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## Research Article

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**Posted Date:** May 13th, 2021

**DOI:** <https://doi.org/10.21203/rs.3.rs-479681/v1>

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**Version of Record:** A version of this preprint was published at BMC Psychiatry on September 6th, 2021.  
See the published version at <https://doi.org/10.1186/s12888-021-03418-5>.

**Locus of control moderates the association of COVID-19 stress and general mental distress: Results of a cross-sectional survey in two large samples from Norway, Germany, and Austria**

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## **Abstract**

**Background:** An internal locus of control (LoC I) refers to the belief that the outcome of events in one's life is contingent upon one's actions, whereas an external locus of control (LoC E) describes the belief that chance and powerful others control one's life. This study investigated whether LoC I and LoC E moderated the relationship between COVID-19 stress and general mental distress in the general population during the early months of the COVID-19 pandemic.

**Methods:** This cross-sectional survey study analysed data from a Norwegian (n=1,225) and a German-speaking sample (n=1,527). We measured LoC with the Locus of Control-4 Scale (IE-4), COVID-19 stress with a scale developed for this purpose, and mental distress with the Patient Health Questionnaire 4 (PHQ-4). Moderation analyses were conducted using the PROCESS macro for SPSS.

**Results:** The association between COVID-19 stress and general mental distress was strong ( $r=.61$  and  $r=.55$  for the Norwegian and the German-speaking sample, respectively). In both samples, LoC showed substantial moderation effects. LoC I served as a buffer ( $p<.001$ ), and LoC E exacerbated ( $p<.001$ ) the relation between COVID-19 stress and general mental distress.

**Conclusions:** The data suggest that the COVID-19 pandemic is easier to bear for people who, despite pandemic-related strains, feel that they generally have influence over their own lives. An external locus of control, conversely, is associated with symptoms of depression and anxiety. The prevention of mental distress may be supported by enabling a sense of control through citizen participation in policy decisions and transparent explanation in their implementation.

**Keywords:** Anxiety, COVID-19, depression, locus of control (LoC), moderator analysis, pandemic, PHQ-4.

**Running Title:** COVID-19 stress, LoC, and general mental distress

## **Background**

Numerous studies found that mental distress has substantially increased during the COVID-19 pandemic, and first systematic reviews and meta-analyses reported prevalence rates ranging from 21.8% to 33.0%, from 22.0% to 33.7%, and from 34.4% to 41.1%, for clinically relevant anxiety, depression, and general mental distress, respectively [1-8]. Researchers observed that people experienced not only mental distress but also stress that was directly related to the pandemic and its aftermath [9, 10]. Thus, several scales were developed to measure stress specifically due to the pandemic. These COVID-19 stress scales primarily assess symptoms of anxiety and fears associated with COVID-19, but also various other facets of stress experience during the pandemic, such as feeling restricted by lockdown measures, uncertainty and doubts of how to protect oneself and loved ones against infections, sleep disturbance, confusion, frustration, anger, loneliness, social isolation, and fears of the future [11, 12]. While there is ample evidence that higher COVID-19 stress is significantly related to symptoms of mental distress [12-17], we do not know much about factors influencing this relationship. In particular, there is a need for investigations into resilience factors and resources that can buffer the effect of acute COVID-19 stress on mental distress. Research on resilience and resources will help inform public health measures and interventions to improve coping with stressful experience during the current pandemic and its aftermath, and it will provide important insights for dealing with future crises.

Until now, several factors were found to serve as resources buffering the effects of stressors, stressful experiences or risk factors on mental health or protective health promoting behaviour during the first year of the pandemic. Among these moderating factors are higher self-esteem [18], greater psychological flexibility and acceptance of difficult experience [19], higher meaning in life and self-control [12], less digital emotion contagion [20], higher age [21], male gender and lower COVID-19 stress [22], emotion regulation by cognitive reappraisal strategies [23], increased resilience [24], trust in the healthcare system [25], identifying positive over negative aspects of COVID-19 lockdown [26], as well as utilizing prenatal care services [27]. Although their stress buffering and/or resilience strengthening effects are empirically confirmed

in the respective study samples, it is open to what extent the protective mechanisms of the mentioned moderators would work in other samples and across various circumstances. Research is needed to identify psychological moderators that are stable, established, and robust, so that their assumed stress-buffering effect would be less dependent on sample characteristics and regional pandemic differences.

Locus of control (LoC) is among the four most widely investigated personality traits [28]. It is a relatively stable dimension that describes the extent to which individuals are convinced to be able to control their environment and future, and to experience significant events as consequences of their own behaviour [29]. LoC covers two aspects. While external LoC refers to the belief that chance and powerful others control one's life, internal LoC describes the belief that the outcome of events in one's life is contingent upon one's actions. LoC has originally been assessed with continuous internal-external scales [e. g. 30, 29], whereas later on, separate scales for internal and external LoC were considered more appropriate [e.g. 31-33]. Cross-sectional and longitudinal studies from various international regions found that higher internal LoC and lower external LoC were moderately associated with greater mental health, lower situational stress, and lower mental distress, like depression and anxiety [30, 34-38]. Thus, with its established validity for more than five decades, a temporal and transnational robustness, as well as replicated associations with perceived stress and mental health, LoC seems to be a promising candidate when it comes to factors that might attenuate the putative relationship between COVID-19 stress and general mental distress.

The objective of this study was therefore to investigate whether internal LoC and external LoC moderated the relation between COVID-19 stress and general mental distress during the early months of the COVID-19 pandemic. In order to assess the robustness of the assumed stress-buffering (LoC I) and stress-exacerbating (LoC E) effects, we collected data in a Norwegian and a German-speaking sample primarily from Germany and Austria. Norway, Germany and Austria showed both differences and similarities in pandemic-relevant aspects of country and societal characteristics, as well as regarding the extent of the pandemic. Most

importantly, population density is substantially lower in Norway, and institutional trust, as in the other Scandinavian countries, is higher than in Austria and Germany [39, 40]. Both regions did not differ substantially regarding timing, extent, and strictness of national COVID-19 restriction guidelines [40, 41]. According to data from the Johns Hopkins University (2021), in the first three weeks of March 2020 Norway had more cumulative confirmed COVID-19 cases per million people than Germany and Austria, but ever since April 1 2020, the number of cumulative confirmed cases per million people was always lower in Norway than in Germany and Austria [42]. The same holds for the cumulative number of confirmed COVID-19 deaths. Despite of the contextual variations, we expected that in both samples, high internal LoC would buffer, and high external LoC would exacerbate the association between COVID-19 stress and general mental distress.

## Methods

This cross-sectional survey was conducted in a Norwegian sample during the weeks when the strict COVID-19 regulations were gradually eased (May, 7, 2020 to June, 4, 2020; [39]), and in a German-speaking sample during the times of strict regulations and in the weeks thereafter (Austria, Germany, April 10, 2020 to May 28, 2020; [12]). Participation was voluntary, without compensation, and could be terminated by participants anytime. Ethical approval was issued by the Review Board (Psychology) of the University of Innsbruck, No 09/2020, as well as by Personvernombudet Innlandet Hospital Trust, Norway, No 20/02104-1. All participants expressed their informed consent by explicitly agreeing to continue with the questionnaire after being informed about the study's aims, employed data protection, participants' rights, and contact points for questions or concerns.

Data were collected by means of convenience sampling, using online questionnaire tools. Invitations to the study were sent out via university, business, worldview-related and regional network newsletters, and posted in several newspapers and news websites.

## **Participants**

The inclusion criteria of this study were a minimum age of 18 years, agreement to participant consent, and completion of the questionnaire. Cases with disproportionately short response times were deleted (n= 2 and n=7 for the Norwegian and the German-speaking sample). After exclusion, the total sample amounted to N = 2,752. The Norwegian sample (n=1,225) included mainly participants with Norwegian nationality (95.5%) and some with Swedish (1.4%), Danish (0.7%), and other nationalities (2.4%). The German-speaking sample (n=1,527) included participants with German (51.9%), Austrian (37.5%), Italian (5.8%), and other nationalities (4.8%). Demographic and psychological characteristics of the participants are shown in Table 1.

## **Measures**

**Locus of Control (LoC).** The 4-item Internal/External Locus of Control-4 Scale, IE-4, [32] was used to assess LoC. The subscales for internal LoC (LoC-I) and external LoC (LoC-E) consist of two items each, describing beliefs of personal control with a range from 1 (does not apply at all) to 5 (applies completely). Kovaleva et al (2012) report extensive data on good psychometric properties of the German version, including content, factorial, and construct validity [32]: Reliabilities for two normative samples were determined by McDonald's omegas of .71 and .70 for LoC-I, and of .63 and .53 for LoC-E. In the present study, Spearman-Brown corrected [43] Cronbach's alphas of LoC-I and LoC-E were .60 and .47 (Norwegian-speaking sample), and .68 and .46 (German-speaking sample). For use in the Norwegian-speaking sample, the original items were translated and a back-translation checked.

**COVID-19 stress.** Because there were no suitable instruments available at that time, we developed a novel scale to determine the extent of acute psychological stress due to COVID-19 [12]. After examining the relevant literature and drawing on population surveys released by the media, we generated seven items tapping a broad range of affective stress reactions (feelings of intolerance, boredom, anger, and being left alone) and fears and pessimism about

internal resources and the future. With a view to the current situation, items are rated on a six-point Likert scale ranging from 0 (strongly disagree) to 5 (strongly agree). For use in the Norwegian sample, the original items were translated and a back-translation checked. Internal consistencies in the present study were good, with Cronbach's alpha coefficients of .73 (Norwegian sample) and .76 (German-speaking sample).

**General mental distress.** We measured mental distress with the Patient Health Questionnaire 4, PHQ-4, [44, 45], a brief four-item measure of core symptoms of depression and anxiety. It uses a four-point Likert scale ranging from 0 (not at all) to 3 (nearly every day). Participants were asked to respond to the items with a view to the past two weeks. The PHQ-4 has demonstrated good reliability and validity in clinical and population samples for the Norwegian and German versions [e.g. 44-49]. Cronbach's alphas in this study were .82 (Norwegian sample), and .84 (German-speaking sample). Several cut-off points have been validated with >2, >3, >5 indicating mild, moderate, and severe mental distress [44, 48].

**Demographics and living conditions.** The sociodemographic section assessed participants' age, gender, relationship status, children, living together status, education, and personal experiences with Sars-CoV-2. The specific categories of the demographic variables are shown in Table 1.

### ***Statistical Analyses***

Descriptive results were expressed as relative frequencies in percent, as well as means and standard deviations. Comparisons of the two samples were performed using chi-square tests for categorical data and t-tests for continuous data. For all statistical tests, a two-tailed p-value ≤.05 was considered statistically significant. Due to their small number, data from participants identifying as gender divers were excluded from analyses that contained gender as a variable.

Moderation analyses were conducted using the PROCESS macro, version 3.5 [50, 51] for SPSS, version 25 [52]. Multiple linear regression models tested whether the independent variables COVID-19 stress, internal LoC, external LoC, and the interaction between COVID-

19 stress and internal and external LoC, respectively, had statistically significant associations with general mental distress as measured by the total score of the PHQ-4. In a further step, these moderation analyses were repeated including the covariates age, gender, relationship status, children, living together status, and education.

The statistical interaction between the independent variables 'COVID-19 stress' on the one hand and 'internal LoC' and 'external LoC' on the other hand indicated whether individual differences in LoC moderated individual differences of severity of mental distress in participants with varying severity of acute COVID-19 stress. In order to probe the interactions, analyses using the Johnson-Neyman technique were conducted for all eight regression models (four regression analyses by two samples) [51]. The Johnson-Neyman technique calculates the statistical significance of the effect of an independent variable, in this study COVID-19 stress, for all values of the moderator variable, in this study internal or external LoC. Thus, the Johnson-Neyman technique can 'identify points of transition along the continuum of the moderator between a statistically significant and nonsignificant effect of X' [51, page 13]. The resulting ranges of the values of the moderator where the independent variable is significantly associated with the dependent variable are called regions of significance.

## Results

### ***Sample characteristics and zero-order correlations***

The two study samples differed significantly concerning demographic and psychological characteristics (Table 1). Compared with the German-speaking sample ( $n=1,527$ ), the Norwegian sample ( $n=1,225$ ) was older and had higher percentages of women, of people with children, and of people with university education. The Norwegian sample had lower scores of both internal and external LoC, lower COVID-19 stress, as well as lower general mental distress, depression, and anxiety. Correspondingly, compared with the German-speaking participants, the Norwegian sample had lower rates of clinically significant depression (14.3 % versus 22.7%), anxiety (10.0% versus 21.0%), and severe general mental distress (9.1 %

versus 19.1%). While there were small but statistically significant differences in relationship status and experiences with Sars CoV-2, the samples did not differ regarding living together status.

**Table 1.** Demographic and psychological characteristics of study participants; mean [SD]; n (%).

	Norwegian sample n=1,209-1,225	German-speaking sample n=1,522-1,527	<i>p</i>
Age (years)	50.26 [13.16]	40.35 [16.66]	<.001
Gender			
Women	897 (73.20)	993 (65.00)	
Men	326 (26.60)	528 (34.60)	<.001
Divers	2 (0.20)	6 (0.40)	
Relationship status			
Married/partnered	683 (55.80)	953 (62.40)	<.001
Other	542 (44.20)	574 (37.60)	
Children			
No	252 (20.60)	975 (63.90)	<.001
Yes	971 (79.40)	552 (36.10)	
Living together status			
Living alone	249 (20.30)	328 (21.50)	.460
Living with others	976 (79.70)	1,199 (78.50)	
Education:			
Secondary	19 (1.60)	190 (12.40)	<.001
Advanced	133 (10.90)	453 (29.70)	
University	1073 (87.60)	884 (57.90)	
Experiences with Sars CoV-2			
I have been infected	14 (1.10)	12 (0.80)	<.001
A close person has been infected	136 (11.10)	130 (8.50)	.001
LoC <sup>a)</sup>			
Internal	3.65 [0.87]	3.94 [0.81]	<.001
External	1.84 [0.75]	2.31 [0.86]	<.001
COVID-19 stress <sup>b)</sup>	1.34 [0.82]	1.54 [0.89]	<.001
General mental distress <sup>c)</sup>	2.51 [2.35]	3.48 [2.82]	<.001
Elevated general mental distress <sup>c)</sup>			
>5	111 (9.10)	291 (19.10)	<.001
>3	355 (29.00)	628 (41.10)	<.001
>2	551 (45.00)	861 (56.40)	<.001
Depression <sup>c)</sup>	1.38 [1.33]	1.82 [1.52]	<.001
Elevated depression (>2) <sup>c)</sup>	175 (14.30)	346 (22.70)	<.001
Anxiety <sup>c)</sup>	1.12 [1.28]	1.66 [1.57]	<.001
Elevated anxiety (>2) <sup>c)</sup>	123 (10.00)	321 (21.00)	<.001

<sup>a)</sup> Locus of control (LoC) measured by the Internal/External Locus of Control-4 Scale (IE-4, [32]), subscales Internal (LoC I) and External (LoC E); range: 1-5, with higher scores measuring higher LoC I and LoC E, respectively.

<sup>b)</sup> Acute psychological stress due to COVID-19 measured by the COVID-19 stress scale [12]; range: 0-5, with higher scores measuring higher stress.

<sup>c)</sup> General mental distress, depression, and anxiety measured by the Patient Health Questionnaire 4 (PHQ-4, [44, 45]). Total scale score ranges from 0 to 12, with higher scores measuring higher distress. Cut-offs >5, >3, >2 for at least severe, moderate, and mild distress, respectively [44, 48]. Subscales depression (PHQ-2) and anxiety (GAD-2) range from 0-6, with cut-offs >2 for elevated depression and anxiety, respectively [44, 45, 47].

**Table 2.** Correlations between Locus of Control, COVID-19 stress, and general mental distress.

**2a.** Norwegian sample (n=1,225)

	LoC I <sup>a)</sup>	LoC E <sup>a)</sup>	COVID-19 stress <sup>b)</sup>
LoC E	-.22***		
COVID-19 stress		-.11***	.32***
General mental distress <sup>c)</sup>	-.14***	.32***	.61***

**2b.** German-speaking sample (n=1,527)

	LoC I <sup>a)</sup>	LoC E <sup>a)</sup>	COVID-19 stress <sup>b)</sup>
LoC E	-.41***		
COVID-19 stress		-.15***	.25***
General mental distress <sup>c)</sup>	-.31***	.35***	.55***

\*\*\* p<.001

<sup>a)</sup> Locus of control (LoC) measured by the Internal/External Locus of Control-4 Scale (IE-4, [32]), subscales Internal (LoC I) and External (LoC E); range: 1-5, with higher scores measuring higher LoC I and LoC E, respectively.

<sup>b)</sup> Acute psychological stress due to COVID-19 measured by the COVID-19 stress scale [12]; range: 0-5, with higher scores measuring higher stress.

<sup>c)</sup> General mental distress measured by the Patient Health Questionnaire 4 (PHQ-4, [44, 45]); range from 0 to 12, with higher scores measuring higher distress.

Table 2 displays the intercorrelations between COVID-19 stress, general mental distress, LoC I, and LoC E. In both samples, COVID-19 stress and general mental distress had large positive correlations. All other correlations were of moderate to small size, with LoC I and LoC E correlating negatively with each other, and COVID-19 stress and general mental distress correlating negatively with LoC I, and positively with LoC E. The psychological variables were only weakly associated with demographic characteristics, however the majority of these correlations reached statistical significance in both samples (Table 3), suggesting to include the demographic variables into adjusted moderation analyses of the psychological variables. No significant correlations were found between psychological variables and experiences with Sars CoV-2.

### ***Moderation analyses***

Table 4a shows the results of multiple regression models analysing the prediction of general mental distress (PHQ-4 sum score). COVID-19 stress, LoC I, LoC E, and the interaction between COVID-19 stress and LoC I and LoC E, respectively, had statistically significant independent effects on general mental distress in both the Norwegian and German-speaking samples. Higher COVID-19 stress, lower LoC I, and higher LoC E predicted higher general mental distress. The significant interactions indicated moderation effects. While higher LoC I buffered the effect of COVID-19 stress on general mental distress, higher LoC E exacerbated the effect. Figures 1a and 1b display plots of Johnson-Newman analyses to illustrate the interactions of COVID-19 stress and LoC I and LoC E, respectively. With increasing scores of LoC I, the conditional effect of COVID-19 stress on general mental distress decreased. With rising scores of LoC E, it increased. The conditional effects were significant for the total range of scores of LoC I and LoC E. Finally, Table 4b shows that all associations between the psychological variables and general mental distress remained significant when the moderation analyses were adjusted for the demographic variables age, gender, relationship status, having children, living together status, and education.

**Table 3.** Correlations between demographic variables and LoC, COVID-19 stress, and general mental distress.

**3a.** Norwegian sample (n=1,209 -1,225)

	LoC I <sup>h)</sup>	LoC E <sup>h)</sup>	COVID-19 stress <sup>i)</sup>	General mental distress <sup>k)</sup>
Age (years)	-.06	-.10**	-.12***	-.19***
Gender <sup>a)</sup>	.03	-.06*	.03	.05
Relationship status <sup>b)</sup>	-.13***	-.01	-.11***	-.12***
Children <sup>c)</sup>	-.03	-.06	-.15***	-.19***
Living together status <sup>d)</sup>	-.05	.04	-.10***	-.10***
Education <sup>e)</sup>	-.02	-.07*	-.08**	-.11***
Infected Sars CoV-2 <sup>f)</sup>	-.04	-.02	-.02	-.01
Close person infected with Sars CoV-2 <sup>g)</sup>	-.02	-.002	.02	-.02

**3b.** German-speaking sample (n=1,521-1,527)

	LoC I <sup>h)</sup>	LoC E <sup>h)</sup>	COVID-19 stress <sup>i)</sup>	General mental distress <sup>k)</sup>
Age (years)	-.20***	.09**	-.21***	-.17***
Gender <sup>a)</sup>	.06*	.00	.11***	.06*
Relationship status <sup>b)</sup>	-.09**	-.07**	-.13***	-.12***
Children <sup>c)</sup>	-.10***	.09***	-.14***	-.14***
Living together status <sup>d)</sup>	.15***	-.01	-.05*	-.06*
Education <sup>e)</sup>	-.02	-.11***	-.08**	-.10***
Infected Sars CoV-2 <sup>f)</sup>	.03	-.03	-.01	-.02
Close person infected with Sars CoV-2 <sup>g)</sup>	.04	-.01	-.004	-.03

\*p<.05, \*\*p<.01, \*\*\* p<.001

<sup>a)</sup> 1=male, 2=female.

<sup>b)</sup> 0=not partnered; 1=married/partnered.

<sup>c)</sup> 0=no children, 1=children.

<sup>d)</sup> 0=living alone, 1=living with somebody.

<sup>e)</sup> 0=secondary/advanced, 1=university.

<sup>f)</sup> 0=not infected with Sars CoV-2/ do not know, 1=infected with Sars CoV-2.

<sup>g)</sup> 0=close person not infected with Sars CoV-2/ do not know, 1=close person infected with Sars CoV-2.

<sup>h)</sup> Locus of control (LoC) measured by the Internal/External Locus of Control-4 Scale (IE-4, [32]), subscales Internal (LoC I) and External (LoC E); range: 1-5, with higher scores measuring higher LoC I and LoC E, respectively.

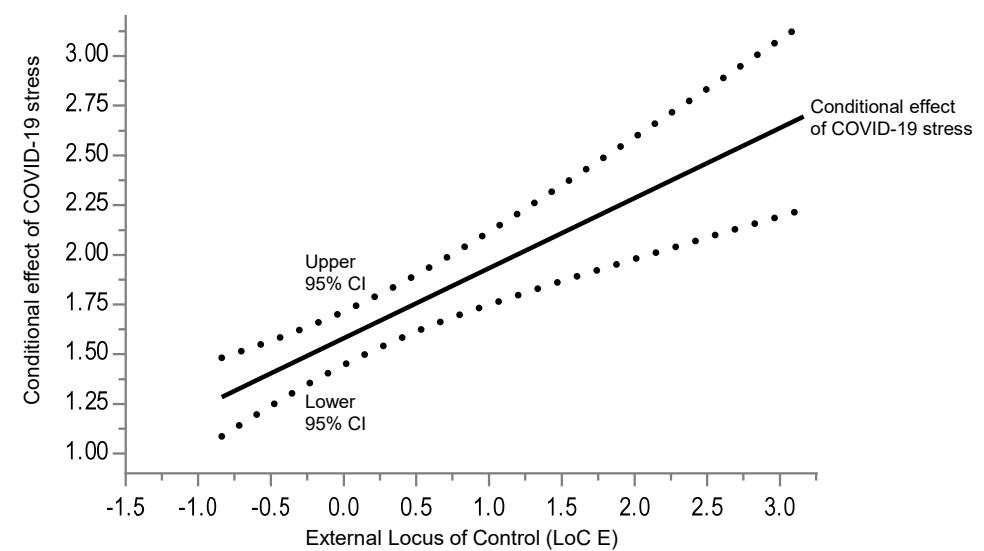
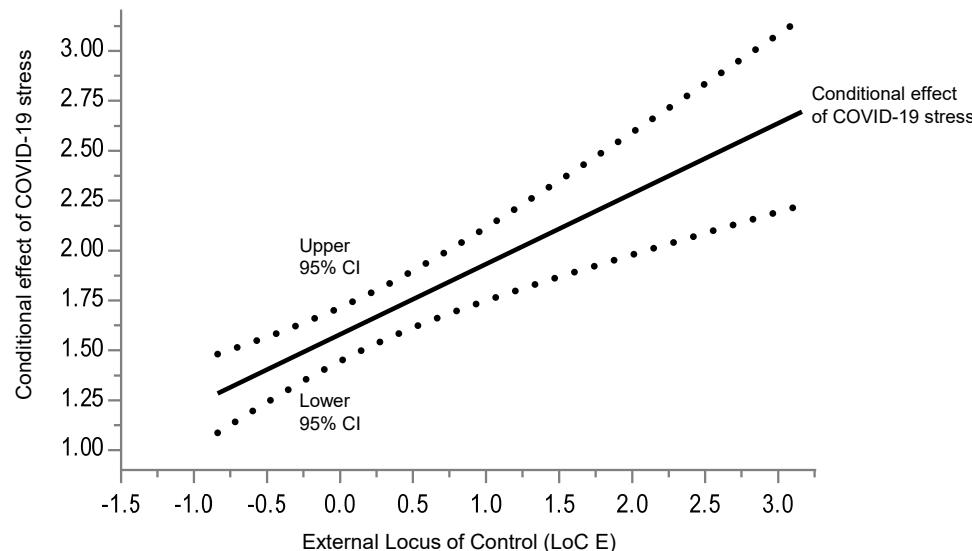
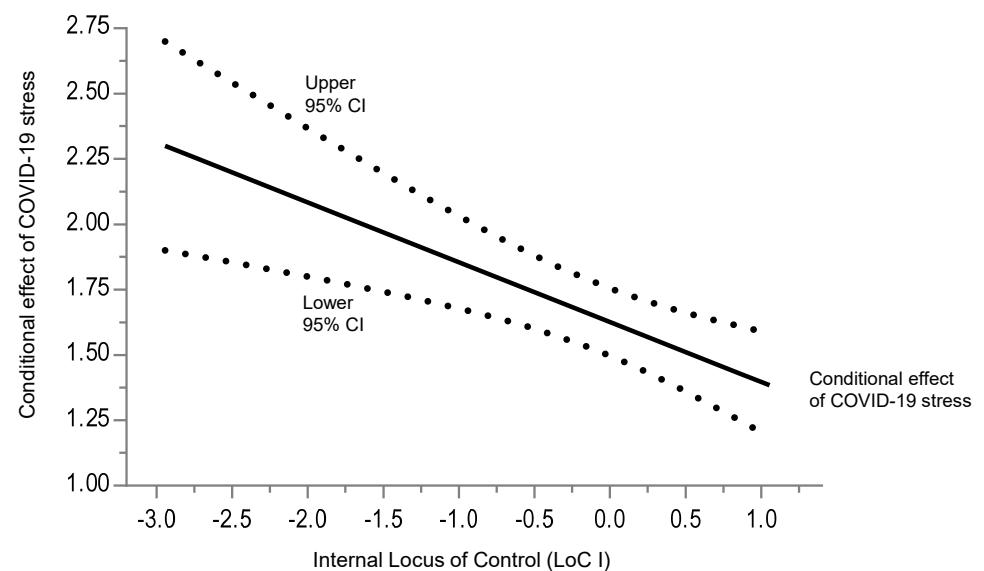
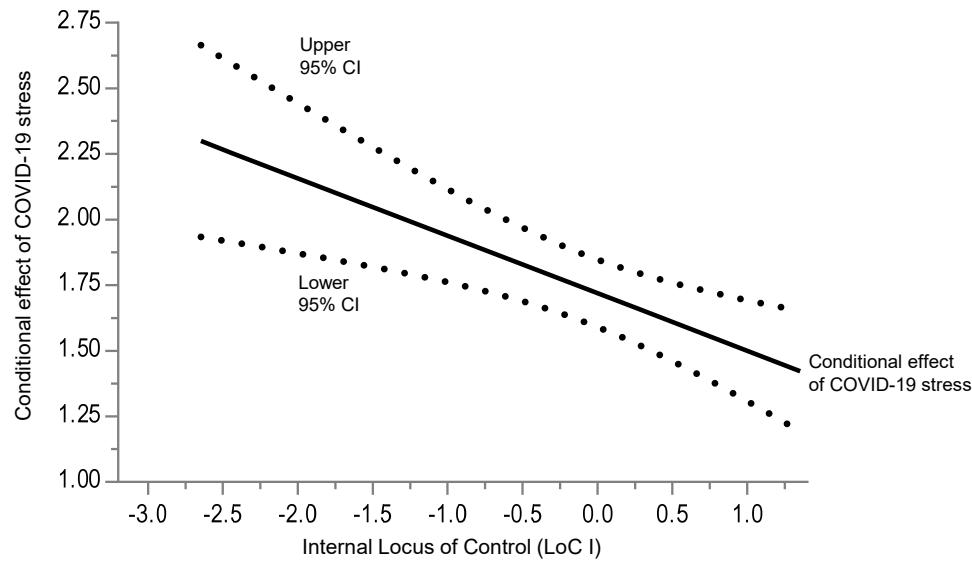
<sup>i)</sup> Acute psychological stress due to COVID-19 measured by the COVID-19 stress scale [12]; range: 0–5, with higher scores measuring higher stress.

<sup>k)</sup> General mental distress measured by the Patient Health Questionnaire 4 (PHQ-4, [44, 45]; range from 0 to 12, with higher scores measuring higher distress.

**Table 4.** Simple moderation: LoC moderates COVID-19 stress predicting general mental distress.

<b>4a. Unadjusted moderation</b>	Norwegian sample (n=1,225)			German-speaking sample (n=1,527)		
<b>Regression analysis 1: Internal locus of control (LoC I)</b>						
	Coeff (SE)	t	p	Coeff (SE)	t	p
Intercept	2.49 (0.05)	46.93	<.001	3.46 (0.06)	59.45	<.001
COVID-19 stress (IV)	1.72 (0.07)	26.31	<.001	1.63 (0.07)	24.66	<.001
LoC I (Mod)	-0.21 (0.06)	-3.40	<.001	-0.75 (0.07)	-10.32	<.001
COVID-19 stress x LoC I	-0.22 (0.07)	-3.23	.001	-0.23 (0.07)	-3.39	<.001
<b>Regression analysis 2: External locus of control (LoC E)</b>						
	Coeff (SE)	t	p	Coeff (SE)	t	p
Intercept	2.44 (0.05)	45.13	<.001	3.43 (0.06)	57.87	<.001
COVID-19 stress (IV)	1.58 (0.07)	23.18	<.001	1.55 (0.07)	22.99	<.001
LoC E (Mod)	0.39 (0.07)	5.28	<.001	0.71 (0.07)	10.05	<.001
COVID-19 stress x LoC E	0.35 (0.08)	4.65	<.001	0.27 (0.07)	3.83	<.001
<b>4b. Adjusted moderation</b>	Norwegian sample (n=1,205)			German-speaking sample (n=1,516)		
<b>Regression analysis 1: Internal locus of control (LoC I)</b>						
	Coeff (SE)	t	p	Coeff (SE)	t	p
Intercept	3.84 (0.36)	10.69	<.001	4.24 (0.34)	5.72	<.001
COVID-19 stress (IV)	1.63 (0.07)	24.66	<.001	1.52 (0.07)	9.06	<.001
LoC I (Mod)	-0.26 (0.06)	-4.30	<.001	-0.84 (0.08)	-3.60	<.001
COVID-19 stress x LoC I	-0.20 (0.07)	-2.91	.004	-0.23 (0.07)	-3.44	<.001
Age (years)	-0.02 (0.01)	-4.04	<.001	-0.01 (0.01)	-2.55	.011
Gender <sup>a)</sup>	0.21 (0.12)	1.75	.080	0.00 (0.12)	-0.03	.979
Relationship status <sup>b)</sup>	0.01 (0.13)	0.04	.969	0.06 (0.14)	0.40	.689
Children <sup>c)</sup>	-0.22 (0.16)	-1.39	.166	-0.31 (0.16)	-1.88	.060
Living together status <sup>d)</sup>	-0.26 (0.16)	-1.62	.105	-0.00 (0.17)	-0.02	.983
Education <sup>e)</sup>	-0.45 (0.16)	-2.82	.005	-0.33 (0.12)	-2.81	.005
<b>Regression analysis 2: External locus of control (LoC E)</b>						
	Coeff (SE)	t	p	Coeff (SE)	t	p
Intercept	3.65 (0.36)	10.28	<.001	4.23 (0.34)	12.44	<.001
COVID-19 stress (IV)	1.50 (0.07)	21.81	<.001	1.46 (0.07)	20.82	<.001
LoC E (Mod)	0.39 (0.07)	5.31	<.001	0.75 (0.07)	10.51	<.001
COVID-19 stress x LoC E	0.37 (0.08)	4.88	<.001	0.28 (0.07)	3.99	<.001
Age (years)	-0.02 (0.01)	-3.73	<.001	-0.01 (0.01)	-1.83	.067
Gender <sup>a)</sup>	0.24 (0.12)	2.01	.045	-0.02 (0.13)	-0.18	.855
Relationship status <sup>b)</sup>	0.02 (0.13)	0.16	.870	0.05 (0.14)	0.38	.706
Children <sup>c)</sup>	-0.22 (0.16)	-1.44	.151	-0.37 (0.16)	-2.30	.022
Living together status <sup>d)</sup>	-0.30 (0.16)	-1.86	.063	-0.24 (0.17)	-1.43	.153
Education <sup>e)</sup>	-0.41 (0.16)	-2.60	.009	-0.18 (0.12)	-1.55	.123

<sup>a)</sup> 1=male, 2=female; <sup>b)</sup> 0=not partnered; 1=married/partnered; <sup>c)</sup> 0=no children, 1=children; <sup>d)</sup> 0=living alone, 1=living with somebody; <sup>e)</sup> 0=secondary/advanced, 1=university.



1a. Norwegian sample (n=1,225); Moderators: LoC I (upper graph), LoC E (lower graph):  
Conditional effect of COVID-19 stress on general mental distress (PHQ-4).

1b. German-speaking sample (n=1,527); Moderators: LoC I (upper graph), LoC E (lower graph):  
Conditional effect of COVID-19 stress on general mental distress (PHQ-4).

## **Discussion**

### ***Major findings***

This study investigated whether internal LoC and external LoC moderated the relationship between COVID-19 stress and general mental distress during the early months of the COVID-19 pandemic. Our major finding is that both aspects of LoC showed substantial moderation effects that proved to be robust in two different samples. In both the Norwegian and the German-speaking sample, LoC I served as a buffer of stress, while LoC E exacerbated stress. These results were found in unadjusted regression models and persisted in adjusted regression analyses. The association between COVID-19 stress and general mental distress was strong and pervasive, as indicated by significant conditional effects for the total range of scores of LoC I and LoC E. However, it was attenuated by the belief that the outcome of events in one's life are contingent upon one's actions (LoC I). On the contrary, the belief that chance and powerful others control one's life (LoC E) even increased the already strong association between COVID-19 stress and mental distress. This suggests that the pandemic is particularly difficult to bear for those people who, in addition to any pandemic-related strains that may arise, feel that they have little influence on their own lives in general. The quasi-invisible and difficult to comprehend threat of a virus as well as restrictions on one's own life determined by "powerful others" seem to reinforce a prevailing lack of self-control, as suggested by the positive correlation between COVID-19 stress and LoC E, and its negative correlation with LoC I. This was accompanied by drastically poorer mental health.

The opposite effect, which was found with a high internal locus of control, suggests that this is an important resource that should be focused on with regard to public health measures. Thus, the actions of political decision-makers can positively or negatively influence citizens' experience of control, depending on the degree of involvement of representatives of different interest groups in decision-making processes [53]. Similarly, the form of policy communication is likely to have an impact on whether citizens perceive themselves as empowered or patronized, as has been evidenced in relation to young adults' conflict strategies with superiors [54]. Last but not least, there are indications that a sense of control is associated with health

behaviour and better health literacy [55, 56] - an aspect which, in the context of a pandemic, should not be separated from mental health. In terms of the current state of research, it can be said that, to our knowledge, until now the moderating role of LoC has not been investigated with respect to COVID-19 related outcomes. Our findings confirm results of previous studies that established LoC as a resource to maintain and improve mental health [30, 34-38].

### ***The study samples in the context of COVID-19 mental distress research***

Both study samples showed consistent major results, although they differed in their contextual background including pandemic stage, and demographic and psychological characteristics. On average, the Norwegian participants were older, better educated, more likely to be female and to have children. They also had better mental health, as indicated by less COVID-19 stress and lower rates of clinically significant general mental distress, also evidenced separately for depression and anxiety. An inspection of sample characteristics of recent psychological studies on pandemic-related moderator factors suggests that in the majority of these, participants were mostly young adults, more likely to be well-educated, and female [24-26 18-23, 27]. Samples with high percentages of young adults and women also characterize epidemiological research on mental distress during the pandemic [2, 3, 6, 8] and the majority of studies of measurement of COVID-19 stress [11]. While both of our samples are comparable with these study characteristics concerning education and gender, the inclusion of middle-aged and older adults counterbalances the overrepresentation of younger adults in psychological COVID-19 research and offers a better generalisability over different age groups.

Concerning mental health, findings are available from recent systematic reviews and meta-analyses of mental distress in the general population at the beginning of the COVID-19 pandemic [1-8]. Compared with these synthesized prevalence data, the frequencies of clinically relevant depression, anxiety, and general mental distress in the German-speaking sample are in the middle range, and in the lower range in the Norwegian sample. Similar results were found in a study comparing mental health during the onset of the pandemic in Norway, Germany, and four other countries [41]. Prevalence of mental distress was higher in another

Norwegian large-scale investigation that was carried out when all COVID-19 regulations were in force, and that was based on a sample with predominantly young adults [57]. Still, both the Norwegian and German-speaking samples presented here revealed degrees of mental distress that are higher than those reported in general population samples before the COVID-19 pandemic [47, 58-60].

### ***Elevated mental distress during the COVID-19 pandemic***

There is ample evidence that mental disorders contribute to individual impairment and disability, as well as global burden of disease [61]. It is thus highly important to prevent COVID-19 stress and elevated mental distress from turning into pathology and mental disorders. On the other hand, elevated COVID-19 stress, and even temporarily increased symptoms of depression and anxiety can be regarded as functional psychological responses to a worldwide outbreak of a novel and life-threatening virus disease. Findings of strong stress reactions to a threatening situation should therefore not be “awfulized” by lurid headlines, which risks further exacerbating pathological developments [see 62]. We should also consider that data are still lacking on the long-term course of mental health after the COVID-19 pandemic. Preliminary follow-up data of the German-speaking sample suggest that mental distress increased directly after the first lockdown in spring 2020, and decreased slightly three months later, when the number of confirmed Sars-CoV-2 infections per million people in Europe was rather low [12, 63]. A recent large-scale study investigated differential trajectories of mental distress over eight weeks of full lockdown and subsequent eight weeks of easing of lockdown [64]. The authors found that previous mental health diagnoses, long-term health conditions, younger age, and lower incomes were among the strongest predictors of worse trajectories. While there are findings of significantly elevated mental distress even months and years after previous viral respiratory epidemics [65-67], these do not refer to the general population but to people who had personally experienced traumatic events, either as health care workers or as survivors of critical disease due to the respective respiratory syndromes.

### ***Limitations and Strengths***

The present study is based on two large samples from the general population which are, however, not representative. We accounted for this limitation by including important sociodemographic covariates in the analyses. Unadjusted as well as adjusted regression analyses yielded consistent results in both samples.

The internal consistency of the 4-item Internal/External Locus of Control-4 Scale (IE-4) was rather low in both datasets. Although higher reliabilities had been reported for the normative samples, it should be noted that Cronbach's alpha was devised for longer scales and is sensitive to the number of items [68]. Nevertheless, the robust results of the current analyses suggest sufficient validity of the IE-4.

It should also be emphasised once again that our main outcome measure, the PHQ-4, does not establish diagnoses of mood or anxiety disorders according to ICD-10 or DSM-5. It measures core symptoms of both, thus indicating, by means of several cut-off scores, occurrence of clinically relevant symptoms. The PHQ-4 has been demonstrated to be a valid screening tool for general mental distress in the general population and clinical populations [e.g. 44-49, 59].

The COVID-19 stress scale was newly developed for the current investigation, as no validated instruments were available at the time we initiated the project [12]. In both of the samples presented here, correlations between this scale and demographic characteristics and indicators of mental distress were comparable to those yielded with other validated scales [13-17, 69-74], thus supporting its validity. Moreover, its relationships with LoC, as well as with meaning in life, self-control, and crisis of meaning [12] corresponded to our hypotheses and can thus be considered as first evidence for construct validity.

### **Conclusions**

Our findings can offer important insights into how people with certain personality characteristics are well-equipped, whereas others are particularly vulnerable in times of crisis. According to the present study, people with an external locus of control are at special risk.

Decision-makers in the field of public health can take this into account. Improving citizens' sense of control can help prevent increased mental distress from developing into mental disorders. Experiencing a sense of control may encourage citizens to adhere to necessary restrictions of individual freedom as a possible outcome of informed personal choice, rather than simply obeying an imposed rule. Possible ways of evoking a sense of control include clear, honest, and substantiated policy communication that is based on multiple perspectives, as well as explicit invitation of citizens to participate in decision-making, e.g. by expressing questions and objections. Although critical situations may require quick decisions and the short-term suspension of democratic processes, this should be done with utmost care, transparent explanation, and the quickest possible return to political action that seriously and credibly incorporates and implements citizens' concerns. Feelings of stress caused by the pandemic on the one hand and of one's own lack of control on the other hand obviously feed off each other, which is reflected in a worrying level of psychological distress.

**Table 1.** Demographic and psychological characteristics of study participants; mean [SD]; n (%).

**Table 2.** Correlations between Locus of Control, COVID-19 stress, and general mental distress.

**Table 3.** Correlations between demographic variables and LoC, COVID-19 stress, and general mental distress.

**Table 4.** Simple moderation: LoC moderates COVID-19 stress predicting general mental distress.

**Figure 1a, b.** Johnson-Neyman plots of the interaction between COVID-19 stress and LoC.

The black continuous lines show the conditional effects of COVID-19 stress on general mental distress (PHQ-4) for all values of LoC, and the dotted lines above and below indicate the corresponding 95% confidence intervals (CI).

## **Declarations**

**Ethics approval and consent to participate.** Ethics approval was issued by the Review Board (Psychology) of the University of Innsbruck, No 09/2020, as well as by Personvernombudet Innlandet Hospital Trust, Norway, No 20/02104-1. All participants expressed their informed consent by explicitly agreeing to continue with the questionnaire after being informed about the study's aims, employed data protection, participants' rights, and contact points for questions or concerns. All methods were carried out in accordance with relevant guidelines and regulations.

**Consent for publication.** Not applicable.

**Availability of data and materials:** The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

**Competing interests.** The authors declare that they have no competing interests. **Funding.** The Norwegian part of the study was financed by Innlandet Hospital Trust, Norway. The German-speaking part was conducted in the absence of financial funding. **Authors' contributions:** HK and TS wrote the manuscript and performed the statistical analyses. HK participated in the investigation of the German-speaking data. LJD and GS conceptualized, developed, and conducted the Norwegian survey; LJD performed data curation and project administration of the Norwegian data set. AH contributed to the conceptualization and development of the Norwegian Survey. TS conceptualized and designed the overall study, conducted the investigation of the German-speaking data, and performed the data curation of both data sets. All authors discussed the results, commented on the paper, contributed to the critical revision of the manuscript, and read and approved the final manuscript.

**Acknowledgements:** We wish to thank Tor-Arne Isene for his help in data management of the Norwegian sampling.

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