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Brief Report

The COVID-19 pandemic's impact on worry and medical disruptions reported by individuals with chromosome 22q11.2 copy number variants and their caregivers

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Abstract

Background The world has suffered immeasurably during the COVID-19 pandemic. Increased distress and mental and medical health concerns are collateral consequences to the disease itself. The Genes to Mental Health (G2MH) Network consortium sought to understand how individuals affected by the rare copy number variations of 22q11.2 deletion and duplication syndrome, associated with neurodevelopmental/neuropsychiatric conditions, were coping. The article focuses on worry and disruptions in medical care caused by the pandemic.

Methods The University of Pennsylvania COVID-19 Stressor List and care disruption questions were circulated by 22 advocacy groups in English and 11 other languages.

Results A total of 512 people from 23 countries completed the survey; most were caregivers of affected individuals. Worry about family members acquiring COVID-19 had the highest average endorsed worry, whilst currently having COVID-19 had the lowest rated worry. Total COVID-19 worries

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were higher in individuals completing the survey towards the end of the study (later pandemic wave); 36% (n = 186) of the sample reported a significant effect on health due to care interruption during the pandemic; 44% of individuals (n = 111) receiving care for their genetic syndrome in a hospital setting reported delaying appointments due to COVID-19 fears; 12% (n = 59) of the sample reported disruptions to treatments; and of those reporting no current disruptions, 59% (n = 269) worried about future disruptions if the pandemic continued. Higher levels of care disruptions were related to higher COVID-19 worries (Ps < 0.005). Minimal differences by respondent type or copy number variation type emerged.

Conclusions Widespread medical care disruptions and pandemic-related worries were reported by individuals with 22q11.2 syndrome and their family members. Reported worries were broadly consistent with research results from prior reports in the general population. The long-term effects of COVID-19 worries, interruptions to care and hospital avoidance require further study.

Keywords 22q11.2 deletion syndrome, 22q11.2 duplication syndrome, copy number variations (CNVs), COVID-19, neurodevelopmental psychiatric disorders (NPDs)

Introduction

The global COVID-19 pandemic has had major reverberating effects on mental and physical health around the world and may have disproportionately affected populations requiring substantial medical and psychiatric care. One such group includes individuals affected by chromosomal microdeletions or microduplications, pathogenic copy number variations associated a priori with increased risk for neurodevelopmental and neuropsychiatric disorders (CNV-NPD) (Merikangas *et al.* 2009; Malhotra & Sebat 2012; Kirov 2015; Martin *et al.* 2020), such as the chromosome 22q11.2 deletion and duplication syndromes. 22q11.2 deletion and duplication syndromes are thought to result from non-homologous meiotic recombination events occurring in approximately 1 in every 1000 fetuses and 1/2148 live births, with the deletion being more common than the duplication (Blagojevic *et al.* 2021). Most deletions are *de novo*, whereas duplications are often familial. Individuals with either condition may present with any combination of congenital anomalies including but not limited to congenital heart disease and palatal differences; endocrine abnormalities, T-cell lymphopenia, feeding difficulty, GORD, failure to thrive, constipation chronic otitis media, hearing loss, sleep apnoea, respiratory distress and asthma; ophthalmologic differences; scoliosis, C-spine differences and craniosynostosis; microcephaly, macrocephaly and dysmorphic craniofacial features; and hypotonia, seizures, migraines, speech delay, expressive speech and language delay, developmental delay and gross motor delay. The chromosome 22q11.2 syndromes also have an elevated risk of developmental and behavioural differences such as attention deficit hyperactivity disorder, anxiety and psychotic disorders (Brunet *et al.* 2008; Hiroi *et al.* 2013; Tang *et al.* 2014; McDonald-McGinn *et al.* 2015; Bassett *et al.* 2017). Despite the phenotypic overlap, 22q11.2 deletion syndrome is typically associated with higher medical burden and intellectual disability than 22q11.2 duplication (Olsen *et al.* 2018), although the syndrome is known to be quite heterogeneous across both the deletion and duplication.

Individuals affected with a CNV-NPD heavily rely on developmental services and medical and mental health care (Fung *et al.* 2015); the multimorbidity often causes a great burden in these individuals and their caregivers (Chawner *et al.* 2020). The stress and care disruptions resulting from the pandemic will likely have long-term effects, making individuals with 22q11.2 syndrome more susceptible to neurodevelopmental or neuropsychiatric disorders. Research quantifying pandemic-related burden and distress will be helpful for longitudinal work that examines developmental pathways associated with genetic vulnerabilities. Thus, the goal of this study was to help better understand the overall impact of the global pandemic on those affected by 22q11.2 duplication and deletion syndrome and their caregivers.

The prevalence of mental health disorders in the general population has increased significantly during the pandemic (Salari *et al.* 2020; Santabárbara *et al.* 2021) and is likely higher for those individuals already at risk for NPDs. Recent work has demonstrated that other groups with neurodevelopmental disorders, such as individuals with Prader–Willi syndrome, a condition associated with obesity and cognitive deficits (Wieting *et al*. 2021), and Down syndrome (Villani *et al*. 2020), have elevated mental health symptoms during the pandemic. Significant increase in parental stress has also been reported in the general population (Fontanesi *et al*. 2020) and in parents of children with autism spectrum disorder or attention deficit hyperactivity disorder (Pecor *et al*. 2021) and developmental disorders (Chan & Fung 2021). Parents of children with CNV-NPDs might be especially vulnerable as pre-pandemic reports document increased levels of stress and caretaking burden in this population (Cohen *et al*. 2017). Little work has been performed to specifically understand the effects of the pandemic on stakeholders affected by chromosome 22q11.2 copy number variants, although it may be expected that they are vulnerable to increased distress due to greater physical and mental healthcare and rehabilitative service needs.

Given the high medical burden in this community, it is also important to examine the impact of medical care disruptions caused by the pandemic in stakeholders affected by chromosome 22q11.2 deletion and duplication syndromes. Because the diagnosis and treatment of COVID-19 were the primary focus of the medical community during the pandemic, patients seeking medical attention for other medical issues often felt disregarded (e.g. Schippers 2020; Chang *et al*. 2021). In a recent report, individuals with rare and undiagnosed conditions reported that the healthcare challenges they faced as a result of the pandemic were so stressful that some considered forgoing treatment altogether (Halley *et al*. 2021). The magnitude of care disruptions on the CNV-NPD community is unknown, but beyond the disruption of treatment itself, such disruptions likely added to the distress experienced by these individuals and their caretakers. Understanding the consequences of pandemic-related medical disruptions for those with CNV-NPDs will also inform strategies to prevent similar future outcomes and strategies to regain trust and build resilience into the healthcare systems for future challenges.

Targeted research is needed to fully understand how the pandemic has impacted individuals affected by 22q11.2 syndrome and their families. Thus, the current study, an initiative of the Genes to Mental Health Network (G2MH) Network, sought to examine perspectives on the impact of the COVID-19 pandemic from a large international cohort of stakeholders affected by 22q11.2 syndromes. It was hypothesised that individuals affected by these with an elevated risk for NPDs and their caretakers would report higher levels of COVID-19 worries compared with recent reports in the general population (Barzilay *et al*. 2020; Gur *et al*. 2020). Given the higher medical and psychological burden associated with 22q11.2 deletion syndrome compared with 22q11.2 duplication (Olsen *et al*. 2018), we hypothesised that pandemic distress and associated medical care disruptions would be higher in the 22q11.2 deletion group compared with the 22q11.2 duplication group.

Methods

Procedures

The study was initiated by a subcommittee of the G2MH, a consortium of researchers across three continents focusing on genetics of CNV-NPD aetiologies. Participants were asked to complete a survey that asked about their worries associated with several COVID-19 stressors and related outcomes, as well as items about their interest and participation in genetic research, which will be reported elsewhere (Crowley *et al*., in preparation). The survey was first developed in English; six additional language versions were created using an artificial language translator, DeepL (DeepL Translator 2020), and verified by native-language speakers. Surveys were distributed, using REDCap electronic data capture hosted at Children's Hospital of Philadelphia (Harris *et al*. 2009), to individuals affected by CNV-NPDs and their families between 5/2020 and 2/2021. Families were targeted through Clinical Centers of Excellence, charities and parent networks. The study was deemed exempt from the Institutional Review Board at the Children's Hospital of Philadelphia.

Participants

A total of 663 participants completed the COVID-19 survey (52 affected individuals, 543 parents of affected individuals, 38 siblings or non-parent caretakers and 30 did not disclose a specific relationship). However, the majority of participants affected with 22q11.2 deletion (n = 443) and 22q11.2 duplication (n = 69) syndrome were being the most represented. As such, the current set of analyses focuses on the 22q11.2 syndromes. Of this group, participants were primarily female (n = 401, 78%; 38 did not report sex). The mean age of the sample was 44.76 years (SD = 10.74, range = 18–76). Individuals from 23 different countries completed the scale (Fig. S1). Most surveys were completed in English (n = 443, 87%); the additional language translations were distributed between 11/2020 and 2/2021. Close to half of participants lived in suburban areas (n = 234, 46%), with an additional 136 reporting to be urban dwellers and 102 residing in rural or farm areas.

Online survey

Participants completed the COVID-19 Stressor List (Barzilay *et al.* 2020), a six-item scale assessing worries about self and family acquiring COVID-19, infecting other's with COVID-19, currently having COVID-19, dying from COVID-19 and the financial burden from the pandemic (scale $\alpha = 0.83$) with a five-item Likert scale (1 – not at all through 5 – a great deal). A total worry score was used by summing endorsed worries across all stressor items. Participants also reported on medical care interruptions: what is the effect of pandemic-related medical care disruptions on health, what areas of care have you experienced care disruptions (i.e. visit cancellations and postponements), did you avoid of hospital-related medical care for fear of acquiring COVID-19, and did you experience and/or have future concerns about medication/treatment disruption.

Data analyses preparation and plan

All analyses focused on 22q11.2 duplication/deletion syndrome. For respondent type, those reporting sibling or non-parent caretaker were combined with those who did not disclose relationship status. A region variable was also created by grouping countries by continent or region (Fig. S1). An 'other' region group was created for the countries (i.e. Thailand and Israel) that did not fit into a region grouping (n = 3) and for those not reporting country (n = 35). Lastly, a timing variable was created to examine differences in survey responses across the duration of the study: early (first wave; 5/2020; n = 193), mid (second wave; 6/2020–9/2020, n = 216) and late (third wave; 9/2020–2/2021, n = 103).

To examine worries, an analysis of covariance was conducted with total COVID-19 worry as a dependent variable and respondent type (affected, parent/primary caregiver and other) and CNV type (22q11.2 deletion and 22q11.2 duplication) as between subjects' variables, controlling for region, dwelling type and timing; only main effects were examined. A series of logistic regressions were used to examine differences in binary responses across medical disruption items by the previous list of covariates, entered simultaneously. To determine if the medical care disruptions were related to COVID-19 worries, a series of analyses of covariance were conducted with total COVID-19 worry as a dependent variable and each of the binary medical care variables (entered in separate models) with the previously mentioned covariates (see the supporting information for tables with main statistical results). Models were also ran with age as a covariate, but no significant effects emerged; given that 40 individuals did not complete some or all demographic items (i.e. sex, age, country and dwelling type), age was not used in main analyses. Subjects with missing data were included as a 'not-reported' group within the given variable.

Results

COVID-19 worries

Figure 1 illustrates the mean level of distress across the six COVID-19 worry items. The average of the total distress score across all participants was 16.78 (SD = 5.36). Neither CNV type nor respondent type was related to total COVID-19 worry (Ps > 0.23). There was a significant effect of timing (wave of the pandemic), $F(1, 505) = 15.72$, $P < 0.001$. Respondents in the third wave reported more worries (M = 18.60, SD = 5.40) than those in the first wave (M = 15.97, SD = 5.14; $P < 0.003$) and second wave (M = 17.02, SD = 5.43; $P = 0.04$). Respondents in the first and second waves did not differ from the other, $P = 0.17$. No other variables were related to total COVID-19 worry ($P > 0.09$). When the model

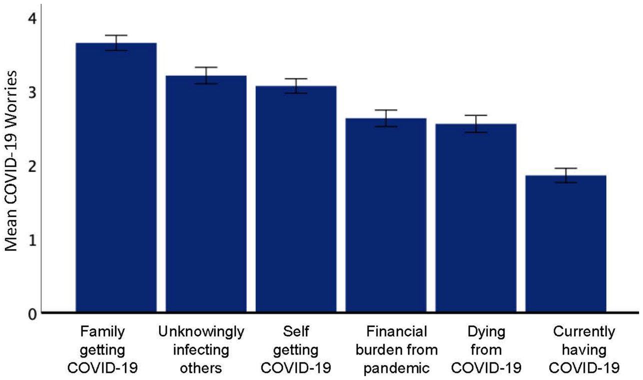


Figure 1. Mean endorsed worry across each of the six COVID-19 worry items. Items are plotted from the highest average endorsed worry to the lowest endorsed worry. A total COVID-19 worry score was created by summing across each of the six items. Error bars represent 95% confidence intervals. [Colour figure can be viewed at wileyonlinelibrary.com]

was restricted to only affect individuals and their parents, there was a tendency for parents to report higher levels of total worry than affected individuals, *F* (1, 472) = 13.34, *P* = 0.07.

Impact of medical care interruptions caused by the pandemic on health

One-third of participants (36%, *n* = 186) reported that pandemic-related care interruptions had a significant effect on their health. Of these, the great majority (95%, *n* = 176) endorsed detrimental effects and 10 (5%) reported life-threatening effects. Report of interruption on health was predicted by respondent group (Wald $\chi^2(2) = 10.01$, *P* = 0.01). Parents and affected individuals did not differ in reports on effects of treatment disruptions (*P* = 0.16), but parents were less likely to report significant health effects than the other/not-reported group [odds ratio (OR) = 2.96, 95% confidence interval (CI) = 1.43–6.12, $P < 0.001$]. Participants were also asked to report on the type of medical care reported as being disrupted during the pandemic (Fig. S2). The most frequently cancelled services were rehabilitation (20% reporting cancellation in this area), and the most reported postponed or delayed services were the specialists or the general practitioners who treat the rare CNV syndrome (44% reporting delay in this area) and rehabilitation services (45% reporting delay). Those reporting health effects from medical disruptions reported higher levels of total COVID-19 worry (M = 17.93, SD = 5.31) compared with those reporting no health effects from medical disruptions (M = 16.38, SD = 5.36), *F*(1, 505) = 9.82, *P* = 0.002 (Fig. 2a).

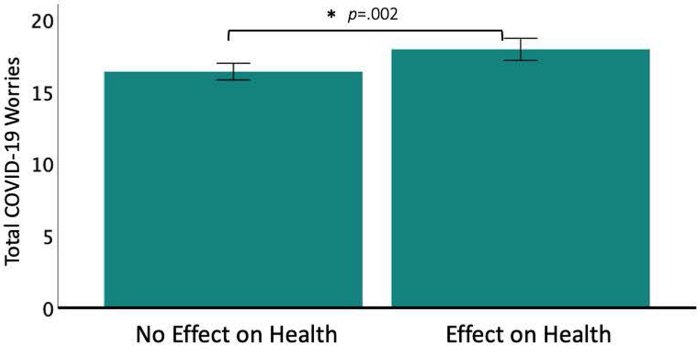
Avoidance of hospitals for care during the pandemic

A total of 252 individuals (49%) reported receiving hospital-based primary care for their rare genetic disorder under usual circumstances. Of these, 111 (44%) reported avoiding hospital care during this period due to fear of acquiring COVID-19. There was a significant main effect of timing (study/pandemic wave) (Wald $\chi^2(2) = 6.59$, *P* = 0.04). Those that completed the survey in the second wave reported more avoidance than those from the first wave (OR = 1.82, 95% CI = 1.01–3.27, *P* = 0.05); there were no differences between the first and third waves (*P* = 0.42). Those reporting care avoidance had significantly higher total COVID-19 worry (M = 18.15, SD = 5.35) than those reporting no care avoidance (M = 16.45, SD = 4.50), *F*(1, 245) = 7.85, *P* = 0.005 (Fig. 2b).

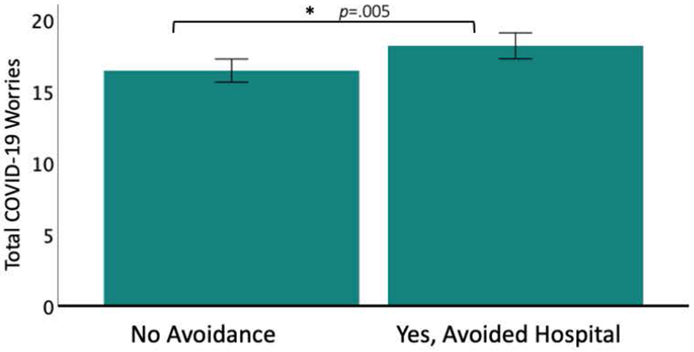
Concerns regarding availability of treatments/medications during pandemic

The majority of participants (*n* = 453, 89%) reported no pandemic-related disruptions to the availability of medication and/or treatment at the time of the survey. A total of 17 (3%) participants reported using an alternative medication/treatment, 36 (7%) reported temporarily stopping medication/treatment and 6 (1%) reported completely stopping medication/treatment. Of those reporting no treatment disruption, over half (*n* = 269, 59%) reported fear that the continuing pandemic would result in medication or treatment interruptions. Dwelling type was related to fear of future medication/treatment disruption, Wald $\chi^2(3) = 17.71$, $P < 0.001$. Those living in rural/farm areas were more likely to report a fear of future

(a) Did Pandemic Related Medical Disruptions Effect Your Health?



(b) Did You Avoid Care at the Hospital Because of Fear of Getting COVID-19?



(c) If the Pandemic Continues, Do you Fear Your Medications or Treatments will be Negatively Affected?

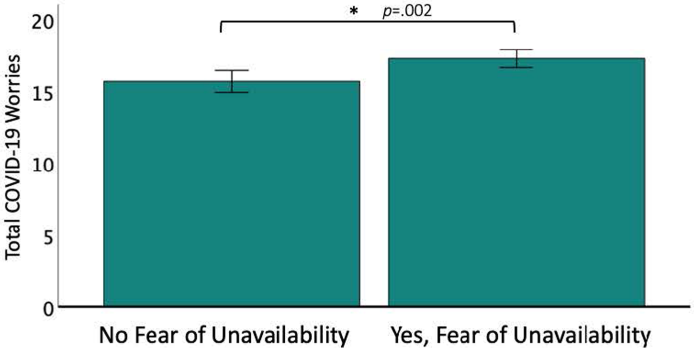


Figure 2. Panel (a) shows that those reporting that pandemic disruptions had a significant effect on health reported more total COVID-19 worries than those reporting that the disruptions had no effect on health. Panel (b) shows that those receiving hospital-based primary care and those reporting avoidance of in-person appointments due to COVID-19 fears reported more total COVID-19 worries than those who did not avoid appointments. Panel (c) shows that those reporting a fear of future pandemic-related treatment disruptions had higher total COVID-19 worries than those reporting no fear of medical treatment disruption. Error bars represent 95% confidence intervals. [Colour figure can be viewed at wileyonlinelibrary.com]

medication/treatment disruption than those living in urban areas, OR = 3.09, 95% CI = 1.76–5.43, $P < 0.001$. Urban residence did not differ from the other dwelling types, *P*s > 0.78. Those reporting higher fear of disruption also reported higher COVID-19 worry (M = 17.24, SD = 5.59) compared with those not endorsing a fear of future disruption (M = 15.79, SD = 4.84; Fig. 2c), $F(1, 446) = 9.78$, $P = 0.002$.

Discussion

This international study aimed to better understand the impact of the global pandemic on those affected by 22q11.2 deletion and duplication syndromes and their caregivers. The findings revealed that COVID-19-related worry in the cohort was broadly consistent with other comparable published reports in the general population, both in total COVID-19 worries and in terms of what items received the highest and lowest mean worry ratings (Barzilay *et al.* 2020; Gur *et al.* 2020; Kornfield *et al.* 2021). The current findings report widespread disruptions of medical care in individuals affected with a 22q11.2 syndrome across 23 countries, which was related to their level of COVID-19 worries. Minimal differences emerged with respondent type; no differences between 22q11.2 duplication and deletion emerged.

Pandemic-related worries were found to be higher for those stakeholders who responded later in the study as the pandemic continued across the globe and parents tended to have higher worries than those affected with 22q11.2 syndromes. Contrary to our prediction, the current cohort did not demonstrate increased COVID-19-related worry compared with population cohorts in Israel and the USA (Barzilay *et al.* 2020; Gur *et al.* 2020; Kornfield *et al.* 2021). For instance, the average total COVID-19 worries were 16.341 (SD = 5.16) in 833 perinatal individuals in the USA (Kornfield *et al.* 2021) and 16.78 (SD = 5.36) in the current cohort. Even the items that received the highest and lowest average worries were similar across cohorts; the highest average worry was worry about families acquiring COVID-19, and the lowest average worry was about currently having COVID-19 themselves (Barzilay *et al.* 2020; Gur *et al.* 2020). These similarities may reflect that the level of worry and anxieties experienced during the pandemic is fairly global, equally affecting cohorts enriched for healthcare workers (Barzilay *et al.* 2020), perinatal women (Gur *et al.* 2020; Kornfield *et al.* 2021) and those individuals with increased NPD and medical burdens, such as the current cohort. Alternatively, the similarities in worries may only be limited to those assessed in the current set of studies; differences in worries across cohorts might appear in responses to pandemic-related stressors that were not assessed. Moreover, despite worries about pandemic stressors being similar, the result anxiety and impacts on life may be different across groups (increased anxiety and more impact on clinical care). Although concurrent anxiety and depression were not assessed in the current study, prior reports show a strong link between pandemic distress and depression and anxiety disorders (Barzilay *et al.* 2020; Gur *et al.* 2020), suggesting that those affected individuals and their caretakers endorsing the most worries might be at increased vulnerability for psychiatric disorders.

Our results also highlight the significant medical care disruptions experienced during the pandemic by individuals affected by a 22q11.2 syndrome, a population with high rates of NPDs and medical needs. In fact, 36% of individuals reporting medical disruptions had significant negative effects on their health. This is especially noteworthy considering a recent report showing that individuals and caretakers with rare and undiagnosed disease reported exacerbations in medical symptoms during the pandemic (Halley *et al.* 2021) and thereby actually had an increased need for medical attention. Over half of the sample expressed fear of medication and treatment disruption if the pandemic continued. Moreover, for each of the pandemic-related medical care items presented in the current report, all were related to respondents' report of overall COVID-19 distress. Much of extant work that has examined the frequency of cancelled or postponed medical care in other populations has not examined the effects of such disruptions on health or stress. In a population of urology patients in Spain, 45% of medical appointments were cancelled without being rescheduled in the first 4 weeks of a national lockdown (Luciani *et al.* 2020); in a cohort of cardiovascular patients in the USA, there was a 33% decrease in outpatient visits in the spring and early summer of 2020 (Wosik *et al.* 2021). Of the studies that did assess stress or health impacts, a survey with chronic obstructive pulmonary disease patients in Spain conducted in May 2020 showed that 90% of patients reported some level of cancellation or postponement of care; however, around 80% of the sample reported that their lung health or general health was as good as it was before the pandemic if not better (Pleguezuelos *et al.* 2020), suggesting minimal effects on health due to the medical disruptions. Alternatively, in a sample of type 1 and type 2 diabetes patients in the USA assessed in April 2020 (Fisher *et al.* 2020), 40% reported that their diabetes care appointments were postponed or cancelled and at least half of the sample reported increased diabetes distress and negative pandemic effects on diabetes management. Thus, although the level of medical disruptions appears to be similar in the current cohort as other patient studies, the impact of such disruptions on perceived health may be heightened in the current cohort. Moreover, when considering an established link between COVID-19 distress and risk for poor mental health outcomes from other studies (Barzilay *et al.* 2020; Gur *et al.* 2020), the results suggest that stakeholders in this rare CNV study may require additional medical as well as psychiatric resources during this and future pandemics.

There are limitations that should be considered when interpreting the current results. Respondents who were mothers of children 22q11.2 CNVs from the USA predominated in the sample. Thus, limited inferences can be made regarding differences across respondent type (e.g. affected individual vs caretaker) and region. The timing variable in the current study was a blunt representation of time, split into three waves; through the duration of the study, the effects of COVID-19 on the community and medical services likely fluctuated in ways the current timing variables do not capture. This is especially true considering the timing of the pandemic effects and experiences differed across countries and regions. Moreover, several of the survey translations were distributed later in the study timeline, confounding the effects of the wave of the pandemic and international region. Thus, all timing differences in the current set of analyses should be interpreted with caution. Additionally, given that the study used online self-report data, individuals without digital access or skills were likely excluded from the study. Lastly, it cannot be determined whether the current results can be attributed to the presence of a CNV-NPD or are the result of having an NPD more broadly.

In conclusion, the effects of the COVID-19 pandemic for individuals affected by 22q11.2 CNVs and their caretakers were broadly consistent with comparable research results obtained from other general populations. Long-term impact from COVID-19 distress, interruptions to care and hospital avoidance require further study, but suggest that the emotional and psychological needs of patients and their families should be considered in routine, non-psychiatric medical appointments. These data also provide important information for the medical community supporting patients with CNV-NPDs to help improve implementation of medical follow-up and treatments during broadly stressful times, such as the COVID-19 pandemic. Lastly, understanding general distress, in terms of both pandemic-related and treatment-related concerns, will provide insight to longitudinal research in 22q11.2 syndrome cohorts to understand how well-being during the pandemic may impact long-term psychological and health outcomes.

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Conflict of Interest

No conflicts of interest have been declared.

Data Availability Statement

The data are available upon request. Please contact the corresponding author.

References

Barzilay R., Moore T. M., Greenberg D. M., DiDomenico G. E., Brown L. A., White L. K. *et al.* (2020) Resilience, COVID-19-related stress, anxiety and depression during the pandemic in a large population enriched for healthcare providers. *Translational Psychiatry* **10**, 291.

Bassett A. S., Lowther C., Merico D., Costain G., Chow E. W. C., van Amelsvoort T. *et al.* (2017) Rare genome-wide copy number variation and expression of schizophrenia in 22q11.2 deletion syndrome. *American Journal of Psychiatry* **174**, 1054–63.

Blagojevic C., Heung T., Theriault M., Tomita-Mitchell A., Chakraborty P., Kernohan K. *et al.* (2021) Estimate of the contemporary live-birth prevalence of recurrent 22q11.2 deletions: a cross-sectional analysis from population-based newborn screening. *CMAJ Open* **9**, E802–9.

Brunet A., Armengol L., Pelaez T., Guillamat R., Vallès V., Gabau E. *et al.* (2008) Failure to detect the 22q11.2 duplication syndrome rearrangement among patients with schizophrenia. *Behavioral and Brain Functions* **4**, 3–7.

Chan R. C. H. & Fung S. C. (2021) Elevated levels of COVID-19-related stress and mental health problems among parents of children with developmental disorders during the pandemic. *Journal of Autism and Developmental Disorders* 1–12.

Chang A. Y., Cullen M. R., Harrington R. A. & Barry M. (2021) The impact of novel coronavirus COVID-19 on noncommunicable disease patients and health systems: a review. *Journal of Internal Medicine* **289**, 450–62.

Chawner S. J. R. A., Mihaljevic M., Morrison S., Eser H. Y., Maillard A. M., Nowakowska B. *et al.* (2020) Pan-european landscape of research into neurodevelopmental copy number variants: a survey by the MINDDS consortium. *European Journal of Medical Genetics* **63**, 104093.

Cohen W., McCartney E. & Crampin L. (2017) 22q11 deletion syndrome: parents' and children's experiences of educational and healthcare provision in the United Kingdom. *Journal of Child Health Care* **21**, 142–52.

DeepL Translator (2020) Available at: https://www.deepl.com/en/blog/20200319 (retrieved 31 May and 1 June 2020).

Fisher L., Polonsky W., Asuni A., Jolly Y. & Hessler D. (2020) The early impact of the COVID-19 pandemic on adults with type 1 or type 2 diabetes: a national cohort study. *Journal of Diabetes and its Complications* **34**, 107748.

Fontanesi L., Marchetti D., Mazza C., Di Giandomenico S. D., Roma P. & Verrocchio M. C. (2020) The effect of the COVID-19 lockdown on parents: a call to adopt urgent measures. *Psychological Trauma Theory Research Practice and Policy* S79–81.

Fung W. L. A., Butcher N. J., Costain G., Andrade D. M., Boot E., Chow E. W. C. *et al.* (2015) Practical guidelines for managing adults with 22q11.2 deletion syndrome. *Genetics in Medicine* **17**, 599–609.

Gur R. E., White L. K., Waller R., Barzilay R., Moore T. M., Kornfield S. *et al.* (2020) The disproportionate burden of the COVID-19 pandemic among pregnant black women. *Psychiatry Research* **293**, 113475.

Halley M. C., Stanley T., Maturi J., Goldenberg A. J., Bernstein J. A., Wheeler M. T. *et al.* (2021) "It seems like COVID-19 now is the only disease present on Earth": living with a rare or undiagnosed disease during the COVID-19 pandemic. *Genetics in Medicine* **23**, 837–44.

Harris P. A., Taylor R., Thielke R., Payne J., Gonzalez N. & Conde J. G. (2009) Research electronic data capture (REDCap) – a metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics* **42**, 377–81.

Hiroi N., Takahashi T., Hishimoto A., Izumi T., Boku S. & Hiramoto T. (2013) Copy number variation at 22q11.2: from rare variants to common mechanisms of developmental neuropsychiatric disorders. *Molecular Psychiatry* **18**, 1153–65.

Kirov G. (2015) CNVs in neuropsychiatric disorders. *Human Molecular Genetics* **24**, R45–9.

Kornfield S. L., White L. K., Waller R., Njoroge W., Barzilay R., Chaiyachati B. H. *et al.* (2021) Risk and resilience factors influencing postpartum depression and mother-infant bonding during COVID-19. *Health Affairs* **40**, 1566–74.

Luciani L. G., Mattevi D., Cai T., Giusti G., Proietti S. & Malossini G. (2020) Teleurology in the time of Covid-19 pandemic: here to stay? *Urology* **140**, 4–6.

Malhotra D. & Sebat J. (2012) CNVs: harbingers of a rare variant revolution in psychiatric genetics. *Cell* **148**, 1223–41.

Martin C. L., Wain K. E., Oetjens M. T., Tolwinski K., Palen E., Hare-Harris A. *et al.* (2020) Identification of neuropsychiatric copy number variants in a health care system population. *JAMA Psychiatry* **77**, 1276–85.

McDonald-McGinn D. M., Sullivan K. E., Marino B., Philip N., Swillen A., Vorstman J. A. S. *et al.* (2015) 22q11.2 deletion syndrome. *Nature Reviews. Disease Primers* **1**, 15071.

Merikangas A. K., Corvin A. P. & Gallagher L. (2009) Copy-number variants in neurodevelopmental disorders: promises and challenges. *Trends in Genetics* **25**, 536–44.

Olsen L., Sparsø T., Weinsheimer S. M., Dos Santos M. B. Q., Mazin W., Rosengren A. *et al.* (2018) Prevalence of rearrangements in the 22q11.2 region and population-based risk of neuropsychiatric and developmental disorders in a Danish population: a case-cohort study. *The Lancet Psychiatry* **5**, 573–80.

Pecor K. W., Barbayannis G., Yang M., Johnson J., Materasso S., Borda M. *et al.* (2021) Quality of life changes during the COVID-19 pandemic for caregivers of children with ADHD and/or ASD. *International Journal of Environmental Research and Public Health* **18**, 3667.

Pleguezuelos E., del Carmen A., Moreno E., Ortega P., Vila X., Ovejero L. *et al.* (2020) The experience of COPD patients in lockdown due to the COVID-19 pandemic. *International Journal of COPD* **15**, 2621–7.

Salari N., Hosseinian-Far A., Jalali R., Vaisi-Raygani A., Rasoulpoor S., Mohammadi M. *et al.* (2020) Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. *Globalization and Health* **16**, 57.

Santabárbara J., Lasheras I., Lipnicki D. M., Bueno-Notivol J., Pérez-Moreno M., López-Antón R. *et al.* (2021) Prevalence of anxiety in the COVID-19 pandemic: an updated meta-analysis of community-based studies. *Progress in Neuro-Psychopharmacology and Biological Psychiatry* **109**, 110207.

Schippers M. C. (2020) For the greater good? The devastating ripple effects of the Covid-19 crisis. *Frontiers in Psychology* **11**, 1–13.

Tang S. X., Yi J. J., Calkins M. E., Whinna D. A., Kohler C. G., Souders M. C. *et al.* (2014) Psychiatric disorders in 22q11.2 deletion syndrome are prevalent but undertreated. *Psychological Medicine* **44**, 1267–77.

Villani E. R., Vetrano D. L., Damiano C., Di Paola A., Ulgiati A. M., Martin L. *et al.* (2020) Impact of COVID-19-related lockdown on psychosocial, cognitive, and functional well-being in adults with Down syndrome. *Frontiers in Psychiatry* **11**, 578686.

Wieting J., Eberlein C., Bleich S., Frieling H. & Deest M. (2021) Behavioural change in Prader–Willi syndrome during COVID-19 pandemic. *Journal of Intellectual Disability Research* **65**, 609–16.

Wosik J., Clowse M. E. B., Overton R., Adagarla B., Economou-Zavlanos N., Cavalier J. *et al.* (2021) Impact of the COVID-19 pandemic on patterns of outpatient cardiovascular care. *American Heart Journal* **231**, 1–5.

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Supporting Information

Additional Supporting Information may be found online in the supporting information tab for this article.

Figure S1: Participants by Country and Region
Figure S2: Appointment Cancellations or Postponements by Type of Medical Care
Table S2: Predicting Total COVID-19 Distress
Table S3: Predicting Medical Care Disruptions on Health
Table S4: Predicting Avoidance of Hospital Due to Fears of Getting COVID-19
Table S5: Predicting Fear of Treatment Disruptions if Pandemic Continues