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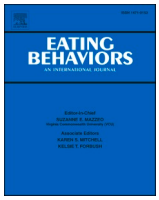

Mental health of individuals with and without eating disorders across six months and two waves of COVID-19

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ABSTRACT

Purpose: The COVID-19 global pandemic has resulted in a significant mental health toll, and recent findings suggest that individuals with an eating disorder (ED) history may be particularly vulnerable. The current study aimed to: (1) identify changes in the pattern of mental health symptoms over the first six months of the pandemic between individuals with an ED history, compared to a community sample without an ED history (non-ED); and (2) identify differences in mental health symptoms and concerns between two waves of the virus and associated lockdowns.

Method: Data from 4915 respondents – 231 with an ED history – were compared across monthly time points from April to September 2020 on psychological symptoms including negative mood, quality of life, coping and hopefulness, as well as changes to eating and exercise behaviours.

Results: Mental health symptoms were increased in the ED group, but generally did not differ from non-ED in the pattern of symptoms reported over time. Increased depressive symptoms and restrictive eating behaviours were found across both groups in relation to the second wave/lockdown, as well as decreased hopefulness and quality of life. Respondents in both groups also reported coping worse during the second wave of the virus compared to the first wave.

Conclusion: Although non-ED and ED groups tended to generally show the same pattern of symptoms, the mental health status of the ED group was significantly poorer than the non-ED group throughout the pandemic, and exacerbations in some symptoms (i.e. increased food restriction and depressive symptoms) is cause for concern.

1. Introduction

Studies from around the world have begun to detail the mental health toll of the coronavirus disease (COVID-19) global pandemic in various populations, including those with eating disorders [e.g. (Clark Bryan et al., in press; Castellini et al., in press; Termorshuizen et al., in press; Phillipou et al., 2020; Schlegl et al., in press)]. In the first published study on disordered eating behaviours during the very early stages of the pandemic, an exacerbation of disordered eating symptoms (increased restricting, binge eating and purging, and changes to exercise), as well as increased levels of depression, anxiety and stress in individuals with eating disorders were identified (Phillipou et al., 2020). A number of studies have since been published further detailing the mental health consequences of this pandemic on individuals with eating disorders in different countries [e.g. (Clark Bryan et al., in press; Castellini et al., in press; Termorshuizen et al., in press; Schlegl et al., in press)].

During the early stages of the pandemic, former eating disorder inpatients in Germany reported increased disordered eating symptoms and sadness (Schlegl et al., in press). Similarly, a study undertaken across the US and the Netherlands reported increased disordered eating behaviours and anxiety, as well as increased fears about being able to find foods

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consistent with meal plans (Termorshuizen et al., in press). Specifically, increased restrictive eating behaviours were found in individuals with anorexia nervosa, and increased binge eating episodes in those with bulimia nervosa or binge eating disorder. Similarly, findings from a study undertaken in Italy suggested that individuals with bulimia nervosa were experiencing an increase in binge eating behaviours during the government-imposed lockdown (Castellini et al., in press). Furthermore, increased compensatory exercise behaviours were also found in the broader eating disorder group during the lockdown in Italy. In the UK, on the other hand, thematic analyses undertaken on interviews conducted during the lockdown identified concerns around access to eating disorder-specific services, as well as disruptions to routine leading to heightened psychological distress and eating disorder symptoms (Clark Bryan et al., in press).

In Australia, changes in mental health have been examined at regular time points over the course of the pandemic in the community, and specifically in individuals with eating disorders, through the COvid-19 and you: mentaL heaLth in AusTralia now survey (COLLATE) project (Tan et al., 2020). As of November 2020, Australia, and specifically the state of Victoria, had not only experienced a second wave of COVID-19 infections and a second lockdown, but had largely managed to confine infections to a very low level for a second time.[1] Consequently, residents in Victoria (and particularly in its capital, Melbourne), had been subjected to two periods of strict lockdown that involved stringent social distancing measures and strict rules on only leaving home for essential purposes (i.e. buying food and other essentials, medical care or caregiving, exercise, and essential work or study, but only if it could not be done from home; with stricter measures implemented in the second lockdown, including limitations on the distance and amount of time permitted to leave the home; see footnote and Supplementary Fig. 1 for details). Victoria was therefore in a unique position at the time of this study compared to most of the world who were still either experiencing their first wave, had only begun to experience a second wave or had not yet started to see a second wave. Thus, there is much to learn from this cohort that will inform how we support the mental health of individuals with and without eating disorders throughout the pandemic around the world.

The primary aim of this study was to identify changes in mental health symptoms over the course of the pandemic between individuals with and without an ED history. Two sub-aims were specified. The first was to identify changes in the pattern of mental health symptoms over the first six months of the pandemic (i.e. April–September 2020) between individuals with a history of an eating disorder (ED), compared to a community sample without an ED history (non-ED), in Victoria. Specifically, changes to negative mood states (depression, anxiety and stress), quality of life, resilience, and hopefulness were investigated, as well as changes to eating and exercise behaviours. The second aim was to specifically identify differences in mental health symptoms and concerns between the first and second waves of the virus and associated lockdowns in Victoria (i.e. represented by data collected on the 1st April and 1st August 2020), in individuals with and without an ED history.

2. Methods

The study received ethical approval from the Swinburne University Human Research Ethics Committee (SUHREC) and complied with the Declaration of Helsinki. Members of the general public were invited to complete the COLLATE project. Participants were required to be residing in Australia and aged 18 years or older to take part. The project is described in detail elsewhere (Tan et al., 2020). Briefly, it includes a series of anonymous online surveys, open for 72 h from the 1st-4th of each month, beginning in April 2020. The data included in the current paper were collected between April and September 2020, roughly representing the first six months of the pandemic in Australia. Data representing the two waves of the virus and associated lockdowns in Victoria were represented by April and August time points. Respondents were recruited through social media and other advertisements, participant registries and non-discriminative snowball sampling. All respondents were asked to self-identify whether they had a history of an eating disorder. A serial cross-sectional design was utilised where the composition of respondents differed every month (some individuals completing multiple months and others responding to the survey on a single occasion) to maximise the number of people assessed over time. Only data collected from respondents residing in Victoria were included in the current study.

The monthly COLLATE surveys cover a broad range of quantitative and qualitative questions probing different aspects of mental health. Only the measures relevant to the current paper are described in detail here (further details can be found in Tan et al. (2020)). Current negative mood states were assessed with the *Depression Anxiety Stress Scale* (DASS-21) (Cronbach's α 0.94, 0.87 and 0.91 for depression, anxiety and stress in the current sample, respectively) (Antony et al., 1998; Lovibond & Lovibond, 1996), with higher scores indicative of increased negative mood symptoms. The *Brief-H-Pos* was used as a measure of hopefulness (Cronbach's α 0.77) (Fraser, 2014; Fraser et al., 2014) and the *Brief Resilience Scale* was administered to assess resilience (Cronbach's α 0.80–0.91) (Smith et al., 2008), with higher scores on these scales representing increased hopefulness and resilience, respectively. The *European Health Interview Surveys-Quality of Life* (EUROHIS-QoL) was used to measure quality of life, with higher scores indicative of better perceived quality of life (Cronbach's α 0.78) (Da Rocha et al., 2012).

In addition to the standardised scales employed, a number of items were also devised by the investigators. As reported in our earlier study (Phillipou et al., 2020), four eating and exercise questions were adapted from the Eating Disorder Examination Questionnaire (EDE-Q), for which participants responded on a 5-point Likert scale (1 = a lot more, 2 = a little more, 3 = no difference, 4 = a little less, and 5 = a lot less). Namely, *1*- In the past week, have you been deliberately trying to limit the amount of food you eat or exclude any foods from your diet to influence your shape or weight? *['Restricting']; 2*- In the past week, have you had episodes of binge eating (eating an unusually large amount of food given the circumstances? *['Binge eating']; 3*- In the past week, have you made yourself sick (vomit) or taken laxatives as a means of controlling your shape or weight? *['Purging'];* and *4*- In the past week, have you experienced any significant changes in your exercise behaviours? *['Exercising']*. Given the rapidly changing nature of the pandemic and associated restrictions, these items were asked in relation to the past week to more sensitively assess current state.

In addition, two free response questions were also asked: 'What are you most worried about during this COVID-19 pandemic in terms of your mental health and wellbeing?' and 'List the top three aspects of the COVID-19 pandemic that you think will have the biggest impact on your mental health and wellbeing in the long term'. Additionally, in the August survey, respondents were asked how they were coping in Wave 2

[1] *First wave in Victoria, Australia*: Peak number of daily cases (106) on 27th March, and peak number of active cases (541) on 28th March 2020. Restrictions started on 13th March with strict lockdown initiated on 31st March. Lockdown and restrictions started to ease from the 13th May (6 weeks of lockdown). *Second wave in Victoria, Australia*: Peak number of daily cases (686) on 4th August, and peak number of active cases (6785) on 7th August 2020. Restrictions and strict lockdown again in Melbourne from 9th July, becoming even stricter from 2nd August (restrictions on time and distance permitted out of your home). As of 1st September 2020, Melbourne was still under lockdown with 87 new cases and 342 active cases, but restrictions eased significantly over the following weeks with lockdown lifting on the 28th October following significantly reduced case numbers (e.g. 0 new cases and 0 deaths from the 31st October for 28 consecutive days, and 0 active cases in the entire state from 24th November). (Victoria State Governement Department of Health & Human Services, 2020). Victoria State Governement Department of Health & Human Services. *Victorian coronavirus (COVID-19) data*. 2020 [cited 2020; Available from: www.dhss.vic.gov.au/victorian-coronavirus-covid-19-data.

compared to Wave 1 of the virus on a 5-point Likert scale (i.e. 1 = a lot better, 2 = a little better, 3 = about the same, 4 = a little worse, 5 = a lot worse).

2.1. Statistical analysis

The data were analysed in SPSS v27 in line with the two overarching aims of the study, i.e. to identify differences over time between the ED group (i.e. monthly from April to September), relative to the non-ED group; and to explore differences between the two virus waves and associated lockdowns in Victoria (i.e. April and August) between groups. To address the first aim of the study, a repeated measures mixed model (RMMM) was performed for each continuous variable across the six time points (i.e. surveys from April to September), to identify significant interactions between group (ED history or no ED history) and month (RMMM analyses do not rely on the same participants completing each time point like repeated measures analyses of variance; but assumes a random selection of participants for each month, while taking account of the repeated measures nature of the data for participants who completed the survey more than once by assuming the same correlation for any pair of months (compound symmetry)). The interaction between group and month was of greatest interest, and the main effects for group were described when interaction effects were not significant. Ordinal categorical variables with more than two response options (e.g. eating and exercise items) were dichotomised (e.g. no change or less restricting = 0, more restricting = 1) and analysed with general linear mixed models. A square root transformation was required for the DASS-21 subscales as scores were not normally distributed. Planned comparisons were undertaken between the April and August time points specifically to address aim two of the study regarding differences between the two waves of the virus and associated lockdowns. Descriptive statistics were also performed on relevant variables. Text mining (Berry & Kogan, 2010) was also performed on the two free response questions probing mental health concerns related to the pandemic for the two waves of the virus. This was done by extracting topics from the text using SAS Enterprise Miner Version 14.2 software.

3. Results

4915 participants from Victoria completed the surveys over the six time points of the study and were included in the current analyses, including 231 with a self-reported ED history and 4684 without an ED (non-ED group) (see Supplementary Tables 1–3 for the number of respondents in each group for each time point, the frequency of different ED diagnoses reported, and the frequency of COVID-19 diagnoses). 17.8% of respondents in the ED group participated in two or more surveys, compared to 9.4% of the non-ED group. Overall, 94.4% of ED respondents were female, compared to 78.9% of non-ED participants ($\chi^2(1) = 39.04$, $p < .001$) ED respondents had a mean age of 28.65 years (SD = 7.43), while non-ED participants had a mean age of 38.33 years (SD = 14.17) ($F(1,4898) = 96.02$, $p < .001$).[2]

3.1. Month-by-month group differences over time from April to September 2020

Patterns over time between groups for each variable are presented in Figs. 1–3.

3.1.1. Negative mood

Significant main effects for month ($F(5,1361) = 2.65$, $p = .022$) and group ($F(1,79) = 78.82$, $p < .001$) were found for the depression subscale of the DASS-21, but there was no significant interaction effect for month and group. The ED group had higher depression scores than the non-ED group, and both groups remained relatively stable over time, except for an increase in depression scores in August, as indicated in Fig. 1 by the lack of overlap in the 95% confidence intervals for July and August. A main group effect was also found for the anxiety and stress subscales of the DASS-21 (i.e. higher anxiety and stress in the ED group; $F(1,3155) = 83.43$, $p < .001$; $F(1,3068) = 68.77$, $p < .001$, respectively), but there was no significant month effect, and there were no significant interaction effects for either variable.

3.1.2. Hopefulness, resilience and quality of life

Main effects for month and group were found for hopefulness ($F(5,2156) = 4.72$, $p < .001$, $F(1,4593) = 49.97$, $p < .001$), but not for their interaction. The ED group had lower hopefulness scores than the non-ED group, and both groups remained relatively stable over time, apart from a decrease in hopefulness in August, followed by an increase in September, as indicated by the confidence intervals in Fig. 2. A main group effect was also found for resilience, with the ED group showing lower resilience than the non-ED group overall ($F(1,4616) = 69.30$, $p < .001$). A main effect for month was not identified, nor was there a significant interaction effect for group and month. Main effects were also found for month and group ($F(5,1780) = 3.02$, $p = .010$, ($F(1,4544) = 105.00$, $p < .001$) for quality of life, but no significant interaction effect was present. The ED group reported a lower quality of life than the non-ED group overall, and there was a trend towards poorer quality of life in both groups in July and August, as indicated in Fig. 2.

3.1.3. Eating and exercise behaviours

In terms of changes to eating and exercise behaviours, a number of significant relationships were found. For changes to restricting behaviours, a main effect for month was found with increased restricting across both groups from August to September ($F(5,4900) = 6.12$, $p < .001$), as shown in Fig. 3, but no main effect for group nor an interaction between group and month were found. No main effects for month or group were found for changes to binge eating, nor was there an interaction between the two. Changes in purging behaviours did not differ significantly between groups, but a significant main effect was found for month ($F(5,4894) = 3.86$, $p = .002$), with the whole sample demonstrating increased purging behaviours from August to September. No interaction was present between month and group. Finally, a main effect for group nor month were found for changes to exercise behaviours, nor an interaction between the two variables.

3.2. Group differences between first and second COVID-19 waves and associated lockdowns

3.2.1. Coping

Participants in both groups reported coping worse in terms of their mental health during the second wave, relative to the first wave, but the distribution of responses was similar for the two groups ($\chi^2(4) = 3.12$, $p > .05$; see Fig. 4).

3.2.2. Negative mood

In terms of depression scores on the DASS-21, increased levels of depression between first and second waves were found for the entire sample ($z = 2.368/0.125$, $p = .018$, 95% *CI* (−0.542, −0.051)). No interaction between group and wave were found. Anxiety and stress did not differ between waves for either group.

3.2.3. Hopefulness, resilience and quality of life

Hopefulness was significantly decreased during the second wave, relative to the first, for the entire sample ($z = 2.338/0.080$, $p = .020$, 95% *CI* (0.029–0.344)); with no interaction between group and wave. Resilience did not differ between waves for either group, whereas a significant decrease in quality of life was found during the second wave across the entire sample.

[2] Given the group differences in sex and age, these variables could not be included as covariates in analyses (Miller & Chapman, 2001).

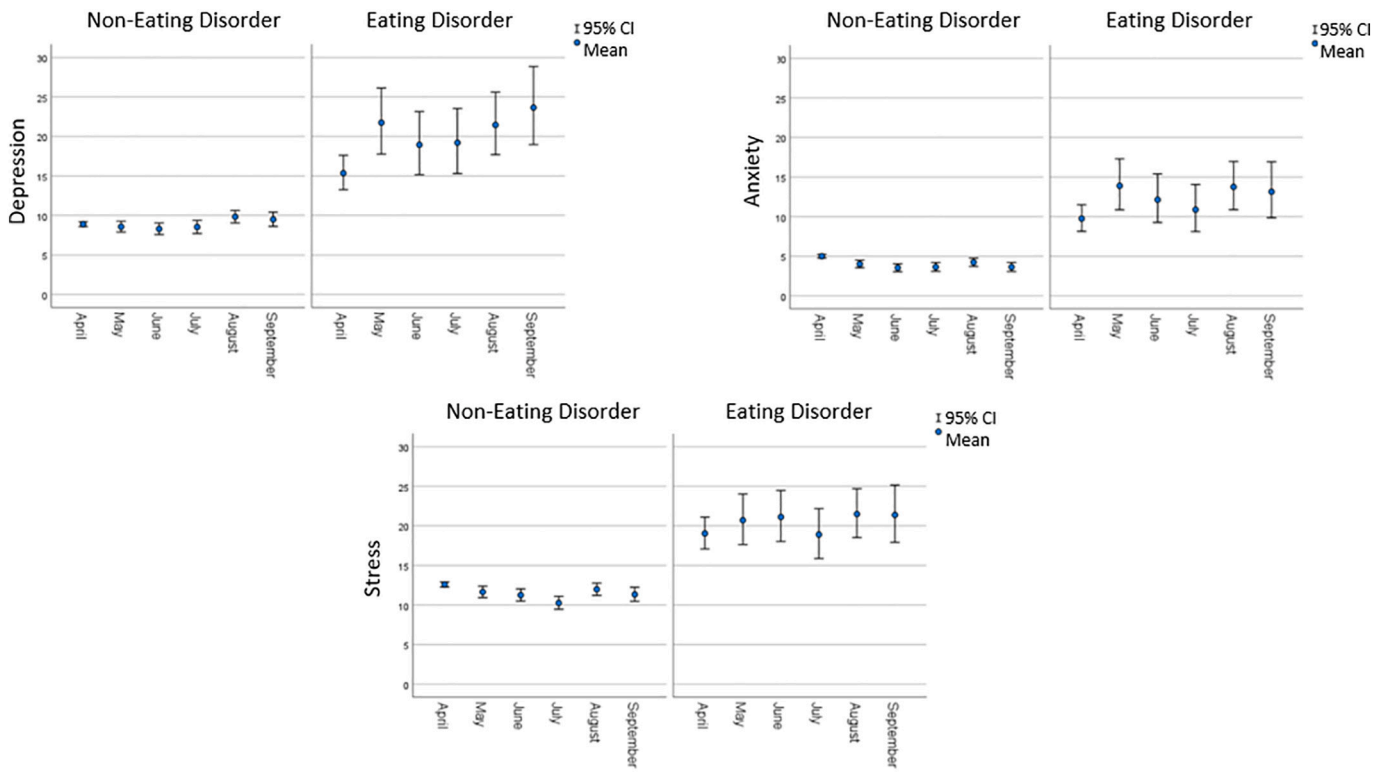

Fig. 1. Depression Anxiety Stress Scale (DASS-21) scores over time.

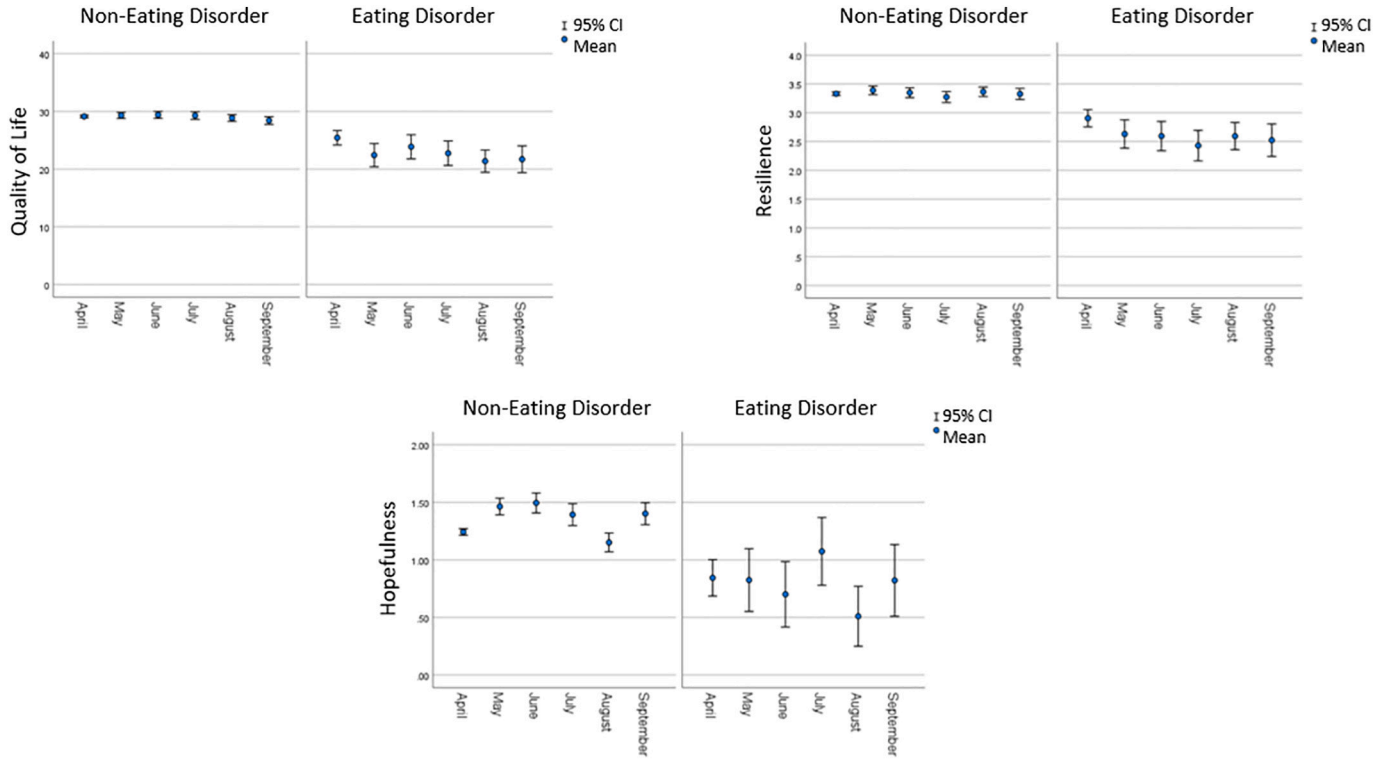

Fig. 2. Quality of life, resilience and hopefulness scores over time.

3.2.4. *Eating and exercise behaviours*

In terms of changes to eating and exercise behaviours, restricting behaviours were increased during the second wave across the entire sample ($F(1,3596) = 2.65$, $p = .010$). Binge eating, purging and exercise behaviours did not differ between waves.

Descriptive statistics were also performed on these variables to provide greater insight into changes in eating and exercise behaviours given the ordinal nature of the response options (see Figs. 5 and 6). Fifty-

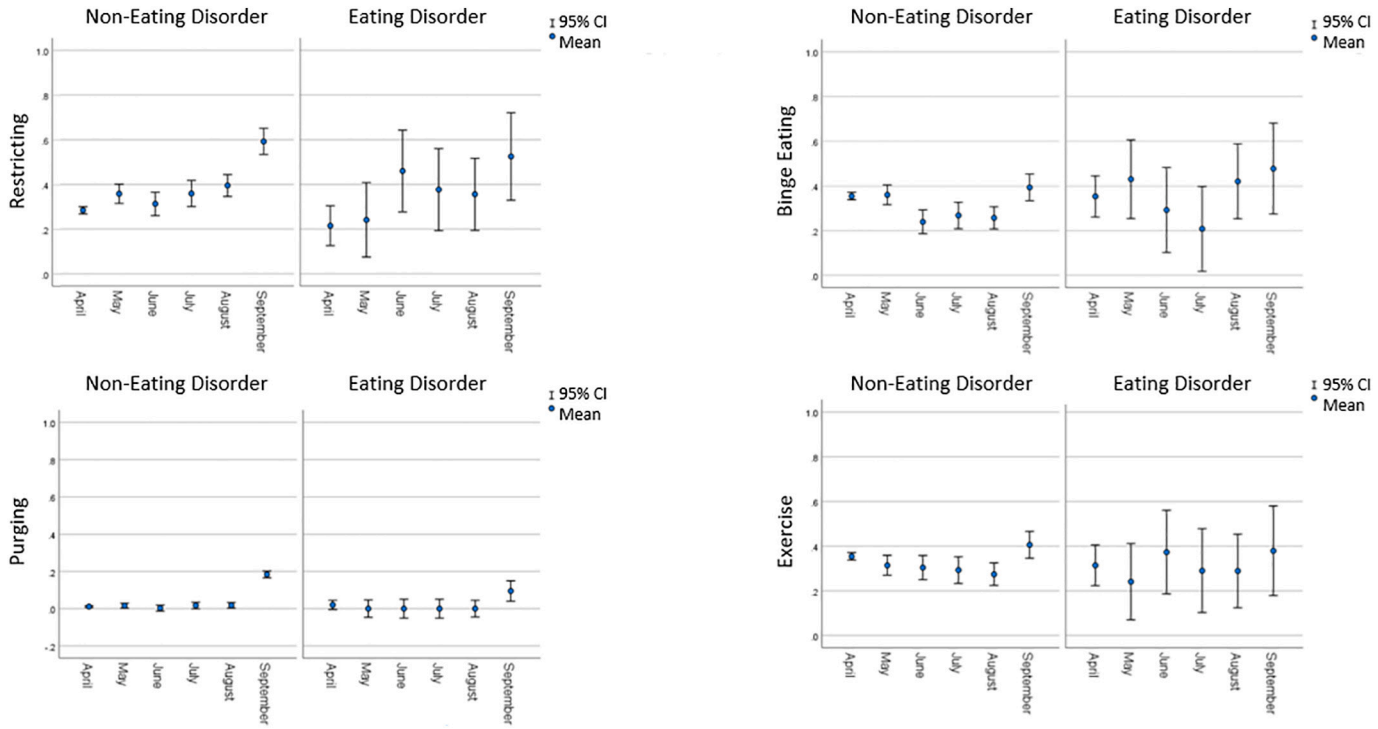

Fig. 3. Changes in eating and exercise behaviours over time.

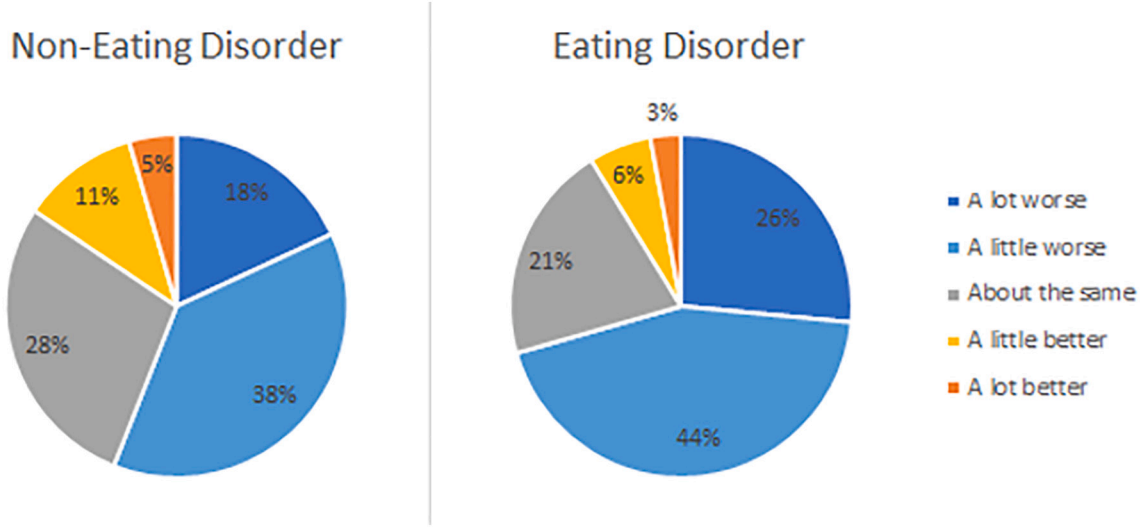

Fig. 4. Perceived coping in wave 2 compared to wave 1 of the COVID-19 pandemic. Participants were asked: 'Compared to the first set of government restrictions related to social distancing in March/April, during this set of government restrictions I am coping….'.

nine percent of the ED group reported restricting more in the first wave of the virus, compared to 67% of the ED group in the second wave. Changes to binge eating, purging and exercise were roughly the same for each wave for the ED group. Restricting behaviours were also increased in the non-ED group in the second wave, relative to the first (i.e. 28% vs 35% restricting a lot or a little more). Binge eating, however, decreased slightly in the second wave for the non-ED group (35% vs 28%), but purging and exercise behaviours were similar across waves.

3.3. Text mining

Text mining analyses on the two open-ended questions revealed a number of key themes (see Supplementary Tables 4 & 5 for text mining output). In relation to current worries in terms of mental health and wellbeing during the first wave of the virus, the ED group were most concerned about the impact of the pandemic on their mental health, as well as re-triggering of their eating disorder. In the second wave, they were most concerned about the effects of isolation, as well as feeling anxious. The non-ED group, on the other hand, were most concerned about social isolation during the first wave, and stress and anxiety levels in the second wave.

In relation to long-term concerns, during the first wave of the virus the ED group were most concerned about social isolation, as well as anxiety and fear around their family and the economy. During the second wave, long-term concerns centred around isolation and employment for the eating disorder group. For the non-ED group, long-term concerns

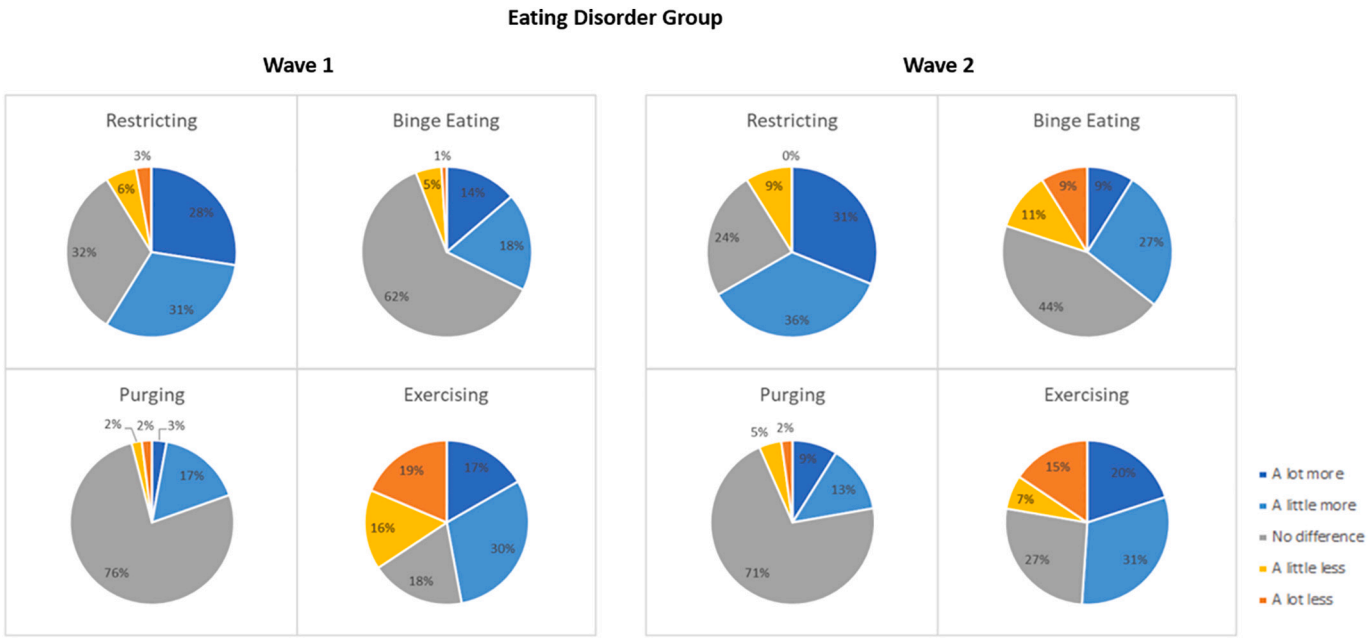

Fig. 5. Changes to eating and exercise behaviours in the past week in wave 1 and wave 2 of the COVID-19 virus for the eating disorder group.

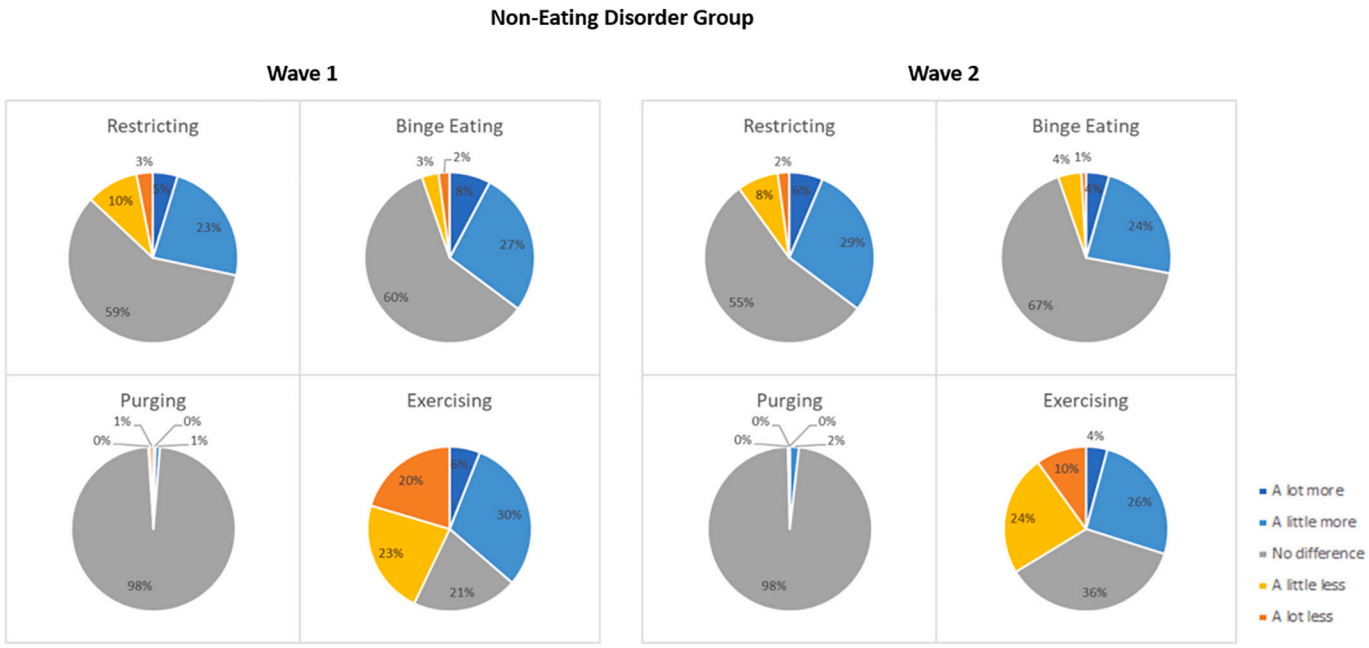

Fig. 6. Changes to eating and exercise behaviours in the past week in wave 1 and wave 2 of the COVID-19 virus for the non-eating disorder group.

in the first wave were focused around financial and economic impacts of the pandemic; and social isolation and concerns about travel during the second wave.

4. Discussion

The primary aim of this study was to identify changes in mental health symptoms month-by-month over the course of the pandemic in Victoria, Australia – and specifically between the first and second waves of the virus and associated lockdowns – between individuals with and without an ED history.

4.1. Month-by-month group differences over time from April to September 2020

In our data, several patterns emerged over the six time points of data collection. From July to August, during the second wave of the virus, while the ED group reported significantly poorer mental health throughout, both the ED and non-ED samples showed increased depressive symptoms, and decreased quality of life and hopefulness. Hopefulness, however, rebounded in September across the sample, likely due to the impending easing of government-imposed restrictions. Anxiety, stress and resilience, on the other hand, remained relatively stable across the six time points. Exercise and binge eating behaviours remained relatively stable over the course of the pandemic, and while

restrictive and purging behaviours were consistent between April and July, they increased across the entire sample from August to September. This result may be reflective of increased disordered eating behaviours typically associated with weight loss, not only in the ED group, but also the general population more broadly. Importantly, this increase occurred well within the second wave of the virus, suggesting that prolonged restrictions and lockdown may increase disordered eating symptoms.

4.2. Group differences between first and second COVID-19 waves

In relation to specific comparisons undertaken between the first and second waves of the virus/lockdowns, although the ED group reported coping worse, both groups reported coping worse during the second wave compared to the first, potentially representing a cumulative effect of repeated lockdowns. In addition, although anxiety, stress, and resilience did not differ between waves (but were poorer in the ED group), depression was found to be increased in the second wave for the sample overall, and both hopefulness and quality of life were decreased. Perceived changes to binge eating, purging and exercise behaviours also did not differ between waves one and two for the ED group. Purging and exercise behaviours were also similar for the non-ED group when comparing waves, but binge eating decreased a little in the second wave. Perceived change to restrictive behaviours, on the other hand, were also found with increased restricting in both groups in the second wave relative to the first, suggesting that cumulative lockdowns may exacerbate disordered eating in both ED and non-ED groups.

Differences between waves were also found for the free response questions probing current and long-term concerns. The ED group reported being most concerned about the effect of the pandemic on their mental health and re-triggering of their eating disorder symptoms during the first wave, but were most concerned about the effects of social isolation and feelings of anxiety during the second wave. Similarly, the non-ED group were concerned about stress and anxiety in the second wave, but instead were more worried about social isolation during the first. Long-term concerns centred around social isolation, anxieties around family and the economy in the ED group during the first wave; and similarly, around the economy for the non-ED group. In the second wave, concerns about isolation continued for the ED group, and were also present for the non-ED group. Short- and long-term concerns around mental health and social isolation were apparent from the results in the ED group in particular, and may require monitoring throughout the course of the pandemic to ensure mental health symptoms are not exacerbated.

4.3. Limitations

The findings of the study should be interpreted in light of some limitations. It should be noted that although the sample size was quite large, the number of respondents at each time point decreased over the course of the study, as is common with this type of research. The design of the study also meant that the same participants were not tracked over time, but the results instead present a snapshot of at different time points over the pandemic. Further, given the nature of online studies, participants were asked to self-report an ED history and we could not independently confirm diagnoses. It should also be noted that the non-ED group represented respondents without an ED history and will therefore have included individuals with other mental health or medical conditions. The online nature of this research also meant that participation involved self-selection, which may not necessarily be representative of the wider Victorian population. Furthermore, the sample was restricted to those residing in Victoria, Australia. Thus, further research will need to occur to ascertain whether these findings are generalisable to other areas that have experienced different government-imposed restrictions to limit the spread of COVID-19, as well as countries that have been affected to a greater degree by the pandemic in terms of COVID-19 case numbers. The current data provides an important snapshot for such comparisons. In addition, further research is required to ascertain whether the results are specific to individuals with an ED, or extend to individuals with mental health conditions more broadly who may be more vulnerable the associated effects of the pandemic.

4.4. Conclusions

Overall, the findings of the study have a number of important implications for understanding the mental health consequences of a global viral pandemic on individuals with and without eating disorders; as well as the impact of multiple waves and associated restrictions/lockdowns on mental health symptoms. The results suggest that although mental health symptoms were consistent between waves of the virus, they were exacerbated during these times relative to when the virus and pandemic were better controlled. Importantly, although non-ED and ED groups tended to generally show the same pattern of symptoms, the mental health status of the ED group was overall significantly poorer than the non-ED group throughout the pandemic. Therefore, although the pandemic and subsequent lockdowns appear to result in increased psychological consequences in the general community that require attention and support – including increased eating disorder symptomatology such as food restriction and purging – the exacerbation of already heightened psychological symptoms in individuals with EDs is a significant concern and should be closely monitored throughout this crisis.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Role of funding sources

This study did not receive funding.

CRediT authorship contribution statement

All authors contributed to the design of the project, obtained ethics approval, engaged in data collection and interpretation of findings. AP prepared the first draft of the manuscript. All authors provided intellectual and editorial input, and agreed to its final form.

Declaration of competing interest

The authors report no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.eatbeh.2021.101564.

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