

## Examining associations between remote work and anxiety and depression: a longitudinal survey study in Israel

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## ABSTRACT

**Introduction** Accumulating evidence points at increases in mental health problems during the COVID-19 pandemic, which has been attributed, among other things, to social distancing policies, such as the shift to remote work from home (henceforth: remote work). The current study examines whether changes during the COVID-19 pandemic in working environments from on-site to remote work (or vice versa) are associated with changes in anxiety and depressive symptoms among Israeli employees with different demographic characteristics.

**Methods** We administered three consecutive online surveys between January and November 2021 among 2389 Israelis who work. We conducted panel regression models with individual fixed effects using anxiety and depressive symptoms as outcomes and remote work as exposure, while accounting for sociodemographic variables. We repeated this analysis among subgroups defined by demographic characteristics.

**Results** Symptoms of anxiety (Generalized Anxiety Disorder-7) and depression (Patient Health Questionnaire-9) decreased from 4.27 and 5.98 in January to 3.35 and 4.57 in November 2021, respectively. Increased risk for anxiety and depressive symptoms were significantly associated with remote work. These associations were significant among non-partnered adults and among adults with no children, but not among partnered adults and those with children. Remote work was significantly associated with anxiety among men and with depression among women.

**Conclusions** Remote work is associated with anxiety and depression and these associations vary across different sociodemographic groups.

## INTRODUCTION

The COVID-19 pandemic has and will continue to induce mental health challenges worldwide. Empirical studies from Asia, the Middle East, Africa and Europe show that nearly one in three suffered stress (29.6%), anxiety (31.9%) and depression (33.7%) during the pandemic.<sup>1</sup> In the USA alone, depression was over threefold higher during the pandemic than before.<sup>2 3</sup> Similarly, in Brazil, dramatic increases in mental health

## WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Previous studies suggest that remote work is known to have mostly negative mental health effects (eg, anxiety, stress) but also few positive effects (eg, well-being, better work-life balance).
- ⇒ However, previous studies on the topic are few and their quality varies, with most studies being US based and cross-sectional.

## WHAT THIS STUDY ADDS

- ⇒ This study provides longitudinal evidence for associations between remote work and mental health adversities in a less studied world region (Israel).
- ⇒ Results show that these associations are not universal and vary across different sociodemographic groups.
- ⇒ Remote work is associated with more anxiety only in men and with depression only in women.
- ⇒ Remote work is associated with both anxiety and depression among employees who are non-partnered (divorced, single, widow), but not among those who are partnered (married, cohabiting), and among those who do not have children but not among those who have children.

## HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ This study's results help raise awareness to the issue and advocate for interventions to minimise mental health adversities among remote workers.
- ⇒ Given the disproportionate impact of the work environment on certain demographic groups, concerted efforts should focus on more vulnerable groups such as those who are non-partnered and have no children.
- ⇒ Interventions may include routine periodic in-person meetings, social events and offering psychological support for employees through in-person conversations or hot lines available 24/7.

problems were documented during the pandemic, with a 6.6-fold increase in depression (3.9–29.1%) and anxiety (4.5–37.8%) as compared with prepandemic levels.<sup>4</sup>

The rise in mental health challenges during the pandemic<sup>1</sup> has been attributed among

other things to social distancing policies, such as shelter in place, quarantine and self-isolation. In Ireland, during the first week of the COVID-19 lockdown, 27.7% suffered from depression or anxiety.<sup>5</sup> In Germany, anxiety and depression were found to be associated with a higher reduction in social contacts and distress due to pandemic restrictions.<sup>6</sup> A US study found that stay-at-home orders were associated with depression, anxiety, insomnia and acute stress, and that individual's distancing behaviour was associated with depression, anxiety, intrusive thoughts and stress.<sup>7</sup> On the other hand, mixed evidence also exists. A study in Hong Kong showed that increases in depressive symptoms were associated with staying at home for more days, but also with lower perceived compliance with social distancing.<sup>8</sup> Despite this mixed evidence, many studies to date point to the detrimental effect of social distancing policies on mental health.<sup>15 6</sup>

Working from home (hereafter: remote work) is one of several social distancing measures that may impact mental health. Interestingly, considerable research suggests that remote work is associated with a wide range of both negative and positive mental health outcomes. Of these, the latter may include positive emotions, high job satisfaction, reduced exhaustion and reduced stress.<sup>9–11</sup> In a recent rapid review, Oakman *et al*<sup>12</sup> show that while many studies on remote work focused on stress, their findings are inconsistent pointing at positive, negative or null effects. A growing body of research, especially but not exclusively during the COVID-19 pandemic, links remote work with mental health adversities, such as anxiety, depression, stress, headache and fatigue.<sup>13</sup> A review of studies on remote work during the COVID-19 pandemic<sup>13</sup> found that it was related to several mental health problems, such as anxiety, depression and stress. In another review and meta-analysis remote work was associated with anxiety and depression.<sup>1</sup> In Indonesia, remote work during the pandemic was related mostly to anxiety (reported by 46% of remote workers) but less so related to depression and stress (reported by 18% and 13% of remote workers, respectively).<sup>14</sup>

The increase in remote work during the pandemic has led to a spike in research on its mental health implications. While pre-pandemic studies on remote work and mental health are available, they are few and their quality varies,<sup>15</sup> with most studies being US based and cross-sectional. To address this research gap, the current study explores how a change in working environment can potentially influence anxiety and depression. Exploring these associations is essential and timely given the current rise in remote work alongside increases in mental health challenges. This study extends earlier research by using a longitudinal design and focusing on different demographic groups. We question whether changes in working environments (from in person to remote or vice versa) are related to changes in anxiety and depressive symptoms among Israeli employees during the pandemic. We further explore whether these associations vary among

employees with different demographics (ie, sex, relationship status, parental status and income).

## METHODS

### Data

This study used longitudinal data obtained from a three-wave online survey administered during 2021 to a nationally representative sample of Israeli adults. A local survey company selected the sample from a pool of participants using quota sampling techniques to ensure that it reflected the demographics of Israel in terms of age, sex, income and religion/religiosity.

The first survey wave was administered during the winter of 2021 (29 December 2020 to 7 February 2021; n=2363), the second during the late spring and early summer of 2021 (13 May to 29 June 2021; n=2076) and the third during the fall of 2021 (26 October to 21 November 2021; n=2362). Given that remote work was the exposure of interest, we excluded unemployed or job-seeking individuals and focused this analysis on a subset of working individuals out of the full survey sample (first wave: n=1440; second wave: n=1413; third wave: n=1650). Overlap in survey participants creates a longitudinal sample of 2389 unique participants, who appear in either one (n=1169, 48.9%), two (n=554, 23.2%) or three (n=666, 27.9%) of the survey waves.

Our study sample represents the Israelis who work with respect to gender, age and income. Sample composition of gender, relationship status, number of children and employment status are also consistent throughout the study waves (table 1). However, age composition slightly differs between waves ( $p<0.10$ ); and ethnicity/religion and income composition have changed between waves ( $p<0.01$ ), mainly due to the low rate of Arab respondents in the last two waves, and an increase in the rate of high-income respondents throughout the survey waves (table 1).

Note that the prevalence and severity of COVID-19 in Israel varied over the study period. COVID-19 cases, hospitalisations and deaths were extremely high during the first survey wave but then decreased in the second and third survey waves. Correspondingly, social distancing policies, such as stay-at-home restrictions and workplace closure, were in effect during the first survey wave but were then lifted during the second and third survey waves (see online supplemental appendix 1 for detailed information). However, economic policies in Israel, such as support and debt relief, have not drastically changed throughout the study period, and thus economic circumstances were held constant.

### Variables

*Working environment* was considered as the main exposure, *anxiety* and *depressive symptoms* as outcomes and several sociodemographic variables were accounted for. *Depressive symptoms* were assessed using the Hebrew version<sup>16</sup> of the Patient Health Questionnaire-9

**Table 1** Sample characteristics

	Winter 2021* (n=1440 (100%))	Spring/Summer 2021† (n=1413 (100%))	Fall 2021‡ (n=1650 (100%))	Significance level
Working environment (%)				
On-site	51.6	65.5	62.7	$\chi^2=131.47^{**}$
Hybrid	22.0	21.7	24.3	
Remote work	25.0	12.2	12.5	
Other (not relevant)	1.4	0.6	0.5	
Mental health				
Anxiety, mean (SD)	4.27 (5.11)	3.68 (4.83)	3.35 (4.67)	F=13.35**
Depression, mean (SD)	5.98 (6.27)	5.11 (5.78)	4.57 (5.58)	F=20.82**
Sociodemographic characteristics				
Sex (%)				
Male	48.8	50.0	48.4	$\chi^2=0.83$
Female	51.0	49.9	51.5	
Age group (%)				
18–24	8.5	10.3	7.1	$\chi^2=16.92^*$
25–44	53.3	48.9	51.6	
45–64	31.2	32.7	33.7	
65+	7.1	8.1	7.6	
Population group (%)				
General Jewish	71.9	81.0	79.1	$\chi^2=94.73^{**}$
Ultra-Orthodox	9.1	11.3	9.6	
Arab Israeli	16.5	5.9	10.1	
Other	2.2	1.7	1.0	
Relationship status (%)				
Partnered (married or cohabiting)	70.0	68.2	70.8	$\chi^2=2.93$
Non-partnered (single, divorced or separated)	29.7	31.6	28.7	
Number of children (%)				
0	47.4	49.3	47.7	$\chi^2=3.26$
1	17.6	16.2	18.1	
2	17.6	16.4	17.0	
3 or more	16.9	17.8	16.9	
Employment (%)				
Full time	74.9	74.5	76.1	$\chi^2=1.14$
Part-time	25.1	25.5	23.9	
Income from work (%)				
NIS0–8000	27.4	25.8	21.5	$\chi^2=66.46^{**}$
NIS8001–17 000	45.6	43.1	38.6	
NIS17 000+	26.5	30.4	39.9	

\*\*P<0.01, \*p<0.1.

\*The winter survey wave was held between 29 December 2020 and 7 February 2021.

†The spring/summer survey wave was held between 13 May and 29 June 2021.

‡The fall survey wave was held between 26 October and 21 November 2021.

NIS, New Israeli Sheqel.

(PHQ-9) scale,<sup>17</sup> which includes nine items describing problems indicative of depression, such as having low energy and negative or self-harming thoughts. *Anxiety*

*symptoms* were measured using the Hebrew version<sup>16</sup> of the Generalized Anxiety Disorder-7 (GAD-7) scale,<sup>18</sup> which includes seven items describing problems

indicative of anxiety, such as feeling afraid or easily irritable. For each item in the depressive (PHQ-9) and anxiety (GAD-7) symptom scales, respondents were asked to recall how often they experienced symptoms within the preceding 2 weeks on a scale from 0 (not at all) to 3 (nearly every day). Participants' responses for the PHQ-9 and GAD-7 variables were then summed to form continuous variables ranging from 0 to 27 for depressive symptoms (PHQ-9) and from 0 to 21 for anxiety symptoms (GAD-7), with higher values representing greater anxiety symptoms.

As to their *working environment*, participants were assigned one of the following options: (1) *on-site* was assigned to participants who reported that they 'must be present at the office', (2) *hybrid* was assigned to participants who reported that they 'can work from partly from home and partly at the office' and (3) *remote work* was assigned to participants who reported that they 'can work entirely from home'. Participants' sociodemographic characteristics were also assessed as covariates, including: age; sex; relationship status (partnered (married/cohabiting) vs non-partnered (single/divorced/separated)); the number of children (0, 1, 2, 3 or more); employment (full time vs part-time); household monthly income (less than NIS8000 (New Israeli Sheqel); NIS8000–17 000; more than NIS17 000)<sup>i</sup> and population subgroup (general Jewish, ultra-Orthodox Jewish and Arab). Omitted from the study sample were respondents who reported different gender (n=71) or different population subgroup affiliations (n=105) across survey waves.

### Empirical model design

To explore the relationship between remote work status and employees' mental health, we employ a set of panel regression models with individual fixed effects. Each model assumes working Israelis' mental health as a function of the availability of remote work in addition to individual socioeconomic attributes. In formal representation,

$$y_{it} = \beta x_{it}^{tele} + \gamma X_{it} + \tau_t + u_i + \epsilon_{it}$$

where  $Y_{i,t}$  stands for the mental health—*anxiety* and *depression*—of an individual  $i$  at survey period  $t$ .  $x_{it}^{tele}$  indicates a categorical variable for remote work status—0: on-site (must be present at work), 1: hybrid (can combine work from home and office), 2: remote work (can work entirely from home). The vector  $X_{it}$  comprises individual sociodemographic characteristics, including age group, relationship status, number of children, employment status and income.  $u_i$  is for individual fixed effects, which controls for time-fixed observables such as gender and ethnicity, and unobservables such as personality traits.

<sup>i</sup>In 2021, the average exchange rate US\$ to NIS) was 3.232. Therefore, the three income groups fall into US\$0–25 855, US\$25 856–54 944 and more than US\$54 944.

$\epsilon_{it}$  is for individual wave-level residuals. In this empirical model, the coefficient  $\beta$  captures the association between persons' change in remote work status and their change in mental health indices.

The main exposure variable, working environment, may either change or remain the same for each individual over time. Employees can either keep the same working environment (be it remote, office or hybrid), or change it from office/hybrid to remote work, or vice versa. Since individual fixed effects are controlled for in our analysis (by the term  $u_i$ ), the  $\beta$  coefficient captures the within-individual association between changes in mental health ( $y_{it}$ ) and changes in remote work environment ( $x_{it}^{tele}$ ) over time. The  $\beta$  coefficient can thus be interpreted as the average change in mental health associated with entering or exiting remote work, while accounting for all other individual-level factors that either remain constant over time (ie, sex, population group) or are controlled by  $X_{it}$  [ie, age group, income group, employment scope (full time/part-time), relationship status and number of children]. In line with the above, significant positive values of the  $\beta$  coefficient would imply that people who worked remotely experience more anxiety and depressive symptoms, compared with themselves when they worked from the office.

The regression models were conducted for the overall sample (n=2389). Given the modelling approach, which accounts for individual fixed effects, the results of the regression models presented in [tables 2 and 3](#) remained the same after excluding participants who appeared only on one survey wave. As a robustness analysis, we repeated the regression models on a subsample including only respondents who participated in all three surveys and the results (not reported) remained consistent with those presented here. The analysis was conducted using Stata (V.16.0), in which the command *xtreg* was used for linear model with individual fixed effects estimation, for the main analysis.

## RESULTS

### Who are the remote workers in Israel?

During our study period, remote working has declined from 25.0% (Winter 2021) to 12.2% (Spring/Summer 2021) and 12.5% (Fall 2021;  $p<0.01$ ). Also, anxiety and depressive symptoms have improved over time: Average scales decreased from 4.27 (anxiety) and 5.98 (depressive symptoms) in Winter 2021 to 3.68 (anxiety) and 5.11 (depressive symptoms) in Spring/Summer 2021, and to 3.35 (anxiety;  $p<0.01$ ) and 4.57 (depressive symptoms;  $p<0.01$ ) in Fall 2021 ([table 1](#)).

As shown in online supplemental appendix 2, the share of remote work varies between subpopulations and over time, as some groups are more represented among remote workers, some are under-represented, and for others, the representation is inconsistent along the waves. Remote work is more common at mid-career ages of 25–44 as of Winter 2021, this age group was over-represented in the



**Table 2** Estimated trajectory of anxiety symptoms over time and by working environment (coefficients, SEs)

	Total sample (n*=4275)	Men (n=2114)	Women (n=2161)	Partnered† (n=3019)	Non- partnered† (n=1256)	No children (n=2053)	One child or more (n=2222)
Time (Ref: Winter‡ 2021)							
Spring/ Summer‡ 2021	0.0801 (0.146)	0.0633 (0.187)	-0.216 (0.228)	-0.422** (0.165)	0.497 (0.306)	0.139 (0.216)	-0.349* (0.202)
Fall‡ 2021	-0.601*** (0.159)	-0.522** (0.203)	-0.646** (0.251)	-0.706*** (0.179)	-0.513 (0.343)	-0.367 (0.239)	-0.835*** (0.223)
Working environment (Ref: On-site)							
Hybrid	0.206 (0.260)	0.145 (0.355)	0.356 (0.390)	0.221 (0.292)	-0.0272 (0.560)	0.285 (0.394)	0.0195 (0.354)
Remote work	0.738** (0.333)	1.217** (0.493)	0.470 (0.466)	0.0989 (0.380)	2.131*** (0.686)	1.375*** (0.485)	-0.00195 (0.468)
Constant	4.636*** (1.111)	1.541 (1.674)	6.149*** (1.575)	5.735*** (1.571)	5.247*** (1.612)	6.351*** (1.709)	3.648 (2.224)
R <sup>2</sup>	0.028	0.031	0.045	0.027	0.082	0.042	0.030
Number of individuals	2389	1145	1244	1677	759	1159	1292
All models are adjusted for time-variant variables: age, relationship status, number of children, employment status (full time vs part-time) and income. SEs are in parentheses. ***P<0.01, **p<0.05, *p<0.1. *n reports the total number of observations across the three survey waves (not limited to unique IDs). †Partnered includes married or cohabiting; non-partnered includes single, separated and divorced. ‡The winter survey wave was held between 29 December 2020 and 7 February 2021; the spring/summer survey wave was held between 13 May and 29 June 2021; and the fall survey wave was held between 26 October and 21 November 2021.							

remote workers group compared with on-site and hybrid worker groups, while later group representation became equal. Remote work is also more common among older individuals (ages 65+); among ultra-Orthodox, those without children, part-time workers and those with high household income, as these subpopulations' share among remote workers is higher than their share in on-site and hybrid workers, consistently over the waves. On the other hand, remote work is relatively uncommon among young

adults (18–24), late-career ages (45–64), Arab Israelis, those having one child, full-time workers and middle income, as their share among remote workers is lower than their share among on-site and hybrid workers, consistently over the waves. The share of complementary groups among remote workers is not consistent over time, as well as comparison by gender.

**Table 3** Estimated trajectory of depressive symptoms over time and by working environment (coefficients, SEs)

	Total sample (n*=4155)	Men (n=2065)	Women (n=2090)	Partnered† (n=2942)	Non- partnered† (n=1213)	No children (n=1998)	One child or more (n=2157)
Time‡ (Ref: Winter 2021)							
Spring/ Summer 2021	-0.318* (0.179)	-0.179 (0.245)	-0.463* (0.260)	-0.639*** (0.202)	0.0816 (0.363)	-0.124 (0.267)	-0.626** (0.245)
Fall 2021	-0.978*** (0.194)	-0.984*** (0.264)	-0.901*** (0.285)	-1.130*** (0.219)	-0.965** (0.404)	-0.718** (0.292)	-1.314*** (0.270)
Working environment (Ref: On-site)							
Hybrid	0.0253 (0.317)	-0.425 (0.458)	0.459 (0.445)	0.0558 (0.354)	-0.412 (0.671)	0.0268 (0.487)	-0.153 (0.424)
Remote work	0.751* (0.412)	0.459 (0.643)	1.085** (0.539)	0.286 (0.467)	1.936** (0.839)	1.334** (0.602)	-0.0225 (0.572)
Constant	4.636*** (1.111)	1.541 (1.674)	6.149*** (1.575)	5.735*** (1.571)	5.247*** (1.612)	6.351*** (1.709)	3.648 (2.224)
R <sup>2</sup>	0.037	0.042	0.071	0.039	0.084	0.047	0.048
Number of individuals	2347	1129	1218	1646	747	1140	1264
All models are adjusted for time-variant variables: age, relationship status, number of children, employment status (full time vs part-time) and income. SEs are in parentheses. ***P<0.01, **p<0.05, *p<0.1. *n reports the total number of observations across the three survey waves (not limited to unique IDs). †Partnered includes married or cohabiting; non-partnered includes single, separated and divorced. ‡The winter survey wave was held between 29 December 2020 and 7 February 2021; the spring/summer survey wave was held between 13 May and 29 June 2021; and the fall survey wave was held between 26 October and 21 November 2021.							

## What is the role of remote work in anxiety and depressive symptoms?

Tables 2 and 3 report the results of the individual fixed effects models regarding *anxiety* and *depressive symptoms*, respectively. Notably, the models' results confirm and reinforce the descriptive results (table 1) suggesting that, regardless of working environment, anxiety and depressive symptoms have decreased on average throughout the study period, with a significant decrease observed in Fall 2021 in particular (as compared with Winter 2021; anxiety:  $-0.601$ ,  $p<0.01$ ; depressive symptoms:  $-0.978$ ,  $p<0.01$ ).

Overall, the first columns in tables 2 and 3 show significant positive associations between remote work and both mental health outcomes: Participants who work remotely experience increases in anxiety (GAD-7) and depressive symptoms (PHQ-9) by  $0.738$  ( $p<0.05$ ) and  $0.751$  ( $p<0.10$ ), respectively, compared with their own levels while working on-site. The relationship between remote work status and individual mental health is, however, not universal, and it varies across different subpopulations defined by sex, relationship and parenting status. Table 2 shows that remote work is positively associated with *anxiety* symptoms only for men, but not for women (men:  $1.217$ ,  $p<0.05$ ; women:  $0.470$ , not significant). On the other hand, remote work is positively associated with *depressive* symptoms only for women, but not for men (women:  $1.085$ ,  $p<0.05$ ; men:  $0.459$ , not significant; table 3). As for relationship status, remote work is associated with increased symptoms of both anxiety (table 2) and depression (table 3) (anxiety:  $2.131$ ,  $p<0.01$ ; depression:  $1.936$ ,  $p<0.01$ ) among non-partnered (divorced, single, widow), while partnered (married, cohabiting) employees are not affected by remote work. Lastly, the associations between remote work and the two mental health outcomes were significant among those without children (anxiety:  $1.375$ ,  $p<0.01$ ; depression:  $1.334$ ,  $p<0.05$ ; column 6), but not among employees who have children.

It should be noted that our analytical analysis addresses within-individual association of remote work status with mental health, without considering the direction of remote work status change. In a side unreported analysis, we discovered that, using the data we have, the main relationship reported in this study between working environment and mental health cannot be explained exclusively by only one of the directions of change in the work environment. Namely, the force of the estimated association between remote work and mental health derives mutually from cases of both entering and exiting remote work.

As a sensitivity analysis (not reported), the models were repeated in tables 2 and 3 for the three population groups separately. The results remained significant among the general Jewish population, which is not surprising given that this group comprises the majority of our sample. Among Arabs, remote work remained significantly related to anxiety but not to depression, and among ultra-Orthodox Jews these relationships were no longer significant. However, this can be attributed to loss

of statistical power given the relatively small sample size of Arabs and ultra-Orthodox Jews.

## DISCUSSION

In this panel study, we find significant correlations between remote work with anxiety and depression during the COVID-19 pandemic in Israel. Our results suggest that remote workers experience increased anxiety and depression compared with themselves as on-site workers (tables 2 and 3). These associations between remote work and anxiety/depression are not uniform but rather vary across different subpopulations defined by demographic characteristics. This implies that some populations may be more vulnerable than others to the mental health adversities introduced by remote work.

Our results linking remote work with increased anxiety/depression support other studies conducted during the pandemic.<sup>13 14 19</sup> These studies, mostly cross-sectional,<sup>13</sup> consensually show a higher prevalence of anxiety and depression among remote workers (compared with office workers). However, by using longitudinal data with individual fixed effects, our results further extend the current state of the art by showing that individuals who shift from office to remote work (or vice versa) are likely to experience more (or less) anxiety and depression (respectively), regardless of their employment status or income.

Since this study was conducted during the pandemic, it is periodic by nature, and thus the results should be interpreted and contextualised accordingly. Interestingly, prepandemic studies found both the positive and negative influences of remote work on health,<sup>15</sup> but studies conducted during the pandemic highlight the negative influences.<sup>13</sup> This is not surprising given that during the pandemic remote work was often mandatory and dictated by employers, while prepandemic remote work was more often a choice made by employees based on their personal preferences. While remote work and mental health problems increased concurrently during the pandemic, other factors, not related to remote work, may have also influenced mental health, such as fear of the virus<sup>20</sup> and perceived risk of infection.<sup>21</sup> However, this is not likely to be the case in our study, as we found that, in a period in which most people experience relief in anxiety and depression, those who shifted from office to remote work experience more anxiety and depression.

We found that the associations between remote work and anxiety and depression were stronger among singles and those without children. This might be attributed to loneliness and isolation, which were also found to be associated with remote work elsewhere.<sup>22</sup> To explore this direction, we repeated the models in tables 2 and 3 after adding a sense of loneliness as a covariate (results not reported), but the results remained the same. These results might be explained by the high levels of social support in Israeli society<sup>23 24</sup>—it might be that, despite working from home, fewer people felt lonely during

the pandemic. Additionally, as suggested in previous research, it might be that remote workers had more free time for social interactions outside the workplace.<sup>9</sup>

An unreported sensitivity analysis showing variations in the associations between remote work and anxiety across population groups suggests that cultural characteristics may play a role in one's susceptibility to mental health adversities due to remote work. We observed low susceptibility among ultra-Orthodox Jews, which may be attributed to the belief in god and its protective effect from anxiety and depression.<sup>25</sup> Arabs showed high susceptibility to anxiety due to remote work, which can be attributed to existing barriers, such as low digital literacy and skill among Arab individuals<sup>26</sup> on the one hand, and restricted internet access in Arab towns on the one hand.<sup>27</sup>

A main strength of our study lies in its longitudinal design, which allows detecting how shifting to and from remote work can affect mental health. However, several limitations should be noted. As a longitudinal study, participant dropout was a challenge across the survey waves. The response rate was not equal among different population groups and varied across the waves, leaving some groups under-represented in our study. Particularly, ultra-Orthodox Jews and Arabs consist of 13% and 21% of the Israeli population, respectively,<sup>28</sup> but consist of only 9–11% and 6–17% of our sample in different waves, respectively (table 1). These under-representations may be attributed to the relatively lower employment rates among Arabs<sup>29</sup> and ultra-Orthodox Jews (especially men).<sup>30</sup> Future research on the topic should look into larger samples of all population groups as well as distinguish between different levels of religiosity in all groups.

Lastly, in this study we examine how individual-level changes in the work environment are associated with mental health, without causal inference. Given the periodic nature of our study as one conducted during the COVID-19 pandemic, we recognise that surges in infections triggered shifts to remote work, and, similarly, infections decline triggered shifts back to on-site work. That is, the need for moving to remote work and then returning to on-site work is exogenous to employees' characteristics. Therefore, we conclude that a large part of the reported relationship may be due to remote working's causal effect. However, it is possible that at the individual level there will be an inverse causal relationship between remote work and mental health. For example, people experiencing anxiety or depression may avoid social gatherings and prefer working from home. For this reason, the relationship we show between remote work and mental health may not represent unidirectional causality. Unfortunately, our data cannot confirm nor deny such reverse causality scenarios; however, future research may benefit from doing so while using more nuanced and qualitative methods.

## Public health implications

While the pandemic is about to show its end, remote work is likely to remain elevated even after the pandemic.<sup>31</sup> Therefore, the adverse impact of changes in the work environment on workers' mental health is not a temporary, or a pandemic-specific, problem, but rather it will become a chronic issue that many societies should address. First, it is important to raise awareness of the possible detrimental health effects of remote work among both employees and employers. Next, it is important to articulate strategies to promote and maintain mental health among remote workers. Such may include routine periodic in-person meetings, social events and offering psychological support for employees through in-person conversations or hot lines available 24/7. Lastly, given the disproportionate impact of the work environment on certain demographic groups, concerted efforts should focus on more vulnerable groups such as those who are non-partnered and have no children.

## CONCLUSIONS

This study provides longitudinal evidence for associations between remote work and mental health adversities in a less studied world region—Israel. Mental health adversities related to remote work are not equally distributed and vary across different sociodemographic groups. Men are more susceptible to anxiety while women are more susceptible to depression in association with remote work. Susceptibility to both anxiety and depression in relation to remote work is higher among employees who are non-partnered (divorced, single, widow) and those who do not have children. These results shed light on the complexity of the association between remote work and mental health, and advocate for a context-sensitive approach to remote work. Such approaches may allow employees to choose between remote, hybrid or office work, especially for those who may be more vulnerable to mental health adversities due to remote work.

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**Contributors** MRM conceived the study and led the manuscript development and writing. OH conducted the statistical analyses and wrote substantial parts of the manuscript, including the Methods section as well as the tables. YC provided feedback on the research design, analysis and interpretation of the results. YS developed, planned and executed the data collection. MG-W acquired funding and supervised the research. MRM acted as a guarantor.

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