or older group (21.78%). More than half of the sample received pandemic-related emotional support (53.78%) and financial support (50.22%), and only 16.22% of the sample received instrumental support during COVID-19.

[Insert Table 1]

Results of multiple linear regressions were presented in Table 2. Model 1 aimed to examine the age differences in perceived preparedness for the continuation of COVID-19 (Hypothesis 1) and the impact of social support on COVID-19 preparedness (Hypothesis 2). Results showed that people aged 18-44 perceived a lower level of pandemic-related preparedness than those aged 65 or over (B = -0.31, p < .01); and there was no significant difference in perceived preparedness between individuals aged 65+ and those aged 45-64. None of the three types of social support was a significant predictor to perceived preparedness for the ongoing COVID-19.

[Insert Table 2]

The interactions between three types of social support and age were separately added in Model 2-4 to examine the moderating effect of social support (Hypothesis 3). In Model 2, the interactions between young age (18-44) and emotional support (B = -0.41, $p < .05$) and between middle age (45-64) and emotional support (B = -0.50, $p < .05$) were significant, indicating that emotional support was more important for people aged 65+ in preparing for COVID-19 than for those aged 18-44 and 45-64. As illustrated in Figure 1, individuals aged 65+ who received emotional support perceived a higher level of preparedness for the ongoing COVID-19 than those who did not, whereas people aged 18-44 had little change in perceived preparedness and those aged 45-64 even perceived a worse level of preparedness when receiving emotional support. The interaction between financial support and age was included in Model 3 and it did not reach statistical significance. Results of Model 4 showed that the impact of instrumental support on perceived COVID-19 preparedness was more prominent for people aged 65+ than for those aged 18-44 (B = -0.80, $p < .05$) and those aged 45-64 (B = -1.35, $p < .01$), which was illustrated in Figure 2.

[Insert Figure 1]

[Insert Figure 2]

Discussion

Using the regional data collected in Texas, United Stated, this study examined the age differences in perceived preparedness for the continuation of COVID-19 from the life course perspective. In addition, the influences of three types of social support (i.e., emotional, financial, instrumental support) on individuals' perception of COVID-19 preparedness and how they affected the age differences in preparing for the ongoing pandemic were investigated.

Hypothesis 1 was partially supported. Individuals aged 18-44 perceived a lower level of preparedness than those aged 65+, but there was no significant difference between people aged 65+ and those aged 45-64 in preparedness level. Following the life course perspective, older adults often have more disaster-related experiences and a higher sense of independence than younger people, which allow them to understand the potential risks and the usefulness of preparedness (Shenk et al., 2009; Tuohy et al., 2014) and to independently take preparatory actions by following public preparedness guidelines (Tuohy & Stephens, 2016; Tuohy et al., 2015). Especially in the context of COVID-19 pandemic, older adults tend to perceive a higher risk of COVID-19 than younger people and therefore see a greater need for long-term adherence to recommended preventive behaviors as the pandemic progresses (Kim & Crimmins, 2020b). Consistent with some prior studies, there was no significant difference between older and middle-aged adults in COVID-19 preparedness (Khalesi et al., 2021; Urbán et al., 2021). Middle-aged adults are usually in the "sandwich generation" when they face multiple responsibilities, such as working and caring for children and parents simultaneously. As a result, even though middle-aged adults have fewer life experiences than older people, they are driven by their social roles and relevant responsibilities to take precautionary actions to avoid the adverse impact of disasters on family and the stress of failed disaster recovery (Adams et al., 2011; Bechard et al., 2021). This finding supports that social roles and human behaviors should be examined based on their timing in individuals' life course (Elder, 1994).

Hypothesis 2 was not supported because none of the three types of social support was significantly associated with perceived preparedness for the ongoing COVID-19. Social networks can provide individuals with preparedness-related resources and behavior assistance, but these supports are not always high-quality or less than expected especially in the time of

pandemic when social interactions are strictly limited. In addition, social support systems can express conflicting opinions about disaster preparedness (Messias et al., 2012). COVID-19 pandemic has deepened the long-standing divides in the United States, most of which is political but also based on education, class, and geography (Fairchild et al., 2020). Different from those inclined to support Democrats, Republicans frequently disseminate information about the low risk of COVID-19, distrust of medical scientists, and no need to take preventive measures (de Bruin et al., 2020; Funk & Tyson, 2020). Dallas County, where the data for this study were collected, is a Democratic stronghold and does not match the overall political climate of Republican-dominated Texas (CNN, 2020). As a result, residents in Dallas County are expected to receive a flood of competing information/advice regarding COVID-19 preparedness from informal and formal support systems across the state and are therefore uncertain about preventive measures, which might explain the insignificant effect of social support in the present study. Since the working sample is geographically restricted, more research is needed to further explore the relationship between social support and COVID-19 preparedness based on representative samples.

Hypothesis 3 was supported for emotional and instrumental support, but not for financial support. As shown in Figure 1 and Figure 2, individuals aged 65+ who received emotional and instrumental support perceived a higher level of preparedness for the ongoing pandemic than those who did not, whereas those aged 18-44 and 45-64 did not report such an increase in perceived preparedness when receiving these two types of social support. According to the life course perspective, people in late adulthood are more likely to experience age-related declines in health and functioning than younger and middle-aged adults (World Health Organization, 2008), and instrumental support that helps people through behavior assistance may counteract those

vulnerabilities and become more important for older adults to get prepared for disasters (Meyer, 2017; Tuohy et al., 2015). As suggested by the socioemotional selectivity theory, older persons are more likely to prioritize emotion-related matters (e.g., emotional quality, intimate relationship) than their younger counterparts (Carstensen, 1995). Accordingly, emotional support that expresses caring and concern may significantly promote the emotional well-being of older adults in response to disasters and motivate them to get better prepared (Cheng & Lo, 2022). In our data, respondents received emotional and instrumental support mainly from family members and friends and were more satisfied with both types of social support; In contrast, financial support was primarily provided by government agencies with a lower level of satisfaction (See supplementary analysis 1). Different from the emotional and instrumental support provided by trusted intimate relationships, older adults may not perceive the financial support from unfamiliar organizations as reliable emergency preparedness resources (Ashida et al., 2017; Brockie & Miller, 2017). Interestingly, people aged 45-64 reported a worse preparedness level when receiving social support in this study. This finding might be because middle-aged adults tend to use the received support to cope with non-pandemic stressors (e.g., dual care responsibilities) (Bechard et al., 2021) and are unable to care for individual disaster preparedness as the pandemic progresses over the years.

Limitations

First, the data used in this study are geographically restricted and contextualized by multiple disasters, which may limit the generalizability of the findings. Dallas County is a densely populated area and a Democrats stronghold in Republican-dominant Texas, and these characteristics may affect residents' perception of COVID-19 risk and lead to competing attitudes towards preventive behaviors within social support networks. Besides, the participants

in this study have experienced a multiple disaster scenario, i.e., the Dallas tornado of October 2019 and COVID-19 pandemic beginning in early 2020. Supplementary analysis showed that the majority of the working sample were less affected by the Dallas tornado and had fully recovered (See supplementary analysis 2), but previous disaster exposure might more or less affect the perceptions of subsequent preparedness. Second, the difference between young-old (aged 65-74) and old-old adults (aged 75 or older) were not examined because the small sample size of old-old adults (N = 26) could affect relevant statistical power. A sensitivity analysis with more detailed age categories showed that there was no significant difference between people aged 65-74 and those aged 75+ in perceived preparedness and the model fit also decreased (See supplementary analysis 3). As life expectancy increases, the broad term "older adults" may not adequately reflect the different life stages of late adulthood. Older adults with an advanced age often have poorer health and limited resources than young-old adults and thus report more barriers to preparing for disasters (Cong et al., 2021). Future studies may consider testing the hypotheses in this study based on representative samples and examining the heterogeneity among older adults in preparing for persistent public health disasters.

Implications for disaster social work

During the COVID-19 pandemic, older adults are frequently described as a vulnerable group and a burden to society due to their high risk for COVID-19 severe illness and mortality (Cohn-Schwartz & Ayalon, 2021), with their strengths in disaster management overlooked. This study highlighted the age differences in COVID-19 preparedness and the unique advantages of older adults, which can provide some implications for social work clinicians and managers in combating the ageist portrayals of aging population and developing age-specific preparedness interventions in the context of public health disaster. First, instead of pathologizing older persons

and excluding them from disaster planning, social workers should appreciate the resources and assets that older adults obtain from life experience and actively incorporate their important lessons and wisdom into disaster preparedness (Kusmaul et al., 2018). For example, social workers can organize community COVID-19 prevention campaigns and invite older adults to share their life experience, knowledge, and coping strategies regarding disaster preparedness with community members, which may contribute to community preparedness and inclusion, combat the prevailing "vulnerability" discourse about older people, and strengthen older persons' social relationships (Tuohy et al., 2014). Second, social workers should pay more attention to younger adults who generally consider themselves at low risk and are reluctant to prepare for public health disasters. In addition to providing public education and preparedness supplies, social workers may consider developing intergenerational programs that link younger and older adults together, which allow younger people to learn from older adults about preparedness, improve younger adults' attitudes toward aging, and enhance older persons' social connectedness (Xu et al., 2022).

The findings also underscored the importance of social support networks in response to the COVID-19 crisis, which can be incorporated in social work practice to promote disaster preparedness especially for older adults. For instance, social workers who work with frail older adults in the community can link emotional and behavioral assistance to those older clients and assist them to create customized preparedness plans. Moreover, some specific training modules, such as developing personal emergency support networks and discussing preparatory activities with social relationships, can be designed in disaster preparedness programs (Ashida et al., 2017; Eisenman et al., 2009). It is emphasized that all of the above social work services are based on the safety of practitioners and clients in the time of public health disasters, which requires social

service agencies to adopt relevant policies and adaptations, such as allowing flexible working practices and adherence to preventive measures (Henley et al., 2021).

Conclusion

This study suggested that individuals aged 65+ perceived a higher level of preparedness for the ongoing COVID-19 pandemic than those aged 18-44, and emotional and instrumental support were respectively more important for people aged 65+ to get prepared than for those aged 18-44 and 45-64. These findings highlighted the unique strengths of older adults in preparing for public health disasters and the importance of social support in promoting preparedness among aging populations, which can be explained following the life course perspective and socioemotional selectivity theory. Based on these findings, disaster social workers can develop age-responsible interventions to promote preparedness and counter the ageist discourse about older adults in the continuation of COVID-19 pandemic and future public health disasters.

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Table 1 Sample characteristics (N = 450)

Variables	*N*	Percentage	Mean (*SD* [a])	Range
Perceived preparedness for ongoing COVID-19			3.51 (0.92)	1-5
Age				
18-44	239	53.11%		
45-64	113	25.11%		
65 or older	98	21.78%		
Emotional support				
No	208	46.22%		
Yes	242	53.78%		
Financial support				
No	224	49.78%		
Yes	226	50.22%		
Instrumental support				
No	377	83.78%		
Yes	73	16.22%		
Gender				
Male	186	41.33%		
Female	264	58.67%		
Race				
Other races	139	30.89%		
White	311	69.11%		
Educational level				
Some college or below	141	31.33%		
Undergraduate degree	154	34.22%		
Graduate or professional degree	155	34.44%		
Marital status				
Non-married	239	53.11%		
Married	211	46.89%		
Income				
$49,999 or below	110	24.44%		
$50,000 - $74,999	94	20.89%		
$75,000 - $99,999	77	17.11%		
$100,000 - $149,999	68	15.11%		
$150,000 or above	101	22.44%		
Risk perception			3.46 (1.20)	1-5
Perceived preparedness before COVID-19			1.91 (1.05)	1-5
Disrupted transportation			1.67 (1.12)	1-5
Inadequate information			2.48 (1.31)	1-5

[a] *SD*, standard deviation

Table 2 Multiple linear regression with moderators (*N* = 450)

Variables	Model 1		Model 2		Model 3		Model 4	
	B	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Age (*ref* = 65 or older) [a]								
18-44	-0.31**	0.11	-0.08	0.16	-0.23	0.14	-0.26*	0.11
45-64	-0.06	0.12	0.20	0.17	0.08	0.16	0.05	0.12
Emotional support (*ref* = no)	0.08	0.09	0.41*	0.17	0.07	0.09	0.07	0.09
Financial support (*ref* = no)	-0.05	0.09	-0.04	0.09	0.16	0.18	-0.05	0.09
Instrumental support (*ref* = no)	0.13	0.12	0.15	0.12	0.14	0.12	0.94**	0.33
Female (*ref* = male)	0.13	0.08	0.13	0.08	0.14	0.08	0.12	0.08
White (*ref* = other races)	0.05	0.09	0.05	0.09	0.06	0.09	0.04	0.09
Educational level (*ref* = some college or below)								
Undergraduate degree	-0.25*	0.10	-0.24*	0.10	-0.24*	0.10	-0.23*	0.10
Graduate or professional degree	-0.12	0.11	-0.10	0.11	-0.10	0.11	-0.14	0.11
Married (*ref* = non-married)	-0.16	0.09	-0.17	0.09	-0.16	0.09	-0.16	0.09
Income	0.06	0.03	0.06	0.03	0.06	0.03	0.07*	0.03
Risk perception	0.05	0.03	0.04	0.03	0.05	0.03	0.05	0.03
Perceived preparedness before COVID-19	0.31***	0.04	0.31***	0.04	0.31***	0.04	0.31***	0.04
Disrupted transportation	-0.06	0.04	-0.07	0.04	-0.06	0.04	-0.06	0.04
Inadequate information	-0.07*	0.03	-0.07*	0.03	-0.06*	0.03	-0.06*	0.03
Emotional support x 65 or older								
18-44			-0.41*	0.20				
45-64			-0.50*	0.23				
Financial support x 65 or older								
18-44					-0.22	0.21		
45-64					-0.35	0.24		
Instrumental support x 65 or older								
18-44							-0.80*	0.35
45-64							-1.35**	0.42
Model fit								
F statistics	7.16		6.69		6.45		7.06	

Degrees of freedom	15, 434	17, 432	17, 432	17, 432
p-value	< .001	< .001	< .001	< .001
Adjusted R-squared	17.07%	17.71%	17.10%	18.66%

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

[a] The reference categories are in paratheses

Figure 1 Perceived preparedness level for the ongoing COVID-19 among people of different age groups by receiving emotional support or not

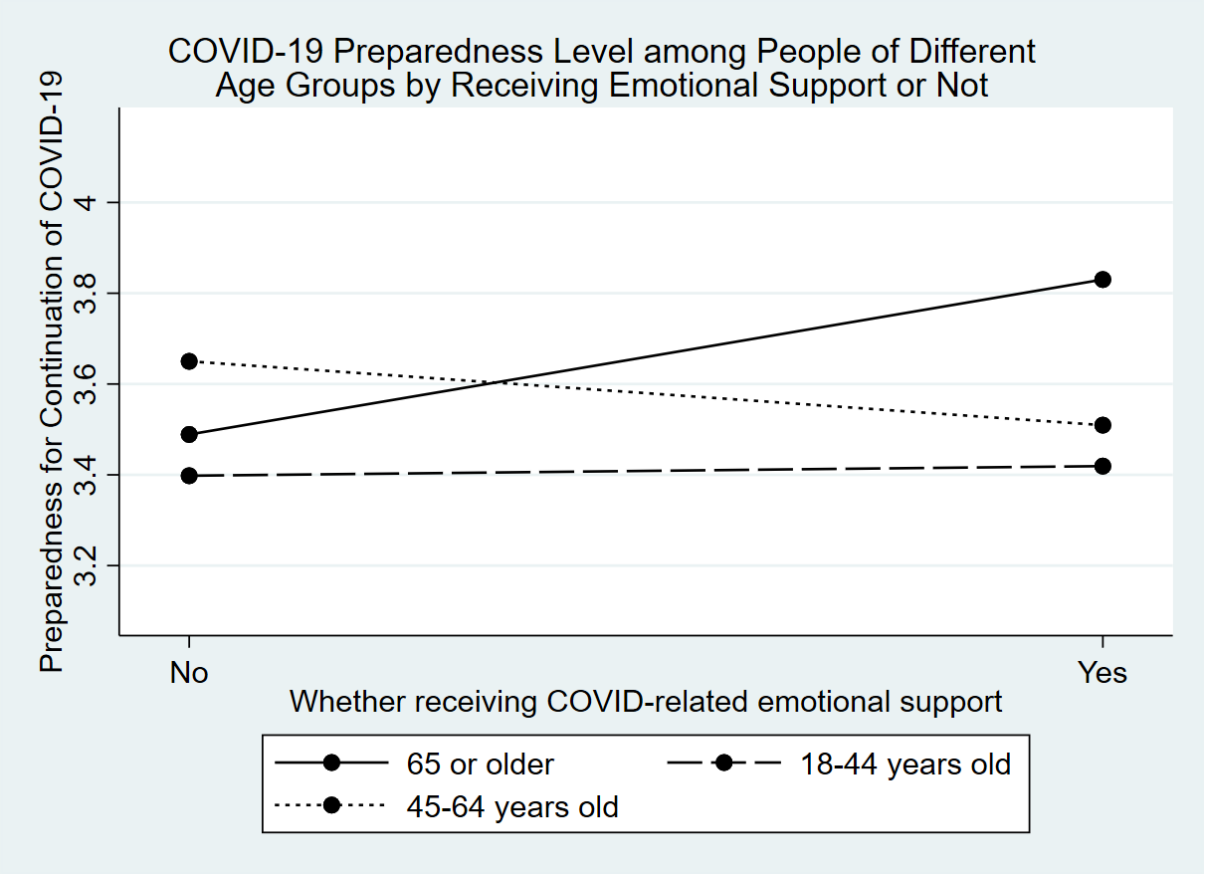
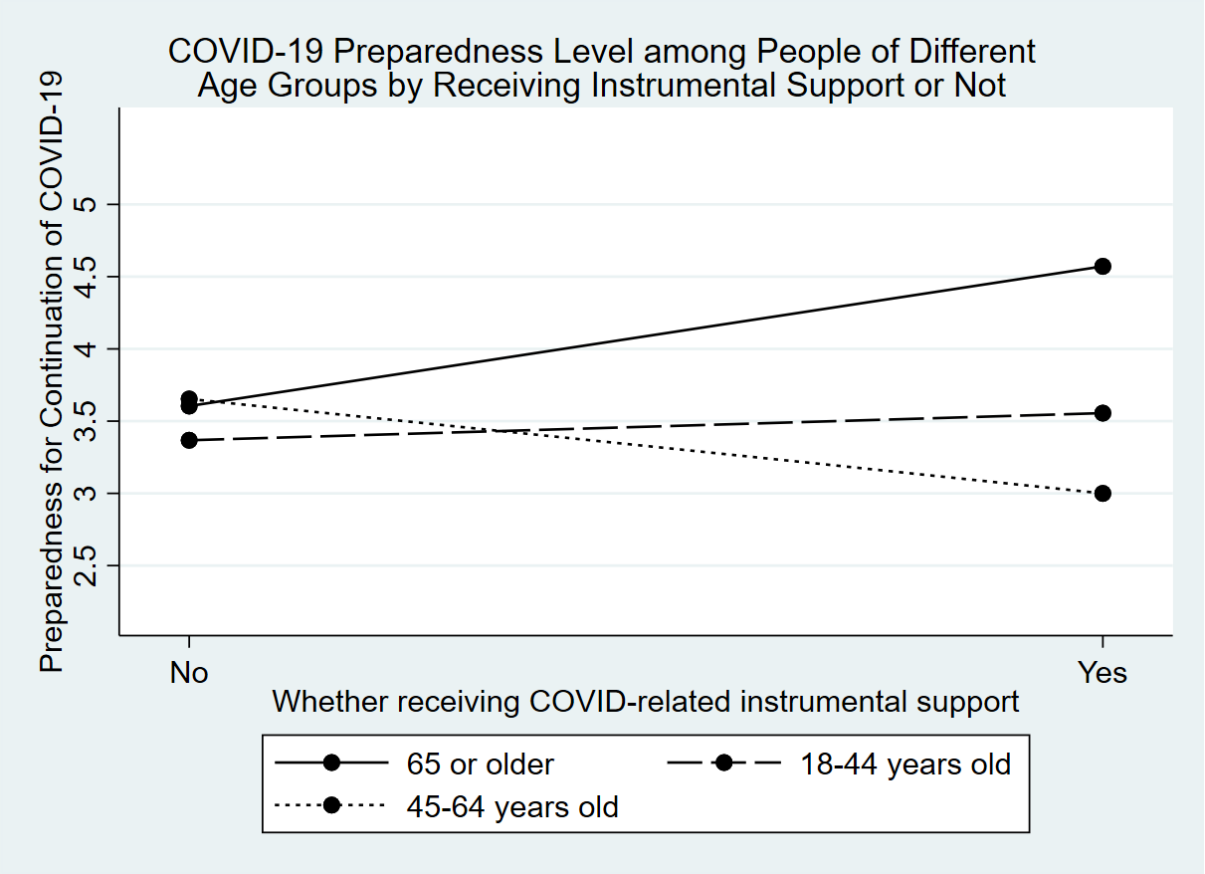


Figure 2 Perceived preparedness level for the ongoing COVID-19 among people of different age groups by receiving instrumental support or not



Supplementary analysis 1 Sources and satisfaction of three types of social support (*N* = 450)

	Emotional support	Instrumental support	Financial support
N of the sample who received the specific social support	242	73	226
N of the sample who received support from following sources [a]:			
Parents	112	36	50
Adult children	65	12	5
Extended family/relatives	89	10	19
Friends	169	20	17
Community	44	11	6
Religious institutions/organizations	66	10	8
Charity	0	1	5
Other non-profit agencies/local organizations/volunteers	7	3	6
Government agencies	5	6	175
Insurance	2	2	7
Other entities	19	4	7
Satisfaction score (mean ± *SD* [b])	3.98 ± 0.94	3.62 ± 1.06	3.08 ± 1.23

[a] Respondents can report multiple sources

[b] *SD*, standard deviation

Supplementary analysis 2 Impact assessment of Dallas tornado (*N* = 450)

	N	Percentage
Home damage		
None	279	62.00%
Minor	104	23.11%
Moderate	58	12.89%
Severe	9	2.00%
Destruction	0	0%
Financial loss		
No loss	295	65.56%
A little bit	85	18.89%
Some	56	12.44%
A lot	14	3.11%
All you had	0	0%
Injury		
No	446	99.11%
Yes	4	0.89%
Recovery level		
No recovery at all	22	4.89%
Recovered a little bit	20	4.44%
Moderately recovered	72	16.00%
Completely recovered	308	68.44%
Even better than before the tornado	28	6.22%

Supplementary analysis 3 Sensitivity analysis for heterogeneity of older adults (*N* = 450)

Variables	Model 1	Model 2	Model 3	Model 4
	B	*B*	*B*	*B*
Age (*ref* = 65-74) [a]				
18-44	-0.29*	-0.09	-0.16	-0.28*
45-64	-0.05	0.19	0.15	0.03
75+	0.06	-0.02	0.25	-0.07
Emotional support (*ref* = no)	0.07	0.41*	0.08	0.07
Financial support (*ref* = no)	-0.04	-0.04	0.30	-0.05
Instrumental support (*ref* = no)	0.13	0.15	0.14	0.75
Female (*ref* = male)	0.14	0.13	0.14	0.12
White (*ref* = other races)	0.05	0.05	0.06	0.04
Educational level (*ref* = some college or below)				
Undergraduate degree	-0.24*	-0.24*	-0.24*	-0.23*
Graduate or professional degree	-0.12	-0.10	-0.11	-0.14
Married (*ref* = non-married)	-0.16	-0.17	-0.17	-0.16
Income	0.06	0.06	0.06	0.06*
Risk perception	0.05	0.04	0.05	0.05
Perceived preparedness before COVID-19	0.31***	0.31***	0.31***	0.31***
Disrupted transportation	-0.06	-0.07	-0.06	-0.06
Inadequate information	-0.07*	-0.07*	-0.07*	-0.06*
Emotional support x 65-74				
18-44		-0.40		
45-64		-0.49		
75+		0.03		
Financial support x 65-74				
18-44			-0.36	
45-64			-0.49	
75+			-0.56	
Instrumental support x 65-74				
18-44				-0.61
45-64				-1.16*
75+				0.37
Model fit				
F statistics	6.70	5.96	5.87	6.31
Degrees of freedom	16, 433	19, 430	19, 430	19, 430
p-value	< .001	< .001	< .001	< .001
Adjusted R-squared	16.89%	17.33%	17.09%	18.34%

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

[a] The reference categories are in paratheses

Chapter 3: Age differences in experiencing negative impacts of the COVID-19 pandemic: A latent class analysis

Abstract

This study examined the latent classes of negative COVID-19 impacts across multiple domains, the age differences in identified class membership, and how the impact of COVID-19 on social relationships moderated such age differences. Data used were from the cross-sectional surveys conducted from October 2020 to August 2021 in Texas, Tennessee, and Alabama, USA. Latent class analysis and multinomial logistic regression were performed based on a sample of 1,080 adults. Three latent classes were identified: class 1 "low overall impacts", class 2 "moderate overall impacts with high emotional distress", and class 3 "severe overall impacts". Compared to those aged 65-74, people aged 18-34, 35-49, 50-64 had higher odds of being in class 3 versus class 1. Individuals whose relationship with community had been positively influenced by COVID-19 had lower odds of being in class 2 over class 1, and those whose relationship with family had been positively impacted by COVID-19 had lower odds of being in class 3 versus class 1. Positive COVID-19 influence on relationships with friends/colleagues and community were respectively more important for those aged 65 to 74 than for those aged 75+ in lowering the likelihood of being in class 3 over class 1. Results highlighted the strengths and heterogeneity of older adults and the importance of social relationships during the prolonged disaster response phase of the COVID-19 pandemic.

Keywords: COVID-19 impacts, older adults, life course perspective, social relationships, latent class analysis

1. Introduction

The COVID-19 pandemic has resulted in an unprecedented disaster to human society and become a global health, economic, and social crisis that affects our everyday life (Abrams & Szefler, 2020). In order to reduce COVID-19 transmission in the community, extraordinary measures have been taken or deployed by individuals, organizations, and governments, such as lockdowns, social distancing, closing of businesses and other public settings. Nevertheless, these restrictions can inadvertently affect people's livelihoods and security, access to medical services, to food, water, work, as well as family life (United Nations, 2020). Consequently, the COVID-19 pandemic not only affects individuals' physical health but also causes a plethora of problems with mental health, finances, employment, transportation, health care, housing, Internet access, etc. (Harvard T.H. Chan School of Public Health, 2020). Such multidimensional impacts make the COVID-19 pandemic a distinct public health disaster and present unique challenges for disaster response.

Another striking feature of the pandemic is its disproportionate impact on older adults. Older adults are more likely to get very sick from COVID-19 than their younger counterparts; and the COVID-19 mortality rate exponentially increases for persons aged 65-74, 75-84, and 85 or older (Centers for Disease Control and Prevention, 2022). Since most precautions are implemented based on how to best protect older people from pandemic-related consequences, older adults tend to be viewed as a homogenously vulnerable group and a burden to society during the COVID-19 pandemic (Cohn-Schwartz & Ayalon, 2021). Despite the old-age vulnerabilities in physical health, older people typically gain wisdom and coping strategies from previous life experience to avoid or reduce experiencing a range of negative impacts during the disaster response process (Tuohy & Stephens, 2012). Failure to shift from a single-dimensional

emphasis on older adults' health vulnerability to their strengths in multidimensional COVID-19 experiences will contribute to the ageist portrayals of older adults and exclude their important lessons from the prolonged COVID-19 response phase.

Using latent class analysis, this study explored the underlying typologies of multiple COVID-19 impacts in economic, health, social, and emotional domains. Following the life course perspective, the study further investigated how older adults differed from people of other age groups in those typologies. Given the profound impacts of COVID-19 pandemic on social relationships that are important social capital in helping people respond to disasters, this study also examined how the COVID-19 influence on the relationships with family, friends/colleagues, and community moderated the above age differences, respectively.

1.1. Multiple dimensions of negative COVID-19 impacts

The COVID-19 pandemic has dramatically affected multiple life domains. The extensive lockdowns, mobility restrictions, and other public health measures rapidly produced the largest global economic crisis in more than a century (The World Bank, 2022). During the COVID-19 economic recession, individuals are facing serious financial problems and housing problems (Harvard T.H. Chan School of Public Health, 2020). Moreover, disrupted markets and interrupted supply chains have resulted in a widespread shortage of necessities (Akseer et al., 2020). In the health domain, the COVID-19 pandemic has severely undermined health insurance coverage and exacerbated the existing disparities in healthcare system (Blumenthal et al., 2020). As a result, healthcare utilization has significantly decreased during the pandemic relative to the pre-pandemic period (Moynihan et al., 2021). The outbreak of COVID-19 also presents a range of challenges to social life. For example, global transportation systems have been significantly disrupted and many households have problems with internet connection to do jobs/schoolwork

(Harvard T.H. Chan School of Public Health, 2020). In addition, individuals are often unable to obtain adequate support from social relationships or sufficient information from reliable sources especially in the early phase of the pandemic (Kessel et al., 2021). The COVID-19 impacts in economic, health, and social domains can further contribute to widespread emotional outcomes, such as insecurity, fear, and emotional isolation (Pfefferbaum & North, 2020). To sum, negative COVID-19 impacts have multiple intertwined dimensions, and using either a single indicator or a cumulative score of several indicators does not depict the full dimensions of negative COVID-19 impacts. Latent class analysis can address this limitation by capturing the associations among multiple dimensions and identifying the underlying typologies of negative COVID-19 impacts.

Several prior studies have examined the multiple dimensions of COVID-19 impacts using latent class analysis. Kringle et al. (2022) explored the typologies of COVID-19 impacts among adults with obesity and depressive symptoms and identified three latent classes: class 1 “mental health and sleep impacts”, class 2 “economic impacts”, and class 3 “less overall impacts”. Likewise, Grasso et al. (2021) examined the COVID-19 impacts regarding work life, home life, social activities and isolation, emotional/physical health and infection, and positive change, yielding a more complex pattern of COVID-19 impacts across the life span. Existing literature has also explored the latent classes of positive and negative aspects of experiencing social distancing (Frounfelker et al., 2022), physical and social aspects of behavioral changes in older adults during the pandemic (Abe et al., 2022), and COVID-19 impacts across functioning domains on children with disability (Yusuf et al., 2022). Beyond these studies, we still have a limited understanding of the multidimensional COVID-19 impacts, especially a more comprehensive investigation into economic, health, social, and emotional domains.

1.2. Age differences in experiencing negative COVID-19 impacts

Older and younger adults could have varied experiences in response to the COVID-19 pandemic, and the life course perspective provides a useful framework for studying such age differences. According to the life course perspective, individuals' disaster experiences should be examined within the context of their life stage and previous life experience (Shenk et al., 2009). People in late adulthood often have several age-related differences from those at early life stages. On the one hand, older adults are typically more vulnerable in health and functional conditions and access to necessary resources (e.g., transportation, immediate social support) than their younger counterparts, making them more susceptible to the physical effects of disasters (Shih et al., 2018). On the other hand, older adults tend to have strengths in disaster response phase, including more life experience from which they can obtain disaster-related knowledge and lessons (Tuohy & Stephens, 2012), age-related enhancements in emotion-focused coping strategies (Brockie & Miller, 2017), and fewer challenges due to age-specific social roles and responsibilities (Adams et al., 2011). In addition to the variability between cohort groups, the life course perspective also posits the diversity in life course pathways within cohorts (Hutchison, 2010), suggesting that we should not only highlight the differences between younger and older cohorts, but also examine the heterogeneity among older populations in disaster experiences.

Generally speaking, age differences in experiencing disaster-related impacts is a result of many counterbalancing factors from the life course perspective. In the disaster context of COVID-19 pandemic, the multidimensional impacts may further complicate such age differences. For instance, since people in late adulthood are often in retirement with multiple sources of income, older adults are less likely to be affected by job loss or pay cuts and face fewer financial concerns than their younger counterparts during the pandemic; But employed older adults tend to report income loss and are less likely to earn more money by working

overtime (Horowitz et al., 2021; Li & Mutchler, 2020). In the health domain, the COVID-19 pandemic amplifies the age-related vulnerabilities in physical health, as older adults are disproportionately affected by COVID-19 with respect to severe illness and mortality and have to forgo or postpone non-COVID-19-related healthcare to protect themselves from COVID-19 infection (Jiskrova et al., 2021). Furthermore, older adults may experience increased loneliness and social isolation, lack of necessary resources and services, and marginalization during the COVID-19 pandemic when the need for social connectedness collides with the risk of pandemic infection (Derrer-Merk et al., 2022; Heid et al., 2021). Nevertheless, older people tend to develop mature coping capacity and high coping efficacy from life experience, which allow them to effectively avoid or reduce experiencing stressors during the COVID-19 pandemic (Klaiber et al., 2021). Given the life course perspective and the complexity of age differences in experiencing negative impacts during the COVID-19 response phase, a latent class analysis of a holistic pattern of COVID-19 impacts is needed to address the barriers to a theoretical interpretation of the rich data.

1.3. Social relationships and negative COVID-19 impacts

Social relationships refer to the connections that exist between individuals who have repeated interactions that are perceived by the participants as meaningful, such as relationships with family members, friends, coworkers, and neighbors (August & Rook, 2020). Following a disaster, social relationships can provide victims with financial assistance, physical healthcare, food, drinking water, clothing, shelter, transportation, relief information, and psychological comfort, which could effectively compensate government or NGOs' aid programs and facilitate individuals' response and recovery processes (Consoer & Milman, 2016; Masud-All-Kamal & Monirul Hassan, 2018). It is noteworthy that the relationships with immediate family are

different from the relationships with friends, coworkers, and community in contributing to disaster response (Islam & Walkerden, 2014). To be specific, family members and relatives often play a more important role in providing immediate support that meets individuals' initial and close needs (Hsueh, 2019) and are able to offer more types of support that lasts for a longer period (Islam & Walkerden, 2014). In contrast, the relationships with friends, coworkers, and neighbors are less intense and their major support is gathering and sharing information and resources (Hawkins & Maurer, 2010); but at the community level, residents usually share similar backgrounds and problems, and they also trust community relationships, which may enable community organizations to identify disaster victims quickly, draw out neighborly support, develop linguistically and culturally appropriate services, and ultimately contribute to wider neighborhood and community revitalization (Bhandari, 2014; Consoer & Milman, 2016; Sanyal & Routray, 2016).

The COVID-19 pandemic has resulted in widespread public health restrictions such as shelter-in-place guidelines and social distancing, which directly and greatly alters social relationships in positive or negative ways. For instance, individuals tend to spend more time at home and are able to re(connect) and re(strengthen) their relationships with spouse, children, and other family members (Pitas & Ehmer, 2020). However, due to the extensive closures of offices, schools, and other social gatherings, most interactions with coworkers/friends are shifted to digital platforms and become less common and more difficult (Philpot et al., 2021; Pitas & Ehmer, 2020). Despite the decreased feelings of friendship and loss of weak ties, there is a surge in community-based support due to geographic restrictions (e.g., stay-at-home orders), with increasing neighborly support and stronger sense of community spirit (Long et al., 2022). Given those pandemic-specific impacts on social relationships and the different roles of various social

relationships in disaster response, more detailed investigations are needed to examine how the COVID-19 pandemic contextualizes different social relationships and how such influences further affect individuals' responses to multidimensional COVID-19 impacts.

1.4. Age, social relationships, and negative COVID-19 impacts

Individuals' lives are interdependent with social worlds (e.g., family, friends, coworkers) across the life span and these social relationships can regulate and support human behaviors (Elder, 1994). Following the socioemotional selectivity theory, as people age, they tend to perceive future time as limited and have an increased preference for emotional quality and smaller social networks occupied with close relationships (Carstensen et al., 1999). As a result, older adults generally have smaller social networks but better social relationships than their younger counterparts (Luong et al., 2011); and older persons are also more likely to derive emotional satisfaction and positive support from close social relationships (Schnittker, 2007). Especially in disaster contexts, older adults tend to trust and heavily rely on familiar family, friends, and neighbors to cope with emergencies, gather information, make plans, rebuild, and obtain physical, emotional, and financial support (Brockie & Miller, 2017), and thus these social relationships could be more important in reducing disaster-related negative impacts and promoting positive response for older persons than for younger adults.

During the COVID-19 pandemic, older adults have been found to reinforce the relationships with family and close friends and reconnect people in the local community to receive emotional and instrumental support (Brown & Reid, 2021). Accordingly, older people may have more social capital, experience less reduction in social interactions especially with family or relatives, and attach greater significance to community-based material and financial support relative to their younger counterparts, which could lead to better subjective well-being,

less negative experience related to pandemic impacts, and stronger resilience during the COVID-19 response phase (Chan et al., 2022). However, younger adults whose interactions with a large number of social relationships have been severely disrupted by COVID-19 are often more capable and urgent to connect with those relationships and actively seek support from them through digital technologies (Long et al., 2022); and a nationally representative survey conducted by Pew Research Center reported that younger Americans were more likely to mention positive impacts of COVID-19 on social relationships than older Americans (Kessel et al., 2021). Because relevant research in this area is quite limited, this study generally hypothesizes that the age differences in experiencing negative COVID-19 impacts are contextualized by pandemic-specific influences on social relationships.

1.5. Research purposes

The present study aimed to (1) identify the latent classes of negative COVID-19 impacts across multiple domains; (2) examine the age differences in the identified class membership; (3) investigate the associations between COVID-19 influences on social relationships and the identified class membership; and (4) examine how the influences of COVID-19 on social relationships moderate the age differences in the identified class membership.

2. Methods

2.1. Data source and study sample

This study used the cross-sectional data from the research project "Vulnerability and Resilience to Disasters" conducted in Texas (October 2020 – January 2021), Tennessee (April – May 2021), and Alabama (July – August 2021). This project provides important information to help people respond to disasters through the investigation of participants' experience of recent tornado and the COVID-19 pandemic. In Texas, address-based random sampling was adopted and about

25,000 addresses were chosen from selected zip codes affected by the Dallas tornado of October 2019. Since Tennessee (Nashville-Cookeville) tornado of March 2020 and Alabama tornadoes of March 2021 occurred in relatively population-sparse areas, tornado tracks were identified with approximately 10,000 addresses selected for each event centering on the tornado tracks. The recruiting mails were sent to the selected addresses, with options to participate in the study via online platform, mail-in-survey, and telephone interview platform. This research project was approved by the authors' university Institutional Review Board. Among the 1,496 participants in the surveys, 1,134 provided valid answers about all the 17 items of negative COVID-19 experiences; Texas survey contributed to the major missingness (N = 295) because planned missing data design was used to avoid overburdening respondents (Little & Rhemtulla, 2013). We further excluded 54 respondents with missing values in analytic variables, so the working sample in the present study consisted of 1,080 adults.

2.2. Measures

Indicators of negative COVID-19 impacts

Negative COVID-19 impacts were measured by 17 questions from social, health, economic, and emotional domains. Participants were asked about how much difficulty they had as a result of the COVID-19 pandemic in (1) disrupted working, (2) financial problems, (3) disrupted transportation, (4) internet access and bandwidth problem, (5) loss of health insurance, (6) shortage of food, water, clothing, or other necessities, (7) problems getting needed medicines or medical attention for conditions related to COVID-19, (8) problems getting needed medicines or medical attention for conditions other than COVID-19, (9) crowded or unsanitary living conditions, (10) family arguments, (11) embarrassment or humiliation, (12) fear of crime, (13) inadequate information from the authorities, (14) feeling insecure, (15) feeling vulnerable, (16)

feeling isolated, and (17) insufficient support from social network. The answers were ranged from 0 = “none”, 1 =” a little”, 2 = “some”, 3= “a lot”, to 4 = “extreme”. Because of the skewness of item measures, we combined the answers 1-4 into “have difficulty”. Therefore, 17 dichotomous indicators of negative COVID-19 experiences were created (0 = “no difficulty”, 1 = “have difficulty”).

Independent variable

Age was categorized into five groups: 65-74 (young-old, reference), 18-34 (young age), 35-49 (early middle-age), 50-64 (late middle-age), and 75 years and older (old-old).

Moderators

Moderators included the COVID-19 influences on the relationships with family, friends/colleagues, and community, which were separately measured on a 5-point Likert scale from 1 = “a lot of negative influence”, 2 = “some negative influence”, 3 = “no influence”, 4 = “some positive influence”, to 5 = “a lot of positive influence”. The three moderators were treated as interval variables due to normal distribution.

Covariates

Participants’ gender, race, ethnicity, educational level, marital status, and home damage by tornado were controlled. Gender was a binary variable (0 = “female”, 1 = “male”). Race was a dichotomous variable (0 = “non-White”, 1 = “White”). Ethnicity was measured by asking “Are you of Hispanic, Latino, or Spanish origin?” (0 = “no”, 1 = “yes”). Educational level was categorized into three groups: 0 = “some college or below” (reference), 1 = “undergraduate degree”, and 2 = “graduate or professional degree”. Marital status was a binary variable (0 = “unmarried”, 1 = “married”). Tornado damage to home was a binary variable (0 = “no”, 1 = “yes”).

2.3. Statistical analysis plan

Latent class analysis (LCA) was used to explore the typologies of negative COVID-19 impacts. Different from more traditional variable-based approaches (e.g., factor analysis, multiple regression analysis), LCA is a person-centered strategy to classify the population into various latent classes based on their answers to a set of observed categorical indicators (McCutcheon, 1987). In the present study, LCA was performed using Mplus 8.3 to obtain the fit indices (see details in Table 1). The decision of the optimal number of classes was made based on multiple indices, such as Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), entropy, and Lo-Mendell-Rubin likelihood ratio test. In addition to model fit, model parsimony and substantive interpretation were considered in model selection (Scotto Rosato & Baer, 2012). Second, posterior probabilities of class membership were used to assign the respondents into different classes and bivariate analyses (i.e., χ^2 and ANOVA) were conducted using Stata 15 to compare the differences in sample characteristics between each class. Third, multinomial logistic regressions with four models were performed using the generalized SEM command that fits models with latent classes in Stata 15 (StataCorp, 2021). Model 1 included all the key variables and covariates. The interaction between age and COVID-19 influence on the relationship with family was added in model 2. Similarly, the interactions between age and COVID-19 influence on the relationship with friends/colleagues as well as between age and COVID-19 influence on the relationship with community were included in Model 3 & 4 respectively.

3. Results

3.1. LCA results

Fit indices for different LCA models were presented in Table 1. As the number of classes increased from two to three, the entropy score rose from 0.806 to 0.843. After that, the entropy

score dropped steadily as the number of classes increased from three to five (from 0.843 to 0.815). Since an entropy value closer to 1 indicates a clear delineation of classes (Celeux & Soromenho, 1996), the three-class model exhibited better class separation than other models. The three-class model also demonstrated reasonable class proportions and great interpretability as illustrated in Figure 1. Although the Lo-Mendell-Rubin likelihood ratio test showed that a four-class model had a better fit than a three-class model, the subsequent multinomial logistic regression based on four classes using Stata 15 did not converge, suggesting that a four-class model was less stable. Considering the model parsimony, interpretability, and stability, a three-class model was chosen as the optimal class solution.

The class 1 "low overall impacts" consisted of 39.07% (N = 422) of the sample. Respondents in this group had generally low probabilities of experiencing all the negative COVID-19 impacts compared to the other two classes (range 0.01-0.53, less than 0.30 in most items). The class 2 "moderate overall impacts with high emotional distress" comprised 46.76% (N = 505) of the respondents and was the largest group. This group reported moderate probabilities of most COVID-19 impacts and had a high rate of feeling insecure (0.84), feeling vulnerable (0.93), and feeling isolated (0.92). The class 3 (N = 153, 14.17%) was characterized as "severe overall impacts", which represented the respondents with the highest probabilities of experiencing most COVID-19 impacts relative to the other two classes (range 0.31-0.96, more than 0.70 in most items).

3.2. Comparative characteristics of three latent classes

Table 2 summarized the sample characteristics by latent classes. The three classes varied significantly in almost all demographic factors and COVID-19 influences on the social relationships, but there were no significant differences in ethnicity. The class 1 "low overall

impacts" had the highest proportion of older adults aged over 65 (23.22%). Respondents in this group were more likely to be male, White, married, and those whose homes were not damaged by tornado. Their scores for COVID-19 influences on the family, friends/colleagues, and communities were respectively higher than those of the other two classes, indicating that their social relationships were more positively affected by the pandemic. The "moderate overall impacts with high emotional distress" (class 2) had the highest proportion of middle-aged adults (aged 35-64, 47.53%). Females and those with graduate or professional degree were at higher odds of being in this group. The class 3 "severe overall impacts" was the youngest group with 50.98% of respondents aged 18-34. People in this group were more likely to be non-White, unmarried, with some college degree or below, and those whose homes were damaged by tornado. Compared to respondents in the other two groups, their social relationships with family, friends/colleagues, and community were most negatively impacted by the COVID-19 pandemic.

3.3. Factors associated with class membership

Table 3 showed the results of multinomial logistic regressions with class 1 "low overall impacts" as the reference group. In Model 1, the first set of estimates compared respondents in class 2 "moderate overall impacts with high emotional distress" with those in class 1. There were no significant age differences in the odds of being in class 2 versus class 1. Individuals whose relationship with community had been positively influenced by COVID-19 had lower odds of being in class 2 over class 1 (Odds Ratio (OR) = 0.76, $p < .05$). The second set of estimates in Model 1 compared respondents in class 3 "severe overall impacts" with those in class 1. Compared to those aged 65-74, people aged 18-34 (OR = 5.93, $p < .001$), aged 35-49 (OR = 3.91, $p < .01$), and aged 50-64 (OR = 3.64, $p < .05$) were more likely to be in class 3 versus class 1. There was no significant difference between individuals aged 65-74 and those aged 75+ in the

odds of being in class 3 over class 1. Those whose relationship with family had been positively impacted by COVID-19 had lower odds of being in class 3 versus class 1 (OR = 0.49, $p < .001$). The interaction between age and COVID-19 influence on relationship with family was added in Model 2, which did not reach statistical significance. Model 3 & 4 examined the moderating effects of COVID-19 influences on the relationships with friends/colleagues and community, suggesting that positive COVID-19 influence on relationships with friends/colleagues (OR = 28.72, $p < .05$) and community (OR = 56.48, $p < .05$) were respectively more important for people aged 65-74 than for those aged 75+ in lowering the likelihood of being in class 3 over class 1.

4. Discussion

The COVID-19 pandemic has profoundly affected human life across multiple domains. This study innovatively explored the latent classes of negative COVID-19 impacts and examined the age differences in those identified classes from the life course perspective. Following the socioemotional selectivity theory, the study further investigated how social relationships affected by COVID-19 moderated the forementioned age differences.

In consistent to previous studies (Grasso et al., 2021; Kringle et al., 2022), this study identified the heterogeneity in experiencing negative COVID-19 impacts with three distinct latent classes. 39.07% of the sample belonged to class 1 “low overall impacts”, 46.76% in class 2 “moderate overall impacts with high emotional distress”, and 14.17% in class 3 “severe overall impacts”. Reassuringly, nearly 40% of the sample were less affected by the COVID-19 pandemic and it echoes the fact that many individuals are resilient and able to maintain stable levels of physical, psychological, and social functioning to cope with disastrous events (Bonanno, 2004). It is not surprising that most people were experiencing a moderate level of

COVID-19 impacts with a surge in emotional distress. In the context of COVID-19 pandemic, infection fears, inadequate supplies, unfamiliar home-confinement directives that violate personal liberties, substantial financial losses, and conflicting information from authorities can lead to widespread emotional distress and increased risk for psychiatric disorders (Brooks et al., 2020; Pfefferbaum & North, 2020). These psychological outcomes are more pronounced and longer-lasting than the physical effects of infection and play a key role in determining how individuals cope with pandemic-related stressors, but attention and resources for mental health are often insufficient especially in the acute phase of COVID-19 outbreak, which should be highlighted in the ongoing pandemic and future public health disasters (Taylor, 2022). The findings also revealed that only a small percentage of people were severely affected by COVID-19 pandemic, who were more likely to be younger, non-white, unmarried, and less educated. Interventions and support should focus more on these groups at higher risk for adverse consequences associated with COVID-19.

This study further examined the age differences in identified latent classes. Results showed that compared to those aged 65-74, people aged 18-34, 35-49, and 50-64 were at higher odds of being in "severe overall impacts" class over "low overall impacts" class, which may be because of older people's strengths related to more life experience and social roles in late adulthood (Shenk et al., 2009). According to the life course perspective, older adults can learn important lessons and develop mature coping strategies from previous life experience, which may allow them to avoid or reduce experiencing a range of negative COVID-19 impacts (Klaiber et al., 2021; Tuohy & Stephens, 2012). In addition, the social roles and responsibilities in old age determine that some challenges, including unemployment, family stressors, and frustrations of failed response, are less common among older people relative to younger and middle-aged adults

during the pandemic (Adams et al., 2011; Horowitz et al., 2021; Klaiber et al., 2021). It is noteworthy that no age differences were detected when comparing people in "moderate overall impacts with high emotional distress" class with those in "low overall impacts" class, suggesting that the forementioned age-related strengths may only protect older adults from the severe overall impacts and they could still be moderately affected by the pandemic especially in emotional domain. There was no significant difference between individuals aged 65-74 and those aged 75+ in class membership, which might be because the poorer health and fewer financial resource at very late adulthood counterbalance the strengths of more life experience.

Study findings also indicated the relationships between COVID-19 influence on social relationships and class membership. Individuals whose relationship with family had been positively impacted by COVID-19 had lower odds of being in "severe overall impacts" class, and those whose relationship with community had been positively influenced by COVID-19 had lower odds of being in "moderate overall impacts with high emotional distress" class. As a result of stay-at-home orders, people could spend more time staying at home and strengthen their relationships with close family members (Pitas & Ehmer, 2020). In disaster contexts, family members can provide immediate and multiple support that are very useful on a daily basis (Hsueh, 2019; Islam & Walkerden, 2014), which may enable victims to effectively respond to disasters and protect them from severe overall impacts. Likewise, people tend to reconnect and strengthen their relationship with community during the COVID-19 pandemic due to guidelines that confine them to local areas (Long et al., 2022). Similar backgrounds and problems can bring community members closer to each other and motivate them to participate in neighborly support during disasters; In a tight-knit community, victims and unmet needs can be easily identified and community organizations can independently provide appropriate assistance to help residents

cope with negative impacts (Consoer & Milman, 2016; Sanyal & Routray, 2016). Nevertheless, in contrast to close family ties, the support of community relationships is often limited to gathering and sharing information and resources (Hawkins & Maurer, 2010) and is difficult to sustain well in the long term (Bhandari, 2014), which might be the reasons for their different impacts on class membership. COVID-19 influence on friend/colleagues relationships did not significantly affect class membership in this study. The assistance of friends and coworkers is also limited and unsustainable in disaster contexts, and the widespread closures of offices, schools, and other public spaces during the COVID-19 pandemic may further weaken these relationships and make their support less common and useful (Pitas & Ehmer, 2020).

Finally, this study examined how COVID-19 influence on social relationships affected the age differences in class membership and only found the heterogeneity among older adults, which supports the principle of diversity in life course trajectories within cohorts (Hutchison, 2010). Results showed that the impacts of COVID-19 influence on relationships with friends/colleagues and community in reducing the likelihood of being in "severe overall impacts" class were more pronounced for people aged 65-74 than for those aged 75+, respectively. Based on the socioemotional selectivity theory, older adults with an advanced age generally perceive less time left in the future relative to young-old adults, and thus they are more likely to prioritize and draw support from close family relationships and reduce interactions with wider world (e.g., friends, community), especially in the context of COVID-19 home confinement. This is also supported by the finding that COVID-19 influence on family relationship did not significantly moderate the difference between young-old and old-old in class membership, i.e., family relationships are important to both. Surprisingly, the COVID-19 influence on social relationships did not significantly moderate the differences between individuals aged 65-74 and their younger

counterparts in class membership. Although older adults are more likely to trust and obtain positive support from social relationships (Brown & Reid, 2021; Chan et al., 2022), younger people who used to have larger social networks tend to experience a huge reduction in social interactions during the COVID-19 pandemic, making them desperate for social relationships and actively seek help from them through online platforms (Long et al., 2022).

There are two major limitations in the present study. First, individuals could experience some positive COVID-19 impacts such as developing new hobbies and paying more attention to personal health (Grasso et al., 2021), but these positive impacts were not included due to a lack of relevant data. Future studies may consider exploring the latent classes of a range of negative and positive COVID-19 impacts and gaining a more complete understanding of age differences in those classes. Second, although the age differences were identified, we can only explain the underlying mechanisms from the life course perspective rather than truly testing the potential mediators (e.g., life experience, coping strategies, social roles) between age and negative COVID-19 experiences. Research using mediation analysis is needed to address this gap and provide more empirical evidence for such age differences.

Despite these limitations, this study provides some important practical implications for disaster response to COVID-19 and future public health disasters. First, although most people are less affected by the negative COVID-19 impacts, their emotional well-being should be paid special attention. In the context of strict and unfamiliar public health measures, insecurity, vulnerability, and isolation are commonly experienced by individuals. Prevention efforts including screening for mental health problems, psychoeducation, and psychological support should be widely available to the public (Pfefferbaum & North, 2020), particularly to those at higher risk for emotional distress (e.g., women, people with higher educational level). Second,

various resources and comprehensive interventions across economic, health, social, and emotional domains should be provided to a small group of severely affected population, who are more likely to be younger, non-White, and unmarried. In addition to focusing on individuals' ability to cope with negative impacts, their relationships with family, friends/colleagues, and community should be emphasized in disaster response phase. Those social relationships can provide a wide range of important support, but they are often greatly affected by extraordinary measures during public health disasters (Long et al., 2022). Disaster-related workers, especially social workers, can assess individuals' quality of social connections and link necessary resources (e.g., live chat tools) to help them strengthen social relationships and receive relevant support. Finally, the findings provide strong evidence for the strengths of older adults in experiencing COVID-19 impacts, which can powerfully combat the prevailing "vulnerability" discourse about older people during the pandemic. Rather than being viewed as dependent and weak, older adults can effectively cope with disasters and advise others based on their rich life experience and mature coping strategies (Tuohy & Stephens, 2012). Besides, public health interventions and policies in disaster response and recovery should also recognize the age differences, especially the strengths and heterogeneity of older adults.

5. Conclusion

Following the life course perspective, this study explored the age differences in the complex patterns of negative COVID-19 impacts and suggested that people aged 18-34, 35-49, and 50-64 were at higher risk of severe overall impacts than those aged 65-74. In addition, people whose family relationship had been positively affected by the pandemic were less likely to experience severe overall impacts; and the influences of friends/colleagues and community relationships in protecting people from severe overall impacts were more salient for people aged 65-74 than for

those aged 75+, which can be explained by the socioemotional selectivity theory. These findings highlighted the strengths and heterogeneity of older adults and guided disaster-related workers to emphasize age differences and social relationships in disaster response phase for the ongoing global pandemic and future public health disasters.

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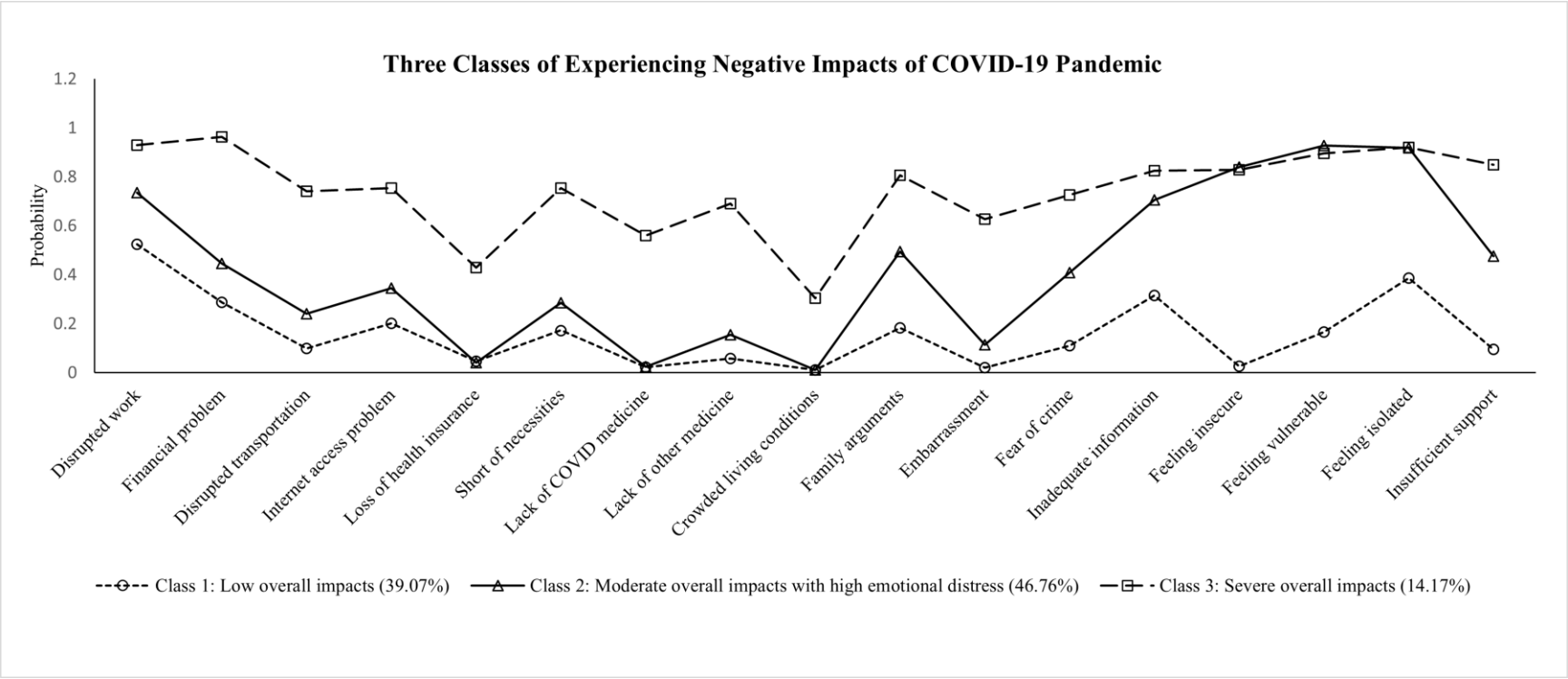

Figure 1 Item response probabilities for the three-class model

Table 1 Fit indices for potential latent class models (N = 1,080)

Model	Log-likelihood	AIC	BIC	aBIC	Entropy	LMR *p* value	Class proportions
1-Class	-10351.29	20736.59	20821.33	20767.33			1.00
2-Class	-9205.03	18480.06	18654.53	18543.36	0.806	< .001	0.50/0.50
3-Class	**-8806.06**	**17718.11**	**17982.30**	**17813.96**	**0.843**	**< .001**	**0.14/0.47/0.39**
4-Class	-8656.60	17455.21	17809.12	17583.61	0.839	.003	0.13/0.11/0.45/0.31
5-Class	-8539.28	17256.55	17700.19	17417.51	0.815	.151	0.22/0.05/0.11/0.34/0.28

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; aBIC = Adjusted Bayesian Information Criterion; LMR = Lo-Mendell-Rubin likelihood ratio test.

Table 2 Bivariate comparison in sample characteristics (*N* = 1,080)

	Whole sample (*N* = 1,080, 100%)	**Class 1 Low overall impacts (*N* = 422, 39.07%)**	**Class 2 Moderate overall impacts with high emotional distress (*N* = 505, 46.76%)**	**Class 3 Severe overall impacts (*N* = 153, 14.17%)**	**Comparison**
	%/M (*SD*)				χ^2/F
Demographics					
Age					37.53***
18-34	34.44%	31.75%	31.68%	50.98%	
35-49	24.26%	24.64%	23.37%	26.14%	
50-64	21.67%	20.38%	24.16%	16.99%	
65-74	14.63%	16.35%	16.24%	4.58%	
75+	5.00%	6.87%	4.55%	1.31%	
Gender					14.55**
Male	40.28%	47.16%	34.85%	39.22%	
Female	59.72%	52.84%	65.15%	60.78%	
Race					35.50***
White	81.67%	86.02%	83.17%	64.71%	
Non-White	18.33%	13.98%	16.83%	35.29%	
Hispanic					5.16
No	88.43%	89.57%	89.11%	83.01%	
Yes	11.57%	10.43%	10.89%	16.99%	
Educational level					27.59***
Some college or below	28.33%	29.15%	22.97%	43.79%	
Undergraduate degree	36.20%	37.68%	36.83%	30.07%	
Graduate or professional degree	35.46%	33.18%	40.20%	26.14%	
Marital status					19.95***
Unmarried	48.52%	43.84%	47.52%	64.71%	
Married	51.48%	56.16%	52.48%	35.29%	
Tornado damage					15.21***

No	58.24%	63.74%	57.43%	45.75%	
Yes	41.76%	36.26%	42.57%	54.25%	
COVID-19 influences on the social relationships					
Influence on family	2.87 (0.86)	3.03 (0.68)	2.85 (0.89)	2.52 (1.05)	20.77***
Influence on friends/colleagues	2.82 (0.90)	2.95 (0.77)	2.80 (0.94)	2.54 (1.03)	12.21***
Influence on community	2.80 (0.80)	2.92 (0.68)	2.76 (0.80)	2.59 (1.01)	10.67***

Note. **$p < .01$, ***$p < .001$

Table 3 Multinomial logistic regression results (*N* = 1,080)

	Model 1		**Model 2**		**Model 3**		**Model 4**	
	Class 2 vs. Class 1	**Class 3 vs. Class 1**	**Class 2 vs. Class 1**	**Class 3 vs. Class 1**	**Class 2 vs. Class 1**	**Class 3 vs. Class 1**	**Class 2 vs. Class 1**	**Class 3 vs. Class 1**
	OR	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**	**OR**
Age (*ref*: 65–74)								
18-34	0.89	5.93***	0.18	0.81	0.31	0.50	0.80	0.56
35-49	0.78	3.91**	0.76	3.19	1.76	1.27	1.63	0.54
50-64	1.10	3.64*	1.43	9.71	1.42	1.39	0.95	0.38
75+	0.59	0.31	0.76	0.49	1.02	0.00*	3.50	0.00*
Male	0.53***	0.78	0.53***	0.80	0.53***	0.80	0.53***	0.79
White	0.80	0.37***	0.82	0.39***	0.80	0.38***	0.79	0.37***
Hispanic	1.21	1.81	1.20	1.71	1.23	1.77	1.23	1.81
Educational level (*ref*: some college or below)								
Undergraduate degree	1.46	0.70	1.44	0.68	1.49*	0.68	1.50*	0.65
Graduate or professional degree	2.04**	0.88	2.03**	0.85	2.03**	0.85	2.02**	0.83
Married	0.84	0.49**	0.84	0.50**	0.82	0.47**	0.83	0.48**
Tornado damage	1.30	2.86***	1.28	2.77***	1.28	2.91***	1.27	2.95***
COVID influence on family	0.86	0.49***	0.73	0.35	0.86	0.50***	0.85	0.50***
COVID influence on friends/colleagues	1.00	0.76	1.00	0.79	0.96	0.36	1.00	0.76
COVID influence on community	0.76*	0.93	0.76*	0.92	0.78	0.95	0.83	0.37
Interaction between COVID influence on family and age								
18-34			1.67	2.05				

35-49	1.01	1.09				
50-64	0.92	0.69				
75+	0.90	0.79				
Interaction between COVID influence on friends/colleagues and age						
18-34			1.42	2.71		
35-49			0.76	1.71		
50-64			0.92	1.56		
75+			0.81	28.72*		
Interaction between COVID influence on community and age						
18-34					1.03	2.71
35-49					0.77	2.39
50-64					1.05	2.58
75+					0.51	56.48*

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

Chapter 4: Age differences in psychological distress after multiple disaster exposures: The effect of multidimensional negative COVID-19 impacts

Abstract

Objectives: This study examined how older adults differed from their younger counterparts in psychological distress following exposures to tornadoes and the COVID-19 pandemic; and how the multidimensional negative COVID-19 impacts contextualized the above age differences.

Methods: Data used were from a two-wave panel study of tornado victims during the COVID-19 pandemic (N = 554). Latent class analysis was first conducted to explore the underlying patterns of negative COVID-19 impacts at T1. Negative binomial regressions were performed to examine the age differences in T2 psychological distress, as well as the moderating effect of the identified latent classes, with baseline psychological distress and covariates controlled.

Results: Three latent classes were identified: class 1 "low overall impacts" (39.24%), class 2 "moderate overall impacts with high emotional distress" (47.71%), and class 3 "severe overall impacts" (13.05%). Individuals aged 65+ reported lower psychological distress at T1 relative to those aged 18-34, 35-49, and 50-64, and their advantages in mental health over people under 50 can be maintained over time. However, compared to people aged 18-34, 35-49, and 50-64, those aged 65+ reported the greatest increases in T2 psychological distress if they had experienced moderate or severe overall COVID-19 impacts at T1.

Discussion: As the frequency and intensity of cumulative disasters increase across the globe, there is a pressing need for mental health interventions that are tailored to multi-disaster scenarios and age-related differences in long-term recovery.

Keywords: cumulative disasters, disaster recovery, latent class analysis, mental health, psychological resilience

Introduction

Experiencing a disaster is a known cause of psychological distress, and cumulative disaster exposures can further increase the risk for adverse mental health outcomes (Harville et al., 2011; Lowe et al., 2019). The COVID-19 pandemic has caused an unprecedented public health disaster to human society, and people are experiencing worsening mental health and increased distress associated with COVID-19 due to fears of infection, economic recession, conflicting information from authorities, and extensive public health measures that violate personal freedom and disrupt daily routines (Pfefferbaum & North, 2020). Besides, the long-term persistence of COVID-19 increases the frequency of multi-disaster scenarios, i.e., the overlap between the pandemic and other disasters (e.g., climate hazards), which could jeopardize public health response by causing conflicts of strategies across sectors and compromise post-disaster recovery (Phillips et al., 2020). Following disasters, the experience of mental health recovery can vary by age, and older adults often have unique strengths in emotion-focused coping and psychological resilience (Adams et al., 2011; Tuohy & Stephens, 2012). In the context of COVID-19 pandemic, older age has also been found to be associated with better psychological health and well-being at the initial stage of pandemic response (Klaiber et al., 2021; Vahia et al., 2020), but it is unclear whether the age-related advantages are maintained after multiple experiences of COVID-19 and other disaster types.

In addition to the increased risk of cumulative disasters, the COVID-19 pandemic has resulted in profound impacts on multiple life domains, including physical and mental health, finances, employment, health care, housing, transportation, and social interactions (Harvard T.H. Chan School of Public Health, 2020). The chronic and complex COVID-19 impacts tend to continuously hinder disaster recovery and increase the risk for long-term psychological

outcomes, especially among older adults (Grasso et al., 2021); but there is a dearth of longitudinal research examining how the age differences in post-disaster mental health recovery are affected by the multidimensional COVID-19 impacts. Using the two-wave panel data collected from individuals who had experienced tornadoes and the COVID-19 pandemic, the present study aimed to examine the age differences in psychological distress after multiple disaster exposures. Besides, latent class analysis was used to explore the typologies of negative COVID-19 impacts across economic, health, social, and emotional domains, based on which this study further investigated how the identified latent classes moderated the above age differences.

Theoretical frameworks

This study was guided by three theoretical frameworks: (1) Life course perspective, (2) socioemotional selectivity theory (SST), and (3) the Strength and Vulnerability Integration (SAVI) model. According to the life course perspective, people's disaster experience should be examined within the context of previous experience and life stage (Shenk et al., 2009). Older adults often have more experience with disasters or other life stressful events that allow them to take a comparative view of current situation and become more optimistic about disaster recovery; Also, social roles in late adulthood determine that older adults do not face multiple responsibilities following disasters and thus experience less psychological distress in recovery process (Adams et al., 2011). SST posits that as people age, they tend to perceive future time as limited and have increased preference for emotionally meaningful goals (Carstensen et al., 1999). As a result, older adults are generally more skilled at emotion regulation which enables them to avoid experiencing negative emotions in stressful contexts and to focus on positive aspects of life (Carstensen et al., 2003). Based on SST, the SAVI model suggests that the age-related enhancement in emotion regulation may be attenuated when older adults experience high

levels of sustained and unavoidable stress, which will lead to prolonged psychological distress and delayed recovery from the event (Charles, 2010). As a whole, these theoretical frameworks assume that older adults generally have greater psychological resilience relative to their younger counterparts after stressful events including cumulative disaster exposures, but the age-related strengths may be diminished in face of some stressors that are complex, chronic, and rare in previous life experience, such as the unprecedented and multidimensional COVID-19 impacts.

Age and mental health following disasters

Disaster research has identified the unique strengths of older adults in mental health recovery and proposed some underlying mechanisms for such resilience. With more experience of stressful life events (e.g., previous disaster, economic crisis, bereavement), older adults can take a long-range view of current disaster, believing that they have experienced similar or tougher times before and they are capable to get it through this time (Adams et al., 2011; Brockie & Miller, 2017). Besides, compared to people at early life stages, especially those in the "sandwich" generation, older adults do not face multiple responsibilities in post-disaster recovery process, such as rebuilding, finding jobs, caring for children and parents simultaneously, which can help them reduce or minimize the fear, stress, and frustrations of failed recovery (Adams et al., 2011). Furthermore, the age-related improvements in emotion-focused coping strategies could allow older persons to be more satisfied with the support they received (Cherry et al., 2010), to focus more on positive emotions, acceptance, and ongoing life and survival than disaster-related losses (Henderson et al., 2010; Rafiey et al., 2016), and to find new sense of interest, meaning, and appreciation for life during the recovery process (Hrostowski & Rehner, 2012; Tuohy & Stephens, 2012).

In the distinct disaster context of COVID-19 pandemic, older adults have also been found to have better mental health and well-being relative to their younger counterparts. Although people of all age groups experience some increases in mental health problems at the beginning of pandemic outbreak, older adults tend to develop fewer problems and show better emotional well-being than younger and middle-aged adults (Daly et al., 2020; Klaiber et al., 2021), which may be because of age-related optimistic outlook and emotion-focused coping strategies (Bruine de Bruin, 2021; Fuller & Huseth-Zosel, 2021). In the early months of pandemic response, older adults can gradually recover from initial problems and maintain good mental health (Pierce et al., 2021); while younger people are more likely to experience psychological distress and related symptoms (Fernández et al., 2022; McPherson et al., 2021). Even though some younger adults have faster improvements than older people in certain mental health issues (e.g., depressive symptoms and anxiety), the age differences still persist over time (Fancourt et al., 2021).

Although the age-related strengths in post-disaster mental health have been well documented as described above, existing studies have primarily focused on the age differences after experiencing a single disaster, with very limited research on multiple disaster exposures. For example, Acierno et al. (2006) examined the residents in Florida counties who experienced the 2004 hurricanes, reporting that older adults had fewer symptoms of PTSD, anxiety, and depression than younger and middle-aged adults. Cherry et al. (2011) also found that compared to older adults, the storm-related stressors, such as trouble getting gasoline and changes in workplace, were more disturbing for younger and middle-aged adults after Hurricanes Katrina and Rita. These initial works suggest that older adults could maintain the age-related advantages in mental health after exposures to cumulative natural hazards, beyond which little is known

about the overlap of other disaster types, especially the multiple disaster scenarios during the COVID-19 pandemic.

Multidimensional COVID-19 impacts and mental health outcomes

The COVID-19 pandemic has dramatically affected human life across a range of domains. Due to COVID-19 economic crisis, people are facing serious problems with finances, employment, housing, as well as affording necessities (Harvard T.H. Chan School of Public Health, 2020). In the health domain, health insurance coverage has been severely disrupted and healthcare utilization has dropped significantly during the pandemic compared to the pre-pandemic period (Moynihan et al., 2021). With regard to social life, the COVID-19 pandemic has caused various problems with global transportation systems, internet access, social interactions, and information seeking from reliable sources (Harvard T.H. Chan School of Public Health, 2020; Kessel et al., 2021). The economic, health, and social impacts of COVID-19 can further lead to widespread emotional consequences, such as insecurity, fear, and emotional vulnerability (Pfefferbaum & North, 2020). Given those intertwined dimensions, we cannot use a single indicator or a summative score of several indicators to capture the full dimensions of negative COVID-19 impacts.

Several prior studies have examined the multidimensions of COVID-19 impacts using latent class analysis and found the significant associations between class memberships and mental health outcomes (Goldstein et al., 2022; Grasso et al., 2021). For example, Frounfelker et al. (2022) explored the typologies of positive and negative aspects of experiencing social distancing and identified five classes: (1) Low Impact, (2) Freedom/Flexibility, (3) Safety, (4) Family/Home, and (5) Hardships; They further reported that individuals in Hardships class were more likely to report a significant impact of COVID-19 on mental health and had more severe

symptoms of depression and anxiety relative to those in Low Impact class. Likewise, Luk et al. (2022) explored the multidimensional impact of COVID-related stressors and yielded four classes: (1) Minimal COVID-related Impact, (2) Work Interruptions, (3) Family/Friends Affected by COVID, and (4) Serious Financial Stress; Compared to those in Minimal COVID-related Impact class, people in Serious Financial Stress class reported higher levels of perceived stress, anxiety, and depressive symptoms. These studies demonstrate the heterogeneity of COVID-19 experiences within populations; and suggest that individuals experiencing a more severe level of overall COVID-19 impacts are at higher risk for psychological distress relative to those who are less affected by the pandemic, which may be because of massive resource loss and disruptions in daily routine (Frounfelker et al., 2022; Goldstein et al., 2022). As the pandemic persists, negative COVID-19 impacts may further increase the incidence of mental health conditions (Vahia et al., 2020) and their long-standing effects could vary across the adult life span.

Older adults in response to multidimensional COVID-19 impacts

In general, older adults exhibit greater psychological resilience than their younger counterparts in response to stressful situations, as a result of accumulated life experience and increased emotion regulation (Charles, 2010). However, when faced with chronic, unavoidable, and severe stressors or exposed to complex unpleasant events that affect multiple life domains, the age-related strengths tend to be compromised and older adults may experience greater difficulties and prolonged psychological distress (Scott et al., 2013; Wrzus et al., 2013). The COVID-19 pandemic has provided a stressful disaster context with unprecedented and long-lasting impacts on nearly every aspect of personal life. In response to the multidimensional COVID-19 impacts, Grasso et al. (2021) found that older adults who reported cumulated adverse COVID-19

experiences in work, home life, and emotional and physical health domains had higher rates of PTSD, anxiety, and depression relative to the older subpopulation who was less affected in multiple life domains. To sum, theoretical frameworks and existing studies have suggested the diminished age-related advantages in coping with the complex and chronic COVID-19 impacts, but the differences between older people and their younger counterparts in experiencing multiple COVID-19 impacts and associated long-term mental health effects remain unclear, which calls for more empirical and longitudinal research.

Study hypotheses

Based on the above discussions, some hypotheses on age differences and mental health in the multi-disaster scenario of tornadoes and the COVID-19 pandemic were developed, with a focus on negative COVID-19 impacts. First, older adults will report a lower level of psychological distress than their younger counterparts after experiencing tornadoes and the COVID-19 pandemic, and they can maintain this advantage over time. Second, there are latent classes of multiple COVID-19 impacts that reflect varying degrees of negative experiences, and people who experience more severe COVID-19 impacts will report greater psychological distress. Third, in face of severe and complex COVID-19 impacts, the age-related strengths in mental health will diminish and older adults may exhibit greater psychological distress than their younger counterparts in the long run.

Methods

Sample

A two-wave panel study was conducted to examine participants' vulnerability and resilience to multiple disaster exposures (i.e., tornadoes and the COVID-19 pandemic) in Texas, Tennessee, and Alabama, USA. The first wave of data collection took place between October 2020 and

August 2021 (T1). In Texas, address-based random sampling was adopted to choose around 25,000 addresses from selected zip codes affected by the Dallas tornado of October 2019. Since Tennessee (Nashville-Cookeville) tornado of March 2020 and Alabama tornadoes of March 2021 occurred in relatively population-sparse areas, approximately 10,000 addresses were identified centering on each tornado track. The recruiting mails were sent to the selected addresses, with options to participate the study via online platform, mail-in-survey, and telephone interview platform. A total of 1,496 participants completed the baseline survey. Participants who agreed to be contacted again for follow-up surveys were sent an email between May and August 2022 (T2), resulting in 655 respondents who completed the baseline and follow-up surveys with an attrition rate of 56.22%. All study procedures were approved by authors' university Institutional Review Board. In the present study, 101 respondents with missing values in analytical variables were excluded, so the working sample consisted of 554 participants. Respondents to Texas survey contributed to the major missingness (N = 100), as the planned missing was used at T1 to avoid overburdening respondents (Little & Rhemtulla, 2013) and thus 29.78% of the participants were not presented COVID-19-related questions. Since the planned missing data are missing completely at random, listwise deletion was used to handle missing values.

Measures

Age

Age was categorized into four groups based on the continuous age at T1: 0 = "65+ (older age, reference)", 1 = "18-34 (young age)", 2 = "35-49 (early middle-age)", 3 = "50-64 (late middle-age)".

Psychological distress

Psychological distress was measured at T1 and T2 by the 6-question Kessler Psychological Distress Scale (K6), which has been widely used in general-purpose health surveys with excellent internal consistency reliability (Kessler et al., 2002). Participants were asked to rate how often in the past 4 weeks they felt: (1) so sad nothing could cheer you up, (2) nervous, (3) restless or fidgety, (4) hopeless, (5) everything was an effort, and (6) worthless, with answers from 0 = "None of the time" to 4 = "All of the time". The sum of the six items ranged from 0 to 24, and a higher score indicated a higher level of psychological distress. Cronbach's alphas for the scale were 0.89 at T1 and 0.91 at T2.

Indicators of negative COVID-19 impacts

At T1, participants were asked about how much difficulty they had as a result of the COVID-19 pandemic in (1) disrupted working, (2) financial problems, (3) disrupted transportation, (4) internet access and bandwidth problem, (5) loss of health insurance, (6) shortage of food, water, clothing, or other necessities, (7) problems getting medicines or medical attention for conditions related to COVID-19, (8) problems getting medicines or medical attention for conditions other than COVID-19, (9) crowded or unsanitary living conditions, (10) family arguments, (11) embarrassment or humiliation, (12) fear of crime, (13) inadequate information from the authorities, (14) feeling insecure, (15) feeling vulnerable, (16) feeling isolated, and (17) insufficient social support. The answers were ranged from 0 = "none", 1 =" a little", 2 = "some", 3= "a lot", to 4 = "extreme". Because of the skewness of item measures, the answers 1-4 were combined into "Have difficulty". Therefore, 17 dichotomous indicators of negative COVID-19 impacts were created (0 = "No difficulty", 1 = "Have difficulty").

Covariates

Several critical demographic variables, tornado-related home damage, and survey location were controlled. Gender was a dichotomous variable (0 = “Male”, 1 = “Female”). Educational level was categorized into three groups: 0 = “Some college or below (reference)”, 1 = “Undergraduate degree”, and 2 = “Graduate or professional degree”. Marital status was a binary variable (0 = “Unmarried”, 1 = “Married”). Ethnicity was measured by the question “Are you of Hispanic, Latino, or Spanish origin?” (0 = “No”, 1 = “Yes”). Race was a dichotomous variable (0 = “Others”, 1 = “White”). Tornado damage to respondents’ homes was a binary variable (0 = “No damage”, 1 = “Have damage”). Survey location included: 0 = “Texas (reference)”, 1 = “Tennessee”, and 2 = “Alabama”. All the covariates were measured at T1.

Analysis strategy

First, latent class analysis (LCA) was used to explore the typologies of negative COVID-19 impacts. LCA is a person-centered data analytic approach to categorize latent population groups based on their answers to observed categorical indicators (McCutcheon, 1987). Based on 1,134 respondents who provided valid answers about all the 17 items of COVID-19 impacts at T1, LCA was performed using Mplus 8.3 to obtain (1) fit indices based on which the optimal number of classes was identified, and (2) posterior probabilities of class membership that were used to assign the respondents into different classes. Second, univariate analyses were used to describe the characteristics of working sample. Third, regression-based approach for cross-sectional and longitudinal data was used to test the hypotheses. Since the outcome variables, psychological distress at T1 and T2, were not normally distributed; and the conditional variance exceeded the conditional mean (i.e., overdispersion), negative binomial regression was chosen (Taylor et al., 2018). Cross-sectional analysis was first conducted with psychological distress at T1 as the outcome variable to examine the initial age differences. Then, two models were performed with

psychological distress at T2 as the outcome variable while controlling for psychological distress at T1. This approach allows us to predict the residualized change between panel waves and produces stronger evidence for the long-term effects of variables at T1 (Blair et al., 2014). Model 1 included the key variables and control variables. The interaction between age and latent classes was added in Model 2. The univariate and regression analyses were performed using Stata 15.

Results

LCA result

Fit indices for different LCA models were presented in Table 1. The three-class model had the highest entropy score, indicating that it exhibited better class separation than other models. The Lo-Mendell-Rubin likelihood ratio test showed that a three-class model had a better fit than a two-class model and four classes were not really needed. The three-class model also demonstrated reasonable class proportions and great interpretability as illustrated in Figure 1. Therefore, a three-class model was chosen as the optimal class solution.

The class 1 "low overall impacts" consisted of 39.24% (N = 445) of the sample. Respondents in this group had generally low probabilities of experiencing all the negative COVID-19 impacts relative to the other two classes (range 0.02-0.52, less than 0.30 in most items). The class 2 "moderate overall impacts with high emotional distress" comprised 47.71% (N = 541) of the respondents. This group had moderate probabilities of experiencing most COVID-19 impacts and a high rate of feeling insecure (0.83), feeling vulnerable (0.92), and feeling isolated (0.91). The class 3 (N = 148, 13.05%) was characterized as "severe overall impacts", which represented the respondents with the highest probabilities of experiencing most COVID-19 impacts compared to the other two classes (range 0.38-0.97, more than 0.70 in most items).

Sample characteristics

Table 2 summarized the characteristics of working sample (N = 554). The average scores of psychological distress were 4.68 (SD = 4.59) at T1 and 4.46 (SD = 4.96) at T2 respectively. People aged 18-34 made up 34.66% of the sample, followed by those aged 35-49 (25.45%), 50-64 (21.12%), and 65+ (18.77%). 36.82% of the respondents were in class 1 "low overall impacts", 50.18% of them were in class 2 "moderate overall impacts with high emotional distress", and 13.00% were in class 3 "severe overall impacts".

Regression analyses results

The results of negative binomial regressions were presented in Table 3. The cross-sectional evidence showed that compared to those aged 65+, people aged 18-34 (B = 0.66, p < .001), aged 35-49 (B = 0.64, p < .001), and aged 50-64 (B = 0.48, p < .001) had greater psychological distress at T1. Relative to people in class 1, those in class 2 (B = 0.70, p < .001) and class 3 (B = 0.98, p < .001) had a higher level of psychological distress at T1. The panel analyses examined the predictors of T2 psychological distress with baseline psychological distress controlled. Model 1 showed that compared to those aged 65+, individuals aged 18-34 (B = 0.33, p < .05) and those aged 35-49 (B = 0.30, p < .05) had a higher level of psychological distress at T2 with covariates and T1 psychological distress controlled. No significant difference was detected between those aged 65+ and those aged 50-64 in T2 psychological distress. Latent classes of negative COVID-19 impacts did not significantly predict T2 psychological distress with covariates and baseline psychological distress controlled. The interaction between age and latent classes was added in Model 2 and reached statistical significance. As shown in Figure 2, older adults showed the greatest increases in T2 psychological distress than their younger counterparts when they were in class 2 and class 3.

Discussion

This study examined how older adults differed from their younger counterparts in psychological distress after experiencing multiple disasters caused by tornadoes and the COVID-19 pandemic; and whether the latent classes of negative COVID-19 impacts moderated such age differences. Findings suggested that individuals aged 65+ reported less psychological distress than those aged 18-34, 35-49, and 50-64 at the initial stage of post-disaster recovery, and their advantages over people under 50 can be maintained over time. Besides, there were underlying typologies of COVID-19 impacts across multiple life domains, which demonstrated a diversity of negative COVID-19 experiences within populations. Although older adults were generally resilient after cumulative disaster exposures, they were at significantly higher risk for long-term psychological distress than their younger counterparts after experiencing a moderate or severe level of overall COVID-19 impacts.

As hypothesized, older adults had better mental health relative to their younger counterparts after experiencing tornadoes and the COVID-19 pandemic. This finding is in line with prior literature (Acierno et al., 2006; Daly et al., 2020) and may be explained by the life course perspective and socioemotional selectivity theory. From previous life experience, older adults can obtain the wisdom developed through years of confronting challenges and accumulated coping strategies to cope with adversity; and their social roles in late adulthood also protect them from the stress related to multiple responsibilities, which may greatly contribute to psychological resilience among older adults in disaster recovery (Adams et al., 2011). Besides, the age-related enhancements in emotion regulation could enable older adults to focus more on positive emotions and appreciation for life, as well as reduce or avoid negative emotional experience with disaster-related losses (Rafiey et al., 2016; Tuohy & Stephens, 2012). It is

noteworthy that our finding extends previous research by focusing on multiple disaster scenarios during the COVID-19 pandemic. As the pandemic persists, there are increased risks of intersection between COVID-19 and other disaster types. Distinct from cumulative natural hazards, the overlap of COVID-19 pandemic and other disasters may provide a more challenging context for recovery, since emergency responses frequently conflict with COVID-19 restrictions and the pandemic also strains healthcare and economy (Phillips et al., 2020). Even under such circumstances, older adults' advantages over those aged 18-34 and 35-49 in mental health can be maintained over time, which provides strong evidence for resilience in older adults and suggests that post-disaster mental health services should focus more on people under 50 who are more likely to experience delayed recovery (Fancourt et al., 2021). Although people aged 50-64 reported more psychological distress at T1, they were not significantly different from older adults at T2, which may be because people in late middle-age tend to be more stressful with multiple disaster exposure, but their coping strategies and resources may allow them to gradually recover over an extended process (Cherry et al., 2011; Pierce et al., 2021).

In consistent with prior studies (Goldstein et al., 2022; Luk et al., 2022), three distinct latent classes of negative COVID-19 impacts and their associations with psychological distress were identified. Nearly 40% of the respondents experienced a low level of overall COVID-19 impacts (class 1), and this finding echoes the fact that many people are resilient and less affected in face of disastrous events (Bonanno, 2004). It is not surprising that most respondents were moderately affected by the COVID-19 impacts with high emotional distress (class 2), as the COVID-19 pandemic has become a global health, economic, and social crisis and significantly contributed to widespread emotional sufferings, including feelings of insecurity, isolation, and vulnerability (Pfefferbaum & North, 2020). Only a small percentage of respondents experienced

severe overall COVID-19 impacts (class 3), and they deserve special attention in recovery process due to their higher risk for adverse consequences associated with COVID-19. Based on the identified latent classes, this study further suggested that respondents who experienced moderate or severe overall COVID-19 impacts had more pronounced psychological distress at T1 relative to those with low impacts, which may be due to abrupt disruptions and resource losses in multiple life domains (Frounfelker et al., 2022). It is noted that the latent classes did not predict psychological distress at T2, but a further examination revealed the age differences in experiencing the long-term mental health effects of negative COVID-19 impacts, as discussed below.

Although older adults were more resilient than their younger counterparts after exposures to tornadoes and the COVID-19 pandemic, they reported the greatest increases in T2 psychological distress after experiencing moderate or severe overall COVID-19 impacts. This finding is in line with the SAVI model, which posits that older adults will experience poor mental health and well-being when confronted with sustained and unavoidable stressors (Charles, 2010). In response to the chronic COVID-19 impacts across multiple domains, age-related enhancement in the use of emotion-focused coping strategies tends to be attenuated or even dissipated over time, and thus older adults may experience more difficulties in regulating emotion and exhibit worse mental health relative to their younger counterparts (Scott et al., 2013; Wrzus et al., 2013). As illustrated in Figure 2, people aged 18-34 and 50-64 reported only a slight increase in T2 psychological distress after experiencing moderate or severe overall COVID-19 impacts and those aged 35-49 were barely affected. This finding suggested that during the long process of recovery from tornadoes and the COVID-19 pandemic, younger and middle-aged adults may be less affected by pandemic-related stressors; and their overall higher

levels of psychological distress relative to older adults might be attributed to the age-related vulnerability to ongoing non-pandemic stressors, such as interpersonal conflicts and daily stressors related to work and family (Klaiber et al., 2021).

There are some limitations in this study. First, the subsamples in Texas, Tennessee, and Alabama may experience different degrees of multiple disaster exposure, because (1) the tornado in Texas occurred in urban areas and the outbreaks in Tennessee and Alabama occurred in population-sparse areas, (2) COVID-19 confirmed cases, death toll, and public health responses vary among these states, (3) the tornado in Texas occurred before the outbreak of COVID-19 while the tornadoes in Tennessee and Alabama occurred during the pandemic. Besides, the time intervals between tornado outbreak and first data collection in Texas and Tennessee were approximately a year, but that for Alabama was four months, which may cause some nuanced differences in baseline measures. Accordingly, even if survey location, tornado damage, and baseline psychological distress were controlled in data analysis to reduce potential bias from those limitations, we should interpret the results with more cautions and consider exploring the heterogeneity in disaster recovery among the subsamples in future studies. Furthermore, this study merely declared the observation of psychological resilience in older adults after experiencing tornadoes and COVID-19 pandemic without empirically explaining the mediating process of resilience (Van Breda, 2018), due to the lack of relevant variables in dataset. Based on existing literature and theoretical frameworks, more mediation analyses are needed to identify the real reasons for the age-related strengths in rebounding from and adapting to multiple disaster exposures. Lastly, since the working sample was primarily non-Hispanic white and highly educated, our findings may not reflect the situation of racial minorities and less educated people who are typically more susceptible to disasters.

Regardless of the limitations, this study is the first to examine the age differences in psychological distress following cumulative exposures to the COVID-19 pandemic and other disasters and how such age differences were contextualized by multidimensional COVID-19 impacts. Our findings highlight the strengths of older adults in post-disaster recovery and have important implications for public health policymaking and practice. Instead of predominantly focusing on older adults' vulnerabilities and excluding them from response activities, current disaster-related policy and intervention efforts should recognize the age-related strengths in mental health and actively engage experienced and resilient older adults in community-based recovery work (Shrira et al., 2014). For vulnerable older adults, disaster-related workers ought to assess their difficulties and special needs in multiple life domains and provide tailored social services and mental health programs on a long-term basis. Particular attention should be paid to younger and middle-aged adults who are generally at higher risk for post-disaster psychological consequences, and the intervention strategies could focus more on non-disaster daily stressors associated with their life stage. As the frequency and intensity of cumulative disaster exposures increase globally, it is important to develop new public policy and mental health intervention strategies tailored to multi-disaster scenarios (Leppold et al., 2022), with the multidimensional disaster impacts and age-related differences in long-term recovery taken into account.

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Table 1 Fit indices for potential latent class models (*N* = 1,134)

Model	Log-likelihood	AIC	BIC	aBIC	Entropy	LMR *p* value	Class proportions
1-Class	-10977.48	21988.96	22074.53	22020.53			1.00
2-Class	-9741.40	19552.80	19728.97	19617.80	0.803	< .001	0.48/0.52
3-Class	**-9282.71**	**18671.42**	**18938.19**	**18769.85**	**0.858**	**< .001**	**0.13/0.48/0.39**
4-Class	-9129.54	18401.07	18758.45	18532.93	0.848	.079	0.10/0.32/0.45/0.12

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; aBIC = Adjusted Bayesian Information Criterion; LMR = Lo-Mendell-Rubin likelihood ratio test.

Table 2 Characteristics of working sample (*N* = 554)

Variables	***N***	**Percent (%)**	**Mean (*SD*)**	**Range**
Psychological distress at T1	554		4.68 (4.59)	0-24
Psychological distress at T2	554		4.46 (4.96)	0-24
Age				
18-34	192	34.66		
35-49	141	25.45		
50-64	117	21.12		
65+	104	18.77		
Latent classes of negative COVID-19 impacts				
Class 1	204	36.82		
Class 2	278	50.18		
Class 3	72	13.00		
Gender				
Male	219	39.53		
Female	335	60.47		
Educational level				
Some college or below	124	22.38		
Undergraduate degree	225	40.61		
Graduate or professional degree	205	37.00		
Marital status				
Unmarried	256	46.21		
Married	298	53.79		
Hispanic				
No	510	92.06		
Yes	44	7.94		
Race				
White	459	82.85		
Others	95	17.15		
Tornado damage to home				
No damage	317	57.22		
Have damage	237	42.78		
Survey location				
Texas	226	40.79		
Tennessee	191	34.48		
Alabama	137	24.73		

Table 3 Predicting psychological distress: negative binomial regressions (N = 554)

	Cross-sectional evidence (Outcome: psychological distress at T1)		**Panel evidence (Outcome: psychological distress at T2)**			
			Model 1		**Model 2**	
	B	***SE***	***B***	***SE***	***B***	***SE***
Psychological distress at T1	-	-	0.08***	0.01	0.08***	0.01
Age (*ref* = 65+)						
18-34	0.66***	0.13	0.33*	0.14	1.04***	0.24
35-49	0.64***	0.13	0.30*	0.15	0.93***	0.26
50-64	0.48***	0.13	0.25	0.15	0.85**	0.27
Latent classes (*ref* = class 1)						
Class 2	0.70***	0.10	0.19	0.11	0.88**	0.25
Class 3	0.98***	0.13	0.27	0.16	1.71***	0.46
Female (*ref* = male)	0.07	0.08	-0.00	0.10	0.01	0.10
Educational level (*ref* = some college or below)						
Undergraduate degree	-0.12	0.11	-0.04	0.12	-0.10	0.12
Graduate or professional degree	-0.29*	0.12	-0.11	0.13	-0.14	0.13
Married (*ref* = unmarried)	-0.17	0.09	-0.15	0.10	-0.19	0.10
Hispanic (*ref* = no)	-0.10	0.15	-0.07	0.17	-0.11	0.17
White (*ref* = others)	-0.06	0.11	-0.12	0.13	-0.11	0.13
Tornado damage to home (*ref* = no)	0.10	0.09	0.08	0.10	0.11	0.10
Survey location (*ref* = Texas)						
Tennessee	0.11	0.10	-0.10	0.11	-0.10	0.11
Alabama	-0.13	0.11	-0.18	0.13	-0.13	0.13
Age × latent classes (*ref* = 65+ × class 1)						
18-34 × class 2	-	-	-	-	-0.87**	0.30
18-34 × class 3	-	-	-	-	-1.78***	0.50
35-49 × class 2	-	-	-	-	-0.71*	0.31
35-49 × class 3	-	-	-	-	-1.86**	0.54
50-64 × class 2	-	-	-	-	-0.81*	0.33
50-64 × class 3	-	-	-	-	-1.16*	0.57

*p < .05, **p < .01, ***p < .001

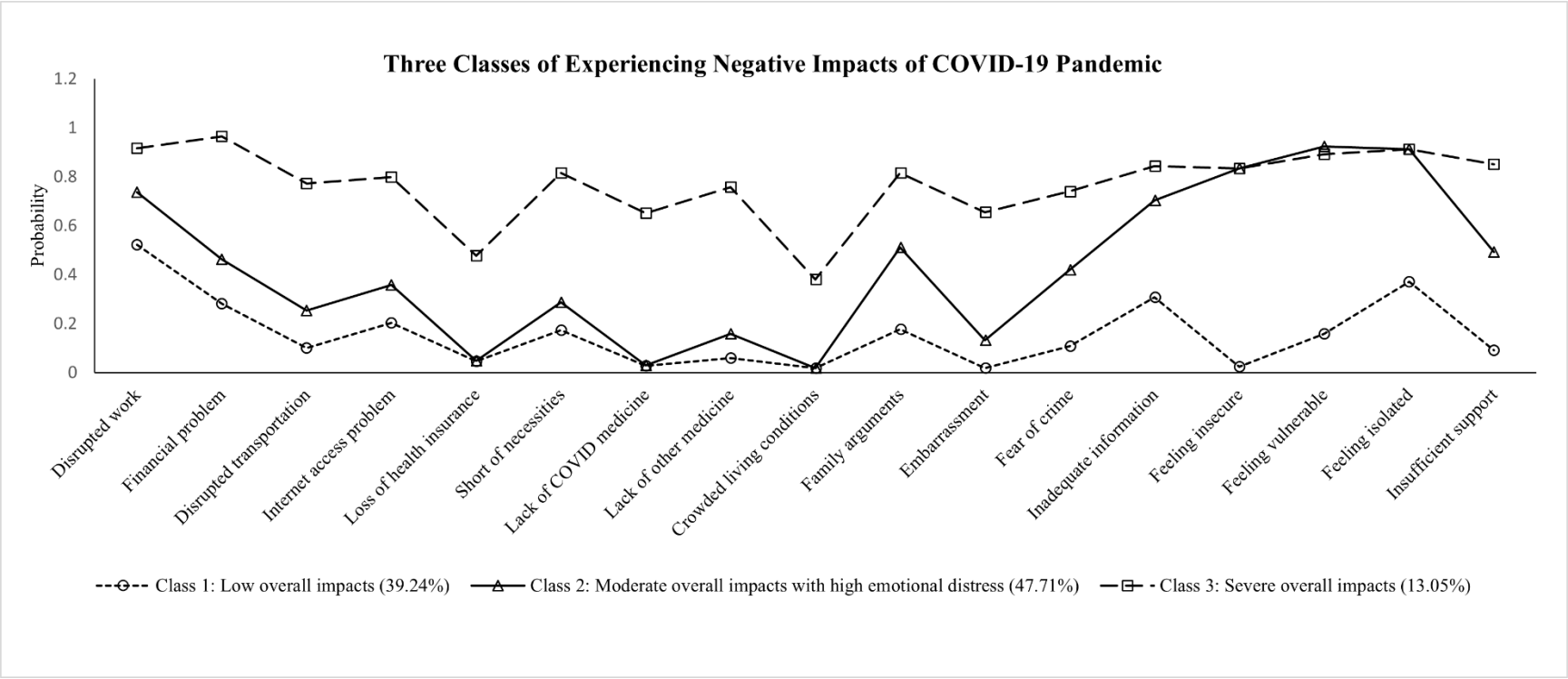

Figure 1 Item response probabilities for the three-class model (N = 1,134)

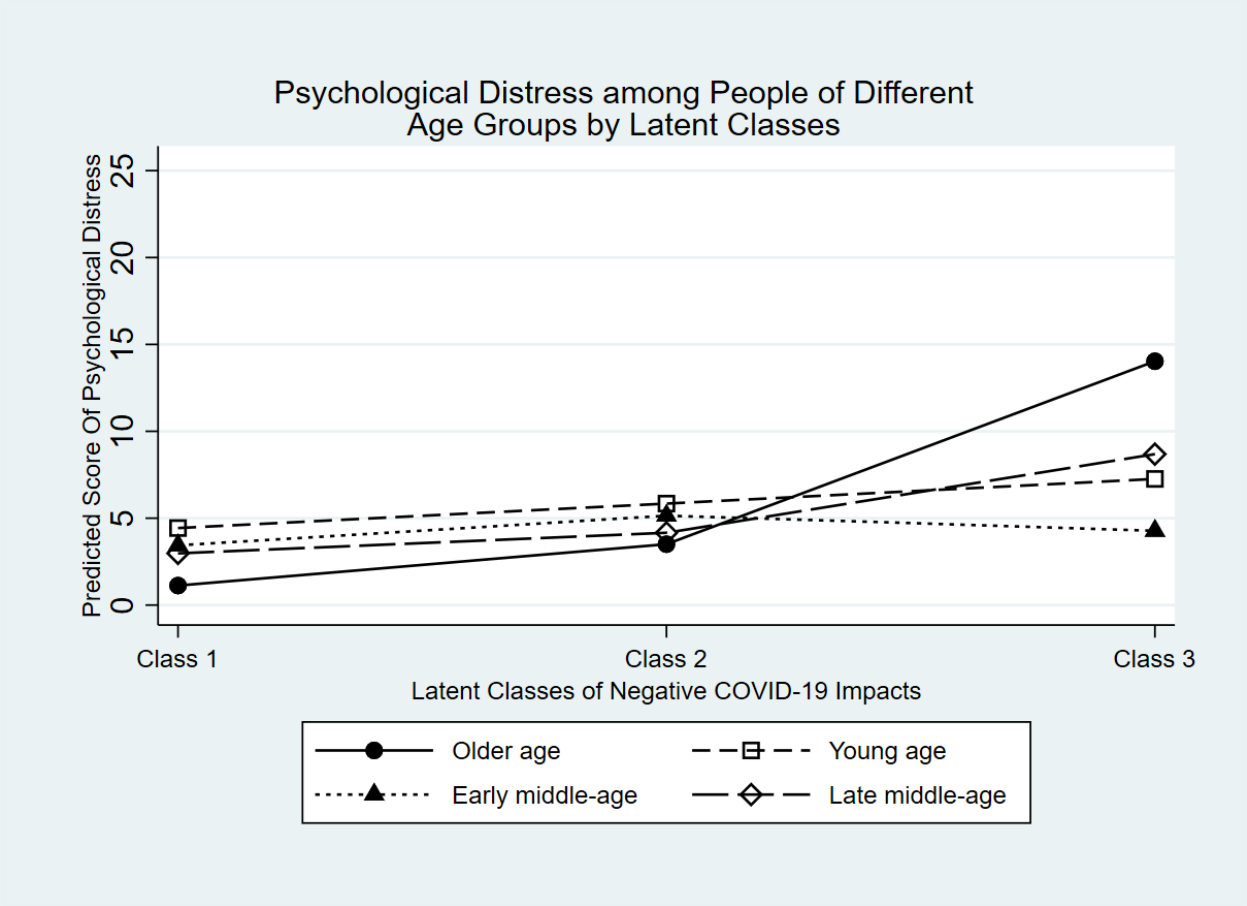

Figure 2 Psychological distress at T2 among people of different age groups by latent classes (*N* = 554)

Chapter 5: Conclusion

The COVID-19 pandemic has resulted in an unprecedented public health disaster to human society. Since the pandemic outbreak is distinct from other disaster types (e.g., natural hazards) in duration and domains of influence, the preparedness, response, and recovery phases with regard to COVID-19 are different from traditional disaster management cycle (Peleg et al., 2021). Besides, older adults aged 65 and over are disproportionately affected by the pandemic in terms of COVID-19 related hospitalization and mortality (Centers for Disease Control and Prevention, 2022), but this group is highly heterogenous with some older people having age-related strengths in coping with disasters (Finlay et al., 2021). This dissertation consists of three articles examining the age differences in preparedness, response, and recovery phases of the COVID-19 pandemic, with an emphasis on the strengths of older adults and with a unique tornado-impacted sample.

Article 1 focused on the COVID-19 preparedness phase. This study examined the age differences in perceived preparedness for the continuation of COVID-19 pandemic and tested the moderating effects of emotional, financial, and instrumental support. Based on a sample of 450 adults in Texas, USA, results showed that compared to individuals aged 65+, those aged 18-44 perceived a lower level of preparedness for the ongoing COVID-19; and there was no significant difference in perceived preparedness between people aged 65+ and those aged 45-64. Receiving emotional and instrumental support were respectively more prominent for individuals aged 65+ to perceive a better level of preparedness than for those aged 18-44 and 45-64. The findings highlighted the strengths of older adults in preparing for the ongoing COVID-19 pandemic, which may be because of accumulated life experience and higher risk perception in late adulthood from the life course perspective (Kim & Crimmins, 2020; Tuohy et al., 2014). In

addition, the importance of social support in disaster preparedness was highlighted, especially for older adults who are more dependent on social support and have increased preference for close social relationships, according to the socioemotional selectivity theory (Carstensen, 1992; Cheng & Lo, 2022).

Article 2 focused on the pandemic-related impacts during the COVID-19 response phase. In the disaster context of ongoing pandemic, people have to experience a prolonged response phase to cope with a wide range of negative impacts (Harvard T.H. Chan School of Public Health, 2020). This study examined the latent classes of negative COVID-19 impacts on multiple life domains and the age differences in identified class membership. As suggested by Article 1, the elements of social networks were included in this study by the investigation of how COVID-19 influences on social relationships moderated the above age differences in class membership. Based on a sample of 1,080 adults in Texas, Tennessee, and Alabama, USA, three latent classes were identified: class 1 “low overall impacts”, class 2 “moderate overall impacts with high emotional distress”, and class 3 “severe overall impacts”. Compared to those aged 65-74, people aged 18-34, 35-49, 50-64 had higher odds of being in class 3 versus class 1. Individuals whose relationship with community had been positively influenced by COVID-19 had lower odds of being in class 2 over class 1, and those whose relationship with family had been positively impacted by COVID-19 had lower odds of being in class 3 versus class 1. Positive COVID-19 influence on relationships with friends/colleagues and community were respectively more important for people aged 65-74 than for those aged 75+ in lowering the likelihood of being in class 3 over class 1. These findings highlighted the strengths of older adults in experiencing the multidimensional impacts during the COVID-19 response process, which may be because of coping strategies developed from prior life experience and age-related social roles from the life

course perspective (Klaiber et al., 2021). Furthermore, the heterogeneity among older populations was identified, possibly due to different perceptions of future time and associated preferences for social relationships between young-old and old-old adults (i.e., socioemotional selectivity theory) (Carstensen, 1992).

Article 3 focused on the COVID-19 recovery process. The COVID-19 pandemic has been ongoing for nearly three years and caused widespread psychological distress, leading to a long journey to mental health recovery (Pfefferbaum & North, 2020). The persistence of the pandemic also increases the risk of overlaps between COVID-19 and other disaster types, which have greater mental health effects than single disaster exposures (Lowe et al., 2019). This study investigated how older adults differed from their younger counterparts in psychological distress following cumulative exposures to tornadoes and the COVID-19 pandemic. Using the same three latent classes of negative COVID-19 impacts identified in Article 2, this study further examined how the above age differences were contextualized by the multidimensional negative COVID-19 impacts. Based on the two-wave panel data collected from individuals who had experienced tornadoes and the COVID-19 pandemic in Texas, Tennessee, and Alabama (N = 554), results showed that individuals aged 65+ reported lower psychological distress at T1 relative to people aged 18-34, 35-49, and 50-64, and their advantages in mental health over people under 50 can be maintained over time. Although older adults were generally resilient after cumulative disaster exposures, they were at significantly higher risk for long-term psychological distress than their younger counterparts after experiencing a moderate or severe level of overall COVID-19 impacts. The findings highlighted the strengths of older adults in psychological resilience and emotion-focused coping during the lengthy recovery process and may be explained by the life course perspective and socioemotional selectivity theory. Nevertheless, the age-related

advantages in mental health tended to be compromised and older adults experienced greater psychological distress when faced with chronic and severe COVID-19 stressors in multiple life domains (Grasso et al., 2021), which was in line with the theoretical model of Strength and Vulnerability Integration (Charles, 2010).

As a whole, this dissertation mainly revealed the unique strengths of older adults relative to their younger counterparts in preparing for the continuation of COVID-19 pandemic, experiencing negative impacts across multiple domains during the COVID-19 response phase, and psychologically recovering from cumulative disaster exposures during the COVID-19 pandemic. Such age differences in disaster management may be associated with previous life experience, social roles across the adult life span, and age-related coping strategies. At the same time, the findings also highlighted the heterogeneity among older adults in social needs and disaster experiences during the global pandemic, suggesting that despite many older adults were generally resilient in coping with disasters, some older people had special needs and were vulnerable to chronic and complex COVID-19 stressors. Disaster-related policy and intervention efforts should consider the differences between and within age cohorts in disaster management, as well as develop new strategies tailored to public health disasters that often persist for a longer time, have multidimensional impacts, and intersect with other disaster types.

Limitations

There are several limitations in this dissertation. First, the data used in the three articles were collected from tornado victims in three states during the COVID-19 pandemic, so the findings were highly contextualized and geographically restricted. The overlap between tornadoes and the COVID-19 pandemic can jeopardize public health work by causing conflicts of strategies across sectors and present unique challenges for disaster preparedness, response,

and recovery (Phillips et al., 2020). In addition, COVID-19 confirmed cases, death toll, and public health responses varied by states, resulting in different disaster contexts. Even though some covariates (e.g., tornado damage to homes, survey location) were controlled in data analysis to reduce potential bias, we still need to interpret and apply those findings with more cautions.

Second, this dissertation identified the age differences in disaster management with regard to the COVID-19 pandemic but can only explain them based on theoretical frameworks and prior literature. In the three articles, the underlying reasons proposed for the strengths of older adults included knowledge and coping strategies developed from life experience, social roles and responsibilities in late adulthood, and age-related perceptions for disasters and disaster management. Future studies may consider using mediation analysis to test the role of those potential mediators in the relationship between age and disaster management behaviors associated with COVID-19, and ultimately identify the real mechanisms behind the identified age differences.

Third, the age categories were inconsistent across the three articles. In Article 1, age was categorized into three groups: 18-44, 45-64, 65+. In Article 2, there were five age groups: 18-34, 35-49, 50-64, 65-74, and 75+. In Article 3, age was categorized into four groups: 18-34, 35-49, 50-64, and 65+. The age groups for Article 1 were simplest due to the smallest sample size (N = 450). Since the working sample in Article 2 included 1,080 respondents, it was possible to have more detailed age categories and examine the heterogeneity in older and middle-aged adults. The data used in Article 3 included 554 respondents and the sample size of old-old adults (aged 75+) was too small, so older adults were not divided into two groups. To sum, age was categorized based on the specific sample size and age distribution in each article, and there were sufficient

respondents in each age group to ensure relevant statistical power. Different age categories may affect the coherence of the three articles as a whole; but given that age categories are not fixed in academic literature, the findings can provide implications for researchers who categorize age in different ways.

Fourth, the health conditions and functional ability of participants were not controlled in this dissertation due to the lack of relevant data. Individuals' chronic diseases, disability, difficulties with activities of daily living (ADLs) and instrumental activities of daily living (IADLs) can significantly affect their ability to prepare for, respond to, and recover from disasters. Besides, as people age, they are more likely to experience worsening health and functioning, which may compromise the strengths of older adults in disaster management. Future research could consider examining the age differences in disaster management with the variables related to health and functioning controlled and paying more attention to physically inactive populations in disaster contexts.

Lastly, the working samples in this dissertation were primarily non-Hispanic white and highly educated, despite great efforts of using a random address-based sampling frame as well as recruiting and disseminating surveys in multiple languages. Thus, the findings may not reflect the situation of racial minorities and less educated people who are typically underrepresented in disaster research, more susceptible to disasters, and marginalized in disaster management, which calls for future studies with diverse research samples.

Strengths and implications

Regardless of the limitations, this dissertation is one of the first to examine the age differences in COVID-19 contexts from a disaster management perspective. The characteristics and uniqueness of COVID-19-related preparedness, response, and recovery phases are

highlighted in the three articles. A pandemic-related disaster management model (Figure 2 in Chapter 1) is developed based on the traditional disaster management cycle (Figure 1 in Chapter 1). As disasters caused by natural hazards, man-made events, and epidemic outbreaks are becoming more frequent and costly across the globe, the newly developed model could complement the traditional framework by breaking the boundaries between linear phases and emphasizing simultaneous and ongoing disaster management to cope with complex disaster scenarios (e.g., public health disaster, multiple disaster exposure). Besides, the strengths and heterogeneity of older adults in COVID-19 disaster management are identified in this dissertation, which can powerfully counter the prevailing "vulnerability" discourse about older people in disaster management and provide empirical evidence for the application of social science theories in disaster contexts, including life course perspective, socioemotional selectivity theory, strengths perspective, and the Strength and Vulnerability Integration model. Furthermore, a variety of statistical methods, such as regression analysis, moderation analysis, latent class analysis, and panel analysis, were used in this dissertation based on the primary data collected during the COVID-19 pandemic. These strengths associated with methodology allow the three articles to provide rich and generalizable evidence for the age differences in various phases of COVID-19 disaster management, which greatly contributes to the quantitative research in this area and provides comprehensive guidance for disaster-related policy and interventions.

This dissertation has several important implications for disaster-related practice and future research. First, disaster social workers and public health practitioners should develop services and programs tailored to the characteristics and special needs of different age groups in disaster management. In particular, older adults should not be viewed as a homogeneously vulnerable group and excluded from disaster planning and response activities; Instead, disaster-

related workers need to recognize the strengths of older populations and engage experienced older adults in different phases of disaster management. For instance, social workers can organize community-based disaster prevention campaigns and invite older adults to share their life experiences, knowledge, and coping strategies with community members, which may greatly contribute to community preparedness and inclusion (Tuohy et al., 2014). Also, resilient older adults can help and comfort others in the post-disaster recovery process, and this kind of voluntary work will allow older adults to feel greater competence and self-esteem as helpers in stressful disaster contexts (Shrira et al., 2014). Second, social support networks can be incorporated into relevant intervention strategies, because of their vital significance in helping individuals prepare for, respond to, and recover from disasters. Especially for social workers who have expertise in assessing and mobilizing clients' social networks, they could help clients strengthen social relationships and link resources needed for disaster management (Alston et al., 2019). When attempting to do so, practitioners should also consider the age-related differences and specific types of disaster, because: (1) people at different life stages have different sizes of social networks, varied preferences for social relationships, and different needs for social support; (2) social relationships and connections are often severely disrupted by public health restrictions during disasters caused by epidemic outbreaks. Third, new public policy and intervention frameworks should be developed to support individuals, families, and communities in complex disaster scenarios. The COVID-19 pandemic has presented a range of unprecedented disaster scenarios (e.g., prolonged duration, negative impacts on multiple life domains, increased risk for multiple disaster exposures) that cannot be well addressed using a traditional disaster management framework. It is necessary to develop new practice strategies to simultaneously

coordinate different phases of disaster management, to cover multiple life domains, sectors, and disciplines, and to adapt to persistent and multiple disasters.

Future research may consider using mediation analysis based on longitudinal data to test the underlying reasons for age differences in disaster management proposed in this dissertation and exploring additional mechanisms. It is important to identify the real mediators in the relationship between age and disaster management behaviors, which could directly guide front-line services and provide empirical evidence for theory development. In addition, more research can be done to develop and evaluate programs involving experienced and resilient older adults in disaster management. To date, such programs are quite limited and older adults are frequently excluded from disaster planning and response activities. Developing a series of evidence-based practice models and specific program evaluation methods can contribute to the participation of older adults in disaster management, facilitate their resilience and growth, and help dispel the "vulnerability" stereotype of older people in disaster contexts. Furthermore, future studies may pay more attention to individuals and communities with pre-existing social vulnerability regarding socioeconomic status, disability, minority status, language, housing, and transportation (Flanagan et al., 2011) and examine how they prepare for, respond to, and recover from complex disaster scenarios.

Conclusion

The COVID-19 pandemic has resulted in catastrophic impacts on human society and forced us to think outside of the traditional disaster management model. This dissertation examined the age differences in preparing for the continuation of the COVID-19 pandemic, experiencing the multidimensional negative impacts during the COVID-19 response phase, and psychologically recovering from cumulative disaster exposures during the pandemic. The main findings

highlighted the unique strengths of older adults in disaster management with regard to COVID-19 and provided empirical evidence for the application of social science theories in disaster contexts. In addition to age differences, the findings on social support and social relationships, underlying patterns of negative disaster impacts, and multi-disaster exposures greatly enriched the dissertation and provided imperative implications for disaster-related policymaking and front-line services. The COVID-19 pandemic is not the last global public health disaster we shall confront, and there will be more complex and costly disaster scenarios as global warming and climate change continue. There is a pressing need to develop new disaster management frameworks and become better equipped to meet future challenges.

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