Prepandemic Resilience to Trauma and COVID-19 Infection in Older Women

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Objective: Prior work suggests that psychological resilience to trauma may protect not only mental but also physical health. This study examined the relationship of prepandemic psychological resilience to lifetime trauma with self-reported COVID-19 infection and symptoms during the early years of the COVID-19 pandemic.

Methods: Data are from 18,670 longitudinal cohort participants in the Nurses' Health Study II. Based on prior evidence that trauma and subsequent distress can increase infection risk and severity, and that psychological assets may offset this risk, we hypothesized higher versus lower psychological resilience to prior trauma would be associated with lower risk for COVID-19 infection. Prepandemic resilience was assessed via self-report between 2017 and 2019 based on self-reported lifetime trauma exposure and psychological health. COVID-19 infection and symptoms were self-reported on seven questionnaires administered between May 2020 and October 2021, from which we derived a composite outcome measure of probable COVID-19 infection, defined as having 3+ COVID-19 symptoms (out of 9) and/or a positive COVID-19 test result at any single assessment.

Results: Multivariable regression revealed significant associations between higher prepandemic resilience scores and lower risk for probable COVID-19 infection, adjusting for sociodemographic and COVID-19–related risk factors (risk ratio [RR] = 0.90 [95% confidence interval {CI}, 0.87–0.93]). Considering subcomponents of the composite COVID-19 infection measure separately, prepandemic resilience was significantly associated with lower risk of reported symptoms (RR = 0.83 [95% CI, 0.79–0.88]), but not with a positive test result alone (RR = 0.96 [95% CI, 0.91–1.01]).

Conclusion: Identifying protective factors for infection risk may help inform psychosocial interventions to improve health outcomes.

Key words: COVID-19, resilience, symptoms, trauma exposure

Abbreviations: CI = confidence interval, **COVID-19** = coronavirus disease 2019, **NDA** = National Institutes of Mental Health Data Archive, **NHSII** = Nurses' Health Study II, **PTSD** = posttraumatic stress disorder, **RR** = risk ratio, **SD** = standard deviation

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INTRODUCTION

In 2020, COVID-19 spread throughout the globe, leading to millions of deaths and a host of health consequences for those infected (1–7). Infectious diseases can be fatal and can also pose a risk of complications leading to long-term health problems (8). Multiple factors influence susceptibility to infection, with prior work suggesting that immune processes involved in infection are affected by psychosocial stress (9–11). Less well known are factors that can protect health or buffer stress–induced immune dysfunction. A key question is whether psychological resilience to trauma exposure, that is, maintaining positive psychological functioning even in the face of trauma, may mitigate the susceptibility to viral pathogens and the harms resulting from infection that can occur in the wake of exposure to significant stressors.

Historically, resilience has been conceptualized as an individual trait (12) or capacity (13), but resilience is increasingly recognized as a complex construct defined by several key components: exposure to potentially traumatic events, exhibiting or maintaining favorable elements of psychological well-being (e.g., sense of purpose) (14,15), and experiencing low levels of psychological distress (16,17). Trait measures of resilience generally focus on capacity for resilience rather than characterizing the nature of an individual's responses specifically in the context of a traumatic event and have only modest associations with outcome-based resilience measures (18). In the current study, we are interested in manifestation of resilience in the face of trauma, rather than the capacity for resilience before one is called upon to be resilient. Although limited literature has focused on whether or how psychological resilience to trauma may influence subsequent physical health outcomes, emerging evidence suggests that it may have protective effects. First, some studies found that resilience was associated with reduced risk for adverse health conditions involving immune and inflammatory processes, such as cardiometabolic disease (19,20). Second, in observational studies, different resilience phenotypes have been found to be associated with healthier immune profiles, characterized by higher levels of anti-inflammatory cytokines and lower levels of proinflammatory cytokines. For example, studies have found individuals classified as resilient (based on having experienced trauma but reporting no symptoms of posttraumatic stress or other psychiatric disorders) had higher levels of anti-inflammatory cytokines compared to less resilient peers with posttraumatic stress disorder (PTSD) (21,22). A study of 779 Dutch adults (aged 18–30 years) found self-reported psychological

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resilience was associated with higher immune function and fewer somatic problems (23). Similarly, a study conducted during the COVID-19 pandemic found that self-reported trait resilience in the general population was associated with fewer somatization symptoms, such as pain, headaches, nausea, and shortness of breath (24).

There are established biological disruptions related to trauma exposure and subsequent psychological distress (25,26). These disruptions in combination with less adaptive behavioral patterns (27) may put individuals with trauma-related mental health conditions at risk for viral infection via chronically activated stress systems and immune system dysregulation (28). Indeed, a study of electronic health records from 61 million US adults found that having a recent psychiatric diagnosis increased risk for COVID-19 infection, compared to no diagnosis (29). Limited work suggests that psychosocial assets related to resilience (e.g., positive affect, social support) are also positively linked to measures of adaptive immune functioning and therefore may be health promotive. Adaptive immune function has been indicated by higher natural killer cell activity and increased cytokine responses to viral challenge (30). Taken together, prior work suggests that individuals who maintain positive psychological functioning even having been exposed to trauma may be less susceptible to infectious disease and that psychological resilience may promote physical health. To our knowledge, no studies have yet tested this relationship with a rigorous longitudinal design, and it remains unclear the extent to which bidirectionality or confounding may be present in associations.

Present Study

In the current study, we examined the prospective relationship between prepandemic psychological resilience to lifetime trauma and probable COVID-19 infection occurring during the first 1.5 years of the pandemic using data from the Nurses' Health Study II (NHSII), a large ongoing cohort of current and former female health care professionals. We hypothesized that higher versus lower psychological resilience to prior trauma would be associated with lower risk for probable COVID-19 infection. A number of methodological and statistical challenges arise for studies of COVID-19 infection initiated early in the COVID-19 pandemic (31). In the first months of the pandemic, testing was not widely available, and rapidly changing information and public guidance led to testing delays and shortages across the United States (11,32). Thus, research conducted at this time must rely on additional metrics to assess probable infection beyond definitive positive test results. Several specific symptoms characterizing COVID-19 and less commonly occurring with other infectious diseases including loss of smell, loss of taste, and breathing problems were identified (33–35). Presence versus absence of these specific symptoms in aggregate may be used to indicate probable infection. We also adjusted for a range of sociodemographic and health-related variables that may confound the association as they have been shown previously to be related to either psychological resilience (36,37) or COVID-19 infection risk (38–40), such as race/ethnicity, socioeconomic status, body weight, smoking status, and chronic conditions like hypertension and diabetes. Additionally, we considered a range of preexisting health conditions that could cause COVID-19–like symptoms as potential confounders and included them in our models as well. Moreover, we examined differences in risk for COVID-19 infection and associations between resilience and COVID-19 infection between women who were and were not current health care workers in the pandemic, as those working in health care may have been at particularly elevated risk for infection during the acute pandemic phases.

METHODS

Study Sample

The Nurse's Health Study II (NHSII) is a longitudinal cohort that comprised 116,429 female registered nurses in the United States who were 25 to 42 years of age at enrollment in 1989. The cohort is ongoing, and participants complete biennial questionnaires. Our study drew on a subsample of participants within the NHSII who completed a supplemental PTSD questionnaire between August 2018 and January 2020, which assessed exposure to lifetime trauma (n = 33,845) and was administered following the 2017 biennial questionnaire.

In April 2020, 55,925 active NHSII participants were invited to complete a series of surveys regarding health and well-being during the COVID-19 pandemic (the last survey was collected in October 2021). A total of 22,626 participants completed both the 2018 PTSD questionnaire and at least one COVID-19 questionnaire (out of seven possible substudy assessments). Data from the 2017 biennial questionnaire and the 2018 PTSD questionnaire were used to characterize prepandemic resilience to trauma. We included only women who reported at least one lifetime traumatic event before the pandemic, as a key element of our conceptualization of resilience is exposure to trauma. Thus, our sample comprised participants who had complete data on the components required for deriving a measure of psychological resilience and on whether they had experienced COVID infection (N = 18,670). Details on participant sample derivation are provided in Figure S1, Supplemental Digital Content, http://links.lww.com/PSYMED/B13. Among the analytic sample, 28.6% of participants were active health care professionals at the baseline COVID-19 survey (April–May 2020). This study was approved by the Partners HealthCare Human Research Committee, and return of questionnaires implied consent. The authors do not have permission to share data and did not have access to any identifiable data from participants.

Measures

Please refer to Figure S2, Supplemental Digital Content, http://links.lww.com/PSYMED/B13, for a timeline of when measures described in this section were obtained.

Exposure: Resilience Before the COVID-19 Pandemic

Psychological resilience in the face of trauma is characterized not only by low levels of psychological distress but also by the presence of positive psychological functioning (14,15). We operationalized *psychological resilience* as multidimensional psychological health relative to lifetime trauma burden, among women reporting at least one lifetime trauma exposure experienced before the pandemic, consistent with prior work in this sample

(16). This included characterizing women based on the following information: a) exposure to trauma and b) psychological health, including three forms of psychological distress (PTSD, depression, and anxiety symptoms) as well as three aspects of psychological well-being (optimism, purpose, and life satisfaction), all reported before the pandemic.

Exposure to lifetime trauma was reported on the 2018 PTSD questionnaire using a modified version of the Brief Trauma Questionnaire (41), which assessed lifetime experience of 15 types of potentially traumatic events (e.g., life-threatening disease, physical assault, natural disaster, unwanted sexual contact) plus one "other" trauma for events not otherwise specified. As many individuals experience more than one trauma during their lifetime, and trauma may have cumulative impact on health (42,43), trauma burden was calculated as a count of total number of trauma exposure types endorsed (potential range, 1–16) (44). Deriving trauma burden in this way is consistent with prior work in this cohort (16,44) as well as with literature suggesting the cumulative negative impacts of trauma (45), even separate from trauma type (46). Because posttraumatic stress symptoms were assessed in relation to "worst" trauma and several measures of psychological health (anxiety, optimism, and purpose) were obtained in 2017 and 2018, to ensure appropriate temporality regarding psychological functioning in relation to trauma experience and burden (i.e., trauma is experienced before when psychological functioning is assessed), we examined the proportion of women who reported their "worst" trauma occurred after 2017. Of our sample, 99.3% ($n = 18{,}540$) reported that their worst trauma occurred before 2017, whereas 0.7% ($n = 130$) indicated that their worst trauma occurred after 2017. The mean age of occurrence of "worst" trauma was 34 years (standard deviation [SD] = 18), and most women reported more than one trauma (mean = 3.2, SD = 1.9).

Psychological health, designed to capture functioning across the mental health spectrum, was operationalized as a composite of psychological distress and positive psychological well-being measures, consistent with prior work (17,47). First, multiple forms of *distress* were measured using validated assessment tools included on questionnaires administered in 2017 and 2018. Self-reported past-month *posttraumatic stress symptoms* with the 20-item PTSD Checklist for the Diagnostic and Statistical Manual, Fifth Revision (PCL-5) (48), and *depressive symptoms* with the 10-item Center for Epidemiologic Studies Depression Scale (49) were reported on the supplemental 2018 PTSD questionnaire. Self-reported past-month *anxiety symptoms* were reported on the 2017 biennial questionnaire using the seven-item Generalized Anxiety Disorder scale (50). Second, *positive psychological well-being* was assessed based on separate previously validated measures of *life satisfaction* (five-item Satisfaction with Life Scale) (51) from the 2018/2019 PTSD questionnaire, *optimism* (six-item Life Orientation Test-Revised) (52), and *purpose* (three-item purpose in life subscale of the Psychological Well-being Scale) (53) from the 2017 biennial questionnaire. Each individual distress (i.e., PTSD, depressive, anxiety symptoms) and positive psychological well-being (i.e., life satisfaction, optimism, purpose) scale were separately standardized ($M = 0$, SD = 1).

We derived a single composite measure of psychological health by summing the inverse of the standardized distress scores as well as standardized positive psychological well-being scores, such that higher sum scores indicate more positive psychological health. A confirmatory factor analysis using these items suggested that this single composite was appropriate, as measures of distress and positive psychological well-being loaded acceptably on a single factor (standardized root mean square residual = 0.057; balanced critical factor index = 0.90).

Psychological resilience to trauma was then defined according to both trauma exposure burden and psychological health. Following prior work, we applied a residual-based approach to create a continuous measure of resilience (16,54). First, we fit a linear regression model with count of lifetime trauma experiences predicting the composite psychological health score. Next, we obtained standardized residuals from this regression model. These residual scores served as a continuous measure of resilience for each individual (54), with higher values indicating better psychological health relative to that predicted by one's level of trauma exposure.

Main Outcome: COVID-19 Infection Early in the COVID-19 Pandemic

Positive COVID-19 diagnostic test results (antibody, antigen, or polymerase chain reaction) and COVID-19 symptoms were self-reported on all COVID-19 questionnaires. Presence of any of nine distinct COVID-19 symptoms was queried (time frame depended on the questionnaire but included past 7 days, past 30 days, and past 90 days): cough, breathing problems, fever, sore throat, muscle aches, loss of taste, loss of smell, digestive symptoms (nausea and vomiting), and "other symptoms related to COVID-19." We created a composite variable indicating probable COVID-19 infection between May 2020 and October 2021 based on a) a reported positive COVID-19 test result and/or b) endorsing ≥3 of the 9 COVID-19 symptoms queried, as present at any single assessment. This measurement is in line with other research that expanded the definition of probable COVID-19 infection beyond positive test results (11). In secondary analyses, we considered alternate definitions of COVID-19 infection: a) test confirmed symptomatic infection (positive test result *and* 3+ symptoms) and b) a COVID-19 symptom profile characterized by the presence of three specific symptoms considered to be paradigmatic of the COVID-19 infection strain circulating at the time (including breathing problems, loss of taste, and loss of smell) (33–35).

Covariates

Covariates were selected based on prior literature suggesting that they may confound the associations of interest. These include socioeconomic status in adulthood, which could be related to trauma, psychological health, and COVID-19 infection. Health care professional status and COVID-19 vaccination status may also be related to differential COVID-19 exposure and infection. We also considered known risk factors for COVID-19 and chronic health conditions that may result in symptoms similar to those occurring with COVID-19. Covariates were all self-reported and assessed at various time points (all biennial questionnaires unless otherwise indicated), and included the following: age (> 65 versus ≤65 years COVID-19 baseline questionnaire in 2020); race/ethnicity (White or non-White [non-White category included participants who identified as Black, Latina, Asian, Native Hawaiian or Pacific Islander, American Indian or Native, Middle Eastern, Other]) reported in 1989; parental educational attainment (highest level of education completed by either parent: high school graduate, 1–3 years of college, or 4 years of college or greater, missing) reported in 2005, as a proxy measure for adult socioeconomic status; median household income of residential US Census tract (in quartiles) in 2009; marital status (married, divorced/separated, widowed, single, other/missing) reported on the supplemental PTSD questionnaire in 2018; living situation (with others versus alone) reported on the COVID-19 baseline questionnaire in 2020; current health care professional status (current versus not a current health care professional) reported on the COVID-19 baseline questionnaire; and COVID-19 vaccination status (yes/no) reported at any COVID-19 questionnaire between May 2020 and October 2021. Risk factors for COVID-19 severity included body mass index (reported on COVID-19 baseline questionnaire in 2020), smoking status (current, former, or never smoker), and history of clinician-diagnosed diabetes, hypertension, high cholesterol, asthma, and cancer (yes/no for each condition), all reported in 2017 on the biennial questionnaire. To assess presence of preexisting health conditions with COVID-19–like symptoms, we created a measure indicating history of any of the following conditions (reported in 2017): sleep apnea, chronic sinusitis, emphysema, multiple sclerosis, systemic lupus, rheumatoid arthritis, and unexplained loss of smell.

Statistical Analyses

We first examined the distributions of covariates in the full analytic sample, as well as by high (above the median) versus low (at or below the median) resilience levels. To address our primary aim, we used multivariable Poisson regression models with generalized estimating equations to estimate the relative risk of COVID-19 infection associated with an SD increase in resilience. Generalized estimating equation is a computationally efficient approach for nonnormal data that requires fewer assumptions and allows calculation of robust standard errors (55,56). A Poisson distribution was chosen given that our outcome was not rare in this sample (> 8%). We conducted models first adjusted for age only (minimally adjusted) and next adjusted for all covariates (fully adjusted). To determine if infection defined based on a test result versus symptoms was driving observed associations between prepandemic resilience and COVID-19 infection, we also examined these as separate outcomes. All analyses were conducted using SAS 9.4 with two-sided hypothesis testing.

Secondary Analyses

We conducted several secondary analyses to test the robustness of our primary models to different operationalizations of COVID-19 infection, using a more conservative estimate of COVID-19 cases that were not captured by tests (as testing was not common in the early months of the pandemic) more conservatively, presence versus absence of COVID symptom profile, and considering a test-confirmed symptomatic case status as the outcome. We also examined number of symptoms across follow-up as a count variable. In addition, we ran our main models treating age as a continuous variable.

Finally, we examined potential interactions between resilience and active health care professional status. As health care professionals experienced high levels of stress and greater exposure to COVID-19 during the pandemic, associations between resilience and COVID-19 infection may differ by health care worker status.

RESULTS

In Table 1, we summarize the sociodemographic and risk factors present in the full sample and for those with high versus low resilience scores (split at median). Overall, participants had a mean age of 66.7 years (SD = 4.5) and a mean body mass index of 27.5 (SD = 6.3), and most identified as White (95.9%). A total of 75.2% of participants were married or partnered, 81.2% lived with others during the start of the COVID-19 pandemic, and 81.3% were vaccinated against COVID-19 during follow-up. Those with high versus low resilience reported being married or partnered and living with others more frequently and less frequently reported having certain known COVID-19 risk factors, specifically hypertension, diabetes, high blood pressure, and being a smoker.

A total of 1365 (13.1%) individuals in our sample met the criteria for our composite definition for probable COVID-19 infection. Among these women, 6.8% (n = 706) had a positive test result only, 7.4% (n = 770) met the three-symptom threshold only, and 8.1% (n = 111) had both a positive test result and met the symptom threshold. Notably, across all waves, 63.3% (n = 447) of participants with positive tests reported no COVID-19 symptoms.

Prepandemic Resilience and Risk of Likely COVID-19 Infection

In the age-adjusted model, prepandemic resilience was significantly associated with lower risk of probable COVID-19 infection (RR per SD resilience = 0.89; 95% confidence interval [CI], 0.85–0.92; Table 2). When adjusting for all covariates and potential confounders, the association attenuated slightly but remained statistically significant (risk ratio [RR] = 0.90 [95% CI, 0.87–0.93]).

When examining positive test result and symptom outcomes separately, prepandemic resilience was not associated with a reported positive test (RR = 0.96 [95% CI, 0.91–1.01]), but had a protective association with symptoms (RR = 0.83 [95% CI, 0.79–0.88]). These results are also summarized in Table 2. Effect estimates for all covariates from these three fully adjusted models (infection composite, positive test result, symptoms) are presented in Table S1, Supplemental Digital Content, http://links.lww.com/PSYMED/B13.

Secondary Analyses

Prepandemic resilience was associated with test-confirmed outcome results (3+ symptoms *and* a positive test result) in age-adjusted (RR = 0.84 [95% CI, 0.76–0.94]) and fully adjusted (RR = 0.84 [95% CI, 0.75–0.95]) models. Prepandemic resilience was also significantly associated with lower likelihood of reporting the COVID-19–specific symptom profile (breathing problems, loss of taste, and loss of smell reported in a single assessment as the outcome), in both age-adjusted (RR = 0.78 [95% CI, 0.70–0.86]) and fully adjusted (RR = 0.81 [95% CI, 0.72–0.90]) models (see Table 3). In separate regression models, we found no evidence of interaction effects between prepandemic resilience and health care professional status in

TABLE 1. Summary of Sociodemographic and Risk Factors in Full Sample (*N*=18,670)

	% (*N*)	High Resilience (Above Median Score), % (*N*)	Low Resilience (Median Score or Below), % (*N*)
Age, mean (SD), y	66.7 (4.5)	66.9 (4.5)	66.5 (4.6)
Race			
White	95.9 (17,896)	95.5 (8648)	96.2 (9248)
Non-White	3.1 (572)	3.3 (299)	2.8 (273)
Parental educational attainment			
High school	46.2 (8622)	45.3 (4103)	47.0 (4519)
Some college	23.1 (4314)	23.1 (2091)	23.1 (2223)
College plus	24.3 (4543)	25.7 (2325)	23.1 (2218)
Median census tract income			
Quartile 1	25.0 (4658)	24.4 (2206)	25.5 (2452)
Quartile 2	24.9 (4642)	24.2 (2194)	25.5 (2448)
Quartile 3	25.1 (4687)	25.1 (2275)	25.1 (2412)
Quartile 4	24.9 (4652)	26.1 (2364)	23.8 (2288)
Marital status			
Married/partnered	75.2 (14,038)	79.6 (7207)	71.0 (6831)
Divorced/separated	12.8 (2381)	10.6 (962)	14.8 (1419)
Widowed	6.4 (1201)	5.6 (505)	7.2 (696)
Single	5.0 (934)	3.6 (323)	6.4 (611)
Risk factors for COVID-19 severity			
Cancer	7.6 (1426)	7.6 (688)	7.7 (738)
Hypertension	26.4 (4930)	24.4 (2211)	28.3 (2719)
Diabetes	6.6 (1223)	5.3 (475)	7.8 (748)
Asthma	8.4 (1564)	7.7 (701)	9.0 (863)
High cholesterol	29.5 (5499)	26.9 (2433)	31.9 (3066)
BMI, mean (SD)	27.5 (6.3)	26.9 (5.8)	28.1 (6.6)
Smoking status			
Never smoker	64.7 (12,076)	66.4 (6013)	63.0 (6063)
Former smoker	32.3 (6030)	31.2 (2826)	33.3 (3204)
Current smoker	3.0 (564)	2.4 (213)	3.7 (351)
Prior conditions with symptom overlap with COVID-19	7.6 (3760)	16.6 (1502)	23.5 (2258)
During COVID-19 pandemic			
Living arrangement			
With others	81.2 (15,168)	84.8 (7674)	77.9 (7494)
Alone	15.7 (2936)	12.9 (1165)	18.4 (1771)
COVID-19 vaccination	81.3 (15,171)	82.3 (7453)	80.3 (7718)
Active health care professional	28.9 (5384)	29.3 (2653)	28.4 (2731)

SD = standard deviation; COVID-19 = coronavirus disease 2019; BMI = body mass index.

Values are means (SD) for continuous variables; percentages and *n* values for categorical variables. Values of polytomous variables may not sum to 100% due to rounding. Prior conditions with symptoms overlapping with COVID-19 were measured in 2017. COVID-19 vaccination status was measured in October 2021. Missingness was 1.0% for race, 6.9% for parental educational attainment, 0.2% for median census tract income, 0.7% for marital status, 3.4% for living arrangement, 0.01% for active health care professional status, and 0.3% for BMI.

their association with COVID-19 infection, adjusting for all other covariates (interaction term $p = .57$). Models treating age as continuous or binary were comparable in significance level and direction, as were analyses considering COVID-19 symptoms as a count versus binary outcome.

DISCUSSION

We found that a continuous measure of prepandemic psychological resilience, defined by greater levels of broad psychological health than predicted by one's lifetime trauma burden, was associated with lower likelihood of reporting COVID-19 infection (defined as 3+ symptoms or a positive test). This relationship appeared to be driven by symptoms, and the magnitude of association was strengthened when we used a more stringent symptom profile (relatively COVID-19 specific). Our findings suggest that prepandemic resilience may be related to lower symptomatology risk during the pandemic and/or a more positive perception of health.

Prepandemic resilience was not associated with self-reported positive COVID-19 test results alone. A possible explanation for our null finding with positive test results and the low overlap between positive test results and reported symptoms (8.1%) may be the inconsistent access and

TABLE 2. Relative Risk of COVID-19 Infection Associated With Prepandemic Resilience to Trauma in Poisson Regression Models (N=18,670)

	Prepandemic Resilience to Trauma		
COVID-19 Infection Indicator	**Case N (%)**	**RR**	**95% CI**
COVID-19 infection composite (symptoms and/or positive test)	1365 (13.1)		
Minimally adjusted		**0.89**	**0.85–0.92**
Fully adjusted		**0.90**	**0.87–0.93**
Positive COVID-19 test result (ever)	706 (6.8)		
Minimally adjusted		0.96	0.91–1.01
Fully adjusted		0.96	0.91–1.01
COVID-19 symptoms (3 or more)	770 (7.4)		
Minimally adjusted		**0.81**	**0.77–0.85**
Fully adjusted		**0.83**	**0.79–0.88**

COVID-19 = coronavirus disease 2019; RR = risk ratio; CI = confidence interval.

Minimally adjusted models adjusted for age only. Fully adjusted models adjusted for age, race, parental educational attainment, census-tract level median income, marital status, current living arrangement, health care worker status, COVID-19 vaccination status, COVID-19 risk factor status, and prior conditions with symptoms similar to COVID-19 symptoms. Overlap between participants reporting a positive test result and 3+ COVID-19 symptoms was 8.1% (n=111).

Resilience was standardized to improve interpretability. p Values <.05 are bolded.

recommendations related to COVID-19 testing during the assessment period. Early in the pandemic, testing was not widely available even among working health care professionals; thus, findings with positive tests may have been related more to access than to true infections. Also, COVID-19 also presented asymptomatically during this period, and tests were sometimes recommended even in the absence of symptoms (32).

Although we considered "probable COVID-19 infection" as a composite capturing experiences of a positive test or symptoms, observed differences in the associations of each indicator with prepandemic resilience suggest that indicators may be capturing different underlying constructs. Positive tests may capture more asymptomatic cases identified through surveillance testing, whereas symptom reports may identify symptomatic cases where individuals may or may not have tested. Although some symptoms occurring with COVID-19 are nonspecific and may indicate a range of somatic or physical illnesses, we adjusted for multiple health conditions that could influence or overlap with these symptoms. We also conducted several secondary analyses that tested the robustness of our primary associations. In aggregate, our findings may suggest that psychological resilience to trauma may be more strongly associated with symptomatic disease than with access to COVID-19 tests or with likelihood of having an asymptomatic infection.

Our findings build on burgeoning literature suggesting that, although trauma and subsequent distress may increase infection risk and severity, psychological assets (e.g., resilience) may offset that increased risk (57,58). Our findings that resilience to trauma is prospectively associated with lower risk of symptomatic COVID-19 illness are consistent with prior work linking resilience to trauma with more adaptive immune function (22); such effects may lead to decreased susceptibility to viral infections. Our findings also are consistent with findings from a smaller cohort study examining COVID-19 and somatic symptoms (59).

Limitations and Strengths

Our study has several limitations. Lifetime trauma exposure was retrospectively reported in 2018–2019, raising the

TABLE 3. Secondary Analysis: Resilience Predicting COVID-19–Specific Symptom Profile or Test-Confirmed Symptomatic Cases (N=18,670)

	Prepandemic Resilience to Trauma		
COVID-19 Infection Indicator	**Case N (%)**	**RR**	**95% CI**
Test confirmed symptomatic cases	111 (1.1)		
Minimally adjusted		**0.84**	**0.76–0.94**
Fully adjusted		**0.84**	**0.75–0.95**
COVID-19–specific symptom profile (loss of taste, smell, and breathing issues)	199 (1.9)		
Minimally adjusted		**0.78**	**0.70–0.86**
Fully adjusted		**0.81**	**0.72–0.90**

COVID-19 = coronavirus disease 2019; RR = risk ratio; CI = confidence interval.

Minimally adjusted models adjusted for age only. Fully adjusted models adjusted for age, race, parental educational attainment, census-tract level median income, marital status, current living arrangement, health care worker status, COVID-19 vaccination status, COVID-19 risk factor status, and prior conditions with symptoms similar to COVID-19 symptoms.

Resilience was standardized to improve interpretability. p Values <.05 are bolded.

possibility of recall bias. Infection status was self-reported or inferred based on self-reported symptoms, although self-reported health outcomes have previously had good validity in these cohorts (27,60). There are multiple possible relationships between symptoms, testing, and true infection, and some could suggest misclassification of our outcome. For example: a) a participant may have had COVID-19 but was asymptomatic and did not test, b) a participant may have been asymptomatic but tested positive for COVID-19, c) a participant may have had several symptoms of COVID-19 but did not test, and d) a participant may have had several symptoms of COVID-19 and tested negative. However, in our sensitivity analyses, such as restricting our symptom-based definition to symptoms that were relatively specific to COVID-19 (e.g., loss of smell), our findings remained consistent with those in our primary models. Although each of these indicators (symptoms versus test result) may have their limitations, they are complementary in their ability to capture probable COVID-19 infection during the early phase of the pandemic. By combining them into a composite measure, we sought to "screen in" as many cases as could be reasonably detected with these data, followed by more stringent sensitivity analyses. It is possible that other factors could influence self-reported symptoms that we were not able to consider (e.g., neuroticism, menopausal symptoms). Trauma burden was operationalized as the number of types of trauma experienced, and we were unable to account for severity or number of individual instances of exposures. Finally, our sample was middle-aged to older adult women who were current or former health care workers and were largely White; thus, generalizability to other groups may be limited. Current and former health care workers may have experienced different stressors during the pandemic compared to the general population, related to caregiving responsibilities, or having colleagues working on the front lines. However, this sample provides key insights into how prior psychological resilience to trauma may be protective against symptomatic infectious disease.

Our study has several strengths both empirically and conceptually. First, we were able to make use of a large, prospective cohort of women with data obtained before and during the COVID-19 pandemic; this permits inferences about whether prepandemic factors influence risk for COVID-19 infection. The prospective study design supports appropriate temporality in our associations and strengthens our confidence in the directionality of the findings. Second, although much of the research related to psychological resilience has focused on predictors or the nature of resilience itself, our prospective study offers novel insights into the potential physical health consequences of psychological resilience to trauma. Third, our study adds conceptual sophistication to the assessment of resilience by examining both psychological distress and positive functioning in relation to trauma burden, thus operationalizing psychological resilience to lifetime trauma in a way that captures responses across the mental health spectrum. Our prospective study design thus extends prior work focusing on trauma exposure, psychological assets such as resilience, and disease risk.

Conclusion

Prior psychological resilience to trauma may be protective against symptomatic illness amid a pandemic among aging women in general and for those in acutely stressful or risky environments such as health care. Understanding protective factors against symptomatic illness may help inform psychosocial interventions to improve health outcomes related to COVID-19 infection and possibly other infectious diseases. Targeting interventions that bolster resilience in survivors of trauma may also improve downstream physical health outcomes in times of collective stress, such as the COVID-19 pandemic.

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Ethical Standards Statement: The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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