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“Can you see me?” Videoconferencing and eating disorder risk during COVID-19: Anxiety, impairment, and mediators

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Abstract

Objective: The use of videoconferencing has increased during the pandemic, creating prolonged exposure to self-image. This research aimed to investigate whether eating disorder (ED) risk was associated with videoconferencing performance for work or study and to explore whether the use of safety behaviors and self-focused attention mediated the relationship between ED risk and perceived control over performance anxiety, impaired engagement, or avoidance of videoconferencing for work or study.

Method: In 2020, an online survey was distributed within Australia to those aged over 18 years via academic and social networks, measuring: use of videoconferencing for work/study, demographics, ED risk, safety behaviors for appearance concerns, self-focused attention, perceived control over performance anxiety, perceived engagement impairment, and avoidance of videoconferencing. A total of 640 participants (77.3% female, $M_{\text{age}} = 26.2$ years) returned complete data and were included in analyses.

Results: 245 participants (38.7%) were considered at-risk for EDs (SCOFF > 2). Those at-risk reported significantly more safety behaviors, self-focused attention, impaired engagement, and avoidance, plus lower perceived control over performance anxiety than those not at-risk. Multiple mediation models found the effects of ED risk on control over performance anxiety, impaired engagement, and avoidance were partially mediated by safety behaviors and self-focused attention.

Discussion: Our cross-sectional findings suggest videoconferencing for work/study-related purposes is associated with performance anxiety, impaired engagement, and avoidance among individuals at-risk for EDs. Poorer videoconferencing outcomes appear more strongly related to social anxiety variables than ED status. Clinicians and educators may need to provide extra support for those using videoconferencing.

Public Significance: Because videoconferencing often involves seeing your own image (via self-view) we wondered whether the appearance concerns experienced by those with eating disorders (EDs) might interfere with the ability to focus on or to contribute to

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work/study videoconferencing meetings. We found that although those with EDs experience more impairments in their videoconferencing engagement/contribution, these were linked just as strongly to social anxiety as they were to appearance concerns.

KEYWORDS

anxiety, appearance concerns, body image, COVID-19, eating disorders, engagement, safety behaviors, self-focused attention, self-view, videoconferencing

1 | INTRODUCTION

The onset of the COVID-19 pandemic led to a rapid shift in work and study as online videoconferencing replaced in-person meetings and classes. During the first 2 months of the pandemic, the videoconferencing market increased by 500%, with Zoom dominating as the chosen application, capturing 50% of all videoconferencing platform use as of 2021 (TrustRadius 2021). Although convenient and necessary for social distancing, videoconferencing involves much greater exposure to one's own appearance, and for longer periods of time, than previous in-person fora. In the past, the absence of your own reflection during meetings for work or study would mean relatively little awareness of one's self-image. During videoconferencing, however, the image created by your own camera (i.e., self-view) is typically visible on the conferencing screen, effectively placing a mirror within constant gaze. Previous research has reported that heightened appearance concerns can be experienced after just 2.5 min of mirror exposure (Veale et al., 2016), and this finding is supported by other studies with varied exposure times (Kollei & Martin, 2014; Windheim et al., 2011). Given that videoconferencing may occur across much of the work or study day, these negative effects may have been strengthened during the pandemic due to prolonged exposure to self-view.

1.1 | Videoconferencing and appearance concerns

Research into the impact of videoconferencing on appearance concerns began during the pandemic (Chen et al., 2021; Choukas-Bradley et al., 2022; Cristel et al., 2020; Gullo & Walker, 2021; Harriger & Pfund, 2022; Hart et al., 2022; Pfund et al., 2020; Pikoos et al., 2021; Rice et al., 2021). Of the eight known studies published to date, six found a positive relationship between videoconferencing use and appearance concerns, one found a negative relationship (Harriger & Pfund, 2022), and one found no significant association (Gullo & Walker, 2021). The studies, however, used considerably different methods and conflicting outcomes may have resulted from variations in measures of videoconferencing and of appearance concerns.

In a recent review of the literature, Hart and colleagues (Hart et al., 2022) note that although *time spent* using videoconferencing showed inconsistent associations with appearance concerns across studies, two consistent findings did arise: (i) use of videoconferencing was associated with an increase in desire for cosmetic surgery and other non-surgical treatments (i.e., fillers, botox); and (ii) *time spent focused on self-view* was related to greater appearance concerns. What

was not clear, however, was whether the focus on self-view was related to self-focused attention unrelated to appearance (as seen in social or performance anxiety), or to greater monitoring of appearance (as seen in body dissatisfaction or eating disorders in particular). One method for parsing out this difference would be to examine the use and frequency of appearance management or “appearance safety behaviors” and how these compare to self-focused attention unrelated to appearance, during videoconferencing. As yet, videoconferencing studies have not compared these variables, nor have they investigated videoconferencing among people at-risk for eating disorders (EDs). These individuals may be a particularly vulnerable subgroup, given the salience of appearance concerns in most EDs.

1.2 | Videoconferencing and EDs

The concurrent surge in EDs (Linardon et al., 2022; Rodgers et al., 2020; Sideli et al., 2021) and the use of videoconferencing during the pandemic, make understanding the links between the two a vital endeavor. We propose that because people living with or at-risk of EDs tend to experience greater levels of appearance concerns than the general population—by definition those with anorexia or bulimia nervosa experience an over-valuation of weight and shape (Fairburn, 2008)—they are more likely to experience performance anxiety during videoconferencing than those who are not experiencing ED symptoms, and this, in turn, may have led to greater impairments in school or work during COVID-19 stay-at-home orders. In this paper, we use the term “at-risk” to refer to individuals with active disordered eating symptoms who would potentially meet the diagnosis for an eating disorder, rather than to refer to individuals who are early in their illness trajectory.

1.3 | Implications for videoconferencing performance: Anxiety, control, and engagement

A known consequence of appearance concerns is performance impairment and reduced vocation and educational outcomes (Fredrickson et al., 1998; Kiefer et al., 2006; Winn & Cornelius, 2020). One way in which appearance concerns may lead to impaired performance is through an increase in performance anxiety. The anxiety-performance relationship is complex; feeling some level of anxiety and its associated physiological arousal can be beneficial for performance, but only when the performer feels they are able to control (regulate) their anxiety symptoms (Cheng et al., 2009; Cheng & Hardy, 2016). Strong

sensations of anxiety can cause flight/fight or freeze responses, which impair good performance (Cheng & Hardy, 2016). *Perceived control over performance anxiety* is therefore an important predictor of successful performance (Cheng et al., 2009); greater “perceived control” allows individuals to regulate their anxiety such that it enhances rather than detracts from performance (Cheng & Hardy, 2016).

Another pathway for appearance concerns to lead to impaired performance is reduced or impaired engagement in classes or meetings. Findings from previous body image research show that appearance concerns are associated with reductions in sport participation (Slater & Tiggemann, 2011; Vani et al., 2020), and work functioning (Becker et al., 2017), as individuals fear negative evaluation and avoid engagement. Understanding whether appearance concerns are associated with reductions in perceived control over performance anxiety or with reductions in contributions/engagement during videoconferencing for school or work, is a new frontier of pandemic-related research, and one that is especially pertinent to those at-risk of EDs.

1.4 | Safety behaviors and self-focused attention: Potential mediators of the appearance concern-performance relationship

Safety behaviors include overt or covert actions that individuals use to reduce anxiety in specific situations (Reilly et al., 2021). In EDs, safety behaviors are thought to manifest from an over-valuation of weight and shape (Fairburn, 2008). Behaviors such as body checking or scanning provide a temporary reduction in appearance-related anxiety, however, in the long term, they reinforce appearance as the basis of self-worth, and ED behaviors as the mechanism to achieve unsustainable body ideals (Mitchison et al., 2013; Nikodijevic et al., 2018).

In the context of videoconferencing, safety behaviors may present as complete avoidance (e.g., not attending the call or not turning the camera on), or as appearance “fixing” (e.g., adjusting lighting/camera angle, using filters, hair or make-up); (Nikodijevic et al., 2018). In addition, during videoconferencing body checking may manifest as monitoring self-view, or in other words, as self-focused attention.

Self-focused attention is a construct theorized as important in the maintenance of social anxiety (Clark & Wells, 1995). Historically, self-focused attention has been conceptualized as the process where one's attention is redirected from the social setting to self-referent information. The redirection of attention has a number of consequences, including an increased reliance on safety behaviors (which are used to reduce the perceived threat of negative appraisals and thereby anxiety), and a reduced capacity to take in other information (leading to reduced engagement or performance impairment). Both safety behaviors and self-focused attention maintain social anxiety as they prevent the information needed to disconfirm fears of negative evaluation from being processed.

Although not originally conceptualized as specific to *appearance* anxiety, these mechanisms likely function in the same way when attention is focused on appearance during social interactions. For example, previous research investigating social media and appearance concerns found that selfie behaviors—the taking of self-portraits and using filters, poses, lighting and angles to improve appearance—were associated with increased

body checking (Yellowlees et al., 2019) and disordered eating (Cohen et al., 2018; Yellowlees et al., 2019). Further, in support of the self-focussed attention-anxiety loop, the more one invests in appearance enhancement for social media, the more appearance concerns are reported (Wang et al., 2019). Thus, similar relationships may be active during videoconferencing and exposure to self-view.

1.5 | The present study

The aim of the current study was to investigate whether videoconferencing outcomes (perceived control over performance anxiety, impaired engagement, and avoidance) differed according to ED risk status (independent variable; IV). In addition, we sought to examine whether the relationships between videoconferencing outcomes and ED risk status were mediated by the use of safety behaviors for appearance concerns, or levels of self-focused attention unrelated to appearance. We hypothesized that:

1. Individuals at-risk for ED would show significantly greater frequency in safety behaviors and self-focused attention during videoconferencing, than those not at-risk.
2. Videoconferencing safety behaviors and self-focused attention would be associated with lower levels of perceived control over performance anxiety, higher impaired engagement, and greater avoidance of videoconferencing. Further, it was expected that these relationships would be stronger in those at-risk for EDs than those not at-risk.
3. Safety behaviors and self-focused attention during videoconferencing would mediate the relationship between ED risk and control over performance anxiety, ED risk, and impaired engagement, as well as ED risk and avoidance.

If found to be significant, these relationships may provide guidance to clinicians who are supporting those with or at-risk of EDs, to effectively use videoconferencing tools without exacerbating appearance concerns and impairing engagement in remote online work or study.

2 | METHOD

2.1 | Participants

Participants were recruited from Australian university mailing lists, and the general community, through online ads and social media. A total of 651 participants completed the survey. Of those, 11 identified with a gender other than male/female. Their data were removed from analyses, given that appearance concerns among this group may be qualitatively different from those of other genders (McGuire et al., 2016; Tabaac et al., 2018). This left a final sample of 640 (78.8% female; see Table 1 for demographics).

Participants ranged in age from 17 to 76 years, with a mean of 26.2 years ($SD = 11.3$). Most were students ($n = 309$, 48.3%). The mean body mass index (BMI; kg/m^2) was 23.1 ($SD = 4.95$). Participants predominantly identified as White ($n = 333$, 52.0%), as well as

TABLE 1 Characteristics of the total sample, those at-risk of an eating disorder (ED), and those not at-risk

Variables	Total (N = 640)	At-risk of ED ^a (n = 249)	Not at-risk (n = 391)	p
Demographic characteristics				
Age in years (M, SD)	26.2 (11.3)	24.6 (9.9)	27.2 (12.0)	.002
Gender (n, % female)	504 (78.8%)	217 (87.1%)	287 (73.4%)	<.001
Ethnicity (n, % non-White)	307 (48.0%)	140 (56.2%)	167 (42.7%)	.001
Married/living with partner (n, % yes)	87 (13.6%)	20 (8.0%)	67 (17.1%)	.002
Heterosexual (n, % yes)	493 (77.0%)	179 (71.9%)	314 (80.3%)	.018
Body mass index (M, SD)	23.1 (4.95)	23.5 (5.99)	22.8 (4.14)	.100
Employment/student status				
Full-time (n, % yes)	111 (17.3%)	35 (14.1%)	76 (19.4%)	.046
Part-time (n, % yes)	68 (10.6%)	28 (11.2%)	40 (10.2%)	
Casual (n, % yes)	73 (11.4%)	28 (11.2%)	45 (11.5%)	
Student (n, % yes)	309 (48.3%)	116 (46.6%)	193 (49.4%)	
Unemployed (n, % yes)	79 (12.3%)	42 (16.9%)	37 (9.5%)	
Eating disorder history				
Lifetime diagnosis for any ED (n, % yes)	83 (13.0%)	68 (27.3%)	25 (6.4%)	<.001
Anorexia nervosa – binge/purging (n, % yes)	11 (1.7%)	8 (3.2%)	3 (0.8%)	
Anorexia nervosa – restricting (n, % yes)	40 (6.3%)	26 (10.4%)	14 (3.6%)	
Bulimia nervosa – purging (n, % yes)	8 (1.3%)	7 (2.8%)	1 (0.3%)	
Bulimia nervosa – non-purging (n, % yes)	1 (0.2%)	1 (0.4%)	0 (0%)	
Binge eating disorder (n, % yes)	6 (0.9%)	5 (2.0%)	1 (0.3%)	
EDNOS or OSFED (n, % yes)	5 (0.8%)	5 (2.0%)	0 (0%)	
Other eating disorders (n, % yes)	12 (1.9%)	6 (2.4%)	6 (1.5%)	
Body mass index (BMI) category				
BMI <18.5 (n, % yes)	77 (12.0%)	34 (13.7%)	43 (11.0%)	.004
BMI 18.5–24.9 (n, % yes)	402 (62.8%)	144 (57.8%)	258 (66.0%)	
BMI 25–29.9 (n, % yes)	104 (16.3%)	37 (14.9%)	67 (17.1%)	
BMI ≥30 (n, % yes)	57 (8.9%)	34 (13.7%)	23 (5.9%)	
Video conferencing used for work/study				
Zoom (n, % yes)	612 (95.6%)	235 (94.4%)	377 (96.4%)	.218
Microsoft Teams (n, % yes)	258 (40.3%)	103 (41.4%)	155 (39.6%)	.665
Skype (n, % yes)	116 (18.1%)	52 (20.9%)	64 (16.4%)	.148
Google Hangouts (n, % yes)	96 (15.0%)	51 (20.5%)	45 (11.5%)	.002
Webex (n, % yes)	90 (14.1%)	43 (17.3%)	47 (12.0%)	.063
Facebook Messenger (n, % yes)	67 (10.5%)	27 (10.8%)	40 (10.2%)	.805
Whatsapp (n, % yes)	63 (9.8%)	27 (10.8%)	36 (9.2%)	.498
Google Duo (n, % yes)	52 (8.1%)	32 (12.9%)	20 (5.1%)	<.001
FaceTime (n, % yes)	56 (8.8%)	24 (9.6%)	32 (8.2%)	.526
GoToMeeting (n, % yes)	57 (8.9%)	32 (12.9%)	25 (6.4%)	.005
Houseparty (n, % yes)	26 (4.1%)	15 (6.0%)	11 (2.8%)	.045
Other platforms (n, % yes)	34 (5.3%)	13 (5.2%)	21 (5.4%)	.934

Note: $p < .05$ (represented in boldface) reflects significant differences between those at-risk or not at-risk of eating disorders using chi-square tests for categorical variables and t-tests for continuous variables.

Abbreviations: ED, eating disorder; EDNOS, eating disorder not otherwise specified; OSFED, other specified feeding or eating disorders.

^aEating disorder at-risk status was assigned on the basis of SCOFF score ≥ 2 .

Asian ($n = 137$, 21.4% Eastern Asian; $n = 93$, 14.5% Southern Asian), with some representation from Hispanic ($n = 10$, 1.6%), Middle Eastern ($n = 7$, 1.1%), African American ($n = 2$, 0.3%), and Aboriginal

Australian ($n = 2$, 0.3%) or “other” ethnic/cultural/racial groups ($n = 56$, 8.8%). Most of the samples were single ($n = 463$, 72.3%) and heterosexual ($n = 493$, 77.0%). Eighty-three (13.0%) reported having

TABLE 2 Means, standard deviations, and correlations among modeled variables

	ED risk	Safety behaviors	Self-focused attention	Performance control	Engagement	Avoidance
ED risk	—					
Safety behaviors	.28	—				
Self-focused attention	.28	.50	—			
Performance Control	-.27	-.40	-.38	—		
Engagement	.25	.45	.49	-.59	—	
Avoidance	.26	.54	.36	-.41	.38	—
M(SD) Total	n/a	3.72 (1.04)	14.70 (4.73)	3.62 (0.94)	7.06 (2.47)	2.11 (1.12)
M(SD) ED risk	n/a	4.09 (0.89)	16.40 (4.53)	3.30 (0.89)	7.84 (2.44)	2.48 (1.11)
M(SD) Not at-risk	n/a	3.49 (1.07)	13.70 (4.54)	3.82 (0.91)	6.56 (2.37)	1.87 (1.07)

Note: All correlations are significant at $p < .001$. ED risk: at-risk = score of ≥ 2 SCOFF, not at-risk = score of < 2 . Safety behaviors: Frequency of use of eight safety behaviors for appearance concerns before or during videoconferencing. Higher scores represent greater use of safety behaviors. Self-focused attention: five items adapted from the Focus of Attention Questionnaire (Woody, 1996). Higher scores indicated greater self-focused attention unrelated to appearance. Performance Control: Perceived control over performance; four items adapted from the Control subscale of the Three Factor Anxiety Inventory (Cheng et al., 2009); higher scores indicate a greater ability to regulate performance anxiety. Engagement: Three items measuring engagement in contribution or performance during videoconferencing. Higher scores indicate greater impairments in engagement (i.e., lower engagement). Avoidance: frequency of avoiding videoconference calls due to appearance concerns; higher scores indicate greater avoidance.

been diagnosed with an ED in their lifetime. Most participants used the platform Zoom (95.6%) or Microsoft Teams (40.3%) to videoconference with others for work or study.

2.2 | Measures

A copy of measures developed or adapted for use in this study can be found in Supplementary Document 1.

2.2.1 | Videoconferencing use

A range of questions was asked about participants' use of videoconferencing including platform used, perceived increase in videoconferencing for work/study since COVID-19 social distancing began (Yes/No), whether videoconferencing is required for work/study (Yes/No), frequency of use (hourly, daily, etc.), and primary type of view used (speaker, gallery, other).

2.2.2 | Eating disorder risk

The SCOFF questionnaire (Morgan et al., 1999) was used to categorize participants into ED at-risk or not at-risk status. Participants indicated whether they agreed ($yes = 1$, $no = 0$) with five questions about their thoughts and behaviors related to food and weight (e.g., "Would you say that food dominates your life?"). Scores were summed. Following Morgan et al. (2000), those with a total score of two or higher were categorized as being at-risk for EDs. This scoring has been found to have high sensitivity and specificity for the identification of EDs, especially anorexia and bulimia (Morgan et al., 2000). Because the SCOFF is a screening rather than a diagnostic tool, the diagnostic status of our

participants was unknown. For this reason, we chose to refer to participants as "at-risk" for an eating disorder, even though those scoring above two likely had a clinically relevant illness.

2.2.3 | Safety behaviors

Given the lack of existing relevant measures, we created a measure of potential safety behaviors that those with appearance concerns may engage in before and during videoconferencing. The authors (experienced clinical psychologists and researchers in EDs and body image) developed the items based on behaviors commonly reported in social media research (Lonergan et al., 2019; Lonergan et al., 2020; Wang et al., 2019) and mentioned by undergraduate students or therapy clients. For this measure, participants were asked to indicate on a 5-point scale (1 = *never*, 5 = *always*) how often they generally engaged in 14 different behaviors before or during a videoconferencing call (see Table 3). These items were combined into a latent variable for use in analyses (see data preparation section below) with higher scores indicating greater engagement in safety behaviors.

2.2.4 | Self-focused attention

The Self-Focus subscale of the Focus of Attention Questionnaire (FAQ; Woody, 1996) was adapted to measure self-focused attention, unrelated to appearance, during videoconferencing for work or study. Participants were instructed to think about the last time they had a videoconference when responding to the five items (e.g., "I was focusing on what I should say or do next," "I was focusing on the impression I was making"). Responses were on a 5-point scale (1 = *not at all*, 5 = *a lot*) and averaged to form an overall score. Higher scores indicated greater self-focused attention unrelated to appearance. The

internal reliability of the adapted self-focus measure in the present study was good ($\alpha = .779$).

2.2.5 | Performance control

Perceived control over performance anxiety was measured with four items that were adapted from the Performance Control subscale of the Three Factor Anxiety Inventory (TFAI; Cheng et al., 2009). Two items were omitted from the original subscale because they focused on future events (i.e., “I feel confident about my upcoming performance”). Participants rated the extent to which they agreed with each item (e.g., “While videoconferencing, I believe in my ability to perform during the call”) on a 5-point scale (1 = *not at all*, 5 = *a lot*). Responses were averaged to form an overall measure of perceived control over one's performance anxiety during videoconferencing for work/study, with higher scores indicating a greater ability to regulate performance anxiety. The internal reliability in the present study was good ($\alpha = .853$).

2.2.6 | Perceived impaired engagement

Three items were created for the current study to measure participants' perceived contribution or performance during videoconferencing. The item “While videoconferencing, I hold back from contributing to the meeting” was rated on a 4-point scale (1 = *never*, 4 = *always*). For the other two items, participants were asked to think about the last time they had a videoconference, and to indicate on a 5-point scale (1 = *not at all*, 5 = *a lot*). Responses to the three items were averaged to form an overall measure, where higher scores indicated greater *impairment in engagement*. The internal reliability for this was adequate ($\Omega = .75$).

2.2.7 | Avoidance

A single item was included to examine whether individuals refrained from videoconferencing because of appearance concerns. Participants were asked to respond to the question *When videoconferencing, do you avoid the calls because you do not like your appearance?* on a 5-point scale (1 = *never*, 5 = *always*) with higher scores indicating more avoidance.

2.3 | Procedure

The study was described to participants as an investigation into videoconferencing and body image concerns during COVID-19 social distancing. Only adults (≥ 18 years) who were fluent in English were eligible to participate. Participants were directed to an online survey after clicking on an electronic link in recruitment materials. Participants were first asked to provide informed consent, then complete the survey, which included demographic questions and the measures

described above. The study was approved by a University Human Research Ethics Committee.

2.4 | Data analytic plan

2.4.1 | Data preparation

Data preparation and analyses were conducted in R (version 4.0.5). Given the small amount of missing data (less than 1% overall) and failure to reject the assumption that these data were missing completely at random ($p = .517$), the mice package was used to generate a single imputed dataset for analyses using imputation via chained equations, conducted at the item-level.

Discriminant function analysis was used to derive a latent variable of eight safety behavior items that maximally discriminated between the ED risk groups (at-risk for ED, not at-risk). Data were checked and found to conform to key assumptions of the general linear model and were thus analyzed untransformed. As the key grouping variable (ED risk status) was not randomly assigned but based on self-report, group differences in demographic variables were examined, and variables with significant differences ($p < .05$; see Table 1) were included as covariates in the regression-based models for hypothesis testing (age, gender, ethnicity, marital status, sexual orientation, employment status).

2.4.2 | Hypothesis testing

Hypothesis 1 was evaluated using *t*-tests to compare safety behavior item scores across ED risk status (at-risk vs. not at-risk). The False Discovery Rate method was used to control for Type I error inflation. Linear regression analyses tested Hypothesis 2. In separate models, the outcome variables (perceived control over performance anxiety, engagement impairment, and avoidance) were regressed onto (1) ED risk status, safety behaviors, and their interaction; and (2) ED risk status, self-focused attention, and their interaction. Hypothesis 3 was tested with multiple mediation models in which the effects of ED risk status on control over performance anxiety (outcome 1), impaired engagement (outcome 2), and avoidance (outcome 3) were mediated by safety behaviors and self-focused attention. Accelerated bias-corrected bootstrapping ($n = 5000$ iterations) was used to test the unique effects of the two mediators as well as test for significant differences in the magnitude of their mediating effects. For both Hypotheses 2 and 3, we report results adjusted for covariates.

3 | RESULTS

3.1 | Videoconferencing use

Almost all participants (99.2%) reported an increase in videoconferencing use after social distancing regulations came into place in

TABLE 3 Group differences in safety behaviors

	ED risk M (SD)	Not at-risk M (SD)	t	p	d (95% CIs)
1. Have your own video visible to yourself	3.91 (1.19)	3.97 (1.19)	-0.57	.66	-0.05 (-0.21, 0.11)
2. Not turning off your camera	3.48 (1.05)	3.67 (1.01)	-2.26	.04	-0.18 (-0.34, -0.02)
3. Have videos of other people visible to you	4.26 (0.93)	4.36 (0.83)	-1.43	.19	-0.12 (-0.28, 0.04)
4. Prepare my appearance or adjust my clothing	3.60 (1.20)	3.55 (1.23)	0.46	.69	0.04 (-0.12, 0.20)
5. Prepare the lighting to make myself look more attractive	3.06 (1.29)	2.80 (1.38)	2.43	.03	0.20 (0.04, 0.36)
6. Adjust the camera angle to make my appearance look better	3.76 (1.20)	3.34 (1.34)	4.02	<.001	0.33 (0.17, 0.49)
7. Turn the camera off because I do not like how I look	2.97 (1.13)	2.44 (1.23)	5.54	<.001	0.45 (0.29, 0.61)
8. Include a virtual background to distract from my appearance	1.60 (1.02)	1.45 (0.93)	1.96	.08	0.16 (0.00, 0.32)
9. Prepare my surroundings to look professional	3.13 (1.34)	3.10 (1.46)	0.31	.76	0.02 (-0.13, 0.18)
10. Add filters to alter my appearance	1.72 (1.24)	1.57 (1.17)	1.54	.17	0.13 (-0.03, 0.28)
11. Avoid talking so I do not bring others' attention to myself	3.03 (1.20)	2.58 (1.23)	4.57	<.001	0.37 (0.21, 0.53)
12. Mute my mic to avoid bringing attention to myself or to my appearance	3.47 (1.22)	2.90 (1.42)	5.16	<.001	0.42 (0.26, 0.58)
13. Use the chat function more than talking to avoid bringing attention to my appearance	2.62 (1.20)	2.17 (1.18)	4.61	<.001	0.37 (0.21, 0.53)
14. Control my audio and video functions in a way that others would not notice (e.g., pressing mute on headphones)	1.96 (1.25)	1.56 (1.04)	4.43	<.001	0.36 (0.20, 0.52)

Note: $p < .05$ (represented in boldface) reflects significant differences between those at-risk vs not at-risk of eating disorders. Participants were asked a series of questions about safety behaviors during videoconferencing. These items were prefaced with the question *When videoconference calling, how often do you...*

2020. One quarter (26.4%) were currently using videoconferencing more than once per day. The majority (67%) reported having avoided conference calls due to concerns about their appearance; 21% said they “rarely,” 25% said they “sometimes,” and 10% said they “often” avoided videoconference calls because they did not like their appearance.

3.2 | Differences between at-risk and not at-risk for ED

Of the 640 participants, 249 (38.9%) were categorized as being “at-risk” of ED based on their responses to the SCOFF. As seen in Table 1, those categorized as being at-risk differed significantly from those not at-risk on age, gender, ethnicity, marital status, sexual orientation, current employment, BMI category, and previous ED diagnosis; but not on average BMI nor use of the main videoconferencing platforms (i.e., Zoom and Microsoft Teams). Those who were categorized as at-risk were found to be younger, more likely to be White, female, non-heterosexual, and not living with a partner/ married, than those who were not at-risk.

To understand how differences in gender may have impacted results, we conducted significance testing across variables of interest. Minimal changes were found and results can be seen in Table S6.

3.3 | Preliminary analyses

Table 2 provides means, standard deviations, and correlations among the variables used in regression analyses. Relative to those not at-risk, individuals at-risk for ED had significantly higher scores on the mediator variables of safety behaviors ($t = 7.49, p < .001$, Cohen's $d = 0.61$, 95% CIs: 0.44, 0.77) and self-focused attention ($t = 7.48, p < .001$, Cohen's $d = 0.61$, 95% CIs: 0.44, 0.77). Those at-risk for ED also showed significantly lower scores on the outcome measures of control over performance anxiety ($t = 7.20, p < .001$, Cohen's $d = 0.58$, 95% CIs: 0.42, 0.75), and significantly higher scores on impaired engagement ($t = 6.60, p < .001$, Cohen's $d = 0.53$, 95% CIs: 0.37, 0.70). Finally, those at-risk also reported significantly greater avoidance of video calls due to appearance concerns, than those not at-risk ($t = 6.60, p < .001$, Cohen's $d = 0.53$, 95% CIs: 0.37, 0.70).

Correlation analyses confirmed small to moderate associations between ED at-risk status and the mediator or outcome variables and moderate to large associations between the mediator and the outcome variables.

3.4 | Hypothesis testing

Hypothesis 1. Table 3 provides a comparison of scores on the safety behavior items across ED risk status. The ED at-

TABLE 4 Moderated regressions evaluating the influence of ED risk on IV-DV relationships

Predictors	Performance control			Engagement			Avoidance		
	<i>b</i>	95% CIs	<i>p</i>	<i>b</i>	95% CIs	<i>p</i>	<i>b</i>	95% CIs	<i>p</i>
Safety	−0.22	−0.30, −0.13	<.001	0.94	0.72, 1.16	<.001	0.48	0.38, 0.57	<.001
ED risk	−0.22	−0.78, 0.34	.436	1.84	0.37, 3.32	.015	0.11	−0.54, 0.75	.744
Safety * ED risk	−0.03	−0.16, 0.11	.723	−0.29	−0.66, 0.08	.121	0.04	−0.12, 0.20	.639
<i>R</i> -squared	.26			.26			.32		
Self-focus	−0.05	−0.07, −0.04	<.001	0.21	0.17, 0.26	<.001	0.07	0.04, 0.09	<.001
ED risk	−0.24	−0.70, 0.22	.308	0.53	−0.65, 1.72	.378	0.37	−0.20, 0.94	.205
Self-focus*ED risk	0.00	−0.03, 0.03	.833	0.00	−0.07, 0.08	.961	0.00	−0.04, 0.03	.853
<i>R</i> -squared	.28			.31			.23		

Note: For brevity, covariates (age, gender, ethnicity, marital status, sexual orientation, and employment status) are not included in the table.

	Performance control <i>b</i> (95% CIs)	Engagement <i>b</i> (95% CIs)	Avoidance <i>b</i> (95% CIs)
Total effect (<i>c</i>)	−0.42 (−0.56, −0.28)	1.08 (0.71, 1.45)	0.49 (0.31, 0.67)
Direct effect (<i>c</i>)	−0.25 (−0.39, −0.11)	0.43 (0.08, 0.78)	0.22 (0.06, 0.38)
Indirect effects			
Safety (<i>a</i> ₁ * <i>b</i> ₁)	−0.06 (−0.11, −0.02)	0.22 (0.12, 0.35)	0.20 (0.12, 0.28)
Self-focus (<i>a</i> ₂ * <i>b</i> ₂)	−0.11 (−0.17, −0.06)	0.43 (0.27, 0.60)	0.06 (0.02, 0.12)

TABLE 5 Multiple mediation results

risk group scored significantly higher on six safety behaviors focusing on “fixing” appearance, while those not at-risk were more likely to have their camera on and to be visible to others during the call. Given these eight items reliably discriminated between those at-risk of ED and those not at-risk, they were used in models testing hypotheses 2 and 3.

Hypothesis 2. As shown in Table 4, both safety behaviors and self-focused attention had significant main effects on all three outcomes of performance control, engagement, and avoidance, but these effects were not moderated by ED risk status. Variance explained in these models ranged from .26 to .32 ($p < .001$ for all).

Hypothesis 3. Multiple mediation analyses revealed significant mediation effects of safety behaviors and of self-focused attention (each controlling for the other) in statistically accounting for the relationship between ED risk and control over performance anxiety, ED risk and impaired engagement, as well as ED risk and avoidance (Table 5). Direct effects of IV on DVs were significant, suggesting that these mediators did not fully account for IV-DV relationships and other variables not accounted for by the models, were at play. Further, a comparison of the mediating effects showed non-significant differences in the unique mediating effects of self-focused attention and safety behaviors, for models involving control over performance anxiety and

impaired engagement, but the mediators significantly differed for the model involving avoidance (larger mediation effect for safety behaviors; $p < .05$).

4 | DISCUSSION

Given the rise of videoconferencing use since the onset of the COVID-19 pandemic and the salient nature of self-view while using virtual platforms, the current study aimed to investigate whether videoconferencing outcomes differed according to ED risk status, and which variables might mediate these relationships. We found that there were very high rates of videoconferencing use, and among the more than one-third of participants who scored at-risk for an ED, there were greater rates of safety behaviors, self-focused attention (unrelated to appearance), and avoiding video calls, plus lower rates of being able to control performance anxiety, and of impaired engagement in videoconferencing for work/study. These findings support our hypotheses and add to the growing evidence that appearance concerns may lead to impairments in videoconferencing performance.

4.1 | Self-focused attention

The subscale of the Focus of Attention Questionnaire (Woody, 1996) asked participants about attention unrelated to appearance. Importantly, in testing for Hypothesis 1, this scale was more strongly

correlated with perceived control over performance anxiety, impaired engagement, and avoidance, than ED risk status was. This suggests that even though those at-risk of an ED reported higher levels of self-focused attention than those not at-risk, the inability to focus on the content of the video call is a more important correlate of performance anxiety regulation, perceived impairments in engagement, and avoiding videoconferencing all together than ED risk is. This finding was also supported by the moderation analyses undertaken to test Hypothesis 2, which showed that ED risk did not significantly influence the relationship between self-focused attention and the videoconferencing outcome variables. Testing for Hypothesis 3 also revealed this consistent pattern. Hypothesis 3 tested whether the effects of ED risk on perceived control over performance anxiety (outcome 1), impaired engagement (outcome 2), and avoidance (outcome 3) were significantly mediated by self-focused attention, and indeed this was the case. In other words, the finding that those at-risk of an ED reported lower performance anxiety regulation than those not at-risk, was in fact accounted for by the presence of self-focused attention. Self-focused attention also accounted for a significant amount of variance in the relationship between ED risk status and impaired engagement, and in avoidance of videoconferencing; however, the mediation did not account for these relationships in full.

Taken together, these results show that it is not only appearance concerns that are associated with impairments in videoconferencing outcomes, but also self-focused attention unrelated to appearance, as originally conceptualized by Clark and Wells (1995) in their theory on social anxiety. Given that videoconferencing is, in its most simple function, a social interaction, it is unsurprising that constructs associated with social anxiety are implicated. A systematic review and meta-analysis by Kerr-Gaffney et al. (2018) assessed the presence of social anxiety in ED diagnoses. The review found that social anxiety is one of the most common comorbid conditions in EDs and that those with higher levels also had greater ED psychopathology (Kerr-Gaffney et al., 2018). Perhaps this helps explain our findings that ED status did not mediate the relationships between self-focused attention and difficulties with videoconference performance. It appears that the higher level of social anxiety in those with EDs, rather than the ED psychopathology or more specifically ED-based appearance concerns per se, statistically contributes to decrements in videoconferencing performance.

4.2 | Safety behaviors

Hypothesis 2—that videoconferencing safety behaviors would be associated with lower levels of performance control, greater impairments in videoconferencing engagement, and greater avoidance—was supported. However, the further expectation—that these relationships would be stronger in those at-risk for ED than those not at-risk—was not. As noted above, given previous research on social anxiety and its associated impairments in performance, it is not surprising to see the detrimental impacts of self-focused attention potentially play out in the contemporary videoconferencing context. What is surprising, however, is that the measure of safety behaviors, which was heavily

focused on strategies for ameliorating anxiety about appearance concerns, was not mediated by ED-risk status in its relationships with impaired videoconferencing performance variables.

Greater engagement in safety behaviors was strongly correlated with avoidance of videoconferencing (.54) and this was not moderated by ED risk status. Further, avoidance mediated the relationship between ED risk status and safety behaviors, and to a more significant extent than self-focused attention did. These findings suggest that videoconferencing avoidance among those at-risk of an ED appears more likely a consequence of the burden of engaging in safety behaviors than of experiencing ED symptoms.

4.3 | Strengths and limitations

The current research had a number of important strengths including the large sample, the contemporary measurement of videoconferencing use, its correlates during stay-at-home orders, and the robust analytic methods. There were, however, important limitations. Our sample was restricted in its diversity, with well-educated, predominantly young adult females from Australia represented. Our sample, however, did vary in race/ethnicity and 23% identified as non-heterosexual, suggesting that respondents were diverse across some domains. In addition, the cross-sectional nature of our data places important limitations on our interpretation of results, as we cannot make temporal or causal claims about the relationships found among the variables measured.

4.4 | Implications for future research and practice

Our findings suggest that videoconferencing taps into mechanisms associated with performance anxiety more strongly than overvaluation of weight and shape. It would therefore be useful for future research to investigate how evidence-based social anxiety interventions could assist in reducing impairments in videoconferencing among those with EDs.

In the meantime, clinicians could focus on adapting effective interventions for social anxiety when working with populations who are both at-risk of EDs and engaging in videoconferencing. Clinical practice guidelines around the world suggest CBT-based psychotherapy as first-line treatment for social anxiety, with exposure to feared social situations, cognitive restructuring with an emphasis on focusing attention outward rather than on the self, and refraining from the use of subtle avoidance or safety behaviors, as key foci of treatment (Andrews et al., 2018; Pilling et al., 2013; Walter et al., 2020). It would therefore be prudent for clinicians or educators to explore the presence of safety behaviors and self-focused attention in clients' video calls, and to provide strategies for reducing these while increasing engagement in the virtual discussion. For example, clients could be encouraged to turn off self-view (rather than turning off their camera) and to re-direct when they become aware of self-focused rather than discussion-focused attention. Alternatively, participants could engage

in a range of behavioral experiments to reduce safety behaviors while increasing adaptive anxiety regulation strategies, such as deep breathing or self-compassion.

4.5 | Conclusions

Individuals at-risk of EDs reported greater impairments in videoconferencing outcomes than those not at-risk. These decrements, however, appear to be better explained by variables related to social anxiety than ED psychopathology specifically. When using videoconferencing, those at-risk of EDs should be supported to reduce safety behaviors, avoidance of video calls, and self-focussed attention, to ensure they can functionally engage in virtual work and study from home.

AUTHOR CONTRIBUTIONS

Laura M Hart: Conceptualization; investigation; methodology; project administration; supervision; writing – original draft; writing – review and editing. **Deborah Mitchison:** Conceptualization; methodology; writing – original draft; writing – review and editing. **Matthew Fuller-Tyszkiewicz:** Conceptualization; data curation; formal analysis; software; writing – original draft; writing – review and editing. **Sarah Giles:** Data curation; formal analysis; investigation; project administration; software; writing – original draft; writing – review and editing. **Jasmine Fardouly:** Conceptualization; methodology; writing – original draft; writing – review and editing. **Hannah Katie Jarman:** Conceptualization; data curation; formal analysis; investigation; methodology; project administration; software; writing – original draft; writing – review and editing. **Stephanie R Damiano:** Conceptualization; methodology; writing – review and editing. **Siân A McLean:** Conceptualization; methodology; writing – review and editing. **Ivanka Prichard:** Conceptualization; methodology; writing – review and editing. **Zali Yager:** Conceptualization; investigation; methodology; project administration; writing – review and editing. **Isabel Krug:** Conceptualization; data curation; formal analysis; investigation; methodology; project administration; software; supervision; writing – original draft; writing – review and editing.

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CONFLICT OF INTEREST

Laura M. Hart, Ivanka Prichard, and Zali Yager are Directors of the not-for-profit organization The Body Confident Collective. Stephanie R. Damiano is an employee of the Butterfly Foundation. Siân McLean and Deborah Mitchison are members of the Executive Committee of the Australia and New Zealand Academy for Eating Disorders. The authors, nor these organizations, will benefit from the publication of this work. Jasmine Fardouly, Hannah K. Jarman, Matthew Fuller-Tyszkiewicz, and Sarah Giles have no conflicts, perceived or real, to declare.

DATA AVAILABILITY STATEMENT

Due to limitations on participant consent for data use, the dataset generated in this study will not be publicly available. However, all data, materials and code are available from the authors via reasonable request made by email to the corresponding author.

ETHICS STATEMENT

This study was approved by the University of Melbourne Human Research Ethics Committee. All participants provided informed written consent via an online survey. *Permission to Reproduce Material from Other Sources:* Adapted measures provided in Supplementary Document 1 are available in the public domain via original publications cited.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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