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A 16-month longitudinal investigation of risk and protective factors for mental health outcomes throughout three national lockdowns and a mass vaccination campaign: Evidence from a weighted Israeli sample during COVID-19

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ABSTRACT

Background: COVID-19 is an ongoing global crisis, with a multitude of factors that affect mental health worldwide. We explored potential predictors for the emergence and maintenance of depression, anxiety, and posttraumatic stress symptoms (PTSS) in the general population in Israel.

Methods: Across the span of 16 months, 2478 people completed a repeated self-report survey which inquired psychiatric symptoms and pandemic related stress factors (PRSF). We applied mixed-effects models to assess how each stressor contributes to depression, anxiety and PTSS at each time point, and longitudinally assessed participants who completed at least two consecutive surveys (\(n = 400\)). We weighted our sample to increase representativeness of the population.

Results: Fatigue was the strongest predictor for depression, anxiety and PTSS at all time points, and predicted deterioration overtime. Financial concerns associated with depression and anxiety at all time points, and with their deterioration overtime. Health related concerns were uniquely associated with anxiety and PTSS at all time points and their deterioration, but not with depression. Improvement in sense of protection overtime associated with decrease in depression and anxiety. Hesitancy towards vaccination was associated to higher financial concerns and lower sense of protection by the authorities.

Conclusions: Our findings accentuate the multitude of risk factors for psychiatric morbidity during COVID-19, and the centrality of fatigue in determining mental health outcomes.

1. Introduction

The COVID-19 pandemic is still an ongoing global crisis, which have so far (as on January 2023) taken the lives of over 6.8 million people, and left many others with long-term health conditions (Mathieu et al., 2023). Even among those who were not infected with the virus, many people’s health has still taken a hit due to the indirect effect of COVID-19 on the economy (Brodeur et al., 2021; Das et al., 2022; Delardas et al.,...
et al., 2020). This distrust reached its peak during the second lockdown and social division, leading to rising distrust in the government (Maor et al., 2021). Moreover, studies from Israel to date are mostly cross-sectional, and as such they do not provide information on the dynamics of risk and resilience factors overtime, as the circumstances changed dramatically through lockdown orders and mass vaccination.

Israel provides a unique example during the early stages of the pandemic, due to a combination of factors that impacted the public both positively and negatively, putting it in a distinct situation. The pandemic coincided with a political crisis in Israel, which included three consecutive elections resulting in a political stalemate and heightened political and social division, leading to rising distrust in the government (Maor et al., 2020). This distrust reached its peak during the second lockdown as tens of thousands of people protested against the government’s restrictive measures, sparking heated debates on the necessity of lockdowns, mobile phone tracking, restrictions on religious gatherings and more (Hittman, 2021). Israel’s dense population in urban areas contributed to a rapid spread of the virus, which prompted the government to impose three national lockdowns in an 8-month span, two of them being nearly consecutive (September-October 2020 and December 2020-February 2021). Meanwhile, Israel’s highly effective public healthcare system (Clarfied et al., 2017) enabled it to become one of the first countries to launch a nationwide vaccination campaign on December 2020. By April 2021, over 70% of the adult population (16 or older) had received two doses of Pfizer’s BNT162b2 vaccine (Israel Ministry of Health, 2021). While the country had one of the highest per capita vaccinated populations globally (Shilo et al., 2021). While bringing hope to some people, the vaccines also promoted polarization between those who chose to vaccinate and those who did not, especially due to the governmental ‘green pass’ ordinance which limited access to public places for unvaccinated people, augmenting institutional distrust even further (Luster et al., 2021; Waitzberg et al., 2021). The pandemic also triggered a financial crisis, causing unemployment rates to skyrocket from 3.8% prior to the pandemic to over 35% in April 2020. Despite the success of the vaccination campaign, on June 2021 (6 months into the operation), unemployment remained high at 8.4%, more than double the pre-pandemic rate (Debowy et al., 2021). The financial, social, and political crisis in Israel, coupled with concerns over physical health, has brought mental health to the forefront of public discussion (Efrati, 2020; Jeffay, 2022). The increasing demand for mental health services which was masked in 2020 by lockdowns and fear of contagion (Dror et al., 2022a; Dvorak et al., 2021; Pikkel Igal et al., 2021; Schreiber et al., 2021), erupted during 2021 (Blu et al., 2022; Dror et al., 2022b; Mevorach et al., 2023), exposing weaknesses in the country’s public mental health system, which was unable to keep up with the sudden influx of patients. This has prompted mental health professionals to raise an alarm and call for immediate government intervention. In July 2020, social workers in Israel declared a strike and held protests nationwide, gaining widespread public support as the significance of mental health professionals was widely recognized and acknowledged (Shlomo and Levin-keini, 2021). These efforts resulted in the government implementing a reform to bolster access to mental health services and allocating an additional $100 million budget for renovating mental health facilities and psychiatric hospitals (Efrati, 2021).

One of the most widely discussed effects of the pandemic is psychological and physical fatigue, which in the current context is often addressed to as ‘pandemic fatigue’ (Michie et al., 2020). In general, fatigue is a wide construct that includes feelings of physical or mental exhaustion and depletion of mental resources, which can be attributed to lack of sleep, health conditions (Phillips, 2015) or chronic stress (Weeks et al., 2010). More specific to COVID-19, pandemic fatigue is a state of exhaustion resulting from the shift from acute to chronic stress caused by the ongoing pandemic and its impact on daily life, with the realization that unlike what was believed at first, the pandemic had become “a marathon rather than a sprint” (Murphy, 2020). Studies have linked pandemic fatigue, i.e., mental and physical exhaustion accompanied by sleep problems, decreased drive, helplessness, and despair (Queen and Harding, 2020), to public weariness from restrictive measures and social isolation required to reduce infection (Hakani et al., 2022; Michie et al., 2020). While ‘pandemic fatigue’ was considered a controversial phenomenon in the early days of the pandemic (Reicher and Drury, 2021), especially since many people viewed it as a common excuse for disobeying governmental restrictions, there have been accumulating evidence to its existence ever since (Morgul et al., 2021; Petherick et al., 2021). We have previously demonstrated the substantial contribution of mental exhaustion and sleep difficulties to adverse mental outcomes among healthcare workers (Cleper et al., 2022; Mosheva et al., 2021, 2020) and relatives of COVID-19-infected patients (Hertz-Palmor et al., 2022) during the early phase of the pandemic in Israel. In both cases, mental exhaustion was the strongest predictor for anxiety, depression, and posttraumatic stress symptoms (PTSS).

In the current study, we expand our previous investigation which focused on the association among depressive symptoms and financial hardships during the first month of the pandemic in Israel and the US (Hertz-Palmor et al., 2021), and report findings from the general population in Israel during a 16-month period, spanning from the early days of the pandemic throughout three national lockdowns and a nationwide vaccination campaign. The overarching aim of the current research was to explore risk and protective factors for depression, anxiety, and PTSS, and assess their longitudinal dynamics. We concentrate on depression and anxiety as these are widely recognized as common mental health issues with high lifetime prevalence, even in mild cases (Kessler et al., 2005). Additionally, Posttraumatic stress symptoms are especially relevant during times of disasters and traumatic events that pose a significant threat to one’s health and safety (Foa et al., 2006). While risk factors for these conditions can be personal and/or contextual, we focus on four clusters of environmental stressors that are examined as possible predictors, using a designated Pandemic-Related Stress Factors (PRSF) inventory (Imai et al., 2010; Mosheva et al., 2020). The original inventory was first presented by Imai et al. to investigate different factors
that affect motivation and hesitation to work among Japanese mental-health workers during the N1H1 pandemic in 2009. Originally, different facets of the questionnaire included risk for infection, knowledge and management, protection, condition, isolation and others. The original inventory was adapted and modified by Mosheva et al. (2020) to fit the factors that might impact mental health during COVID-19 using minimal modifications such as adding a financial query or addressing the healthcare system as a whole instead of the hospital (see sup. materials). In our previous work, we used single items pertaining to different stressors (e.g., financial concerns, fear of infection, mental exhaustion etc.) and found strong correlations with depression, anxiety and posttraumatic symptoms among the general population and relatives of people who were hospitalized due to COVID-19 illness at the early pandemic stages (Dorman-Ilan et al., 2020; Hertz-Palmor et al., 2022, 2021, Matalon et al., 2021). To reduce dimensionality in these environmental stressors, here we conducted an exploratory factor analysis that converged with the theoretical constructs of the PRSF inventory and concluded in four latent factors: financial, health-related, fatigue, and sense of protection by the authorities (Sup. Table S1).

In line with our findings among healthcare workers (Mosheva et al., 2020) and caregivers of COVID-19 patients (Hertz-Palmor et al., 2022), we hypothesized that fatigue would be the strongest predictor for depression, anxiety and PTSS. In line with our previous findings among the general population (Hertz-Palmor et al., 2021), we expected that financial concerns would most strongly associate with depression, and would exceed the association of health-related concerns with depression.

2. Method

2.1. Participants, setting and procedure

Participants of this study were Israeli adults (18 years or older), that were invited to participate via social media and instant messaging. On March 17th, 2020, the Israeli government has announced a national lockdown. A day later, we launched our first survey (T1) using the Qualtrics platform and distributed it through Facebook groups and chain messages on WhatsApp. After completing the survey, the participants were offered to leave their contact information if they wished to be re-contacted for future surveys. The next three surveys were delivered at the end of the first lockdown (T2, April-May 2020) and at the beginning of the second (T3, September-October 2020) and third (T4, December 2020) lockdowns. The fourth time point (T4) was adjacent to the beginning of the national vaccination campaign. The fifth and final survey was conducted on June 2021, 6 months after the beginning of the vaccination campaign (Fig. 1). At that time of final survey, there were initial reports regarding a fourth ‘wave’ of COVID-19 and the emergence of the delta variant (Shirit et al., 2021), leading to the reinstatement of face mask mandates and the “Green Pass” restrictions (Wilf-Miron et al., 2021). Our sampling was timed to coincide with significant events such as lockdowns, mass vaccinations, and pandemic waves. We conducted two rounds of participants recruitment- cohort 1 (n = 1262) was recruited during T1 and was followed throughout T2-T5. Cohort 2 (n = 1216) was recruited during the second lockdown (T3) and followed throughout T4-T5, in order to expand our investigation as we realized by then that the unique reality of COVID-19 was likely to persist for an extended period, longer than initially anticipated.

2.2. Measures

To measure Depression and Anxiety, we used the well-validated Patient-Reported Outcome Measurement Information System (PROMIS; see www.nihpromis.org). PROMIS is a set of self-reported outcome measures developed by the National Institutes of Health (NIH) to assess physical, mental, and social health in adults and children (Cella et al., 2010). PROMIS measures were created using a rigorous, multi-step process including item development, testing, and refinement, and were tested in diverse populations to ensure their validity and reliability (Ader, 2007). PROMIS has been found to be a valid and reliable tool for measuring mental-health outcomes in various clinical samples (Schalet et al., 2016) and has been widely adopted in research and clinical settings (Cella et al., 2019; Magasi et al., 2012). It is now used to assess a wide range of health conditions and has been translated into multiple languages. PROMIS has good convergent validity with common self-report measurement tools for psychopathology, such as the Patient-Health Questionnaire-9 (PHQ-9) and General-Anxiety-Disorder-7 (GAD-7; Choi et al., 2014; Schalet et al., 2016,2014; Sunderland et al., 2018), and it was successfully translated to Hebrew (Yardeni et al., 2021, 2020) and utilized in previous studies on mental health in Israel during COVID-19 (Cleper et al., 2022; Dorman-Ilan et al., 2020; Hertz-Palmor et al., 2022, 2021, Matalon et al., 2021, Mosheva et al., 2021, 2020). PROMIS have validated cutoffs for probable depression (Choi et al., 2014) and anxiety (Schalet et al., 2014), equivalent to the common ≥10 cutoff of PHQ-9 and GAD-7. We previously used PROMIS cutoffs to portray the prevalence of depression and anxiety among relatives of COVID-19 patients (Hertz-Palmor et al., 2022). Cronbach’s alpha values in the current study ranged between 0.91-0.94 for PROMIS anxiety, with an average of 0.93 (SD=0.01) and between 0.90-0.95 for PROMIS depression, with an average of 0.93 (SD=0.01; internal consistency values by time point for all of the study measures are presented in sup. Table S2).

Posttraumatic stress symptoms were screened with the validated
Hebrew version of the Primary Care PTSD Screen for DSM-5 (PC-PTSD-5; Sposto et al., 2015). PC-PTSD-5 has a cutoff of $\geq 3$ for probable PTSD. Cronbach’s alpha values in the current study ranged between 0.62-0.83, with an average of 0.71 (SD=0.06).

COVID-19 related stressors were assessed with a designated inventory of pandemic-relates stress factors (PRSF), originated by Imai et al. (2010) during the NH11 pandemic and modified by Mosheva et al. (2020) to the context of the COVID-19 pandemic. The PRSF inventory includes queries on several relevant stressors on a 4-point Likert scale, and a cutoff of $\geq 3$ for high stress (Mosheva et al., 2020). Cronbach’s alpha values in the current study ranged between 0.68 and 0.80, with an average of 0.76 (SD=0.04).

We inquired for income with a 5-point Likert rating scale, addressing income with regards to the average wage in Israel (which was extracted from Israel Bureau of Statistics). Actual income loss during the pandemic was assessed on a 5-point Likert scale ranging from “no income loss” to “extreme income loss”. Sociodemographic items were presented at the beginning of the survey. To incentivize recurring participation and survey completion, the participants were presented at the end of each survey with previous findings from older surveys.

2.3. Statistical analysis

We use descriptive statistics to present the sample’s characteristics, with respect to the two cohorts that were recruited during the first (cohort 1, March 2020) and second (cohort 2, September 2020) national lockdowns.

2.3.1. Cross-sectional investigation

To explore risk and protective factors, we conducted three separate mixed-effects linear regressions with depression, anxiety and PTSS scores as the dependent variable in each model. Independent variables included PRSF and the following sociodemographic factors: age, sex, living with a spouse, living with children and income. Participants who completed two or more time points were included as random effects in the models, to control for within-person variability. The time of survey completion, the participants were presented at the end of each survey with previous findings from older surveys.

2.3.2. Longitudinal investigation

To explore the synchronization among changes in stressors and mental health outcomes (i.e., their covariance overtime), we used longitudinal data (i.e., participants who completed at least two consecutive time-points, $n = 400$, observations=960) to calculate delta measures for depression, anxiety, PTSS and PRSF, by subtracting each measure score at time T from the preceding score at time T-1. For example, the delta measure for depression was calculated as follows:

$$\Delta \text{Depression} = \text{Depression}_T - \text{Depression}_{T-1}$$

Positive scores in the delta measures represented a rise in depression, anxiety, PTSS or PRSF, while negative scores represented a reduction of symptoms. We repeated our main analysis with the delta scores to assess whether exacerbation (i.e., increase) in mental health outcomes was associated with increased pandemic-related stressors.

To address data biases, we weighted our data to resemble the age and sex distribution in Israel 2020. Weighting is a statistical technique used to make a sample more representative of the population by adjusting for over- or under-representative observations. This is done by assigning a weight to each observation in the sample, which represents its influence on the final analysis. Weighting helps to combat survivorship bias, attrition, nonresponse bias, and measurement error (Biemer and Christ, 2012). We weighted our sample with data curated from the Israel Central Bureau of Statistics official website (available at https://www.cbs.gov.il/EN/pages/default.aspx), and created different weights for each time point and type of analysis (cross-sectional and longitudinal), based on its specific representativeness patterns and detected biases (e.g., overrepresentation of women and young people at some assessments). A detailed description of the weighting procedure is available in the supplemental materials of the online version (Sup. Tables S3–S7). To account for potential survivorship biases, participants who dropped were compared with participants who did not on age, sex, income, income loss, depression, anxiety and PRSF (PTSS was not compared because it was not measured on T1), using independent samples t-tests adjusted for multiple comparisons. Drop outs from cohort 1 were compared based on their baseline at T1, while drop outs from cohort 2 were compared with their peers based on their baseline at T3 (i.e., their first measurement). Effect sizes were assessed using Cohen’s $d$ for continuous measures and Cramer’s $v$ for sex.

In all of our analyses we used a stringent $\alpha$ of 0.01. Analysis was conducted using the stats and lmerTest packages in R (Kuznetsova et al., 2017).

3. Results

Overall, 2478 participants completed at-least one time point and were included in the study. Cohort 1 included 1262 (50.9%) participants, and cohort 2 included 1216 participants (49.1%). 517 participants (20.9%) completed at least two surveys. The average non-response rate (out of participants who agreed to be re-contacted) was 57.4% (sup. table S8). The mean age of the participants was 34.2 (SD = 11.9), and their age ranged 18 to 91. Of the participants, 1394 were female (56.2%), 1474 (59.4%) lived with their spouse and 1008 (40.7%) lived with at least one of their children. The sample’s sociodemographic properties, stratified by the time of survey’s completion, are presented in Table 1. We found a significant difference in average age and sex distribution between drop-outs and non-drop-outs from cohort 1, though with small effect sizes (cohen’s $d$ = 0.22, cramer’s $v = 0.14$), with no other difference in depression, anxiety, PRSF or income between the participants (Sup. Table S9).
presenting the strongest association with both. Health-related stressors negatively associated with financial stressors (β = 0.05, p < .0001), but not with protection. Largest effect sizes were observed during the first and third lockdowns (T1 & T4). While financial concerns associated with anxiety at all timepoints with a medium average effect size (β = 0.52), income loss was only associated with it during the third lockdown (T3) and after the vaccination campaign (T5), with a small average effect size (β = 0.35). Financial concerns and income loss were associated with PTSS only on T2 (β = 0.42, p < .0001 & β = 0.29, p < .001, respectively).

Post-hoc analysis of health-related stressors showed that anxiety about getting infected and infecting one’s family associated with depression during the first (T1) and second (T3) lockdowns, while lack of knowledge (both about virulence and about protection from the virus) associated with depression during the first lockdown and after the vaccination campaign (T5). Anxiety about getting infected and infecting family associated with overall anxiety at all time points except for T5, with a medium average effect size (β = 0.43 for both). Lack of knowledge associated with anxiety during the first, second and third lockdowns (T1, T3 & T4), with a medium average effect sizes (β between 0.37–0.41). All health-related stressors associated with PTSS during the second lockdown (T3), while only anxiety about getting infected associated with PTSS after the vaccination campaign (T5).

Fatigue factors associated with depression at all time points, with largest average effect size noted for mental exhaustion (average β=1.13) followed by physical exhaustion (β=0.71), sleep difficulties (β=0.68) and social disconnection (β=0.39). Same was observed for the association of fatigue factors with anxiety across all time points, where again mental exhaustion had the largest average effect size (β=1.19), followed by physical exhaustion (β=0.86), sleep difficulties (β=0.75) and social disconnection (β=0.39). Lastly, fatigue factors were associated with PTSS at all time points, with mental exhaustion having the largest average effect size (β=0.63), followed by sleep difficulties (β=0.50), physical exhaustion (β=0.45) and social disconnection (β=0.28).

Examining factors related to sense of protection, feeling protected by the government and local authorities negatively correlated with depression and anxiety during the first lockdown (T1, β=−0.17, p < .01). Stronger effect sizes were observed after the first lockdown, when both feeling protected by the government and local authorities and feeling protected by the healthcare system negatively correlated with anxiety, with medium effect sizes (β between −0.39 to −0.40, p < .0001). None of the factors associated with PTSS at any time point.

The complete report of all post-hoc analyses is detailed in the Sup. Tables S10–S12.

3.2. Longitudinal intercorrelations among changes in PRSF and mental health outcomes

Worsening in (i.e., increase in) fatigue had the strongest association with worsening of depression (β=−0.36, p < .0001) and PTSS (β=−0.22, p < .0001). Worsening of financial stressors...
was associated with worsening of depression ($β=0.18$, $p<.0001$) and anxiety ($β=0.16$, $p<.0001$) but not PTSS. Worsening of health-related stressors was associated with worsening in anxiety ($β=0.11$, $p<.001$) and PTSS ($β=0.16$, $p<.0001$) but not depression. Worsening (i.e., decrease in) feelings of protection was associated with worsening in depression ($β=0.09$, $p=.003$) and anxiety ($β=0.16$, $p<.0001$), but not PTSS. The results are depicted in Fig. 2.

### 3.3. Effects of the decision to get vaccinated on PRSF and mental health outcomes

The national vaccination campaign started in Israel during T4, and by T5 most of the adult population was vaccinated with at least one (90.5% of people $≥$ 18 years old) or two (83.3%) doses (Mathieu et al., 2023; State of Israel Ministry of Health, 2023). We explored the potential impact of the vaccines on our study outcomes using an analysis of variance (ANOVA) and post-hoc Bonferroni tests. At T4, 30 participants were already vaccinated (9.4%), 241 reported that they plan to get vaccinated (75.5%), and 36 participants (11.3%) reported that they do not intend to get vaccinated ($n=11$, 3.4%) or haven’t decided yet ($n=25$, 7.8%). Twelve participants did not report their status (3.8%). At T5, 282 participants were vaccinated with two doses (94.0%), 7 were vaccinated with one dose (2.3%), and 8 were not vaccinated (2.7%). Of people unvaccinated, 2 reported that they do not intend to vaccinate in the future, 5 did not decide, and 1 was planning to vaccinate soon. Three participants did not report their status (1.0%).

At T4, significant age differences were observed between the 3 groups (vaccinated/plan to get vaccinated/do not intend to get vaccinated; $F_{(2,229)}=9.99$, $η_{partial}^2=0.06$, $p<.0001$). Specifically, those who did not intend to get vaccinated were significantly younger (30.8 years old on average) than the other groups (plan to vaccinate: 37.5, vaccinated: 44.3 years old on average, $p<.01$). There were no group differences in sex distribution. Following these group differences, age was included as a covariate in the following models. An analysis of co-variance (ANCOVA) showed significant group differences in financial concerns ($F_{(2,230)}=6.20$, $η_{partial}^2=0.04$, $p=.002$) and sense of protection ($F_{(2,230)}=6.53$, $η_{partial}^2=0.04$, $p=.002$). In both cases, people who did not intend to get vaccinated had significantly higher financial concerns and lower sense of protection compared to the other groups (all $p<.001$). Other PRSF and mental-health outcomes did not differ between groups (Sup. Table S13).

At T5, groups did not differ in age or sex, therefore we conducted ANOVAs to explore PRSF and mental health outcomes. The only significant group difference was found for sense of protection by the authorities ($F_{(2,229)}=5.10$, $η_{partial}^2=0.03$, $p=.007$), as those who did not vaccinate felt significantly less protected compared to those vaccinated with two doses ($p=.005$) (Sup. Table S13).

### 4. Discussion

In this study we examined the relationship between numerous pandemic-related stressors (financial, health-related, fatigue and sense of protection by the authorities) and mental health outcomes, specifically anxiety, depression and PTSS. Findings showed that financial concerns were associated with depression and anxiety, while health-related concerns were more consistently associated with anxiety and PTSS than with depression. Notably, fatigue was the only stressor that had strong and consistent associations with all three outcomes. We regard these associations as most notable, since they emerged repeatedly across different analyses (observed both cross-sectionally and longitudinally), thus illustrating consistent relations between specific stressors and specific psychopathologies. Sense of protection by authority was
only mildly associated with anxiety when examined cross-sectionally, but its deterioration overtime was associated with exacerbation of both anxiety and depression.

As expected, fatigue was the most prominent risk factor for mental health, and the strongest predictor for emotional deterioration in all facets. Put differently, individuals who experienced a depletion in energy and resources as the pandemic progressed were the ones who were most likely to experience an increase in anxiety, depression and PTSS. This robust connection between fatigue and mental health might paint a gloomy picture for some individuals: while most people succeeded in building resilience to health-related concerns, they failed to do the same for fatigue, meaning they could not adapt to the constant feeling of mental and physical exhaustion, sleep problems and sense of social disconnection. This strong association might be partially explained by the centrality of sleep disorders in the pandemic (Mandelkorn et al., 2021). Sleep disruptions have become a central public concern during COVID-19 (Clemmensen et al., 2020). It is possible that lack of physical activity, alterations in eating habits and weight gain have promoted sense of physical exhaustion, which translated to depression and anxiety by both biological mediators (e.g., endocrine abnormalities (Hryhorczuk et al., 2013)) or psychological factors such as decrease in self-esteem (Vittengl, 2018). Another aspect of fatigue, mental exhaustion, can be linked to psychological fatigue and burnout, both concepts whom potential contribution to mental health deterioration was highly discussed during the pandemic (Griffith, 2020; Michie et al., 2020). Our findings emphasize the magnitude of this link, above and beyond many

Fig. 2. Longitudinal intercorrelations of PRSF with Depression, Anxiety and PTSS. Y axis values represent the standardized change in depression, anxiety and PTSS between two consecutive time points. X axis values represent the standardized change in PRSF between two consecutive time points.

\[ * p < .01 \]

\[ ** p < .001 \]

\[ *** p < .0001 \]
other prominent stressors. However, the observational nature of our study and the extensive time that passed between each of our surveys (which ranged from several weeks to several months) limit our ability to clearly determine directionality between fatigue and psychiatric morbidity, since the impact of these processes over one another most probably occur much faster. Thus, fatigue might not be solely a stressor, but also a symptom (American Psychiatric Association, 2013). Another crucial factor that may impact the relationship between fatigue and mental health outcomes is the individual’s COVID-19 status. As fatigue is a hallmark symptom of both COVID-19 and long-COVID (Ceban et al., 2022), individuals who have been infected may experience higher levels of fatigue and experience emotional distress related to the virus. However, as our study did not collect information on participants’ COVID-19 status, we were unable to control for this potential influence. It is important to consider this factor in future research.

Our study replicated previous findings which tied financial and health related concerns to spiking rates of depression and anxiety at the early stage of the pandemic (Argabright et al., 2022; Barzilay et al., 2020; Bitan et al., 2020; Hertz-Palmor et al., 2021; Hoffart et al., 2021; Thayer and Gildner, 2021). However, on the span of sixteen months, financial concerns became uniquely correlated with depression, while health-related concerns became prominently associated with PTSS. A possible explanation for this difference might be that financial strain led to degradation of social stance, self-esteem, self-confidence and self-efﬁcacy (as opposed to helplessness), which are known precursors of dysphoria, despair and eventually depression (Blazer, 2002; Lorant et al., 2007; Pryce et al., 2011; Roberts and Monroe, 1994). In contrast, the substantial health threat posed by COVID-19 might have highlighted the possibility of death, arising the potential of health-related fears to translate into traumatic symptomatology (Holbrook et al., 2001). These findings are especially interesting since depression and PTSS many times entangle together (O’Donnell et al., 2004).

In accordance with previous reports, most PRSF affected mental health most strongly during the first lockdown (Levy and Cohen-Louck, 2021; Niedzwiez et al., 2021; Patsali et al., 2020), and gradually declined as time elapsed (Fancourt et al., 2021; Picó-Pérez et al., 2021; Prati and Mancini, 2021). Interestingly, several months into the vaccination campaign we observed the re-appearance and strengthening of these associations (e.g., financial concerns with depression and anxiety, health-related concerns with depression). In the case of health-related concerns, this might be explained by changes in the public opinion on the fatality of the disease, which eased by the second lockdown. Surprisingly, the correlation restored its original strength after the vaccination campaign. This might be due to rumors of the more dangerous delta variant, which were reported to reinstate worries among the public (Ahfassan et al., 2021). Notion of this new danger, being even more devastating after the hope of defeating the virus with mass vaccination, might have reinstated the association between fear of contraction and feelings of despair and depression. In contrary, the association of mental health to financial concerns was not influenced by lockdowns, and even increased after the vaccination campaign. This association seemed to be unaffected by fluctuations in the severity of the pandemic situation in the country. This finding validates and elaborates previous findings, showing that the damage that economic hardships place on mental health is consistent and exclusive (Hertz-Palmor et al., 2021).

Our findings suggest that attitudes towards vaccinations impact financial worries and perceived protection. Those who were hesitant about getting vaccinated displayed higher levels of financial concerns and lower sense of protection provided by the authorities. This trend was most evident at the onset of the vaccination campaign among individuals who did not plan to get vaccinated or were unsure, as well as 6 months later among those who did not receive the vaccine. This could be attributed to the controversial “green pass” policy in Israel, which linked access to indoor public spaces and free movement to either proof of vaccination or a negative PCR test result (Waitzberg et al., 2021; Wilf-Miron et al., 2021). This policy faced opposition from many who claimed it was a violation of human rights, and resulted in a decrease of trust in the government among significant portions of the population who felt discriminated due to their decision not to vaccinate (Kamin-Friedman and Peled Raz, 2021; Luster et al., 2021). It is also worth noting that despite the availability of the vaccine to all individuals in Israel without cost, some individuals with autoimmune background conditions may have been unable to receive it (Boekel et al., 2021). These individuals may feel that the government is not adequately protecting their safety and freedom, despite not being able to vaccinate due to their medical history.

These findings highlight the need for healthcare providers to address the mental health consequences of the pandemic, particularly for individuals who may be more vulnerable for emotional distress. This group of vulnerable individuals may include those who have lost their jobs, are part of a high-risk group for COVID-19, have had significant changes to their daily routine, live alone, have low income, or feel unprotected due to increased distrust in institutions. As we are entering the fourth year of the pandemic, and while many countries returned to pandemic routines, healthcare professionals must keep in mind that stressors that may seem less relevant as lockdowns ease may re-emerge and cause distress. While a lot of focus was given to the impact of the pandemic on children’s well-being (Benton et al., 2022) and older adults (Lee et al., 2020; Vahia et al., 2020), we must bear in mind that other populations, such as younger adults in their 20’s, who usually lack job security, were also heavily affected (O’Connor et al., 2021). Coinciding with other studies (Vahia et al., 2020; Wilson et al., 2021), we showed that age negatively correlated with anxiety and depression among our participants. Finally, as demand for mental health services might be overwhelming during times of crisis and a myriad of stressors (Tausch et al., 2022), the facilitation of remote-therapy during the pandemic may help alleviate this burden and provide adequate support to people in acute distress during shocking events (James et al., 2022; Li et al., 2022; Witteveen et al., 2022).

This study has several limitations. First, the sampling was not random, but rather a “snowball” recruitment. Although by weighting the data we have narrowed the error margins, it does not neutralize the selection bias completely (Pierce et al., 2020b). Second, although our cross-sectional data relies on a large sample, our longitudinal data relies on a much smaller body due to high rates of attrition. Although this might expose our study to type II errors and biases, to the best of our knowledge our study is still the first endeavor to examine so many participants over many time points in Israel. Considering the relatively small population and the limited body of current studies on COVID-19 in the country, we believe that our data shed much needed light on the situation in Israel during the first year and a half of COVID-19. Lastly, our study employed online crowdsourcing data gathering, using self-report measures with their inherent limitations (Fadnes et al., 2009). Still, arguably the robustness of the findings we report, replicated for different time points, cohorts and analyses, mitigates most doubts regarding generalizability of our findings. Future likewise studies, whether focused on COVID-19 or other major crises, should attempt to recruit representative samples using probability sampling (Acharya et al., 2013). Regarding attrition, future studies should incentivize recurring participants using monetary compensation, to reduce drop out. Lastly, future studies should make efforts to include higher representation of marginalized groups whom experiences during the pandemic differ from those of majority groups, such as Arab-Palestinian citizens of Israel and ultraorthodox (Haredi), in the Israeli case.

5. Conclusion

This study expands our understanding of the unique and dynamic influence of COVID-19 on mental health in Israel during its first 16 months. Three years into this ongoing global crisis, we recognize that the mental needs and risks of the public varies at different points in time, and interacts with lockdown orders and the virus’ spread. Our findings
emphasize the centrality of fatigue in the conservation and exacerbation of common mental disorders, to a larger extent than other prominent stressors such as financial, health-related concerns, or concerns about protection by the authorities. Most importantly, our findings accentuate the multitude of risk factors for psychiatric morbidity during this complicated epoch, and signals policy makers not to disregard mental health when confronting the virus.

Contributors
All authors contributed to, reviewed, and approved the final manuscript. Conceiving and designing the study: NH-P, NM, MM, SDI, RG, DG, IM-P. Data collection: NH-P, NM, DG. Statistical analysis: NH-P. Data interpretation and writing the final manuscript: NH-P, SR. Reviewing and editing the final manuscript: NM, MM, SDI, AA, EM-D, IH-O, RG, DG, IM-P.

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Availability of data and materials
The datasets used and/or analyzed during the current study are available from the corresponding author upon request.

Ethics statement
The study was approved by the Institutional Review Board of Sheba Medical Center, Tel Hashomer, Israel (IRS#SMC-7182-20).

Declaration of Competing Interest
The authors declare no conflicts of interest.

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Supplementary materials
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