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Stress-Related Psychopathology During the COVID-19 Pandemic

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Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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ABSTRACT

The COVID-19 pandemic has introduced widespread societal changes that have required ongoing adaptation. Unsurprisingly, stress-related psychopathology has increased during the pandemic, in both children and adults. We review these patterns through the lens of several leading conceptual models of the link between stress and psychopathology. Some of these models focus on characteristics of environmental stressors—including cumulative risk, specific stressor types, and stress sensitization approaches. Understanding the specific aspects of environmental stressors that are most likely to lead to psychopathology can shed light on who may be in most need of clinical intervention. Other models center on factors that can buffer against the onset of psychopathology following stress and the mechanisms through which stressors contribute to emergent psychopathology. These models highlight specific psychosocial processes that may be most usefully targeted by interventions to reduce stress-related psychopathology. We review evidence for each of these stress models in the context of other widescale community-level disruptions, like natural disasters and terrorist attacks, alongside emerging evidence for these stress pathways from the COVID-19 pandemic. We discuss clinical implications for developing interventions to reduce stress-related psychopathology during the pandemic, with a focus on brief, digital interventions that may be more accessible than traditional clinical services.

The COVID-19 pandemic has produced massive societal changes that have touched nearly every aspect of daily life. Social isolation, health threats, employment and financial instability, increased caretaking responsibilities, difficulty accessing basic necessities, reduced contact with family and friends, loss of loved ones to the coronavirus, dramatic changes to the structure of work and school, and disruption of daily routines are but a few of the innumerable challenges that have been routinely encountered during the pandemic (Gruber et al., 2021). The continued rise and fall of virus case counts related to the emergence of new variants has introduced ongoing uncertainty and a reduced sense of control for many over the two years since the coronavirus was discovered. Perhaps unsurprisingly, the prevalence of mental health problems among children, adolescents, and adults has increased since the start of the pandemic, with estimates from longitudinal studies and meta-analyses documenting meaningful increases in depression and anxiety, in particular, relative to pre-pandemic levels (Holman, Thompson, Garfin, & Silver, 2020; Pierce et al., 2020; Racine et al., 2021; Robinson, Sutin, Daly, & Jones, 2022; Rosen et al., 2021; T.; Wu, Jia, et al., 2021).

Stressful experiences involve changes in the environment that require adaptation; stress is typically perceived when the demands of a situation outweigh one's ability to cope effectively with those demands (Lazarus & Folkman, 1984; Monroe, 2008). Experiences that involve threat, danger, or potential harm (e.g., risk of serious illness or death from the coronavirus), loss (e.g., of loved ones, income, status, employment), uncertainty and unpredictability (e.g., changing health guidance, insecure access to childcare, introduction of new variants), and lack of control are particularly likely to be perceived as stressful and are powerful predictors of the emergence of mental health problems (Brown, Harris, & Hepworth, 1995; Dickerson & Kemeny, 2004; Kendler, Hettema, Butera, Gardner, & Prescott, 2003; Lazarus & Folkman, 1984). Unfortunately, these types of experiences have been remarkably common during the pandemic and have required ongoing adaptation. At the same time, access to many effective coping strategies and protective factors that can buffer against the emergence of psychopathology following experiences of stress, such as social support, has been more difficult during much of the pandemic.

Stressful experiences have not occurred at random during the pandemic, with racial and ethnic minority communities experiencing disproportionately greater increases in infection rates, hospitalizations, and deaths (Macias Gil et al., 2020; Mude, Oguoma, Nyanhanda, Mwanri, & Njue, 2021), along with myriad other stressors. Some have

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declared this period a "pandemic on a pandemic," whereby Black and Asian communities, in particular, are simultaneously experiencing the racial trauma of police brutality (i.e., George Floyd murder) and the rise in hate crimes against Asians fueled by public rhetoric about the origins of the pandemic, respectively (Gover, Harper, & Langton, 2020; Laurencin & Walker, 2020). Although population representative data indicate that White adults had the highest rates of anxiety and depression prior to the pandemic, the relative increases in these mental health problems during the pandemic were more pronounced for Asian, Hispanic, and Black adults relative to Whites (Thomeer, Moody, & Yahirun, 2022). Disparities in access to mental health care for these groups relative to Whites also widened during the pandemic (Thomeer et al., 2022).

The widespread exposure to pandemic-related stressors along with increases in mental health problems and disparities over the first two years of the pandemic highlights the urgent need for new approaches to intervention to prevent stress-related psychopathology. These efforts should be guided by the substantial existing theory and scholarship on the links between stress and psychopathology across the life-course. Here, we review several leading theoretical approaches to conceptualizing stress-related psychopathology that can be leveraged to determine who may be in greatest need of intervention during the pandemic and what the targets of such interventions could be (see Fig. 1). Some of these approaches focus primarily on the environmental aspect of stress, as in cumulative risk and stress sensitization models, which are relevant for understanding which groups might be most vulnerable to stress-related psychopathology. Other models emphasize a transactional perspective centered on stress perception and appraisal or the role of key mediators or moderators of the link between stress and psychopathology, which can be used to inform intervention strategies to prevent stress-related mental health problems. We highlight existing empirical evidence for these stress frameworks from prior widescale community stressors, such as natural disasters and terrorist attacks, that provide parallels to some of the experiences encountered during a pandemic (e.g., experiences involving threat, shared exposure to stressors among community members, dissolution of social support networks, etc.), as well as recently emerging research on their relevance to stress-related psychopathology during the COVID-19 pandemic.

1. Cumulative risk

Cumulative risk approaches to conceptualizing stress emerged from early work in developmental psychopathology demonstrating that youth who experience multiple stressors in are at greater risk for psychopathology than those who experience a single stressor (Rutter, 1979; Sameroff et al., 1987). This approach involves counting the number of stressful experiences or risk factors someone has encountered to create a risk score (Evans et al., 2013). A critical assumption in cumulative risk models is that the number of exposures to adverse events has an additive effect on health-related outcomes. Numerous population-based studies have demonstrated that as the number of adverse experiences increases, so does the likelihood of developing psychopathology (Green et al.,

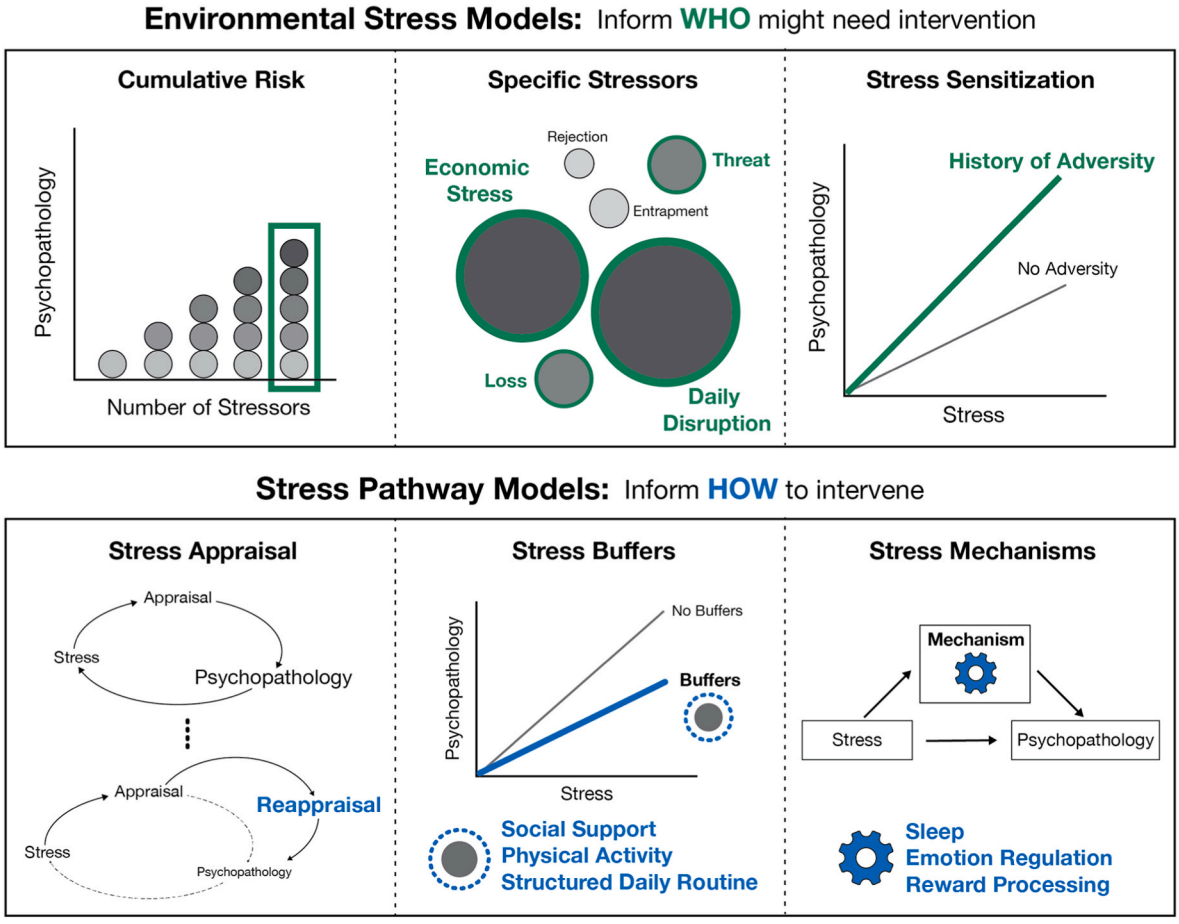

Fig. 1. Conceptual models focused on characteristics of environmental stressors—including cumulative risk, specific stressors, and stress sensitization—highlight who may be most in need of intervention as a function of stressful experiences. These include individuals with exposure to a large number of chronic stressors; who have experienced economic adversity, loss, and ongoing daily disruptions; and who have experienced early-life adversity. Stress pathway models centered on stress appraisals, buffers, and mechanisms, in contrast, point to potential targets for interventions to reduce stress-related psychopathology, including appraisal processes, social support, physical activity, sleep, emotion regulation, and reward processing.

2010; McLaughlin et al., 2012). The cumulative risk approach has numerous notable advantages. Inclusion of multiple stressors accounts for a larger proportion of the variance in psychopathology outcomes than models focused on individual events (Evans et al., 2013), and substantial evidence suggests that exposure to distinct stressors co-occur at moderate rates (Dong et al., 2004; Finkelhor, Ormrod, Turner, & Hamby, 2005; McLaughlin et al., 2012). Cumulative risk indices have also been criticized for ignoring meaningful distinctions among different experiences, such as their timing, duration, and severity (McLaughlin & Sheridan, 2016; McLaughlin, Sheridan, Humphreys, Belsky, & Ellis, 2021). Nevertheless, the cumulative risk framework remains a dominant approach for modeling risk for psychopathology following adverse experiences.

The cumulative risk framework has proved useful for capturing the degree of risk for emergent mental health problems following community-wide stressors, such as natural disasters and terrorist attacks. Because these types of events often involve unique individual-level stressors (e.g., life threat, destruction of property, flooding, exposure to dead bodies, etc.), many studies create cumulative risk indices that are tailored to the particular types of stressful experiences that accompany these large-scale events (Galea et al., 2007; McLaughlin, Fairbank, et al., 2009). The number of unique stressors encountered as well as the proximity to the event (e.g., residence in New Orleans during Hurricane Katrina, distance to the epicenter of an earthquake) (Galea et al., 2002, 2007) are often included in cumulative risk indices.

Systematic reviews and meta-analyses indicate consistently that the cumulative degree of exposure to stressors during these types of community-level disruptions is associated with increased risk for the onset of anxiety, depression, post-traumatic stress disorder (PTSD), substance abuse, behavior problems, and other forms of psychopathology (Goldmann & Galea, 2014; Neria, Nandi, & Galea, 2008; Norris, 1992; Norris, Friedman, & Watson, 2002). The increasing likelihood of psychopathology associated with increasing exposure to stressors has been observed across different event types, including hurricanes (Galea et al., 2007; LaGreca, Silverman, Vernberg, & Prinstein, 1996; McLaughlin, Fairbank, et al., 2009), tsunamis (Catani et al., 2010), earthquakes (Lai, Chang, Connor, Lee, & Davidson, 2004), floods (Verger et al., 2003), man-made disasters (e.g., nuclear disasters, oil spills) (Loganovsky et al., 2008; Lowe et al., 2019; Osofsky, Osofsky, Weems, Hansel, & King, 2016), and terrorist attacks (Cohen Silver, Holman, McIntosh, Poulin, & Gil-Rivas, 2002; Galea et al., 2003; Galea et al., 2008). Similar patterns have been observed for both children and adults and across numerous forms of psychopathology. Together, this evidence suggests that risk for transdiagnostic psychopathology after community-level stressors increases as the degree of cumulative exposure to the event increases, and that these cumulative stressors can have lasting influences on mental health (Goldmann & Galea, 2014).

1.1. Cumulative risk and psychopathology during the COVID-19 pandemic

Similar to patterns observed in the context of community-level disasters, growing evidence demonstrates that those exposed to a greater number of pandemic-related stressors are at particularly elevated risk for the onset of mental health problems during the COVID-19 pandemic (Cohodes, McCauley, & Gee, 2021; Kuhlman, Straka, Mousavi, Tran, & Rodgers, 2021; Kujawa, Green, Compas, Dickey, & Pegg, 2020). Several longitudinal studies have demonstrated associations between the degree of exposure to pandemic-related stressors and increases in symptoms of psychopathology during the pandemic, controlling for pre-pandemic symptom levels, in children, adolescents, and adults in a variety of cultural contexts (Hawes, Szenczy, Klein, Hajcak, & Nelson, 2021; Pereira et al., 2021; Rosen et al., 2021; Weissman et al., 2021).

A wide range of pandemic-related stressors have been assessed across these studies. For example, in two studies from our lab that followed several cohorts of families from prior to the pandemic through the early lockdown periods in spring 2020 and again in fall 2020, pandemic-related stressors were assessed across five domains: health (e.g., contracting COVID-19; experiencing loss of a loved one to COVID-19), social (e.g., social isolation, worsening relationships between family members), financial (e.g., losing a source of income, food insecurity), school (e.g., noisy environment in which to do homework), and physical environment (e.g., crowding in the home). In both children and adolescents, the degree of exposure to pandemic-related stressors was associated with increases in internalizing and externalizing symptoms relative to pre-pandemic levels (Rosen et al., 2021; Weissman et al., 2021).

2. Specific stressor types

The COVID-19 pandemic has introduced a wide range of stressors into daily life. Although cumulative risk is a common approach to studying the impact of stressful life events, it is possible that certain types of stressors have a more pronounced influence on risk for psychopathology than others. Stressor types that have been proposed to have unique influences on mental health in prior work include events involving threat/danger, loss, social rejection, entrapment, and humiliation (Brown et al., 1995; Kendler et al., 2003; Slavich & Irwin, 2014). Some previous work on disasters and terrorist attacks has examined the differential impact of specific stressors that occurred during those events. Dimensions of experience that have been examined in the context of community-wide disruptions include life threat, loss, and disruptions to daily life, among others.

The degree of life threat experienced during disasters, terrorist attacks, and other traumatic events is strongly related to the emergence of anxiety, depression, and PTSD, including in meta-analyses (Fullerton & Ursano, 2005; Galea et al., 2007; Hoven et al., 2005; LaGreca et al., 1996; Ozer, Best, Lipsey, & Weiss, 2003). Community-level stressors often involve meaningful loss, such as death of a loved one, loss of property or possessions, and unexpected unemployment. Across many stressful events, these types of experiences were the most powerful predictors of the onset of psychopathology symptoms, in some cases more so than threat to one's personal safety (Eksi et al., 2007; Galea et al., 2002; Hoven et al., 2005; LaGreca et al., 1996; McLaughlin, Fairbank, et al., 2009; Shear et al., 2011). Indeed, unexpected death of a loved one is one of the most common and worst traumatic events individuals report experiencing, even when they have experienced other traumas (Keyes, Pratt, et al., 2014). Finally, community-level stressors can lead to lasting psychological impact via long-term disruptions in daily life and the experience of "loss spirals" (Hobfoll, 1989). Individuals who are more directly impacted by these events are also more likely to suffer secondary, and often chronic, stressors such as displacement, unemployment, loss of social support, and financial insecurity (Kessler et al., 2008; Lowe, Tracy, Cerdá, Norris, & Galea, 2013; Norris, Perilla, Riad, Kaniasty, & Lavizzo, 1999). In other words, acute stressors (e.g., death of a loved one, property or job loss) can lead to further losses (e.g., housing instability, financial strain, family disruption). Indeed, the degree of ongoing, chronic stressors following disasters is among the strongest predictors of the onset of mental health problems (McLaughlin, Fairbank, et al., 2010; Norris & Uhl, 1993). Similarly, Kessler and colleagues observed that disasters were only linked to increases in psychopathology if they were accompanied by secondary traumatic events (Kessler et al., 2012).

2.1. Specific stressors linked with psychopathology during the COVID-19 pandemic

Emerging evidence during the COVID-19 pandemic suggests that economic stressors (e.g., lost wages) and those causing ongoing disruptions in daily life (e.g., changes in caretaking responsibilities) are among the strongest predictors of increases in acute stress and depression, even when compared to stressors involving health threat, like

personal exposure to disease (Holman et al., 2020). In fact, those who continued working jobs with in-person interactions, despite greater risk of contracting the virus, had lower depression symptoms than those who were not working (Holman et al., 2020). Similarly, several studies observed that pandemic-related lifestyle and economic disruptions were strongly related to symptoms of psychopathology, whereas health risks to self and loved ones had little impact (Li & Wang, 2020; Shanahan et al., 2022). Numerous studies suggest that these types of economic stressors were more commonly experienced during the pandemic by Black and Hispanic than White individuals. Specifically, these groups were more likely than Whites to experience job loss, food insecurity, and housing instability (Avalos et al., 2022; Hofmann, 2021; McKnight-Eily et al., 2021; Park, 2021; Stockman, Wood, & Anderson, 2021). This disproportionate exposure to the stressors most strongly linked to mental health problems during the pandemic are likely drivers of the greater increases in anxiety and depression experienced among racial and ethnic minority communities relative to Whites (Thomeer et al., 2022). Black and Hispanic adults were also more likely to work in occupations that carried greater risk of contracting COVID-19 than White individuals (Goldman, Pebley, Lee, Andrasfay, & Pratt, 2021), which is one of many factors contributing to racial and ethnic disparities in infection and mortality. In contrast, experiences of discrimination related to the pandemic were experienced most commonly by Asian and Black adults (Liu, Finch, Brenneke, Thomas, & Le, 2020; Wu, Qian, & Wilkes, 2021). Greater perceived discrimination during the pandemic was associated with higher symptoms of depression and anxiety and explained some of the disparities in these symptoms among Asian-Americans relative to Whites (C. Wu, Jia, et al., 2021).

Parental job loss, work disruptions, and financial instability have been linked to increased distress not only for parents, but also for children (Wang et al., 2021). In a survey of parents about pandemic-related experiences, loss of employment/wages or inability to provide for their family was the most commonly reported worry (52%), whereas fear about contracting the virus or of others dying was only reported by 16% of participants, although more than half the sample reported knowing someone who had contracted the virus, and about one-quarter knew someone who had died from the virus (Brown, Doom, Lechuga-Peña, Watamura, & Koppels, 2020). Children reported similar patterns, endorsing school-related disruptions as the most common worry (endorsed by 72% of participants), whereas fewer reported concern about the possibility of becoming infected (7%) or a loved one becoming infected (30%) (Ellis, Dumas, & Forbes, 2020).

3. Stress sensitization

The stress sensitization model posits that experiencing early-life adversity may increase vulnerability for developing psychopathology in response to stressors encountered later in life (Hammen, Henry, & Daley, 2000). The stress sensitization hypothesis posits that exposure to childhood adversity creates a lower stress threshold for the development of depression. Early studies found that childhood adversity moderated the association between adult stressors and onset of depression, such that those who experienced childhood adversity had higher rates of depression following low levels of recent stress compared to those who had not experienced adversity (Hammen et al., 2000; Harkness, Bruce, & Lumley, 2006). Subsequent studies reported stress sensitization patterns that emerged following exposure to higher levels of recent stress, such that the association between recent stressors and depression was stronger among those with a history of childhood adversity (Bandoli et al., 2017; McLaughlin, Conron, Koenen, & Gilman, 2010; Rousson, Fleming, & Herrenkohl, 2020). Although the original stress sensitization hypothesis focused specifically on vulnerability to depression, numerous studies have shown that early-life adversity may increase risk for the emergence of transdiagnostic psychopathology following exposure to stressful life events at subsequent points in development (Hammen, 2015), including anxiety, depression, PTSD, and substance use problems (Espejo et al., 2006; Harkness et al., 2006; McLaughlin, Conron, et al., 2010; McLaughlin et al., 2017; Myers, McLaughlin, Wang, Blanco, & Stein, 2014). Taken together, substantial evidence indicates that experiencing early-life adversity can increase vulnerability to developing psychopathology following stressful life events later in life.

Stress sensitization has also been observed in the context of disasters and community-level stressors, such that those who have experienced prior adversity are at greater risk of developing psychopathology following these types of community-level disruptions (Galea et al., 2002; Keyes, Shmulewitz, et al., 2014; Meyers et al., 2015). For example, in a large national sample, the association between exposure to content related to the September 11th terrorist attacks through media, friends, or family and internalizing and externalizing symptoms was stronger among individuals who had experienced childhood maltreatment (Meyers et al., 2015).

3.1. Stress sensitization during the COVID-19 pandemic

Emerging evidence suggests that individuals who have experienced childhood adversity may also be at greater risk of developing mental health problems during the COVID-19 pandemic. Several studies have observed that individuals with a history of child maltreatment or other adversity experiences were more likely to develop anxiety, depression, and PTSD symptoms during the pandemic relative to those without exposure to adversity; this has been observed among adolescents in rural China (Guo et al., 2020), adults in Israel and Germany (Seitz, Bertsch, & Herpertz, 2021; Siegel & Lahav, 2021), as well as children, adolescents, and adults in the U.S. (Gotlib et al., 2021; Kalia, Knauft, & Hayatbini, 2020). These associations persisted after adjustment for exposure to pandemic-related stressors (Guo et al., 2020; Siegel & Lahav, 2021) and pre-pandemic symptoms (Gotlib et al., 2021). Few studies have examined whether the association between pandemic-related stressors and psychopathology symptoms is stronger among those with adversity experiences, however. In one study of adolescents, the associations of experiencing COVID-19 or having a loved one with COVID-19 with symptoms of anxiety and PTSD were stronger among those who had experienced childhood adversity (Guo et al., 2020). Although research examining whether childhood adversity amplifies vulnerability to developing psychopathology following pandemic-related stressors is limited, several studies have identified potential mechanisms linking childhood adversity with increased risk for distress and psychopathology during the pandemic. These include higher levels of loneliness and social isolation (Shreffler et al., 2021), reduced social support (Seitz et al., 2021), difficulties with emotion regulation (Janiri et al., 2021), a reduced ability to flexibly adapt to new challenges (Kalia et al., 2020), and higher levels of perceived stress (Gotlib et al., 2021; Kalia et al., 2020).

Taken together, although the stress-sensitization hypothesis provides insight into why individuals who have experienced childhood adversity may be at heightened risk for developing mental health problems during the pandemic, few studies have tested directly whether the association between pandemic-related stressors and psychopathology is magnified following experiences of childhood adversity. While some evidence suggests that youth exposed to adversity are indeed at heightened risk for the development of mental health problems during the pandemic, longitudinal studies that examine childhood adversity, exposure to pandemic-related stressors, and trajectories of mental health over time are needed to evaluate the role of stress sensitization in response to stressors related to the COVID-19 pandemic (Prime, Wade, & Browne, 2020).

4. Stress appraisal and reappraisal

Transactional models of stress focus not only on the role of environmental stressors, but the way these events are interpreted and appraised in shaping stress responses (Monroe, 2008). Influential

models of stress appraisal argue that threat perception occurs with when the demands of a situation outweigh one's perceived ability to cope with those demands effectively (Blascovich & Mendes, 2000; Lazarus, 1999). These appraisals are commonly assessed by evaluating the degree to which one's life circumstances are perceived as stressful in a global way (Cohen & Janicki-Deverts, 2012; Cohen, Kamarck, & Mermelstein, 1983). Stress appraisals shape physiological and neural responses to stressors (Rodman, Jenness, Weissman, Pine, & McLaughlin, 2019; Tomaka, Blascovich, & Kelsey, 1993) and have powerful associations with mental health outcomes following stressful experiences (Cohen et al., 1983; Cristóbal-Narváez, Haro, & Koyanagi, 2020).

Even when a situation is perceived as stressful, ongoing appraisal processes—frequently referred to as cognitive reappraisal—can alter the interpretation of a situation over time. Cognitive reappraisal is conceptualized as an adaptive emotion regulation strategy (Jamieson, Mendes, & Nock, 2013; Ochsner & Gross, 2005). Indeed, engaging in cognitive reappraisal modulates subjective, cardiovascular, and neural responses to stressors and negative affective stimuli in adaptive ways, and improves performance in stressful situations (Gross, 1998; Jamieson, Mendes, Blackstock, & Schmader, 2010; Ochsner, Hughes, Robertson, Cooper, & Gabrieli, 2008). Cognitive reappraisal also has positive influences on stress-related psychopathology, such that individuals who engage in high levels of reappraisal generally exhibit lower levels of psychopathology and are less likely to develop symptoms of depression and anxiety after experiencing stressful life events (Gross & John, 2003; John & Gross, 2004; McRae, Jacobs, Ray, John, & Gross, 2012; Moore, Zoellner, & Mollenholt, 2008; Rodman et al., 2019; Troy, Wilhelm, Shallcross, & Mauss, 2010). Greater global perceptions of stress have been consistently associated with higher symptoms of depression and anxiety in the aftermath of natural disasters, terrorist attacks, and other community-level stressors (Besser, Neria, & Haynes, 2009; Leon, Hyre, Ompad, DeSalvo, & Muntner, 2007; Schwartz et al., 2016; Shahar, Cohen, Grogan, Barile, & Henrich, 2009).

4.1. Stress appraisals during the COVID-19 pandemic

Global perceptions of stress during the COVID-19 pandemic are higher in those who experience a greater number of pandemic-related stressors (Cohen & Janicki-Deverts, 2012), and have been linked with the emergence of psychopathology. Higher levels of perceived stress have been linked to increased symptoms of depression and anxiety in children, adolescents, and adults during the pandemic (Brown et al., 2020; Duan et al., 2020; Gotlib et al., 2021; Kalia et al., 2020; Zandifar et al., 2020), as well as greater externalizing problems in children (Achterberg, Dobbelaar, Boer, & Crone, 2021).

Emerging evidence also suggests that the link between pandemic-related stress and psychopathology is weaker in adolescents and adults who engage in high levels of cognitive reappraisal. Specifically, use of cognitive reappraisal moderated the association between perceived stress and symptoms of anxiety among adults during the early phase of the pandemic (Xu et al., 2020) and between exposure to pandemic-related stressors and symptoms of depression and anxiety in adolescents (Kuhlman et al., 2021). One study of healthcare workers additionally reported a positive influence of cognitive reappraisal on levels of emotional exhaustion (Wang et al., 2021). Together, these findings provide preliminary support for the mental health benefits of reappraisal during the pandemic, particularly for those experiencing high levels of pandemic-related stress.

5. Stress buffering

Exposure to stressful life events is a powerful predictor of the onset of psychopathology; however, most people who experience adversity do not develop mental health problems. This is true even after traumatic events, loss of loved ones, and exposure to natural disasters and terrorist attacks (Bonanno, Westphal, & Mancini, 2011). Protective factors that buffer against the emergence of psychopathology following experiences of adversity have been studied extensively and operate at numerous levels of influence (Bonanno et al., 2011; Luthar, Cicchetti, & Becker, 2000; Masten & Narayan, 2012). These include individual-level characteristics that make one less susceptible to mental health problems following stressful life events—such as personality traits, cognitive abilities, or even aspects of neurobiological function; interpersonal factors, such as the availability of social support; and characteristics of the broader social context, including school, community, and cultural systems that contribute to resilience. Extensive empirical work has examined factors that contribute to resilience following adversity, particularly in children, and many prior reviews of this topic exist (Bonanno et al., 2011; Luthar et al., 2000; Masten, 2007; Masten & Narayan, 2012). Here, we highlight one illustrative example.

Social support is one powerful buffer against the emergence of psychopathology following community-level stressors like natural disasters and terrorist attacks (Arnberg, Hultman, Michel, & Lundin, 2012; Ghuman, Brackbill, Stellman, Farfel, & Cone, 2014; Henrich & Shahar, 2008; LaGreca, Silverman, Lai, & Jaccard, 2010; McGuire et al., 2018; Shahar et al., 2009; Shahar & Henrich, 2016). Social support can be defined in numerous ways, but the quality of emotional support following stressors is particularly likely to buffer against the emergence of mental health problems (Cohen, 2004; Shang et al., 2019). The availability of social support is often eroded following natural disasters, which can disrupt entire communities and fracture social networks (Kaniasty & Norris, 1995; LaGreca et al., 2010; Lowe, Chan, & Rhodes, 2010). This loss of access to support networks can exacerbate the impact of stressors experienced during these events. Importantly, although higher levels of support is almost universally associated with lower levels of psychopathology following natural disasters and terrorist attacks, some studies find that support serves as a mediator of the link between disaster-related stressors and psychopathology rather than as a buffer that reduces the association of stressors with psychopathology symptoms (Kaniasty & Norris, 1993; Norris & Kaniasty, 1996; Platt, Lowe, Galea, Norris, & Koenen, 2016; Schiff, Pat-Horenczyk, & Peled, 2010).

5.1. Stress buffering during the COVID-19 pandemic

The social distancing that has been encouraged to reduce the spread of COVID-19 has made it more difficult to maintain social relationships and access social support for many people. This parallels the deterioration of social support frequently observed following natural disasters (Kaniasty & Norris, 1995). Despite these challenges, higher levels of social support have been consistently associated with better mental health outcomes during the pandemic. Lower levels of depression and anxiety symptoms have been observed in adults who report higher levels of social support (Grey et al., 2020; Özmete & Pak, 2020) and in children and adolescents who reported higher levels of social connectedness and spent more time talking to others during the early phase of the pandemic (Magson et al., 2021; Oliva et al., 2021). A stress buffering role of social support has also been reported in several studies during the pandemic. In adults, the association of exposure to pandemic-related stressors with perceived stress and of pandemic-related worry with psychological distress were lower in adults who perceived higher levels of social support (Szkody, Stearns, Stanhope, & McKinney, 2021; Zhen, Nan, & Pham, 2021). The link between experiences of discrimination and depression symptoms was lower in Asian American adults who reported higher levels of social support (Lee & Waters, 2021), suggesting that social support may help to buffer against disparities in stress-related psychopathology related to stigma and discrimination during the pandemic. Additionally, a study of college students found a positive association between pandemic-related stressors and rumination but not among students who reported higher levels of social support (Ye et al., 2020). Children who maintained some degree of in-person socialization during the stay-at-home orders in the U.S. and both children and

adolescents who retained a sense of social connection to peers were protected against the emergence of internalizing symptoms following exposure to pandemic-related stressors in a longitudinal study (Rodman et al., 2021). Parental support, in particular, has emerged as an important protective factor for both youths and young adults. The association of pandemic-related stressors with internalizing and externalizing problems was lower in young adults who experienced higher levels of parental support and had lower levels of parent-child conflict prior to the pandemic (Skinner et al., 2021) and in children and adolescents who spent more time with their parents (Oliva et al., 2021), who experienced lower conflict with parents (Qu et al., 2021), and whose parents used more emotion coaching strategies (Cohodes et al., 2021). Together these studies suggest that social support and connection are important protective factors that have the potential to facilitate resilience during the pandemic.

Numerous other factors appear to protect against the onset of stress-related psychopathology during the pandemic, including higher levels of physical activity, lower screen time and consumption of news media related to the pandemic, and maintaining a structured daily routine. Higher engagement in physical activity is associated directly with better mental health and lower likelihood of developing stress-related mental health problems (Ren, He, Bian, Shang, & Liu, 2021; Silva Moreira et al., 2021; Zhang, Zhang, Ma, & Di, 2020). Screen time use has increased dramatically among youth during the pandemic and has been linked to increases in mental health problems (Nagata et al., 2021; Oliva et al., 2021). Conversely, the association between pandemic-related stressors and internalizing problems was reduced in children and adolescents who had low levels of passive screen time use and reduced consumption of news media about the pandemic (Rosen et al., 2021). Many experienced a loss of structure and routine during the pandemic with school closures, loss of access to activities, and a move to remote work. Children and adolescents whose families were able to maintain a structured routine during the pandemic exhibited lower levels of externalizing problems, and a reduced association between pandemic-related stressors and symptoms of psychopathology (Cohodes et al., 2021; Glynn, Davis, Luby, Baram, & Sandman, 2021; Rosen et al., 2021).

6. Stress mechanisms

Exposure to stressors can increase risk for psychopathology through a variety of intervening mechanisms. Pathways that have garnered empirical support including changes in emotion regulation strategies, sleep, reward processing, and social engagement. Each of these factors is influenced by experiences of stress, is associated prospectively with the emergence of symptoms of psychopathology, and explains at least some of the relationship between stress and psychopathology. Exposure to stressors has been linked to changes in emotion regulation in numerous prospective studies in both children and adults. Stressful experiences are associated with increases in the use of maladaptive emotion regulation strategies like rumination and suppression, which explain the prospective association between stressors and symptoms of depression and anxiety (Hatzenbuehler, Nolen-Hoeksema, & Dovidio, 2009; McLaughlin & Hatzenbuehler, 2009; McLaughlin, Hatzenbuehler, & Hilt, 2009; Michl, McLaughlin, Shepherd, & Nolen-Hoeksema, 2013). Reductions in sleep duration and quality following exposure to stressors has been observed frequently and are, in turn, associated with increases in symptoms of depression, anxiety, and externalizing problems over time in children and adults (Baglioni et al., 2016; Bates, Viken, Alexander, Beyers, & Stockton, 2002; Harvey, 2008; Roberts & Duong, 2017; Shanahan, Copeland, Angold, Bondy, & Costello, 2014; Veeramachaneni, Slavish, Dietch, Kelly, & Taylor, 2019; Vidal Bustamante et al., 2020). Finally, experiences of stress are consistently associated with changes in reward processing reflecting more blunted patterns of reward responsivity and approach motivation that contribute to the emergence of anhedonia and depression symptoms (Bogdan & Pizzagalli, 2006; Bress, Foti, Kotov, Klein, & Hajack, 2013; Nelson, Perlman, Klein, Kotov, & Hajack, 2016; Pizzagalli, 2014; Pizzagalli, Bogdan, Ratner, & Jahn, 2007; Vidal-Ribas et al., 2019). Some of these associations have been observed following community-wide disasters, although reward processing has rarely been studied in the context of these types of stressors.

6.1. Stress mechanisms during the COVID-19 pandemic

Emerging evidence points to the relevance of these mechanisms linking stress and psychopathology during the COVID-19 pandemic. Heightened levels of rumination and suppression have been observed in those exposed to higher levels of pandemic-related stressors, and are associated with higher levels of depression and anxiety symptoms, including in prospective studies (Low, Overall, Chang, Henderson, & Sibley, 2021; Weissman et al., 2021; Ye et al., 2020; Zhou, MacGeorge, & Myrick, 2020). The pandemic has resulted in meaningful changes in sleep quantity and quality, and disruptions in sleep have been linked to higher levels of pandemic-related stress as well as symptoms of depression and anxiety (Benham, 2021; Gupta, Sharma, Kumar, & Mahajan, 2020; Merikanto et al., 2021; Robillard et al., 2021; Stanton et al., 2020; Ulrich et al., 2021; Werner, Kater, Schlarb, & Lohaus, 2021). Although data on reward processing during the pandemic is limited, a prospective study found that blunted pre-pandemic reward processing was associated with greater suicidal ideation during the pandemic (Hutchinson et al., 2021).

7. Clinical implications

Emerging evidence on the link between pandemic-related stressors and mental health can be leveraged in at least two ways to inform interventions to prevent the onset stress-related psychopathology as the pandemic continues (see Fig. 1). First, existing work rooted in environmental conceptualizations of stress has highlighted characteristics of stressors that may be important for identifying who is most in need of interventions. Second, work on stress appraisal, buffers, and mechanisms points to specific psychosocial processes that could be targeted by interventions designed to prevent stress-related psychopathology. Before discussing these topics further, a key issue is how to reach those most in need. Access to mental health services has become challenging during the pandemic, as need for services has increased substantially. Racial and ethnic disparities in access to mental health services have become more pronounced (Thomeer et al., 2022), and other groups who are particularly vulnerable to stress-related psychopathology as the result of cumulative exposure (e.g., healthcare workers) may be the least likely to have the time and/or resources to seek out mental health care. Single-session and digital interventions hold much promise in that regard (Gruber et al., 2021; Schleider & Weisz, 2017). Below, we focus specifically on interventions that can be delivered in these types of brief formats that may be more widely accessible than specialty mental health services.

Unsurprisingly, individuals who have experienced a high degree of cumulative exposure to stressors, particularly those that are chronic and ongoing during the pandemic, are likely to be the most vulnerable to developing stress-related psychopathology. Healthcare workers, in particular, have experienced some of the highest levels of ongoing stressors throughout the pandemic, and recent meta-analyses document substantial rates of anxiety and depression in this group (Al Maqbali, Al Sinani, & Al-Lenjawi, 2021; Marvaldi, Mallet, Dubertret, Moro, & Guessoum, 2021). More specifically, chronic economic stressors and experiences creating ongoing disruptions in daily life (e.g., unstable access to childcare) appear to be particularly likely to trigger the onset of depression and anxiety symptoms. The disproportionate exposure to these types of stressors in racial and ethnic minority communities may be one of many factors fueling increases in mental health disparities during the pandemic. These findings point to the importance of identifying strategies for reaching those who have experienced persistent work-related disruptions during the pandemic (e.g., restaurant and

hospitality workers), as well as groups who have experienced ongoing instability in daily life, such as parents of young children and college students. Finally, individuals who have experienced early-life adversity appear to be more likely to develop symptoms of psychopathology during the pandemic, although limited work has examined whether this reflects greater vulnerability to pandemic-related stressors. Recent efforts to integrate screening for early-life adversity in primary care settings (Pardee, Kuzma, Dahlem, Boucher, & Darling-Fisher, 2017) provides one avenue for identifying those who may be particularly likely to benefit from interventions to prevent stress-related psychopathology as a result of experiences of adversity early in life.

With regard to the content of interventions, there is likely to be meaningful heterogeneity across contexts and populations in the types of interventions that are most effective in treating stress-related psychopathology (Bryan, Tipton, & Yeager, 2021). Interventions targeting stress appraisals and/or reappraisal are one promising avenue. Cognitive restructuring has long been a mainstay of cognitive-behavioral interventions. However, several recent approaches have demonstrated the utility of very brief interventions focused on shifting stress appraisals to focus on the adaptive benefits of stress (Jamieson, Crum, Goyer, Marotta, & Akinola, 2018). These interventions can be delivered through brief videos and have demonstrated positive impacts on anxiety and depression symptoms as well as physiological responses to stress and performance-related outcomes (Jamieson et al., 2018; Liu, Ein, Gervasio, & Vickers, 2019). Online cognitive reappraisal interventions have also been adapted to target specific types of stressors, such as relationship conflict, and have demonstrated positive influences on these sources of stress during the pandemic (Rodriguez, Stewart, & Neighbors, 2021).

Substantial evidence on the stress buffering role of social support, including during the pandemic, highlights the potential for interventions aimed at increasing social support to prevent the onset of psychopathology during the pandemic. However, interventions designed to enhance support have often been administered in group settings, which may not be feasible during the pandemic, and the effects on mental health have been mixed (Hogan, Linden, & Najarian, 2002). Although online support interventions have the potential for wider reach, evidence for positive mental health effects remain limited. The impact of such interventions during the pandemic, when social isolation has increased dramatically, is largely unknown. Interventions targeting other factors that have emerged as stress buffers during the pandemic—including physical activity, reduced passive screen time, and maintaining a structured daily routine may also be useful strategies for reducing stress-related mental health problems. For example, adults who participated in digital platforms for physical activity (e.g., streaming services, subscriber fitness programs, etc.) during the pandemic were more likely to maintain recommended levels of physical activity (Parker et al., 2021). Similarly, a wide range of interventions have demonstrated positive effects on reducing screen time and sedentary behaviors in both children and adults (Nguyen et al., 2020; Wu, Sun, He, & Jiang, 2016). Increasing access to these types of services and interventions may promote more adaptive stress management through multiple pathways, including increased physical activity and reduced screen time.

Brief self-guided digital interventions hold particular promise for reducing stress-related psychopathology during the pandemic. Accumulating evidence suggests that even single-session interventions administered digitally can have lasting influences on symptoms of depression and anxiety in both adolescents and adults (Schleider & Weisz, 2017). Some of these interventions have targeted processes that serve as key mechanisms linking stress with the onset of psychopathology. For example, behavioral activation targets motivational and reward-related processes that contribute to depression. Recent evidence indicates that a single-session behavioral activation interventions was effective in reducing depression symptoms in adolescents during the COVID-19 pandemic (Schleider et al., 2021), demonstrating the utility of this approach specifically in the context of the pandemic. An increasing number of brief self-guided digital interventions target emotion regulation processes that serve as mechanisms linking stress and psychopathology. For example, a small open trial of an self-guided digital intervention comprised of three lessons aimed at reducing rumination and worry was associated with reductions in repetitive negative thinking of large effect size that persisted for one month (Joubert et al., 2021). Another digital intervention aimed at increasing positive affect across five self-guided sessions led to increased positive affect and reduced negative affect, perceived stress, and depression symptoms in a small randomized controlled trial (Addington et al., 2019). Interventions that encourage the flexible regulation of emotions based on one's goals and context are likely to be particularly helpful. Finally, numerous digital interventions have been developed to improve sleep quality, some of which have shown good feasibility and acceptability during the pandemic (Philip et al., 2020). A recent study further demonstrated that individuals who participated in a digital sleep intervention prior to the pandemic were less likely to develop insomnia and depression symptoms during the pandemic (Cheng, Casement, Kalmbach, Castelan, & Drake, 2021). Increasing access to these types of digital interventions among groups who continue to experience chronic stressors and disruptions in daily life as the pandemic progresses—including healthcare workers, parents of young children, college students, those experiencing ongoing economic stressors, and individuals who have encountered discrimination—may be one avenue for reducing stress-related psychopathology.

8. Conclusion

The COVID-19 pandemic has produced dramatic societal changes that have touched virtually every domain of life. Increases in stressful experiences are a major contributor to the elevations in symptoms of depression and anxiety that have occurred during the pandemic in children, adolescents, and adults, and disproportionate exposure to pandemic-related stressors has been a key factor contributing to widening racial and ethnic disparities in mental health. Existing models of stress-related psychopathology can be leveraged not only to determine which individuals may be most in need of intervention, but also what the targets of those interventions should be. Brief, digital interventions that target mechanisms known to link stress with the emergence of psychopathology are one promising strategy for providing increased access to interventions that have the potential to reduce stress-related psychopathology and mental health disparities as the pandemic continues.

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