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Negative Impacts of COVID-19 Outbreak on Mental Health: A Review of Literature to Propose Future Research

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Abstract: Epidemiological research which focused on impacts of the COVID-19 pandemic on mental health have been conducted worldwide. This article aimed to: 1) review relevant research articles to identify both risk and protective factors of negative impacts caused by the pandemic, 2) to identify still needed information, and finally 3) to propose particular types of research necessary for the future. A variety of demographic variables as well as psycho-social factors were found to be risk factors or protective factors. It has not been clarified whether these factors interdependently function when the COVID-19 outbreak negatively impacts an individual's mental health. In addition, only presumable factors have been examined as to whether they are risk or protective factors. Compared to epidemiological studies targeting a relatively large sample, there were few clinical case studies which described the psycho-social process leading to an individual's maladaptation. In order for these issues to be solved, the author proposed a few essentials in conducting future research.

Keywords: COVID-19, Mental health, Risk factors, Protective factors.

Introduction

The COVID-19 pandemic caused drastic changes in people's lives globally. Not only the biological violence of the virus, but also its deteriorating effects on people's social and cultural activities are tremendous. In many countries, the lockdown and staying home order restricted people's lives severely (Flanagan et al. 2021; Park et al., 2021). Students were not allowed to go to school (Pinchoff et al., 2021) and had to take online-classes (Uji, 2020). Many people have been put in serious economic situations (Pinchoff et al., 2021; Singh et al., 2020). Patients admitted to hospitals have not been able to meet family members. Healthcare professionals have become exhausted (Zhou et al., 2021). Until several months ago in Japan, some moderate to severe patients with COVID-19 infection who needed admission had not been provided with hospitalization, because hospitals were overwhelmed by the outbreak. National and local governments inevitably have had to make difficult decisions regarding whether to tighten or loosen restrictions in consideration of economic stagnation or the COVID-19 outbreak. In order to control the outbreak, public welfare had been given priority over individual rights, provoking repulsion among the people. Fears towards the invisible virus as well as stresses caused by the restriction of freedom had driven some people to find visible targets of aggression: people infected by COVID-19 and healthcare professionals who treated patients with COVID-19 (Uji, 2020).

In the realm of psychiatry and psychology, many researchers have already conducted epidemiological studies on negative impacts of the COVID-19 pandemic on mental health, identifying several factors which influence magnitudes of the impacts. The target population, country where each study was conducted, as well as symptoms or behaviors chosen as indices of maladaptation depend on the study. Common facts obtained from a variety of studies conducted in many countries need to be clarified. To do this, the literature needs to be reviewed. Although some articles review previous studies targeting community-based populations (Prati & Mancini, 2021; Santabárbara et al., 2021), there are few articles which review those targeting patients infected by COVID-19, healthcare professionals, and others. This article aims to review each subject-category separately: 1) studies targeting

community-based populations, 2) those targeting people infected by COVID-19, 3) those targeting healthcare workers, 4) those targeting mental health disorder patients, and 5) others.

The above epidemiological studies are quantative studies examining tendencies observed among relatively large populations. It is assumed that, compared to quantative studies, qualitative case studies targeting specific clinical cases are few and far between. This study will also review those qualitative case studies, which will surely provide us with valuable knowledge.

To summarize, purposes of this article are:

1) To review previous studies on negative impacts of the COVID-19 pandemic on mental health to identify risk and protective factors of the impacts, separately for each subject-category,
2) To clarify still lacking information, and
3) To propose some specific types of research necessary in the future.

Methods

To identify relevant articles, electronic databases, and major journals related to mental health were utilized. Key search words such as "mental health", "addiction", and "distresses" were combined with "COVID-19" to find the articles. Original research articles, published between April 2020 and June 2021, examining either risk or protective factors of negative psychological impacts of the COVID-19 pandemic were reviewed. Those factors were identified for each subject-category separately: 1) community-based populations, 2) people infected by COVID-19, 3) healthcare workers, 4) patients with mental disorders, and 5) others. Not only epidemiological quantitative studies, but qualitative case studies were also reviewed. Ideas of the above referred review article (Santabárbara et. al., 2021) were partially introduced to discuss the interpretations of risk and protective factors obtained from the author's review. After that, still lacking information was clarified, and then research which should be conducted in the future was proposed.

Results

Epidemiological Studies Targeting Large Populations

Community-based populations

A variety of symptomatic problems, and maladaptive behaviors have been chosen as indices. Among them, many studies have chosen dysphoric mood, i.e. depression and anxiety (Almandoz et al., 2020; Turna et al., 2021), posttraumatic symptoms (Guo et al., 2020; Tsur & Abu-Raiya, 2020), psychological distresses (Gan et al., 2020), and addiction including substance abuse (Almandoz et al., 2021). Previous researches identified lots of risk factors, and though much fewer, some protective factors. They can be classified into demographic variables, personality characteristics, and social factors.

Demographic variables identified as risk factors

Many studies have identified demographic variables such as being a woman (Banks & Xu, 2020; Cardel & Dominick, 2020; Cénat et al., 2021; Debowska et al., 2020; Gazmararian et al., 2021; O'Connor et al., 2020; Iob et al., 2020; Turna et al., 2021), racial/ethnic minority (Iob et al., 2020), younger age (Banks & Xu, 2020; Cénat et al. 2021; O'Connor et al., 2020; Turna et al., 2021), unemployed (Ammar et al., 2020; Chandola et al., 2020; Guo et al., 2021), and of low Socio-economic Status (SES) (Brown et al., 2020; Iob, et al., 2020; Kwong, et al., 2020; O'Connor et al., 2020; Yee et al., 2021) as risk factors. I would like to focus on the risk factors one by one, by introducing these studies.

First, regarding gender difference, there are abundant studies showing the result that being a woman is one of the risk factors for negative impacts of the COVID-19 outbreak on mental health. On the other hand, there are a few studies concluding that there is no difference between male and female subjects (Neill et al., 2020; Pollard et al., 2020). The above studies, which concluded that being a woman is one of the risk factors of vulnerability to the

outbreak, chose internalizing symptoms (depression, anxiety, and post-traumatic symptoms, among others) as indices, with the exception of Iob et al.'s (2020) study which applied externalizing symptoms (abuse and self-harm). On the other hand, the index applied in these two studies which found no gender difference was alcohol drinking, an externalizing symptom. However, it is too simplistic to conclude that women are more likely than men to show internalizing symptoms during the COVID-19 outbreak, and that there is no gender difference in the increase of externalizing symptoms.

Of particular importance is that Neill et al. (2020) demonstrated that being a woman became statistically non-significant as a factor for increased alcohol drinking after proximal factors [such as job loss, eating more, changes to sleep as well as stress and depression] were taken into consideration. This means that if these proximal factors had not been taken into consideration, being a woman would have been a risk factor for increased alcohol drinking. This suggests that not being a woman per se is a risk factor, but psychological stresses provoked within social relationships and/or financial difficulties such as job loss due to being a woman determine the mental vulnerability to the COVID-19 outbreak. Indeed, in Japan, Ueda et al. (2021) showed that young women under 40 years of age, the population with the highest percentage of income and job loss, were the most likely to commit suicide during the COVID-19 outbreak. However, they were unable to conclude whether the female biological factor or the social factor was the culprit contributing to the vulnerability, because they did not conduct statistical analyses by controlling confounding factors such as job or income loss.

Kamal et al. (2021) showed the result that the sexual and gender minority (SGM) were more likely than non-SGM to experience depression and PTSD symptoms as well as COVID-19-related worries and grief, even after controlling family support, lifetime discrimination, and pre-existing mental health diagnoses. This seems to mean that several unknown factors other than discrimination or lack of family support contribute to a gender minority individual's mental health impairment during the COVID-19 outbreak to a considerable degree. However, it is impossible to obtain information on those factors because of a deficiency of studies examining how being in a gender minority group impacts mental health during the COVID-19.

Racial/ethnic minority has also been identified as a risk factor of mental health impairment caused by the COVID-19 outbreak. Most of these studies, which concluded that the racial/ethnic minority was one of the risk factors, chose externalizing symptoms as indices. Iob et al. (2020) reported that frequency of abuse, self-harm, thoughts of suicide or self-harm were higher among Black Asian and minority ethnic (BAME) groups. Kovler et al. (2020) demonstrated that 75% of patients who were children with injuries caused by physical abuse was Black with public health insurance. As with being a woman, there needs to be careful consideration as to whether racial/ethnic minority per se is a risk factor for mental health impairment caused by the outbreak or if several social factors associated with racial/ethnic minority are risk factors. Financial distresses can contribute to making racial/ethnic minority a risk factor. Indeed, Mann et al. (2020) showed the result that Black people were more likely to report economic anxiety.

In contrast to these studies, (Almandoz et al., 2020) reported that compared to non-Hispanic Whites (NHWs), Hispanics showed less anxiety. This also could be interpreted that rather than biological factors of a specific racial/ethnic group, socio-cultural factors constitute vulnerability or resilience to mental health impairment caused by the COVID-19 outbreak.

In addition to the female gender and racial/ethnic minority, younger age has been reported as a risk factor of mental vulnerability to the COVID-19 outbreak. Santabárbara et al. (2021), reviewing previous these studies, wrote that this was because of younger people's financial worries, uncertainty about future jobs, and excessive information from social media using smartphones. Meanwhile, older people were more likely to be afraid of COVID-19 itself (Schweda et al., 2021). Mann et al. (2020), in their original research, reported that younger people were more likely to show anxiety about financial hardships, and that perceived vulnerability to disease as well as neuroticism (which will be explained later) were additional risk factors. It is probable that this perceived vulnerability is higher among older people although an individual's personality also plays a big role.

Aside from the above three variables, a demographic variable that needs to be discussed is low socio-economic status (SES). Among employment statuses, job loss was identified as a risk factor for alcohol drinking (Neill et al., 2020; Pollard et al., 2020), and child abuse (Lawson et al., 2020). Financial difficulties also were related to child abuse (Brown, et al., 2020). These results could be expected. The indices chosen in these studies were

externalizing symptoms. It is also assumable that low SES can be intricately related to the three aforementioned risk factors: female gender, racial/ethnic minority, and younger age, making them ostensible risk factors. In particular, as with the studies demonstrating racial/ethnic minority as a risk factor, those indicating low SES as a risk factor of mental health impairment provoked by the COVID-19 outbreak also chose externalizing symptoms as indices. It is probable that racial/ethnic minority becomes a risk factor when accompanied by a low SES. On the other hand, studies concluding that being female and younger age were risk factors chose anxiety and/or depression as indices. It seems that these two risk factors are not related to low SES in impairing mental health during the outbreak. However, it is appropriate to consider that internalizing and externalizing symptoms are not on opposite sides of the continuum, but are related to each other. Namely, it is presumable that being female and/or younger age are also influenced by low SES when identified as risk factors.

Further risk factors were being unmarried (Al-Sofiani et al., 2021), not having a partner (Yee et al., 2021), children in the household (Twenge & Joiner, 2020), young children in particular (Ebert & Steinert, 2021), and previously diagnosed mental disorders (Varga et al., 2021; Wright et al., 2021) as well as chronic diseases (Varga et al., 2021). All of these factors are not surprising. The risk factor "[young] children in the household" could be a major cause of the female gender being a risk factor, because mothers are more likely than fathers to undertake the role of care for children in almost all cultures. This will be argued in more detail in the Discussion section.

Personality Types Identified as Risk or Protective Factors

Personality traits mainly identified as risk factors by previous studies were neuroticism (Mann et al., 2020; Schweda, et al., 2021), avoidant coping (Margetić et al., 2021), and trait anxiety (Buckner et al., 2021), whereas those mainly identified as protective factors were mindfulness (Brose et al., 2021), resilience (Guo et al., 2021; Kocjan et al., 2021), emotional stability (Margetić, et al., 2021), active coping (Margetić, et al., 2021), religious coping (Yee et al., 2021), keeping a daily routine, physical activity, as well as positive reappraisal/reframing (Shanahan et al., 2020), and the three Big Five personality traits, i.e., agreeableness, openness, and conscientiousness. All of these factors had been confirmed as risk or protective personality trait factors among the mental health related studies before the COVID-19 outbreak. Therefore, the results produced by the above-mentioned studies are understandable. Even during the outbreak, each personality trait functions in the same way that it did when there were no viral outbreaks.

Regarding extraversion, one of the Big Five personality traits, Nikčević et al. (2020) demonstrated its protecting function against the generalized anxiety during the outbreak. They conducted path analyses to examine how generalized anxiety and depressive symptoms were affected by each Big Five personality trait via COVID-19 associated anxiety assessed by three scales (Coronavirus Anxiety Scale, COVID-19 Anxiety Syndrome Scale, and Patient Health Questionnaire Anxiety and Depression Scale). One of the results was that Extraversion was negatively associated with the three mediators, which, in turn, were positively associated with generalized anxiety and depressive symptoms. On the other hand, Zacher & Rudolph (2021) showed incoherent results: whether extraversion functions as a risk or protective factor of perceived stressfulness depends on the timeframe during the COVID-19 outbreak. Volk, Brazil, Franklin-Luther, Dane, & Vaillancourt (2021), using HEXACO (Ashton & Lee, 2007) which is more advantageous than the Big Five, examined the hypothesis that the influences of demographic variables (gender, income, number of children) on three coping styles (seeking socioemotional support, avoidance, problem-solving strategies) taken during the COVID-19 outbreak as well as on negative appraisal of the outbreak are mediated by some specific personality traits. They demonstrated several indirect paths from demographic variables to several coping styles and appraisal, such as the path from being a woman to higher levels of negative appraisal by way of Extraversion (X), and paths from having more children or a higher income to lower negative appraisal through higher X. These results suggest that it is inappropriate to conclude whether some specific personality traits are risk or protective factors of mental health impairment during the outbreak. Rather, it would be better to conclude that the impairment is developed as a function of a variety of demographic variables and personality traits.

Social Factors Identified as Risk Factors or Protective Factors

Studies which examined whether some social factors were risk or protective factors can be classified into two categories: those examining the role of past social events and those examining the role of social events in an individual's current life. These two categories of studies will be reviewed in order.

Regarding past social factors, Tsur & Abu-Raiya (2020) showed that child abuse before 18 years of age influenced the development of acute stress symptoms caused by the COVID-19 outbreak, as well as fear of COVID-19, via posttraumatic stress (PTS) and disturbances in self-organization (DSO). Guo et al. (2020) demonstrated that childhood adverse experiences, such as abuse and neglect were risk factors of posttraumatic symptoms or feelings of anxiety when an individual, a family member, a friend, or someone in the neighborhood was infected by COVID-19. Ginzburg et al. (2021) presented the result that respondents who had been prisoners of war had higher fear of COVID-19 and COVID-19-induced acute stress disorder than those who had not. These results mean that past traumatic experiences play big roles in developing re-traumatization induced by later negative life events. Shanahan et al. (2020), targeting young adult respondents, reported that pre-COVID-19 emotional distress (perceived stress, internalizing symptoms, and anger) and pre-pandemic social stressors (perceived social exclusion, bullying victimization, low social support and stressful life events) predicted mid-COVID-19 emotional distress.

As to current social factors, several studies show that [perceived] social support (Amendola et al., 2021; Sommerlad et al., 2021; Szkody et al., 2020) or daily face-to-face or phone/video contact (Sommerlad et al., 2021) function as protective factors. On the other hand, some studies showed that poor or lack of social support (Margetić, et al., 2021) were psychological risk factors. These results regarding social support are consistent with previous studies examining the role of social support during disasters other than the COVID-19 outbreak. What is important is the nature of social support needed during the COVID-19 outbreak. Inferring from the result that daily face-to-face or phone/video contact (Sommerlad et al., 2021) were preventing factors, emotional social support is surely required for individuals psychologically vulnerable to the COVID-19 outbreak.

Patients infected by COVID-19

Compared to the above studies targeting community-based populations, those targeting patients infected by COVID-19 have been scarce. Most of these studies applied post-traumatic stress symptoms as indices (Gu et al., 2020; Kheradmand et al., 2021b).

As with the results targeting community-based populations, female gender was reported as a risk factor for symptoms of post-traumatic stress, anxiety, depression, and perceived stress (Gu et al., 2020). Lower education levels, existence of other diseases among family members, and duration of less than seven days from onset to admission were risk factors causing one or more symptoms of anxiety, depression, insomnia and perceived stress (Gu et al., 2020). Kheradmand et al. (2021b) used Impact of Event Scale-Revised (IES-R) and General Health Questionnaire-12 Items (GHQ-12) to assess post-traumatic stress symptoms and probability of mental disorders, respectively. Although they reported that prevalence of helplessness, risk of anxiety disorder, and that of mood disorder were low among the patients infected by COVID-19, they identified some demographic variables as risk and protective factors. Risk factors for post-traumatic stress symptoms were being an employer, having contact with sick people, and being a smoker, whereas protective factors were joblessness, and being undereducated. These protective factors will be argued in the Discussion section. Risk factors for the probability of mental disorders were having a history of psychiatric illnesses, having underlying chronic diseases, and moderate to high economic status. According to their results, female gender was not associated with higher prevalence of poor metal health status.

Mahmoudi et al. (2021), designating COVID-19-related self-stigma and PTSD as independent variables, proved their influence on quality of life and insomnia by way of mental health. This is understandable from the fact that stigma threatens an individual's value and identity.

There also have been a few qualitative studies targeting a relatively small sample of COVID-19 infected individuals. Moradi et al. (2021) found that self-blaming and regret, depression, and anger contributed to psychological maladaptation. On the other hand, spiritual meditation, self-hopefulness, avoiding the COVID-19 infodemic, and normalization had moderating effects of stresses.

Due to the shortage of studies targeting COVID-19 infected individuals, it is difficult to generalize these results for all COVID-19 infected individuals. However, some results — having contact with sick people or having a chronic disease were identified as risk factors — were reasonable in view of the biologically fierce characteristics of COVID-19.

Healthcare Workers/Health Professional Students

In the studies targeting healthcare workers, similar results were obtained as in the studies targeting community-based populations, i.e. female gender (Asnakew et al., 2021; Baumann et al., 2021; Bettinsoli et al., 2020; Jácome et al., 2021; Kheradamand et al., 2021a; Zhan et al., 2020), poor social support (Asnakew et al., 2021), fear of being infected (Leng et al., 2021), perceived stress (Jácome et al., 2021; Shen et al., 2021; Zhan et al., 2020), fear of COVID-19 (Shen et al., 2021; Zhan et al., 2020), physical illness (Zhan et al., 2020), mental illness (Asnakew et al., 2021), childhood adversity (Cabello et al., 2020; Li et al., 2021), low levels of resilience (Jácome et al., 2021), subjective appraisals of social isolation or loneliness (Cabello et al., 2020), and low education levels (Kheradmand et al., 2021a) have been identified as risk factors.

With regard to age, there have been no consistent results. Pan et al. (2020) reported that being a junior-grade professional was associated with depression whereas older age was associated with generalized anxiety, somatization, and short sleep duration. At first glance, this result is not in accord with results demonstrated by the previously introduced studies targeting community-based populations, concluding that being young was a risk factor and being old was a protective factor. Interpretations of these results will be discussed later in the Discussion section.

Similar to COVID-19 infected individuals, having family members with chronic diseases was reported as a risk factor among healthcare workers. This was understandable considering comparatively high probabilities of infection due to their jobs. Other risk factors reported by studies targeting healthcare workers, though not necessarily specific to healthcare workers, were not receiving psychotherapy despite the need to do so (Romero et al. 2021), and working in geographical areas with the highest incidence of COVID-19 infection (Romero et al., 2021). The latter risk factor can have more power in predicting mental health impairment among healthcare workers because of the high frequency of being in contact with, or working with COVID-19 infected patients. Regarding yet another risk factor, "stressful life event experiences during the past year (Li et al., 2021)", it is difficult to judge whether the experiences were related to the participants' professional or personal lives.

On the other hand, high levels of resilience (Labrague, 2021), COVID-19-related education (Heo et al., 2021), self-efficacy (Heo et al., 2021), sense of coherence (Reverté-Villarroya, 2021), being vaccinated (Labrague, 2021), and good family functioning (Li et al., 2021) have been identified as protective factors. Being asymptomatic (Romero et al. 2021) and being vaccinated (Labrague, 2021) can be stronger protective factors among healthcare staff, in view of the high probability of contact or work with COVID-19 infected individuals.

Risk factors specific to healthcare workers were working with patients with confirmed COVID-19 (Asnakew et al., 2021; Cho et al., 2021; Erkin et al., 2021; Kheradamand et al., 2021a; Sagherian et al., 2020; Wang et al. 2020) and/or those with suspected COVID-19 (Erkin et al., 2021; Wang et al. 2020), working in an isolated environment (Leng et al., 2021), concerns about personal protective equipment shortage and usage (Leng et al., 2021), physical and emotional exhaustion (Leng et al., 2021), intensive workload (Leng et al., 2021), and insufficient work experiences with COVID-19 (Leng et al., 2021), long working hours, low frequency of 30-minute breaks (Sagherian et al., 2020), high frequency of night shifts (Shen et al., 2021; Zhan et al. 2020), and experience of working through more than two epidemics (Shen et al., 2021). Protective factors among healthcare worker populations were hospital safety climate (Cho et al., 2021), adequate information and availability of protective measures (García-Fernández et al., 2020), COVID-19-related education (Heo et al., 2021), and increased staffing (Labrague, 2021).

Regarding types of jobs, there seems to be no consensus between studies. Jobs identified as high risk were doctors (Wang et al., 2020), nurses (García-Fernández et al., 2020), physician trainees (García-Fernández et al., 2020), and assistant nurses (Kheradmand et al., 2021a). On the other hand, Toh et al. (2021) reported that other essential workers (OEWs) defined as those "whose services are considered indispensable for the smooth continuation of daily life for the majority of our population" were more likely than healthcare workers or the general public to

show impaired mental health. It is difficult to identify the job most vulnerable to impaired mental health during the COVID-19 outbreak, because each medical job has different terms depending on the country, region, and healthcare institution.

Patients with Mental Disorders

Some studies targeting a community-based population presented that current mental disorder (Iob, et al., 2020) or previously diagnosed mental disorder (Varga, 2021) constitutes one of the risk factors of mental health impairment caused by the COVID-19 outbreak. As with the studies targeting COVID-19 infected individuals, those specifically targeting mental disorder patients are insufficient.

Neill et al.'s study (2020), already introduced as a study targeting a community-based population, showed that not only being a woman, but self-reported history of mental illness also became non-significant as a risk factor of increased alcohol drinking after proximal factors, including job loss, eating more, changes to sleep as well as stress and depression, were taken into account. This suggests that a mental disorder itself does not have a direct negative impact on mental health during the COVID-19 outbreak, but could have an indirect negative impact by way of other factors associated with the mental disorder.

Iasevoli et al. (2020) demonstrated that during the outbreak, patients with mental disorders, such as schizophrenia spectrum, bipolar disorder, and recurrent major depression, marked significantly higher mean scores than non-psychiatric participants on the Perceived Stress Scale (PSS), the Generalized Anxiety Disorder Scale (GAD-7), the Patient Health Questionnaire (PHQ-9), the Specific Psychotic Experience Questionnaire (SPEQ), and Paranoia subscale. They also showed that mental disorder patients were more likely to have other diseases. This might play a big role in the high mortality due to COVID-19 among patients with a mental disorder as presented by Jeon et al. (2021), suggesting that patients with mental disorder are more likely to have psychological stress during the COVID-19 outbreak.

Quittkat et al. (2020) concluded that COVID-19 may reinforce symptom severity and psychosocial stress in individuals with mental disorders including depression, generalized anxiety disorder, illness anxiety disorder and body dysmorphic disorder. Khosravani et al. (2021) demonstrated that feeling responsible for harm and having unacceptable thoughts experienced by obsessive compulsive disorder patients had indirect effects on suicidal ideation through the specific stress responses to COVID-19. Melegari et al. (2020) examined whether the lockdown during the COVID-19 outbreak had impacts on mood state and behaviors of children and adolescents with ADHD. The result they came to was that those with low severity showed worsened symptoms, whereas those with moderate and high severity showed improved symptoms. According to them, this was due to the fact that for those with low severity, lockdown functioned as "the sudden interruption of friendly relationships or opportunities of pleasant activities", and contrarily, for those with moderate and high severity, "the restriction could have represented a protective condition from common social stressors."

Clinical Case Studies

Compared to epidemiological studies targeting a large population, there have only been a small number of clinical case reports or studies. Among them, psychotic reactions have been reported as those triggered by the outbreak (Gillett & Jordan, 2020; Lazzari et al., 2020; Mirza et al., 2020; Smith et al., 2020). Lazzari et al. (2020) reported six cases with psychotic reactions related to COVID-19. They did not provide information regarding family members, their dynamics, or anteceded stressors. By referring to previous studies, they suggested that COVID-19 stressors causing extreme anxiety and fear contribute to functional changes in the brain, i.e. increased dopamine level resulting in [pseudo] hallucinations.

Studies reporting single clinical cases provide information concerning the patient's occupation, family members, family histories, and details of COVID-19-related stresses. Gillett & Jordan (2020) reported a clinical case of a 37-year-old male healthcare worker who had manifested hallucinations, confusion, and suicide attempt. They viewed this case from both biological and psycho-social aspects. Biological factors, which probably had contributed to the patient's symptoms, were COVID-19 infection, and insomnia; psycho-social factors were loss of a number of COVID-19 patients in the facility he was working, worry of infecting his family members, and self-isolation.

Mirza et al. (2020) reported of a 53-year-old male office clerk who experienced auditory hallucination and engaged in self-harming behavior following COVID-19 infection. From the fact that he had no psychiatric past history and that his pre-morbid personality was well-balanced, they seem to view his psychotic reactions as being due to direct injury to the central nervous system caused by COVID-19.

Smith et al. (2020) presented a case of a 37-year-old female nurse who showed persecutory delusion and decreased sleep following COVID-19 infection. Smith et al. (2020) argued that viral biological factors such as direct neurotoxicity and heighted immune response contributed to the psychotic symptoms, despite the inability to negate the probability of heightened stress from COVID-19 infection or medication.

From the above clinical case reports or studies, despite the small number of reported cases, the characteristics of psychotic reactions caused by COVID-19 can be summarized as follows: speedy recovery after launching pharmacotherapy, more specifically, medication of atypical anti-psychotics (Gillett & Jordan, 2020; Lazzari et al., 2020; Mirza et al., 2020; Smith et al., 2000), short-term episodes of psychotic state (Gillett & Jordan, 2020; Lazzari et al., 2020; Mirza et al., 2020; Smith et al., 2000), no past history of mental disorders (Gillett & Jordan, 2020; Lazzari et al., 2020; Mirza et al., 2020; Smith et al., 2000), and no family history of mental disorders (Smith et al., 2000). The patient reported by Gillett & Jordan (2020) who had family histories of mental disorders was the exception. Additional factors common among two or more cases were being healthcare staff (Gillett & Jordan, 2020; Smith et al., 2000), COVID-19 infection (Gillett & Jordan, 2020; Mirza et al., 2020; Smith et al., 2000), and black ethnicity (Gillett & Jordan, 2020; Smith et al., 2000), all of which have been reported by previously introduced epidemiological studies as psycho-social risk factors.

Of particular note is that the patients in all three articles reporting single cases had family members. This seems to contradict the previously introduced epidemiological study concluding that subjective appraisals of social isolation or loneliness (Cabello et al., 2020), being unmarried (Al-Sofiani et al., 2021), or not having a partner (Yee, et al., 2021) were risk factors of mental health impairment, during the COVID-19 outbreak. This will be argued later in the Discussion.

There also have been reported non-psychotic reactions provoked by the outbreak. Chong (2020) reported a clinical case of a woman with a diagnosis of borderline personality disorder who received psychodynamic psychotherapy, and argued that the feeling of emptiness and fear of abandonment experienced by those with borderline personality disorder may exacerbate under the mass indoor quarantine and social distancing during the COVID-19 outbreak. Ünver et al. (2020) reported three adolescent girls whose anorexia nervosa symptoms occurred when curfews were imposed during the COVID-19 outbreak. Phenomena common to the three cases were: restricted eating and excessive sports ascribed to the fear of gaining weight. They did not have any past history of mental disorders. They also had depression and anxiety, treated with pharmacotherapy using olanzapine and SSRIs. In addition to the pharmacotherapy as well as cognitive behavioral therapy for each patient, family interviews were also said to have been conducted. To understand the mechanism of anorexia nervosa, information of family dynamics, in particular, mother-daughter relationship is crucial. It is not clear whether the three girls' withdraw from the family was related to the pathologies imbedded in family dynamics or if it happened only after the quarantine during the COVID-19 outbreak. Ünver et al. (2020) attributed the causes of the three girls' anorexia nervosa specifically to social isolation and quarantine during COVID-19, but it is impossible to talk about anorexia nervosa without considering the patient's personality including internalized object-relations formed by family dynamics.

Discussion

I would like to discuss the results obtained from reviewing previous studies targeting general people, COVID-19 infected individuals, healthcare workers, and individuals with mental disorders, one by one.

Many studies targeting general populations reported some demographic variables, such as being a woman, younger age, racial/ethnic minority, and low SES, as risk factors. In addition to internalizing symptoms such as depressive-, anxiety-, and post-traumatic stress symptoms, externalizing symptoms such as excessive alcohol drinking, self-harm, and child abuse were chosen as indices.

With regard to the risk factor "being a woman", it has not been clearly examined whether women were more likely than men to show negative psychological reactions to the COVID-19 pandemic, or had always had worse mental

state since before the pandemic, because almost all of the studies concluding that the female gender was a risk factor did not have pre-pandemic data. However, it is better to assume that both are true, i.e., women had been more likely than men to have psychological distresses, amplified by the pandemic. As mentioned in the Results section, being a woman was associated with income or job loss, which probably makes being a woman a risk factor. There may be other issues associated with being a woman. Volk et al. (2021), referring to previous studies, wrote that "women often bear a relatively disproportionate cost of caretaking duties during a pandemic." As introduced in this article, having children (Twenge & Joiner, 2020), young children in particular (Ebert & Steinert, 2021), were risk factors of mental health impairment during the COVID-19 outbreak. This means that, compared to men, women are more burdened with responsibilities of taking care of their children who stay at home because of school closure. Difficulties in handling household finances caused by the economic recession, and the increased probability of becoming a victim of domestic violence could be additional distresses for women. Multivariate analyses to include these variances should be conducted in order to clarify whether being a woman itself is a risk factor, or its associated elements contribute to making a woman a risk factor.

Women have been reported by a few studies targeting senior high or university students (Debowska et al., 2020; Gazmararian, et al., 2021) to be more mentally vulnerable to the COVID-19 outbreak. If this result is confirmed as general phenomena among any student population, other issues associated with being a woman should also be examined, because disparities between male and female social status or employment situations are probably minimal. For example, women are probably more likely than men to be affected by the decrease in opportunities to communicate with other people during the COVID-19 outbreak, because they are more social. Uji et al. (2013) showed the result that women tend to report feelings of depression or anxiety more than men, as well as negative life events (NLEs), which can be interpreted in three ways. First, women are actually more prone to experience feelings of depression, anxeity and NLEs compared with men. Second, women are more sensitive to recognize their dysphoric moods, or NLEs. Third, women are more social than men, which is probably why they are more likely than men to report these feelings and NLEs even in questionnaire style. If the last interpretation is the case, decreased communication caused by the outbreak must be a damaging to women's mental health.

Regarding racial/ethnic minority, the next risk factor, in addition to the economic anxiety introduced in the Results, insufficient opportunities for education and the social status of a racial/ethnic minority group can also play big roles in increasing externalizing symptoms during the outbreak by way of internalizing symptoms, such as anxiety and depression. Among multi-ethnic countries, discrepancies in economic and social status between ethnic groups had already existed before the COVID-19 outbreak, and had been serious issues to be improved. The outbreak merely amplified these discrepancies. As mentioned earlier, excessive drinking of alcohol and child abuse, framed as addictions or externalizing symptoms, tend to be manifested among individuals with low SES or of racial/ethnic minority. This could be attributed to the lack of opportunities for education those individuals can afford.

Younger age was also found to be a risk factor of mental health impairment, in particular, excessive anxiety, during the COVID-19 outbreak. Volk et al. (2021) discussed the possible reason for younger age being a risk factor, e.g. less positive thinking as a coping strategy, and older age being a protective factor, e.g. ability to contextualize a novel stressor, increased comfort with concepts of illness and death, and stable and better-paying jobs. Of particular note is that there is a variety of anxiety during the outbreak, e.g. financial anxiety, anxiety of being infected by the virus, or anxiety of family members being infected by the virus. As introduced in the Results, Santabárbara et al. (2021) and Mann et al. (2020) wrote that younger people tended to worry about financial difficulties. On the other hand, older people were more likely to be afraid of COVID-19 itself (Schweda, et al., 2021). However, what is more important is that not only an individual's age itself, but the connection between age and situation could determine whether the individual is at risk of mental health impairment caused by the COVID-19 outbreak, as with being a woman, or being of a racial/ethnic minority. Examples of the situation are: being infected by COVID-19, which can cause anxiety of being excluded, being a healthcare worker or having chronic somatic diseases, which probably cause anxiety of infection, a family member being infected by COVID-19 and its worsening, which can provoke anxiety of losing the member, among others.

Each demographic variable identified as a risk factor has been discussed above. However, of particular importance to be taken into account is the probability of connections between the demographic variables. These

interrelations are very likely complicated. Furthermore, other demographic variables, e.g. education level, or family members, would also play a big role by being associated with the demographic variables introduced in this article.

Personality traits found to be risk or protective factors among general populations during the COVID-19 outbreak were almost the same as those identified during the period without the outbreak. It is understandable that the nature of each individual's stresses caused by the outbreak depends on the individual's personality. For example, Nikčević et al. (2020) demonstrated the path from an individual's personality to generalized anxiety and depressive symptoms via COVID-19 associated anxiety. There is a big problem with epidemiological studies like this. To begin with, a respondents' personality traits are assessed by using existing scales, thus detailed information on personality characteristics, which are not included in the scales, as well as the respondents' life history in which the personality characteristics have been developed, are dismissed. In addition, anxieties associated with COVID-19 are also assessed by scales. This type of assessment does not reflect the anxiety a respondent has experienced, accurately. Clinical case studies could solve these issues. Of course, empirical research has strength. In order for empirical studies and clinical case studies to generate synergic effects, these should be conducted in a well-balanced way.

I have argued about the importance of taking into account the connections between demographic variables in determining whether or not an individual's mental health is impaired. Here, I would like to emphasize those between demographic variables and other variables, such as personality characteristics or interpersonal relationships. As introduced, Volk et al. (2021) showed the results that demographic variables and personality traits interact with each other, determining coping styles and appraisal of the COVID-19 outbreak. However, the model examined by Volk et al. (2021) did not include current social support or adverse experiences in early life. The influences of the COVID-19 outbreak on an individual's mental health should be examined by targeting the individual's whole life history.

The studies targeting individuals infected by COVID-19 also showed that being a woman and having a low level of education were risk factors. They further reported that physical diseases of the infected individual as well as those of his/her family member(s), past history of the individual's mental disorder, self-blaming and anger, COVID-19-related stigma, and short duration between onset and admission played roles as risk factors. On the other hand, spiritual meditation, self-hopefulness, avoiding the COVID-19 infodemic, and normalization worked as protective factors to alleviate the distresses caused by the infection. The result that joblessness, and being undereducated were protective factors needs to be discussed. It is probable that the individuals do not have to work for a living. Therefore, they are not concerned about economic loss due to the infection. Also, they are free from COVID-19 infection-related obstacles in accomplishing their duties.

The studies targeting healthcare workers showed almost the same results as those targeting general populations, e.g. being a woman, low social support, high perceived stress, fear of COVID-19, working in a high infection geographical area, having a physical disease, having a mental disorder, childhood adversity, loneliness, and low education levels were risk factors. It is understandable that, in particular, working in a high infection geographical area can be a stronger risk factor for healthcare workers than general people.

Regarding age, no consistent results were demonstrated by studies targeting healthcare workers. This was different from those targeting general populations, which reported that being younger was a risk factor. This discrepancy can be interpreted in two ways: that younger participants in the studies targeting healthcare workers have stable economic status without worrying about losing their jobs due to the COVID-19 outbreak, and that older healthcare workers are still working and have greater opportunities to be exposed to COVID-19. In addition to this, they are more likely than young healthcare workers to live with their family members, thus probably have fear of infecting their family members with COVID-19. From these interpretations, as with the female gender or racial/ethnic minority, young or old age per se do not determine whether they function as risk or protective factors. However, other associated factors are intertwined when making young or old age up to be risk or protective factors.

The studies targeting mental disorder patients referred to the possibility of psychological vulnerability inherent in mental disorders, as well as biological susceptibility, i.e. high mortality due to COVID-19 infection. In this sense, a mental disorder patient is at risk of mental health exacerbation or recurrence caused by COVID-19. As with being a woman and of racial/ethnic minority, other associated factors such as having physical diseases, job loss,

and/or eating more can make mental disorder a risk factor. However, for the present, the number of mental disorder specific studies is extremely small, which makes it imprudent to induce general ideas by reviewing only these studies.

Like studies targeting COVID-19 infected individuals and mental disorder patients, clinical case studies or reports are also insufficient. Another problem with the clinical studies or reports was that while family dynamics or an individual's life history, which usually cannot be clarified in detail by epidemiological studies targeting a large population and are expected to be demonstrated therein, were almost always dismissed. In particular, this information is crucial in understanding non-psychotic symptoms. On the other hand, COVID-19 biological influences seem to play a big role in developing psychotic symptoms. In order to explore the mechanism of the influences, vigorous clinical case studies and biological experiments are awaited.

I would like to discuss the discrepancy between many epidemiological studies and clinical studies of the three patients with psychotic reactions. The epidemiological studies concluded that being unmarried, not having a partner, and subjective appraisals of social isolation or loneliness were risk factors of mental health impairment assessed by GHQ-12, during the COVID-19 outbreak. On the other hand, all three patients with psychotic reactions in the clinical case studies or reports had a partner and family. This discrepancy can be interpreted in two ways.

First, all the subjects with psychotic reactions in the clinical case studies had been infected by COVID-19. Although COVID-19 biological influences as a whole are a paramount contributor in developing psychotic symptoms, psychogenic stresses cannot be neglected. Possible psychogenic factors are worries about giving the virus to family members or the partner, and distresses that they had to keep physical distance from their family members or the partner.

Second, it is important that subjective social isolation or loneliness are different from not having a family. There was no information regarding whether or not the clinical patients described in the three articles perceived social isolation or loneliness. Information on the dynamics between members of the current family as well as members of the family each individual had come from was also lacking, although these are crucial factors contributing to the feeling of isolation or loneliness.

Third, we have to keep in mind that, as noted, Cabello et al. (2020) used GHQ-12 to assess non-psychotic symptoms as an index. It is not impossible to understand the process leading to the onset of depression or anxiety symptoms by taking into consideration psycho-social factors, including subjective appraisal of social isolation. On the other hand, from the above introduced case studies or reports, it is probable that psychotic symptoms during the outbreak are caused by viral biological toxicity and that contribution of psycho-social factors is minimal, though the factors cannot be dismissed. However, there are not enough reported clinical cases with psychotic symptoms during the COVID-19 outbreak, necessitating further studies and reports which take into account bio-psycho-social factors.

Based on this review of the previous studies, supporting strategies for COVID-19-related mental health impairment should be argued. Among the risk factors were being a woman or racial/ethnic minority, which associated issues e.g. income or job loss, or low SES contributed to the mental health impairment. We need to keep in mind that the socio-economic disadvantage of female gender as well as racial/ethnic minority had existed since long before the COVID-19 outbreak and only became more serious due to the outbreak. Regarding these issues, politico-economic strategies, rather than mental health care should be prioritized. These issues should not be medicalized or psychologized. Empathy or anxiolytic drug do not do anything for hunger.

For some other risk factors, however, psychological intervention can be useful. For example, personality characteristics identified as risk factors could be a target of intervention. When assuming the personality characteristics that mediate between NLEs and stresses, individual detailed assessments of the personality characteristics as well as the specific information regarding the COVID-19-related NLEs, which caused the mental health impairment, are required. The information contributes to understanding personality characteristics.

Furthermore, inferring from the previous studies, for those with a mental disorder, tailored support is required, as they react to the COVID-19 outbreak in different ways from individuals without mental disorders to a varying degree. In addition to the insufficiency of epidemiological studies targeting those with mental disorders, clinical case studies are also lacking, as noted previously. More epidemiological and clinical case studies targeting patients with mental disorders are anticipated, in order to construct a mental health supporting system for individuals with mental disorders.

Finally, I would like to mention my views regarding studies to be conducted in the future. As noted, it is difficult for epidemiological studies to explore unknown variables. We have to go back to clinical case studies by taking the uniqueness of COVID-19-related mental health impairment into account. The number of clinical case studies is extremely lower than that of epidemiological studies regarding COVID-19-related mental health impairment. Even in the clinical case studies conducted up to date, there seems to be no description of developing processes leading to the mental health impairment, that include information about personality characteristics and social factors. Concerning the influence of psycho-social factors, only those immediately before the outbreak or mental breakdown were described. In order to understand an individual's mental breakdown, the individual's psycho-social factors from early life on needs to be understood. Selected findings or facts induced from a sufficient number of case studies should be included in the epidemiological studies as new variables. It is especially important to go back and forth between clinical case studies and epidemiological studies.

Conclusion

It is likely that each risk factor does not contribute to the mental health impairment independently from other risk factors. Instead, risk factors are interrelated when developing the impairment. Furthermore, there are much fewer clinical case studies than empirical studies. To solve this, the aggregation of both clinical case studies, which describe each individual's process towards maladaptation in detail, and epidemiological studies, which examine hypothesis models taking into account a variety of risk and protective factors simultaneously, is essential.

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