Resilience in the Face of the COVID-19 Crisis:
A Prospective Cohort Study of Frontline Health Care Workers in New York City

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Frontline health care workers (FHCWs) endured unprecedented exposure to illness and death, work-life balance interruption, and perilous working conditions during the height of the coronavirus disease 2019 (COVID-19) pandemic. These experiences have been linked to elevated rates of depression, anxiety, and burnout,[1] as well as job turnover.[2]

While the prevalence and burden of mental health difficulties in FHCWs have been investigated, scarce research has examined the prevalence and correlates of psychological resilience, defined as adapting well in the face of high pandemic-related stressors, in this population. This information is critical to informing prevention and treatment efforts designed to promote and maintain the mental health of FHCWs, as well as to prepare for subsequent disaster response efforts.

Using data from FHCWs working at a large tertiary urban hospital in New York City, we previously found that positive emotions, self-efficacy, and nonengagement in substance use served as the coping strategies that correlated most strongly with resilience during the spring 2020 acute phase of the COVID-19 pandemic.[3] Here, we have sought to extend these findings by examining the prevalence and correlates of resilience over time in this cohort.

METHODS

Participants included 786 FHCWs working at Mount Sinai Hospital, New York, New York, who participated in 2 anonymous surveys over time. The first survey was administered during the middle and downward slope of the initial pandemic peak in April–May 2020 (time 1 [T1]) and the second at a 7-month follow-up between November 2020 and January 2021 (time 2 [T2]), which corresponded with the subsequent rise and plateau of the second pandemic surge in New York City, as indicated by inpatient census data (Supplementary Material).

Psychological resilience was operationalized as a low probability of screening positive for pandemic-related

Table 1. Correlates of Psychological Resilience in Frontline Health Care Workers in New York City[a,b]

Variable	β	*t*	*P*
Age	−0.07	1.52	.13
Male sex	**0.08**	**2.21**	**.027**
Married/partnered	−0.07	1.67	.095
Attending physician vs other professions	0.04	1.00	.32
Years in practice	**0.09**	**2.00**	**.046**
History of mental illness	−0.05	1.20	.23
Perceived preparedness	**0.13**	**3.50**	**<.001**
Work pride and meaning	−0.06	1.48	.14
Feel valued and supported at work	**0.13**	**3.33**	**<.001**
Positive emotions	−0.04	0.93	.35
Perceived social support	**0.09**	**2.25**	**.025**
Protective psychosocial characteristics	0.00	0.10	.92
Self-sufficient coping	−0.10	1.42	.16
Socially oriented coping	−0.10	1.70	.090
Nonengagement in avoidance coping	−0.07	1.27	.20
Sleep hours	**0.11**	**2.92**	**.004**
Physical exercise	0.03	0.79	.43
Currently receiving mental health treatment	−0.03	0.62	.54

[a]Post hoc analyses revealed that the following items were associated with greater probability of psychological resilience: *perceived preparedness*: I am adequately informed about my clinical duties and the role I am expected to play (β = 0.13, *t* = 3.57, *P* < .001), and I have a good idea of how long my current level/volume of work will last (β = 0.08, *t* = 2.07, *P* = .039); *feel valued and supported at work*: feel valued by close supervisors (β = 0.19, *t* = 4.88, *P* < .001); *perceived social support*: someone to give you good advice in a crisis (β = 0.10, *t* = 2.68, *P* = .007).
[b]Bolded values indicate significant correlates of psychological resilience in the multivariable model.

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posttraumatic stress, major depressive, and generalized anxiety disorder symptoms in the presence of high exposure to pandemic-related stressors at T1 and T2 (Supplementary Material).[4] Logistic regression and relative importance analyses were conducted to identify T1 variables associated with resilience scores.

RESULTS

Of 393 FHCWs with greater than the median number of pandemic-related exposures and stress (2.3 SDs higher), 179 (45.5%) demonstrated resilience by having no positive screens for psychological outcomes at T1 or T2.

Male sex, more years in practice, greater perceived preparedness, feeling valued and supported at work, perceived social support, and sleep hours assessed at T1 were all independently associated with a greater probability of resilience over the study period (total $R^2 = 0.32$, Table 1).

Relative importance analysis further indicated that feeling valued by one's close supervisor (34% relative variance explained [RVE]), being adequately informed about one's clinical duties and role (24% RVE), and a greater number of sleep hours (17% RVE) during the pandemic surge were most strongly associated with resilience, accounting for 75% of the explained variance in this outcome.

DISCUSSION

Results of our prospective cohort study of FHCWs conducted during the COVID-19 pandemic build on our initial findings[3] and suggest that 45% of FHCWs who were highly exposed to pandemic stressors remained psychologically resilient. They further reveal that feeling valued by one's close supervisor and being adequately informed about clinical duties and role, as well as a greater number of sleep hours during the initial pandemic surge, were most strongly associated with resilience over the 7-month study period.

Taken together, results of this study suggest that organizational and personal factors are likely associated with resilience to pandemic-related stress in FHCWs. Accordingly, they highlight the importance of organizational efforts designed to enhance a sense of being valued and robust authentic communications during disaster response.[5] Additionally, workplace interventions to bolster sleep health[6] during large-magnitude disasters may be beneficial. Further research is needed to evaluate the effectiveness of such interventions to promote resilience for current and future generations of the health care workforce.

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Supplementary material: See accompanying pages.

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Supplementary material follows this article.

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Supplementary Material

Article Title: Resilience in the Face of the COVID-19 Crisis: A Prospective Cohort Study of Frontline Health Care Workers in New York City

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List of Supplementary Material for the article

1. Supplementary Material

Disclaimer

This Supplementary Material has been provided by the author(s) as an enhancement to the published article. It has been approved by peer review; however, it has undergone neither editing nor formatting by in-house editorial staff. The material is presented in the manner supplied by the author.

Supplementary Material

Participants

Surveys were administered using the Research Electronic Data Capture (REDCap) platform, and links were emailed to eligible participants. At T2, we sent a follow-up email to the entire T1 sample inviting them to complete the second assessment. Self-generated research codes were used to preserve anonymity, and T1 and T2 surveys were linked using approximate deterministic linkage methods. Linked surveys were considered to be those with exact code matches and those with codes within one generalized Levenshtein edit distance in addition to having matches on 4 out of 5 five demographic variables. Participants were eligible to receive prizes via raffle by filling out a separate unlinked form. The Institutional Review Board (IRB) of Icahn School of Medicine at Mount Sinai approved this study.

A total of 3,360 of the 6,026 invited HCWs completed the T1 survey (55.8%), of which 2,579 (76.8%) endorsed frontline responsibilities (FHCWs). 786 (30.5%) FHCWs analyzed at T1 completed the T2 survey. Distributions of age, sex, profession, marital and parental status, leadership and redeployment status, and pre-pandemic psychiatric history between T2 completers and non-completers did not differ (all $\chi^2<1.32$, all p's>0.20), nor did demographics differ among T2 completers and non-completers or compared with MSH Human Resources data.

Assessment of psychological distress

Pandemic-related posttraumatic stress disorder (PTSD) symptoms were assessed using the PTSD Checklist for DSM-5 (sample item: "In the past 2 weeks, how much were you bothered by repeated, disturbing, and unwanted memories of your experiences related to the COVID-19 pandemic?; a brief 4-item version[1] used at T1 [α=0.82] and full 20-item version[2] at T2 [α=0.95]). A score ≥8 on the 4-item version and ≥33 on the 20-item version was indicative of positive screens for pandemic-related PTSD symptoms.

Major depressive disorder (MDD) symptoms were assessed using the Patient Health Questionnaire-8[3] (α_{T1}=0.87; α_{T2}=0.90). A score ≥10 was indicative of a positive screen for MDD symptoms.

Generalized anxiety disorder (GAD) symptoms were assessed using the Generalized Anxiety Disorder-7[4] (α_{T1}=0.91; α_{T2}=0.91). A score ≥10 was indicative of a positive screen for GAD symptoms.

Derivation of psychological resilience scores

Exploratory factor analyses of COVID-19 pandemic exposures (see Supplemental Table 1) assessed at T1 and T2 were conducted to yield factor scores summarizing common dimensions of pandemic-related exposures and stressors. These factor scores were then summed to yield an aggregate measure of pandemic-related exposures and stressors. Using data on PTSD, MDD, and GAD screening status at T1 and T2, a dichotomous variable was created to indicate presence (coded 1) or absence (coded 0) of any disorder at either timepoint. This variable was then

regressed onto factor scores of pandemic-related exposures and stressors to yield probabilities of screening positive for any disorder at either timepoint for each individual. These probabilities were then subtracted from 1 to yield a measure reflecting relative probability of resilience.

Sample characteristics

Of the 786 FHCWs, 451 (57.4%) were 18 to 34 years old, 183 (23.3%) 35 to 44, 84 (10.7%) 45 to 54, and 68 (8.6%) 55 and older; n=571 were female (72.6%); 569 were married/partnered (72.4%); and 235 (29.9%) had children residing in their household. With regard to profession, n=267 (34.0%) were registered nurses, 184 (23.4%) residents/clinical fellows, 183 (23.3%) attending physicians, 114 (14.5%) physician assistants or advanced practice registered nurses, and 38 (4.8%) other (i.e., social workers, psychologists, chaplains). The median number of years in practice was 5.0 (interquartile range [IQR]=7.0); median number of hours working onsite was 37.5 (IQR=18.0); and median number of COVID-19 patients treated was 30.0 (IQR=58.0).

Supplementary Table 1. Prevalence of COVID-19 pandemic exposures in frontline healthcare workers (n=786)

	Mean (SD) or n (%)
Number of hours worked on site per week	37.4 (19.2)
Number of COVID-19 patients assessed/treated	53.2 (64.5)
Redeployed to different unit during COVID-19 pandemic	272 (34.6%)
Personal medical risk for COVID-19-related complications	
Low	547 (69.6%)
Medium	181 (23.0%)
High	58 (7.4%)
Made difficult decision prioritizing COVID-19 patients	199 (25.3%)
Number of coworkers infected with COVID-19	8.5 (9.4)
Know a coworker hospitalized or in ICU to treat COVID-19	246 (31.3%)
Know a coworker who died from COVID-19	54 (6.9%)
Not enough personal protective equipment	223 (28.4%)
Not enough COVID-19 testing for staff	586 (74.6%)
Not enough COVID-19 testing for patients	243 (30.9%)
Occupational COVID-19 exposures	
Cared for patients in person who have gotten sick from the virus	608 (77.4%)
Cared for patients in person who have died from the virus	438 (55.7%)
Cared for patients via telemedicine who have gotten sick from the virus	155 (19.7%)
Cared for patients via telemedicine who have died from the virus	62 (7.9%)
Personal COVID-19 exposures	
Know a friend or colleague who has gotten sick from COVID-19 and required hospitalization	545 (69.3%)
Know a friend or colleague who has died from the virus	259 (33.0%)
Have a family member not living with me who has gotten sick but did not require hospitalization	226 (28.8%)
Have a family member not living with me who has gotten sick and required hospitalization	78 (9.9%)
Have a family member who did not live with me who has died from the virus	40 (5.1%)
Have a family member living with me who has gotten sick but not required hospitalization	93 (11.8%)
Have a family member living with me who has gotten sick and required hospitalization	8 (1.0%)
Have a family member who lived with me who has died from the virus	0 (0%)
I have gotten sick but did not require hospitalization	179 (22.8%)
I have gotten sick and required hospitalization	0 (0%)
I have gotten sick and required an ICU stay	0 (0%)
Feel torn between desire/duty to help patients vs. loved ones	494 (62.8%)
People with whom you reside are fearful to be near you due to possible COVID-19 exposure	382 (48.6%)

Supplementary Table 2. Assessment of resilience-related factors assessed at T1

History of mental disorder	History of mental disorder was assessed with the following question?: Have you ever been diagnosed by a doctor of healthcare professional with clinical depression, an anxiety disorder, posttraumatic stress disorder, or another mental health condition?
Perceived preparedness	Sum of affirmative responses to the following questions (assessed using No vs. Yes response options): 1. My work and activities before the coronavirus pandemic provided me with helpful training to perform my current clinical work 2. In my current clinical setting, I am adequately informed about my clinical duties and the role I am expected to play 3. At present, I have a good idea of how long my current level/volume of work will last. 4. I am adequate trained to perform the professional tasks required of me during this pandemic.
Work pride and meaning	Sum of responses to the following questions (Assessed on 3-point scale: Disagree, Neutral, Agree) 1. I have felt more pride than usual to be a healthcare worker 2. I have derived more meaning from my clinical work than during life as usual. 3. I have been inspired by colleagues who I consider to be role models.
Feel valued and supported at work	Sum of standardized scores on the following questions (Assessed on 4-point scale: Not at all valued, Slightly valued, Moderately valued, Very much valued): In your opinion, to what extent do you feel valued by: 1. Your immediate supervisors (team leader, service chief, etc.) 2. Hospital leadership In your opinion, what is the current level of: (Assessed on 3-point scale: Low, Medium, High): 1. Camaraderie/team spirit among your group of co-workers in your own clinical practice team or setting. 2. Support from your hospital leadership.
Positive emotions	Score on the positive affect subscale of the Positive and Negative Affect Schedule-Short Form (PANAS-SF[5]), which assesses 10 positive emotions: interested, excited, strong, enthusiastic, proud, alert, inspired, determined, attentive, active.
Perceived social support	Score on abbreviated 3-item version of the Medical Outcomes Study Social Support Scale[6] (Assessed on 5-point scale: None of the time, A little of the time, Some of the time, Most of the time, All of the time). How often is each of the following kinds of support available to you if you need it?

	1. Someone to love you and make you feel wanted (i.e., emotional support) 2. Someone to help you if you were confined to bed (i.e., instrumental support) 3. Someone to give you good advice in a crisis (i.e., appraisal support)
Protective psychosocial characteristics	Factor score of the following measures: 1. Items assessing self-efficacy from the Connor-Davidson Resilience Scale-2 (CD-RISC2[7]; Responses on 5-point scale ranging from Not true at all to True nearly all the time): I am able to adapt when changes occur; I tend to bounce back after illness, injury, or other hardships. Items assessing dispositional gratitude, optimism, curiosity/exploration, purpose in life, and religiosity/spirituality (Responses on 7-point scale ranging from Strongly Disagree to Strongly Agree): 2. I have so much in life to be thankful for.[8] 3. In uncertain times, I usually expect the best.[9] 4. I frequently find myself looking for new opportunities to grow as a person (e.g., information, people, resources).[10] 5. I have discovered clear-cut goals and purpose in my life.[11] 6. In my life, I experience the presence of the Divine (i.e., God).[12]
Self-sufficient coping strategies	Count of engaging in the following coping strategies to help cope with COVID-19-related experiences (adapted from the Brief COPE[13]): planning (e.g., coming up with a strategy for what to do), active coping (e.g., taking action to make the situation better), positive reframing (e.g., looking for something positive in what happened), acceptance (e.g., accepting the reality that it happened), humor (e.g., trying to find humor in the situation), religion (e.g., praying, meditating, or finding comfort in spiritual beliefs).
Socially oriented coping strategies	Count of engaging in the following coping strategies to help cope with COVID-19-related experiences (adapted from the Brief COPE[13]: use of emotional support (e.g., getting comfort or understanding from others), use of instrumental support (e.g., getting advice from others), venting (e.g., expressing negative feelings).
Nonengagement in avoidance coping strategies	Count of non-engaging in the following coping strategies to help cope with COVID-19-related experiences (from the Brief COPE[13]): self-distraction (e.g., turning to work or other activities to get mind off things), denial (e.g., refusing to believe that it happened), substance use (e.g., using alcohol, nicotine, or drugs to help get through it), behavioral disengagement (e.g., giving up in trying to deal with it), self-blame (e.g., blaming or criticizing myself for what happened).
Restorative behaviors	Sleep hours: “At present, on average how many hours per day do you sleep (out of 24 hours), on a typical workday?”

	Physical exercise: “At this time, during the pandemic, how many days per week do you engage in physical activity (i.e., exercise, sports, yoga, etc.)?”
Mental health treatment	“Are you currently receiving treatment for a mental health condition?”

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