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Changes in contamination-related obsessions and compulsions during the COVID-19 pandemic: A Norwegian longitudinal study

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ABSTRACT

Background: Early stages of the COVID-19 pandemic have been associated with increasing obsessive-compulsive symptoms (OCS), but less is known regarding these symptoms' long-term trajectories. The aim of this study was to examine changes in contamination-related OCS in the Norwegian public during early and late stages of the pandemic, as well as characteristics that might be associated with these changes.

Methods: In a longitudinal online survey, 12 580 participants completed self-report questionnaires in April 2020, including a retrospective assessment of contamination-related OCS severity (DOCS-SF) prior to COVID-19. In December 2020, 3405 (27.1%) of the participants completed the survey again.

Results: In April, participants retrospectively recalled that their contamination-related OCS were lower prior to COVID-19 ($d = 1.09$). From April to December, symptoms slightly decreased ($d = -0.16$). The proportion of participants scoring above the clinical cut-off on DOCS-SF ($\geq$16) changed accordingly from 2.4% pre-COVID to 27.8% in April and 24.0% in December. Previous severity of contamination-related OCS and symptoms of distress related to COVID-19 were the most powerful predictors of contamination-related OCS severity during the pandemic.

Conclusions: Elevated levels of contamination-related OCS were detected at both early and late stages of the pandemic, but the long-term symptom trend seems to be slightly declining.

Author statement

KH, GK, JE, and SLH are responsible for the BryDeg2020-project and obtained ethical approval. Conceptualization and design of this paper: TG and SS; Data preparation and formal analysis: TG and SS; Writing original draft: TG; Rewriting and editing: TG, SS, KH, GK, JE and SLH. All authors have read and agreed to the published version of the manuscript.

1. Introduction

The worldwide spread of the COVID-19 virus has led to a great interest in its mental health consequences. Several studies and reviews report adverse psychological outcomes in the early stages of the pandemic (e.g., Bueno-Notivol et al., 2021; Pierce et al., 2020; Xiong et al., 2020), although some studies suggest a more pronounced worsening in people with no or less severe mental health disorders as compared to those with severe mental health disorders (Pan et al., 2021; Robinson et al., 2021). Increases in mental health symptoms have been found across several symptom types, e.g., symptoms of depression (Bueno-Notivol et al., 2021), anxiety (Santabárbara et al., 2021), sleep problems (Jahrami et al., 2021), and obsessive-compulsive symptoms (OCS; Guzick et al., 2021).

OCS might be disproportionately affected by the pandemic, as one of

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its main symptom dimensions involves fear of contamination and infectious illnesses, as well as cleaning compulsions. Due to the contagiousness and rapid spread of COVID-19, its massive focus in the media, as well as the explicit governmental recommendations on how to deal with the virus (e.g., frequent hand washing and physical distancing), there were concerns that the pandemic might lead to an increased number of individuals affected by obsessive-compulsive disorder (OCD), as well as worsening of symptoms among people with OCD (Fontenelle & Miguel, 2020; Shafran et al., 2020).

The literature on the pandemic's impact on OCS is already quite extensive, including five narrative or systematic reviews: Zaccari et al. (2021, $k = 14$), Liu et al. (2021, $k = 13$), Guzick et al. (2021, $k = 67$), Grant et al. (2022, $k = 32$), and Linde et al. (2022, $k = 79$). Whereas the first two reviews had a narrower scope (e.g., considered only clinical samples), the latter three reviews examined OCS in general population samples and individuals with OCD during the pandemic, including both cross-sectional and longitudinal studies. Based on their literature reviews, all three (Guzick et al., 2021; Grant et al., 2022; Linde et al., 2022) argued that most (but not all) studies reported a worsening of OCS during the early stages (i.e., spring/summer 2020) of the pandemic, both in the general population and in individuals with OCD. However, the pandemic's degree of impact on OCS severity and course varied greatly between studies.

In longitudinal studies of individuals with OCD, approximately 20–65% of the participants reported symptom worsening during the early stages of the pandemic, i.e., from March to June (Grant et al., 2022). The variation was even larger in clinical cross-sectional studies, with the proportion of participants rating their OCS as worsened (yes/no) ranging from 6% (Chakraborty & Karmakar, 2020) to 92.9% (Kaveladze et al., 2021). Likewise, using established cut-offs on the Obsessive Compulsive Inventory-Revised (OCI-R) and the Dimensional Obsessive-Compulsive Scale (DOCS), several cross-sectional non-clinical studies reported elevated rates of clinically significant OCS, e.g., 12.4% in Portugal in March (Silva Moreira et al., 2021), 21.4% in Germany in March/April (Munk et al., 2020), and 38.6% in the US in July (Fontenelle et al., 2021). There were also mixed results regarding the impact of contamination on symptom severity and course, with some studies (e.g., Alonso et al., 2021; Jelinek, Moritz, et al., 2021; Khosravani, Aardema, et al., 2021; Pacitti et al., 2022) finding a more pronounced worsening in contamination-related OCS (including washing compulsions), whereas others (e.g., Fontenelle et al., 2021; Loosen et al., 2021) did not. Evidently, the estimates of worsening OCS during the COVID-19 pandemic vary a lot across studies. This variation might be due to the large heterogeneity in study designs and quantification methods, as well as the particular circumstances of the pandemic at a given point in time and geographical area (Grant et al., 2022; Guzick et al., 2021).

Although increasing mental health symptoms following major life stressors, such as the pandemic, are common, most people experience a recovery in distress in the longer term (e.g., Galatzer-Levy et al., 2018; Robinson et al., 2021). A limitation to the literature examining the pandemic's impact on OCS severity and course is that most of the research is cross-sectional in nature (76% of studies in the review by Linde et al., 2022) and/or conducted in the first months of the pandemic (spring/summer 2020). Consequently, we know little about the long-term trajectories of these symptoms.

The results of the studies that have investigated the long-term trajectories of OCS during the COVID-19 pandemic longitudinally, i.e., by measuring the same sample more than once after the onset of COVID-19, have been mixed. The trajectories of OCS symptoms (in both non-clinical and clinical samples) have been found to be slightly increasing (e.g., Jelinek, Göritz, et al., 2021; Loosen et al., 2021), decreasing (e.g., Fioravanti et al., 2022; Ji et al., 2020; Tandt et al., 2021), as well as dependent on moderating factors such as resilience (Hezel et al., 2022) and OCS subtype (Jelinek, Voderholzer, et al., 2021). In a study of 179 individuals with OCD, Jelinek, Voderholzer, et al. (2021) found that contamination-related OCS remained unchanged from the beginning of the pandemic to three months later, whereas other types of OCS slightly improved. However, even among these longitudinal studies, only a few (e.g., Fioravanti et al., 2022; Tandt et al., 2021) have measured OCS in later stages of the pandemic, such as the second wave in autumn/winter 2020. Consequently, there is a need for more longitudinal studies of OCS during COVID-19, especially regarding these symptoms' long-term trajectories.

Besides exploring trajectories of change, effort has also been made to find factors associated with OCS severity and change during the pandemic. As reviewed in Guzick et al. (2021), a wide range of clinical factors have been tested and found to be positively associated to OCS severity and change (i.e., worsening of symptoms) during the early months of the pandemic, e.g., pre-COVID OCS severity (Alonso et al., 2021; Fontenelle et al., 2021), COVID-19 related stress symptoms (Khosravani, Asmundson, et al., 2021), greater adherence to COVID-19 guidelines (Loosen et al., 2021), and symptoms of anxiety and depression (Ji et al., 2020; Samuels et al., 2021). Likewise, several positive associations were found between OCS during COVID-19 and sociodemographic factors, such as female gender (Fontenelle et al., 2021), younger age (Samuels et al., 2021), and psychiatric comorbidity (Højgaard et al., 2021; Samuels et al., 2021).

However, results across studies are characterized by inconsistency. To exemplify, Fontenelle et al. (2021) and Samuels et al. (2021) found OCS severity to be positively related to female gender and male gender, respectively, whereas Fioravanti et al. (2022) failed to find any association between OCS severity and gender. Likewise, younger age predicted OCS severity in the study by Samuels et al. (2021), but not in the studies by Højgaard et al. (2021) and Jelinek, Göritz, et al. (2021). One of the most robust findings so far seems to be the link between worse baseline OCS and subsequent worsening of OCS severity and change. These two variables have been found to be positively related in several longitudinal studies across sample type, i.e., clinical (e.g., Alonso et al., 2021) and non-clinical (e.g., Fontenelle et al., 2021; Jelinek, Göritz, et al., 2021) samples.

In summary, evidence points to elevated levels of OCS in both clinical and non-clinical samples following the COVID-19 pandemic, but the evidence is mixed regarding the rate of worsening, as well as the course of OCS during the later stages of the pandemic. Do OCS severity increase further, stabilize, or decline? Furthermore, factors predicting OCS severity during the COVID-19 pandemic are not well understood, indicating a need for further studies.

Consequently, the aim of the current study was twofold. First, we wanted to examine whether contamination-related OCS in the general population changed during early (April 2020) and late (December 2020) stage of the COVID-19 pandemic. Second, we sought to explore sociodemographic and clinical factors that might be associated with contamination-related OCS severity during the pandemic. The choice of contamination-related OCS as the OCS type of interest was made based on a hypothesis that this symptom type could be disproportionately negatively affected by the pandemic due to its strong link to pandemic-related guidelines and worries. Based on previous studies (e.g., Alonso et al., 2021; Fontenelle et al., 2021; Khosravani, Aardema, et al., 2021; Knowles & Olatunji, 2021), we hypothesized that contamination-related OCS would worsen in the early stage of the pandemic, and that a higher baseline contamination-related OCS severity would be associated with a higher subsequent contamination-related OCS severity.

2. Material and methods

2.1. Participants and procedure

This study is part of a longitudinal online survey study called BryDeg 2020 (TakeCare2020), which aims to investigate how the COVID-19 pandemic has affected coping abilities and mental health in the Norwegian public in the short and long term. So far, participants have answered online questionnaires during April 2020 and December 2020.

Additionally, the presence and severity of some mental health symptoms pre-COVID, e.g., contamination-related OCS, were also measured retrospectively.

The current study reports data from the first two data waves, as well as symptoms of contamination-related OCS pre-COVID. In Norway, strict governmental regulations were introduced on March 12. These regulations included closure of all educational institutions, workplaces and other public spaces, restrictions on traveling, encouraging of home office, banning events where physical distancing would prove difficult, as well as home isolation if infected. Thus, our first time point (i.e., April 2020) corresponded to the immediate period after the COVID-19 outbreak in Norway.

During May and June 2020, most governmental regulations were lightened in severity, e.g., schools reopened, domestic travel restrictions removed, and size of social contact groups increased to 20 individuals. However, the number of infected individuals with COVID-19 increased again during autumn 2020, leading to more severe restrictions in November and December 2020. Although not as strict as the first regulations in March and April, several restrictions were introduced, e.g., size of social contact groups reduced to five individuals. Thus, our second time point (i.e., December) corresponded to a "second wave" of COVID-19. For more details regarding the Norwegian governments COVID-19 infection control regulations in April and December 2020, see Appendix (Table A1).

The BryDeg 2020 survey collects information about demographic characteristics and mental health symptoms such as anxiety, depression, contamination-related obsessions and compulsions, and sleep quality. In total, the survey takes approximately 15–20 min to answer. The project was approved by the regional ethics committee (REK-Nord, ref. no. 123324) in Norway. For a closer description of the overarching longitudinal study, see https://www.uib.no/en/takecare2020 and Hagen et al. (2021).

Several channels were used to recruit participants, including social media and general media outlets. Additionally, many institutions such as high schools, universities, and healthcare authorities helped to spread the surveys by sending e-mails directly to their students, members, or employees. Participants were aged ≥18 years and signed an informed consent before answering the survey. A total of 19 372 (11 883 students) persons completed the survey in April and 6017 (31.1%) in December. However, 28 participants were excluded from the current study, as they reported residency abroad. Furthermore, since questions regarding contamination-related OCS were added to the survey in the middle of the first wave of data collection, the number of participants in the current study is smaller: April: $N = 12\,580$; December: $N = 3405$. Evidently, the attrition of this study was high, but the differences between the participants' demographic and clinical characteristics in the two waves were of small magnitude. As compared to those who participated in both waves, individuals participating in April only reported slightly higher symptoms of contamination-related OCS ($d = 0.13$), anxiety ($d = 0.05$), and depression ($d = 0.03$). Furthermore, as noted by Unnarsdóttir et al. (2022) and Lassen et al. (2022), the dropouts were characterized by lower age and a higher proportion of students and men.

Table 1
Demographic characteristics among participants in study 1 (N = 12 580) and study 2 (N = 3405).

Characteristic	Study 1	Study 2
	%	%
Female gender	75.2	77.5
Have children (yes)	15.3	16.1
Living situation pre-COVID		
Alone	19.1	21.0
With parent(s)	12.0	9.2
With partner	35.7	37.8
Shared flat	29.2	27.9
Other	4.0	4.1
Highest academic level		
High school	15.9	14.0
College	13.0	12.7
Bachelor's	22.9	26.0
Master's	9.3	11.7
PhD	0.4	0.4
Not reported	38.4	35.1
Employment status pre-COVID		
Student	79.0	75.2
Paid work	18.9	22.1
On social benefits	0.8	1.2
Other	1.4	1.5
Previous or current treatment for mental health problem	28.4	31.4
Treatment for anxiety and/or OCD		
Current treatment	4.5	4.9
Previous treatment	12.1	13.2
Never	83.4	81.8
Possible or confirmed COVID-19 in oneself or family	23.0	22.1
Belonging to an at-risk group	19.4	18.9

2.2. Demographics and participant characteristics

Demographic and participant characteristics included were age, sex, living situation pre-COVID, children (yes/no), education, employment status pre-COVID, possible or confirmed COVID-19 in oneself or family, as well as the presence of pre-existing physical and mental health problems. Participants were asked whether they belonged to one of the groups that the health authorities considered as a risk group in relation to COVID-19 (type of disorder not specified). Participants were also asked whether they had received or were currently receiving treatment for anxiety disorder and/or OCD or any other mental health problem (e.g., mood disorder, psychotic disorder, eating disorder, etc.).

2.3. Measures

Several self-report inventories were included to measure participants' symptoms of mental health problems and adherence to the Norwegian governments COVID-19 infection control recommendations. The primary measure of interest in this study, i.e., the DOCS-SF, was measured at three time-points: pre-COVID (retrospectively), April 2020, and December 2020. The remaining measures were assessed in April 2020.

2.3.1. The Dimensional Obsessive-Compulsive Scale Short-Form

(DOCS-SF, Eilertsen et al., 2017) was used to measure the presence and severity of contamination-related obsessions and compulsions. The DOCS-SF is a 5-item version of the original 28-item version of DOCS (Abramowitz et al., 2010), and contains a checklist with four symptom dimensions: contamination/washing, harm obsessions/checking compulsions, symmetry/ordering, and unacceptable thoughts. However, the current study measured only contamination-related obsessions and compulsions, and their severity was rated according to the following five criteria: 1) time occupied, 2) avoidance, 3) associated distress, 4) interference with function, and 5) refraining from compulsions. Each item was measured on a 0–8 scale, yielding a total score between 0 and 40. The DOCS-SF was developed and validated in Norwegian for use in both individuals with OCD and non-clinical individuals (Eilertsen et al., 2017). Except for weak discriminant validity in the OCD group (which may be a result of comorbidity and restriction of range), internal consistency, convergent validity, diagnostic sensitivity, and specificity were found to be good. Receiver-operating characteristics suggested a cut-off score of 16 or more to be indicative of OCD (Eilertsen et al., 2017). Internal consistency was also good in the current study, with a Cronbach's α of 0.85 pre-COVID (retrospectively), 0.91 in April, and 0.90 in December.

2.3.2. The patient health Questionnaire-9

(PHQ-9, Kroenke et al., 2001) and the ***Generalized Anxiety Disorder-7*** (GAD-7; Spitzer et al., 2006) were used to measure symptoms of

depression and anxiety. However, due to a substantial overlap between these two dimensions (April: $r = 0.82$, $p < .001$), we chose to combine them into the ***Patient Health Questionnaire Anxiety and Depression Scale*** (PHQ-ADS; Kroenke et al., 2016) as a general measure of symptoms of anxiety and depression. The total score of the PHQ-ADS ranges from 0 to 48, with higher scores indicating higher levels of anxiety and depressive symptoms. Several studies have found the PHQ-ADS to be a reliable and valid composite measure of depression and anxiety (Kroenke et al., 2016, 2019). Internal consistency was good in the current study, with a Cronbach's α of 0.94 in April.

2.3.3. The Bergen Insomnia Scale

(BIS; Pallesen et al., 2008) was used to measure symptoms of insomnia. The BIS is a self-report questionnaire consisting of six items, where the first three measure problems with sleep onset, maintenance, and early morning wakening the past two weeks. The last three items concern not feeling adequately rested after sleep, experiencing daytime impairment, and feeling dissatisfied with sleep. Participants rate the number of days per week (0–7) that they have experienced the various sleep problems. The total score ranges from 0 to 42, with higher scores indicating more severe levels of insomnia. The BIS has demonstrated good psychometric properties (Pallesen et al., 2008). Internal consistency was good in the current study, with a Cronbach's α of 0.84 in April.

2.3.4. The Impact of Event Scale

(IES; Horowitz et al., 1979) is a self-report questionnaire designed to assess subjective distress related to a specific life event. In the current study, participants were asked to rate their subjective distress related to the COVID-19 pandemic. The IES consists of 15 items, whereof seven items concern intrusive symptoms (e.g., intrusive thoughts and images, nightmares) and eight concern avoidance symptoms (e.g., avoidance of feelings, situations, and ideas). Each symptom is rated on a 4-point Likert scale (1 = Never; 2 = Rarely; 3 = Sometimes; 4 = Often), yielding a total score between 15 and 60. The IES has demonstrated good psychometric properties (Sundin & Horowitz, 2002), also with modifications for COVID-19 (Vanaken et al., 2020). Internal consistency was good in the current study, with a Cronbach's α of 0.92 in April.

2.3.5. Adherence to the Norwegian governments COVID-19 infection control recommendations

was measured on a 6-item inventory that was designed for the present study. On a scale from 1 to 4, participants were asked to rate their degree of adherence (1 = No adherence; 2 = Some adherence; 3 = Medium adherence; 4 = Great adherence) to each of the following six COVID-19 recommendations in April: handwashing/hygiene; maintaining physical distancing; avoiding social activities/gatherings; using home office; coughing into the elbow; and avoiding travels that are not strictly necessary. Cronbach's α was 0.62 in April.

2.4. Statistical analysis

All statistical analyses were performed using the IBM SPSS Statistics 27 and STATA 17 software. Due to the large difference in sample size in April and December, the subsequent result section will be organized into two parts: one for participants that completed the DOCS-SF pre-COVID (retrospectively) and in April (Study 1) and one for participants that completed the DOCS-SF at all three time-points (pre-COVID, April, and December: Study 2). Consequently, the first study will be centered on changes in contamination-related OCS from pre-COVID to April, whereas the second study takes all three time-points into consideration, with a primary focus on changes in contamination-related OCS from April to December.

In both samples, descriptive analyses were reported using means and standard deviations, and the proportion of participants with DOCS-SF scores at or above the clinical cut-off (≥16) was calculated. Furthermore, to investigate whether contamination-related OCS changed throughout the pandemic (pre-COVID, April, and December), a one-way repeated-measures ANOVA was performed. The assumption of sphericity was met, and no influential observations were found, as measured by Cook's distance. Effect sizes were reported as partial eta squared (η_p^2), where values of 0.01, 0.06, and 0.14 are considered to reflect small, medium, and large effects, respectively. (Cohen, 1988). Cohen's d was also calculated, using the pooled standard deviation, and controlling for related means (Lakens, 2013). An effect size of 0.20–0.49 is considered small, 0.50–0.79 as medium, and ≥0.80 as large.

To examine the relationship between contamination-related OCS severity and possible covariates, two multiple linear regression analyses were conducted, one for each dependent variable: 1) contamination-related OCS severity in April; 2) contamination-related OCS severity in December. The following ten demographic and clinical variables were entered simultaneously as predictor variables: age, gender (female = 1), student status (no/yes), previous or current treatment for a mental health problem (no/yes), previous or current treatment for anxiety and/or OCD (no/yes), baseline contamination-related OCS (DOCS-SF pre-COVID or April), symptoms of anxiety/depression (PHQ-ADS in April), symptoms of insomnia (BIS in April), symptoms of distress related to COVID-19 (IES in April), and adherence to COVID-19 guidelines (April). Multicollinearity did not appear as a problem with any of the predictor variables, with VIF ranging from 1.04 to 2.55 and tolerance from 0.39 to 0.96. No influential observations were found, as measured by Cook's distance. However, as heteroskedasticity was detected, all regression analyses were run as robust regressions in Stata to obtain heteroscedasticity-robust standard errors.

3. Results

3.1. Study 1

3.1.1. Sample characteristics

Study 1 is comprised of the participants that completed DOCS-SF at the first two time-points: pre-COVID (retrospectively) and April ($N = 12\,580$). The mean age of the sample was 27.28 ($SD = 9.04$), with an age range from 18 to 84. A summary of the participants' demographic characteristics is provided in Table 1.

3.1.2. Change in contamination-related OCS from pre-COVID to April

Participants retrospectively recalled that their contamination-related OCS were significantly lower pre-COVID, $M = 2.69$ ($SD = 4.69$), as compared to April, $M = 11.50$ ($SD = 9.98$), $t\,(12\,568) = -118.87$, $p < .001$. The effect size was large, $d = 1.13$. As such, the proportion of participants exceeding the DOCS-SF's clinical cut-off of 16 increased from 3.1% pre-COVID (retrospectively) to 31.6% in April.

3.1.3. Predictors of contamination-related OCS severity in April

A multiple regression analysis was performed to explore ten demographic and clinical variables' potential impact on the severity of contamination-related OCS in April. Descriptive statistics and intercorrelations among the clinical variables can be seen in the Appendix (Table B1), whereas a summary of regression statistics is presented in Table 2. Overall, the regression analysis accounted for 58.1% of the variance in contamination-related OCS in April. Among the demographic variables, younger age, and past/current treatment for anxiety and/or OCD were associated with higher contamination-related OCS, whereas past/current treatment for a mental health disorder (in general) was associated with lower contamination-related OCS. Higher symptoms of all clinical variables, i.e., pre-COVID contamination-related OCS, symptoms of anxiety and depression, sleep problems, subjective distress related to COVID-19, as well as adherence to COVID-19 guidelines, were associated with higher contamination-related OCS. Contamination-related OCS pre-COVID and subjective distress related to COVID-19 (April) emerged as the two most powerful individual predictors.

Table 2
Predictors of contamination-related OCS severity in April.

	DOCS-SF April		
	β	*t*	*p*
Age	−.04	−5.75	**.001**
Female gender	.01	1.36	.175
Student	−.01	−1.19	.234
Past or current treatment for mental health problem	−.05	−5.66	**.001**
Past or current treatment for anxiety/OCD	.02	2.30	**.021**
DOCS-SF pre-COVID*	.36	47.81	**.001**
PHQ-ADS	.07	6.67	**.001**
BIS	.08	9.31	**.001**
IES	.45	58.08	**.001**
Adherence to COVID-19 guidelines	.07	11.02	**.001**

Note. DOCS-SF = The Dimensional Obsessive-Compulsive Scale Short-Form; PHQ-ADS = The Patient Health Questionnaire Anxiety and Depression Scale; BIS = Bergen Insomnia Scale; IES = Impact of Event Scale. *Pre-COVID data were measured retrospectively in April.

3.2. Study 2

3.2.1. Sample characteristics

Study 2 is comprised of the participants that completed DOCS-SF at all three time-points: pre-COVID (retrospectively), April, and December ($N = 3405$). The mean age of this sample was 28.13 ($SD = 9.29$), with an age range from 18 to 79. A summary of the participants' demographic characteristics has already been displayed in Table 1.

3.2.2. Changes in contamination-related OCS from pre-COVID, to April, and December

The severity of contamination-related OCS pre-COVID (retrospectively), in April, and December is presented in Table 3. Participants retrospectively recalled that their contamination-related OCS were lower prior to COVID-19, $M = 2.33$ ($SD = 4.38$), as compared to April, $M = 10.56$ ($SD = 9.68$). From April to December, contamination-related OCS slightly decreased to a mean of 9.41 ($SD = 9.12$). As such, the proportion of participants with contamination-related OCS scores exceeding the clinical cut-off changed from 2.4% pre-COVID to 27.8% in April and 24.0% in December.

Repeated measures ANOVA revealed a significant main effect of time, $F(2, 6808) = 1978.6$, $p < .001$, $\eta_p^2 = 0.37$. Post hoc analysis with Bonferroni correction indicated a large and significant increase in OCS from pre-COVID to April ($p < .001$, $\eta_p^2 = 0.51$, $d = 1.09$), followed by a small, but significant decrease in OCS from April to December ($p < .001$, $\eta_p^2 = -0.02$, $d = -0.16$). The severity of contamination-related OCS at all three time-points were significantly correlated: pre-COVID – April: $r = 0.56$; pre-COVID - December: $r = 0.41$; April–December: $r = 0.61$.

Fig. 1 displays changes in contamination-related OCS in two subgroups: people below (Low OCS) versus above (High OCS) the clinical cut-off of 16 at DOCS-SF. In Fig. 1a, the formation of low and high OCS groups was based on the participants' retrospective pre-COVID DOCS-SF scores. Although both subgroups recalled their contamination-related OCS as lower prior to COVID-19 than in April, the high OCS group had the largest decrease in symptoms from April to December. The high OCS group almost returned to its mean pre-COVID symptom level, whereas the low OCS group remained elevated as compared to its mean pre-COVID symptom level.

In Fig. 1b and c, the formation of low and high OCS groups was based on the participants' DOCS-SF scores in April and December, respectively. According to both figures, most participants were classified into the low OCS group. This group reported slightly elevated contamination-related OCS during the pandemic but remained in the subclinical range of OCS severity throughout all three time-points. However, there was also a substantial proportion of participants who was classified into the high OCS group (27.8% in April and 24% in December). This group retrospectively recalled a mean increase in contamination-related OCS, which corresponded to a change from the subclinical to the clinical range.

Table 3
Changes in contamination-related obsessive-compulsive symptoms before and during the COVID-19 pandemic (N = 3405).

	DOCS-SF contamination/washing		
	Pre-COVID*	April	December
M (SD)	2.33 (4.38)	10.56 (9.68)	9.41 (9.12)
Above cut-off (≥16)	2.4%	27.8%	24.0%
Minimal (0–7)	90.4%	48.5%	52.2%
Mild (8–15)	7.2%	23.7%	23.8%
Moderate (16–23)	1.7%	15.1%	13.9%
Severe (24–31)	0.6%	9.3%	8.1%
Extreme (32–40)	0.1%	3.4%	2.0%

Note. DOCS-SF = The Dimensional Obsessive-Compulsive Scale Short-Form. *Pre-COVID data were measured retrospectively in April.

3.2.3. Predictors of contamination-related OCS severity in December

The same ten demographic and clinical variables from the multiple regression analysis in Study 1 were entered as predictors of contamination-related OCS severity in December. Descriptive statistics and intercorrelations among the clinical variables can be seen in the Appendix (Table C1), whereas a summary of regression statistics is presented in Table 4. Overall, the regression analysis accounted for 39.9% of the variance in contamination-related OCS severity in December. Age emerged as the only significant demographic predictor variable, with younger age being associated with higher contamination-related OCS. High levels of all clinical factors but insomnia was associated with higher contamination-related OCS in December, with contamination-related OCS in April as the most powerful individual predictor.

4. Discussion

In this longitudinal survey study, we set out to explore changes in contamination-related OCS in the Norwegian general population during early (April 2020) and late (December 2020) stage of the COVID-19 pandemic, as well as ten sociodemographic and clinical characteristics that might be associated with these changes. In April, participants retrospectively recalled that their contamination-related OCS were lower prior to COVID-19. From April to December, symptoms slightly decreased. The proportion of participants scoring above the clinical cut-off on DOCS-SF changed accordingly. Several sociodemographic and clinical characteristics were associated with contamination-related OCS severity, with baseline (pre-COVID or April) contamination-related OCS severity and symptoms of distress related to COVID-19 as the two most powerful individual predictors.

4.1. Trajectories of contamination-related OCS during the COVID-19 pandemic

As hypothesized, contamination-related OCS worsened in the early stage of the pandemic. Although our ratings of contamination-related OCS pre-COVID were done in retrospect and therefore may be prone to recall bias (Van den Bergh & Walentynowicz, 2016), the large increase in symptoms is in line with previous longitudinal studies with pre-COVID data in both non-clinical (e.g., Knowles & Olatunji, 2021) and clinical (Alonso et al., 2021; Khosravani, Aardema, et al., 2021) samples. The level of contamination-related OCS in April is also higher than what has been reported in Norwegian pre-pandemic population samples (e.g., Eilertsen et al., 2017: $M = 4.58$, $SD = 6.42$).

Likewise, the proportion of participants exceeding the DOCS-SF cut-off for clinically relevant OCS increased from 2.4% pre-COVID to 27.8% in April. As such, most participants experienced a symptom increase within the subclinical range of contamination-related OCS, but there

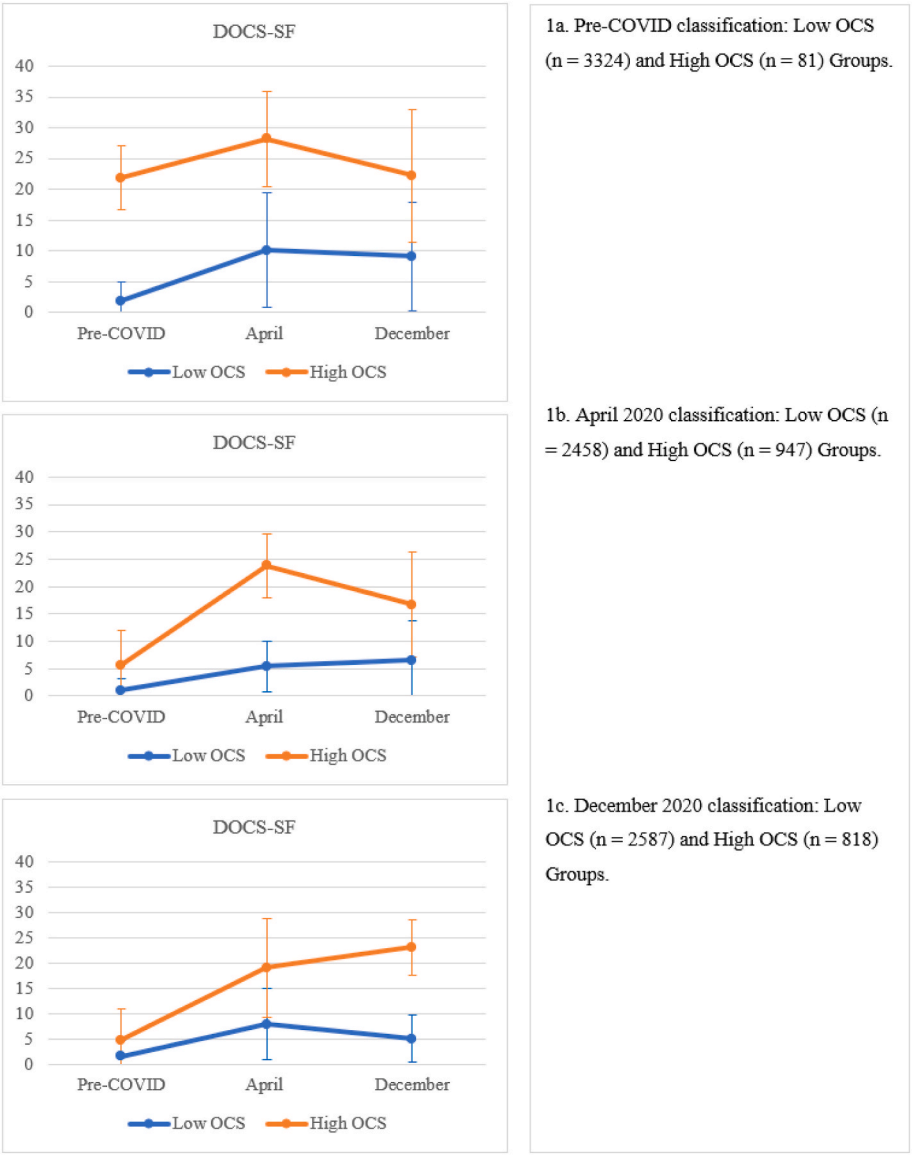

Fig. 1. Changes in Contamination-Related OCS During the COVID-19 Pandemic. *Note.* DOCS-SF = The Dimensional Obsessive-Compulsive Scale Short-Form; Low OCS = Participants with a DOCS-SF score ≤15 when classified (pre-COVID, April or December); High OCS = Participants with a DOCS-SF score ≥16 when classified (pre-COVID, April or December). Pre-COVID data were measured retrospectively in April.

Table 4
Predictors of contamination-related OCS severity in December.

	DOCS-SF December		
	β	*t*	*p*
Age	−.04	−2.57	**.010**
Gender	.00	0.22	.826
Student	.01	0.39	.700
Past/current treatment for mental health problem	−.03	−1.76	.079
Past/current treatment for anxiety/OCD	.01	0.72	.469
DOCS-SF April	.44	21.44	**.001**
PHQ-ADS	.08	3.55	**.001**
BIS	.00	0.14	.886
IES	.16	7.46	**.001**
Adherence to COVID-19 guidelines	.06	4.23	**.001**

Note. DOCS-SF = The Dimensional Obsessive-Compulsive Scale Short-Form; PHQ-ADS = The Patient Health Questionnaire Anxiety and Depression Scale; BIS = Bergen Insomnia Scale; IES = Impact of Event Scale. All predictor variables were measured in April.

was also a substantial portion of participants with symptoms increasing from the subclinical to the clinical range (see Fig. 1). Our estimate of 27.8% is clearly higher than previous Norwegian and international lifetime prevalence estimates of OCD, which typically have ranged from 1 to 3% (Kessler et al., 2012; Kringlen et al., 2001). The estimate is also comparable to several other studies of clinically relevant OCS at the same stage of the pandemic, e.g., 23.8% in Germany in March (Jelinek, Göritz, et al., 2021) and 20.4% in the US in March (Knowles & Olatunji, 2021). However, comparisons between studies must be made with caution due to variations in OCS questionnaires and severity cut-offs, as well as the country and time-period of sampling. As mentioned, rates of clinically relevant OCS in the early stages of the pandemic have varied greatly between studies, ranging from 11.3% in China in February (Ji et al., 2020) to 38.9% in Italy in March/April (Pacitti et al., 2022).

Looking at the OCS trajectory at a later stage of the pandemic, contamination-related symptoms showed a weak, but significant decrease in December. There was also a corresponding decrease in clinically relevant OCS from 27.8% to 24%, with the largest decreases among participants in the high OCS group (see Fig. 1). Thus, nine

months after the pandemic's outbreak in Norway, the severity of contamination-related OCS was still clearly higher than pre-pandemic levels, but the symptom trend seemed to be slightly declining.

In the few longitudinal studies that have explored trajectories of OCS during COVID-19 so far, results have been inconsistent, reporting symptom trends as slightly increasing (e.g., Jelinek, Göritz, et al., 2021; Loosen et al., 2021) or decreasing (e.g., Fioravanti et al., 2022; Jelinek, Voderholzer, et al., 2021; Ji et al., 2020; Tandt et al., 2021). As Grant et al. (2022) and Guzick et al. (2021) pinpointed, this variation might be due to the heterogeneity in populations and quantification methods, as well as the particular circumstances of the pandemic at a given point in time and geographical area. Our results of still elevated, but slightly declining OCS are in line with the two longitudinal studies measuring OCS at the same pandemic stage as ours, i.e., "the second wave" in November/December 2020 (Fioravanti et al., 2022; Tandt et al., 2021).

The variation in response to the pandemic might also be explained by moderating factors such as resilience. In a sample of 30 healthy individuals and 33 people with OCD, Hezel et al. (2022) found that resilience moderated the long-term trajectory of OCS during COVID-19. Higher baseline resilience was associated with more stable trajectories of OCS, whereas low resilience was associated with worsening OCS over time.

As such, the current study's finding of increasing symptoms in the early stage of the pandemic, followed by decreasing symptoms in the later stages, is in line with previous research of resilience and recovery following major life stressors (e.g., Galatzer-Levy et al., 2018; Hezel et al., 2022). Given the health authorities' and medias massive focus on the contagiousness of COVID-19 and the need for restrictions, it may be argued that participants engaged in contamination-related worries and behavior when the pandemic prompted them to and the government instructed them to, followed by a decrease when the pandemic situation improved, and guidelines eased. Moreover, as most participants in our study experienced symptom changes within the subclinical range of contamination-related OCS, it is conceivable that this might be a normal and resilient response to the pandemic.

However, as there also was a subgroup of participants that retrospectively recalled an increase in contamination-related OCS from the subclinical to the clinical range, it might also be argued that a smaller subgroup of individuals might experience a more persistent and pathological response with clinically relevant contamination-related OCS. Although self-report measures and clinical interviews may differ, Eilertsen et al. (2017) reported a moderate to strong correlation between DOCS-SF and the interview version of Y-BOCS, which is regarded as the gold standard measure of OCS. Moreover, its AUC was 0.98, thereby indicating a good ability to discriminate between individuals with OCD and controls. As our last measurement of contamination-related OCS was collected while the pandemic was still ongoing, further longitudinal studies are warranted to track this subgroup's further symptom development. It would be important to monitor whether their symptoms will decrease and return to pre-pandemic levels or whether they will keep struggling with their contamination-related OCS even though the pandemic situation improves.

4.2. Predictors of contamination-related OCS severity during COVID-19

Among the demographic variables, younger age was associated with higher contamination-related OCS severity in both April and December. Previous/current treatment for a mental health problem was associated with lower contamination-related OCS in April only, whereas previous/current treatment for anxiety/OCD specifically was associated to higher contamination-related OCS in April only. Gender and student status were unrelated to contamination-related OCS at both time-points. Even though some of the demographic variables emerged as significant predictors of contamination-related OCS, their β-coefficients were of low strength, indicating that these factors only affected contamination-related OCS severity to a small degree. As reviewed in the introduction, previous literature on demographic variables' association to OCS during the pandemic have also been characterized by instability in results, thus making it difficult to conclude regarding their strength of impact.

The clinical variables (i.e., baseline contamination-related OCS, symptoms of anxiety and depression, insomnia, distress related to COVID-19, adherence to COVID-19 guidelines) seemed to affect the severity of contamination-related OCS to a greater degree than the demographic variables. All clinical variables (except insomnia in December) were associated with higher contamination-related OCS severity in both April and December, with previous contamination-related OCS severity (pre-COVID or April) and symptoms of distress related to COVID-10 as the two most powerful individual predictors.

The emergence of a positive association between previous and subsequent contamination-related OCS severity was expected, as it corresponds to the results of several previous longitudinal studies of OCS during COVID-19, both clinical (e.g., Alonso et al., 2021) and non-clinical (e.g., Fontenelle et al., 2021; Jelinek, Göritz, et al., 2021) studies. Participants with the highest baseline (pre-COVID or April) contamination-related OCS also had the highest contamination-related OCS in subsequent time-points.

The strength of the association between symptoms of distress related to COVID-19 (measured with the IES) and contamination-related OCS severity was stronger in April than December. This might be due to the variables being measured cross-sectionally in April (both measures from April) and longitudinally in December (the IES in April predicted the DOCS in December). It should also be noted that the strength of the association in our study might have been slightly inflated due to the COVID-19 adaptations in both scales, as questions were modified to measure distress due to COVID-19 and contamination-related OCS.

Nevertheless, a positive association between OCS and symptoms of distress/trauma has also been found in previous studies of OCS during pandemics (e.g., Chen et al., 2005; Taylor et al., 2020). The COVID-19 adapted versions of the IES and DOCS-SF share many similarities with the COVID stress syndrome, as described by Taylor et al. (2020). Furthermore, in a sample of nurses ($N = 128$) working under the threat of contagion by severe SARS, Chen et al. (2005) reported a correlation coefficient of 0.59 between the IES and the obsessive-compulsive subscale of the Symptoms Checklist 90R. This corresponds to a correlation coefficient of 0.65 between the DOCS-SF and the IES in the current study. Furthermore, both studies found a higher correlation between OCS and the IES intrusion subscale than the IES avoidance subscale, which may indicate that the occurrence of intrusive images or thoughts are a core element in both symptom types.

4.3. Limitations

This study has several strengths, such as a large sample size and a longitudinal design. It is one of the first longitudinal studies to explore contamination-related OCS at a late stage of the pandemic, i.e., "the second wave", thereby bringing new information about the long-term trajectories of contamination-related OCS. It is also the first to explore contamination-related OCS during COVID-19 in a Norwegian cohort. It is, however, important to interpret the results within the context of several study limitations. First, only contamination-related OCS were measured in this study, and the results are therefore not generalizable to all types of OCS.

Second, the sample was recruited online as convenience sampling, with institutions such as high schools, universities, and healthcare authorities helping to spread the surveys to their students, members, or employees. Thus, the sample was not designed to be epidemiologically representative of a particular population, and caution must be made regarding generalization of the results. Compared to the Norwegian population, the overarching BryDeg2020-study included a higher percentage of students, women, participants with a higher level of education, as well as a higher percentage of people with prior or current

mental health problems (Hagen et al., 2021).

Third, participants were asked to retrospectively rate their contamination-related symptoms pre-COVID. As this assessment relied on patients' memory, it may be subject to recall bias (Van den Bergh & Walentynowicz, 2016) and therefore must be interpreted with caution. Although the validity of retrospective assessments is lower than longitudinal data, a comparison of prospective ecological momentary assessment and retrospective self-report in OCD indicated that the participants managed to recall the frequency and duration of OCD symptoms fairly accurate (Gloster et al., 2008). Moreover, as Fontenelle et al. (2021) pointed out, the magnitude and severity of the pandemic as well as the temporal proximity of the assessment to the onset of COVID-19 may have facilitated a more accurate recall by the participants. Lastly, the validity of the current study's retrospective assessment is further supported by the results of previous longitudinal studies with pre-pandemic data (e.g., Alonso et al., 2021; Khosravani, Aardema, et al., 2021; Knowles & Olatunji, 2021), which also reported OCS worsening during the early stages of the pandemic.

Fourth, we only assessed self-reported contamination-related OCS at two time-points during the pandemic, and the attrition from April to December was high (27.1% completed both). To better verify the identification of clinically relevant contamination-related OCS, a combination of different methods of measurement would have been preferable, e.g., self-report and clinical interviews. Further longitudinal studies are needed to replicate our findings, as well as explore the long-term trajectories of contamination-related OCS throughout and after the pandemic.

5. Conclusions

In summary, elevated levels of contamination-related OCS were detected at both early and late stages of the pandemic, but the overall long-term trend was decreasing. As most participants in our study experienced a symptom increase within the subclinical range of contamination-related OCS, it is conceivable that this might be a normal and resilient response to a stressful life event. However, there was also a substantial group of participants that retrospectively recalled an increase from subclinical to clinically relevant contamination-related OCS, indicating a potential increased need for mental health care for this group. Further longitudinal studies are needed to track the long-term trajectories of contamination-related OCS throughout and after the pandemic.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendices.

Table A.1
The Norwegian Governments COVID-19 Infection Control Recommendations in April and December 2020

Recommendation	April	December
Suspicion of or confirmed COVID-19 symptoms ->isolation	Yes. Isolation in 7 days after you are asymptomatic	Yes. Isolation in 7 days after positive test.
Contact with anyone infected by COVID-19 ->quarantine	Yes. 14 days quarantine.	Yes. 10 days quarantine.
Social and physical distancing	Keep 2-m distance to individuals outside your household. Disallowed from being in groups with more than five people.	Keep 1-m distance to individuals outside your household. Limit the total number of social contacts. Only 5 guests outside your household.
Closing kindergartens, schools, and universities	Yes	No
Closing bars, pubs, and restaurants	Yes	No. National liquor bans from 12 a.m.
Closing all retail and personal care businesses (e.g., hairdressers, beauty salons), except for essential stores (e.g., grocery stores, pharmacies)	Yes	No
Cancellation of cultural events (e.g., concerts), closing leisure and sporting facilities	Yes	No. Given 1-m distance, events with 50 attendees are allowed.
Encouraging the use of home office	Yes	Yes
Hospital and health institutions	Access control. Regular visitation routines are stopped. Health personnel disallowed from leaving the country.	Recommendation to wear face masks when contacting hospitals and other health institutions.
Traveling restrictions	Traveling to and staying overnight at one's leisure property outside the individual's residing municipality is not allowed. The borders are closed for visitors from other countries. Individuals visiting or returning to Norway receive 14 days quarantine.	Traveling is allowed, but unnecessary travels domestically and abroad should be avoided. Individuals visiting or returning from countries with high risk of COVID-19 infection receive 10 days quarantine.
Recommendation to wear face masks	No	Yes. Recommendation to wear face masks in places where it is difficult to keep physical distancing, e.g., public transport, shopping malls

Table B.1
Descriptive Statistics and Intercorrelations Among Clinical Characteristics in Study 1 (N = 12 580)

Measure	2	3	4	5	6	*M (SD)*
1. DOCS-SF pre-COVID	.56**	.30**	.29**	.32**	.09**	2.7 (4.69)
2. DOCS-SF April		.49**	.42**	.65**	.16**	11.5 (10.0)
3. PHQ-ADS April		–	.68**	.56**	.05**	15.9 (11.2)
4. BIS April			–	.41**	.05**	14.4 (9.9)
5. IES April				–	.13**	30.4 (9.5)
6. Adh. guidelines April					–	27.3 (2.5)

Note. DOCS-SF = The Dimensional Obsessive-Compulsive Scale Short-Form; PHQ-ADS = The Patient Health Questionnaire Anxiety and Depression Scale; BIS = Bergen Insomnia Scale; IES = Impact of Event Scale, Adh. guidelines = Adherence to COVID-19 guidelines. Pre-COVID data were measured retrospectively in April.
**$p < .01$.

Table C.1
Descriptive Statistics and Intercorrelations Among Clinical Characteristics in Study 2 (N = 3405)

Measure	2	3	4	5	6	*M (SD)*
1. DOCS-SF April	.61**	.49**	.42**	.65**	.17**	10.6 (9.7)
2. DOCS-SF December		.40**	.32**	.51**	.17**	9.4 (9.1)
3. PHQ-ADS April		–	.68**	.57**	.07**	15.6 (11.0)
4. BIS April			–	.41**	.05**	14.0 (9.6)
5. IES April				–	.13**	21.5 (15.0)
6. Adh. guidelines April					–	27.3 (2.4)

Note. DOCS-SF = The Dimensional Obsessive-Compulsive Scale Short-Form; PHQ-ADS = The Patient Health Questionnaire Anxiety and Depression Scale; BIS = Bergen Insomnia Scale; IES = Impact of Event Scale; Adh. guidelines = Adherence to COVID-19 guidelines.
**$p < .01$.

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