Post-Traumatic Stress Symptoms After Corona Virus Disease 19 (COVID-19):

The Role of Gender and Distressing Social Media Exposure As Risk Factors

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Abstract
Direct (e.g. being in contact with the virus) and indirect traumatic experiences (e.g. Distressing Social Media Exposure: DSME) of the COVID-19 pandemic led to a variety of psychological and psychosocial consequences. They represent COVID-19-related Posttraumatic Stress Symptoms (PTSS) risk factors, whereby their interactions and their relations to gender have not yet been explored in detail.
1368 participants filled out an online survey between January and March 2021. Risk ratios and 95% CIs were calculated to estimate the magnitude of risk related to a self-reported COVID-19 infection, self-reported COVID-19 symptom severity, gender and DSME on COVID-19-related PTSS. A 2x2x2 ANOVA was used to determine main and interaction effects of a self-reported COVID-19 infection, gender and DSME on COVID-19-related PTSS.
174 (13%) participants reported COVID-19-related PTSS, which was more prominent in female (n=127; 15%), than in male participants (n=49; 9%). Individuals, who reported to have or have had a COVID-19 infection showed a significantly higher risk (RR=2.50, LCI=1.87, UCI=3.32) for COVID-19-related PTSS, especially when severe COVID-19 symptoms were reported (RR=4.01, LCI=2.66, UCI=6.03). Whereas non-infected females were at higher risk than males (p≤.001, LCI=16.96,UCI=23.81), a non-significant mean difference of 6.54 (p=.159, LCI=-14.62,UCI=1.54) between males and females was found at self-reported COVID-19 infections. DSME increased the Risk Ratios by 2.81 (LCI=2.08, UCI=3.79) and was more prominent in males.
The results from this study indicate that self-reported severe COVID-19 symptoms, DSME and female gender are risk factors for COVID-19 related PTSS. This underlines the need for effective public health measures for prevention.

Keywords: COVID-19, traumatic stress, crisis, pandemic, social media

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1 Introduction

In December 2019, the World Health Organisation (WHO) published concerns on a new Coronavirus (SARS-CoV2) that began to spread in November 2019 in Wuhan, China. The novel Coronavirus disease (COVID-19) caused by SARS-CoV2 showed high transmission and fatality rates. In beginning of March 2020, the number of COVID-19 cases increased by a 13-fold and the number of affected countries tripled within two weeks. Due to the concerns over its geographic spread, the WHO declared the outbreak of SARS-CoV2 a worldwide pandemic (WHO, 2020). Accordingly, governments worldwide adopted different approaches to contain SARS-Cov2, such as lockdown strategies, strict quarantine measures, curfews, social distancing measures as well as closing of public places and events. In addition, there was also a change in recommendations concerning hygiene measures, e.g. wearing a mask in public areas or supermarkets, frequent hand washing or using disinfecting agents (Regmi & Lwin, 2021). Nevertheless, within 18 months of the COVID-19-pandemic more than 200 million people all over the world were infected and nearly 4.5 million people died from COVID-19 (WHO Coronavirus (COVID-19) Dashboard, 2021).

The effects of the pandemic were varying. Besides affecting the health of those who were infected, general population sam-

ples showed an impact on mental health as well. This has various reasons like losing a loved one, changing of the work like having to work from home or unemployment (Cénat et al., 2021). This is underlined by the results of Nochaiwong et al. (2021), showing that during the pandemic the global estimate for depression was 28%, 26.9% for anxiety and 24% for PTSS and are now higher than before the COVID-19 pandemic (Steel et al., 2014; Zhou et al., 2021). In their meta analysis, including studies from 1980 to 2013, Steel et al. (2014) reported a lifetime prevalence of 29.1% for mental illness, 9.6% for mood disorders and 12.9% for anxiety disorders in adults. PTSS showed a prevalence of 14% in the Canadian population in Reynolds et al. (2008)s study. This corresponds to results from previous outbreaks of infectious diseases (e.g. Ebola, SARS, MERS-Cov, Zika, Influenza), showing high prevalence of post-traumatic stress symptoms in the respective aftermath, with a pooled prevalence of 17% (Zhou et al., 2021). For the COVID-19-pandemic it is still unclear how many people will suffer from post-traumatic stress. Multiple studies were reporting rates from 4% to 96% (Bo et al., 2021; Cai et al., 2020; Chen et al., 2021; Einvik et al., 2021; Horn et al., 2020; Ismael et al., 2021; Janiri et al., 2021; Khademi et al., 2021; Mazza et al., 2020; C. Wang et al., 2020). Additionally, evidence is scarce regarding the role of direct exposure to COVID-19 (e.g., being infected with COVID-19) such as by assessing the role of severity of COVID-19 infection (Chamberlain et al., 2021), indirect exposure (e.g., knowing someone who is COVID-19 infected), Distressing Social Media Exposure (DSME) and individual factors, such as gender (Janiri et al., 2021; Zhang et al., 2021), in the development of PTSS (Wang et al., 2021).

Post-traumatic stress symptoms (PTSS) result from experiencing a traumatic event, such as natural disasters, violent assaults, or other negatively experienced events that are outside the realm of common human experience (Deja et al., 2006). COVID-19 related PTSS refers to the consequences of the COVID-19 pandemic on the population, which is often interpreted as a collective traumatic event due to its global spread with possible long-term harmful consequences (e.g. Long COVID-19) (Houben-Wilke et al., 2022; Sanchez-Gomez et al., 2021). Symptoms of PTSS occur early after the event and are in their nature consistent with those of a post-traumatic stress disorder (Sparks, 2018). Studies have previously shown that viral outbreaks may have the potential to be experienced as disturbing and traumatic (Deja et al., 2006) and can lead to trauma-related symptoms such as intrusion, avoidance and hyperarrousal (Deja et al., 2006). Trauma may result in a clinically significant post-traumatic stress disorder (Sparks, 2018), but with a prevalence rate of 8%, it is more often the exception than the rule (Tsao et al., 2006), especially when considering the high lifetime exposure rate to trauma, ranging from 51% to 60% in the American population (Kessler, 1995). Following this, PTSS research appears especially relevant as it addresses a part of the population which is experiencing troubling symptoms due to a traumatic event, despite not meeting the diagnostic criteria for PTSD (Erickson et al., 2013).

One characteristic of the current pandemic is that COVID-19 is the first worldwide pandemic in the age of social media platforms, such as Facebook, Instagram, YouTube, Twitter or TikTok. Several studies show a relationship between social media use, smartphone use and rates of depression, anxiety and post-traumatic stress (Bendau et al., 2021; Neill et al., 2021; Pieh et al., 2021; Wang et al., 2020; Yang et al., 2021) whilst research on PTSS is lacking. Social media use, as one of several types of smartphone use, has been found to be particularly relevant to mental health (Twenge & Farley, 2021). Research indicates that the time spent on social media (>2 hours per day) or checking social media (five times a day) were significantly associated with anxiety, higher likelihood of experiencing PTSD and a decrease in overall mental health (Bendau et al., 2021; Neill et al., 2021). This effect was seen across all age-groups (Yang et al., 2021).

The aim of the current study was to investigate the effect of potential risk factors (symptom severity, gender, social media exposure) for developing COVID-19-related PTSS during the COVID-19 pandemic in a German speaking sample. Furthermore, we hypothesize that there are specific interaction effects of risk factors for COVID-19-related PTSS. Consequently, we set our focus on the following research questions:

Previous studies showed a strong association between a reported COVID-19 disease and COVID-19-related PTSS (Bridgland et al., 2021; Ren et al., 2020; Wang et al., 2020) and has linked the severity of a COVID-19 infection with a greater psychological impact (Horn et al., 2020). The purpose of this study is to provide detailed information on whether a diagnosis with COVID-19 alone is sufficient for increased PTSS¸ when symptom severity is considered in detail, and whether there are differences in PTSS gradients between levels of symptom severity. Therefore, our first research question addresses the following:

(1a) Does a self-reported COVID-19 infection influence COVID-19 related PTSS?

(1b) Is COVID-19 related PTSS intercorrelated with self-reported COVID-19 symptom severity?

An important risk factor for developing PTSD after traumatic exposure is female gender (Irish et al., 2011a). However, the exact impact of the pandemic on PTSS is unclear. While Brivio et al. (2021) defined gender as an essential discriminatory variable in this scenario, with women as the more affected part, Cénat et al. (2021) cites women and men as equally burdened. Linking the evidence from both studies while including self-reported COVID-19 infection would lead to the hypothesis, that among *uninfected* individuals, females are thought to be at increased risk (Brivio et al., 2021), while *infected* individuals are equally at risk (Cénat et al., 2021).

(2) How do women and men differ regarding COVID-19 related PTSS, and what roles does the self-reported infection status play regarding the PTSS outcome?

Moreover, as the pandemic is portrayed on various social media sites (Goreis & Kothgassner, 2020), a study by Wang et al. (2021) showed that frequency of media exposure is

related to COVID-19 related PTSS. In this study, the frequency using social media is surveyed and additionally elicited whether the perceived COVID-19-related social media *content* is reported as predominantly distressing. The impact of distressing social media exposure will be determined with the following research question:

(3) What impact does DSME show on reported COVID-19 related PTSS severity?

Therefore, we propose that the defined risk factors do not act as individual phenomena but interact with each other and mutually foster each other. Therefore, we state the following research question:

(4) What main and interaction effects do all three factors show on COVID-19 related PTSS?

This study is – to our knowledge – the first study combining one of the most important direct traumatizing factors (being infected with the virus) with individual factors, such as gender and indirect effects, such as knowing someone who is COVID-19 infected or experiencing DSME (Wang et al., 2020) and looking into the interplay between these factors. Traumatic experiences may lead to a variety of psychological and psychosocial consequences, but since PTSS has been shown to be the predominant one, it will be considered in depth for possible prevention measures (Norris et al., 2002).

2 Method

2.1 Procedure and Participants

For this observational, cross-sectional study, participants were recruited from the end of January to the end of March 2021 via various Facebook groups, Instagram channels and Reddit forums. Prior to this, the study protocol (no. 2171/2020) was reviewed and approved by the ethics committee of the Medical University of Vienna.

To take part, participants had to be at least 14 years of age and had to approve to the General Data Protection Regulation (GDPR)-compliant data storage and utilization of their given data. After providing informed consent, the survey was started. Out of 1384 participants, 16 had to be excluded from the analysis due to a large number of missing values. Missing values that accounted for less than 10% of the total scale were compensated by imputing the median per participant per scale, to form a valid sum score. For individuals who identified themselves as diverse ($n = 9$) or did not specify their gender ($n = 7$), it was not possible to achieve a satisfactory group size to make representative statements regarding inter- and intra-individual group differences. For this reason, these individuals had to be excluded from the analysis.

Outliers were examined but did not lead to further exclusion. This resulted in a final sample size of N=1368 German-speaking participants, out of which 524 (38%) were male and 844 (62%) were female. 361 (26.4%) participants were 20-29 years and 303 (22.1%) 30-39 years old. The minority of people were 14 – 19 years old (n=84; 6.1%) as well as 60 years and older (n=132, 9.6%). 195 (14%) of the analyzed sample reported to have or have had a self-reported COVID-19 infection.

2.2 Materials

Sociodemographic variables. Concerning demographic data, age, gender, highest level of education, occupational status, monthly income and country of residence were recorded, as well as data regarding the relationship status.

Frequency and duration of digital social media use as well as receipt of news and current information were collected. To measure the frequency of social media use, subjects reported the number of minutes spent on social media daily or weekly, depending on their pattern of use.

Impact of Event Scale with modifications for COVID-19 (IES-COVID-19). This self-report questionnaire was used to estimate COVID-19 related PTSS in terms of short- and long-term impact on participants. Three subscales with 7 items each were used to measure intrusion (e.g. "Other things kept reminding me of the COVID-19 outbreak."), avoidance (e.g. "I keep trying not to think about this pandemic.") and hyperarrousal (e.g. "I've been easily irritable and jumpy since the pandemic started."). All items are rated on a four-point Likert scale (0 = *not at all*, 1 = *rarely*, 3 = *sometimes*, 5 = *often*). The subscales are formed by summing values, whereas the total score is calculated by using a regression equation. This is due to the intercorrelation of the symptoms over time (Horowitz et al. 1986). According to Maercker and Schützwohl (1998), the diagnostic test score formula is derived from the following regression equation: Diagnostic score = – 0.02 * intrusion + 0.07 * avoidance + 0.15 * hyperarrousal – 4.36. A value > 0 is to be interpreted as a clinical meaningful cut-off of PTSS and a high scores indicate a stronger psychological influence of the COVID-19 outbreak (Vanaken et al., 2020). The psychometric properties of this scale showed excellent internal consistency of the IES-COVID-19 total sumscore (α=.92), as well as for the subscales Intrusion (α=.86), Avoidance (α=.86) and Hyperarousal (α=.87).

Distressing Social Media Exposure. Subjects were asked about the frequency of social media exposure ("How often do you use social media per day or per week?") and their total consumption time ("How many minutes in total do you use social media per day or per week?"). If used daily, participants indicated frequency and duration per day; if used less than daily, frequency and duration was indicated per week. If weekly use was indicated, it was adjusted to correspond the daily intake. To get an outline of the use of the various platforms, the use/non-use of the following social platforms was queried: Facebook, Twitter, Instagram, WhatsApp, Telegram, Snapchat, Reddit, TikTok, Tumblr, Pinterest, LinkedIn, Youtube. The extent of perceived distress due to general media exposure with regards to COVID-19 was assessed

with the use of a single bivariate item, asking if participants have seen content on social media related to COVID-19 and the pandemic, that they can't let go of or found predominantly distressing.

Self-reported COVID-19 health status. The self-reported COVID-19 infection status of the respondents was assessed using up to two items: The respondents were asked if they had experienced a COVID-19 infection themselves. If symptoms were reported, participants were asked to self-assess the severity according to the list of symptoms displayed. Categories ranged from no symptoms, mild to moderate symptoms (cough and sore throat, up to breathing problems and fever), severe symptoms (cough, sore throat, breathing problems, fever, lung infection) to severe symptoms with hospitalization. These symptom severity ratings represent a self-assessment of the affected participants and will therefore be labeled as "self-reported" in the following paragraphs. To be able to exclude possible influencing factors, it was also asked whether relatives or people close to them are or have been severely ill with COVID-19 and whether subjects had witnessed dire situations or circumstances regarding COVID-19 or the pandemic, such as seeing a loved one suffer from the disease.

2.3 Statistical Analysis Plan

Risk Ratios were calculated using the IES-COVID-19 cut-offs to determine the extent of the risk factors surveyed. Confidence intervals determined the significance regions. A 2x2x2 ANOVA with the factors (self-reported infection no/yes) x (gender female/male) x (DSME no/yes) was used to determine the main and interaction effects on COVID-19-related PTSS. The focus of the analysis was on the influence of the three independent variables on the overall sum score of the IES-COVID-19 scale: A comparison was made between reported COVID-19 infected and non-infected subjects, males and females and the information on DSME. Chi-squared test were performed to test the group differences for significance. The Bonferroni correction was used to avoid alpha error accumulations. Post hoc tests and simple contrast estimators with a Bonferroni correction were used for analyzing in-depth group differences.

Power analysis using G*Power (Faul et al., 2007) showed that to find a small effect of $f = 0.1$ with 80% power and an alpha level of 0.05, it was necessary to sample at least 787 people in factorial ANOVAs. This power calculation holds for main effects (e.g., the impact of self-reported infection or gender) and interactions, as the denominator degrees of freedom were all 1 (all factors had 2 factor levels).

SPSS version 27 was used for the analysis. Additional testing of the calculation using the robust t3way anova (WRS2 package) with R (Version 4.1.2.) yielded comparable results. An alpha of 5% was considered statistically significant.

3 Results

The final sample consisted of 1368 participants, out of which the majority was female (61.7%), was between 20 and 29 years old (69.1%), stated to be in a relationship of some kind (72.0%) and was highly educated (48.1%). Austrian residents where the most likely to participate in this study (83.4%) and had a steady income of 1501 to 3000 Euro per month (35.8%). A detailed description is found in table 1.

Table 1. *Sample characteristics*

Characteristics	n	(%)
Gender		
Female	844	(61.7)
Male	524	(38.3)
Age in years		
14–19	84	(6.1)
20–29	361	(26.4)
30–39	303	(22.1)
40–49	282	(20.6)
50–59	205	(15.0)
60–69	86	(6.3)
70–79	29	(2.1)
≥ 80	17	(1.2)
Relationship status		
single	264	(19.3)
in a relationship	487	(35.6)
married/registered partnership	506	(37.0)
divorced	75	(5.5)
widowed	8	(0.6)
other	28	(2.0)
Highest level of education		
no compulsory education	7	(0.5)
compulsory education	79	(5.8)
apprenticeship	210	(15.4)
high school diploma	211	(15.4)
high school diploma plus apprenticeship	43	(3.1)
Bachelor or equivalent studies and higher	658	(48.1)
Monthly income		
Less than 500 €	102	(7.5)
501 € to 1100 €	264	(19.3)
1101 € to 1500 €	282	(20.6)
1501 € to 3000 €	490	(35.8)
more than 3000 €	177	(12.9)
no regular income	45	(3.3)
Country of residence		
Austria	1141	(83.4)
Germany	192	(14.0)
other	35	(2.5)

Out of the total sample, 14% (*n*=194) reported to have been infected with COVID-19; of these, 10% (*n*=19) reported no symptoms, 64% (*n*=124) reported mild-moderate symptoms, 20% (*n*=38) reported severe symptoms and 7% (*n*=13) stated severe symptoms requiring hospitalization.

Depending on the severity of the self-reported symptoms results in men and woman differed (X^2 (4, N=1359)=14.131, *p*=.007). The widest difference was found in the reporting of no self-reported symptoms and particularly severe self-reported symptoms with hospitalization: 7% (*n*=7) of women and 13% (*n*=12) of men were infected with no self-reported symptoms (*p*=.002). Mild-moderate self-reported symptoms were slightly more common in women (*n*=68; 67%) than in men (*n*=56; 60%) (*p*=.028). Similarly, this was observed for severe self-reported symptoms, where women were affected in 22% (*n*=22) of cases and men in 17% (*n*=16) of cases (*p*=.617). However, in the case of severe self-reported symptoms with hospitalization, men (*n*=9; 10%) were more frequently impacted than women (*n*=4; 4%; *p*=.021).

Furthermore, 174 (13%) participants scored an IES-COV-ID-19 value of >0, indicating having a COVID-19-related PTSS. COVID-19-related PTSS was more prominent in female (*n*=127; 15%), than in male participants (*n*=49; 9%).

Most of the participants used social media platforms, such as Facebook (*n*=1196; 87%), Instagram (*n*=711; 52%), Youtube (*n*=912; 67%), Pinterest (*n*=289; 21%), Twitter (*n*=279; 20%), LinkedIn (*n*=209; 15.3%), Snapchat (*n*=197; 14.4%) and communication applications like WhatsApp (*n*=1205; 88%) and Telegram (*n*=339; 25%). Other platforms were used by less than 10% of the participants. On average, 2 hours per day were spent using social media platforms (*M* in minutes =120.30; *SD*=128.62). The majority of participants spent at least 1 hour (*n*=979; 72%), 22% even more than 2 hours daily (*n*=300) on social media platforms. Only 95 (7%) of participants reported spending less than half an hour per day on social media. On average, female participants spent 1.8 hours (*M*=1.88; *SD*=2.12) and male participants 2.2 hours (*M*=2.16; *SD*=2.16) daily on social media platforms. Mean values and correlations of the main variables and are displayed in table 2.

3.1 Self-Reported COVID-19 Infection and COVID-19-Related PTSS

All participants who reported a COVID-19 infection showed a 2.5 times increased risk to score above the cut-off criterion COVID-19-related PTSS, compared to non-infected participants (see figure 1). When classified according to self-reported COVID-19 symptom severity, the sole infection (without symptoms) with COVID-19 did not increase the risk for COVID-19-related PTSS. Participants self-reporting mild to moderate symptoms showed a 1.8 times higher risk for scoring above the cut-off for COVID-19-related PTSS. However, when self-reported symptoms were severe, the likelihood for COVID-19-related PTSS above the cut-off increased to a 4-fold risk as compared

Table 2. Spearman's Rho Correlation of variables and main outcomes

Variable	n	M	SD	1	2	3	4	5	6	7	8	9
Self-reported COVID-19 Infection[a]	1359	0.14	0.35	–								
Self-reported COVID-19 Symptom Severity[b]	1359	1.32	0.83	.99**	–							
Gender[c]	1359	0.38	0.49	.08**	.08**	–						
DSME[d]	1356	0.43	0.49	.13**	.14**	-.16	–					
Hours on social media platforms	1294	1.90	1.80	-.01	-.01	.05	.05	–				
COVID-19 related PTSS (Cut-off criterion)[e]	1355	0.13	0.33	.17**	.18**	-.09**	.19**	.02	–			
COVID-19 related PTSS Severity	1355	-2.10	1.68	.15**	.16**	-.35**	.34**	-.02	.58**	–		
Age in years	1359	39.24	15.26	.10**	.10**	.07*	-.10**	-.31**	.04	-.05	–	
Highest level of education[f]	1202	3.80	1.43	-.04	-.04	-.24**	.07*	-.07*	-.13**	.06	-.19**	–
Montly Income[g]	1352	3.18	1.28	-.01	-.01	.09**	-.11**	-.18**	-.05	-.10**	.44**	.08**

[a] 0 = reported no COVID-19 Infection and 1 = reported COVID-19 Infection
[b] 1 = reported no COVID-19 Infection, 2 = reported COVID-19 Infection/asymptomatic, 3 = reported mild symptoms, 4 = reported severe symptoms, 5 = reported severe symptoms with hospitalisation
[c] 0 = female, 1 = male
[d] 0 = no DSME, 1 = DSME
[e] 0 = no PTSS, 1 = PTSS (value was recoded following IES-COVID-19 regression values <0 for no PTSS and >0 equals PTSS)
[f] 0 = no compulsory education, 1 = compulsory education, 2 = apprenticeship, 3 = high school diploma, 4 = high school diploma and apprenticeship, 5 = Bachelor or equivalent studies and higher
[g] 0 = no income, 1 = less than 500 €, 2 = 501 € to 1100 €, 3 = 1101 € to 1500 €, 4 = 1501 € to 3000 €, 5 = more than 3000 €

* $p < .05$. ** $p < .01$.

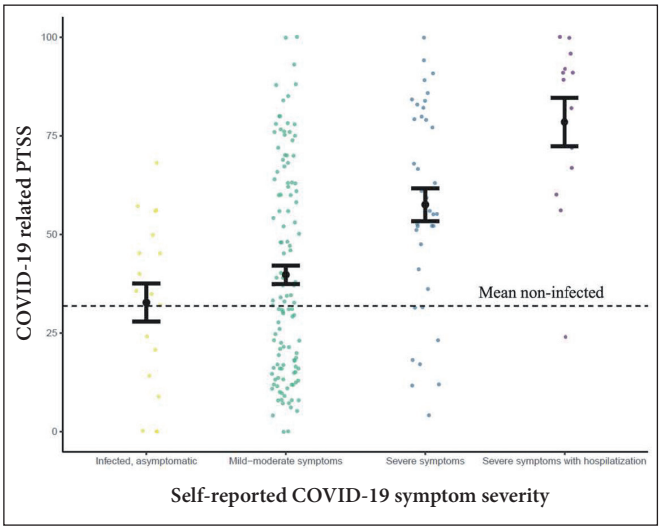

Figure 1. Mean differences in self-reported COVID-19 symptom severity regarding COVID-19 related PTSS sum scores.

Note. Reported numbers are mean differences in COVID-19-related PTSS. Graphs show IES-COVID-19 means and standard error of the mean. Dotted line represents the mean of all participants reporting to have had no COVID-19 infection.

to non-infected participants and to a 7-fold risk when patients showed severe self-reported symptoms and were hospitalized.

As seen in figure 1, COVID-19-related PTSS values were similar in self-reported non-infected individuals (*M*=31.84; *SEM*=0.67) and in patients reporting an asymptomatic COVID-19 infection (*M*=32.68; *SEM*=4.82). In patients with self-reported mild-moderate symptoms, mean values were higher compared to self-reported non-infected or infected, but self-reported asymptomatic patients (*M*=39.73, *SEM*=2.34). Patients suffering from self-reported severe symptoms with hospitalization showed markedly higher levels of COVID-19-related PTSS (*M*=57.51; *SEM*=4.18 and *M*=78.46; *SEM*=6.12, respectively).

There was a non-significant increase in COVID-19-related PTSS between self-reported no COVID-19 infection and self-reported asymptomatic COVID-19 infection (mean difference: 0.06, *p*=1.000, LCI=-1.12, UCI=1.01). Similarly, the difference between self-reported asymptotic COVID-19 infection and self-reported mild-moderate symptoms was marginal (mean difference: 0.41, *p*=.080, LCI=-0.84, UCI=0.02). The comparison between self-reported mild-moderate symptoms and self-reported severe symptoms yielded significant group differences (mean differences: 1.23, *p*≤.001, LCI =-2.13, UCI =-0.42). The comparison between self-reported severe symptoms and self-reported severe symptoms with hospitalization yielded a weakly non-significant difference (mean differences: 1.42, *p*=.068, LCI=-0.05, UCI=2.90).

3.2 Gender and COVD-19-Related PTSS

As compared to women, men face a 1.4 times higher risk to experience COVID-19-related PTSS when a COVID-19 infection was reported (see figure 3). Notably, in the non-infected population, the probability of suffering from COVID-19-related PTSS above the cut-off was 3.4 times higher in women as compared to men. When compared to non-infected individuals, the risk for infected individuals to score above the cut-off for COVID-19-related PTSS was 1.6 higher for women and 7.4 times higher for men.

Interestingly, 11% (*n*=122) of the individuals who have not reported a COVID-19 infection scored above the cut-off for COVID-19-related PTSS, which seems especially relevant for women. As seen in figure 2a, simple contrast estimators with a Bonferroni correction showed significant mean difference of 20.39 (*p*≤.001, LCI=16.96, UCI=23.81) between self-reported non-infected males and females and a non-significant difference of 6.54 (*p*=.159, LCI=-14.62, UCI=1.54) between males and females when a COVID-19 infection was reported.

3.3 Distressing Social Media Exposure and COVD-19-Related PTSS

Individuals who reported a COVID-19 infection were more likely to report DSME (59%; *n*=114) compared to non-infected (40%; *n*=464), whereas time spent on social media differed barely (self-reported COVID-19 infection: *M*=1.95; SD=1.87; Non-infection: *M*=2.02; *SD*=2.19). If DSME was reported, 20% (*n*=117) of participants scored above the cut-off for COVID-19-related PTSS. Only a small number of participants (7%; *n*=56) suffered from COVID-19-related PTSS without DSME.

When DSME was reported, the risk to score above the cut-off for COVID-19-related PTSS was found to be increased by a 2.8-fold, as seen in figure 3. Simple contrast estimators with a Bonferroni correction yielded a significant mean difference of 18.39 (*p*≤.001, LCI=20.79, UCI=15.99) between DSME and no DSME in COVID-19-related PTSS.

As seen in figure 2a, both genders showed significantly increased COVID-19-related PTSS values when DSME was reported (females: mean difference=2.67, *p*≤.001, LCI=-8.63, UCI=3.31; males: mean difference=29.59, *p*≤.001, LCI=23.15, UCI=36.02), but there was no significant gender difference (mean difference=6.54, *p* =.159, LCI=-14.62, UCI=1.54).

3.4 Influence of Self-Reported COVID-19 Infection, Gender and DSME on COVID-19-Related PTSS Severity

To test whether there were significant differences between self-reported COVID-19 infection, genders and DSME in the manifestation of COVID-19-related PTSS severity, a univari-

ate analysis of variance was calculated, using age as a covariate. The total model was found to be significant ($F(8,1343)=65.568$, $p \leq .001$). As shown in table 3, gender predicted significant differences in COVID-19-related PTSS severity ($F(1,1343)=15.433$, $p \leq .001$), as well as a self-reported COVID-19 infection ($F(1,1343)=42.807$, $p \leq .001$) and DSME ($F(1,1343)=139.352$, $p \leq .001$). Interaction effects of males and females and a self-reported COVID-19 infection indicated significant differences in PTSS symptom severity ($F(1,1343)=28.324$, $p \leq .001$), just as the interaction of males and females with DSME ($F(1,1343)=19.143$, $p \leq .001$) and a self-reported COVID-19 infection and DSME ($F(1,1343)=8.028$, $p=.033$). Age did not show any effects on COVID-19-related PTSS severity ($F(1,1343)=0.111$, $p=.739$).

4 Discussion

The aim of this study was to evaluate potential risk factors for COVID-19-related PTSS in the context of the COVID-19 pandemic. The main question was whether a self-reported COVID-19 infection leads to significant differences in COVID-19-related PTSS and, if so, whether self-reported symptom severity can predict these differences. Furthermore, gender differences concerning COVID-19-related PTSS were analyzed. In addition to that, we examined whether the consumption of social media content affects the participants' trauma-related COVID-19 stress symptoms scores.

The analyses have shown that a self-reported COVID-19 infection increased the likelihood of reporting COVID-19-related PTSS. A thorough examination has further revealed that the presence of a COVID-19 infection alone, as well as self-reported mild-moderate symptoms, had little impact on the self-reported severeness of COVID-19 related PTSS symptomatology, but the presence of self-reported severe COVID-19 symptoms, as well as hospitalization, significantly increased the likelihood of COVID-19 related PTSS. When considering the effect of gender, women were exposed to a higher risk of COVID-19-related PTSS among the non-infected participants. However, there was no significant difference between gender when a COVID-19 infection was reported. Additionally, an association between DSME and COVID-19-related PTSS could be shown. Based on the analysis of the data, it is reasonable to assume that heightened DSME increases the likelihood of developing COVID-19-related PTSS. Concerning gender, both males and females showed a higher risk to score above the cut-off for COVID-19-related PTSS when DSME was reported. Nevertheless, values increased considerably greater in men. Regardless of gender, it has been shown that high DSME levels interact with a self-reported COVID-19 infection and possibly lead to particularly high COVID-19-related PTSS scores.

Previous studies showed a strong association between a self-reported COVID-19 disease and increased COVID-19-related PTSS (Bridgland et al., 2021; Ren et al., 2020; Wang et al., 2020). Furthermore, it was reconfirmed that a confrontation with

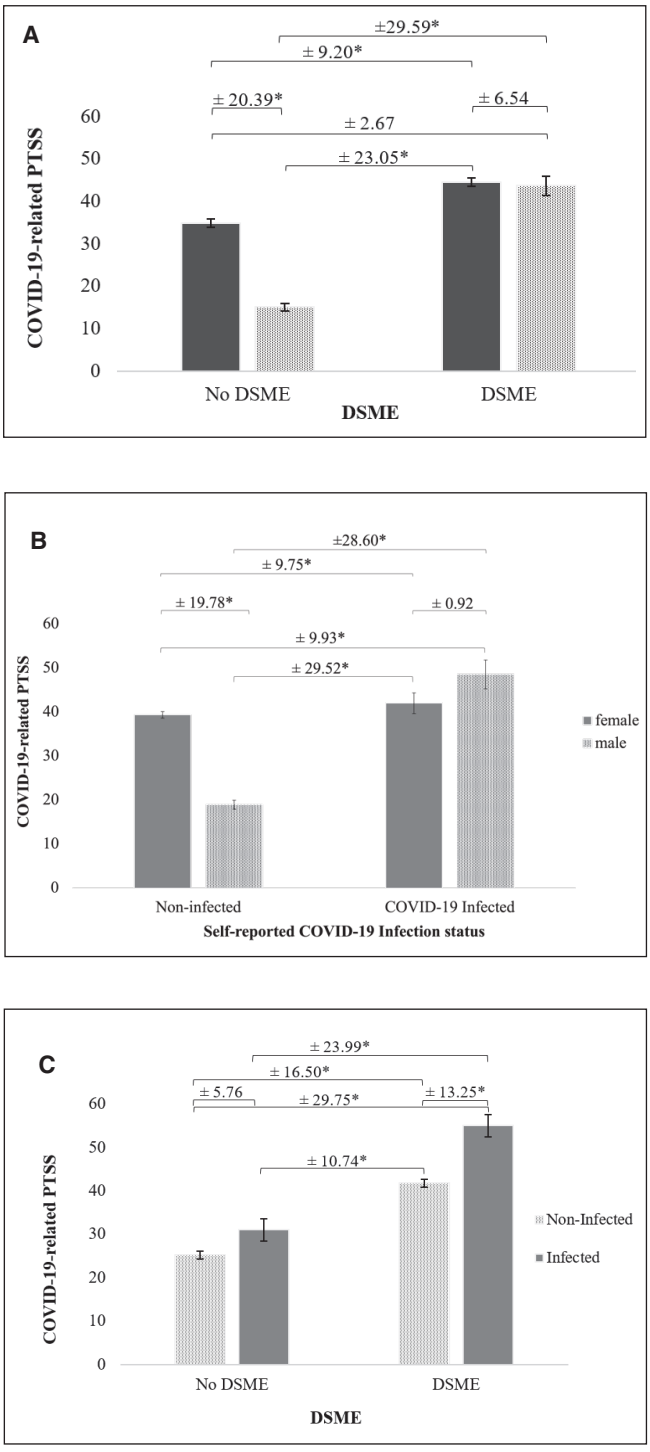

Figure 2ABC. Mean differences of A) self-reported infection status and gender, B) DSME and gender and C) DSME and self-reported infection status regarding COVID-19 related PTSS.

Note. Reported numbers are mean differences in COVID-19-related PTSS. Bar graphs show IES-COVID-19 means and standard error of the mean. Bonferroni adjustment was used.

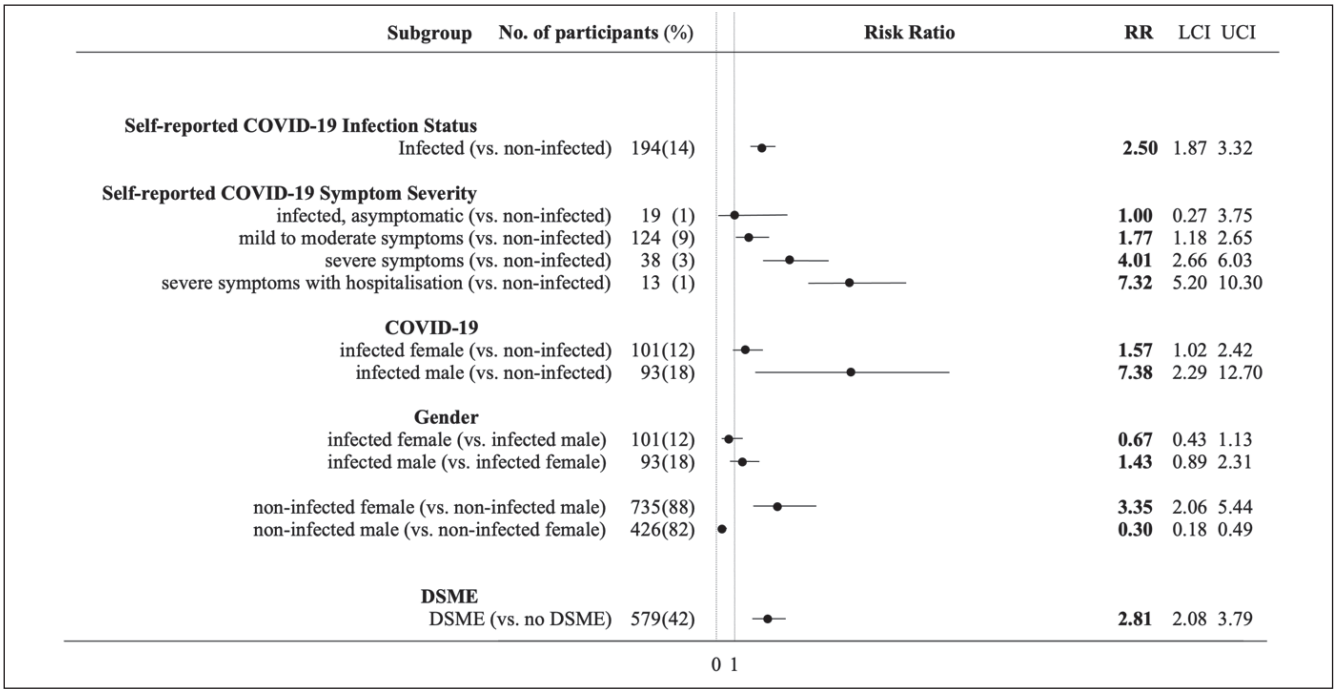

Figure 3. Risk Ratios on COVID-19-related PTSS.

Note. Risk ratios were calculated and presented using their CIs. Values <1 indicate an increased risk for the respective category. Reference groups are indicated in parentheses. Overall sample size is N = 1355, except for the comparison DSME vs. no DSME (n = 1352).

COVID-19, in this case, an infection yielded higher COVID-19-related PTSS values than an indirect confrontation (e.g. sorely DSME) (Bridgland et al., 2021). A novelty in this study is the differentiation of self-reported COVID-19 infections according to self-reported symptom severity. The analysis revealed a clear difference in the extent of the COVID-19-related PTSS depending on the self-reported severity of the disease symptoms. Thus, it seems that the sole diagnosis with COVID-19 does not seem to lead to a significant increase in COVID-19-related PTSS risk. COVID-19 disease appears to be a risk factor for COVID-19-related PTSS only when severe COVID-19 symptoms are reported. Once this is the case, the risk increases steeply and in a linear manner with higher symptom severity.

Gender differences in the development of COVID-19-related PTSS have been the subject of various studies and may be attributable to physiological and psychological behavioral tendencies in traumatic experiences (Irish et al., 2011a). Consistent with previous literature, the risk of non-infected individuals developing COVID-19-related PTSS above cut-off is higher in women than in men (Brivio et al., 2021; Cénat et al., 2021; Irish et al., 2011a), as shown in this study it increased by 1.4. This result is particularly interesting in direct comparison to infected individuals. When a COVID-19 infection has occurred, men appear to be at a slightly greater risk than women. As such, women seem to have a generally higher tendency to develop PTSS and COVID-19-related PTSS (Brivio et al., 2021; Irish et al., 2011a). Specifically, (Brivio et al., 2021) found women to be at greater psychological and emotional risk during a traumatic event, such as the COVID-19 pandemic. However, it is important to note the heterogeneity of the findings. (Cao et al., 2020) found that stressors were perceived similarly by men and women during the pandemic. (Cénat et al., 2021) on the other hand found an increased prevalence for women to report anxiety and depression symptoms but found no gender difference in the development of COVID-19-related PTSS. One possible cause might be demographic factors: for example, the gender difference in the development of COVID-19-related PTSS might be less pronounced in Asian countries (Cao et al., 2020; Cénat et al., 2021; Chen et al., 2021; Gao et al., 2020; Huang & Zhao, 2020) than in Central and Western European countries (Mazza et al., 2020; Moghanibashi-Mansourieh, 2020). However, based on the results of this study it is more likely that the gender effects are particularly prominent when a distinction is made between self-reported infected and non-infected individuals. So, although an increased risk in the development of COVID-19-related PTSS was shown in women, it was solely in self-reported non-infected ones. When self-reported COVID-19 infected individuals were considered, males showed higher risk ratios than females, whereby group differences were not significant.

The indirect experiences of traumatic events through DSME have been linked to the development of COVID-19-related PTSS. (Wang et al., 2021) argued that the frequency of DSME (more than five times per day) predicts COVID-19-related PTSS. For this purpose, (Bendau et al., 2021) defined the critical cut-off of seven accesses per day and 2.5 hours of daily exposure to distinguish between the likelihood of mild-moderate or

Table 3. Fixed effects univariate ANOVA results using COVID-19-related PTSS as the criterion

Predictor	Sum of squares	df	Mean Square	F	partial η2
Intercept	673296.27	1	673296.27	1602.62	0.54*
Age	46.70	1	46.70	0.11	0.00
Self-reported COVID-19 Infection	17984.15	1	17984.15	42.81	0.03*
Gender	6483.86	1	6483.86	15.43	0.01*
DSME	58544.94	1	58544.94	139.35	0.09*
Self-reported COVID-19 Infection x Gender	11899.48	1	11899.48	28.32	0.02*
Self-reported COVID-19 Infection x DSME	3372.89	1	3372.89	8.03	0.01*
Gender x DSME	8042.46	1	8042.46	19.14	0.01*
Self-reported COVID-19 Infection x Gender x DSME	345.25	1	345.25	0.82	0.00
Error	564224.59	1343	420.12		

Note. * p≤.001

moderate expressions of psychological distress, such as depression and anxiety disorders. Wang et al. (2021) even argue that as few as five accesses per day significantly increase the likelihood of COVID-19-related PTSS. Surprisingly, the quantity of time spent on social media between individuals with and without COVID-19-related PTSS showed no group differences in our analysis whatsoever. DSME as such increased the likelihood of COVID-19-related PTSS. This might rather be due to the quality of the content than the quantity of time spent online. Social media represents one of the most used sources to receive information about the Covid-19 pandemic. Simultaneously, increased information-seeking behaviors promote increased symptoms of anxiety and post-traumatic stress disorder (Brivio et al., 2021). Hence, DSME can promote COVID-19-related PTSS and result in intensified information seeking behaviors. Thus, a self-promoting dynamic might evolve.

One possible cause of the increased COVID-19-related PTSS strain in men with a COVID-19 infection may be due to the coping strategy used. Problem-focused coping is more frequently used by men than women (Endler & Parker, 1990; Matud, 2004). Since the pandemic outbreak, a high density of information has circulated, including many ambivalent recommendations and misinformation on social media. An infection with the disease means an uncertain prognosis for the individual and may be in the way of engaging in solving, altering or mentally restructuring the issue, which is typical for the problem-focused coping strategy (WHO, 2020; Folkman, 2013).

The way women and men use social media may provide insights into why males show significantly higher COVID-19-related PTSS than females when reporting DSME. Women are more likely to use social media to share feelings and engage in social interactions and generally report higher perceived social support via social media use than men do (Tifferet, 2020). Since perceived social support can serve as a buffer for stressful and traumatic circumstances (Cohen & Wills, 1985), this could prevent negative effects on COVID-19-related PTSS.

Moreover, individuals who feel more stressed, such as after a diagnosis, are more tempted to seek DSME (Thompson et al., 2020) to find information to address their feelings of uncertainty (Lachlan et al., 2009). If there is a high exposure to COVID-19 related information, there is a high chance that risk perception will be biased, promoting an increased risk (Zeballos Rivas et al., 2021). This is contrary to reducing the stress response and minimizing the feeling of uncertainty. Since no chronological sequence can be inferred from these results, it is also possible that the increased time spent on social media reflects an initiated coping strategy (Cauberghe et al., 2021), possibly resulting from experienced PTSS. Yet, the "infodemic" (WHO, 2020) contributes to social media platforms being swamped with pandemic-related information. This uncontrollability of information may have an intensified traumatizing effect on the individual, thus jeopardizing the use of DSME as a coping strategy.

5 Limitation

When interpreting the results, the following be considered: Although a balanced sample was aimed for, more women than men agreed to participate in the study. As a result, the ratio of 1:1.6 is not demographically matched. In addition, the study did not include individuals who belong to a gender other than male or female. In past studies, gender diverse individuals have been associated with a higher PTSS prevalence compared to their male or female counterparts (Loeb et al., 2018). The greater experience of adverse lifetime events, such as experienced discrimination, is seen as one of the possible causes (Loeb et al., 2018; Roberts et al., 2012).

Substantiated statements about the mental health of COVID-19 infected were aimed for, which requires a large sample of those affected. Although the affected individuals in this sample consisted of only 194 participants, they nonetheless accounted for 14% of the total sample, which was more than twice the per-

centage of affected individuals in the Austrian population at the time (31. March 2021; *AGES Dashboard COVID19*, n.d.).

Thus, set of relevant predictors of COVID-19-related PTSS were identified, a magnitude of other possible predictors has not been considered in this study. For example, socioeconomic status, not just income, has been an established predictor on multiple levels (Chi et al., 2021; Paxson et al., 2012; Peverill et al., 2021). Following Peverill et al. (2021), the socioeconomic status is a significant vulnerability factor in the development of mental health problems, particularly in prolonged public health emergencies extending six months (Chi et al., 2021). Considering women being affected more often by a low socioeconomic status (*Gender Equality in the Labour Market and Socioeconomic Equality – Federal Chancellery of Austria*, n.d.) and given the gender differences found in this study, it's possible that there may be a bias at play. Further gender-relevant predictors include the individual's psychiatric history previous to the traumatic incident as well as being in "lockdown" a restrictive isolating measure taken to limit the spread of the virus. Both of which have shown to play a significant role in predicting COVID-19-related PTSS (Coloma-Carmona & Carballo, 2021; Kalaitzaki et al., 2022).

Furthermore, due to economic considerations, the IES-COVID-19 measurement tool has been used, instead of diagnostic interviews. Although the IES-R is a widely used and validated measurement, with satisfying reliability and validity criteria, it is based on self-assessments (Chew et al., 2020; González Ramírez et al., 2020; Luceño-Moreno et al., 2020; Rossi et al., 2020; Vanaken et al., 2020).

Results of past surveys have varied in their assessment of the accuracy of self-assessments compared to clinical instruments. In their study, Griffin et al., 2004 found generally promising performance of the PDS compared to the CAPS in diagnosing PTSD, with a tendency to over-diagnose. Creamer et al. (2003) compared IES-R and CAPS, and found a very satisfactory sensitivity and specificity rates in favor of the IES-R. Nevertheless, it must be assumed that these results, which refer to PTSD and other measurement instruments, may not be transferrable onto this survey and the assessment of the COVID-19 related PTSS. This is especially important to consider as Shakespeare-Finch and Armstrong (2010) have showed the success of self-report measurement instruments may differ depending on the specific trauma.

Also, subjects were asked if they had *ever* been infected with COVID-19 and if so, how they would rate the symptom severity. The information regarding their infection status as well as their symptom severity is based on self-assessment and neglects to address both the duration of infection itself and the time gap between being infected and filling out the survey. The more immediate the infection, the more accurate are estimations of infection-related characteristics (Coolbrandt et al., 2011). For example, Coolbrandt et al. (2011) showed that in self-reports fewer symptoms and less severe symptoms are reported. Additionally, the impact of the symptom may be under- or overestimated, depending on the nature of the symptom (Coolbrandt et al., 2011). Future research projects would benefit in validity from diagnosis, documentation of symptom progression during illness and its severity, based on a professional.

Due to the nature of the survey, it should also be noted that it was not possible to ensure that the information on time spent on social media in minutes per day or week was always accurately reported. In many cases, this may not have been more than an estimate.

Moreover, this study is based on an online survey, it may only make conclusions about people who use the social media channels mentioned in the recruitment process. Nevertheless, it was essential to precisely reach this target group to determine the impact that DSME might have when using social media platforms. Although the presence of DSME is based on only one item, efforts were made to ensure that framework factors were collected in detail, such as the duration of social media platform use per day or week as well as the choice of channels.

6 Conclusion

In conclusion, individuals with self-reported COVID-19 infection, especially when severe symptoms are reported, are at high risk of developing COVID-19-related PTSS. In principle, women are at a higher risk of developing COVID-19-related PTSS. Nonetheless, the risk increased markedly in men infected with COVID-19. DSME has emerged as a prominent risk factor, especially in interaction with a COVID-19 infection. Both, males and females were at increased risk with DSME, although the effect increased significantly more in males. Both, future research and public health prevention should pay special attention to those with self-reported severe COVID-19 symptoms and emphasize DSME as a risk factor. Measures that target the likelihood of the occurrence of severe COVID-19 symptoms, such as vaccination, could subsequently be a preventive measure to address COVID-19-related PTSS. Since it could be shown that not the time on social media spent alone, but rather the perception of distressing content led to an increased COVID-19-related PTSS risk, the question arises whether and how content differs in its potential contribution. Warnings, guidelines for social media content or ethical codes could thus reduce the possible occurrence among social media users and may represent important preventive measures to combat COVID-19-related PTSS.

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Conflict of Interest

All authors declare no conflict of interest.

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