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Biology 4920G: Let's Talk Science

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More Than Just a Flu: The Biopsychosocial Impacts of COVID-19 on Learning in School-Age Children

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1. Introduction

At the end of 2019, a severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus spread globally, causing the coronavirus pandemic (COVID-19). It was well reported that the virus mainly affects the respiratory system and causes problems with breathing. In addition, some COVID-19 patients experienced symptoms related to the nervous system's function, including headaches, disturbed consciousness, and paresthesia (Wu et al., 2020). While the physical symptoms of COVID-19 have been well documented, the psychological and social impacts of COVID-19 have not been as thoroughly analyzed, especially in children. To understand how the COVID-19 pandemic has impacted children, the best approach is to use the biopsychosocial model, which considers the biological, psychological, and social aspects simultaneously (Figure 1; Wu et al., 2020). This model can be used to specifically analyze how COVID-19 lockdowns and school closures have impacted the learning of school-aged children. School-aged children are in their formative years developing who they are, what they like, and how to interact with others. Therefore, they are more susceptible to the negative impacts of the COVID-19 pandemic, such as lockdowns and school closures. Using the biopsychosocial model, we can analyze how these negative factors affect school-age children. In regards to the biological aspect, we can look at how children with disabilities are impacted by the pandemic as well as look at how the overall change in lifestyle has contributed to the decline of physical health, for example, vision. Looking at the psychological aspect, we can see how the pandemic has impacted children's mental health and engagement in school. When considering the social aspect, we can examine how lockdowns have impacted the family dynamic. Additionally, this lens allows us to investigate the importance of social interactions in children's development.

2. Social Impacts

2.1. The Importance of Social Interactions and Education

Humans are creatures of habit and routine; people develop habits throughout adolescence, which persist throughout adult life. Consider the circadian rhythm; for example, a person feels lethargic during nighttime because the rhythmic release of melatonin at night encourages sleep. Disrupting this daily routine, even for one night, can leave a person feeling fatigued and lifeless throughout the day. So, when a pattern that has been established for years is suddenly disturbed, the consequences may prove severe. In a time when people are connected via a single click of a button, the COVID-19 pandemic introduced an unprecedented level of disconnect. National policies implemented to limit the spread of COVID-19 drastically changed people's social lives. A sudden shift from regular, daily life to the inability to leave home introduced feelings of uncertainty and entrapment. These feelings were most prominent in growing school-aged children and their parents. Families become accustomed to the weekly routine; children go to school five days a week, and parents work or housekeep. In this stage of life, social interactions are extremely important for the developing young minds of children.

Humans are social creatures; large parts of the brain are designed to interpret social cues and emotions. Brain development and social skills can be significantly altered when

children are deprived of these cues. A child removed from school/social activities positively correlates with depressive symptoms ($P < 0.001$; Almeida et al., 2022). Loneliness is an effective predictor of depression. Anxiety, sadness, depression, and guilt were also direct consequences of loneliness (Almeida et al., 2022). Furthermore, the pandemic increased the likelihood of post-traumatic stress disorder (PTSD) in isolated or quarantined children. These children were 30% more likely to experience PTSD symptoms (Almeida et al., 2022). This was likely a direct consequence of parents experiencing the same symptoms because 85.7% of parents living with PTSD have children that experience the same symptoms; on the other hand, only 14.3% of parents without PTSD have children with the same symptoms (Almeida et al., 2022).

PTSD, anxiety, sadness, and depression all have significant effects on social life. These people require social support from peers and families; however, they might refrain from seeking help due to fear of the stigma associated with such mental illnesses (Pevalin & Goldberg, 2003). Mental illness can cause individuals to further isolate themselves from peers and family, further limiting social interaction, which is vital for recovery (Kent et al., 1995). This, in turn, results in a positive feedback loop of negative emotions due to the lack of social support and results in a higher rate of hospitalizations and relapse (Kent et al., 1995). Some children despise going to school five days a week; however, school is necessary for developing children. It enforces education and socialization, which can help break that loop children can find themselves stuck in. A descriptive study surveyed 625 students during the pandemic, and 234 (44.1%) students described emotional detachment from family and peers, as well as changes in psychological and social behaviors (Meo et al., 2020). These students also exhibited decreased work output, which their marks reflected. Evidently, learning was severely hindered in students, which is a problem because by providing everyone with equal education, the gap in social inequality becomes narrower (Zajda et al., 2010). Knowledge is power, and without it, feelings of inferiority and self-doubt can plague a person's mind. When considering all of this, it appears that although the isolation was for the sake of the greater good, it might have introduced more harm than good. Eventually, it even resulted in a new form of a pandemic, one depriving people of social interaction and proper education.

2.2. Family and COVID-19

Family dynamics are not as linear as some might imagine; it involves parent-child, marital, and sibling interactions that interplay with one another. A perfectly harmonious family maximizes child and caregiver well-being, but this has become increasingly rare with the introduction of social disruptors with COVID-19 (Figure 2; Browne et al., 2020). Social disruptors can impact the well-being of caregivers and children. A social disruptor can be something like job loss or isolation, which would cause distress in the parents, which is passed onto the children in ways such as academic performance and peer relationships (Browne et al., 2020). More than ever before, conflicts between caregivers are at an all-time high (Browne et al., 2020). A subsequent spillover to parent-child relationships is highly likely. This cascading effect can make a household chaotic and dysfunctional, which is especially problematic for school-aged children. The hostility in the household can impede the children's perception of social interactions as a whole.

The pandemic increased the amount of time children spent with family. While this should be a positive aspect of isolation, it often causes negative feelings to linger within homes. A descriptive study surveyed 3000 adults living with and without children younger than 18. Around 44.3% of individuals living with children expressed a decline in mental health compared to the 35.6% without children (Zajda et al., 2010). The presence of children significantly decreased mental health in parents ($P < 0.001$). Furthermore, the mental decline of the parents seems to be reflected in the children as well, as 24.8% of parents describe that their children's mental health has worsened as well. These feelings can be attributed to disruptors such as stress and financial insecurities brought on by the pandemic (Zajda et al., 2010). Unfortunately, many parents have resorted to substance abuse as a coping mechanism; 27.7% of parents have increased their alcohol consumption relative to the 16.1% of adults without children ($P < 0.001$), which impacts parenting styles and, more importantly, more cases of domestic abuse (Browne et al., 2020).

As the COVID-19 pandemic progresses, it becomes evident that it is far more than just a health crisis. COVID-19 has plagued homes worldwide and embedded itself in many people's lives, but not just in the form of flu-like symptoms but in the form of social issues that will persist for years.

3. Psychological Impacts

3.1. The Effects of COVID-19 on Mental Health

The COVID-19 pandemic has had several effects on students: risks to their own and their families health, school closures, and the shift to online learning in March 2020, a prolonged summer of physical distancing, and then the struggle of returning to in-person school in September 2020 (Schwartz et al. 2021). Most schools have encountered shifts in curriculum online delivery. All these factors have had a major impact on students' education and mental health. Recent studies have been conducted to investigate the impact of the COVID-19 pandemic on academic achievement. Australian research found increased depression symptoms and anxiety in young students, as well as substantial disruptions in life satisfaction, such as a lack of outdoor activity and altered sleeping habits (Hertz et al., 2022). Moreover, COVID-19-related regulations (isolation and required quarantine), online learning challenges, and higher conflict with parents have contributed to the mental health impacts (Schwartz et al., 2021). Other studies reported that students who received virtual school learning were more likely to experience mental health issues, including stress, depressive symptoms, and suicidal thoughts than students who attended school in person or in a hybrid way of learning (Schwartz et al., 2021). Students were compelled to stay at home and were subjected to additional study demands, such as changes in the environment and teaching styles and a lack of assistance with learning strategies and interpersonal connections.

It is crucial to feel socially connected to teachers and friends to mitigate these difficulties. That was proven by studies stating that a sense of belonging to a school and family has been shown to buffer poor mental health outcomes such as emotional stress (Hertz et al. 2022). Middle school students were targeted in these studies because their emotional development was not entirely stable, making them vulnerable to psychological discomfort when learning efficiency is decreased because of a lack of learning skills. These effects, however, are dramatically decreased when strengthening the feelings of connectedness to school or family is

taken into account (Hertz et al., 2022). By implementing remote and in-person therapy services, including activities and academic engagement, feeling connected at school could be improved. This is especially essential since children who believe that their school counselors understand them personally and will successfully respond to their issues are more likely to experience feelings of attachment to their school (Hertz et al., 2022). Moreover, family connectedness is as important as school connectedness. Children must have a close relationship with their families. Feeling loved and respected by their parents is an effective defense against mental illness (Hertz et al., 2022). According to research, psychological distress, suicidal thoughts, nonsuicidal self-injury, and behavioural issues are less common among children who feel emotionally attached to their parents. Students with a high level of school and family engagement had a decreased risk of various unfavorable adult health outcomes, including emotional distress (Hertz et al., 2022).

In addition, emotional resilience is a critical component of adolescent mental health and enhances coping abilities when confronted with severe life events. It mediates the association between negative life experiences and depression symptoms, suggesting that it can protect adolescents by reducing the impact of negative life events (Zhang et al. 2020). Building good emotional resilience will help students overcome fears related to COVID-19. Emotional resilience alters the attention bias effect that could occur when students experience negative emotions. Adolescents with a poor level of emotional resilience have a more pronounced negative attention bias. The better an individual's emotional resilience is, the faster they acquire learning skills and flexibility (Zhang et al. 2020). Boosting emotional resilience could be done by applying mental health interventions in school. Firstly, we need to build psychological assistance programmes in schools about virus prevention information; control knowledge to avoid excessive anxiety, extreme emotions, and behaviors; and resolve negative emotions to build a good social environment (especially a family environment) (Zhang et al. 2020). Furthermore, online schooling could be utilized to increase middle school students' environmental management skills and emotional resilience. That could be done by teachers in addition to academic teaching tasks, as they listen to their students' feelings (Zhang et al. 2020). Individuals with strong emotional resilience can quickly recover from negative emotions, which is vital for mental health, actively pursuing academic accomplishment and success, and demonstrating superior adaptation and psychological health.

3.2. School Engagement

Emerging research shows that lockdowns and other public health measures associated with the COVID-19 pandemic negatively affect the psychological well-being of school-aged children (Maunula et al., 2021). This, in turn, affects student engagement in school, which is associated with learning capabilities, academic performance, and relationships with peers and teachers (Thorsteinsen et al., 2021). Therefore, studying the psychological effects of the COVID-19 pandemic on school engagement is an important topic since the school environment has changed drastically in response to COVID-19. Furthermore, developing meaningful techniques to improve student engagement via virtual platforms can improve their psychological well-being.

Previous studies, such as the one by Maunula and colleagues in 2021, demonstrated that COVID-19 led to feelings of loneliness and boredom, causing a drastic increase in screen

time as a way to cope with a sudden change in lifestyle. Schools that moved to an online format also report a decrease in students' engagement in school, an important factor that promotes learning, building relationships, and academic success (Thorsteinsen et al., 2021). The in-person school environment, compared to online learning, improves students' mental health and psychological well-being, which causes students to be more engaged in the classroom and school activities (Vaillancourt et al., 2021). However, psychopathology is more prevalent in school-aged children during the COVID-19 pandemic causing students to be less engaged in school (Maunula et al., 2021). Creating an engaging environment for students attending school online can enhance their learning and psychological health. Studies like the one by Jinyoung Kim (2020) suggest some ways that can improve engagement via virtual platforms. Making use of the available online tools and knowing how to use them can help with increasing engagement in the virtual classroom. These tools can be using the virtual whiteboard, sharing the screen, and online polls. This can increase student engagement because they are able to interact with the material presented to them. Another important factor is avoiding asynchronous teaching due to its limitations. These limitations include the student's inability to provide feedback and opinions, engagement with the teacher and peers, and the inability to provide real-time interactions. In a synchronous environment, the feeling of being in-person is the closest, allowing students to share and interact. Finally, communication is key to ensuring that the needs of each student are met. Communication with parents especially can help ensure a better online experience. In Jinyoung Kim's study (2020), a weekly email was sent to parents outlining the learning objectives and lesson plans for that week. This allowed parents to help prepare their children for their classes, such as providing them with necessary materials for hands-on activities or creating an appropriate environment to enhance the learning experience. By incorporating these suggestions, students can still have the full experience of learning and socializing via virtual platforms, which in turn can have a positive effect on their psychological well-being.

4. Biological Impact

4.1. Impact of school closures due to COVID-19 on Children's Physical Health

There are long-term effects related to the COVID-19 pandemic, such as a drastic change in students' lifestyles and negative effects on physical health. To limit the spread of the virus, there have been multiple restrictions. The worldwide regulations include closing schools, parks, and recreational centers. This caused a decrease in the likelihood of students participating in physical activities, which in return contributed to an unhealthy and inactive lifestyle. In addition, in-person school attendance provides many physical activities unavailable for years for students. Studies have also shown that e-learning causes students to have a less structural day, leading to a sedentary lifestyle (Di Renzo et al.). Staying more indoors than outdoors will gradually lead to obesity for some elementary school students. A recent research study has shown that the excess weight gain during the lockdown may not be reversible and lead to fat/adipose tissue build-up. (Arantes de Araújo et al, 2020) This will have a long-term effect on young kids' health and might very well persist until adulthood.

Another aspect of physical health affected by the global COVID-19 pandemic is eyesight; there is no way to avoid using digital services as they are essential communication tools between teachers and students. However, the excess use of digital devices negatively impacts

eyesight. Some of the symptoms include eye discomfort, dry eyes, and blurred vision. In addition, research shows that younger individuals are more susceptible to these symptoms than adults (Cooper Institute, 2021). Computer vision syndrome occurs when an individual stares at a digital screen for a prolonged period, preventing the eye muscle from recovering from the tension it is experiencing.

4.2. Impact of school closures due to COVID-19 on children with disabilities and special educational needs

The needs of children with disabilities and special education are often overlooked when discussing how online school impacts children. These children need to be discussed separately when looking at how pandemic lockdowns have affected their lives as they face a unique set of challenges. Children with learning disabilities, for instance, had less access to specialized facilities, therapies, and equipment as a result of lockdowns (Theis *et al.*, 2021). These missing resources had an overall negative effect on children resulting in poor behavior, mood, social and learning regressions as reported by parents (Theis *et al.*, 2021). Children with learning disabilities are also more severely impacted by lack of physical activity from lockdowns; this can also lead to poorer behavior and mood, among other things (Theis *et al.*, 2021).

A study showed that children with dyslexia had increased anxiety and depression symptoms during quarantine (Soriano-Ferrer *et al.*, 2021). Furthermore, parents reported their children having more emotional symptoms, hyperactivity-inattention, and conduct problems (Soriano-Ferrer *et al.*, 2021). The same study also found children with dyslexia had decreased motivation to read and read less in general (Soriano-Ferrer *et al.*, 2021). Another study by Baschenis *et al.* (2021) found that most children with dyslexia did not improve their reading skills to the level expected during remote learning. Also, through a parent survey, researchers found that children with dyslexia showed greater social isolation and were less worried about the pandemic and school closures (Baschenis *et al.*, 2021).

School closures and distant learning have negatively impacted children with Autism Spectrum Disorders (ASD). Parents reported increased behavioral problems in their children with ASD during lockdowns (Yarımkaya and Esentürk 2020; Colizzi *et al.*, 2020). Additionally, one study talking to parents found physical inactivity during quarantine led to an increase in sedentary behavior, excess feeding, and behavioral problems (Yarımkaya and Esentürk 2020). The parents also reported an increase in the previously mentioned behaviors led to a decrease in their child's motor skills (Yarımkaya and Esentürk 2020).

All of the above examples show how unprepared parents were to help their children thrive without teachers and other support workers. Parents need to be more informed by teachers and support workers on what they need to do to help their children succeed in a remote learning environment. The research also shows how children with special educational needs and disabilities need help and support differently than other children as they face challenges unique to them. More research should be done in this area in the future to see how these children can succeed and thrive in an online learning environment.

5. Conclusion and Recommendations

5.1. Biological Effects

The COVID-19 pandemic has affected school-aged children and their learning experience as learning moved to an online format. This is evident in the majority of children but especially in children with disabilities and special education needs. Lockdowns resulted in them learning from home, whereby they may have less access to the resources that assist their learning. With less access to these resources, such as specialized facilities, therapies, or equipment, their learning experience is negatively affected. Alongside less physical activity due to staying indoors, these issues can lead to negative behavior, poor mood, and learning regressions. Specifically, many studies reported these negative effects in children with dyslexia and ASD. Anxiety, depression, less motivation to read, and social isolation were common symptoms associated with dyslexic children and children with ASD. These children need specialized assistance to optimize their virtual learning experience. Therefore, there needs to be strong communication between parents, teachers, and support workers to ensure that parents can be prepared and well informed on how they can optimize the learning experience from home for their children.

With children staying indoors, their physical activity decreases and they experience changes to their lifestyle. Less structured days and less physical activity lead to excess weight gain that may have long-term effects. Moreover, with increased screen time, they may experience tension, discomfort, dryness, and blurriness in their eyesight. It is recommended that children spend some time outdoors doing physical activities to mitigate the negative effects of the prolonged screen and indoor times.

5.2. Social Effects

Social interactions are important for the development of school-aged children. Disrupting their regular lifestyle suddenly introduced negative feelings that school-aged children and their families experienced the most. Loneliness, anxiety, and depression were among many symptoms that resulted in these children due to less exposure to social activities that being in school provides. PTSD was more common in isolated children; children with families with a history of PTSD were most affected. Those who experience these symptoms may not seek support from others, which prevents their recovery. Social disruptors introduced by COVID-19 can include things like job loss, which would cause stress in the parents that is felt by the whole family. Children are highly influenced by their parents, whom they spend more time with now that they stay home. When the parents experience mental health decline, this is also experienced by the children.

Making use of the tools that have become increasingly available now that physical interactions are limited, such as ZOOM, FaceTime, and others, can still give children the opportunity to socialize with their friends. This can limit feelings such as loneliness and give children the opportunity to develop their social skills.

5.3. Psychological Effects

Throughout the COVID-19 pandemic, significant mental health concerns have arisen. COVID-19 has affected the learning of school-aged children, consequently affecting their mental health. Stressful life events, prolonged house isolation, and excessive internet use all affect

students' mental health. Because of this, teenagers must be given the necessary amount of physical and emotional care by school and family. They should use all available services and treatments in order to assist in coping with the pandemic's impact. Family and school connectedness are important for mitigating student stress during the pandemic. This sense of connectedness can be enhanced by using online and in-person therapeutic services and activities and academic engagement. Furthermore, Emotional resilience reduces the influence of stressful life events on depressive symptoms, implying that it will protect teenagers against negative life events. The school could increase students' emotional resilience by adding therapeutic support programmes which spread awareness about virus prevention, manage anxiety, intense emotions, and resolve negative emotions. It is fundamental for mental health that people have emotional resilience since this allows them to recover rapidly from unpleasant feelings.

School engagement is a good measure of the psychological well-being of school-aged children. Learning capabilities, academic performance, and relationships are all a part of school engagement. An online format resulted in lower student engagement, which negatively impacts learning capabilities, relationships with peers and teachers, and academic performance. Increased psychopathology is more prevalent in children learning from home, causing decreased engagement. Taking advantage of the provided tools, avoiding asynchronous teaching, and having strong communication with parents and guardians at least every week can help increase school engagement. With a positive learning experience, the psychological health of school-aged children will be better.

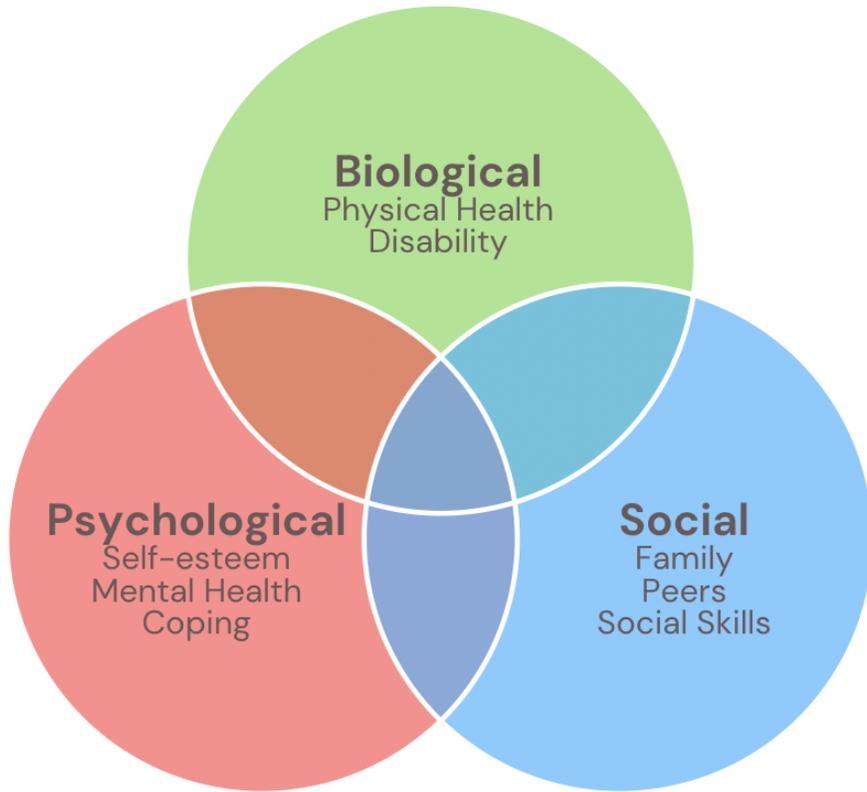


Figure 1. The biopsychosocial model that portrays the interconnection between biological, psychological, and social factors.

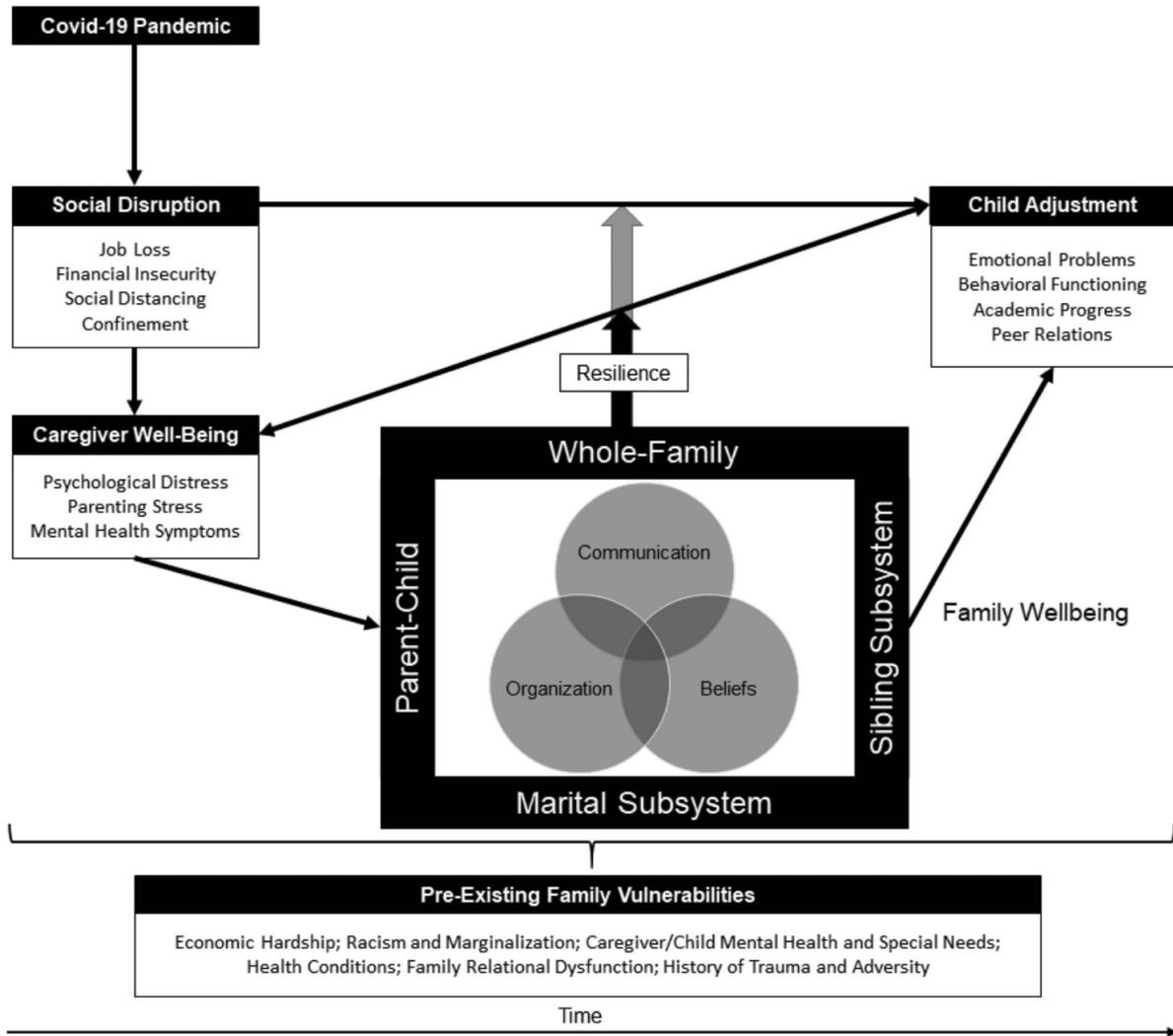


Figure 2. The impact of social disruptors arising from the COVID-19 pandemic on family well-being (Browne et al., 2020).

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