



Course and predictors of eating disorder symptoms, anxiety symptoms, and pandemic-related eating disorder concerns among adults with eating disorders during the first year of the COVID-19 pandemic

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Funding information

Center for Mental Health Services, Grant/Award Number: H79 SM081924; National Institute of Mental Health, Grant/Award Numbers: R01MH119084,

Abstract

Objective: The COVID-19 pandemic and public health mitigation measures have negatively impacted individuals with eating disorders (ED). We evaluated changes in and predictors of ED symptoms, pandemic-related ED concerns, and anxiety symptoms across the first 12 months of the COVID-19 pandemic among individuals with self-reported EDs in the United States (US), Sweden (SE), and the Netherlands (NL).

Method: Participants in the US ($N = 510$), SE ($N = 982$), and NL ($N = 510$) completed an online survey assessing ED symptoms (binge eating, restriction, compensatory behaviors, and anxiety about being unable to exercise), general anxiety symptoms, and pandemic-related ED concerns about accessing food, lack of structure and social support, being in a triggering environment, and food and treatment costs. In the US and NL, respondents completed surveys beginning April 2020 and continuing monthly for a year. In SE, respondents completed baseline surveys in May 2020, a six-month follow-up around December 2020, and a 12-month follow-up in May 2021.

Results: Three patterns emerged: (1) a curvilinear course with the highest level of symptoms at baseline, declining through November 2020, and increasing through the rest of the year; (2) a linear declining course over time; and (3) a stable course with no changes. Worries about COVID-19 infection, lockdown, concerns about lack of structure and social support, and concerns about accessing food consistent with one's recovery meal plan predicted increases in ED symptoms.

Discussion: ED symptoms tracked with pandemic-related concerns in people with EDs. Conceptualizing predictors of symptoms may inform therapy and public health resources that reduce the impact of pandemics on mental health.

R01MH120170; Vetenskapsrådet,
Grant/Award Number: 538-2013-8864; Brain
and Behavior Research Foundation
Distinguished Investigator Grant; Lundbeck
Foundation, Grant/Award Number:
R276-2018-4581; Agency for Healthcare
Research and Quality; Health Resources and
Services Administration, Grant/Award
Number: D40-HP45688

Action Editor: Ruth Striegel Weissman

Public Significance: Our findings suggest that the COVID-19 pandemic had negative impacts on people with eating disorders, including amplification of mental health symptoms and stressors around peak periods of infection and COVID-19 restrictions. These findings inform medical providers, policy-makers, and community-based supports about the information and resource needs of this group to ensure efficient dissemination in future public health emergencies and during the ongoing COVID-19 pandemic.

KEYWORDS

anxiety, coronavirus, COVID-19, eating disorders, lockdown, pandemic, quarantine

1 | INTRODUCTION

The 2019 novel coronavirus (COVID-19) pandemic has had profound effects on mental health—particularly among those with pre-existing mental illnesses such as eating disorders (EDs) (Galletly, 2020; Kaufman et al., 2020). The pandemic and public health measures to reduce virus transmission have produced a range of stressors for individuals with EDs. A review found several factors associated with an increase in ED symptoms including: challenges related to disruptions in daily routines and exercise habits, decreased availability of food, diminished social contacts and increased interpersonal stresses, reduced access to treatment, and increased time spent engaging in triggering activities like social media (Weissman & Hay, 2022). Challenges were most pronounced early in the pandemic, during heightened widespread uncertainty and anxiety, lockdowns, school and business closures, home-life and job transitions, and supply-chain problems, leading to panic buying and hoarding. At the time, individuals in the United Kingdom (UK), Australia, and Spain with EDs expressed concerns about isolation and loneliness, and reported that dietary restriction and food and weight preoccupation were being triggered by the lack of daily routine (S. Brown et al., 2021; Fernández-Aranda et al., 2020). Potential infection, difficulty leaving home to go grocery shopping, and household stockpiling of groceries associated with increased binge eating have been other concerns in the US, UK, and Sweden (SE) (Birgegård et al., 2022; Brown et al., 2021; Ter-morshuizen et al., 2020). Prospective data examining changes in mental health throughout the pandemic are limited.

Some European studies have shed light on the impact of lockdowns on ED symptoms reporting that individuals with EDs experienced an increase in symptoms (e.g., binge eating and dietary restriction) (S. Brown et al., 2021; Castellini et al., 2020; Fernández-Aranda et al., 2020; Giel et al., 2021). Specifically, individuals with EDs reported increases in compensatory exercise behaviors, binge eating, and weight and shape concerns during lockdown periods compared to before lockdown (Castellini et al., 2020; Giel et al., 2021). However, these studies examined only two time points (pre- and post-lockdown), and to our knowledge, no longitudinal data have examined multiple time points (e.g., monthly) throughout the pandemic. Although individuals in Germany with a history of an ED are at risk for

symptom exacerbation and relapse during the pandemic (Giel et al., 2021), the patterns of symptom change across the pandemic are unknown. Further, it is unknown which factors predicted better or worse than expected outcomes among people with EDs over the pandemic. Understanding the experiences and needs of people with EDs during the COVID-19 pandemic is important for planning our response to future public health crises and to help individuals with EDs better tolerate future disruptions due to COVID-19. Preparedness and response planning may need to be different depending on the policy and public health context. Public health responses to COVID-19 differed across countries, with many nations like the US and the Netherlands (NL) enacting restrictive lockdown orders, mask mandates, and school closures, in contrast to SE, which had a more lenient approach that focused on personal responsibility (Ludvigsson, 2020).

Accordingly, the overall aim of the current study was to evaluate changes in ED symptoms, pandemic-related ED concerns, and general anxiety symptoms during the COVID-19 pandemic among individuals with an ED history in three countries: the US, SE, and NL. The 12-month data collection spanned the critical period of the first COVID-19 pandemic year, which created widespread uncertainty and sudden and profound challenges (Figure 1 shows the weekly COVID-19 infection cases in the time period of this study). The second aim was to explore predictors of these outcomes over this time period. Specific predictors examined included sociodemographics, ED status and treatment, adverse pandemic experiences, and pandemic-related ED concerns (only for ED symptom outcomes). Given the study was exploratory in nature, we did not formulate explicit hypotheses. However, we broadly predicted that the pandemic would have negative impact on the outcomes, which would be sustained over time.

2 | METHODS

2.1 | Participants

Participants from the US, SE, and NL were invited to take part in an online survey. US participants were recruited through social media (e.g., Twitter, Facebook, Instagram advertisements), or via emails to

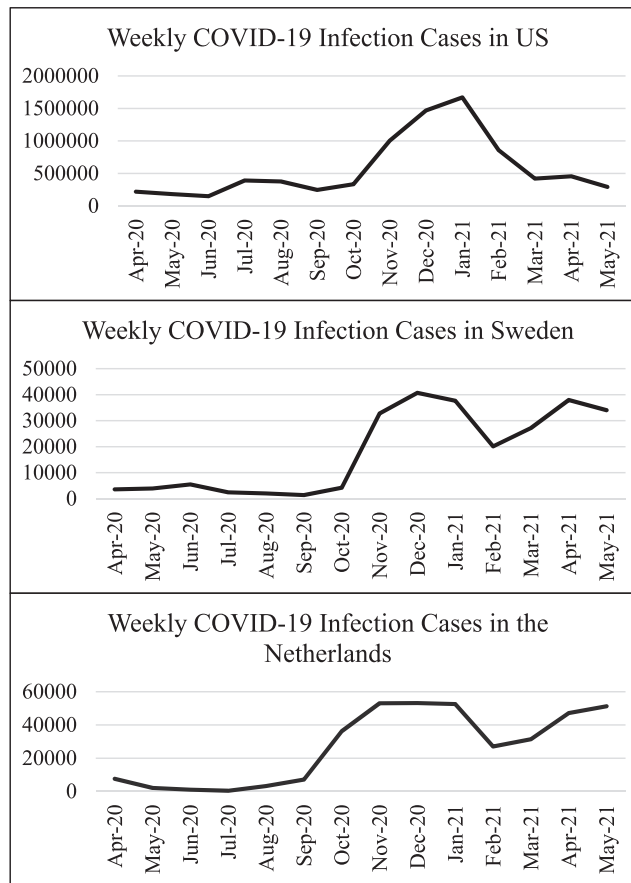


FIGURE 1 Weekly COVID-19 infection cases in the US, Sweden, and the Netherlands from April 1, 2020 through May 30, 2021. Data for this figure came from the World Health Organization COVID-19 Dashboard which tracks the infection rate for each country since the beginning of the pandemic (World Health Organization, 2022).

participants from ongoing studies who consented to being recontacted (Bulik et al., 2020; Thornton et al., 2018). SE recruited participants who had given permission to be recontacted from prior studies of individuals with a lifetime history of an ED. NL participants were recruited via social media, the online platform Proud2BeMe, and the Dutch Eating Disorder Register (NER). All participants self-reported a lifetime ED, and were a minimum of 18 years old in the US and 16 years old in SE and NL. In the US, participants enrolled during a 29-day period from April 8, 2020 (the day the survey launched in the early phases of the COVID-19 pandemic) up to and including May 6, 2020. In SE, enrollment took place between May 27, 2020, and July 8, 2020, and in NL enrollment occurred between April 17, 2020 and May 15, 2020. During this time, all countries were in different phases of the pandemic with the first COVID-19 patient diagnosed in the US on January 20, 2020 and 1204 confirmed cases per million by April 8, 2020. In contrast, in SE, the first patient was diagnosed on February 29, 2020, with 800 confirmed cases by May 27, 2020, and in NL, the first patient was diagnosed on February 27, 2020, with 1069 confirmed cases by April 17, 2020. The three countries for this study were chosen because they were the locations of the research collaborators' IRBs and research infrastructure and given the need to rapidly expedite data collection on COVID-19 impact.

2.2 | Procedure

In the US and NL, participants who consented to participate agreed to be recontacted monthly on 12 occasions over the course of a year. No compensation was offered except for entry into a raffle for an electronic tablet to encourage responses at 12 months in the US. Ethical approval was granted by the University of North Carolina Biomedical Institutional Review Board. In NL, the study was evaluated by the Medical Research Ethics Committee (MREC-LDD) of Leiden University Medical Centre and determined to be exempt from approval. In SE, participants were recontacted 6 months after their baseline participation, and again 12 months after their baseline participation. The study was approved by the Swedish Ethical Review Authority (Dnr 1010-04136).

2.3 | Measures

In all three countries, the online survey asked a series of questions assessing concerns and challenges participants were facing regarding their ED and general mental health due to the COVID-19

TABLE 1 Descriptive statistics for key study variables at baseline in US (N = 510), SE (N = 982), and NL (N = 510)

Variables	Country	M (SD) or n (%)	ICC
Sociodemographic			
Race (% Caucasian) ^a	US	231 (93.5)	-
Ethnicity (% Hispanic) ^a	US	12 (5.0)	-
Gender (% female)	US	483 (94.7)	-
	SE	954 (97.1)	-
	NL	498 (97.6)	-
Eating disorder diagnosis, illness status, and treatment			
Anorexia nervosa, lifetime	US	317 (62.2)	-
	SE	632 (64.4)	-
	NL	347 (68.0)	-
Binge-type (BN/BED), lifetime	US	281 (55.1)	-
	SE	451 (45.9)	-
	NL	152 (29.8)	-
Active eating disorder	US	221 (43.3)	-
	SE	156 (16.0)	-
	NL	299 (58.6)	-
Treatment (% enrolled)	US	276 (54.9)	-
	SE	101 (11.0)	-
	NL	259 (50.8)	-
Adverse pandemic experiences			
COVID-19 exposure (self or family)	US	103 (20.2)	-
	SE	168 (17.1)	-
	NL	95 (18.6)	-
Lockdown	US	456 (89.4)	-
	SE	455 (46.3)	-
	NL	206 (40.4)	-
Worries about COVID-19 infection	US	4.69 (1.34)	-
	SE	3.59 (1.32)	-
	NL	4.55 (1.26)	-
Job loss (anyone in family)	US	126 (24.7)	-
	SE	0 (0.0)	-
	NL	33 (6.5)	-
COVID-19 death (do you know anyone) ^b	US	51 (17.2)	-
	SE	-	-
	NL	41 (8.0)	-
Eating disorder symptoms			
Binge eating	US	1.79 (0.94)	.69
	SE	1.33 (0.68)	.64
	NL	1.48 (0.86)	.63
Restricted intake	US	2.44 (1.05)	.55
	SE	1.49 (0.79)	.46
	NL	2.17 (1.08)	.47
Compensatory behaviors	US	1.07 (1.10)	.58
	SE	1.36 (0.70)	.47
	NL	2.15 (1.09)	.54

TABLE 1 (Continued)

Variables	Country	M (SD) or n (%)	ICC
Felt anxious because unable to exercise	US	2.68 (1.07)	.56
	SE	1.98 (1.04)	.56
	NL	2.64 (1.21)	.57
General anxiety symptoms	US	12.61 (5.59)	.69
	SE	9.47 (5.67)	.70
	NL	11.83 (5.41)	.72
Pandemic-related eating disorder concerns about...			
...having enough food	US	2.21 (1.02)	.40
	SE	1.25 (0.56)	.39
	NL	1.81 (0.91)	.54
...accessing foods consistent with meal plan	US	2.76 (1.05)	.44
	SE	1.38 (0.71)	.49
	NL	2.13 (1.06)	.59
...lack of structure	US	3.24 (0.95)	.46
	SE	1.97 (1.02)	.60
	NL	2.90 (1.04)	.51
...lack of social support	US	2.68 (1.15)	.54
	SE	1.69 (0.95)	.59
	NL	1.50 (1.10)	.55
...living in triggering environment	US	2.78 (1.16)	.52
	SE	1.93 (1.04)	.61
	NL	2.60 (1.11)	.57
...cost of food	US	1.63 (0.95)	.60
	SE	1.25 (0.66)	.52
	NL	1.39 (0.74)	.58
...cost of treatment	US	1.71 (1.07)	.58
	SE	1.16 (0.56)	.57
	NL	1.27 (0.68)	.57

Abbreviations: BED, binge-eating disorder; BN, bulimia nervosa; ICC, intraclass correlation; NL, Netherlands; SE, Sweden; US, United States.

^aRace and ethnicity were not assessed in SE and NL.

^bDeath (knowing anyone who died due to COVID-19) was first assessed at the three-month follow-up in US and at the two-month follow-up in the NL sample. It was only assessed at 1-year follow-up for SE sample, so it was not included in analyses.

pandemic. The survey was developed in English and translated to Swedish and Dutch. Specific details about the composition of survey questions are reported elsewhere (Termorshuizen et al., 2020).

2.3.1 | Demographics and eating disorder history

Participants reported their age, gender identity, race (US only) and ethnicity (US only). Lifetime ED diagnoses (anorexia nervosa or binge-type diagnosis which included both bulimia nervosa and binge-eating disorder), illness status (current active ED versus past ED with no symptoms/past ED with lingering symptoms), and current treatment status (enrolled in any kind of ED treatment or not enrolled in treatment) were self-reported.

2.3.2 | Adverse pandemic experiences

Survey questions assessed COVID-19 exposure (including exposure to the virus, diagnosis in self or family), whether or not there were current lockdown restrictions (e.g., quarantine, voluntary or mandatory isolation, or stay-at-home or shelter-in-place order), and pandemic-related job loss for self or family (yes or no). Four Likert scale items (1 = *not at all worried* to 7 = *very worried*) assessed worry about COVID-19 infection and were averaged to create a mean score: “How worried are you about (1) being infected yourself; (2) others being infected; (3) your physical health could be influenced by COVID-19; (4) your mental health could be influenced by COVID-19?” Cronbach’s alphas were .81, .78, and .72 in the US, SE, and NL samples respectively. In the US sample, beginning in the third month of the study, and in the NL sample, beginning in the second month, participants indicated if they knew

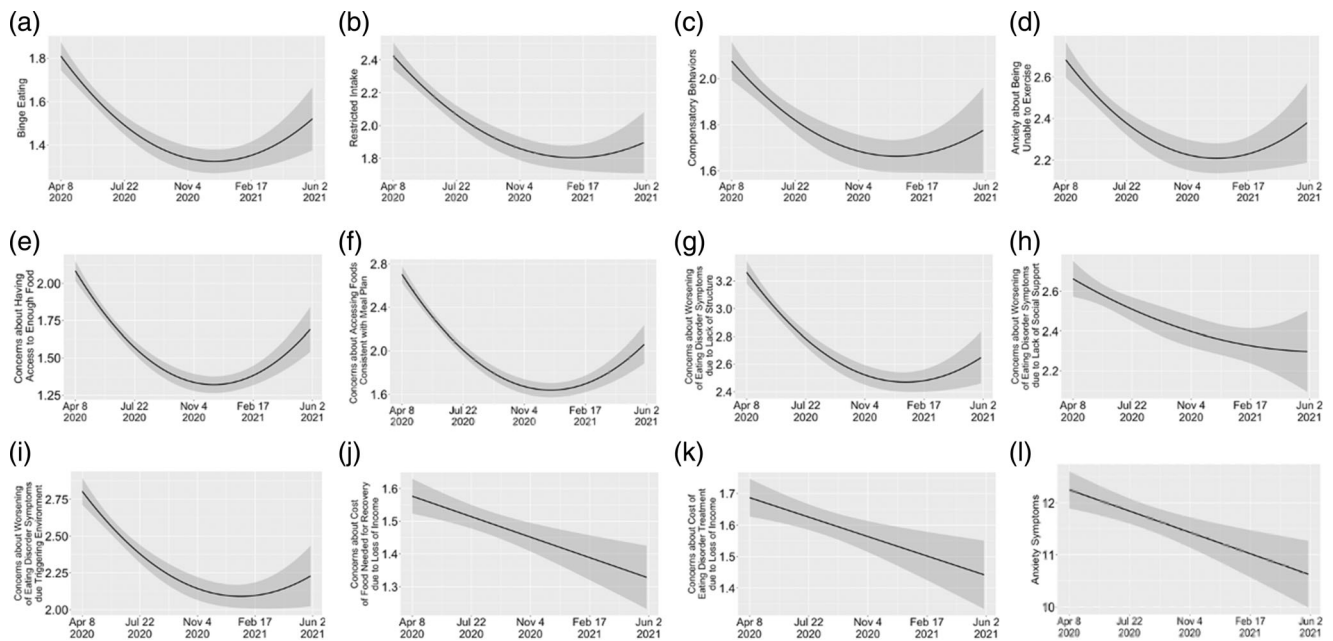


FIGURE 2 Longitudinal conditional growth models of changes in eating disorder symptoms, pandemic-related eating disorder concerns, and general anxiety symptoms during the first year of the COVID-19 pandemic in US sample. Likelihood ratio tests revealed quadratic growth models of best fit for changes in binge eating (A), restricted intake (B), compensatory behaviors (C), anxiety about being unable to exercise (D), concerns about having access to enough food (E), concerns about accessing foods consistent with one's meal plan (F), concerns about worsening of symptoms due to lack of structure (G), lack of social support (H), and increased time in a triggering environment (I). Results revealed an initial decrease followed by an increase in symptoms between November 2020 and January 2021. Changes in general anxiety symptoms (L), concerns about the cost of food needed for recovery due to loss of income related to COVID-19 (J) and about the cost of eating disorder treatment due to loss of income related to COVID-19 (K) were best fit using linear growth models suggesting a steady decline in symptoms over time.

anyone personally who had died from COVID-19; in the SE sample, this question was asked at 1-year follow-up only, and was therefore not included in analyses. Job loss was not included as a predictor in SE models due to no variance ($\sigma^2 = 0$) since no one lost their job.

2.3.3 | Eating disorder symptoms

Four Likert scale items (1 = *not at all*, 2 = *once or twice*, 3 = *frequently*, 4 = *daily or more*) assessed COVID-related impact on behavioral ED symptoms in the past 2 weeks. Questions assessed binge eating (“I have binged on food that I or my family or roommate have stockpiled”), restricted intake (“I have restricted my intake more because of COVID-19-related factors”), compensatory behaviors (“I have engaged in more compensatory behaviors such as self-induced vomiting, excessive exercise, misuse of laxatives and/or water pills because of COVID-19-related factors”), and exercise (“I have felt anxious about not being able to exercise”). No cognitive-affective symptoms were included. Cronbach's α did not support combining the items into a scale (US $\alpha = .60$, SE $\alpha = .61$, and NL $\alpha = .69$), therefore each item was evaluated separately.

2.3.4 | Pandemic-related eating disorder concerns

Seven Likert scale items (1 = *not at all concerned*, 2 = *slightly concerned*, 3 = *somewhat concerned*, 4 = *very concerned*) assessed

COVID-19-related ED-related concerns within the past 2 weeks. Participants were asked to rate their level of concern about (1) “having access to enough food (e.g., unable to go to a grocery store regularly, unable to leave home, etc.),” (2) “accessing foods that are consistent with one's current meal plan/style of living,” (3) “worsening of one's ED due to lack of structure,” (4) “worsening of one's ED due to lack of social support,” (5) “worsening of one's ED due to increased time living in a triggering environment,” (6) “being able to afford the food that one needs for recovery due to loss of income associated with COVID-19,” and (7) “being able to afford ED treatment due to loss of income associated with COVID-19.” Cronbach's α 's for the seven items ranged from .61 to .75 in the US, SE, and NL sample. Due to the relatively low collective reliability of the items and the differences in their face validity (i.e., concerns about triggering environment versus concerns about accessing enough food), we evaluated the scale items separately.

2.3.5 | Anxiety symptoms

The total score of the Generalized Anxiety Disorder-7 scale (GAD-7; Spitzer et al., 2006) assessed general anxiety symptoms in the past 2 weeks. The total ranges from 0 to 21, with higher scores reflecting more severe symptoms. The GAD-7 has excellent internal consistency ($\alpha = .92$) and test-retest reliability (ICC = .83; Spitzer et al., 2006). Cronbach's α was .91, .91, and .88 in the US, SE, and NL samples respectively.

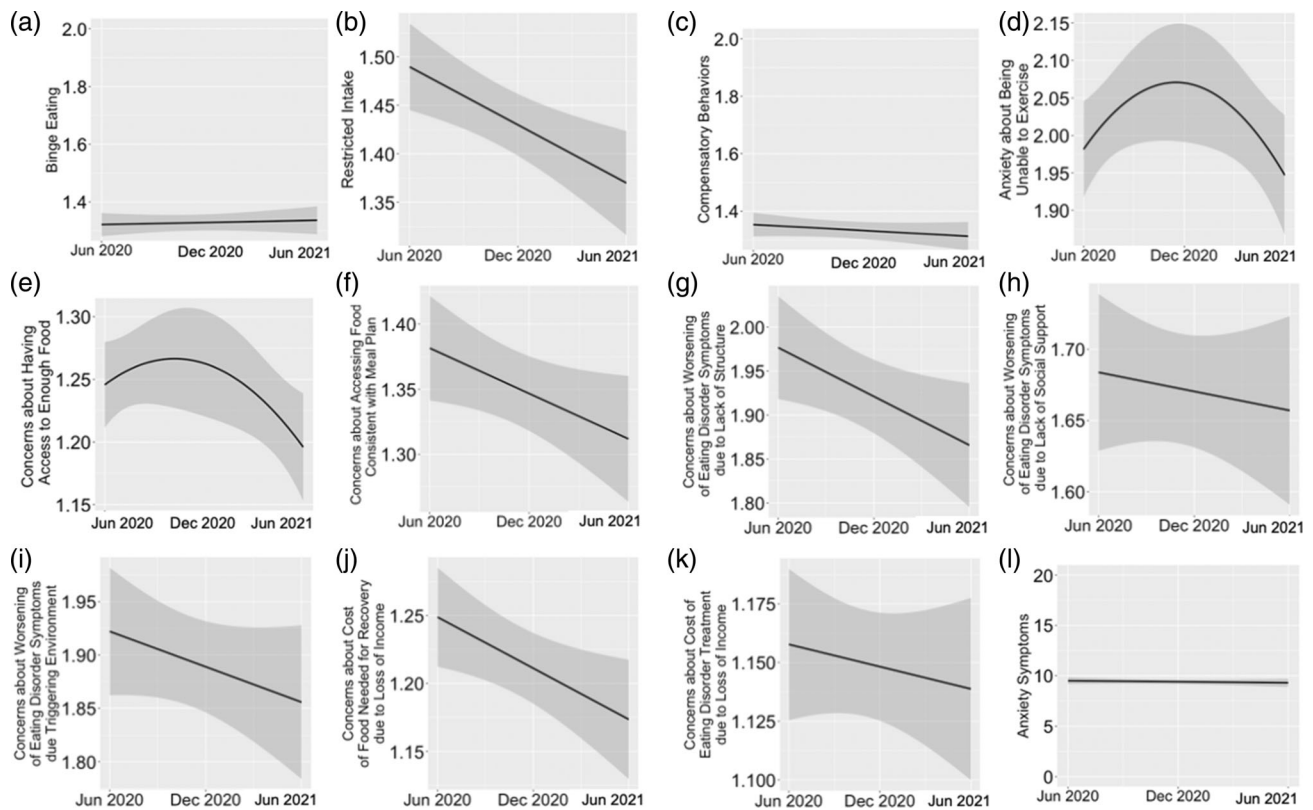


FIGURE 3 Longitudinal conditional growth models of changes in eating disorder symptoms, pandemic-related eating disorder concerns, and general anxiety symptoms during the first year of the COVID-19 pandemic in SE sample. Likelihood ratio tests revealed linear models of best fit suggesting a general decline over time for restricted intake (B), concerns about accessing food consistent with meal plan (F), concerns about lack of structure (G), concerns about lack of social support (H), concerns about living in a triggering environment (I), concerns about the cost of food (J), and concerns about the cost of treatment (K). Quadratic models were best fit for anxieties about not being able to exercise (D) and concerns about accessing enough food (E). Finally, baseline levels of binge eating (A), compensatory behaviors (E), and anxiety symptoms (L) remained stable across the first year of the pandemic.

2.4 | Statistical analysis

Data from each country were analyzed separately. Descriptive statistics were calculated to describe the baseline sample, key study variables at baseline, and sample size at each wave (Table S1; US: average missingness of 69%, range 0%–85%; SE: average missingness of 35%, range 0%–35%; NL: average missingness of 74%, range 0%–83%).

The outcome variables for the primary aim were the ED symptom, pandemic-related ED concerns, and general anxiety symptoms measures. To investigate the primary aim we explored the course of these outcomes across the first 12 months of the pandemic using multilevel modeling (MLM). MLMs incorporate random and fixed effects with maximum likelihood estimation to describe variation in the outcome, account for missing data, and allow for the use of all available data from each participant and time point. Formulas for each MLM model are detailed in Supporting Information.

For each outcome, we tested a series of models as follows. Following the strategy proposed by Singer and Willett (2003), we fit an unconditional means model (i.e., model that has no predictors; Model 0) to examine mean differences in the outcome among individuals using

baseline random intercepts. We calculated the intraclass correlation (ICC) to determine the level of dependency within the data and saved model fit information to make comparisons to more complex models. For each country, results from the unconditional means models indicated within-subject dependency, or correlation within participants responses across repeated measurements suggesting that the MLM analysis strategy was appropriate (ICCs ranged from .46 to .69; Table 1).

Next, we fit unconditional growth models to evaluate change in each outcome across time. Since the exact trajectory of change in symptoms across the 12 months was exploratory, we evaluated linear (using the single Time variable; Model 1) and quadratic models (using Time \times Time; Model 2). Time was entered as both a fixed and random effect to allow for differences in intercepts and slopes between individuals. Likelihood ratio tests (LRT) were used to select the best-fitting model among models 0, 1, and 2.

Finally, to assess the second aim of the study—exploring predictors of the course of ED symptoms, pandemic-related ED concerns, and general anxiety symptoms—we evaluated conditional models. We followed the screening strategy of Mackenzie et al. (2013) and evaluated each predictor individually (Model 3). Significant predictors were

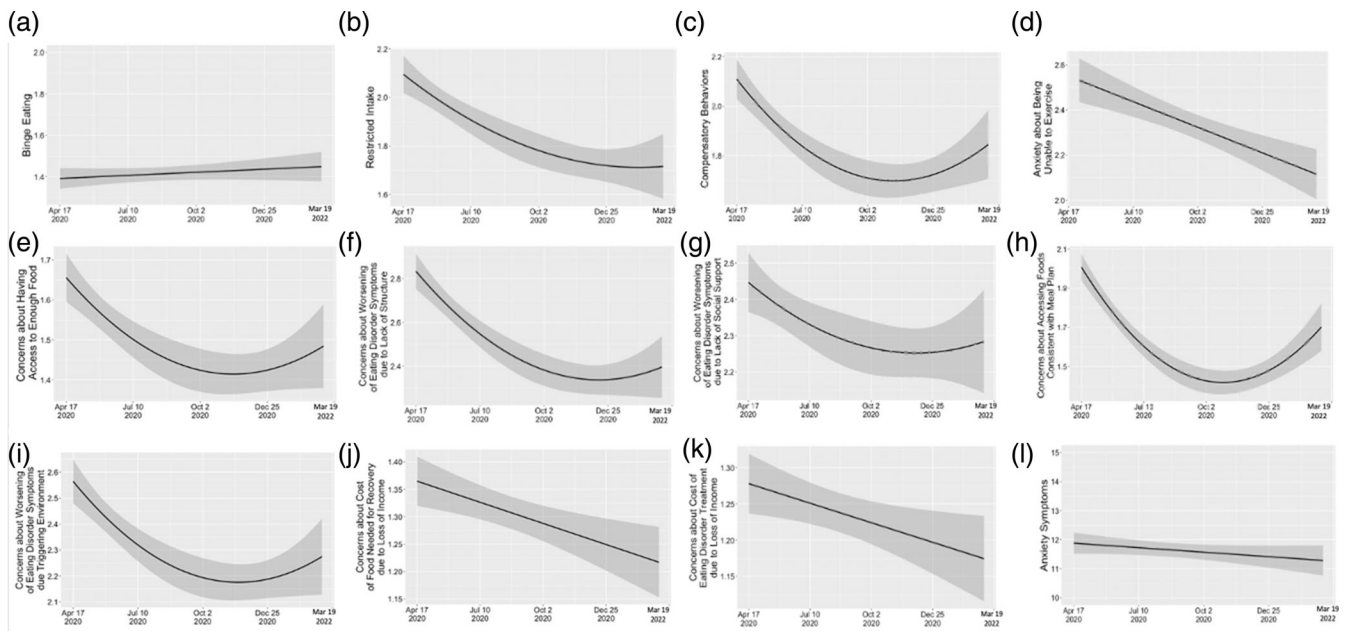


FIGURE 4 Longitudinal conditional growth models of changes in eating disorder symptoms, pandemic-related eating disorder concerns, and general anxiety symptoms during the first year of the COVID-19 pandemic in NL sample. Longitudinal growth models revealed neither binge eating (A), nor general anxiety symptoms (L) significantly changed across the study period. Likelihood ratio tests revealed quadratic growth models of best fit for changes in restricted intake (B), compensatory behaviors (C), concerns about having access to enough food at grocery stores (E), concerns about worsening of symptoms due to lack of structure (F), lack of social support (G), accessing foods consistent with meal plan (H), and increased time in a triggering environment (I). Results revealed an initial decrease followed by an increase in symptoms between November 2020 and January 2021. Further, anxiety about being unable to exercise (D), concerns about the cost of food needed for recovery due to loss of income (J), and concerns about the cost of treatment due to loss of income (K) were best fit using linear growth models suggesting a steady decline in symptoms over time.

then tested together in a multivariate conditional model predicting the outcome across time. Gender, race (US only), and ethnicity (US only) were included as covariates. This “forward stepping” method of model testing is recommended for smaller sample sizes so the models do not burden the “carrying capacity” of the dataset by overloading too many predictors in a model (Nezlek, 2008).

Although multiple analyses were conducted, given the exploratory premise of the study, we retained an alpha level of .05. Analyses were done in SPSS version 27 for US and NL and SPSS version 26 for SE.

3 | RESULTS

3.1 | Participant and baseline characteristics

Table 1 presents baseline summary data for participants in the US ($n = 510$), SE ($n = 982$), and NL ($n = 510$). In each country, the majority of participants identified as female, and in the US, participants identified predominately as Caucasian and non-Hispanic. The mean age of the US sample was 30.7 years ($SD = 9.4$, range = 18–67) and for the SE sample, 32.1 ($SD = 8.7$, range = 18–77). In the NL survey, age was measured with age bands: 25% ($n = 127$) were 16–21, 43% were 22–29 ($n = 219$), 32% ($n = 164$) were 30–69, and four participants (1%) were 70+ years.

COVID-19 exposure at baseline was comparable across countries, ranging from 17% in SE to 20% in US. Rates of lockdown varied, ranging from a high of 89% among US participants, to 46% in SE, and 40% in NL participants, respectively. Pandemic-related job loss was highest in the US (25%) and comparably lower in SE (0%) and NL (6%). At the Month 3 follow-up survey (the fourth administered survey about August 2020), 17% of US participants knew someone who had died from COVID-19. At the two-month follow-up in the NL sample (June/July 2020), 8% knew someone who had died from COVID-19. This question was only asked at 1-year follow-up for the SE sample, and was therefore not included in analyses.

3.2 | Course of eating disorder symptoms, pandemic-related eating disorder concerns, and general anxiety over the first year of the COVID-19 pandemic

Figures 2–4 show the course of outcomes from the beginning of the pandemic to the end of the one-year observation period. MLM analysis results are shown in Table 2. The results suggest three general patterns over time: curvilinear, linear, or stable. The curvilinear U-shaped pattern was seen in 75% (i.e., 9/12) of US, 58% of NL, and 16% of SE outcomes; the linear downward pattern was seen in 58% of SE, 25%

TABLE 2 Unconditional growth models of eating disorder symptoms, pandemic-related eating disorder concerns, and general anxiety symptoms in US, SE, and NL samples

Dependent variables	Country	Model	Intercept	Intercept variance	Time	Time variance	Time ²	χ^2 diff
<i>Eating disorder symptoms</i>								
Binge eating	US	1	1.73***	0.58***	-0.03***	0.003***	-	76.66*
		2	1.79***	0.57***	-0.10***	0.003***	0.01***	28.35*
	SE	1	1.32***	0.30***	0.01	0.002	-	1.35
		2	1.33***	0.30***	-0.04	0.002	0.03	2.03
	NL	1	1.43***	0.41***	0.01	0.003***	-	72.37*
		2	1.45***	0.41***	-0.02	0.003	0.03	3.56
Restricted intake	US	1	2.35***	0.65***	-0.08***	0.005***	-	169.22*
		2	2.45***	0.66***	-0.18***	0.005***	0.01***	34.17*
	SE	1	1.49***	0.27***	-0.06***	0.00	-	15.80*
		2	1.49***	0.27***	0.0003	0.00	-0.03	1.27
	NL	1	2.07***	0.61***	-0.05***	0.005**	-	100.36*
		2	2.12***	0.61***	-0.13***	0.01***	0.009***	14.70*
Compensatory behaviors	US	1	2.01***	0.78***	-0.05***	0.01***	-	132.73*
		2	2.10***	0.78***	-0.13***	0.01***	0.01***	22.27*
	SE	1	1.36***	0.23***	-0.02	0.004	-	2.45
		2	1.36***	0.23***	-0.01	0.005	-0.01	0.05
	NL	1	2.06***	0.68***	-0.04***	0.005***	-	75.59*
		2	2.12***	0.67***	-0.14***	0.01***	0.01***	29.76*
Felt anxious because unable to exercise	US	1	2.58***	0.68***	-0.05***	0.004**	-	96.54*
		2	2.68***	0.70***	-0.17***	0.005***	0.01***	34.80*
	SE	1	2.01***	0.72***	-0.01	0.04*	-	14.89*
		2	1.98***	0.72***	0.21**	0.05*	-0.12***	13.76*
	NL	1	2.57***	0.88***	-0.04***	0.01***	-	81.76*
		2	2.49***	0.89***	0.01	0.01***	-0.01	3.34
<i>Pandemic-related eating disorder concerns about...</i>								
...having enough food	US	1	1.92***	0.42***	-0.08***	0.004**	-	201.87*
		2	2.08***	0.42***	-0.25***	0.04***	0.02***	95.57*
	SE	1	1.25***	0.12***	-0.03**	0.00	-	6.93*
		2	1.25***	0.12***	0.05	0.00	-0.04*	3.90*
	NL	1	1.64***	0.40***	-0.03***	0.002*	-	46.00*
		2	1.69***	0.40***	-0.09***	0.003***	0.01***	21.32*
...accessing foods consistent with meal plan	US	1	2.49***	0.60***	-0.12***	0.01***	-	358.60*
		2	2.72***	0.62***	-0.37***	0.01***	0.03***	166.14*
	SE	1	1.38***	0.30***	-0.04**	0.03**	-	30.33*
		2	1.37***	0.30***	-0.01	0.03**	-0.02	0.68
	NL	1	1.95***	0.56***	-0.05***	0.002**	-	104.07*
		2	2.04***	0.54***	-0.18***	0.002**	0.02***	66.33*
...lack of structure	US	1	3.14***	0.51***	-0.09***	0.01***	-	211.14*
		2	3.27***	0.51***	-0.22***	0.01***	0.02***	44.01*
	SE	1	1.98***	0.60***	-0.07***	0.002	-	19.28*
		2	1.97***	0.60***	-0.04	0.002	-0.02	0.28
	NL	1	2.81***	0.60***	-0.05***	0.005***	-	120.51*
		2	2.85***	0.59***	-0.12***	0.005***	0.01***	12.63*
...lack of social support	US	1	2.64***	0.70***	-0.05***	0.01***	-	78.48*

(Continues)

TABLE 2 (Continued)

Dependent variables	Country	Model	Intercept	Intercept variance	Time	Time variance	Time ²	χ^2 diff
...living in triggering environment		2	2.68***	0.70***	-0.09***	0.01***	0.005*	4.06*
		SE	1	1.68***	0.51***	-0.03	0.01	-
		2	1.68***	0.51***	-0.03	0.01	0.001	0.00
		NL	1	2.42***	0.62***	-0.02**	0.003***	-
		2	2.46***	0.62***	-0.08***	0.003***	0.01**	8.80*
		US	1	2.70***	0.77***	-0.08***	0.01***	-
		2	2.81***	0.77***	-0.20***	0.01***	0.02***	35.92*
		SE	1	1.92***	0.62***	-0.05**	0.01	-
		2	1.92***	0.62***	-0.08	0.01	0.02	0.28
		NL	1	2.53***	0.76***	-0.04***	0.01***	-
	...cost of food	2	2.58***	0.75***	-0.12***	0.01***	0.01***	18.20*
		US	1	1.60***	0.60***	-0.02**	0.01***	-
	2	1.60***	0.59***	-0.02	0.01***	0.0003	0.04	
	SE	1	1.25***	0.30***	-0.04**	0.05***	-	65.64*
	2	1.25***	0.30***	-0.05	0.05***	0.01	0.13	
	NL	1	1.37***	0.35***	-0.01**	0.002***	-	55.27*
...cost of treatment	2	1.37***	0.35***	-0.02	0.002***	0.001	0.09	
	US	1	1.69***	0.74***	-0.03***	0.01***	-	113.51*
	2	1.71***	0.74***	-0.05**	0.01***	0.002	1.30	
	SE	1	1.16***	0.21***	-0.01	0.02***	-	20.34*
	2	1.16***	0.21***	-0.03	0.02***	0.01	0.52	
	NL	1	1.27***	0.31***	-0.01*	0.002***	-	65.68*
General anxiety symptoms	2	1.27***	0.31***	0.004	0.002***	-0.002	1.35	
	US	1	12.32***	22.00***	-0.16***	0.21***	-	124.46*
	2	12.42***	21.99***	-0.27**	0.21***	0.01	1.67	
	SE	1	9.47***	22.30***	-0.12	0.74*	-	7.67*
	2	9.47***	22.30***	-0.04	0.74*	-0.04	0.07	
	NL	1	11.71***	21.49***	-0.05	0.10***	-	54.71*
	2	11.70***	21.49***	-0.04	0.10***	-0.001	0.01	

Note: Model 1 = unconditional linear growth model which includes Time as a fixed predictor. Model 2 = unconditional quadratic growth model which includes curvilinear Time² as a fixed predictor. χ^2 Diff = likelihood ratio test comparing the fit of nested models as follows: Model 1 is compared to Model 0, an unconditional means model (results not shown), and Model 2 is compared to Model 1. Time is coded as six-week intervals beginning April 8, 2020. Abbreviations: NL, Netherlands; SE, Sweden; US, United States.

*Significant time effect and likelihood ratio test are $p < .05$. **Significant time effect and likelihood ratio test are $p < .01$. ***Significant time effect and likelihood ratio test are $p < .001$.

of US, and 25% of SE outcomes; and the stable pattern was seen in 25% of SE, 16% of NL, and 0% of US outcomes. Although some samples shared the same pattern of change for outcomes, the following is important to note: visually, the US sample self-rated higher COVID-19 impacts on ED symptoms and concerns in the beginning of the pandemic than the SE and NL samples, and the SE sample reported the least severe impacts. For instance, as pictured in Figures 2-4, regarding the impact of COVID-19 on worsening of symptoms due to a lack of structure, the average response was slightly above “somewhat concerned” for the US sample, fell between “slightly concerned” and “somewhat concerned” for the NL sample, and was near “slightly concerned” for the SE sample.

For the curvilinear models, the fixed effects revealed in general the highest symptom levels at the beginning of the pandemic, in April 2020. For some outcomes, this was followed by a decrease over time until around November 2020, after which increases occurred to the end of the one-year observation period, though not to initial levels. In the US and NL samples, restricted intake, compensatory behaviors, and most of the pandemic-related ED concerns variables followed this pattern. In the US sample, binge eating and anxiety about being unable to exercise also followed this pattern. Exceptions to the curvilinear U-shaped pattern described above were anxiety about being unable to exercise and concerns about having access to enough food in the SE sample, which were

TABLE 3 Predictors of eating disorder symptoms and general anxiety symptoms during the first year of the COVID-19 pandemic in US, SE, and NL

Predictors	Country	Outcomes				
		Binge eating B (SE)	Restricted intake B (SE)	Compensatory behaviors B (SE)	Anxiety about being unable to exercise B (SE)	General anxiety symptoms B (SE)
Race ^a	US	-	-	-	-	-
Ethnicity ^a	US	-	-	-	-	-
Female	US	-	-	-	-	-
	SE	-	-	-	-	-
	NL	-	-	-	-	-
AN diagnosis	US	-0.26 (0.05)***	0.32 (0.08)***	0.26 (0.06)***	0.21 (0.06)***	0.96 (0.29)**
	SE	-0.18 (0.04)***	-	0.16 (0.03)***	-	-
	NL	-0.15 (0.06)*	0.24 (0.07)***	-	-	1.13 (0.41)**
Binge-type diagnosis	US	0.38 (0.05)***	-0.19 (0.08)*	-	-	-
	SE	0.30 (0.03)***	-	0.10 (0.03)**	-	-
	NL	0.56 (0.06)***	-0.23 (0.07)**	-	-	-
Active eating disorder	US	0.10 (0.04)**	0.24 (0.06)***	0.22 (0.05)***	-	0.94 (0.22)***
	SE	-	-	0.25 (0.05)***	-	-
	NL	-	-	0.33 (0.07)***	0.20 (0.09)*	1.54 (0.41)***
Treatment	US	-	-	-	-	-
	SE	-0.13 (0.06)*	-	-	-	-
	NL	-	-	-	0.12 (0.06)*	-
COVID-19 exposure	US	-	-	-	-	-
	SE	-	-	-	-	-
	NL	-	-	-	-	-
Lockdown	US	-	-	-	-	-
	SE	-	-	-	-	-
	NL	-	0.22 (0.05)***	0.11 (0.05)*	0.19 (0.08)*	-
Worries about COVID-19 infection	US	-	-	-	0.07 (0.02)***	0.74 (0.08)***
	SE	-	0.04 (0.01)**	-	0.08 (0.02)***	-
	NL	-	0.05 (0.02)**	-	0.11 (0.02)***	0.68 (0.08)***
Job loss ^b	US	-	-	-	-	-
	SE	-	-	-	-	-
	NL	-	-	-	-	-
COVID-19 death	US	-	0.13 (0.06)*	-	-	-
	SE	-	-	-	-	-
	NL	-	-	-	-	-
Concerns about...having enough food	US	-	-	-	-	0.27 (0.13)*
	SE	-	-	-	-0.13 (0.06)*	-
	NL	0.06 (0.02)**	0.11 (0.03)***	-	-	-
...accessing foods consistent with meal plan	US	-	0.10 (0.03)**	-	0.07 (0.03)**	-
	SE	-	0.10 (0.03)**	0.06 (0.02)*	0.16 (0.05)**	-
	NL	-	0.10 (0.03)***	0.09 (0.03)**	0.17 (0.04)***	-
...lack of structure	US	0.05 (0.02)**	0.14 (0.03)***	0.06 (0.02)**	0.10 (0.02)***	0.42 (0.11)***
	SE	0.08 (0.02)***	0.16 (0.03)***	0.13 (0.02)***	0.22 (0.04)***	-
	NL	0.06 (0.02)***	0.17 (0.02)***	0.17 (0.02)***	0.10 (0.03)***	0.36 (0.10)***
...lack of social support	US	-	0.09 (0.03)**	0.08 (0.02)***	-	0.49 (0.10)***
	SE	-	0.08 (0.03)**	-	-	-
	NL	-	0.10 (0.02)***	0.09 (0.02)***	-	0.66 (0.10)***

(Continues)

TABLE 3 (Continued)

Predictors	Country	Outcomes				
		Binge eating B (SE)	Restricted intake B (SE)	Compensatory behaviors B (SE)	Anxiety about being unable to exercise B (SE)	General anxiety symptoms B (SE)
...living in triggering environment	US	0.06 (0.01)***	0.06 (0.03)*	0.09 (0.02)***	0.08 (0.02)***	0.40 (0.09)***
	SE	0.11 (0.02)***	0.08 (0.02)***	0.11 (0.02)***	0.14 (0.04)***	-
	NL	0.09 (0.02)***	0.06 (0.02)**	0.14 (0.02)***	0.11 (0.03)***	0.39 (0.09)***
...cost of food	US	-	-	-	-	-
	SE	-	0.12 (0.03)***	-	-	-
	NL	0.06 (0.02)*	-	-	-	-
...cost of treatment	US	-	-	0.05 (0.02)*	0.09 (0.03)**	0.23 (0.11)*
	SE	-	-	0.08 (0.03)*	-	-
	NL	-	0.08 (0.04)*	-	-	-

Note: For clarity of presentation, only significant predictors are shown; extended results are in Table S3

Abbreviations: AN, anorexia nervosa; B, unstandardized beta coefficient; NL, Netherlands; SE, Sweden; US, United States.

^aRace and ethnicity were not assessed in SE and NL.

^bJob loss was not included as a predictor in SE models due to no variance ($\sigma^2 = 0$) as no one lost their job.

* $p < .05$. ** $p < .01$. *** $p < .001$.

characterized by a curvilinear increase from baseline until around December 2020, after which there was a decline to the initial level (Figure 2). Random intercept and slope variances were generally statistically significant in the curvilinear models (Table 2), suggesting that baseline levels and rate of change in the outcomes varied significantly among participants.

The next most common pattern was described best by the unconditional linear growth model and a significant negative fixed effect of Time. Participants had the highest level of symptoms at baseline followed by a steady decline over the one-year follow-up period. In all three countries, concern about being able to afford the foods needed for recovery due to COVID-19-related loss of income followed this pattern. In both the US and NL, concern about treatment cost followed this pattern. In the US, general anxiety also followed this pattern. In SE, restricted intake and concerns about accessing meal plan foods, lack of structure, and triggering environment followed this pattern, and anxiety about being unable to exercise followed this pattern in the NL sample.

The third pattern was the least common. In these models, there were no statistically significant fixed effects of Time, reflecting stability of symptoms over the study time frame. In SE and NL, binge eating and general anxiety symptoms did not change over time, and unique to SE, compensatory behaviors, concerns about a lack of social support, and concerns about the cost of treatment did not change over time.

3.3 | Predictors of eating disorder symptoms over time

For all countries, the univariate models (i.e., separate models per predictor) for each outcome are presented in Tables S1 and S2. Tables 3

and 4 present the multivariable models, and for clarity of presentation, only statistically significant results are shown; full results are provided in Tables S3 and S4. Age was considered as an analysis covariate, given that it can be a proxy for duration of illness in EDs and may have impacted relative concern about health outcomes secondary to COVID-19. Although age was not significantly associated with outcomes in the US sample, there were some significant correlations with outcomes in the NL and SE samples (for p 's $< .05$, r 's ranged between $-.11$ and $.08$), therefore age was included as a covariate in those particular analyses.

In all three countries, exploratory variables predicted binge eating, restricted intake, compensatory behaviors, and anxiety about being unable to exercise in our multivariate models. In the US, worse ED outcomes were predicted by AN history, binge-type diagnosis, having an active ED, knowing someone who had died of COVID-19, and several pandemic-related ED concerns (i.e., access to meal plans, lack of structure and social support, triggering environment, and treatment costs). Many of the same predictors were significant in SE and NL with worries about infection predicting worse outcomes in both countries and being in lockdown predicting worse outcomes in NL. Unique to SE, being in treatment was a protective factor against binge eating.

3.4 | Predictors of pandemic-related eating disorder concerns over time

In all three countries, binge-type diagnosis, active ED, and being in lockdown predicted worse concerns about lack of structure. Additionally, an active ED and worries about COVID-19 infection positively predicted concerns about accessing foods. Similarly, worries about infection also predicted concerns about having enough food in all three countries. In the US and NL (and not in SE), worries about infection predicted

TABLE 4 Predictors of pandemic-related eating disorder concerns during the first year of the COVID-19 pandemic in US, SE, and NL

Predictors	Country	Pandemic-related eating disorder concerns about...									
		...having enough food B (SE)	...accessing foods consistent with meal plan B (SE)	...lack of structure B (SE)	...lack of social support B (SE)	...living in triggering environment B (SE)	...cost of food B (SE)	...cost of treatment B (SE)			
Race ^a	US	-	-	-	-	-	-	-	-	-	-
Ethnicity ^a	US	-	-	-	-	-	-	-	-	-	-
Female	US	-	-	-	-	-	-	-	-	-	-
	SE	-	-	-	-	-	-	-	-	-	-
	NL	-	-	-	-	-	-	-	-	-	-
AN diagnosis	US	-	-	-	0.18 (0.06)**	-	-	-	-	-	-
	SE	-	-	-0.11 (0.05)*	-	-	-	-	-	-	-
	NL	-	-	-	-	-0.25 (0.09)**	-	-	-	-	-
Binge-type diagnosis	US	-	-	0.20 (0.06)**	-	-	0.19 (0.07)**	-	-	-	-
	SE	-	-	0.23 (0.05)***	-	-	-	-	-	-	-
	NL	-	-	0.33 (0.08)***	-	-	0.30 (0.09)**	-	-	-	-
Active eating disorder	US	-	0.19 (0.05)***	0.36 (0.05)***	0.34 (0.05)***	0.36 (0.05)***	0.36 (0.05)***	0.19 (0.05)***	-	-	-
	SE	0.14 (0.04)**	0.39 (0.06)***	0.67 (0.08)***	-	-	-	-	-	-	-
	NL	0.32 (0.08)***	0.58 (0.07)***	0.53 (0.07)***	0.54 (0.08)***	0.58 (0.08)***	0.58 (0.08)***	0.19 (0.05)***	-	-	-
Treatment	US	-	0.14 (0.05)**	-	0.16 (0.06)**	-	-	-	-	-	-
	SE	-	0.14 (0.06)*	0.23 (0.08)**	-	-	-	-	-	-	-
	NL	-	-	-	-	-	-	-	-	-	-
COVID-19 exposure	US	-	-	-	-	-	-	-	-	-	0.12 (0.04)**
	SE	-	-	-	-	-	-	-	-	-	-
	NL	-	-	-	-	-	-	-	-	-	-
Lockdown	US	0.23 (0.05)***	0.18 (0.04)***	0.10 (0.04)*	-	-	-	0.08 (0.03)*	-	-	-
	SE	-	-	0.255 (0.05)***	-	-	-	-	-	-	-
	NL	0.16 (0.07)*	0.22 (0.05)***	0.11 (0.06)*	0.15 (0.06)**	-	-	-	-	-	-
Worries about COVID-19 infection	US	0.10 (0.02)***	0.16 (0.02)***	0.12 (0.02)***	0.13 (0.02)***	0.11 (0.02)***	0.11 (0.02)***	0.09 (0.01)***	0.08 (0.02)***	-	-
	SE	0.11 (0.01)***	0.12 (0.01)***	-	-	-	-	-	-	-	-
	NL	0.18 (0.03)***	0.15 (0.02)***	0.18 (0.02)***	0.16 (0.02)***	0.10 (0.02)**	0.10 (0.02)**	0.09 (0.03)**	-	-	-

(Continues)

TABLE 4 (Continued)

Predictors	Country	Pandemic-related eating disorder concerns about...						
		...having enough food B (SE)	...accessing foods consistent with meal plan B (SE)	...lack of structure B (SE)	...lack of social support B (SE)	...living in triggering environment B (SE)	...cost of food B (SE)	...cost of treatment B (SE)
Job loss ^b	US	-	-	-	-	-	0.16 (0.04)***	0.22 (0.05)***
	SE	-	-	-	-	-	-	-
	NL	0.37 (0.14)**	-	-	-	-	0.29 (0.13)*	0.30 (0.13)*
COVID-19 death	US	-	-	-	-	-	-	-
	SE	-	-	-	-	-	-	-
	NL	-	-	-	-	-	-	-

Note: For clarity of presentation, only significant predictors are shown; extended results are in Table S4
 Abbreviations: AN, anorexia nervosa; B, unstandardized beta coefficient; NL, Netherlands; SE, Sweden; US, United States.

^aRace and ethnicity were not assessed in SE and NL.

^bJob loss was not included as a predictor in SE models due to no variance ($\sigma^2 = 0$) as no one lost their job.

* $p < .05$. ** $p < .01$. *** $p < .001$.

increased concerns about lack of structure, lack of social support, triggering environment, and the cost of food. Concerns about the cost of treatment was positively predicted by an active ED, being in treatment, COVID-19 exposure, worries about COVID-19 infection, and job loss in the US only. No variables predicted concerns about the cost of treatment in SE, and only job loss predicted these concerns in NL.

3.5 | Predictors of general anxiety symptoms over time

In the US and NL, general anxiety was positively predicted by AN, active ED, worries about infection, lack of structure, lack of social support, and triggering environment. Concerns about having enough food and treatment cost were further significant predictors of general anxiety in the US sample. In SE, no predictors of general anxiety were significant.

4 | DISCUSSION

This study evaluated patterns and predictors of ED symptoms, pandemic-related ED concerns, and anxiety symptoms across the first 12 months of the COVID-19 pandemic among individuals with an ED history in three different countries: the US, SE, and NL.

4.1 | Course of eating disorder symptoms, pandemic-related eating disorder concerns, and general anxiety over the first year of the COVID-19 pandemic

In the US sample, ED symptoms demonstrated a curvilinear pattern across time with the highest levels of symptoms at the beginning of the pandemic decreasing the first several months, and then increasing in November 2020 through the rest of the study period. Similar patterns were found in the NL sample for restricted intake, compensatory behaviors, and all pandemic-related ED concerns except for concerns about food and ED treatment cost. These findings mirror the World Health Organization report for tracking COVID-19 infections in all three countries (see Figure 1; World Health Organization, 2022), suggesting peaks in COVID-19 infection rates and greater stringency of public health restrictions may be related to increases in ED symptoms and pandemic-related ED concerns among people with EDs. These patterns may also reflect constraints on outdoor activities and disruptions to normal routines, with the highest disruption being observed in the beginning when the course of the pandemic was largely unknown (Rodgers et al., 2020). Additionally, although prior evidence suggests the holidays are a particularly vulnerable time for individuals with EDs (Dannibale, 2014), the holiday season of 2020 may have been especially distressing due to concerns about spreading COVID-19 to family members and public health policies urging people not to travel and to isolate rather than participate in large family gatherings. The holiday period during the pandemic could have increased feelings

of isolation, depression, and ED symptoms among people with EDs (Marks, 2020). Interestingly, data indicate that suicide rates in each country do not appear to mirror COVID-19 infection rates throughout the first year (Kim, 2022; Rück et al., 2020; van der Burgt et al., 2022; World Health Organization, 2022), suggesting that these findings may be unique to ED symptoms and do not necessarily reflect trends in mental health symptoms more broadly.

Another temporal pattern that emerged was a steady linear decline over the first pandemic year. In the US sample, general anxiety symptoms demonstrated a steady linear decline over the 12-month period, which mirrors longitudinal data in Germany suggesting that individuals may have habituated to some degree to the pandemic during the first year (Mata et al., 2021). Additionally, the declining fatality rate of COVID-19 in the first pandemic year (Preskorn, 2020) and the availability of vaccinations toward the end of the study period (Anthes, 2021) may also have lessened general anxiety symptoms. Similarly, concerns about food and treatment costs due to loss of income associated with COVID-19 did not show the U-shaped curvilinear change like other concerns, perhaps owing to greater economic impacts (i.e., job losses, furloughs, hiring freezes) at the pandemic beginning compared with later as economic stimulus packages emerged.

In contrast to periods of high impact of COVID-19 on study outcomes and declining or curvilinear change over subsequent COVID-19 infection peaks, the SE sample had the lowest baseline means on the study outcomes and experienced no changes in frequency of binge eating and compensatory behaviors, concerns about social support and cost of treatment, and general anxiety over the first pandemic year. In the NL sample, binge eating and general anxiety followed this pattern. The recruitment methods within and between countries varied, and the Swedish sample seemed different in composition from the US and Dutch samples, which generally seemed similar. Approximately 16% of the SE sample reported a current ED in contrast to 43% in the US and 59% in the NL samples, which was consistent with a lower rate of treatment engagement (11% in SE sample in contrast to 55% and 51% in the US and NL samples respectively). Therefore, being in recovery from an ED may be one explanation for these findings (Birgegård et al., 2021). Indeed, those with an active ED in SE fared worse on COVID-specific impact on binge eating and compensatory behaviors, lending support to this conjecture. Socialized medicine in SE might explain the lack of concern about treatment cost. Another factor that may have played a role is country-level responses to COVID-19, with SE among the countries adopting less stringent policies and SE and NL providing among the strongest economic stimulus responses (Siddik, 2020). The US and NL adopted similar public health policies related to social distancing, masking, and lockdown policies. Evidence suggests US media coverage of the pandemic contributed to fear, panic, and worsening mental health symptoms (Su et al., 2021). In contrast, SE had a less restrictive approach with no lockdowns and a focus on slowing rather than stopping the virus (Ludvigsson, 2020). Finally, recruitment methods differed by country. The US and SE recruited participants who consented to being recontacted from other studies about EDs. However, the US and NL

also recruited via social media, whereas SE did not. Possibly, social media recruits self-selected based on their active ED status and interest in the study.

4.2 | Predictors of eating disorder symptoms, pandemic-related eating disorder concerns, and general anxiety over the first year of the COVID-19 pandemic

Our data indicate that individuals with eating disorders in all three surveyed countries experienced a worsening of their mental health (ED-related and otherwise) during the first year of the COVID-19 pandemic, but these were a few notable differences between countries. For example, concerns about lack of structure and living in a triggering environment predicted increases in each ED symptom in the US, SE, and NL. Additionally, concerns about accessing foods and lack of social support predicted more restricted intake in all countries. Consistent with the findings related to the parallel courses in ED symptoms and concerns between the US and NL, similarities were found between the US and NL regarding predictors (e.g., worries about COVID-19 infection and lack of social support predicted general anxiety symptoms in the US and NL), but not in SE. As noted above, these comparable findings between the US and NL, and the differences in SE, may reflect the varying public health policies between countries with the US and NL adopting more similar and strict policies with SE implementing a less restrictive approach.

Overall, these findings demonstrate worries about COVID-19 infection and being in quarantine or lockdown are robust predictors associated with increased symptoms over time. Interestingly, actual exposure to COVID-19 did not predict as many outcomes as worries about infection which could suggest anticipatory anxiety related to future threat uncertainty is of more concern than the event itself, and similarly, intolerance of uncertainty could be another mechanism (Grupe & Nitschke, 2013). Being unable to tolerate uncertainty during times of crisis may generate maladaptive coping through ED behaviors to regain a sense of personal control. Indeed, intolerance of uncertainty has been implicated as a vulnerability and maintenance factor in EDs (M. Brown et al., 2017).

4.3 | Limitations and strengths

Limitations of the current study include the analysis of data from each country separately, which could not be combined due to data sharing restrictions across countries and the use of nonpsychometrically validated measures (due to the time-sensitive urgency of fielding a survey at the beginning of the pandemic and the lack of validated pandemic-related measures at the time). By using single items, it is possible we did not appropriately capture the full conceptualization of each symptom (e.g., the wording about being “anxious” to exercise might not represent the precise sentiment that individuals with exercise symptoms felt). Additionally, the samples in each country were racially and

ethnically homogenous with more than 90% identified as non-Hispanic Caucasian females which limits generalizations to other racial and ethnic groups. Another limitation was the different number of time points across countries; however, the US and NL were most similar in design. Although a strength of MLM is that it makes use of all available observations and thus accounts for missing data in longitudinal analyses (Singer & Willett, 2003), there was variation in attrition between time points in the US and across countries. Given the unique historical context of understanding ED symptoms during a largely unprecedented global pandemic, the exploratory nature of the study aims, and the desire to test and identify predictors from an inclusive perspective given that any of these predictors could be important clinically, we followed the analytic approaches of prior studies and did not correct for potential alpha inflation (Hawes et al., 2021; Terracciano et al., 2020; Wright & Fancourt, 2021). As a result, these results may be vulnerable to Type I errors. We placed a greater emphasis on reducing Type II errors, otherwise known as false-negatives. The choice of the specific three countries reflected the locations of the collaborators' IRBs and research infrastructure, and differences in analytic timepoints and recruitment methods reflected site factors (i.e., independent IRB timelines, recruitment pools) and the time-sensitive need to rapidly expedite data collection on COVID-19 impact. Ideally, longitudinal data from many economically, culturally, and geographically diverse countries would be collected together.

Further limitations include the use of convenience samples and that individuals self-selected based on their interest in participating in the research, which mean that the sample may not be established as being representative, our use of self-reported ED diagnoses which were not verified by trained clinicians, and the study design, which did not include a non-ED control group to make comparisons and reduced some conclusions that could be made.

Despite these limitations, strengths of the current study include the number of time points collected as part of the longitudinal design. To the best of our knowledge, other longitudinal examinations of ED symptoms during the pandemic assessed a maximum of three time points. By analyzing up to 13 time points, we were able to understand the pattern of change across time in more detail. Additionally, the inclusion of data in three countries strengthens the generalizability of conclusions, particularly given the data reflects several countries with varying public health responses.

4.4 | Implications and future directions

These findings have important clinical implications for caring for people with EDs during a pandemic. The similarities in courses between ED symptoms and infection rates suggests individuals may have used ED symptoms to regulate negative affect associated with the pandemic which is consistent with affect regulation models of EDs (Heatherton & Baumeister, 1991; Wonderlich et al., 2015). This could be explored with patients in therapy, further, case formulations could be updated to incorporate stressors that possibly exacerbate ED symptoms in pandemic crises (i.e., increased time living in a triggering

environment, lack of structure, lack of social support, lockdowns). This study only examined behavioral ED symptoms, and although some of the pandemic-related ED concerns may tap into cognitive-affective ED symptoms (i.e., concerns about lack of structure could tap into feelings of loss of control over eating), more research is needed to assess other cognitive-based ED symptoms including overvaluation of weight and shape, fear of weight gain, or feeling fat. Future research should also track the degree of associations between changes in ED symptoms with COVID-19 infection rates, which was not possible in this study because participants were recruited from diverse locations within countries.

Regarding public health implications, results demonstrating the negative impact of worries about infection and being in lockdown highlight the need for public health measures that provide adequate information and protection while not increasing anxiety and mental health symptoms. A public health emergency requires quick action focused on the well-being of the majority of individuals, but the ED field must act quickly to aid our patients in finding ways to follow public health guidance in a pandemic while offsetting potential mental health ill-effects. These findings can assist community-based organizations to efficiently disseminate evidence-based information and resources at times of pandemic, as these are the first points to which patients, their families, and professionals typically turn for support. Importantly, ED community-based organizations require ongoing financial support to quickly mobilize information and support and achieve this critical task.

Finally, it is of note that concerns about accessing meal plan foods predicted greater restricted intake, compensatory behaviors, and anxieties about being unable to exercise. At several points throughout the pandemic, disruptions to the food supply chain and "panic buying" led to low inventory and empty grocery stores (Felix et al., 2020; Lewis, 2020) which interferes with one's ability to adhere to their recovery meal plan. Although there are no empirical data evaluating the effects of "panic buying" on ED symptoms, the current data suggest that concerns about food access predicted ED symptoms, which may be related to supply chain issues or self-isolation preventing grocery shopping owing to worries about infection.

Future research should focus on the application of evidence-based practices for ED treatment during the pandemic (e.g., delivery via telehealth). More data are needed to understand how treatments can adjust to target these pandemic-related ED concerns while adhering to the evidence-base. Additionally, it is important to understand not only the experience of individuals with EDs, but also that of clinicians to identify potential challenges faced in delivering ED treatment during the pandemic. Finally, more research is needed to evaluate these constructs in non-European countries and among individuals with more varied demographic presentations.

5 | CONCLUSIONS

In conclusion, peaks in ED symptoms and pandemic-related ED concerns mirrored peaks in COVID-19 infection with some increases

occurring between November 2020 and January 2021. Although the pandemic had clear negative impacts on the mental health of people with EDs, country-specific differences were observed.

AUTHOR CONTRIBUTIONS

Katherine A. Thompson: Conceptualization; formal analysis; project administration; methodology; writing – original draft. **Elin Hedlund:** Formal analysis; writing – review and editing. **Quan Sun:** Conceptualization; methodology; writing – review and editing. **Christine M. Peat:** Conceptualization; writing – review and editing. **Rachel W. Goode:** Conceptualization; writing – review and editing. **Jet D. Termorshuizen:** Conceptualization; writing – review and editing. **Laura M. Thornton:** Conceptualization; writing – review and editing. **Stina Borg:** Conceptualization; investigation; methodology. **Eric F. van Furth:** Conceptualization; investigation; writing – review and editing. **Andreas Birgegård:** Conceptualization; formal analysis; investigation; methodology; resources; supervision; writing – review and editing. **Cynthia M. Bulik:** Conceptualization; funding acquisition; investigation; project administration; resources; supervision; writing – review and editing. **Hunna J. Watson:** Conceptualization; methodology; project administration; supervision; writing – review and editing.

ACKNOWLEDGMENTS

Dr. Bulik acknowledges support from the National Institutes of Health (R01MH118278, R01MH119084, R01MH120170, R01MH124871), Brain and Behavior Research Foundation Distinguished Investigator Grant, Swedish Research Council (Vetenskapsrådet, Grant/Award Number: 538-2013-8864), and Lundbeck Foundation (Grant no. R276-2018-4581). Dr. Peat acknowledges support from the Agency for Healthcare Research and Quality (EPC VI RFTO #45) and the Health Resources and Services Administration (D40-HP45688). Drs. Peat, Goode, and Bulik acknowledge support from the Substance Abuse and Mental Health Administration (H79 SM081924). Dr. Goode acknowledges support from K23DK129832.

CONFLICT OF INTEREST

C.M.B. reports: Shire (grant recipient, Scientific Advisory Board member); Pearson (author, royalty recipient); Equip Health Inc. (Clinical Advisory Board); C.M.P reports: Equip Health (Clinical Advisory Board).

DATA AVAILABILITY STATEMENT

The datasets analyzed are available from the corresponding author on reasonable request.

IRB STATEMENT

The study was approved by the Biomedical Institutional Review Board of The University of North Carolina (IRB number 20-0964) (United States) and the Swedish Ethical Review Authority (Dnr 2020-04136) (Sweden). The Medical Research Ethics Committee of Leiden University Medical Centre reviewed the study protocol and decided that the Medical Research Involving Human Subjects Act (WMO) does not apply to this study (Netherlands). Informed

online consent was provided by participants in all three countries. This study was performed in line with the principles of the Declaration of Helsinki and in conformity with local regulations and guidelines.

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How to cite this article: Thompson, K. A., Hedlund, E. L., Sun, Q., Peat, C. M., Goode, R. W., Termorshuizen, J. D., Thornton, L. M., Borg, S., van Furth, E. F., Birgegård, A., Bulik, C. M., & Watson, H. J. (2022). Course and predictors of eating disorder symptoms, anxiety symptoms, and pandemic-related eating disorder concerns among adults with eating disorders during the first year of the COVID-19 pandemic. *International Journal of Eating Disorders*, 1–18. <https://doi.org/10.1002/eat.23870>