DISSERTATION

PSYCHOLOGICAL DISTRESS AND COPING DURING THE COVID-10 PANDEMIC: A STRUCTURAL TOPIC MODELING APPROACH

Submitted by

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ABSTRACT

PSYCHOLOGICAL DISTRESS AND COPING DURING THE COVID-19 PANDEMIC:

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In this study, I focused on two closely related phenomena, namely psychological distress and distress-coping mechanisms during the initial outbreak of the COVID-19 pandemic. I examined participants' voluntary written responses to two open-ended questions on psychological distress and coping in an online survey using an unsupervised machine learning approach called structural topic modeling. I chose to extract 17 topics from the collection of participants' responses. Among these topics, 11 were mostly about different factors contributing to participants' mental health during the COVID-19 pandemic, including but not limited to, uncertainty due to the coronavirus, financial/work-related concerns, living conditions, and concerns about personal health and safety as well as the well-being of loved ones and others in general. Besides, I also found 5 topics discussing many ways people took care of their mental health during this challenging time. Surprisingly, one topic revealed different feedback people had for researchers who designed and implemented the survey. I also found cross-country differences in terms of the prevalence of each of the resultant topics. In summary, I documented a number of findings that are congruent with the existing literature on psychological distress and coping during the COVID-19 pandemic while at the same time, pointed out some important nuances in the qualitative responses of participants. Implications, strengths, and limitations, as well as directions for future research were discussed in the study.

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CHAPTER 1 – SPECIFIC AIMS

The COVID-19 pandemic, spawned by the SAR-CoV-2 coronavirus in 2019, is among the most pressing societal issues. It has affected every aspect of life and has resulted in millions of casualties. As of this writing, nearly 7 million people have lost their lives in the battle against COVID-19 (*COVID-19 Map*, n.d.). Researchers worldwide have conducted numerous studies to disseminate scientific knowledge of the coronavirus to the public (e.g., Badr et al., 2020; Cartenì et al., 2020; Jiang & Luo, 2020; Sasidharan et al., 2020; Shereen et al., 2020), report countries' best practices and lessons learnt (e.g., Jin et al., 2020; McGuire et al., 2020; Milošević Đorđević et al., 2021; Myers et al., 2022), as well as identify ways to better support people during this challenging time (e.g., Cameron et al., 2020; Goldberg et al., 2021; Gorenko et al., 2021; R. Wilkinson et al., 2020). Research topics during this COVID-19 pandemic are diverse, ranging from predictive models for COVID-19 cases (e.g., Šušteršič et al., 2021; Turk et al., 2021; Zhao et al., 2021), to people's perceptions about COVID-19 vaccines (e.g., Milošević Đorđević et al., 2021; Niznik et al., 2022; Solak et al., 2022), trust and transparency in times of crisis (Enria et al., 2021), coping with conflicting information on COVID-19 (Cheng et al., 2021; Yoon et al., 2021), and many other interesting and important topics. Among the studied topics, psychological distress and distress-coping mechanisms has been a primary focus. A quick search on Google Scholar using the keywords "distress" and "covid" since 2019 generated nearly 90,000 results.

One motivation for studying psychological distress is the notoriously complex nature of it. Psychological distress, one's subjective evaluation of stress, is a multidimensional

undesirable experience that can manifest in forms of normal melancholy and fears, which can grow in intensity over time (Barry et al., 2020; Vitek et al., 2007). Existing evidence documents the links between psychological distress and considerable negative health outcomes and behaviors (e.g., mortality risks, worsen physical and cognitive function, suicidal behaviors, child victimization; Barry et al., 2020; Cuevas et al., 2010; Hamer et al., 2009; Kramer et al., 2009; Lee & Singh, 2021; Pillai et al., 2009; Wilson et al., 2006). Previous studies also point out different contributors to psychological distress (e.g., interpersonal violence, high work-related demands, lack of control, and low support; Dorahy et al., 2007; Gelles & Harrop, 1989; Kachi et al., 2014; Leino et al., 2011; Marchand et al., 2012; Weaver & Clum, 1995) and show that certain populations (e.g., people with low socioeconomic status or racial/ethnic minority identities, those who live with chronic diseases; Barry et al., 2015, 2020; Horesh et al., 2020; R. G. Wilkinson & Marmot, 2003) can be more prone to psychological distress. In the context of a global health crisis, the COVID-19 pandemic, a lot of people seem to go through notable psychological distress that negatively influences their life and hampers effective crisis management (Duran & Erkin, 2021; Gómez-Salgado et al., 2020; Lieberoth et al., 2021; Siebenhaar et al., 2020; Vlake et al., 2021). Extended efforts to understand psychological distress during COVID-19 are of importance.

Another concept that is often examined alongside psychological distress is coping – the cognitive and behavioral strategies one may use while experiencing distress (Littleton et al., 2007; Nielsen & Knardahl, 2014; Shechter et al., 2020; Vungkhanching et al., 2017; M.-M. Zhang et al., 2021). Coping can be adaptive or maladaptive, and hence, additional knowledge of individuals' distress and coping mechanisms may not only help individuals stay mindful of their

health and well-being, but also inform practitioners and policy makers of ways to better support people during such difficult times like the COVID-19 pandemic.

On a different note, during the COVID-19 pandemic, online platforms play an important part in dissemination of COVID-19-related knowledge to the public and engaging everyone in a virtual togetherness, allowing people to communicate and participate in communal activities (Gesser-Edelsburg, 2021; E. M. Goldberg et al., 2021; Hacker et al., 2020; L. Lin et al., 2022; Turk et al., 2021; H. Zhao et al., 2021). Similarly, researchers circumvent safety concerns with in-person studies (e.g., honoring social distancing, limiting exposure to COVID-19 , etc.) by employing telephone interviews, online survey designs, and surveillance data from smart devices (e.g., Chivers et al., 2020; Enria et al., 2021; Mavragani & Ochoa, 2019; Nicomedes & Avila, 2020; Turk et al., 2021; Yamada et al., 2021). Extant quantitative research on coronavirus-related issues at the national level generated indispensable findings and implications for interventions and policies to promote individuals' awareness and well-being during this pandemic (Atkinson et al., 2020; Hatef et al., 2021; Kazemzadeh Atoofi et al., 2020; Kene, 2020; Picchio et al., 2020; R. Wilkinson et al., 2020). Great sources of global data on COVID-19 also exist, such as the COVIDiSTRESS surveys assessing adults' behavioral and psychological responses to COVID-19 (Blackburn et al., 2022; Yamada et al., 2021), the data on the anxiety of front-line healthcare workers during COVID-19 (Cag et al., 2021), and the COVID-SCORE data on public perceptions of government responses to COVID-19 (Lazarus et al., 2020). These global datasets allow for comparisons of the strength of the relationships between public responses and the corresponding political and social situations across different countries.

However, less prevalent is qualitative work in comparable scope to probe for deeper understanding of people's lived experiences during this devastating pandemic.

Qualitative research is an invaluable approach to exploring people's lived experiences (Christenson & Gutierrez, 2016; Paoletti et al., 2021). Qualitative methods, such as observations, interviews, and diary studies, provide rich insights into the contexts surrounding the research participants' feelings and behaviors and/or the processes underlying the research phenomena (e.g., Alizadeh et al., 2020; Bosma et al., 2019; Braun et al., 2021; Christenson & Gutierrez, 2016; Jack & Phoenix, 2022). Researchers have extensively used qualitative methods, especially in conjunction with quantitative methods (often referred to as integrated mixed methods approach) to study complicated topics that may not be easily captured by established measures of constructs. In situations where researchers are limited by under-developed or unavailable measurement or structural models of causal processes, qualitative methods offer flexibility to develop and extend theoretical understanding of the topic of interest. Furthermore, unrestricted by researchers' predefined response options, qualitative methods have the potential to capture a wide range of perspectives in under- and un-explored research areas (Braun et al., 2021). Given these potential advantages, researchers should utilize qualitative methods whenever possible to help maximize insight produced by the investigation.

One can argue that qualitative research is not always possible due to the considerable requirements of time and resources. The process of qualitative data collection and analysis can be extremely resource intensive (Chung et al., 2022; Pietsch & Lessmann, 2018). This is particularly true when researchers want to conduct observational studies, for example, when

they need to spend weeks or even months in the field in order to collect sufficient data for analysis (Paoletti et al., 2021). Such an argument is valid and fair but leaves out the possibility of incorporating qualitative work in online survey research to address the time-consuming process of data collection. In addition, advancements in textual digitization and computing powers allow researchers to make use of machine-learning capabilities to dissect unstructured textual data for meaningful information, which can potentially reduce the human power needed for coding qualitative data. Owing to these modern statistical tools, application of quantitative approaches to analysis of textual data is growing rapidly (e.g., Chung et al., 2022; Enria et al., 2021; Haynes et al., 2019; Pietsch & Lessmann, 2018; Rosenberg & Krist, 2021). In the current era of big data, the role of qualitative data analysis is even more critical (Eck et al., 2019; Mills, 2018; Strong, 2014). Modern computer-aided tools are crucial for effectively producing insights from qualitative data of this nature, where traditional methods of hand-coding data are not feasible given the amount of information available in big data settings. While quantitative data analysis shows the trends and the flow of information between different stakeholders, researchers can and should collect qualitative data for analysis to further explain the implicit meanings behind these patterns and the human social processes (Braun et al., 2021; Carr, 1994; Chung et al., 2022; Enria et al., 2021; Lakshman et al., 2000; Wertz, 2014).

To this end, I conducted a qualitative study using the textual data obtained from the first round of the COVIDiSTRESS global survey. The main focus of the study was on people's behavioral and psychological responses during the coronavirus pandemic, including the perceived stress, loneliness, availability of social provisions during distressing situations, trust in

people and different government agencies, and concerns over several health-related and social consequences of COVID-19, among other important variables measured on standard Likert scale rating systems (Yamada et al., 2021). The survey also included two free-text questions, one presented after participants were asked about sources of distress and the other after they were asked about different means to cope with discomfort throughout the COVID-19 crisis. Specifically, participants read and rated agreement to curated lists of several sources of distress and coping mechanisms. Then, participants had an opportunity to further explain their situations in their own words by responding to the "Other?" questions presented at the end of each of the distress and coping question blocks. These free-text questions were completely voluntary with a single leading text. As such, answers to these open-ended questions can be about anything that participants want to communicate to the researchers, including description of participants living situations, any other sources of distress or means for coping with distress that were not covered in the research team's predefined list of items, feedback about the survey, and others. Venturing into these written responses may allow for a richer, more personal understanding of people's thoughts and thinking process as they went through the study questions.

This study's aims were two-fold. First, I aimed to identify factors that contributed to people's psychological distress as well as ways of handling undesirable psychological states during the period between March 2020 to May 2020, just a few months after COVID-19 was declared a global public health emergency (Jee, 2020). Second, I aimed to demonstrate how modern statistical tools can be utilized to extract information from a rich source of textual data, supporting the importance and potential of qualitative inquiry in big data settings. Specifically,

I used structural topic modeling (STM; Roberts et al., 2014), an unsupervised machine learning approach to examine the large volume of unstructured textual data from the aforementioned COVIDiSTRESS dataset. Since the written comments were in over 40 different languages, the first step was to rely on Google Translate to convert these texts into English for further analysis. Then, STM was used to process the unstructured textual data and identify patterns of co-occurring words in participants' written responses. Based on these patterns, I was able to identify the topics that emerged from participants' shared responses. Moreover, I also incorporated different participants' country of residence as a covariate to determine if and how the prevalence and topic contents changed with regards to this additional information.

While it was impossible to provide an exact prediction of the study's findings given its exploratory nature, before beginning data analysis, I speculated that the approach could have substantial potential. First, the topic modeling results could shed light on participants' lived experiences during COVID-19. The study results could enrich our understanding of the contexts surrounding participants' responses and could also reveal unexpected aspects that may have been overlooked in the design and implementation of the COVIDiSTRESS global survey. Second, examining variations in prevalent topics between countries could detail a clearer picture of people's needs and resilience throughout the COVID-19 pandemic under varying social and political contexts. I posited that some people may be able to go on with their lives just fine despite restrictions while others, under certain circumstances, may not be as fortunate. For example, people with terminal illness may not be able to get timely treatment due to hospital strain. Open-ended questions provide a space for people to voice their concerns and describe what has or has not helped them overcome any psychological distress they may feel. As such,

the potential knowledge derived from this study in terms of the development of better need-based interventions to reduce harm and enhance individuals' well-being was a primary motivator for me to conduct this work. Last but not least, I was propelled to apply machine learning approaches to the ample and complicated qualitative data generated by the COVIDiSTRESS study; as my application could complement traditional hand-coding approach to qualitative research and produce important insights for studies of COVID-19, as well as other topic areas.

In the following sections, I discussed more about how qualitative research can contribute to scholars' quest of understanding sophisticated human experiences. Particularly, I expanded on the benefits of qualitative research, challenges faced by researchers when conducting qualitative research, and the role of online, machine-aided tools in addressing such challenges. Then, I provided an overview of qualitative research results during the COVID-19 pandemic, with special emphasis on studies covering psychological distress and coping approaches. I also compared qualitative results on these topics with evidence gained from quantitative work on distress and distress-coping mechanisms. That section is followed with descriptions of the computational grounded theory (Nelson, 2020) that set the stage for application of STM (an unsupervised machine-learning tool) to examine how participants in the COVIDiSTRESS global survey delineated their psychological distress and coping means.

CHAPTER 2 – THE INDISPENSABLE ROLE OF QUALITATIVE METHODS IN SCIENTIFIC INQUIRY

Qualitative methodologies have a long-standing history in both academic and commercial realms (Bailey, 2014). More specifically, in a review of the history of qualitative inquiry in psychology, Wertz (2014) emphasized the ubiquity and fundamental role of qualitative research in the enterprise of science since as early as the late 19th century. Often involving careful observations, in-depth interviews, and serious derivation of archival texts, qualitative methods are critical for answering "how?" and "why?"-type questions. Darwin's (1871, 1872) investigations of emotions and moral sense, Maslow's (1954, 1968) studies of self-actualization, and Flanagan's (1954) critical incidence technique for contextually sensitive reports of effective and ineffective behaviors are among many influential qualitative legacies that facilitate theoretical and applied work in several scientific disciplines.

It is not an exaggeration to say that qualitative methodologies have an important stake in the advancement of science (Wertz, 2014). When studying archival records (e.g., diaries, recordings, etc.), scholars are able to paint a rough picture of who the subjects of those records may be, their life experiences at the time, and why the records were produced. Combined with other secondary data sources (e.g., historical events, economic and political contexts at the time), the qualitative data can aid researchers in formulating a theory explaining the phenomenon of interest (F. Lee & Peterson, 1997; Wertz, 2014). In other words, qualitative work can inspire further research questions and studies to test and validate a theory, contributing to a more comprehensive understanding of a topic (Chun Tie et al., 2019; Chwalisz et al., 2008; Glaser & Strauss, 1999; Sonpar & Golden-Biddle, 2008). Carefully designed and

implemented, qualitative methodologies (e.g., focus-group interviews, online open-ended questionnaires, etc.) offer not only enhanced openness and flexibility, but also a rigorous methodology for researchers to ask a wide range of questions, and probe for clarification when necessary (Blustein et al., 2022; Braun et al., 2021; Chung et al., 2022; Chwalisz et al., 2008; Mills, 2018; Strong, 2014; Wertz, 2014). This property makes qualitative methodologies a unique and irreplaceable tool for scientific inquiry, especially when research is done on a nascent topic or when there is a lack of effective, reliable quantitative measure to capture researchers' construct of interest (Braun et al., 2021).

Revolving around a person-centered, minimal to non-directive approach to research, qualitative methodologies allow for a deeper, humanistic understanding of several phenomena through the lenses and narration of either the direct observers or the individuals experiencing such phenomena (Bailey, 2014; Braun et al., 2021; Carr, 1994; Lakshman et al., 2000; Wertz, 2014). The person-centered nature of qualitative methodologies presents an opportunity to get a wide-angle view of the research topic. Participants are not limited within the response options provided by the researchers. As such, a qualitative approach can potentially capture diverse perspectives and experiences of the target population (Braun et al., 2021; Carr, 1994; Chung et al., 2022; Lakshman et al., 2000; Tandt et al., 2022). Furthermore, participants' own descriptions of the studied phenomenon may reveal the meanings behind their responses that may come across as surprising or unexpected to the researchers. Participants may also take the chance to reflect and provide feedback about the construct conceptualization or the research design and implementation. This exchange of ideas between the research participants and the

research investigators through articulated accounts are of critical importance for the research progress and results (Braun et al., 2021).

CHAPTER 3 – SOME CHALLENGES WITH QUALITATIVE RESEARCH

Despite several advantages that qualitative methodologies garner and their nonignorable contribution to the advancement of science, qualitative approaches are not without drawbacks (Carr, 1994; Chwalisz et al., 2008; Lakshman et al., 2000; Mills, 2018). Scholars have raised concerns about the significant amount of time and effort needed to gather qualitative data (Braun et al., 2021; Lakshman et al., 2000). After the data is procured, further resources will be required to decipher and interpret the data. Nevertheless, time consumption and effort exertion should not be a barrier to research. Every approach to produce high quality work, regardless of its qualitative or quantitative nature, requires serious planning, implementation, and evaluation, which are time intensive and effortful (Braun et al., 2021; Chwalisz et al., 2008). Indeed, qualitative research is ever-growing and has been contributing to the collective knowledge of countless phenomena, including child development (Gladstone et al., 2010; Jack & Phoenix, 2022; Papadopoulou et al., 2014), motivation (Gerster et al., 2013; MacGregor et al., 2006; Wilhelmsen et al., 2013), behavioral change (Aschbrenner et al., 2013; Lehberger et al., 2021; Staniford et al., 2011), among many other important topics.

Occasionally, people may express concerns about ethical issues pertaining to qualitative work (Braun et al., 2021; Eysenbach & Till, 2001; Richards & Schwartz, 2002). For instance, while conducting research on a sensitive topic (e.g., addiction, eating disorder, etc.), researchers may ask poorly framed or triggering questions that are harmful to participants' well-being. Alternatively, when working with large and diverse populations, researchers may run the risk of treating individuals from under-represented/marginalized groups as the

spokesperson for their groups. These practices can undermine the research efforts and do injustice to the parties involved in the work (Braun et al., 2021). However, ethical concerns are not peculiar to qualitative methodologies. Hence, it is expected that investigators are thoroughly trained to evaluate the research risks and benefits, to deliver the research procedures professionally, to detect any unfavorable or potentially detrimental circumstances and to timely intervene or provide appropriate resources for participants at risk.

Another potential aspect of concern with qualitative research, just as other quantitative approaches, is measurement issues (Chung et al., 2022; Nelson, 2020). A lot of constructs of interest to social researchers are latent, which require approximation by other simplified, observable indicators. For example, in quantitative research, to gauge one's degree of substance abuse, researchers may ask questions about their drinking or smoking frequency over the past 30-day period (Cullum et al., 2010; Shah et al., 2009). At times, participants' answers to those manifested variables do not reflect their true score on the latent construct, possibly due to inattention, restriction of range, or incorrect interpretation of the study phenomenon (Curran, 2016; Johnson, 2005). Social desirability is another factor that may impact participants' responses. Similarly, researchers doing qualitative work need to be mindful of the questions asked and, in most cases, rely on other contextual measures to get at the gist of participants' generated information. Transparency in the research procedure, detailed coding manuals, and processes to warrant inter-rater reliability are critical for interpretation models of high caliber (Chung et al., 2022; Nelson, 2020).

CHAPTER 4 – CONTRIBUTIONS OF ONLINE MEANS TO QUALITATIVE RESEARCH

In the past few decades, with the expeditious growth of science and technology, humans are capable of connecting with one another more than ever. Such connections can transcend several geographic and physical borders. Scientific and technological advancements also allow for more affordable, easy-to-access options for data collection (A. D. Gibson et al., 2015; Granello & Wheaton, 2004; Lefever et al., 2007; Topp & Pawloski, 2002). Online platforms like Qualtrics, Amazon Mechanical Turk or social media sites like Facebook, Twitter, Reddit and so on are common, wide-reach channels for researchers to reach and collect data from a large number of participants (Beymer et al., 2018; Casler et al., 2013; Goodman et al., 2013; Ibarra et al., 2018; T. P. Schofield et al., 2019). In fact, utilizing these online tools, researchers were able to draw important conclusions and build more comprehensive studies based on these studies' results. Some example work include Schofield et al. (2019)'s examination of the persistence of welfare stigma and Farrehi et al. (2020)'s study on how individuals with spinal cord injury access and evaluate information related to clinical trials and experimental therapies.

There are some limitations in terms of generalizability when these online studies operate with the assumptions that participants have access to the internet, or that participants possess certain degree of listening or reading skills (Braun et al., 2021; van Deursen & van Dijk, 2019). One may also question the ethics revolving around the use of individuals' social media data (Braun et al., 2021; Eysenbach & Till, 2001; Richards & Schwartz, 2002). These hotly debated topics continue to receive considerable social concern (Maxwell, 2021; Polit & Beck,

2010). However, application of online platforms to conduct research continues to grow rapidly (Sassenberg & Ditrich, 2019).

Despite having some undesirable properties, online tools can be beneficial for research, especially qualitative work. Braun et al. (2021) provided an overview of how online survey can serve as beneficial channels for qualitative work. One of the benefits is the notable outreach and the relatively low cost for research, making it an attractive tool for exploration of the constructs of interest. In addition, online open-ended questions enable anonymity of responses, which may attenuate the impact of social desirability as participants respond to the questions. Anonymity on online platforms may even encourage disclosure and engagement in sensitive topics that participants may otherwise be hesitant to share with the research investigators (Braun et al., 2021). Participants also have the autonomy to engage in the research as much (or as little) as they want, share their thoughts and feelings about the research topic in their own words, and provide any feedback that they may have about the research design and implementation to the researchers.

In circumstances where other means of research are not possible (e.g., during the COVID-19 outbreak when face-to-face interaction is not recommended), online qualitative research thrives to provide insightful initial findings about people's lived experiences (Chivers et al., 2020; Enria et al., 2021; Lehberger et al., 2021; Lieberoth et al., 2021; Nicomedes & Avila, 2020; Siebenhaar et al., 2020). These findings motivate better design and implementation of future studies for a deeper dive into researchers' area of focus.

CHAPTER 5 – QUALITATIVE RESEARCH DURING THE COVID-19 PANDEMIC

The COVID-19 pandemic is a source of global concern. Humans have not experienced such health crisis of this scope since the 2009 H1N1 pandemic (Centers for Disease Control and Prevention, 2019). A lot of exploratory qualitative work has been done to identify changes in one's life amidst COVID-19, risk and protective factors that influence one's health and well-being, their needs, existing and desired resources during this traumatic time to disseminate important information and inform more effective public policies.

For instance, in the initial stage of the COVID-19 pandemic, researchers noted the significance of panic buying – a form of herd behavior steered by factors like the perceived scarcity, anticipated regret and arousal whereby people uncommonly purchase huge amount of goods (Chua et al., 2021; Islam et al., 2021; Lehberger et al., 2021). Although panic buying may be temporary, it can have deleterious effects on people's mental state by infusing fear, anxiety, insecurity and panic in their already uncertain life (Arafat et al., 2020; Chua et al., 2021; Islam et al., 2021). Excessive stockpiling is wasteful since many goods are perishable; furthermore, one can only utilize a limited number of non-perishable stocks over a certain period of time. Consequently, panic buying leads to ineffective resource allocation and potential stockouts that can hamper societal efforts to fight the COVID-19 pandemic. Qualitative research on the issue revealed various reasons, including fear of losing control, reduction of shopping frequency (to minimize exposure and in-person contact), fear of food shortage, and peer influence (Lehberger et al., 2021). Conversely, the reasons for not participating in panic buying were disbelief in its necessity, normative stockpiling habits (people buy more than the amount that they need,

whereas not more than the amount they normally purchase), lack of fear in a potential food shortage, and altruism reasons (e.g., concerns for others' needs, believing that stockpiling is unethical and antisocial). Another qualitative study done by Arafat et al. (2020) highlighted the role of sensible reporting through social media to prevent rumor-mongering about panic buying and enhance public trust in the authority in our collective battle against COVID-19. These results complement existing quantitative work on panic buying (Lehberger et al., 2021; Nicomedes & Avila, 2020; Prentice et al., 2022), which have important implications on policies to halt panic buying and ameliorate the negative impacts of panic buying on the society.

Amid the COVID-19 pandemic, knowledge on the experiences of those who have close contacts with COVID-19 patients not only yield important educational values but also have invaluable practical implications to facilitate frontline COVID-19 workers in responding to the disease. Chen et al. (2020) analyzed interview data from 15 close contacts of COVID-19 patients and identified three procedural themes depicting participants' experiences throughout the beginning, middle, and ending stage of the quarantine. They noted the change in people's initial resistance to acceptance of quarantine as well as changes in their feelings, ranging from feeling of fear and stigmatization to calmness and hopefulness towards the end of the quarantine period. More interestingly, persistence in self-coping and external support (e.g., from healthcare professionals, family members, etc.) is pivotal for people's recovery. Other qualitative research on the experiences of healthcare workers during this COVID-19 pandemic in different countries consistently described psychological struggles (e.g., stress, fear of death, anxiety, feeling stigmatized, concern about spreading the coronavirus to others, conflict between fear and conscience, etc.) and behavioral challenges (e.g., wearing appropriate

protective equipment, keeping distance from others, etc.), albeit some positive aspects such as increased self-esteem, empowerment and compassion (Abdulah et al., 2022; Kwaghe et al., 2021; Özlük & Bıkmaz, 2021; Sezgin et al., 2021; Shin & Yoo, 2022; Tan et al., 2020).

Among several topics of research during this COVID-19 pandemic, researchers have studied sources of psychological distress and means of coping with distress in earnest. As COVID-19 affects various facets of one's life, psychological distress and its coping mechanisms are not limited to any single population (e.g., Alizadeh et al., 2020; Buyukkececi, 2021; Chivers et al., 2020; Duran & Erkin, 2021; Heath et al., 2020; Lieberoth et al., 2021; Toulabi et al., 2021; Vlake et al., 2021). In the next section, I discussed findings from qualitative studies on psychological distress and means of coping with distress in relation to quantitative evidence on the same topics.

CHAPTER 6 – PSYCHOLOGICAL DISTRESS AND COPING DURING THE COVID-19 PANDEMIC

During the initial outbreak of the COVID-19 pandemic, researchers conducted multiple studies on the mental health of healthcare workers (HCW). Faced with similar difficulties of COVID-19 as the general public (e.g., uncertainty about the disease and lack of information), HCW are also challenged with unique issues due to the nature of their occupation. In fact, many studies found that HCW tend to report higher levels of psychological distress than the general public (Al-Hanawi et al., 2020; Krishnamoorthy et al., 2020; Rahman et al., 2020). Quantitative studies on psychological distress among HCW associated elevated psychological distress with lower sense of coherence (the ability to appraise the situation as understandable, manageable, and meaningful; Gómez-Salgado et al., 2020; Padmanabhanunni, 2022; Pretorius & Padmanabhanunni, 2022; Ruiz-Frutos et al., 2021), and higher fear of COVID-19 (Alnazly et al., 2021; Labrague & de los Santos, 2021; Morawa et al., 2021; Yıldırım et al., 2022). Other factors that were positively related to increased psychological distress in HCW include increased workloads and work demands (Barello et al., 2020; Shoja et al., 2020; Zhou et al., 2020), lack of guidance and social support (Bhargava et al., 2020; Cag et al., 2021; Podder et al., 2020; Shechter et al., 2020), concerns over infection risks for the self and for others (Firew et al., 2020; Mijiritsky et al., 2020; Shacham et al., 2020; Sirois & Owens, 2021), sleep disturbance (Alyami et al., 2022; Diaz et al., 2022; Olagunju et al., 2021), as well as having to constantly witness and deal with coronavirus-induced deaths (Mosheva et al., 2021).

Other quantitative studies on other adult, non-HCW populations such as students, workers in non-health care fields, and vulnerable populations (i.e., pregnant women, people

with chronic and/or terminal illnesses, the elderly, and COVID-19 patients, etc.) also documented high levels of psychological distress during the COVID-19 pandemic (Al-Hanawi et al., 2020; Hao et al., 2020; Hasan & Bao, 2020; Hedegaard et al., 1993; Krishnamoorthy et al., 2020; Marzo et al., 2021; Nishimura et al., 2021; Ostacoli et al., 2020; Romito et al., 2020; Vlake et al., 2021; H. Yan et al., 2020). Similar to HCW, the upsurge in psychological distress in these populations were also shown to be associated with coronavirus-related fear (Casagrande et al., 2020; Fernández et al., 2020; C.-Y. Lin et al., 2020; Rahman et al., 2020), intolerance of uncertainty (Ben Salah et al., 2022; Bottesi et al., 2022; Cohen et al., 2022; de Sousa et al., 2022; Reizer et al., 2021), social isolation (Ju et al., 2021; Kim & Jung, 2021; Mikocka-Walus et al., 2022), and sleep problems (Alimoradi et al., 2021; Bi et al., 2023; Cipriani et al., 2021). Beside these common patterns, researchers noted unique issues that seem to positively correlate with psychological distress for different non-HCW populations. For instance, it was shown that higher psychological distress in students also correspond to higher concerns over e-learning crackups and academic delay (Hasan & Bao, 2020; Hossain et al., 2021; Qazi et al., 2021). On the other hand, people with terminal illnesses experienced psychological distress related to the stage and progression of their diseases, disruption of care, and their immunocompromised status (Momenimovahed et al., 2021).

Cross-sectional studies on psychological distress also revealed some demographic characteristics that are associated with psychological distress during the COVID-19 pandemic. In a recent review of 12 different systematic review papers on mental health difficulties and 5 systematic review papers on interventions to ameliorate mental health issues, Camara et al. (2023) noted that socio-economic disadvantages (i.e., lower education level and low income,

unemployment) are associated with higher psychological distress. Further, the authors also noted in most systematic reviews, being a migrant, being a member of an ethno-racial minority group, and/or being homeless are potential factors associated with higher psychological distress (Camara et al., 2023). It is worth pointing out that not all systematic reviews cited in Camara et al. (2023) looked at the same populations, variables of interest, and arrived at a consensus on differential psychological distress across different demographic characteristics. A meta-analysis focused on predominantly general populations by Y. Wang et al. (2020) noted, beside the aforementioned demographic characteristics, differences in psychological distress with regard to sex, age, and risk status. Particularly, the authors found that being female, being younger (below 35 years of age), and being in a high-risk group (i.e., having pre-existing physical and mental health issues) are associated with higher odds of psychological distress (Y. Wang et al., 2020). In explaining these associations between different demographic characteristics and elevated psychological distress, researchers speculated that certain groups of people (e.g., people with socio-economic disadvantage) may not have financial security to support themselves during the COVID-19 pandemic (Duarte & Jiménez-Molina, 2021; Sekścińska et al., 2022; Y. Wang et al., 2020). Others (e.g., people of ethno-racial minority identities, immigrants, homeless people) may be in precarious living situations and/or experience discrimination (B. Gibson et al., 2021; Hintermeier et al., 2021; Robinson & Daly, 2021; Tsamakis et al., 2021). Compared to older people, young adults may have lower tolerance for uncertainty and be exposed to too much coronavirus-related information on social media that stimulates misinformation, uncertainty, and fear (Breslau et al., 2021; Glowacz & Schmits, 2020; C.-Y. Lin et al., 2020; Qiu et al., 2020; Y. Wang et al., 2020). Moreover, having increased caring

responsibilities with little to no time to relax may also be attributable to worsened mental health in female compared to male individuals (Xue & McMunn, 2021).

With regards to how people have been coping with psychological distress during the COVID-19 pandemic, researchers highlighted that coping can be both adaptive and maladaptive. Many turned to drinking and smoking in an attempt to deal with psychological distress (Hahm et al., 2023; Lechner et al., 2020; Rahman et al., 2020; Robinson & Daly, 2021; Rodriguez et al., 2020). Some found exercising, getting therapy, having social support from family, friends, and co-workers, engaging in mindfulness practices, and limiting time spent on social media and coronavirus-related news helpful in alleviating distress (Bendau et al., 2021; Conversano et al., 2020; Heath et al., 2020; Petzold et al., 2020; Shechter et al., 2020).

Results from the extant qualitative literature on distress and coping mechanisms during the COVID-19 pandemic seem to be congruent with reports from most quantitative studies. Qualitative and mixed-methods researchers have examined psychological distress and means of coping among healthcare professionals (Alizadeh et al., 2020; Galehdar et al., 2020; Luquiens et al., 2021; Özlük & Bıkmaz, 2021; van der Goot et al., 2021), COVID-19 patients and COVID-19 survivors (Moradi et al., 2020; Toulabi et al., 2021), and some vulnerable populations with existing mental health issues or comorbidity risks (Brownstone et al., 2021; Chivers et al., 2020; Hunter & Gibson, 2021; Sit et al., 2022; Tandt et al., 2022). Results from these studies suggest that an unsurprising source of distress for many people is the nature of COVID-19 – the uncertainty and unpredictability surrounding the disease, how severe and highly contagious the disease can be. Beyond this reason, work and financial insecurity, lack of social support, perceived loneliness and isolation, emergence of negatively obsessive thoughts, lack of quality

sleep and restricted mental health services for certain populations in need also contribute to one's psychological distress. In managing distress, people employed several different strategies, which are not limited to fostering meaningful, supportive relationships and engagement in self-care activities (Blustein et al., 2022; Brownstone et al., 2021; Burke-Garcia et al., 2021).

To reiterate, previous studies on COVID-19 phenomena bring about important insights to enhance awareness and foster personal and communal resilience in fighting this pernicious pandemic. It is a concern that existing quantitative studies have not provided a clear definition of psychological distress and many different measurement tools have been used for self-report assessment of psychological distress (Camara et al., 2023). The Kessler Psychological Distress Scale (Kessler et al., 2002, 2003), General Health Questionnaire (GHQ; D. P. Goldberg & Blackwell, 1970), and Depression, Anxiety, and Stress Scale (DASS; Antony et al., 1998; Henry & Crawford, 2005; Lovibond & Lovibond, 1995) are among the various scales used in the literature. Limited evidence from small-sample qualitative studies offers some additional confidence in the results of quantitative findings. Nevertheless, there remains an opportunity to expand these findings by looking at responses from a bigger, more diverse sample. By doing so, researchers may be able to identify more subtle or even surprising themes and compare results by different sample characteristics.

CHAPTER 7 – COMPUTATIONAL GROUNDED THEORY APPROACH

First introduced by Nelson (2020), the computational grounded theory approach is a methodological framework that extends the traditional grounded theory (Chun Tie et al., 2019; Glaser & Strauss, 1999) for analyzing a large body of textual data. The computational grounded theory approach conjoins human expertise and machine powers to perform content analysis in a rigorous and interpretive way (Nelson, 2020).

Chun Tie et al. (2019) provided a comprehensive history of the original grounded theory to analyze qualitative data and Nelson (2020) explained some problems with such approaches. Particularly, the original grounded theory approach is highly subjective and prone to confirmation bias, difficult to reproduce the analysis, time-consuming, challenging to carry out with a large amount of data. For a content analysis to be scientifically sound, it has to satisfy the following conditions: (1) reliable – researchers should be able to arrive at consistent results every time, (2) intersubjectively valid – results are analogous when interpreted by independent, informed analysts, and (3) fully reproducible – given access to the data, its description, and the analytic steps, any researcher should be able to produce the same output (Nelson, 2020).

The computational grounded theory framework involves three iterative steps (Nelson, 2020). The first step is pattern detection to explore the textual data using unsupervised machine learning techniques. After the digitized text is imported and pre-processed (e.g., removing whitespaces, converting text to all lower cases, deleting html tags, etc.), researchers rely on computer-assisted coding to classify text into different categories. This process is similar to human-coding where researchers read and manually assign categories to the text.

Researchers are able to realize new ideas and concepts while staying well-grounded in data (Glaser & Strauss, 1999; Nelson, 2020). Although computer-assisted coding is not completely objective, decisions made by the researchers are directly embedded in the coding process. Hence, machine-aided analysis of textual data is transparent and fully reproducible.

In the second step, researchers revisit the data to confirm the plausibility of the identified patterns in the previous step, add interpretation, and make necessary modifications to the resultant categories for a more holistic view of the data (Nelson, 2020). This guided deep reading process requires researchers to attend to the data and rerun the analysis multiple times before achieving consistent and meaningful results. With advanced computerized tools and the incredible processing power of modern machines, researchers can not only find "hidden" themes that may not be easily detectible by humans' eyes but also reproduce every stage of the process and scale the techniques to incorporate big data.

The third step is meant to confirm patterns within text (Nelson, 2020). In other words, researchers test the reliability of the grounded theory process, evaluating if the detected patterns are generalizable to the whole collection of textual data. Researchers have a lot of flexibility in deciding how to computationally confirm patterns. One can hand-code a random collection of documents relying on the patterns identified in the first two steps and code the remaining documents using supervised machine learning method to see if the results are consistent. Alternatively, depending on the research question, one can rely on prebuilt, external dictionaries or in case of mixed-method study, the quantitative results to confirm the identified patterns.

Several resources are available for computer-assisted text analysis (see Nelson, 2020 for some suggestions). The computational grounded theory framework allows researchers to analyze large corpus of text in an efficient, rigorous, and fully reproducible manner. Hence, the current study will use this framework for reference.

CHAPTER 8 – STRUCTURAL TOPIC MODELING

As previously noted, in this era of big data, computer-assisted algorithms are constantly gaining momentum and becoming more accessible for researchers to conduct a large-scale qualitative work, which would have been insurmountable with traditional hand-coding approaches (Chung et al., 2022; Enria et al., 2021; Nelson, 2020; Pietsch & Lessmann, 2018; Roberts et al., 2014; Tausczik & Pennebaker, 2010). Among several techniques to handle large amount of textual data, STM is a semiautomated approach to infer rich latent topics based on the co-occurrence of words within the free-text data (Roberts et al., 2014). As an example, words like "social", "cost", "service", "immigrant", "care", "welfare" that appear together in a corpus on public views of immigration are likely to belong to a topic describing people's fear (Roberts et al., 2014). Markedly, STM also allows researchers to link metadata about the respondents (e.g., gender, ethnicity, job position, etc.) and the identified topic. That is, researchers will be able to test if certain topics are more prevalent among specific groups of people.

The STM was developed by Roberts et al. (2014) by extending the Latent Dirichlet Allocation (LDA) modeling algorithm. LDA works under the assumption that the words within each document are generated by some unobserved, latent topics (Blei et al., 2003). In short, LDA is a hierarchical Bayesian model where "each document d_m is modelled as a finite mixture over a set of K corpus-wide topics z_k" and "each topic is a distribution over a fixed set of V words w_v" (Blei et al., 2003, as cited in Pietsch and Lessmann, 2018). Conceptually, the LDA generation process consists of three steps. First, the probability over words for each topic z

(ϕ_z) is drawn from a prior distribution $\phi_z \sim Dir(\beta)$ that is a symmetric Dirichlet distribution with parameter β. Second, the probability over topics for each document d (θ_d) is drawn from a prior distribution $\theta_d \sim Dir(\alpha)$ that is a symmetric Dirichlet distribution with parameter α. In the last step, for each word in document d (w_{dn}), a topic z_{dn} is drawn from a multinomial distribution with parameter θ_d: $z_{dn} \sim Multinomial(\theta_d)$. Conditional on the selected topic, the word w_{dn} is chosen from the multinomial distribution with parameter $\phi_{z_{dn}}$: $w_{dn} \sim Multinomial(\phi_{z_{dn}})$. The number of topics ($K$) and the prior Dirichlet hyperparameters for the document-topic distribution (α) and topic-word distribution (β) are selected a priori to modeling, whereas the remaining posterior distributions are derived using collapsed Gibbs sampling algorithm (Blei et al., 2003; Pietsch & Lessmann, 2018; Roberts et al., 2014).

The STM builds on the LDA algorithm to allow for inclusion of covariates (Roberts et al., 2014). Unlike in the LDA model, topics are free to correlate in the STM. Instead of using a global mean, the STM allows each document within the corpus to have its own prior distribution over topics which varies as a function of the covariates under consideration. Furthermore, under the influence of certain covariates, words within a topic are also allowed to fluctuate. The added flexibility serves as a mechanism to structure prior distributions, facilitating model inference.

To summarize, the STM is a useful tool for analyzing a large corpus of textual data in a laborsaving, transparent, and fully reproducible manner (Chung et al., 2022; Roberts et al., 2014, 2019). Though the analysis process with STM is of an iterative nature, requiring intimate knowledge of the data source and expertise in reading the text, STM prevents researchers from having to create a coding manual from scratch. This computerized method also enables

researchers to explore a large volume of data that can be overwhelming and even impossible for hand-coding (Roberts et al., 2014, 2019). Moreover, all the decisions made while fitting these computer-assisted models are readily available for reference and comparison. Given these benefits, it is worthwhile to incorporate this method in research.

CHAPTER 9 – THE PRESENT STUDY

In this study, I used the computational grounded theory as a framework and the STM algorithm to explore people's psychological distress and their means of coping with distress during the COVID-19 pandemic. Psychological distress has been linked to worsened mental health, declined relationship quality and increased mortality risk, among many other critically important variables whereas coping mechanisms work differently for people in dissimilar situations (e.g., Barry et al., 2015; Chivers et al., 2020; Daly & Robinson, 2021; Littleton et al., 2007; Shechter et al., 2020; Vungkhanching et al., 2017; Weaver & Clum, 1995). In the context of a global pandemic, understanding of individuals' psychological distress and their coping mechanisms can facilitate a sense of shared reality, motivate adherence to public health guidance, and inform public policies to better support people (e.g., Brownstone et al., 2021; Chivers et al., 2020; Daly & Robinson, 2021; Galehdar et al., 2020; Horesh et al., 2020; Lieberoth et al., 2021; Shechter et al., 2020; Siebenhaar et al., 2020; Toulabi et al., 2021). Methodologically, this study also showcased how computer-assisted tools can be utilized as researchers increasingly work with big data.

Previous research demonstrated that psychological distress differs by demographics (Barry et al., 2015, 2020; Horesh et al., 2020; R. G. Wilkinson & Marmot, 2003). Specifically, scholars studying COVID-19 found cross-country differences in several issues, including but not limited to psychological distress, coping with distress, panic buying behaviors, mortality risks, and trust in governmental efforts (Buyukkececi, 2021; Islam et al., 2021; Lazarus et al., 2020; Lieberoth et al., 2021). Several theoretical frameworks, including the theory of social

comparison processes by Festinger (1954) and the cultural dimension framework by Hofstede (1984, 2001), can be used to make sense of such national differences. The COVID-19 pandemic is full of uncertainty (Matta et al., 2022; Yoon et al., 2021). In such a time when objective and non-social means for comparison are available, people tend to evaluate their opinions and abilities against those of others (Festinger, 1954). Applying this framework to COVID-19, individuals residing in the same country are subject to a certain shared reality such as the temporal precedence of the outbreak and government policies for containment and protection against coronavirus (Nicola et al., 2020; Perlstein & Verboord, 2021). Since countries had incomparable states of affairs and deployed different responses to handle the COVID-19 crisis, the COVID-19 impacts on individuals' psychological distress and subsequently their coping mechanisms would be different across countries (Lieberoth et al., 2021; Marzo et al., 2021). To put it another way, individuals living the same country are likely to have more similar experiences than others in different countries. Furthermore, Hofstede (1984, 2001, 2010) proposed a cultural framework consisting of six dimensions (power distance, uncertainty avoidance, individualism versus collectivism, masculinity versus femininity, long-term versus short-term normative orientation, and indulgence versus restraint) that explains how the national culture influence the way people appraise and utilize their environment. As an example, high power distance countries (characterized by clear social hierarchy and unequal distribution of power among citizens) may have more forceful policies to address COVID-19 rather than giving out recommendations and relying on mutual obligation, thus jeopardizing democracy and individual autonomy (C. Chen et al., 2021; Gokmen et al., 2021). Similarly, people in more individualistic societies may find extended restrictive measures against COVID-

19 a violation of their rights. As previous studies highlighted cross-country differences in multiple coronavirus-related phenomena (e.g., Buyukkececi, 2021; Gokmen et al., 2021; Lieberoth et al., 2020), and based on the above cultural frameworks, I incorporated country as a covariate in my analytic model. By doing so, I can obtain some preliminary understanding of whether the topic prevalence differs by country. In other words, the topic model with country as the covariate can offer some initial evidence to how people residing in different countries may describe a particular source of distress more frequently than others.

CHAPTER 10 – METHOD

Data

The data used in this study were derived from the first wave of the COVIDiSTRESS global survey project (https://osf.io/z39us/). The project was conducted under the collaboration of a diverse team of researchers from several countries. The questionnaires were originally formulated in English, translated into different languages and then, blindly back-translated to English by independent collaborators as suggested by C.-C. Lee et al. (2009). The translators reviewed and resolved discrepancies between the original and back-translated English versions with the help of other experts as necessary. Given the urgent need for comparable data across the globe to understand people's experiences during that early stage of the COVID-19 pandemic, we were not able to carry out the forward and backward translation process multiple times as done in C.-C. Lee et al. (2009). However, we made sure that the survey was translated, back translated, and reviewed at least once before we did a soft launch in Denmark and Kosovo. After we did a final check on the soft launch data, we launched the survey in all participating countries. Over the span of two months from the end of March to the end of May in 2020, the project collected over 170000 responses from participants living in over 40 countries. The dataset includes a wide range of measures, such as perceived distress, availability of social provisions, compliance with different health recommendations and policies alongside some demographic information, allowing for cross-cultural comparisons of many interesting phenomena. More details on the data collection and data cleaning process, as well

as the final list of measurements used can be found in Yamada et al. (2021) and our pre-registration on the Open Science Framework (https://osf.io/z39us/).

In this paper, I subset the data to include participants who provided responses to at least one of the open-ended questions. The final sample includes 12567 participants. Most participants were female (79.59%), 18.48% were male, and the remaining participants did not disclose their sex. Participants were between the age of 18 and 105 (M = 40.59, SD = 14.08). In terms of marital status, the majority of participants (51.12%) were married or cohabiting and 33.87% were single. Over three quarters of participants (88.04%) either had attended some college classes or had obtained college degree or higher. For a more detailed description of the sample characteristics, please refer to Table 1.

Table 1

Sample characteristics (n = 12567).

	n	%	*M*	*SD*	Range
Age	12567		40.59	14.08	18-105
Country of residence					
Finland	2566	20.42%			
Argentina	2227	17.72%			
France	1188	9.45%			
Mexico	1073	5.54%			
Denmark	1032	8.21%			
Croatia	623	4.96%			
Lithuania	345	2.75%			
United States	320	2.55%			
Sweden	290	2.31%			
Bulgaria	284	2.26%			
Poland	225	1.79%			
United Kingdom	157	1.25%			
Japan	155	1.23%			
Italy	144	1.15%			
Czech Republic	143	1.14%			
Germany	139	1.11%			
Netherlands	137	1.09%			
Indonesia	133	1.06%			
Kosovo	109	0.87%			

Other/NA	1277	10.16%
Sex		
Female	10002	79.59%
Male	2322	18.48%
Other/Would rather not say	220	1.75%
NA	23	0.18%
Education level		
Up to 6 years of school	172	1.37%
Up to 9 years of school	139	1.11%
Up to 12 years of school	1014	8.07%
Some college, short continuing education or equivalent	3165	25.19%
College degree, bachelor, master	6501	51.73%
PhD/Doctorate	1398	11.12%
Other	66	0.53%
NA	112	0.89%
Employment		
Not employed	1345	10.71%
Part-time employed	1335	10.62%
Full-time employed	5096	40.55%
Self-employed	1644	13.08%
Student	1799	14.32%
Retired	1230	9.79%
NA	117	0.93%
Working as an expat		
Yes	2116	16.84%
No	10397	82.73%
NA	54	0.43%
Marital status		
Single	4256	33.87%
Married/Cohabiting	6424	51.12%
Divorced/Widowed	1253	9.97%
Other/Would rather not say	555	4.42%
NA	79	0.63%

Measures

Textual Data

While the main focus of this COVIDiSTRESS dataset is quantitative, there were two open-ended questions on perceived distress and coping mechanisms that were asked after a series of potential sources of distress and coping strategies (delineated by the research team). There were no restrictions in terms of language selection, response length, or content. In other

words, participants had the opportunity to share with the investigators any reflection that they may have about the questionnaires and the study, or to disclose further information about their distress and coping that are not covered by the researchers in their own language, however detailed as they preferred.

Psychological Distress. Participants read the opening statements "Now we would also like to know more about how the coronavirus situation affects your daily life in your country. […] In the current situation, do you feel distressed over…" Then, on a 6-point Likert scale (1 corresponds to "Strongly disagree" and 6 corresponds to "Strongly agree"), participants indicated their agreement with a list of items such as "My day-to-day income right now", "My children's education", and "Future job prospects", etc. For these items, participants also had the option to select "Does not apply to my situation". At the end of this survey block on psychological distress, we asked "Other?" and participants could choose to type out their answer or skip this open-ended question.

Coping Mechanisms. Similar to the psychological distress survey block, participants read the leading statements "Now something very important: Coping with the coronavirus situation. [...] I have found the following helpful for reducing feelings of discomfort during the coronavirus situation…" Then, on a 6-point Likert scale (1 corresponds to "Strongly disagree" and 6 corresponds to "Strongly agree"), participants indicated their agreement with a list of items such as "Information from the government", "Phone calls or other long-range interactions with friends and family", and "God, religion or spirituality", etc. At the end of this survey block on coping with the COVID-19, we asked "Other?" and participants could choose to type out their answer or skip this open-ended question.

As responding to these two open-ended questions was voluntary and required more effort from the participants, it is unsurprising that the matrix containing written responses was rather sparse. For the current study, I extracted participants' free-text answers across these two questions and combined them into one record per participant. Then, I used this data to conduct a STM analysis.

Country as a Covariate

Participants selected their place of residence from a drop-down list of countries.

Structural Topic Modeling Workflow

Preprocessing Data

In the first step of the analysis, I gathered responses to the psychological distress and coping questions and created a single free-text variable. Since the written responses are in multiple languages, there were two general approaches to handle multiple languages in computer-assisted analysis of textual data, language-specific preprocessing and translation of all languages into a single language before processing (Lucas et al., 2015). Notably, existing packages to handle multi-language analysis have not been well designed to automatically handle language-specific preprocessing for all languages. Certain languages have very different sentence structure and words that are considered "filler words", or "stop words" that need to be removed before further analysis (Lucas et al., 2015). Thus, the first approach would work best if I was only dealing with very common, well-trained languages like English, Spanish, and Chinese, etc. For this study, I opted for the second approach. I relied on Google Translation to convert all text to English before estimating analytic models. Though imperfect, the use of

machine-aided translation is becoming common in research settings and accuracy is consistently improving (S.-M. Lee, 2022; Welnitzova et al., 2021).

After all documents were converted into English, I deleted some test responses from the research team (e.g., “this is a test of the survey from the Mexican team”). I also removed texts saying that participants had nothing to add or the predefined list of distress and coping items had covered everything participants wanted to say (e.g., “no others”, “nothing more to say thank you”). Furthermore, I discarded gibberish responses (e.g., “xxx”, “n n”, “nthg”) and combined the available textual responses to the two open-ended questions on distress and coping into a new column for further preprocessing.

I used the *quanteda* package (https://quanteda.io/) to preprocess the textual data to make it easier for the machine to recognize and categorize text efficiently. Keeping in mind that most responses were on psychological distress and coping, I decided that numbers, html tags, special characters (e.g., $, %, @, &), and extra white space may not be of much importance. As such, I removed all punctuation in the text. Additionally, since the machine distinguishes lowercase from uppercase letters, I converted all text to lowercase for consistency. My initial plan was to reduce the complexity of the text by stemming words (removing all prefixes and suffixes; e.g., “doing” and “making” become “do” and “make”). However, during execution, I realized that the existing algorithm for stemming is not perfect. As an example, “uncertainties” got changed into “uncertainti”, “families” turned into “famili”, and so on. Despite its potential benefit, stemming made it challenging to interpret the resultant topic models. This observation was supported by A. Schofield and Mimno (2016). As a result, I decided to proceed without using the built in stemmer from the *stm* package and

instead manually reduced some of the commonly used words to their root word (e.g., "playing", "plays", "played" all got changed to "play"). Common English stop words like "and", "a", "the", "is", and "are" do not offer any contextual understanding for topic identification, hence these were removed from the corpus. In addition, I removed some custom words like "covid-19", "covid19", "covids", "coronavirus", and "pandemic" from the list of unigrams extracted from participants' written responses. These words describe the shared context surrounding all documents and they do not help me understand the underlying topic. To further simplify the document-word matrix, I converted noticeable synonyms to one consistent word. For example, "job", "occupation", and "career" became "work" whereas "cat", "cats", "dogs", "dog", and "pets" all became "pet". In this study, I chose not to include bigrams and/or trigrams (hereby referred to as "n-grams") in the analysis for some practical reasons. I did not want to expand the dimensions of the word co-occurrence matrix. Extracting n-grams from the text would expand the size of the matrix and make it more sparse, which can make it difficult for the model to converge. N-grams are often useful when researchers were interested in the words' order or the sentiments (i.e., negative versus positive) of a document; n-grams can allow for negation (i.e., "like" versus "not-like"). This study focused on the general themes/topics of a text; words' order and sentiments, despite their potential usefulness, are not critical for interpretation of the resultant topics.

It is worthwhile to note that this preprocessing step was not linear. Even though the description described all relevant tasks in this step, as I carried out the analysis, it was necessary to iterate through the steps several times and as I fitted candidate models to the data.

Model Estimation

In this step, I utilized the searchK function from the *stm* package (Roberts et al., 2019) to iteratively estimate multiple models each with a different number of topics (where *k* denotes the number of topics). Since open-ended survey responses are typically shorter and more focused than other forms of textual data, I will specified an initial range for *k* between 5 and 50 topics (Chung et al., 2022; Roberts et al., 2014). To account for possible variation in the results due to different starting values and to make sure that results are consistent and can be replicated, I specified used spectral initialization as recommended by previous studies (Chung et al., 2022; Roberts et al., 2019). Spectral initialization assumes the word co-occurrence matrix is generated from an infinite number of documents. Relying on the word co-occurrence matrix, spectral initialization identifies anchor words that uniquely identify one topic and calculates other words' topic loadings. This initialization method ensures a more stable and globally consistent solution (Roberts et al., 2019). The *stm* package allows for inclusion of covariates that can influence both topic prevalence (i.e., how much responses are associated with certain topics) and topic content (i.e., words that are used to describe certain topics; Roberts et al., 2019). In this study, I was interested in country of residence as the covariate and with the use of Google Translation to convert all texts to English, I believed that the covariate only had an impact on the topic prevalence.

Model Selection

I compared model specifications using the document-completion held-out likelihood and examined residuals from the fitted models (Roberts et al., 2019). The first is similar to cross-validation, where I removed some of the words from a document during the estimation

step and eventually tried to estimate the probability of such words appearing in the document (Asuncion et al., 2009; Hoffman et al., 2013; Wallach et al., 2009). By default, the searchK function from the *stm* package randomly holds back half of the words from 10% of the documents in the corpus to calculate the held-out likelihood. A model with high held-out likelihood will be able to generate high probability of the held-out words appearing in the document that they are sampled from (Wallach et al., 2009), overdispersion of the residual variances is the sign that more topics may be needed to improve model fit (Taddy, 2012). I used *stm*'s built in plotting functionality to visualize these metrics and paid close attention to models with the highest held-out likelihood and lowest residuals. Since *stm* also provides the marginal log-likelihood for candidate models, I also took this into consideration and preferred models with a high lower bound.

As described by Roberts et al. (2014), changing the *k* number of topics to be extracted from the text corpus influences the degree of granularity in viewing the data. In other words, models with a greater number of topics will be able to capture more variances within the collection of documents; however, too many topics can conflate the topic content. Therefore, selecting the optimal *k*-topic model among competing candidate models for useful, interpretable topics is key. Unlike other quantitative models, selection of a topic model cannot solely rely on diagnostic statistics like the marginal likelihood or the test of residuals as they capitalize on model fit rather than interpretability (Chung et al., 2022; Roberts et al., 2014, 2019). Following suggestions from previous studies, I assessed the interpretability of the topic model by looking at the semantic coherence and semantic exclusivity. Semantic coherence and exclusivity can also be understood as the internal consistency of words within a given topic and

the differentiation or diversity of words between topics, respectively (Roberts et al., 2014). According to Roberts et al. (2019), semantic coherence was first introduced as a criterion to evaluate topic models by (Mimno et al., 2011). Semantic coherence is "maximized when the most probable words in a given topic frequently co-occur together" (Roberts et al., 2019, p.10). Roberts et al. (2014, 2019) pointed out that high semantic coherence was easily attainable by having a lot of common words and a small number of topics and subsequently proposed to use semantic exclusivity in conjunction with semantic coherence to evaluate topic quality. Semantic exclusivity was based on the FREX metric (Airoldi & Bischof, 2016; Bischof & Airoldi, 2012); it captures the most probable words in a given topics weighted by the overall frequency of such words in the whole corpus. Similar to the held-out likelihood, residuals, and lower bound statistics, semantic coherence and exclusivity indices are important factors to consider when selecting the final model where higher values are preferred.

In reference to finer details, I subjectively evaluated the topic-word distribution across models. When a set of most probable words in a certain topic tended to co-occur, then I considered the topic to be semantically coherent. For instance, documents on work-related issues can give rise to a topic of "work delegation", with words like "direct", "report", "manager", and "responsibility" that are likely to occur together. Likewise, when a set of frequently co-occurring words appear in a topic with high probability while simultaneously are unlikely to appear together in other topics, then the topic is semantically exclusive. Using the previous example, "work delegation" topic is characterized by words like "direct", "report", "manager", "responsibility" whereas "work prioritization" contains different topic words like "time", "management", "project", and "workload". Aside from unigrams associated with each

topic, I also went through exemplary documents of each topic while judging the usefulness of the resultant topics.

In summary, I chose the model with the highest interpretability (high coherence and high exclusivity) while favoring models with optimal scores for the held-out likelihood and residuals. When examining the selected model, if I encountered synonyms and special characters that may jeopardize interpretability, I went back to the preprocessing step and reiterated the modeling steps from there, I repeated this process until I did not see any special characters in the list of extracted words and synonyms did not appear in the list of most frequent words for two different topics in the selected model.

Model Interpretation

After selecting an optimal model, I interpreted the model by exploring the most probable words and exemplary documents of every single topic. Specifically, words with the highest probability within a topic (in the *stm* model results, these are called PROB words) and words with the highest frequency weighted by their overall frequency and exclusivity within a topic (FREX words) are useful for making sense of the topics. While naming the extracted topics, I also drew on exemplary documents for further guidance and validation. For demonstration, if a topic is highly associated with “spouse”, “support”, and “involvement” with some example documents highlighting how spousal support and spousal involvement are helpful for coping with parenting stress during lockdown, then the topic can be named “spousal support” (Chung et al., 2022). Such classification is also consistent with existing evidence on the role of spousal support in coping with stress among parents (Chung et al., 2022). In short, I relied on the probable words and exemplary documents for naming the resultant topics. Then,

I compared the results with existing literature on psychological distress and coping during the COVID-19 pandemic to validate my model.

Model Validation

Once all the topics were identified, I examined their validity by scrutinizing the semantic coherence and exclusivity metrics produced by the selected model in conjunction with subjective reading of the topic words and exemplary documents from each topic. This step helped make sure that the emerged topics were internally consistent and distinctive from one another (Chung et al., 2022; Roberts et al., 2014). To strengthen my trust in the model, I also estimated the topics' proportional prevalence across all participants' responses. Since the *stm* can also calculate the correlations between topics, I relied on these two estimates to examine which topics were of concern to most participants and which topics often went together in their responses. I expected to see some degree of overlap between the results of this study and previous literature on people's experiences during the COVID-19 pandemic.

Further, since the data used in this study was taken from a global survey on COVID-19 experiences that were primarily quantitative. I compared my results from the *stm* to participants' numerical ratings of the psychological distress and coping items (generated by the COVIDiSTRESS symposium members) for triangulation. To illustrate, if someone showed strong agreement to the statement describing future job prospects as a source of psychological distress for them during the pandemic, it is likely that they will open up more about the situation leading up to that source of distress.

Estimate Covariate Influence

Once I chose a satisfactory model and was able to name and validate the topics, I turned to evaluate the potential influence of documents' metadata on the prevalence of the extracted topics. To reiterate, each participant's response can be composed of multiple topics with different proportions and the topic proportions for a single document equals to one (Roberts et al., 2019). I wanted to determine if and how participants from different countries differ in disclosure of their psychological distress and coping with distress during this pandemic. I first assumed that the topic proportions estimated in the chosen k-topic model were fixed. Fixed in this context means that there was no uncertainty in the topic proportions that were sampled from the variational posterior distribution estimated by the STM algorithm. Accounting for uncertainty in the estimation of the topic proportions is important to evaluate the robustness of the study findings. The current built in function of the *stm* package does not allow for multi-level modeling; thus, I decided to work with the no uncertainty assumption to get a general idea of the cross-country differences in topic prevalence. To clarify, estimation of the influence of country as the covariate was not done in two separate steps; rather, the enumeration of topics and the assessment of covariate effects was performed simultaneously (following the procedure outlined in Roberts et al., 2019) During the prior estimation process, I set the argument to allow topic prevalence to vary among countries. In this step of evaluating the influence of country, I simply extracted the topic proportion matrix from the chosen model. This topic proportion matrix is a wide data frame where each row represented a participant's response, and the proportion of the resultant topics for such response were contained in separate columns. As such, each record showed the proportion of document *i* (a participant's

written response) that belonged to topic *j* (one in *k* available topics). Using this topic proportion matrix, I ran a series of unconditional multi-level models with random intercepts. In these multi-level models, the second-level (i.e., clustering or grouping) variable was country of residence. From this model, I computed the intraclass correlations (ICC) to determine how much of the variance in the topic proportions may be attributed to differences across countries. Further, to see if people residing in the United States (US), the country with the highest death counts and is among countries with the highest mortality rates per 100,000 people (*Mortality Analyses*, n.d.), were more concerned over certain topics compared to those living in other countries, I used the same topic proportion matrix to estimate a collection of linear regressions. In these regressions, the predictor was a dummy code representing participants' country of residence (the US was used as a reference group for comparison). Then, I tested the null hypotheses that the prevalence of topic 1 through *k* was the same in the US in all other non-US countries by constraining all regression coefficients to be zero and comparing the constrained versus the unconstrained models. For each of these k number of linear regressions, a large *t*-statistic and a significant *p*-value would signify that I can reject the null hypothesis.

The procedure outlined above assumed that topic proportions were estimated without any uncertainty. To further examine cross-country differences and account for estimation uncertainty of the topic proportions, I used the estimateEffect function embedded in the *stm* package (Roberts et al., 2019). The estimateEffect function used the method of composition to draw multiple topic proportions from the variational posterior distribution, simulated the coefficients for a number of times (I used the default setting of 25) and averaged over those simulated coefficients for the final estimates (Roberts et al., 2019). This approach compared

the prevalence of each of the *k* topics in each non-US country against the topic prevalence in the US.

CHAPTER 11 – RESULTS

The results from the model selection step were inconsistent for conclusion. That is, based on the aforementioned indices, namely the held-out likelihood, lower bound, residuals, and semantic coherence and exclusivity, I was not able to identify the best-performing model for further analysis. Figure 1 depicted these comparison statistics in finer detail. If I were to pick the optimal model based on semantic coherence and residuals, the 31-topic model would be the choice. However, the held-out likelihood lower bound statistics for the same model were the lowest, suggesting that the 31-topic model was not the most desirable. The reason for the drop in held-out likelihood and lower bound of the 31-topic model could be attributable to the dissimilar length of participants' responses. In this study, I used voluntary written responses to two open-ended questions in an online survey. Hence, some of the responses were rather short (i.e., containing only a couple words), making it challenging for the algorithm to consistently estimate the likelihood-based indices for a candidate model. Generally, it is notable that there was some fluctuation in the held-out likelihood statistics (as shown in the top left panel of Figure 1), but the differences among candidate models seemed to be small in magnitude. As such, the held-out likelihood was not too useful in helping me decide the final model. On the top right panel, the residuals followed a downward trend as more topics were estimated from the data. However, the residuals bounced up and down after the 16-topic model and reached a new high point once every few additional topics. This trend in the residuals suggested that the optimal model may be anywhere among the 13- to 29-topic models. Further, models with higher number of topics tended to have lower semantic

coherence (as shown in the bottom left panel in Figure 1) and higher lower bound statistic (as shown in the bottom right panel in Figure 1). I did not want to proceed with a model that penalizes semantic coherence too much as semantic coherence is crucial for interpretation. Thus, I decided to further examine the 10- to 21-topic models. Within this range of topics, there were some fluctuations, but the lower bound seemed to improve while the residuals followed a general downward trajectory as the number of topics increased. This range of topics also captured the high points of held-out likelihood, lower bound and lower residuals. Though the semantic coherence was on a downturn, it was not the lowest among all candidate models.

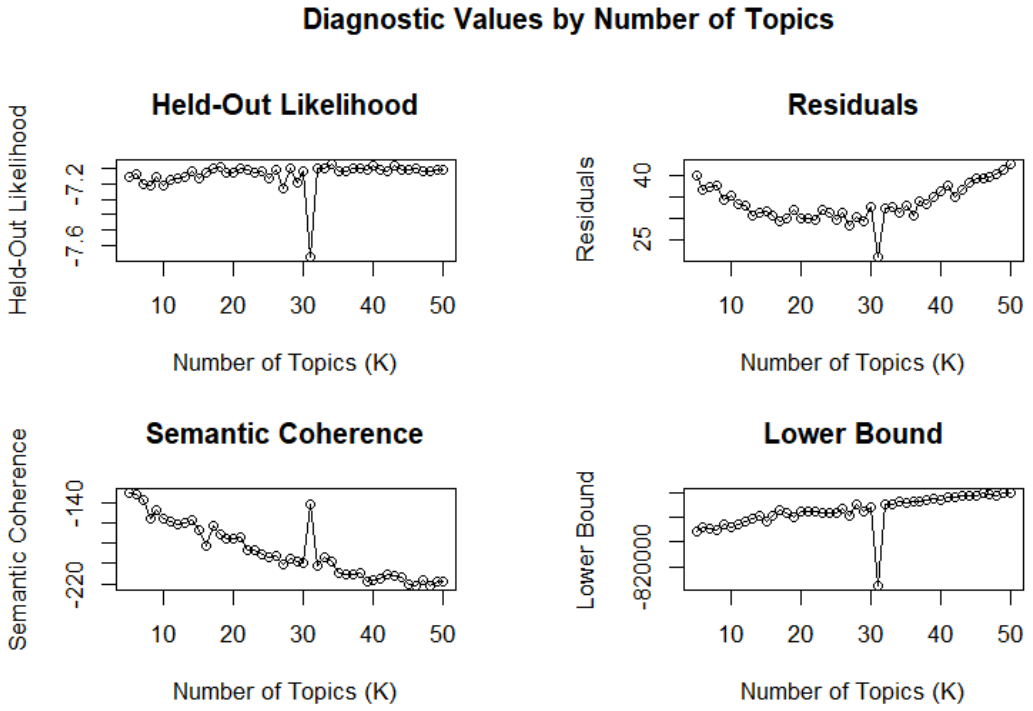

Figure 1

This figure details the goodness of fit statistics for different k-number of topics from the searchK results. An optimal model would have high held-out likelihood and lower bound, relatively high semantic coherence and low residuals.

I plotted the semantic coherence and semantic exclusivity of all models from the search results in Figure 2. Ideally, good candidates for the optimal model should be closer to the top right corner of the graph, signifying high semantic coherence and high semantic exclusivity. The 11- to 14-topic models seemed similar in terms of semantic coherence and semantic exclusivity. In conjunction with the information from Figure 1, I noticed that the 13- and 14-topic models had higher lower bound, held-out likelihood and lower residuals than the 11- and 12-topic models. With similar semantic coherence, the 17-topic model had higher semantic exclusivity than the 12-topic model. Considering both figures together, I noticed that among the 10- to 21-topic models, the held-out likelihood and lower bound were maximized with the lowest residuals for the 17-topic models. Based on the diagnostic statistics, I concluded that models with 13, 14, and 17 topics were promising for further scrutiny.

Figure 3 displayed the semantic coherence and exclusivity for each topic for the potential models. I was interested in models where all the points clustered on the top right corner of the plot, supporting high semantic coherence and high semantic exclusivity. It is notable that the 13-topic model had two topics that were comparatively lower in quality (i.e., lower scores in both semantic coherence and semantic exclusivity). As depicted in Figure 3, topic 4 and topic 9 in the 13-topic model were low in topic exclusivity; while there were some topics within the 13-topic model and the other two models with similar scores on semantic coherence, those topics had higher exclusivity scores. Further, topics 3, 6, and 9 in the 14-topic model had high semantic coherence with lower scores of semantic exclusivity than most topics in the 17-topic model (with an exception of topic 7 in the 17-topic model). Topic 7 in the 17-topic model was lower in both the semantic coherence and semantic exclusivity dimensions

while topic 7 in the 14-topic model has low semantic coherence with comparable level of semantic exclusivity.

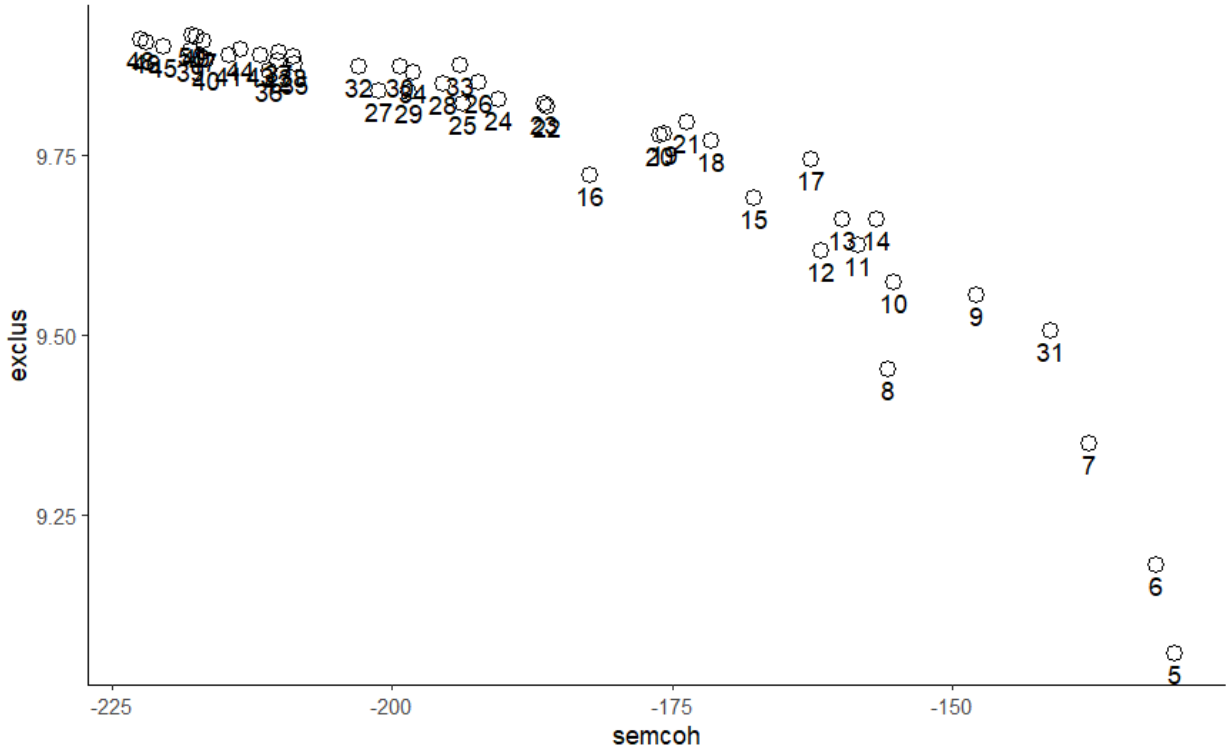

Figure 2

This scatterplot shows the average semantic coherent versus semantic exclusivity of topics in different k-topic models from the searchK results. An optimal solution would have high scores on both semantic coherence and semantic exclusivity.

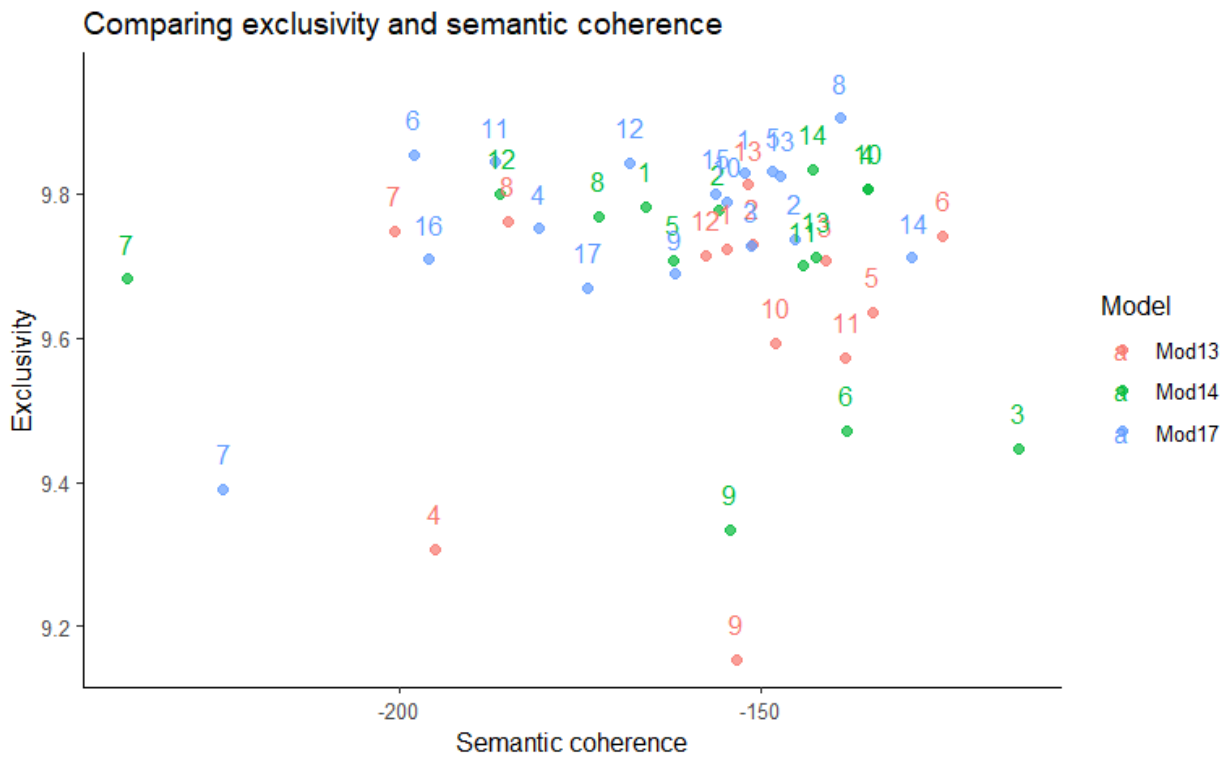

Figure 3

This scatterplot shows the semantic coherent versus semantic exclusivity of each topic in the candidate k-topic models (k = 13, 14, and 17). An optimal solution would have high scores on both semantic coherence and semantic exclusivity.

I proceeded to estimate all three candidate models to better evaluate the interpretability of the resultant models. Details on all fitted models can be found in the Appendix. Looking at the PROB[1] and FREX[2] words of the fitted models, I found it challenging to name all topics in the 13- and 14-topic models. For example, topic 7 of the 13-topic model was described by PROB words like "work", "read", "long", "music", "income", "listen", "self" and FREX words like "work", "protective", "lose", "layoff", "workload", "literature", "wedding". These words could have been used to talk about the work situation (i.e., work demands, work

[1] PROB: words with high probabilities of being in a given topic.
[2] FREX: words with high probabilities of being in a given topic, weighted by their overall frequency and how exclusive they are in the topic.

conditions, work layoff, etc.). However, some words (i.e., music, literature, and wedding) did not seem relevant to work-related concerns. Documents that were considered "typical" for this topic did not seem to consistently capture work-related themes. For example, the two following responses were both considered highly representative for topic 7 in the 13-topic model:

> "I work for a dentist. We handle emergencies 1 or 2 mornings a week. No income, holidays terminated, and layoffs required. Difficulty in finding personal protective equipment such as fpp2 masks."
> "Reading (novels, History), listening to music (tango, folklore, Bach, Vivaldi)."

It is apparent that the first response was about concerns in the workplace while the other discussed leisure activities. The 14-topic model was also not easy to interpret. For instance, topic 10 in this model was characterized by PROB words like "home", "get", "life", "infect", "sick", "fear" and FREX words like "home", "life", "normal", "everyday", "focus", "busy", "thing". At first glance, this topic seemed to be about staying at home during the pandemic, possibly in response to the fear of infection. However, the representative documents for this topic did not seem to be consistent with this observation:

> "I don't want the government to bash my head in."
> "Doing lots of sports."
> "This too shall pass ... and hopefully we will have a more humane world and not one that depends on GDP but on saving the lives of the most vulnerable and marginalized. Keeping the mind occupied with things of beauty and love. There is nothing that you can control apart from yourself and your response. Once you accept that, life becomes easier."

Given the diagnostic statistics and the model interpretability, I decided that the 17-topic model was the most optimal. Table 2 summarized the PROB words, FREX words as well as the prevalence of each topic of the resultant model.

Table 2

Topic results from structural topic modeling (k = 17), arranged from the most frequent to least frequent topic

Topic	Proposed label	PROB words	FREX words	Topic proportion
2	Leisure activities/Hobbies	read, know, music, cook, online, play, listen	music, cook, play, listen, sports, games, video	8.36%
1	Concerns about the future	health, economy, country, future, world, concerned, quarantine	health, economy, future, society, end, change, impact	6.77%
13	Being away from loved ones	able, home, see, live, alone, parents, stay	able, partner, son, another, travel, anguishes, province	6.77%
10	Concerns for others	people, time, take, care, others, fear, enough	spend, spending, homeless, take, properly, die, poor	6.65%
12	Access to nature	worry, exercise, nature, walk, garden, meditation, daily	exercise, nature, walk, meditation, birth, moving, baby	6.45%
11	Financial/Work-related concerns	work, income, continue, without, money, possibility, loss	income, money, loss, pay, works, lost, students	6.34%
16	Self-care/Access to self-care	activity, book, outdoor, pets, school, access, medical	activity, outdoor, pets, access, inability, crafts, pregnancy	6.28%
14	Managing thoughts	thing, like, much, think, just, even, little	back, moment, else, calm, maternity, like, anything	6.11%
7	Thoughts about COVID-19 and the political/social climate	crisis, state, confinement, behavior, human, agree, political	confinement, behavior, sport, freedoms, crown, mass, corruption	5.93%
9	Government responses/Media coverage	government, information, measures, news, spread, media, population	government, information, measures, news, scientific, false, reliable	5.65%
5	Isolation experiences	isolation, physical, well, friends, mentalhealth, loved, ones	isolation, physical, mentalhealth, loved, ones, isolated, mental	5.40%
15	Living situations	go, situation, lack, due, house, everything, afraid	employment, emotional, street, contagion, lack, patio, house	5.21%
3	Navigating a high-risk situation	risk, infect, child, concern, spouse, group, even	child, finland, coping, equipment, nurse, protective, workload	5.20%
6	Uncertainty	family, social, long, study, uncertain, last, personal	study, uncertain, last, term, workal, impossibility, progress	5.14%

17	Survey feedback	question, answer, whether, can, worry, f2f, discomfort	question, answer, whether, f2f, discomfort, colleagues, interaction	4.86%
4	Health and safety concerns	children, sick, mother, need, person, elderly, grandchildren	children, mother, grandchildren, ill, young, domestic, older	4.74%
8	Spirituality	get, life, anxiety, help, can, feel, normal	get, life, help, everyday, god, everyone, spirituality	4.16%

These words served as the basis for choosing the appropriate labels for the emerged topics. I first examined the PROB words and FREX words for each topic to come up with a conceptual label that could potentially capture the meaning and/or common context surrounding such words. With the assumption that most of the words participants used were to portray their subjective experiences of psychological distress and/or how they coped with distress, I tried to arrive at labels that were consistent with what had been covered by previous scholars. To illustrate, the first topic in the 17-topic model was described with words like "health", "economy", "country", "future", "world", "concerned", "quarantine", "change", "end", and "impact". An overarching label for this topic could be "Concerns about the future", encompassing concerns about the economic prospects during the pandemic, as well as the impact of a country's COVID-19 measures (e.g., social distancing, quarantine, etc.) on different aspects of one's life (e.g., educational outcome, child development, mental health, etc.). These were sources of psychological distress that were well documented in the literature (Duarte & Jiménez-Molina, 2021; Hasan & Bao, 2020; Lu & Lin, 2021; H. Yan et al., 2020).

In naming these topics, I also relied on participants' responses that were most representative of each topic (i.e., exemplary documents). Though the documents were not exclusively classified into any particular topic, reading documents with high topic proportions

alongside the PROB and FREX words is helpful for naming the topic. For instance, Table 3 provided some example documents within the two most frequent topics.

Table 3

Two topics with highest topic proportions and their exemplary documents

Topic 2: "Leisure activities/Hobbies"
"Reading (novels, History), listening to music (tango, folklore, Bach, Vivaldi)."
"Learning college material, reading books, drawing, listening to music, watching youtube videos."
"Listen to music, cook and clean."
"Cooking, playing an instrument, painting, drawing, listening to music."
Topic 1: "Concerns about the future"
"I am concerned that the economic downturn caused by the pandemic will not lead to reforms leading to a sustainable lifestyle, such as the acceleration of measures to combat climate change, but will instead accelerate climate change because no change is desired."
"That we are returning to an old unsustainable and unequal lifestyle that emphasizes the interests of the individual and unnecessarily burdens biodiversity and the climate, and we are not learning from this challenge / opportunity and moving our society in a more sustainable direction. Reflecting on the causes and solutions to the sustainability crisis (a more worrying and far-reaching issue) and innovating in a new, more sustainable society, and finding a role in this change for a better, more sustainable and more equitable future for all (biodiversity-maintaining organisms)."
"The origin of the virus and the possible aftershocks of similar situations worldwide."
"I am concerned that, due to the economic impact of the corona, environmental awareness and desire, as well as the capacity to build a sustainable future, will suffer a setback after the epidemic."

Semantic coherence and semantic exclusivity describe the quality of the resultant topics, they were evaluated with the likelihood of certain words appearing in a topic. On the other hand, every participant's response has a proportion belonging to every topic. The topic correlations captured the degree to which people tended to talk about any pair or pairs of topics together. Estimation of the topic correlations was automatically done using the topicCorr function in the *stm* package. Roberts et al. (2019) extended the work from Blei and Lafferty (2007) and used the topic proportion matrix to estimate such correlations. The topic proportion matrix is a $n \times p$ matrix where n is the number of participants and p is the number of

topics, each record in the matrix shows the estimated proportion of a topic in a given document. Table 4 showed that most of the correlations were within the very small to small effect size threshold suggested by Funder and Ozer (2019). However, there were some topic correlations that were in the medium to large effect size threshold. For example, topic 2 – "Leisure activities/Hobbies" were less mentioned together with topic 3 – "Navigating a high-risk situation" (r = -.28), topic 8 – "Spirituality" (r = -.21), topic 10 – "Concerns for others" (r = -.21), and topic 14 – "Managing thoughts" (r = -.29). Interestingly, the correlation between topic 8 – "Spirituality" and topic 14 – "Managing thoughts" was considered a large effect (r = .43).

I merged the topic proportion matrix with the quantitative portions of the COVIDiSTRESS global survey and found that higher proportion of topic 11 – "Financial/Work-related concerns" was associated with higher level of agreement that participants felt distressed over their day-to-day income (r = .16) and their ability to perform their work well (r = .11). Additionally, higher proportion of topic 3 – "Navigating a high-risk situation" was associated with higher level of agreement that participants felt distressed over the risk of themselves or others they know catching COVID-19 (r = .03) and getting hospitalized or dying from COVID-19 (r = .04). These provided some evidence for the validity of the extracted topics from participants' written responses. Participants who rated highly on a given quantitative distress question could be more inclined to open up more about such source of distress in the open-ended questions.

Table 4

Correlations between topics in the 17-topic model

		Correlations															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Concerns about the future	-															
2	Leisure activities/Hobbies	-.20	-														
3	Navigating a high-risk situation	-.13	-.28	-													
4	Health and safety concerns	-.16	-.18	.18	-												
5	Isolation experiences	-.12	-.07	.07	.16	-											
6	Uncertainty	.14	.14	-.18	-.05	.08	-										
7	Thoughts about COVID-19 and the political/social climate	.16	-.17	-.16	-.19	-.20	-.12	-									
8	Spirituality	-.17	-.21	.11	.15	.04	-.13	-.13	-								
9	Government responses/Media coverage	.14	-.15	-.12	-.18	-.28	-.10	.26	-.16	-							
10	Concerns for others	.00	-.21	.04	.03	-.10	-.04	.00	.07	.10	-						
11	Financial/Work-related concerns	-.02	-.11	.02	-.07	-.13	-.04	-.18	-.02	-.15	-.02	-					
12	Access to nature	-.19	.06	.00	-.06	.07	-.15	-.16	-.04	-.25	-.15	-.07	-				
13	Being away from loved ones	-.19	.06	-.13	.10	.10	.14	-.26	-.01	-.30	-.12	.08	.00	-			
14	Managing thoughts	-.12	-.29	.03	.03	-.03	-.14	-.11	.43	-.10	.04	.06	-.14	.02	-		
15	Living situations	.15	-.03	-.21	-.13	.00	.11	-.06	-.05	-.07	.11	.14	-.13	.19	-.05	-	
16	Self-care/Access to self-care	-.17	.31	-.07	-.05	.04	-.03	-.20	-.18	-.17	-.17	-.13	.24	-.11	-.28	-.17	-
17	Survey feedback	-.11	-.19	-.05	-.06	-.13	-.16	-.06	.09	.00	-.12	-.12	-.12	-.17	.18	-.20	-.19

Once I selected an optimal topic model and came up with labels for all resultant topics, I turned to evaluate the potential influence of the covariate, country of residence, on the prevalence of each topic. Results from the unconditional random intercept models were summarized in Table 5 below. Topic 8 – "Spirituality", topic 10 – "Concerns for others", and topic 15 – "Living situations" had the highest intra-class correlation of .93, .91, and .85, respectively, suggesting that over 80% of the variance in the prevalence of these topics could be attributable to cross-country differences. Some other topics with high ICC included topic 11 – "Financial/Work-related concerns" (*ICC* = .65) and topic 7 – "Thoughts about COVID-19 and the political/social climate" (*ICC* = .50).

Table 5

Differences in ICC for each topic when topic prevalence was assumed as fixed

	Topic	ICC
1	Concerns about the future	.44
2	Leisure activities/Hobbies	.22
3	Navigating a high-risk situation	.14
4	Health and safety concerns	.12
5	Isolation experiences	.19
6	Uncertainty	.22
7	Thoughts about COVID-19 and the political/social climate	.50
8	Spirituality	.93
9	Government responses/Media coverage	.17
10	Concerns for others	.91
11	Financial/Work-related concerns	.65
12	Access to nature	.19
13	Being away from loved ones	.37
14	Managing thoughts	.24
15	Living situations	.85
16	Self-care/Access to self-care	.11
17	Survey feedback	.41

Using the US as the country of reference, I fitted 17 different linear regressions comparing the prevalence of each topic in all other non-US countries versus the same topic's

prevalence in the US. In these analyses, I used the same topic proportion matrix where each row represented a participant's response, and each column represented the proportion of such response that "belongs" to a given topic. I created a dummy variable to describe participants' country of residence, where 0 represented other countries and 1 represented the US. As shown in Table 6, nearly all the *p*-values obtained from the significance tests were well below .01. Topic 5 – "Isolation experiences", topic 8 – "Spirituality", and topic 11 – "Financial/Work-related concerns" were discussed significantly differently in the US compared to non-US countries ($p < .05$). The prevalence of two of 17 topics, topic 3 – "Navigating a high-risk situation" and topic 17 – "Survey feedback" did not significantly differ for US versus non-US residence.

Table 6

Results from models comparing topic prevalence between the US and non-US countries. These models assumed that topic proportions were fixed.

	Topic	*t*	*p*
1	Concerns about the future	-3.45	<.01
2	Leisure activities/Hobbies	-6.87	<.01
3	Navigating a high-risk situation	-1.32	.19
4	Health and safety concerns	-2.94	<.01
5	Isolation experiences	-2.55	.01
6	Uncertainty	-2.91	<.01
7	Thoughts about COVID-19 and the political/social climate	3.32	<.01
8	Spirituality	-2.38	.02
9	Government responses/Media	7.45	<.01
10	Concerns for others	9.65	<.01
11	Financial/Work-related concerns	2.29	.02
12	Access to nature	3.68	<.01
13	Being away from loved ones	-3.38	<.01
14	Managing thoughts	2.90	<.01
15	Living situations	-3.12	<.01
16	Self-care/Access to self-care	-3.62	<.01
17	Survey feedback	0.98	.33

To determine which topic was more frequently discussed by people living in the US compared to people residing in other countries, I obtained every topic prevalence in the US, and took an average of each topic prevalence in other countries to create Figure 4. For example, for topic 9 - “Government response/Media coverage”, 9.19% provides the estimated average proportions of all US residents’ responses that pertained to this particular topic whereas only 5.56% of responses outside of the US were about the same topic. The biggest differences were found in topic 9 – “Government responses/Media coverage”, followed by topic 10 – “Concerns for others” and topic 7 – “Thoughts about COVID-19 and the political/social climate”. Moreover, US residents also discussed topic 12 – “Access to nature”, topic 11 – “Financial/Work-related concerns”, topic 14 – “Managing thoughts”, and topic 17 – “Survey feedback” more frequently than people living in other countries. The difference in the prevalence of topic 17 in the US versus non-US countries was less than .50 percent. Overall, a couple percentage-point difference on its own did not seem to be a sufficiently substantial difference to be deemed meaningful. However, relative to the overall prevalence of each topic in the US versus non-US countries (which was less than 10%), a 3.63% difference in the topic prevalence was not ignorable.

The linear regressions comparing topic prevalence in the US versus other countries assumed that topic proportions extracted from the chosen 17-topic model were fixed. Results from the estimateEffect function call (accounting for uncertainty in the estimates of topic prevalence) revealed some significant differences in the prevalence of all topics for people living in the US compared to those in each of the non-US countries. Table 1 in the Appendix described these differences in more detail.

Figure 4

Difference in topic prevalence between the US and other countries

CHAPTER 12 – DISCUSSIONS

Summary of Study Findings

I found that a 17-topic model provided optimal fit to the collection of free-text responses to two open-ended questions on psychological distress and coping. Among the extracted topics, 11 of them were mainly about different sources of psychological distress for people. Topic 1 was about participants' concerns about the future as the pandemic is underway, including discussion about economic performance, lessons learnt from people's unsustainable lifestyle, and other societal changes (e.g., economic downturn, unsustainable lifestyle, potential impact on future generations). Topic 6 further discussed the multifaceted uncertainty during the COVID-19 pandemic, including uncertainty in one's personal life (e.g., college admission, study progress, etc.), uncertainty involving other people (e.g., relationship, health of loved ones), and general uncertainty. Topic 4 dived deeper into the health and safety concerns during the pandemic, including disclosure of the pre-existing health conditions and distress over insufficient/lack of access to care (for one's self and for family members) when needed. Along this line, people also talked about navigating a high-risk situation in topic 3, citing the risk of contracting the coronavirus from public places (e.g., grocery stores, pharmacy, or schools), particularly from individuals who did not wear masks. Financial struggles and work-related concerns (e.g., increased workload, business closure, missed payments, loss of income, etc.) was another source of distress for people.

On a different note, participants shared their thoughts about the origin and nature of the COVID-19 pandemic as well as the political and social climate during this pandemic (topic 7).

Some said that the coronavirus was manufactured, and that the pandemic enabled political and economic gain for certain groups (e.g., expansion of government control and monetary gains for pharmaceutical companies) while promoting social unrest (e.g., discrimination towards Asian people). Others voiced the idea that the pandemic was not too terrible and might even be beneficial for the human race and the earth. Quite a few people mentioned the role of public agencies' responses (information from the governments and/or media coverage) in facilitating psychological distress (topic 9). For example, among the representative documents for this topic were description on the lack of coronavirus-related facts and excessively aggressive policies that violated the rights of individuals. Furthermore, one's living conditions (topic 15; e.g., lack of resources, inability to access resources due to citizenship status) and being away from loved ones (topic 13; e.g., not living in the same place with the family, not being able to keep in contact and visit family members) were distressing. Amidst the pandemic, many people lived in isolation following the social distancing and quarantine recommendations/mandates. This study's participants described their experiences during isolation in topic 5, reporting loneliness and longing for physical contacts (e.g., hugs, physical intimacy) with their loved ones. Some people highlighted the physical and mental health difficulties during isolation. More broadly, people expressed care and concerns for others even beyond their family and loved ones such as the homeless, the immigrants, and people who struggled financially (topic 10).

In terms of coping mechanisms, people reported engagement in indoor leisure activities and hobbies (topic 2) such as reading, listening to music, cooking and cleaning. Besides, people also talked about the importance of self-care activities (topic 16; e.g., active outdoor activities,

self-development activities to further one's education), getting access to nature (topic 12), and managing their thoughts (topic 14). During a challenging time like the COVID-19 pandemic, people also reported connection and engagement with spirituality (topic 8).

The remaining topic was unrelated to psychological distress and coping mechanisms. Topic 17 was about participants' further clarification of their numerical ratings to the previous quantitative questions on distress or coping and their comments on the survey instruments. For example, some people made notes about the ambiguous, unclear translation of the survey from English to their primary language. Some indicated that the survey wording was confusing with double negatives. Others noted the problematic premise of the questionnaire as it assumed that everyone must have experienced psychological distress.

Main Findings in Relation to Existing Literature

The contents of the resultant topics were congruent with previous research on psychological distress and coping during the COVID-19 pandemic. During the initial outbreak of the COVID-19 pandemic (when this study's survey was administered), there was much uncertainty surrounding the nature of the coronavirus and effective means to limit its spread (Freeston et al., 2020; Galehdar et al., 2020; Koffman et al., 2020; Merow & Urban, 2020). Researchers also noted the detrimental effect of uncertainty stemming from disruption of daily life activities and personal plans (Hasan & Bao, 2020; S. X. Zhang et al., 2020). Correspondingly, participants in this study opened up about their psychological distress due to uncertainty:

> "Overall high level of uncertainty regarding so many factors all at once. I can tolerate a fair amount of ambiguity, but this ongoing ambiguity paired with relative personal inactivity to impact the overall situation is distressing."
> "Uncertainty about what will happen to my dissertation and project because it depends on recruiting people (I am conducting a clinical study and currently we cannot conduct research)."

Faced with a highly infectious pandemic like the COVID-19, people had to conscientiously keep good hygiene (i.e., washing their hands) and adhere to public health guidance (i.e., social distancing and wearing face masks) in an attempt to minimize transmission of the coronavirus. Siebenhaar et al. (2020) demonstrated that a higher level of distress was associated with better compliance; however, this positive association went away when distress was associated with information avoidance, which subsequently led to lower compliance. The current study demonstrated a slightly different issue when non-compliance by other people could be a source of distress for the individual. For instance, one participant wrote:

> "Annoying and disturbing are the completely carefree who do not lift the collar or scarf in front of their mouth and nose and do not wear protective equipment in shops when encountering other people."

The battle against the COVID-19 pandemic requires communal, joint efforts from multiple parties. As shown in previous studies, participants experienced psychological distress over their own health and well-being, as well as the health and safety of their loved ones and others beyond their immediate groups of friends and family (Eales et al., 2021; Mosheva et al., 2021; Rahman et al., 2020). I observed similar issues in the current study:

> "Not being able to obtain the cannabis that I consume to relieve the symptoms of a chronic illness, being intolerant to most medications (and particularly to analgesics and anxyolitics."
> "Worried about my sick 89-year-old mother who is in hospital and I am not allowed to visit her and help with technical details (hearing aids connected to smartphone)."
> "Concerned about the fate of migrants and homeless people who have no means of subsistence, hygiene or protection..."

In line with studies on healthcare professionals' experiences (e.g., Alizadeh et al., 2020; Galehdar et al., 2020; Shin & Yoo, 2022; Tan et al., 2020; M.-M. Zhang et al., 2021), participants in this study felt distressed over job-related issues such as increased work demands, lack of

proper protective equipment, fear of infection, and expressed that supportive resources and social support from peers, family, co-workers and supervisors helped relieving some of the distress. Particularly, participants wrote:

> "Lack of PPE at my work… As I am a nurse, and the nursing situation in the private sector does not allow them to use PPE…"
> "I am a doctor. I am anguished by the overload of work and the possibility that many of my patients will die."
> "Being an essential health care worker (psychologist) and being expected to continue working with patients but not being provided with the proper PPE and not working on a roster system so as to minimize exposure and risk to myself or my patients."

These work-related issues were nonexclusive to healthcare workers; other concerns for working people included unemployment, layoffs, etc. (Duran & Erkin, 2021; Kumar et al., 2021; S. X. Zhang et al., 2020). Respondents in this study also discussed these aspects at length; some examples were:

> "Losing my job because even with contingency we have not stopped working. There are not sufficient sanitary conditions in my work."
> "My work anguishes me because I work in theater, it is my main income, therefore I am not earning money."
> "I live from my closed business. I have 150 thousand fixed expenses without employees because it is a family business. I am anguished not meeting my commitments and the total reduction of my income…"

Existing records of people's experiences during the coronavirus outbreak also looked at other broader issues that were closely related to effective crisis management and public health such as the perceptions towards governmental measures and policies in dealing with the coronavirus (Koch & Park, 2022; Lazarus et al., 2020; McGuire et al., 2020), access to reliable, consistent information about the coronavirus, medical equipment and facilities, as well as mental health interventions (Barello et al., 2020; Chivers et al., 2020; E. M. Goldberg et al., 2021; Siebenhaar et al., 2020; Yoon et al., 2021). This theme emerged from the free-text

responses in this study. It is important to note that participants' thoughts on the government's responses to COVID-19 were mixed with both positive and negative sentiments:

> "Concerns that FHM does not give us the right facts to prevent the spread of infection as the authority seems to be fact - resistant and does not take into account the latest findings and knowledge regarding the spread of the corona virus. Other countries' counterparts to FHM have issued other advice and injunctions regarding the limitation of the spread of infection, and they are closer to the truth according to the research reports I have read. FHM seems to have knowledge corresponding to the Stone Age in comparison with other countries' authorities."
> "Democratic politics has not been implemented, and people in the ruling party, opposition parties, and non-party members cannot fully obey government policies during the anti-epidemic period, resulting in the implementation rate of good policies cannot be higher."
> "I have confidence in Shanghai's urban governance but not in the CCP's government."
> "The local and state government response is favorable, but the federal government is a disaster."

Participants talked about their living situations by describing their living accommodation, the behaviors of people around them, and how such factors contributed to their mental health. Below are a couple examples:

> "Discrimination is visible. Prohibition to leave the place of residence, but passes are obtained, but there is no public transport..."
> "That in a country that I am not a citizen (I live in Slovakia, I am Czech, I often went to the Czech Republic before the corona) I will not receive health care in case of health problems other than the corona. That something will happen, I will have to travel to the Czech Republic and I will no longer be able to get to Slovakia (I live, study and live in Slovakia, but I do not have a single document entitling me to enter Slovakia - I do not have a permanent employment here. Without these documents, people are not allowed to enter the country)…"

Concerns over the economy and society during this COVID-19 pandemic were also examined extensively in the literature (Bi et al., 2023; Duarte & Jiménez-Molina, 2021; McKee & Stuckler, 2020; Robinson & Daly, 2021). In the same vein, this study's participants shared in their concerns about the future:

> "I am concerned that the economic downturn caused by the pandemic will not lead to reforms leading to a sustainable lifestyle, such as the acceleration of measures to combat climate change, but will instead accelerate climate change because no change is desired…"
> "I wonder (a lot) what it is for a society that waits when the pandemic is over. Does it change our way of thinking? Behaviors? Is it - roughly speaking - fascism or community we wake up to?"
> "I am concerned that, due to the economic impact of the corona, environmental awareness and desire, as well as the capacity to build a sustainable future, will suffer a setback after the epidemic."

These examples were not at all exhaustive, and they did not cover the depth of participants' responses. However, they serve as evidence that the study findings were congruent with what has been shown in previous studies.

The COVID-19 pandemic was a global calamity. Among various public health recommendations and policies to combat the pandemic, stay-at-home policy was not without resistance as it first came into effect (Czeisler et al., 2020). As the coronavirus situation dragged on, isolation seemed to take a toll on some people (Every-Palmer et al., 2020; Gorenko et al., 2021; Kim & Jung, 2021; Mikocka-Walus et al., 2022); one participant wrote, "Loneliness and complete lack of communication from friends, work colleagues, family. This is complete isolation for me, not by choice...", another said "Exacerbation of mental health problems due to isolation." Conversely, some study participants seemed to do fine in isolation, stating that they just wanted to stay home, and that isolation is "the norm" for them anyway.

With regards to distress-coping mechanisms, participants reported leisure activities and hobbies (e.g., reading, dancing, knitting, etc.), get access to nature and outdoor, self-care activities (e.g., walking, running, practicing tai chi in the park, etc.) as helpful active coping strategies. These behaviors are beneficial to one's well-being in normal times and moreover,

are evidently beneficial during the pandemic (Shechter et al., 2020; Yu et al., 2020). Those who were not able to continue the exercises/behaviors they had pre-pandemic felt at loss, some were able to adapt to the new situation, continued their pre-pandemic behaviors with some slight adjustments or picked up a new hobby. Some people mentioned coping with distress by themselves, while others highlighted the importance of spending time doing various activities with their family members or friends. Some participants found condolence and relief from engagement in spirituality (e.g., confide in god, practice meditation), similar to what have been reported in previous studies (Alizadeh et al., 2020; Garcini et al., 2022; Shechter et al., 2020). Some people in this study also discussed the importance of acknowledging and managing unhelpful, detrimental thoughts (e.g., "… I want to die. I want my life back", "… I try not to feed hostile or anxious threads of thought"), staying positive and resilient during this difficult time (e.g., "Calm and happy thoughts can strengthen immunity", "I always look forward to something positive"). Others seemed more nonchalant, stating that they did not experience much psychological distress and that life continued as always for them, some even expressed enjoyment at the opportunity to be home with the family. Indeed, this notion of resilience in the face of a catastrophic event like the COVID-19 has been discussed thoroughly in the literature (Burke-Garcia et al., 2021; Eales et al., 2021; Huerta-González et al., 2021; Ojo et al., 2021).

Despite many overlaps between this study's topic modeling results with existing literature on psychological distress and distress-coping mechanisms, I was not able to identify maladaptive coping strategies (e.g., information avoidance, increased in substance use and substance abuse such as drinking and smoking) as shown in previous studies (Al-Tammemi et

al., 2020; Hahm et al., 2023; Lechner et al., 2020). A quick search through the collection of participants' responses using the word "drinking" showed that there were people talking alcohol consumption as a means of coping. However, it is impossible to determine from participants' responses whether they engaged in casual or problematic drinking. In addition, responses featuring drinking behaviors were relatively scant, which could potentially explain why a topic of maladaptive coping did not emerge in this study's results.

Surprisingly, there was a whole topic dedicated to participants' feedback on the survey design and implementation. Many studies on coronavirus-related issues done during the initial period of the outbreak were conducted in response to the dire need to understand and disseminate knowledge about the COVID-19, and to provide timely and effective support for people during this challenging time. Many journals allowed fast-track publication for coronavirus-related studies during the pandemic (e.g., *SAGE Journals*, n.d.). Given the pressing social need and time-sensitive nature of such studies, there can be room for improvement in the planning and execution of the research. In the description of the COVIDiSTRESS global survey, the authors did acknowledge that the questionnaire was designed and administered online for a quick turnover (Lieberoth et al., 2021; Yamada et al., 2021). In the free-text responses, some participants raised concerns about the survey's assumption, question format, and response options:

> "Some questions are poorly worded. At several it is so wrong that I am unsure whether the correct answer is that I 'strongly agree' or vice versa 'strongly disagree'. I will therefore not forward the questionnaire, because the results will not be credible."
> "Strongly disagree for face-to-face interaction => no interaction. These cannot be answered unambiguously, depending on interpretation. The questions should be clarified or options expanded (for example: not applicable)."

> "If you disagree with the answers to the above questions, you feel at ease, and if you agree, you feel uneasy. The problem seems to be the double negative sentence, which has a different grammar in Chinese than in English."

Differences in Distress and Coping among Countries

The results of the chosen topic model with country as the covariate showed the prevalence of topics mentioned in participants' responses differed by country. Scholars described cross-country differences in multiple phenomena during the pandemic, including psychological distress, coping with distress, trust in the government, and compliance, among many other topics (e.g., Buyukkececi, 2021; Gokmen et al., 2021; Kim & Jung, 2021; Lieberoth et al., 2021; Marzo et al., 2021; Rahman et al., 2020). Under the assumption that the extracted topic proportions from the chosen topic model were fixed, I found 8 out of 17 topics with over 30% of the variance in the topic proportion that could be attributable to differences in country of residence. These included topic 1 – "Concern about the future", topic 7 – "Thoughts about COVID-19 and the political/social climate", topic 8 – "Spirituality", topic 10 – "Concerns for others", topic 11 – "Financial/Work-related concerns", topic 13 – "Being away from loved ones", topic 15 – "Living situations", and topic 17 – "Survey feedback". While the reasons for such differences should be explored in future investigations, one can suspect that differences in governments' approaches to handling COVID-19 (more versus less stringent policies), the peculiarity in severity and damage coronavirus had on different countries, as well as differences in culture could be potential explanatory factors (Kim & Jung, 2021; Mijiritsky et al., 2020). On the other hand, differences in the prevalence of topic 17 – "Survey feedback" could be due to issues regarding the translation of the COVIDiSTRESS survey from English to other languages.

Again, with the assumption that there was no uncertainty in the estimation of the topic proportions, results from the linear regressions comparing the prevalence of different topics in the US versus in all other countries revealed consistent patterns. Specifically, I found that for all 17 topics, the prevalence differed for at least one of the non-US countries. The US is among countries that were relatively slower in responding to the threat of the coronavirus (Hatcher, 2020; Joyce & Suryo Prabowo, 2020). The insufficient preparedness and delayed in response time, together with the ineffective crisis communication in the US have resulted in thousands of daily deaths (*COVID-19 Map*, n.d.) and politicization of beliefs that can undermine efforts to fight the COVID-19 pandemic (Bolsen & Palm, 2022; Hatcher, 2020; Joyce & Suryo Prabowo, 2020; Tanase et al., 2022; Yamey & Gonsalves, 2020). In a summary of the government responses, Joyce and Suryo Prabowo (2020) posited that actions taken by the government at the federal and state levels raised the deficits and led to budget shortfalls in future years. They even compared government responses to the COVID-19 pandemic to responses to the Great Recession, citing the devastating impact of the COVID-19 on unemployment and on worsening the income division between the rich and the poor. Based on this information, it is unsurprising that people residing in the US expressed concerns about the future, talked about political and social climate during the pandemic as well as the government responses and media coverage of coronavirus-related information, among other sources of psychological distress.

To take a closer look at cross-country differences in topic prevalence and to take into account the uncertainty in the estimation of topic proportions, I reviewed the results from the estimateEffect function call from the *stm* package. I discovered some significant differences between certain countries compared to the US and such differences were not the same for

every topic (see Table 1 in the Appendix). Existing quantitative cross-country comparisons posited that between-country differences could be attributable to the timing of the data collection (the COVID-19 grew in severity asynchronously across countries), conflicts within the countries (i.e., war), institutional arrangements (i.e., centralized versus decentralized government), and cultural orientation (i.e., tight versus loose culture; collectivist versus individualistic; Aknin et al., 2022; Alzueta et al., 2021; Kim & Jung, 2021; Rahman et al., 2021; B. Yan et al., 2020). Alzueta et al. (2021) examined the impact of the COVID-19 pandemic in 59 different countries and emphasized that cross-country comparisons were complex and challenging and called for caution in interpretation. Similar to cross-country comparisons of quantitative results, evaluating differences in the prevalence of qualitatively different coronavirus-related issues for multiple countries' residents is not so straightforward. Perhaps the way in which specific COVID-19 policies implemented by the US government was the reason why US residents seemed to discuss government measures more often than citizens of European or Asian countries. Perhaps the collectivist culture in countries like Argentina and Japan made people living in those countries less likely to question authorities' decisions and hence, less likely to openly discuss government measures than US residents.

It is not possible to deterministically conclude the reasons why certain topics were more prevalent than others in a given country and between countries. Part of the reason was the emerged topics were not exclusively positive nor exclusively negative and that this structural topic modeling approach did not assign participants' responses into any particular topic(s). The other reason was that there was uncertainty in the estimation of the topic prevalence. Further, it is important to point out that the number of participants from each participating country is

unequal, with some countries having a very small number of participants. As such, these cross-country comparison results should be interpreted with caution.

Practical Implications

Using a rich source of textual data, I was able to identify factors that contributed to people's psychological distress as well as various ways people handled distress during the COVID-19 pandemic. To reiterate, people voiced their concerns over the safety and well-being of themselves, their loved ones, less fortunate people, vulnerable, high-risk individuals, and society. In particular, they mentioned living conditions (e.g., conditions in specific countries, feeling lucky to live close to nature, etc.), being far away from their loved ones, work-related issues (e.g., job security, work performance, worries over lack of proper protective equipment and increased work demands, etc.), concerns about uncertainty (e.g., nature of the coronavirus, disruption of personal plans, etc.) and navigating a high-risk situation like the COVID-19 pandemic, concerns about the future (e.g., possibility of social unrest, economic outlook, etc), . Some people suffered distress for being kept in isolation for a prolonged period of time, some were not able to get access to medical facilities for proper health care. Others, however, felt fine staying at home and experienced very little to no distress. These observations highlighted the need for a wider array of targeted interventions and policies to support people better during and after a global pandemic.

Indeed, from the date of this data collection to the time of this writing, a lot of systems have been put in place to help people handle the coronavirus situation. For instance, more and more mental health services are delivered through online channels when in-person contacts are not recommended (Gorenko et al., 2021; Pang et al., 2023; R. Wilkinson et al., 2020). Online

chatbots and self-testing kits are available for people to monitor their health at the comfort of their homes while enabling better surveillance for COVID-19 incidences (Bharti et al., 2020; Faezipour & Abuzneid, 2020; Jairoun et al., 2022; Kersh et al., 2021; Miner et al., 2020; Stohr et al., 2022; Turk et al., 2021). Many jobs were changed to online and considerable opportunities remain open for people who prefer remote working (Baudot & Kelly, 2020; Brynjolfsson et al., 2020; B. Wang et al., 2021). Multiple online crafting workshops, educational bootcamps and courses, as well as e-books became increasingly popular, some educational resources were even offered free-of-charge for a duration of time (Diana, 2020). Thanks to the availability of several online platforms, people are also able to engage in a sense of virtual togetherness by having online workout sessions, online coffee talks, going on virtual tours around the world and so on. Despite the abundant resources available, studies using more recent data still documented varying degrees of psychological distress in several groups of people (Camara et al., 2023; B. Gibson et al., 2021; Momenimovahed et al., 2021; Y. Wang et al., 2020; H. Yan et al., 2020). As such, more work to uncover the detrimental impact of the COVID-19 situation on individuals is needed to better support people during this pandemic and to prepare for any similar calamity in the future.

Qualitative research like the current study can reveal more nuanced differences in people's seemingly similar quantitative ratings of a psychological construct. In an oversimplified example, two participants both strongly agreed that prolonged isolation was distressing for them. However, one revealed in their free-text response that they were very sociable and craved physical touch while the other explained that they were terrified of going out as a high-risk individual. Support would look very different for these two people.

It is not an exaggeration to say that scientific knowledge is liberating and empowering. Researchers studying COVID-19 phenomena emphasized repeatedly that uncertainty is among the main reasons why this pandemic is so deleterious (Ben Salah et al., 2022; Freeston et al., 2020; Koffman et al., 2020; Matta et al., 2022; Reizer et al., 2021; Yoon et al., 2021). In the face of uncertainty, mixed messages from the media and irresponsible reporting gave rise to a phenomenon called the "infodemic" (Cheng et al., 2021; Siebenhaar et al., 2020; Yoon et al., 2021). Leading researchers have already called out the responsibilities of news channels in delivering truthful and scientific information (Fernández-Torres et al., 2021; Gesser-Edelsburg, 2021; Irwin, 2020; E. Zhao et al., 2020). This qualitative study further supports the notion that people, as consumers of information, can and should also be pro-active in searching out evidence-based knowledge. As shared by participants in this study, monitoring information in moderation (e.g., not spending the whole day following negative reports of the pandemic, critically evaluating information from scientific sources) is helpful for handling psychological distress.

On a different note, this study also found that some people did not seem to suffer from the pandemic as the study premises suggested. Instead, they seemed to thrive under this circumstance where they could spend more time at home. Although this idea is relatively less common, some research showed that flexible work-life arrangement during COVID-19 was preferred by certain people (Baudot & Kelly, 2020). With the infrastructure in place, it is possible that companies will continue to offer remote working for people who desire this kind of arrangement. More interestingly, some people noted that this pandemic served as a great opportunity for them to connect with themselves, to learn something new, and to pick up what

they have not had time to do before. These ideas are likely to be less popular, but they can be motivating, positive messages for people during this challenging time.

In summary, the key takeaways from the study findings are that at the individual level, staying vigilant and preparing for unexpected circumstances by saving up for emergencies, as well as being pro-active and critical in search and consumption of information, may be helpful actions to take during a pandemic. Spending time in nature, doing physical activities, taking up or maintaining a hobby, engaging in self-care activities and self-development, and getting connected with higher beings or immersion in spirituality may be actions that people can perform to take care of their mental health during such a challenging time like the COVID-19 pandemic. At the national level, as previous studies have noted, different countries have different power structures and cultures, and it is likely that different policies to combat a global pandemic like the COVID-19 will be needed. There are actions that can be taken uniformly across countries such as maintaining reserves of proper protective equipment and stockpile for national emergencies, having a verifiable, reliable, and easy-to-access channel for communicating scientific information to the public. On the other hand, communication and adoption of government policies to effectively combat a public health emergency as the COVID-19 pandemic will look very different based on the culture within each country, including the institutional arrangements (i.e., centralized versus decentralized government) and individual values (i.e., individualistic versus socialist; B. Yan et al. 2020). I found that for this study's sample, US residents frequently shared their thoughts regarding the political and social climate surrounding the COVID-19 pandemic. They also frequently wrote about their perceptions of how the government and media handled (or mishandled) the COVID-19 situation. Perhaps for

an individualistic society like the US, where many people place a high value on freedom of choice, stringent policies (i.e. masks mandate, stay-at-home order, etc.) must be heavily accompanied by scientific evidence on the benefits of such policies as well as clear messages on how such policies are not meant to jeopardize people's rights.

Research Strengths and Limitations

Strengths and Limitations of the Research Methodology

The unsupervised machine learning approach, STM, serves as a great tool for exploring a large body of textual data that is overwhelming for traditional qualitative approach of hand-coding. The method offers flexible options for researchers to manipulate their textual records and incorporate prior beliefs during the estimation process (i.e., what word is/is not relevant to the topic model, or what is a reasonable number of topics to be extracted from the model). With the power of computing, I was able to fit and compare multiple models and pick an optimal model based on diagnostic statistics and subjective judgement of the model's interpretability. This method of analyzing textual data allowed me to extract great insights from the textual records that have been overlooked due to the overwhelming amount of information in them.

More importantly, with this method, I was able to document each and every decision that I made during the data processing, model estimation, and model validation stages. This allows for a guaranteed reproducibility of the work. This study showcased how online survey research can incorporate open-ended questions to gauge participants' explanation of their numerical ratings of certain items, obtain additional information about the participants' experiences on the research topic and acquire participants' feedback on the design and

implementation of the research. This study highlighted some interesting, unexpected findings (i.e. feedback on research assumption and the wording of a survey item, nuances in how participants described their dissimilar levels of trust to the policies of different levels of governments, etc.) that are valuable inputs for future studies. With the aid of machine power, researchers can conduct more mixed-method designs to compare and contrast their quantitative and qualitative findings for a deeper, more robust understanding of the research topic.

Despite the benefits of the STM, I had to acknowledge that the estimated topic models were not perfect. For example, the use of the spectral initialization during the search for an optimal number of *k* topic without specifying a seed in the searchK function call can result in dissimilar diagnostic statistics. To put it differently, the solution to the searchK function is not globally consistent. Though results from the searchK function were only used to get the optimal number of topics for fitting the final topic model, using different seeds in the searchK function could lend support for dissimilar *k* as the optimal number of topics to be extracted from the data. Furthermore, the choice of *k* as the optimal number of topics was subjective. An independent researcher can look at the model comparison statistics and decide that they want a model with more topics to capture more nuances in the data.

Strengths and Limitations of the Current Study

This study data was extracted from a global survey on coronavirus-related phenomena. With the available quantitative data on distress and coping, I was able to validate the emergent topics using the quantitative portion of the COVIDiSTRESS survey. I had reasonable confidence in the model results as I estimated the candidate models multiple times, checked for potential

data cleaning errors, chose an optimal model, and validated it. I found topics that were consistent with what have been shown in previous studies on psychological distress and distress-coping mechanisms. Remarkably, I found some important nuances in people's experiences that have not been covered extensively during the initial outbreak of the COVID-19 pandemic. For example, during the beginning stage of the COVID-19 pandemic, some subset of participants did not experience much psychological distress. Further, aside from low socio-economic status, people experienced psychological distress as a result of living away from their loved ones, or from having unstable or unsafe living arrangements. Using country as the covariate in my model, I was able to determine that people residing in different countries discussed certain topics at different frequencies. While reasons for such differences are interesting topics for future studies, the existence of cross-country differences is congruent with the literature comparing mental health issues in various countries (Aknin et al., 2022; Buyukkececi, 2021; Gokmen et al., 2021; Rahman et al., 2021).

This study offers preliminary understanding of issues that were distressing for people as well as how people coped with distress during the initial outbreak of the COVID-19 pandemic. However, as noted by some participants' responses, the survey questionnaire was built with the assumption that everyone experienced distress, but that was not necessarily the case for some people. Further, participants noted some imperfections and lack of clarity in the wordings and translation of the questionnaire, explaining that their answers were somewhat influenced by how the survey was presented. The COVIDiSTRESS team did do some pre-testing, but under the pressing needs of getting data and making sense of the early stage of the pandemic, this piloting was not without errors. This emphasizes the importance of meticulous testing of

survey questionnaires before researchers fully launch the data collection. Ideally, researchers may want to build in some open-ended questions and give participants the chance to communicate with the research team in their own words.

In this study, I worked with over 12,000 free-text responses using an unsupervised machine learning approach. While this is a large number of documents, it is only roughly 10% of the original COVIDiSTRESS sample size. Since responses to open-ended questions in the survey were completely voluntary, I was able to get mostly genuine responses (except for those who typed in "none" as an answer). Because of the vast discrepancy between the original COVIDiSTRESS sample and the final sample of available textual responses, the resultant topics from the chosen model were not generalizable to the whole sample. The summary of the sample characteristics also revealed that most participants in this study were highly educated with at least some college-level classes or equivalent. Previous studies in the literature have documented the mixed findings in the association between educational level and mental health issues (e.g., Bonati et al., 2021; Mazza et al., 2020; Patel et al., 2022; Y. Wang et al., 2020; Yu et al., 2020). While some researchers noted that lower education was related to elevated psychological distress, others found that highly educated people experienced more deterioration in mental health during the COVID-19 pandemic. Given the high proportions of people in this study sample with high educational levels, this study findings may not be generalizable for people of lower levels of education. There might be some other factors contributing to their mental health that did not arise in this study's findings. Besides, the COVIDiSTRESS survey was administered in multiple different languages; participants responded to the open-ended questions in the language of their choice. I employed google translation to

convert all responses into English. Even though the accuracy of machine-aided translation has improved remarkably (S.-M. Lee, 2022; Welnitzova et al., 2021), it is possible that the automatic translation might have not perfectly preserved the sentiments and intentions of the original text. This could influence the interpretation of the resultant model.

In general, social scientists have begun to use computerized tools to aid analysis and understanding of qualitative data (e.g., Chung et al., 2022; Enria et al., 2021). In spite of its potential and power, STM was not an all-encompassing method that could replace human judgement and it is best used in an exploratory way to gather insights (Chung et al., 2022; Roberts et al., 2019).

Future Directions

Psychological distress is a notoriously complex phenomenon. A future cross-country study on people's experience of distress and distress-coping mechanisms can improve upon the current study by making sure that the sample sizes in participating countries are relatively the same for more robust cross-country comparisons. As suggested by Braun et al. (2021), researchers can and should make use of online platforms to reach out to a wide array of people. Similar to this COVIDiSTRESS global survey, researchers should incorporate both quantitative and qualitative (open-ended) questions in the survey flow in order to understand more deeply the thinking process and reasonings behind participants' numerical ratings to the question of interest. Further, this study highlighted the importance of a meticulous procedure to pilot and evaluate these questionnaires before administering them to the population of interest. Checking for double-negative and ambiguous items and adding in a "not applicable"

response option in a questionnaire can help make it easier for participants to comprehend and respond to the ask questions.

This study identified some nuanced differences in how people described seemingly common determinants of psychological distress in the literature, including the multifaceted uncertainty during COVID-19 and concerns for the future (i.e., uncertainty stemming from lack of understanding of the nature of the coronavirus disease, worries over the economic prospects post-pandemic after everything has been shut-down, disruption in personal development during the pandemic, etc.). In addition, people described behaviors of other people that made it challenging to navigate the COVID-19 situation as well as how living away from loved ones and working as an expat in a foreign country strained their mental health. Those with preexisting physical and/or mental health difficulties had to deal with the psychological distress from not having sufficient care and/or access to health care facilities and resources. Quite a few people discussed issues with the political and social climate during the pandemic and the measures taken by the government as well as the dissemination of coronavirus-related information. I found that for some people, the levels of trust they had towards the governments' actions differed based on the levels of governance. For example, one may feel strong disagreement with the US federal government's responses to COVID-19 while at the same time, held very high regards to the state/local government's responses (as mentioned in at least a couple of participants' responses). Some people expressed distress from the overwhelming amount of information available online relating to the COVID-19 topic; others found self-initiating efforts to look for scientific information very useful to alleviate distress. Many of the nuances in participants' qualitative responses did not show up in the literature on

psychological distress and distress-coping mechanisms. Future researchers might consider asking research participants to rate more targeted questions to quantify how much each factor contributes to one's psychological distress. As an example, when asking about unemployment or potential lay-off, it would be helpful to ask about the job prospects of both partners in the household (if the participant is married).

In this study, I used participants' ratings for two psychological distress items to validate the topics extracted from the textual responses. I was able to demonstrate that participants who rated highly on a certain item on psychological distress was likely to open up more about the same topic in their written responses to the open-ended questions. Similar to this approach, future researchers conducting mixed-method studies on psychological distress can utilize available items measuring other relevant quantitative questions to enhance their confidence in the topics extracted from the qualitative portion of their survey. Moreover, the people coming from certain demographic backgrounds (i.e., low socio-economic status, lower income, lower education, etc.) experience psychological distress differently than others from different backgrounds (e.g., Alimoradi et al., 2021; Camara et al., 2023; Krishnamoorthy et al., 2020; Y. Wang et al., 2020). It would be interesting to determine if participants with certain demographic characteristics are likely to voluntarily respond to open-ended questions in an online survey, which topic is more or less prevalent to people of certain characteristics, and whether such patterns are consistent with the existing evidence.

All in all, the use of machine-aided tools is promising, and more social sciences' research using machine learning is important. Researchers will be able to navigate through a large collection of textual data which is traditionally challenging with hand coding. More research

using machine learning will allow for systematic evaluation of the effectiveness and consistency in such methods. Related to this point, based on results from existing studies, researchers can build a dictionary to identify emerging themes in textual data using supervised machine learning methods. Supervised machine learning has been promising when being applied in multiple areas; recommendation systems in e-commerce and entertainment are great examples.

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APPENDIX

Table 1

Differences in the prevalence of different topics based on country of residence. The United States was used as the reference for comparison.

	b	*SE*	*t*	*p*
Topic 1 - "Concerns about the future"				
Argentina	.02	.01	2.66	.01
Bangladesh	.15	.03	5.20	<.01
Brazil	.04	.02	2.17	.03
Bulgaria	.02	.01	2.51	.01
France	.01	.01	2.11	.04
Japan	.02	.01	2.42	.02
Kosovo	.05	.01	3.75	<.01
Kyrgyzstan	.48	.11	4.32	<.01
Lithuania	.02	.01	2.76	.01
Mexico	.05	.01	7.63	<.01
Panama	.04	.01	3.25	<.01
Romania	.07	.03	2.01	.04
Topic 2 - "Leisure activities/Hobbies"				
Belgium	.04	.02	2.29	.02
Bosnia and Herzegovina	.07	.02	3.34	<.01
Canada	.06	.02	3.06	<.01
Colombia	.11	.04	2.96	<.01
Croatia	.10	.01	1.22	<.01
France	.04	.01	5.18	<.01
Germany	.03	.01	2.72	.01
Greece	.11	.03	4.26	<.01
Italy	.03	.01	2.56	.01
Mexico	.05	.01	5.35	<.01
Panama	.07	.02	3.58	<.01
Philippines	.10	.03	3.08	<.01
Portugal	.08	.02	3.24	<.01
Serbia	.12	.03	3.50	<.01
Spain	.09	.02	3.53	.00
Switzerland	.06	.02	3.12	.00
Thailand	.23	.09	2.40	.02
Topic 3 - "Navigating a high-risk situation"				

Argentina	-.04	.00	-7.56	<.01
Bangladesh	-.04	.02	-2.16	.03
Bosnia and Herzegovina	-.02	.01	-1.97	.05
Brazil	-.03	.01	-2.29	.02
Bulgaria	-.02	.01	-3.19	<.01
Colombia	-.05	.01	-3.10	<.01
Croatia	-.03	.01	-4.81	<.01
Finland	.08	.01	15.68	<.01
France	-.02	.01	-3.35	<.01
Greece	-.04	.01	-2.98	<.01
Indonesia	-.03	.01	-3.55	<.01
Italy	-.02	.01	-2.00	.05
Kosovo	-.02	.01	-2.37	.02
Mexico	-.03	.01	-5.13	<.01
Panama	-.04	.01	-3.47	<.01
Serbia	-.03	.02	-2.05	.04
Slovakia	-.02	.01	-2.08	.04
Spain	-.03	.01	-2.41	.02
Sweden	.03	.01	4.67	<.01
Turkey	-.02	.01	-2.08	.04
Topic 4 - "Health and safety concerns"				
Bangladesh	-.03	.02	-2.07	.04
Denmark	.02	.01	4.06	<.01
Finland	.03	.00	5.84	<.01
Greece	.04	.02	2.05	.04
Italy	-.02	.01	-2.13	.03
Lithuania	.02	.01	2.22	.03
Malaysia	-.03	.01	-2.14	.03
Netherlands	.03	.01	2.83	<.01
Poland	.03	.01	4.06	<.01
Sweden	.03	.01	4.16	<.01
Topic 5 - "Isolation experiences"				
Australia	.03	.02	2.06	.04
Brazil	.04	.02	2.32	.02
Denmark	.01	.01	2.24	.02
Finland	.03	.01	4.86	<.01
Germany	.02	.01	2.27	.02
Japan	-.02	.01	-2.99	<.01
Korea, South	-.05	.02	-2.29	.02
New Zealand	-.04	.02	-1.97	.05
Taiwan	-.05	.01	-4.34	<.01
Topic 6 - "Uncertainty"				

Argentina	.02	.00	5.54	<.01
Czech Republic	.02	.01	2.28	.02
France	.02	.00	4.15	<.01
Hungary	-.02	.01	-2.58	.01
Korea, South	-.04	.02	-2.47	.01
Mexico	.02	.00	4.81	<.01
Turkey	.03	.01	2.60	.01
Topic 7 - "Thoughts about COVID-19 and the political/social climate"				
Angola	.44	.15	2.92	<.01
Argentina	-.03	.01	-2.90	<.01
Bulgaria	.04	.01	3.11	<.01
Croatia	.02	.01	1.96	.05
Denmark	-.04	.01	-4.15	<.01
Estonia	.50	.11	4.35	<.01
Finland	-.04	.01	-4.09	<.01
France	.04	.01	3.91	<.01
Japan	.04	.01	2.60	.01
Lithuania	-.02	.01	-2.23	.03
Mexico	-.03	.01	-3.54	<.01
Montenegro	.66	.22	3.04	<.01
Netherlands	-.03	.01	-2.13	.03
Other	.12	.04	2.90	<.01
Poland	-.03	.01	-2.50	.01
Sweden	-.04	.01	-3.50	<.01
Taiwan	-.05	.02	-2.53	.01
Turkey	-.05	.02	-2.82	<.01
Topic 8 - "Spirituality"				
Bulgaria	.01	.00	3.46	<.01
Chile	.05	.02	2.27	.02
Colombia	.03	.01	2.05	.04
Denmark	.01	.00	3.68	<.01
Ecuador	.10	.04	2.24	.02
Finland	.01	.00	4.14	<.01
Greece	.02	.01	2.10	.04
Jamaica	.84	.13	6.37	<.01
Japan	.01	.00	2.88	<.01
Korea, South	-.03	.01	-2.85	<.01
Kosovo	.02	.01	2.14	.03
Latvia	.09	.04	2.23	.03
Lithuania	.01	.00	2.85	<.01
Pakistan	.06	.03	2.49	.01
Philippines	-.03	.01	-3.19	<.01
Poland	-.01	.00	-3.36	<.01

Portugal	.04	.01	3.28	<.01
Spain	-.02	.01	-3.51	<.01
Sweden	.01	.00	2.23	.03
Turkey	.02	.01	2.11	.03
Uganda	.20	.07	2.84	<.01
Topic 9 - "Government responses/Media coverage"				
Argentina	-.05	.01	-5.44	<.01
Belgium	-.04	.02	-2.50	.01
Bosnia and Herzegovina	-.04	.02	-2.60	.01
Bulgaria	-.02	.01	-2.02	.04
Croatia	-.04	.01	-3.79	<.01
Denmark	-.05	.01	-5.77	<.01
Finland	-.05	.01	-5.93	<.01
Greece	-.05	.02	-2.08	.04
Ireland	-.06	.03	-2.04	.04
Italy	-.07	.01	-5.18	<.01
Korea, South	.11	.05	2.18	.03
Lithuania	-.03	.01	-2.95	<.01
Malaysia	-.04	.02	-2.04	.04
Maldives	.49	.23	2.16	.03
Mexico	-.02	.01	-2.27	.02
Netherlands	-.04	.01	-2.77	.01
Portugal	-.07	.02	-3.71	<.01
Slovakia	-.06	.02	-3.17	<.01
Spain	-.07	.02	-3.90	<.01
Sweden	-.02	.01	-1.99	.05
Taiwan	.05	.02	2.33	.02
United Kingdom	-.05	.01	-3.42	<.01
Topic 10 - "Concerns for others"				
Afghanistan	-.06	.02	-3.10	<.01
Andorra	.23	.08	2.77	.01
Argentina	-.02	.01	-3.85	<.01
Bolivia	.90	.05	19.60	<.01
China	-.08	.03	-2.57	.01
Colombia	.05	.02	2.57	.01
Croatia	-.03	.01	-3.98	<.01
Cyprus	-.08	.03	-2.63	.01
Czech Republic	-.02	.01	-2.33	.02
Denmark	-.03	.01	-4.66	<.01
Egypt	-.08	.03	-2.94	<.01
Finland	-.02	.01	-4.52	<.01
France	-.03	.01	-4.51	<.01

Guatemala	.08	.04	2.16	.03
Iceland	-.08	.03	-2.89	<.01
Ireland	-.05	.02	-2.56	.01
Italy	-.05	.01	-6.01	<.01
Japan	-.03	.01	-3.23	<.01
Latvia	.15	.06	2.31	.02
Lithuania	-.04	.01	-4.90	<.01
Malaysia	-.05	.01	-4.55	<.01
Morocco	-.06	.03	-2.18	.03
Netherlands	-.03	.01	-3.81	<.01
New Zealand	-.07	.02	-3.54	<.01
Norway	-.07	.02	-4.16	<.01
Other	-.08	.02	-4.79	<.01
Panama	-.04	.01	-3.20	<.01
Poland	-.03	.01	-4.54	<.01
Portugal	-.03	.01	-2.79	.01
Slovakia	-.03	.01	-3.21	<.01
Slovenia	-.08	.03	-2.65	.01
Solomon Islands	.87	.07	13.17	<.01
Sweden	-.02	.01	-2.43	.02
Taiwan	-.05	.01	-4.89	<.01
Turkey	-.04	.01	-3.66	<.01
Uganda	-.08	.03	-2.62	.01
United Arab Emirates	-.07	.03	-2.07	.04
United Kingdom	-.03	.01	-3.30	<.01
Topic 11 - "Financial/Work-related concerns"				
Afghanistan	-.06	.03	-2.36	.02
Canada	-.03	.01	-2.27	.02
Chile	.11	.04	2.58	.01
Croatia	-.03	.01	-3.48	<.01
Finland	-.03	.01	-3.89	<.01
France	-.02	.01	-3.28	<.01
Germany	-.03	.01	-2.79	.01
Korea, South	-.07	.02	-2.91	<.01
Kosovo	-.04	.01	-3.19	<.01
Mexico	.03	.01	3.39	<.01
Pakistan	.15	.06	2.66	.01
South Africa	.28	.06	4.65	<.01
Taiwan	-.07	.01	-4.97	<.01
Topic 12 - "Access to nature"				
Argentina	-.04	.01	-6.22	<.01
Australia	-.04	.01	-2.63	.01
Bangladesh	-.05	.02	-2.57	.01

Brazil	-.04	.01	-2.78	.01
Chile	-.06	.03	-2.20	.03
Colombia	-.04	.02	-2.35	.02
Croatia	.02	.01	3.26	<.01
France	-.04	.01	-5.34	<.01
Greece	-.04	.02	-2.56	.01
Indonesia	-.03	.01	-3.37	<.01
Italy	.12	.02	7.70	<.01
Japan	-.02	.01	-2.13	.03
Lithuania	-.03	.01	-3.04	<.01
Mexico	-.03	.01	-4.80	<.01
Panama	-.04	.01	-3.26	<.01
Poland	-.03	.01	-3.56	<.01
Portugal	-.05	.01	-3.50	<.01
South Africa	-.06	.03	-2.52	.01
Spain	-.04	.01	-2.51	.01
Topic 13 - "Being away from loved ones"				
Argentina	.07	.01	12.62	<.01
Burkina Faso	.26	.13	2.03	.04
Croatia	-.01	.01	-2.26	.02
Finland	-.02	.01	-2.98	<.01
Georgia	.27	.12	2.31	.02
India	.15	.07	2.26	.02
Italy	.04	.01	3.95	<.01
Korea, South	-.05	.02	-2.10	.04
Mexico	.02	.01	3.17	<.01
Portugal	.06	.02	3.83	<.01
Taiwan	-.03	.01	-2.41	.02
Turkey	.04	.01	3.00	<.01
Topic 14 - "Managing thoughts"				
Argentina	-.02	.01	-3.66	<.01
Colombia	-.04	.02	-2.60	.01
Croatia	-.02	.01	-3.53	<.01
Indonesia	.06	.01	6.02	<.01
Korea, South	.06	.03	2.09	.04
Mexico	-.02	.01	-2.72	.01
Netherlands	.04	.01	3.63	<.01
Panama	-.03	.01	-2.65	.01
Serbia	-.04	.02	-2.85	<.01
Switzerland	-.02	.01	-2.09	.04
Taiwan	-.03	.01	-2.17	.03
United Kingdom	-.03	.01	-3.15	<.01
Topic 15 - "Living situations"				

Argentina	.04	.00	12.33	<.01
Austria	-.03	.01	-3.16	<.01
Bangladesh	.05	.02	3.40	<.01
Belgium	-.02	.01	-2.23	.03
Brazil	.04	.01	3.83	<.01
Colombia	.03	.01	2.30	.02
Croatia	.01	.00	2.81	<.01
Cyprus	.13	.06	2.36	.02
Czech Republic	.02	.01	2.81	<.01
Denmark	-.01	.00	-2.92	<.01
Finland	-.01	.00	-3.41	<.01
Greece	.03	.01	1.99	.05
Korea, South	-.04	.01	-2.97	<.01
Malaysia	.03	.01	2.97	<.01
Mexico	.02	.00	4.86	<.01
Philippines	-.02	.01	-2.04	.04
Russia	.12	.06	2.09	.04
Slovakia	.04	.01	3.07	<.01
Sweden	-.01	.00	-2.54	.01
Taiwan	-.03	.01	-3.39	<.01
Venezuela	.63	.10	6.29	<.01
Topic 16 - "Self-care/Access to self-care"				
Belgium	.05	.02	2.76	.01
Croatia	.06	.01	7.25	<.01
Czech Republic	.03	.01	2.70	.01
Denmark	-.01	.01	-2.23	.03
Finland	.03	.01	5.35	<.01
France	.02	.01	2.56	.01
Germany	.04	.01	3.65	<.01
Hungary	-.03	.01	-2.56	.01
Japan	-.02	.01	-2.42	.02
Kosovo	.03	.01	2.04	.04
Lithuania	.05	.01	5.36	<.01
Poland	.05	.01	5.45	<.01
Turkey	.03	.02	2.02	.04
Topic 17 - "Survey feedback"				
Argentina	-.05	.01	-6.51	<.01
Bangladesh	-.05	.02	-2.22	.03
Brazil	-.05	.02	-3.34	<.01
Bulgaria	-.02	.01	-2.03	.04
Colombia	-.06	.02	-2.85	<.01
Croatia	-.03	.01	-3.29	<.01
Denmark	.11	.01	12.07	<.01

Finland	-.02	.01	-2.56	.01
Germany	-.03	.01	-2.02	.04
Greece	-.05	.02	-3.04	<.01
Korea, South	.17	.05	3.34	<.01
Malaysia	.07	.03	2.91	<.01
Mexico	-.03	.01	-4.46	<.01
Norway	.12	.05	2.45	.01
Panama	-.04	.01	-2.71	.01
Poland	-.03	.01	-2.94	<.01
Sweden	.04	.01	3.62	<.01
Taiwan	.25	.03	9.71	<.01
Undisclosed	.08	.03	2.74	.01

Note. This table only shows statistically significant ($p < .05$) results.