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Mental distress of parents with chronic diseases during the COVID-19 pandemic in Australia: A prospective cohort study

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ABSTRACT

Objective: To-date there has been limited examination of the experience of the COVID-19 pandemic in parents who suffer from chronic physical conditions. We aimed to 1) examine whether presence of a chronic disease predicts differential latent distress profile memberships, and 2) assess factors that could predict different distress profiles in the sub-group of parents with a chronic disease.

Methods: We used a sample of 1618 parents, from the longitudinal COVID-19 Pandemic Adjustment Study, who completed a measure of mental distress (Depression, Anxiety and Stress Scale) at 13 data collection points. Distress profiles were assessed with the latent profile analysis.

Results: We identified four distinct mental distress profile memberships, with the most common membership characterised by very low (48.1%), followed by low (31.9%), moderate (15.7%), and high (4.3%) distress scores. A higher proportion of parents with chronic diseases belonged to profiles experiencing low (34.7% vs. 30.4%), moderate (18.7% vs. 14.1%), and high (5.5% vs. 3.7%) compared to very low (41.2% vs. 51.8%) distress levels than other parents. Residing in Victoria, younger age, lower levels of social support and appraisal of COVID as risk were associated with membership to higher compared to very low distress profiles.

Conclusion: Our findings highlight the importance of considering chronic disease co-morbidity as an additive risk factor in addressing mental health outcomes of parents during pandemic-like events, since parents with chronic conditions are more vulnerable to experiencing worse mental distress. Future interventions should focus on ways to strengthen social support and provide guidance for managing threat appraisal.

1. Introduction

On the 11th of March 2020, the coronavirus (COVID-19) was declared a pandemic by the World Health Organization, after the announcement of its first case in December 2019 in Wuhan, Hubei Province, China [52,88]. Since the first confirmed case of COVID-19 was reported in Australia in late January 2020, the state and federal governments have introduced a number of measures to stop the spread of the virus, such as national and local lockdowns, isolation, curfew, and social distancing [13]. Given the extent of the disruption, in addition to the uncertainty of the situation [49], it is not surprising that these measures imposed a serious change in people's daily, work and social activities and exacerbated or triggered psychological distress

[16,37,41,49,74,79,94]. Yet, research on mental health outcomes, especially in parents with chronic diseases, during the pandemic has been limited and mostly cross-sectional with a lack of prospective designs. Importantly, understanding how such a crisis influences mental health outcomes for parents with chronic diseases is crucial in order to develop effective interventions targeted to their needs [65,92].

For parents, there is emerging evidence that changes and concerns related to the COVID-19 pandemic led to more reported symptoms of anxiety and depression, increased alcohol consumption, stress about being safe from physical and emotional domestic violence, and experience of suicidal thoughts and feelings, in comparison to individuals without children [33,60,77]. Parents with a chronic health condition may be disproportionately affected and have a heightened risk for worse

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mental health outcomes due to layering of risks of being a parent during the pandemic and having a chronic health condition, each associated with its own stressors and risks for developing negative mental health outcomes. In addition, COVID-19 is more prevalent among people with chronic physical conditions, such as diabetes or cardiovascular diseases [5,40,84]. Individuals with chronic diseases demonstrate higher mortality rates and admissions to the intensive care unit [90,96], are at higher risk for developing severe COVID-19, and oftentimes have worse prognosis [96,105]. Thus, individuals with chronic diseases might be at increased risk for having worse mental health outcomes due to their potential of developing more serious coronavirus symptoms and complications [13,18,109].

Furthermore, individuals with a co-morbid physical condition in general are more at risk for experiencing mental distress ([8,27,93,103]; Canadian Mental Health [17]). For many individuals with a chronic disease, such risk is additionally aggravated by social or relationship problems, poor levels of perceived health [103], with uncertainty and concerns for one's health also playing a role [2,51,72,81]. Studies show that lockdown measures negatively affected individuals with chronic diseases (such as diabetes, hypertension, and pulmonary diseases), due to changes in daily routines, diet, physical exercise, and difficulty accessing health care providers/services [20,91]. Since the pandemic started people with chronic diseases have experienced more sleep disturbances [25,38], increased levels of anxiety, depression, and stress than healthy controls [16,31,92]. Additionally, in a survey conducted in March–April 2020 ($n = 202$), 80% of healthcare professionals indicated that mental health of their patients with a chronic disease had worsened during COVID-19 [20].

The COVID-19 Pandemic Adjustment Survey (CPAS) offers a rare opportunity to examine for the first-time repeated measures (13 time-points of data from April 2020 to March 2021) mental health outcomes in parents with chronic disease. The CPAS examines the impact of the COVID-19 pandemic on a large sample ($n = 2365$) of Australian families and aims to provide information on the mental health impacts of the COVID-19 crisis on parents and children in Australia by (1) identifying communities, parents, families, and children most at risk of poor outcomes; and (2) identifying potential factors to address in clinical and public health interventions to reduce risk. While the levels of adult mental distress have increased during the pandemic compared to pre-pandemic levels, very few studies to-date have focused specifically on parents or parents with chronic diseases, who might be additionally vulnerable to worse mental health outcomes. In particular, this group have pre-existing heightened risk for mental health problems compared to individual without chronic diseases (e.g., [8,19,43,93]); they tend to develop more serious coronavirus symptoms and complications after contracting the virus [13,18,109]; and face unique challenges regarding the pandemic such as accessing healthcare providers and necessary medication reported as the main challenges during past natural disasters (e.g., Hurricane Katrina) (e.g., [10,55]).

The aim of the present cohort study is to utilise the CPAS to investigate mental distress outcomes over time during the COVID-19 pandemic in parents who are diagnosed with a chronic disease. We aimed to: (1) Examine whether the presence of a parental chronic disease predicts differential mental distress (measured by the total score of the Depression, Anxiety and Stress scale) profile memberships identified with the use of latent profile analysis (LPA) over the course of 13 study waves. Based on the existing literature, it is hypothesised parents with a chronic disease will be more likely to belong to latent profiles characterised by higher mental distress compared to parents without a chronic physical condition. We also aimed to: (2) Assess whether there are certain factors (i.e., gender, state of residence, age, appraisal of COVID-19 risk and social support) that could predict differential mental distress profiles in the sub-group of parents with a chronic disease. Specifically, past research has demonstrated that during the COVID-19 pandemic, women/mothers have an increased risk of poorer mental health outcomes [39,112], which has been linked to increased unpaid work and

caregiving or distance education responsibilities associated with lockdowns [21]. Residing in Victoria was chosen as a predictor since the state of Victoria (compared to other Australian states) has experienced one of the strictest lockdowns in the world and we wanted to investigate whether such drastic measures (compared to more lenient guidelines) would contribute to higher levels of mental distress. Further, COVID-19 studies have demonstrated that older adults are less negatively affected in terms of mental health outcomes compared to younger adults (e.g., [6,7,77]) but it is unclear if this relationship exists in parents. In addition, past research demonstrated that higher epidemic risk perception was associated with higher distress (e.g., [61,63]) but the data for parents and those with chronic illness are largely lacking. Finally, lack of social support might be particularly problematic for vulnerable individuals (e.g., those with pre-existing mental or physical conditions) and for parents and, thus, we assessed the possible interaction effect between presence of a chronic disease and social support.

2. Methods

2.1. Ethical approval

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. The present study was approved by the Deakin University Human Ethics Advisory Group (HEAG-H 52.2020). Participants indicated their consent to participate in the study at the start of the online questionnaire. In addition, participants were invited to complete separate (and optional) consent to be contacted for future research participation.

2.2. Participants

Participants were recruited as a part of a larger longitudinal cohort study: COVID-19 Pandemic Adjustment Survey (CPAS, $n = 2365$) [106]. CPAS examines the impact of the COVID-19 pandemic on a cohort sample of Australian families. Parents were recruited via paid and unpaid social media advertisements, utilizing variety of methods to increase the representativeness of the sample, that contained a web link directing them to a Qualtrics survey (distributed every two to four weeks). Recruitment occurred over the period of three weeks from 8th to the 28th of April 2020, during a 'level three' national lockdown in Australia. Parents were eligible to participate if they were an Australian resident, English speaking, a parent of a child aged 0–18 years, and 18 years or over. The present analysis used data from 13 waves (W1–W13) collected from the period of April 2020 to March 2021. Participants were selected if they completed a measure of mental distress (DASS-21) in at least three study waves. This left a sample of 1618 parents. There were 1323 women, 277 men, and 18 did not specify their gender. Parents were aged between 22 and 69 years ($M = 38.97$, $SD = 6.82$).

2.3. Materials

The measures chosen for the present analyses are listed below and were selected from the CPAS survey. Mental distress was assessed at 13 times points and the remaining measures were taken at baseline.

2.3.1. Primary measures

Presence of a chronic disease was assessed by asking the participants the following questions: "Have you ever been treated for a chronic condition?", "Have you ever been treated for endometriosis/hypertension/Type 2 diabetes/Type 1 diabetes/ulcerative colitis/Crohn's disease/cardiovascular disease?", and "Have you ever been treated for any other chronic condition?". The presence of a physical chronic disease was coded as binary (0='No', 1='Yes').

Mental distress was measured with the well-validated Depression,

Anxiety and Stress Scale (DASS) 21-item version [9,47,64]. It is comprised of three 7-items subscales that measure symptoms of depression ($\alpha = 0.89$), anxiety ($\alpha = 0.82$), and stress ($\alpha = 0.87$). Example item: "I found it hard to wind down". The items are rated on a 4-point Likert scale ranging from 0 = 'Did not apply to me at all' to 3 = 'Applied to me very much, or most of the time'. Total DASS scores (combined scores of depression, anxiety, and stress symptoms, named distress ($\alpha = 0.88$; [101]) can range from 0 to 120 and higher scores indicate greater symptom severity.

2.3.2. Secondary measures

Appraisal of COVID-19 as a serious health risk was measured using the item adopted from CRISIS: "COVID-19 is a serious health risk for someone like me.", rated on a 7-point scale ranging from 1='strongly disagree' to 7='strongly agree'.

Social support was assessed with one item adopted from the Longitudinal Study of Australian Children (LSAC) [11]: "Overall how do you feel about the amount of support or help you get from family or friends living elsewhere?", rated on a 4-point scale from 'I get enough help' to 'I don't get any help at all' and 'I don't need any help'.

The remaining measures were binary (gender (0='male', 1='female'), state of residence (0='Victoria', 1='Other'), and continuous (age measures in years).

2.3.3. Demographic measures

Demographic measures were binary (completion of high school (0='did not complete all years of high school', 1='completed all years of high school'), language other than English spoken at home (0='No', 1='Yes'), place of birth (0='born in Australia', 1='born overseas'), Aboriginal or Torres status (0='No', 1='Yes'), geographical remoteness (0='Major cities in Australia', 1='Remote areas'), history of mental health concerns (0='No', 1='Yes'), single parent household (0='Yes', 1='No'), household income (0='Bad', 1='Good'), or categorical (number of children (1='one child', 2='two children', 3='3 children, 4='four or more children').

2.4. Missing data

Analyses were conducted in MPlus v.8 [71] and SPSS v.27. Item level missing data ranged from 0.06 to 69.2% on baseline characteristics and variables of interest, with the most missing values detected for DASS at the 12th wave ($n = 1120$). Missing data, with exception of DASS scores, were replaced using multivariate multiple imputation. The reported results utilized the imputed variables.

2.5. Statistical analysis

First, potential differences in demographic and baseline characteristics between parents with and without a chronic disease were assessed with the use of independent-samples *t*-test or χ^2 . Second, we examined whether there are subgroups in the sample that experienced different profiles of mental distress over the 13 waves of the data analysed. This was done using a latent profile analysis conducted in MPlus v.8. LPA is a categorical latent variable modelling approach that aims to identify latent subpopulations (i.e., latent profiles) based on a set of variables using maximum likelihood estimation [22,97,111]. We used LPA to model the variability that exists in the data (rather than imposing predetermined standards such as specific cut-offs on the data). LPA is a 'person-centred approach' that identifies patterns across multiple variables within each person, allowing grouping of participants who have similar responses (patterns) across the selected variables.

In the present study in order to identify the optimal number of latent profiles, we began with a two-profile model and added one profile at a time. Bootstrapped likelihood ratio test (BLRT) can be used to select the optimal number of profiles, however in large samples it will continue to suggest that the data fit will be improved by the addition of more

profiles. Thus, we selected the optimal number of profiles based on two criteria; first, visual examination of elbow plots of the information criteria, including Akaike Information Criteria (AIC), the Bayesian Information Criteria (BIC), and sample-adjusted BIC (SABIC) (see [42,66,68,69]). Next, we considered Nylund et al. [73]'s specified additional criterion that the posterior probabilities should be greater than 0.70 (i.e., entropy; the probability that an individual belongs to their assigned profile and no other).

Lastly, we examined whether the presence of a chronic disease can predict DASS profile memberships (Aim 1). This was done using the multinomial logistic regression in SPSS v.27. We ran two models. In the first model we entered dummy variables associated with profile membership as the dependent variables (the profile associated with the lowest level of mental distress, compared to each other profile), and chronic disease presence as a predictor, together with gender, age, state of residence, appraisal of COVID as risk to one's health and social support. In the second model, interaction terms were added between chronic disease presence and the appraisal of COVID as risk for one's health and social support, in order to examine whether those factors are more likely to predict membership of profiles characterised by higher mental distress in parents with chronic diseases (Aim 2).

3. Results

3.1. Sample characteristics

Of the 1618 respondents, 568 reported a chronic disease. Within the latter group, the most commonly treated physical diseases were not specified ($n = 187$), followed by endometriosis ($n = 138$), hypertension ($n = 133$), Type 2 diabetes ($n = 36$), Type 1 diabetes ($n = 20$), ulcerative colitis ($n = 20$), Crohn's disease ($n = 18$), and lastly cardiovascular disease ($n = 16$). Parents with and without a chronic disease did not differ on the following socio-demographic characteristics, including place of birth, language spoken at home, completion of all years of high school, household income, current state of residence, and geographical remoteness. However, parents with a chronic disease were older, were more likely to be of Aboriginal or Torres Strait Islander background, were a single parent household, and more commonly reported being treated for their mental health compared to parents without a chronic disease. There were also more females and fewer males diagnosed with a chronic disease. Lastly, parents with chronic diseases were more often a one- or three-children's households, and less often a two- or four or more children's households than parents without a chronic disease. Please see Table 1.

We have previously demonstrated that CPAS sample is broadly representative of the Australian parent population in terms of number of children, geographic location, parents born overseas, and single parent households, however it is to some degree under-representative of parents with a low income and low education, and of course under-representative of fathers [107].

3.2. Mental distress latent profile memberships

The information criteria for two to six profiles indicated that a four-profile solution was the best fit of the data with the probability that an individual belongs to their assigned profile and no other (i.e., entropy) of 0.87. The four profile-solution was furthermore chosen for subsequent analyses because of the overall big sample size, and it improved the data fit. The mean values of mental distress at each of the thirteen data collection times for the four profiles are displayed in Fig. 1. Profile 1 (Very low distress) ($n = 778$, 48.1%) was the most common membership, and consistently showed the lowest level of mental distress, with distress scores ranging from 9.4 to 17.6 across the waves. Profile 2 (Low distress) ($n = 516$, 31.9%) consistently displayed low levels of mental distress, ranging from 23 to 33.1, that were the most stable across the waves compared to the other profiles. Profile 3 (Moderate distress) ($n =$

Table 1
Comparison of baseline characteristics between parents with and without a chronic disease.

Variable	Parents without a chronic disease (n = 1050)	Parents with a chronic disease (n = 568)	Differences between groups	
	Mean (SD)	Mean (SD)	t(df)	Mean difference
Age	38.38 (6.5)	40.07 (7.27)	-4.632 (1056)***	-1.69
	%	%	χ^2 (df)	% difference
Gender			8.56 (2)*	
Male	19.6%	14.3%		-5.3%
Female	80.1%	85.0%		4.9%
Other	0.3%	0.7%		0.4%
Aboriginal or Torres Strait Islander	1.0%	3.0%	8.20 (1)**	2.0%
Born overseas	17.4%	15.3%	1.18 (1)	-2.1%
Language other than English	3.6%	3.2%	0.22 (1)	-0.4%
Did not complete high school	13.8%	16.2%	1.68 (1)	2.4%
Low household income	12.5%	13.0%	0.10 (1)	0.5%
Single parent household	7.9%	11.8%	6.64 (1)**	3.9%
State			2.69 (1)	
Victoria	52.9%	48.6%		-4.3%
Other	47.1%	51.4%		4.3%
Geographical remoteness			0.25 (1)	
Major cities of Australia	70.4%	69.2%		-1.2%
Other	29.6%	30.8%		1.2%
Number of children			8.91 (3)*	
1 child	25.1%	31.5%		6.4%
2 children	49.5%	43.5%		-6.0%
3 children	18.0%	18.7%		0.7%
4 or more children	7.3%	6.3%		-1.0%
History of mental health concerns			11.15 (1)***	
Yes	39.0%	47.5%		8.5%

Note. Asterisks indicate significant results: * $p < .05$ ** $p < .01$ *** $p < .001$.

254, 15.7%) was characterised by scores raging from 44.5 to 56.1 across the waves, which were just below the recommended cut-off value of 60 to be classified as ‘high’ or ‘severe’ (scores above or equal to 21 for the depression, 15 for the anxiety, and 26 for the stress sub-scale are labelled as ‘high’ or ‘severe’; [14,64]). Lastly, Profile 4 (High distress) ($n = 70$, 4.3%) consisted of the smallest fraction of participants, who displayed the highest mean scores of mental distress, ranging from 73.7 to 86.6. The scores were approximately 20–35 points higher than scores of the

Profile 3 (Moderate distress). Representation of profile memberships of parents with and without a chronic disease can be seen in Fig. 2.

Higher proportion of parents with chronic diseases belonged to Profile 2 (Low distress) (34.7%, $n = 197$ vs. 30.4%, $n = 319$), Profile 3 (Moderate distress) (18.7%, $n = 106$ vs. 14.1%, $n = 148$), and Profile 4 (High distress) (5.5%, $n = 31$ vs. 3.7%, $n = 39$) compared to Profile 1 (Very low distress) (41.2%, $n = 234$ vs. 51.8%, $n = 544$) than parents without a chronic disease.

3.3. Chronic disease and differential mental distress profile memberships

Likelihood ratio tests ($\chi^2(18) = 197.5, p \leq 0.001$) from multinomial regression analyses with each mental distress profile compared to Profile 1 (Very low distress) indicated that the model fits the data. R^2 values were 0.12 (Cox and Snell), 0.13 (Nagelkerke), and 0.05 (McFadden). Relative to the Profile 1 (Very low distress), membership of Profiles 2 (Low distress) and 3 (Moderate distress), were predicted by chronic disease presence, residing in Victoria, not having social support, and appraising of COVID as risk to one’s health. Relative to the Profile 1, predictors of the Profile 4 (High distress) included having a chronic disease, not having social support, appraising COVID as a risk, and age.

In the second model, two interaction terms were additionally added between chronic disease presence and the appraisal of COVID as risk for one’s health and social support. Likelihood ratio tests ($\chi^2(24) = 213.06, p \leq 0.001$) indicated that model 2 fits the data as well. R^2 values were 0.12 (Cox and Snell), 0.14 (Nagelkerke), and 0.06 (McFadden). Relative to Profile 1 (Very low distress), membership in Profile 2 (Low distress) was predicted by having a chronic disease, residing in Victoria, not having social support, and appraisal of COVID as a risk. The predictors of the Profile 3 (Moderate distress) membership included residing in Victoria and not having social support. There was a significant interaction between presence of chronic disease and appraisal of COVID as risk to one’s health ($p = .003$). Lastly, the predictors of the Profile 4 (High distress) membership were having chronic disease, not having social support, and age. Neither of the interaction effects were significant ($p = .122$ and $p = .121$). Please see Table 2.

4. Discussion

This prospective study investigated profiles of mental distress in Australian parents over the course of 13 waves of data collection, during the COVID-19 pandemic. Despite evidence of population level increases in mental distress compared to pre-pandemic scores in the Australian population of parents [107], findings from the current study suggest that mental distress remained within the normal range for the majority of parents [64]. This could be due to the response of the Australian government to the pandemic, in terms of rapid and effective implementation of policies and actions to mitigate the spread of the COVID-19 virus, and Australia’s geographical advantage of being a remote island [48,53]. However, compared to parents without a chronic disease, parents with a chronic disease were overrepresented in latent profiles experiencing

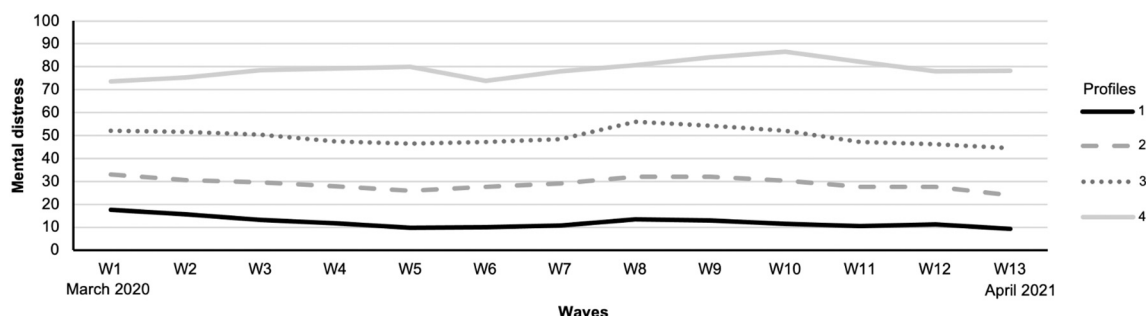


Fig. 1. Mean Mental Distress Values For Each Latent Profile Over Time.

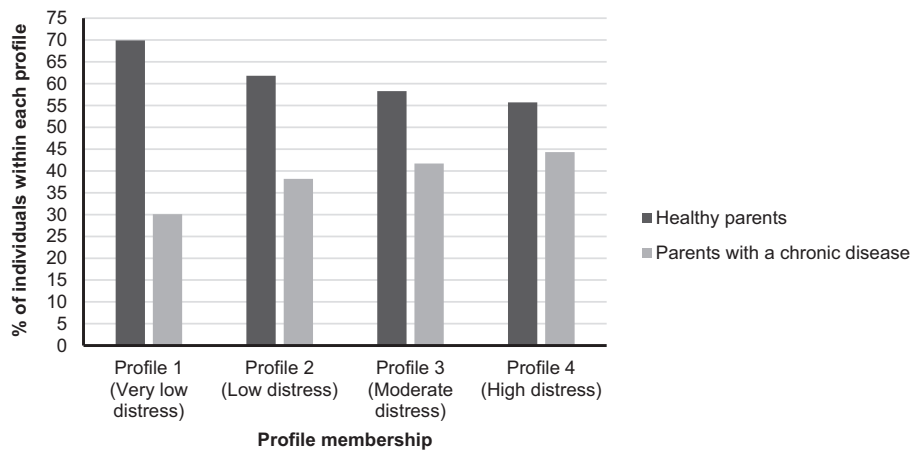


Fig. 2. Distribution of Distress Profile Memberships in Parents With and Without Chronic Disease.

Table 2
Multinomial Regression Analysis Results Predicting Mental Distress Profile Memberships (n = 1618).

	Profile 2 (Low distress)				Profile 3 (Moderate distress)				Profile 4 (High distress)			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	B	Exp (B) (95% CI)	B	Exp (B) (95% CI)	B	Exp (B) (95% CI)	B	Exp (B) (95% CI)	B	Exp (B) (95% CI)	B	Exp (B) (95% CI)
Chronic disease	0.31*	1.36 (1.06, 1.73)	0.65**	1.91 (1.18, 3.09)	0.37*	1.45 (1.06, 1.99)	0.53	1.69 (0.99, 2.89)	0.60*	1.83 (1.08, 3.08)	0.99*	2.68 (1.25, 5.81)
Female gender	0.31	1.36 (0.99, 1.86)	0.31	1.36 (0.99, 1.86)	0.40	1.49 (0.96, 2.29)	0.39	1.48 (0.96, 2.28)	-0.41	0.66 (0.35, 1.25)	-0.42	0.65 (0.35, 1.24)
Age	-0.01	0.99 (0.97, 1.00)	-0.01	0.99 (0.97, 1.00)	-0.01	0.99 (0.97, 1.01)	-0.01	0.99 (0.96, 1.01)	-0.04*	0.96 (0.92, 1.00)	-0.04*	0.96 (0.92, 1.00)
Victoria	0.35**	1.41 (1.12, 1.78)	0.34**	1.41 (1.12, 1.78)	0.37*	1.44 (1.07, 1.95)	0.36*	1.43 (1.06, 1.93)	0.41	1.51 (0.90, 2.52)	0.39	1.48 (0.89, 2.47)
Appraisal of COVID	0.10**	1.11 (1.03, 1.18)	0.11*	1.12 (1.02, 1.21)	0.20***	1.23 (1.12, 1.34)	0.10	1.10 (0.99, 1.23)	0.20**	1.22 (1.06, 1.41)	0.11	1.11 (0.91, 1.36)
Social support	-0.86***	0.42 (0.33, 0.55)	-0.72***	0.49 (0.35, 0.67)	-1.46***	0.23 (0.17, 0.32)	-1.36***	0.26 (0.17, 0.38)	-1.74***	0.18 (0.11, 0.30)	-1.43***	0.24 (0.12, 0.47)
Chronic disease * Appraisal of COVID			-0.01	0.99 (0.87, 1.14)			0.27**	1.31 (1.10, 1.58)			0.24	1.27 (0.94, 1.70)
Chronic disease * Social support			-0.43	0.65 (0.37, 1.14)			-0.37	0.69 (0.36, 1.34)			-0.84	0.43 (0.15, 1.25)

Note. Model 1 included chronic disease presence, female gender, age, state of Victoria, appraisal of COVID as risk to one's health and social support as predictors. Model 2 in addition included interaction terms between chronic disease presence and appraisal of COVID as risk to one's health and social support. Asterisks indicate significant results: * p < .05 ** p < .01 *** p < .001.

higher overall distress. Thus, our findings are consistent with past pandemic research suggesting that individuals with chronic physical diseases score higher on measures of depression, stress and anxiety and are at more risk for poorer mental health outcomes compared to individuals without co-morbid physical conditions [4,16,26,92,104]. We extend this literature by focusing specifically on parents, and furthermore we did find an association between parental chronic physical condition and mental distress profiles, where parents with a chronic condition were more likely to be characterised by low, moderate, or high distress profiles compared to the very low profile.

We additionally found that appraisal of COVID-19 as a serious risk for one's health was associated with profile memberships characterised by low, moderate and high compared to very low distress levels. Appraising COVID as risk was associated with profile membership characterised by moderate compared to very low levels of distress for

parents with a chronic condition. Self-perceived health risks of the virus can be regarded as a form of threat appraisal, associated with increased levels of worry, even more limited social interactions, and increased isolation, which are linked to worse mental health outcomes [16,30,36,46,50,63,77,82,98]. For those with chronic conditions such appraisal of threat could be linked to the heightened vulnerability to worse health outcomes after contracting the virus, including higher mortality rates [26,76,87,90,92,96,105,113]. Our findings are in line with other pandemic research, showing that COVID risk perception among individuals both with and without chronic conditions has been associated with worse self-rated mental health [45,58]. For parents and especially single parents such appraisal of threat might be additionally aggravated since getting infected with COVID could hold more dire consequences such as financial repercussions or temporary diminished support within the family.

Parental chronic condition being associated with profiles characterised by higher distress during the pandemic may be due to a number of factors. Existing pandemic research has shown that parents have been at heightened risk for developing symptoms of anxiety and depression, experiencing stress, burnout, suicidal thoughts and feelings [3,33,77]. Having a chronic physical condition may amplify risk generally, in light of the documented pre-existing risk for individuals with co-morbid physical to experience mental distress [8,27,70,86,93,103]. However, parents with chronic disease may also have experienced additional challenges posed by the specific context of the pandemic. For example, quarantine and COVID-19 preventive measures make it challenging for individuals with chronic diseases to access routine medical care, in addition to being particularly susceptible to stress related to potential shortages in available medicine and human resources, especially in more low- and middle-income countries [67,78]. However, importantly, the present study did not measure the severity of the chronic illness, its burden or current treatment and these factors could add to the present data and make its interpretation more nuanced.

Consistent with past pandemic research, we also demonstrated that lack of social support from friends or family was associated with profiles characterised by higher distress levels [34,62,110]. Importantly, social support was the strongest and the most consistent predictor within the models, suggesting that for parents (not unique to only those with chronic diseases) receiving diminished help from friends or family was associated with higher levels of reported states of depression, anxiety and distress. Lack of social support might be particularly problematic for parents, since they are also responsible for taking care of their children who experience worse sleep quality, depression, anxiety, and irritability symptoms compared to pre-pandemic levels [75]. Conversely, strong perceived social support, especially from those close to a person, can be a protective factor against adverse mental health outcomes (e.g., depressive symptoms, distress), which is not surprising, since those around us can help to cope with stressful situations and offer support in times of crisis, such as the pandemic providing a buffer against adverse life events [1,56,57,63,80,99,100].

Furthermore, residing in Victoria was associated with membership to profiles with low and moderate compared to very low distress levels, which is not surprising since the state of Victoria experienced one of the strictest and longest lockdowns in the world [108], and periods of lockdowns have been linked with deteriorating mental health [28,74,95]. Lastly, we showed that lower age was associated with the profile characterised by high parental distress. In recent years, there has been a documented increase in mental health issues among younger adults [44,54,102], which during the pandemic may have been further exacerbated by labour market crisis, concerns about employment, finances [24], and managing all the responsibilities as a younger parent.

Our findings highlight the importance of considering chronic disease co-morbidity in addressing mental health outcomes of parents during pandemic-like events. For individuals with chronic diseases contextual factors might be of great importance, since they can impact the process of self-management and have implications for health outcomes [15,23,89]. For example, policies should make it easier for those with co-morbid conditions to access healthcare providers and necessary medication. Furthermore, peer support groups may offer support and allow for exchange of information and coping strategies, to strengthen social supports for parents with chronic conditions and improve their mental health outcomes [29,32,83]. Investigating interventions promoting active coping strategies could also be useful, since such coping (including concentrating on one's efforts on doing something about current situation and taking action to make the situation better) has been associated with decrease in stress for individuals with chronic conditions during the COVID-19 pandemic [35]. Lastly, managing appraisal of threat, such as reaching for reliable information from government, reducing excess media consumption, which can lead to increased negative emotions [59,85] and confusion due to inconsistent and insufficient information regarding the pandemic, strengthening

own's coping responses and mechanisms (e.g., those that increase resilience or positive affect), and increasing social support might offer further help.

The present study has a number of strengths, such as a longitudinal prospective design, large cohort sample, inclusion of measures to assess chronic diseases, which tend to be underreported in COVID-related research, and the use of a well-validated questionnaire for the main outcome measure of mental distress. However, some limitations of the study need to be noted. First, the sample consisted predominantly of mothers. Therefore, the findings of the present study should be interpreted with caution in relation to fathers. Second, the present study used a convenience sample which might not be fully representative of the Australian population. However, past research utilizing the whole sample from CPAS demonstrated that the data was close to being representative [108]. Further, the presence of chronic disease symptoms and the general burden of disease as well as the specific treatment participants took were not known. However, it is the presence of a chronic disease rather than treatment that appears as a common mental health risk factor in research. Of course, some treatments (e.g., immunomodulators) might influence the responses more than others. While there might be a difference in disease burden, even within one diagnosis the severity of symptoms might differ quite drastically.

Future research should focus on further investigating factors that could ameliorate the mental distress, especially for those individuals who experience multiple risk factors. The characteristics of those parents displaying low and very low distress levels should be investigated in order to understand the protective factors that may boost resilience during future pandemics. It would also be beneficial to examine separate profiles of subtypes of mental health problems (e.g., anxiety, depression) in parents with chronic diseases. This would allow for more accurate tailoring of future interventions. Lastly, mental distress profiles and factors influencing them should be investigated in a cross-national sample or in distinct nationally representative samples, since it is possible that in people with chronic physical conditions outcomes vary depending on the COVID restrictions posed by different countries and their governments or differential access to mental health providers.

In summary, our findings indicate that parents with chronic physical conditions, and especially those individuals with multiple risk factors, are more vulnerable to worse mental distress outcomes. One factor that should especially be paid attention to is the amount of social support acquired from family members and friends, since its low levels are consistently associated with increased mental health concerns. Future interventions should focus on individuals with multiple risk factors, while forthcoming research should further address factors that predict both low and high levels of mental distress in various sub-populations in order to tailor those interventions to their specific needs.

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Data sharing

All data are available now on the Australian Data Archive.

Authors' contribution

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Kinga Bik-Multanowska, Julian Fernando and Elizabeth Westrupp. The first draft of the manuscript was written by Kinga Bik-Multanowska and all authors commented on versions of the manuscript. All authors read and approved the final manuscript. Elizabeth Westrupp has verified the underlying data.

Declaration of Competing Interest

The Authors declare that there is no conflict of interest.

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