Experiences of U.S. Nurses Compared With Nonnurses in the First Year of COVID-19

Findings From a National Registry

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Background: Nursing professional organizations and media sources indicated early in the pandemic that the physical and psychological effects of COVID-19 might be distinct and possibly greater in nurses than in other types of healthcare workers (HCWs).

Objectives: Based on survey data collected in Healthcare Worker Exposure Response and Outcomes (HERO), a national registry of U.S. HCWs, this study compared the self-reported experiences of nurses with other HCWs during the first 13 months of the pandemic.

Methods: Nurse responses were compared to responses of nonnurse HCWs in terms of viral exposure, testing and infection, access to personal protective equipment (PPE), burnout, and well-being. Logistic regression models were used to examine associations between nurse and nonnurse roles for the binary end points of viral testing and test positivity for COVID-19. We also examined differences by race/ethnicity and high-risk versus low-risk practice settings.

Results: Of 24,343 HCWs in the registry, one third self-identified as nurses. Nurses were more likely than other HCWs to report exposure to SARS-CoV-2, problems accessing PPE, and decreased personal well-being, including burnout, feeling tired, stress, trouble sleeping, and worry. In adjusted models, nurses were more likely than nonnurse HCWs to report viral testing and test positivity for COVID-19 infection. Nurses in high-risk settings were more likely to report viral exposure and symptoms related to well-being; nurses in low-risk settings were more likely to report viral testing and test positivity. Black or Hispanic nurses were most likely to report test positivity.

Discussion: Differences were identified between nurses and nonnurse HCWs in access to PPE, physical and mental well-being measures, and likelihood of reporting exposure and infection. Among nurses, testing and infection differed based on race and ethnicity, and type of work setting. Our findings suggest further research and policy are needed to elucidate and address social and occupational disparities.

Key Words: COVID-19/epidemiology • COVID-19/nursing • healthcare workers • nurses • pandemics

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Mounting evidence has highlighted the remarkable toll that COVID-19 has taken on frontline workers, particularly healthcare workers (HCWs), not only in infection and mortality rates compared with the general population (Hughes et al., 2020) but also in well-being, burnout, mental health, and intent to stay on the job (Aiyer et al., 2020; Norman et al., 2021). During the first year of the pandemic, nursing professional organizations and unions—as well as a handful of preliminary research studies—suggested that, even compared with other HCWs, nurses and nursing assistants seemed to have borne a disproportionate burden of the pandemic’s physical and psychological effects (Gómez-Ochoa et al., 2021; Hughes et al., 2020; National Nurses United, 2020). In one national-level survey of more than 9,000 nurses conducted in autumn 2020, almost one in five reported plans to leave bedside practice (NurseGrid, 2021), a
trend with the potential to profoundly affect both the delivery capacity and the quality of healthcare for years to come. In September 2021, the American Nurses Association (ANA) urged federal officials to declare a national nursing staffing crisis (ANA, 2021).

Much of the existing research about the pandemic’s effects on HCWs has been based on data collected at the level of individual institutions or within cities or regions. In contrast, larger scale or national studies have been inconsistent, reflecting heterogeneity in research methodologies and data sources (N. Goldman et al., 2021). Research is needed to provide a broad comparative overview of nurse experience relative to the experience of other HCWs. The purpose of this analysis of national Healthcare Worker Exposure Response and Outcomes (HERO) Registry data (heroresearch.org) is to describe nurses’ experiences during the first year of the pandemic and compare them with those of other HCWs.

METHODS

The HERO Registry (ClinicalTrials.gov Identifier NCT04342806), funded by the Patient-Centered Outcomes Research Institute (PCORI) and partnered with the national Patient-Centered Clinical Research Network (PCORnet) sites, contains self-report data, which served as the primary source for this descriptive cohort analysis. HCWs voluntarily joined the registry on a rolling basis by signing up for an online database and answering survey questions about virus exposures, testing, job burnout, and physical and emotional distress measures. The HERO Registry defines a HCW as anyone, clinical or nonclinical, working in a facility or organization providing healthcare services. Eligible participants were 18 years or older and able to read English; participation was open to any clinician, first responder, support staff, technician, or administrative staff employed in an organization providing patient care, including hospitals, emergency medical services departments, clinics, and skilled nursing facilities. Enrollees self-reported their titles by selecting from a drop-down menu of role options. Nurse role identifiers included registered nurse, nurse practitioner, licensed practical nurse, nurse anesthetist, and midwife. For this study, anyone registered under the above mentioned categories was considered a “nurse”; any other role was considered a “nonnurse HCW.”

Data for this analysis were collected from HERO enrollee responses registered between April 10, 2020 (registry start date) and May 31, 2021. More than 29,000 participants enrolled during this period, making the registry one of the largest national-level convenience samples of U.S. HCWs self-reporting about the pandemic. The instrumentation embedded in the HERO Registry, including survey items and classification of high-risk versus low-risk settings, was utilized in this ancillary study. Descriptions of the survey items have been reported elsewhere with methodological annotations (Forrest et al., 2021; Friedland et al., 2021). Work settings were classified into two broad categories:

1. intensive care units, emergency departments/urgent care centers, COVID-19 therapeutic or diagnostic units, respiratory services, anesthesia, and emergency medical services—which were designated “high-risk settings”—based on milieu characteristics such as presence of aerosol-generating procedures and critically ill patients and
2. all other areas, including nursing homes, skilled nursing facilities, and dialysis centers, which were designated “low-risk settings.”

Well-being measures included a seven-question Daily Impact Index (self-reports of physical and emotional distress) modified from the Gallup Negative Experience Index used in the Global Well-Being report (Forrest et al., 2021; Gallup, 2019); Patient-Reported Outcomes Measurement Information System (PROMIS) Global Physical Health and Global Mental Health Scales; and Emotional Distress—Depression—Short Form 4a, which scores well-being-related feelings and functional impairment (Pilkonis et al., 2011). Burnout was measured with a single item derived from the Maslach Burnout Inventory and validated psychometrically by Dolan et al. (2015).

Exposure to the SARS-CoV-2 virus was self-reported based on three contact options: direct contact in a healthcare setting, community exposure, or no known exposure. Questions related to infection/testing elicited self-reports based on three testing options (nasal or oral swab for active viral testing, blood/serologic test to detect antibodies, or diagnosis of COVID-19 by a licensed healthcare provider without testing). COVID-19 infection was defined as SARS-CoV-2 viral or antibody test positivity or physician diagnosis of COVID-19. Respondents were prompted to provide the most recent test date, results, or diagnosis. As the pandemic continued, the registry was adjusted to reflect emerging concerns beyond those addressed by the initial survey items. For example, questions regarding access to personal protective equipment (PPE) were added in May 2020, whereas questions regarding viral exposure were removed at the end of April 2021.

Statistical Analyses

The statistical analyses addressed the following specific aims: (a) to describe and compare nurses nationally with nonnurse HCWs on all variables in the HERO Registry using the analytic methods described in the baseline paper (Forrest et al., 2021) and (b) to examine differences in nurse testing and exposure based on race/ethnicity and high versus low-risk settings.

Primary Analysis

Descriptive heat maps were created to depict the number of nurse participants by state of residence based on zip codes. Nurses were compared with nonnurse HCWs in demographic characteristics, type of work setting, response to testing questions, response to infection questions, PPE access and use, well-being, and burnout. Wilcoxon rank-sum tests were used to compare continuous and ordinal variables, and chi-square tests were used to compare categorical variables.
Logistic regression models were then used to examine the associations between nurse and nonnurse roles for two binary end point outcomes of primary concern during the first year of the pandemic: (a) COVID-19 testing (yes/no) and (b) COVID-19 infection (yes/no). The covariates used in adjustments of the multivariate logistic regression models included age, gender, race/ethnicity, type of healthcare facility where employed, work setting, risk for COVID-19 exposure, week of survey completion, medical conditions (hypertension, diabetes, coronary artery disease, chronic obstructive pulmonary disease, asthma, smoking, chronic kidney disease, metastatic cancer, and autoimmune disease), and geographic region of residence. Associations with the two end points of testing and infection were additionally examined by race/ethnicity by adding an interaction term of race/ethnicity and nurse versus nonnurse status in the models. Results were reported as odds ratios (ORs) with 95% confidence intervals (CI). Analyses were performed using SAS software (Version 9.4). All p-values were two-sided and were considered statistically significant at <0.05.

**Secondary Subgroup Analysis** A secondary subgroup analysis was also conducted to shed light on differences in experience among nurses working in high-risk practice settings compared with low-risk practice settings. Comparisons included demographic characteristics, testing, infection, PPE access and use, well-being, and burnout. Wilcoxon rank-sum tests were used to compare continuous and ordinal variables, and chi-square tests were used to compare categorical variables.

Procedures for the original HERO Registry study were previously reviewed by the Duke University School of Medicine Institutional Review Board (IRB) and approved by the Western IRB (Forrest et al., 2021). This project was determined to be nonhuman subjects research by the internal IRB.

**RESULTS**

A total of 29,904 participants enrolled in the HERO Registry between April 10, 2020, and May 31, 2021. Enrollees were excluded from this analysis if data were missing for age, healthcare role, medical condition, or residential zip code. This resulted in a total of 24,343 HCW participants in the study sample. Of this group, 35.4% (n = 8,606) were nurses, and 19.9% (n = 4,841) were physicians, physician assistants, or physician assistants; the remaining 44.8% (n = 10,896) represented a wide array of other titles and roles.

All 50 states and the District of Columbia were represented. Geographically, most nonnurse respondent HCWs were from the South (43.5%) or Northeast (26.5%). Most nurse respondents resided in the South (42.4%) or Midwest (25.7%; see Figure 1).

**Demographics**

The average age of nurse and nonnurse respondents was similar (42.3 vs. 41.4 years). Most nurse respondents self-identified as White (85%) and female (92%). Nonnurses were less likely to identify as White (74%) or female (71%) (Table 1).

**Comparisons Between Nurses and Other HCWs**

**SARS-CoV-2 Exposure, Testing, and COVID-19 Illness**

Overall, 48.3% of respondents reported exposure to SARS-CoV-2. Nurses were more likely than nonnurses to report exposure (54.4% vs. 44.8%, p < .0001) (Table 2). Most exposed HCWs reported that the workplace was a source of exposure (88.5%); community was a much less frequently reported source (21.2%). Among those who reported exposure, more nurses than nonnurses attributed it to a workplace source (92.2% vs. 86.0%, p < .0001).

Of the overall sample of registry enrollees, only 40.9% reported having been tested for SARS-CoV-2 virus, and 16.7% reported having been tested for the presence of antibodies for COVID-19. Nurses were no more likely than nonnurses to report COVID-19 infection (a positive viral or antibody test result or COVID-19 diagnosed by a physician without a test) (6.7% vs. 6.3%, p = .1751) (Table 2).

No significant differences were found in unadjusted models between nurses and nonnurse HCWs for outcomes of viral testing and presence of infection. However, in the adjusted models, nurses showed significantly higher odds of having viral testing (OR = 1.15, 99% CI [1.08, 1.24], p < .0001) and of having COVID-19 infection (OR = 1.18, 99% CI [1.05, 1.32], p = .0049). In addition, in the adjusted models, the likelihood of viral testing was not equal across all racial and ethnic subgroups; there were interaction effects between race/ethnicity and role. Black nurse and nonnurse HCWs experienced greater differences in accessibility of COVID-19 tests than other race/ethnicity groups. No significant interactions were seen in COVID-19 infection (Table 3).

**Access to PPE**

About half of all respondents (n = 12,056) completed questions related to PPE at their workplace. Nurses were more likely than nonnurses (clinical and nonclinical HCWs) to respond to questions about PPE access (54.1% vs. 47.0%, p < .0001). Nurses reported more problems accessing PPE such as respiratory masks, surgical masks, face shields, gloves, gowns, and hand sanitizers than nonnurses (p < .05 for each type of PPE). Nurses were also more likely than nonnurses (58.4% vs. 44.7%, p < .0001) to report that they had to reuse respirators or surgical masks for most or all patients (Table 2).

**Personal Well-Being**

Response rates to personal well-being questionnaires varied between nurses and nonnurses and between nurses in high- and low-risk settings (Table 2). Among respondents, nurses reported significantly more symptoms of physical pain, worry, sadness, stress, trouble sleeping, and feeling tired than other HCWs, with 48.8% of nurses reporting three or more of these symptoms compared to 41.3% of nonnurse HCWs (p < .0001; Table 2). Nurses reported higher
depression scores (mean T score 53.5 vs. 52.1, \( p < .0001 \)), indicating worse depression, and lower scores of global physical and mental health than nonnurses, indicating worse physical and mental health (mean Global Physical Health T score 51.7 vs. 53.1, \( p < .0001 \), and mean Global Mental Health T score 49 vs. 50, \( p < .0001 \)) (Table 2).

| TABLE 1. Healthcare Worker (HCW) Characteristics by Nurse Versus Other Roles and by Risk Settings in Nurse Participants |
|---------------------------------------------------------------|
| Characteristic                                      | Overall | All HCW participants | Nurse participants only |
| | n = 24,343 | n = 8,606 | n = 15,737 | p | n = 2,794 | n = 5,812 | p |
| Demographics                                      |         |                    |            |        |                |             |     |
| Age in years, mean (SD)                           | 41.7 (11.7) | 42.3 (11.3) | 41.4 (11.9) | <.0001 | 39.0 (10.4) | 43.9 (11.4) | <.0001 |
| Age group, years, n (%)                           | <.0001  |         |            |        |                |             |     |
| 18–29                                          | 3,838 (15.8) | 1,174 (13.6) | 2,664 (16.9) | 566 (20.3) | 608 (10.5) |         |        |
| 30–49                                          | 13,996 (57.5) | 5,043 (58.6) | 8,953 (56.9) | 1,727 (61.8) | 3,316 (57.1) |         |        |
| 50–64                                          | 5,829 (23.9) | 2,200 (25.6) | 3,629 (23.1) | 478 (17.1) | 1,722 (29.6) |         |        |
| 65+                                            | 680 (2.8) | 189 (2.2) | 491 (3.1) | 23 (0.8) | 166 (2.9) |         |        |
| Female, n (%)                                    | <.0001  |         |            |        |                |             |     |
| White                                           | 18,969 (77.9) | 7,282 (84.6) | 11,687 (74.3) | 2,324 (83.2) | 4,958 (85.3) |         |        |
| Black/African American                           | 1,090 (4.5) | 255 (3.0) | 835 (5.3) | 75 (2.7) | 180 (3.1) |         |        |
| Hispanic/Latino (any race)                       | 1,889 (7.8) | 480 (5.6) | 1,409 (9.0) | 174 (6.2) | 306 (5.3) |         |        |
| Asian/Pacific Islander                           | 1,497 (6.1) | 338 (3.9) | 1,159 (7.4) | 144 (5.2) | 194 (3.3) |         |        |
| Other/mixed/prefer not to answer                  | 898 (3.7) | 251 (2.9) | 647 (4.1) | 77 (2.8) | 174 (3.0) |         |        |
| Type of healthcare facility, n (%)               | <.0001  |         |            |        |                |             |     |
| Hospital                                        | 15,149 (62.2) | 6,082 (70.7) | 9,067 (57.6) | 2,572 (92.1) | 3,510 (60.4) |         |        |
| Skilled nursing facility                         | 861 (3.5) | 360 (4.2) | 501 (3.2) | 28 (1.0) | 332 (5.7) |         |        |
| Outpatient clinic/facility\(^a\)                 | 2,598 (10.7) | 809 (9.4) | 1,789 (11.4) | 19 (0.7) | 790 (13.6) |         |        |
| Urgent care clinic/ emergency services           | 677 (2.8) | 129 (1.5) | 548 (3.5) | 101 (3.6) | 28 (0.5) |         |        |
| Other\(^b\)                                     | 5,058 (20.8) | 1,226 (14.2) | 3,832 (24.4) | 74 (2.6) | 1,152 (19.8) |         |        |
| High COVID-19 exposure risks                     | 6,001 (24.7) | 2,794 (32.5) | 3,207 (20.4) | <.0001 | — | — | — |

Note. The age difference was assessed with Wilcoxon signed-rank test, and all other variables were analyzed with chi-square test. SD = standard deviation.

\(^a\)Outpatient clinic/facility categories include outpatient physical therapy, speech pathology, ambulatory clinic, and rural health.

\(^b\)Other facilities can include surgical centers, end-stage renal disease facilities, home health agencies, hospice, psychiatric facilities, research centers, or pharmacies.

FIGURE 1. State of residence for 8,606 nurses based on individuals reported five-digit zip codes of residence.
| Variable                                                                 | Overall (N = 24,343) | All HCW participants (n = 8,606) | Nurse participants only (n = 2,794) |
|-------------------------------------------------------------------------|----------------------|----------------------------------|-------------------------------------|
| Exposure to SARS-CoV-2 virus, n (%)                                      |                      |                                  |                                     |
| Any exposure                                                            | 11,109 (48.3)        | 4,563 (54.4)                     | 6,546 (44.8)                        |
| Exposed at workplace                                                    | 9,836 (42.8)         | 4,207 (50.2)                     | 5,629 (38.5)                        |
| Exposed in community                                                    | 2,351 (10.2)         | 790 (9.4)                        | 1,561 (10.7)                        |
| Exposed at workplace among those reported any exposure                  | 9,836 (88.5)         | 4,207 (92.2)                     | 5,629 (86.0)                        |
| SARS-CoV-2 viral test, n (%)                                            |                      |                                  |                                     |
| Ever tested (among overall)                                             | 9,958 (40.9)         | 3,493 (40.6)                     | 6,465 (41.1)                        |
| Tested positive (among ever tested)                                     | 940 (9.4)            | 356 (10.2)                       | 584 (9.0)                           |
| SARS-CoV-2 antibody test, n (%)                                         |                      |                                  |                                     |
| Ever tested (among overall)                                             | 4,055 (16.7)         | 1,523 (17.7)                     | 2,532 (16.1)                        |
| Tested positive (among ever tested)                                     | 1,827 (5.3)          | 702 (4.1)                        | 1,125 (4.3)                         |
| SARS-CoV-2 viral or antibody test positive or physician diagnosis of COVID-19 (COVID-19 infection) |                      |                                  |                                     |
| Problem with access PPE—type of equipment                               |                      |                                  |                                     |
| Filled out PPE questionnaire                                             | 12,056 (49.5)        | 4,659 (54.1)                     | 7,397 (47.0)                        |
| Respiratory mask (e.g., N95, KN95, or other), yes (%)                   | 3,042 (33.2)         | 1,345 (35.1)                     | 1,697 (31.8)                        |
| Surgical mask, yes (%)                                                  | 1,827 (16.1)         | 782 (17.4)                       | 1,045 (15.3)                        |
| Powered air purifying respirator, yes (%)                               | 1,322 (43.5)         | 631 (43.6)                       | 691 (43.4)                          |
| Face shield/goggles, yes (%)                                            | 2,039 (22.2)         | 914 (23.4)                       | 1,125 (21.3)                        |
| Gloves, yes (%)                                                          | 586 (5.3)            | 202 (4.5)                        | 384 (5.8)                           |
| Gowns, yes (%)                                                           | 1,873 (20.1)         | 863 (21.4)                       | 1,010 (19.0)                        |
| Hand sanitizer, yes (%)                                                 | 1,767 (14.9)         | 738 (16.0)                       | 1,029 (14.2)                        |
| Soap, yes (%)                                                            | 422 (3.6)            | 177 (3.9)                        | 245 (3.4)                           |
| Cleaning/disinfecting products, yes (%)                                 | 3,347 (28.9)         | 1,520 (33.4)                     | 1,827 (25.9)                        |
| During the last day you were at work, for how many patients did you have to reuse the same N95/KN95 mask respirator or surgical mask when you would have otherwise used a new mask? |                      |                                  |                                     |
| All patients                                                            | 5,140 (42.7)         | 2,399 (51.6)                     | 2,741 (37.1)                        |
| Most patients                                                           | 875 (7.3)            | 316 (6.8)                        | 559 (7.6)                           |
| Some patients                                                           | 1,158 (9.6)          | 425 (9.1)                        | 733 (9.9)                           |
| Non (1 mask per patient)                                                | 1,353 (11.2)         | 533 (11.5)                       | 820 (11.1)                          |
| Did not have patient contact                                            | 3,507 (29.1)         | 977 (21.0)                       | 2,530 (34.3)                        |
| Missing (%)                                                             | 23 (0.2)             | 9 (0.2)                          | 14 (0.2)                            |
| Had to reuse respirator or surgical masks for most or all patients, n (%) | 6,015 (50.0)         | 2,715 (51.6)                     | 3,300 (44.7)                        |
| Healthcare worker well-being                                           |                      |                                  |                                     |
| Filled out Daily Impact Questionnaire                                   | 12,703 (52.2)        | 4,831 (56.1)                     | 7,872 (50.0)                        |
| (1) Did you have trouble sleeping last night?                           | 5,123 (40.4)         | 2,187 (45.4)                     | 2,936 (37.4)                        |
| (2) Did you feel physical pain a lot of the day yesterday?              | 2,465 (19.4)         | 1,121 (23.3)                     | 1,344 (17.1)                        |
| (3) Did you worry a lot of the day yesterday?                           | 4,748 (37.5)         | 1,952 (40.6)                     | 2,796 (35.6)                        |
| (4) Did you feel sad a lot of the day yesterday?                        | 2,581 (20.4)         | 1,107 (23.0)                     | 1,474 (18.8)                        |
| (5) Did you feel angry a lot of the day yesterday?                      | 1,775 (14.0)         | 736 (15.3)                       | 1,039 (13.2)                        |
| (6) Did you feel stressed a lot of the day yesterday?                   | 6,415 (50.7)         | 2,546 (52.9)                     | 3,869 (49.3)                        |
| (7) Did you feel tired a lot of the day yesterday?                      | 6,787 (53.6)         | 2,820 (58.6)                     | 3,967 (50.5)                        |
| Number of indicators endorsed above positively                          |                      |                                  |                                     |
| Mean (SD)                                                               | 2.4 (2)              | 2.6 (2.1)                        | 2.2 (2)                             |
| 3 or more, n (%)                                                       | 5,502 (44.1)         | 2,311 (48.8)                     | 3,191 (41.3)                        |

(continues)
Fewer than a third of registry enrollees responded to the question about burnout, with nurses slightly more likely to respond (28.7%) than nonnurses (26.7%) \( (p = .0005) \). Among the small group who responded, nurses were more likely to report burnout than nonnurses (46.1% vs. 40.2%, \( p < .0001 \)).

### Table 2. Comparisons Among Healthcare Workers by Nurse Versus Nonnurses and Risk Settings in Nurse Participants for SARS-CoV-2 Exposures and Testing and COVID-19 Infection, Appropriate Access to Personal Protective Equipment (PPE) for Healthcare Workers, and Healthcare Worker Well-Being, Continued

| Variable | Overall | All HCW participants | Nurse participants only |
|----------|---------|----------------------|------------------------|
| | \( N = 24,343 \) | Nurses | Nonnurses | High risk | Low risk |
| | | \( n = 8,606 \) | \( n = 15,737 \) | \( n = 2,794 \) | \( n = 5,812 \) |
| PROMIS measures | | | | | |
| Filled out Global Health Scale Questionnaire | 12,440 (51.1) | 4,750 (55.2) | 7,690 (48.9) | .0001 | 1,677 (60.0) | 3,073 (52.9) | .0001 |
| T score—Global Physical Health, mean (SD) | 52.6 (7.1) | 51.7 (6.7) | 53.1 (7.3) | .0001 | 51.7 (6.5) | 51.8 (6.8) | .7241 |
| T score—Global Mental Health, mean (SD) | 49.6 (8.1) | 49 (7.7) | 50 (8.2) | .0005 | 49.3 (7.6) | 48.9 (7.7) | .0629 |
| Filled out Depression Questionnaire | 6,710 (27.6) | 2,489 (28.9) | 4,221 (26.8) | .0005 | 864 (30.9) | 1,625 (28.0) | .0045 |
| T score—Depression | 52.7 (8.1) | 53.5 (8.1) | 52.1 (8.1) | .0001 | 53.9 (8.2) | 53.3 (7.9) | .074 |
| Filled out Burnout Questionnaire | 6,668 (27.4) | 2,474 (28.7) | 4,194 (26.7) | .0005 | 856 (30.6) | 1,618 (27.8) | .0072 |
| Burnout (levels iii, iv, v) | 2,822 (42.4) | 1,138 (46.1) | 1,684 (40.2) | .0001 | 451 (52.7) | 687 (42.5) | .0001 |
| Note. SD = standard deviation. |

**Subgroup Analysis**

#### Nurse-Specific Comparison Between High- and Low-Risk Settings

Demographic information for nurses working in high- versus low-risk settings is summarized in Table 1. Most nurse respondents (67.5%) reported working in low-risk settings.

### Table 3. Viral Testing and COVID-19 Infection by Nurses Versus Other Healthcare Workers and by Race/Ethnicity Subgroup With Odds Ratio for Nurses Versus Others Among Each Subgroup

| End point | Unadjusted analysis | Adjusted analysis |
|-----------|---------------------|------------------|
| | \( OR \) (99% CI) | \( p \) Interaction | \( OR \) (99% CI) | \( p \) Interaction |
| Viral testing done | | | | |
| Race subgroup | Nurses | Other | Reference | 0.98 (0.93, 1.03) | 0.4540 | 1.15 [1.08, 1.24] | <.0001 |
| White | Nurse | Other | Reference | 0.98 (0.93, 1.04) | 0.5603 | 1.12 [1.04, 1.21] | .0023 |
| Black | Nurse | Other | Reference | 1.13 (0.85, 1.49) | 0.4057 | 1.83 [1.29, 2.58] | .0006 |
| Hispanic (any race) | Nurse | Other | Reference | 0.96 (0.78, 1.19) | 0.7330 | 1.34 [1.05, 1.72] | .0208 |
| Asian | Nurse | Other | Reference | 0.97 (0.75, 1.24) | 0.7943 | 1.07 [0.80, 1.45] | .6389 |
| Other | Nurse | Other | Reference | 1.11 (0.83, 1.49) | 0.4684 | 1.36 [0.95, 1.94] | .0894 |
| COVID-19 infection | Nurses | Other | Reference | 1.08 (0.97, 1.20) | 0.1752 | 1.18 [1.05, 1.32] | .0049 |
| Race subgroup | Nurses | Other | Reference | 1.05 (0.93, 1.19) | 0.4394 | 1.13 [1.00, 1.29] | .0547 |
| White | Nurse | Other | Reference | 1.05 (0.93, 1.19) | 0.4394 | 1.13 [1.00, 1.29] | .0547 |
| Black | Nurse | Other | Reference | 1.42 (0.90, 2.25) | 0.1303 | 1.59 [1.00, 2.54] | .0515 |
| Hispanic (any race) | Nurse | Other | Reference | 1.35 (0.94, 1.93) | 0.1047 | 1.54 [1.06, 2.23] | .0220 |
| Asian | Nurse | Other | Reference | 1.00 (0.61, 1.65) | 0.9996 | 1.05 [0.63, 1.74] | .8641 |
| Other | Nurse | Other | Reference | 1.64 (0.97, 2.75) | 0.0640 | 1.75 [1.03, 2.97] | .0382 |

*Note. Italics indicate significance of \( p < .05 \). OR = odds ratio; CI = confidence interval.*
settings. Those working in high-risk settings tended to be younger than those in low-risk settings (mean age 39.0 vs. 43.9, \( p < .0001 \)). The high-risk setting group was more likely to report any form of viral exposure (70.9% vs. 46.4%, \( p < .0001 \)), more likely to say they reused respirators or masks for most of their patients (68.1% vs. 53.0%, \( p < .0001 \)), and more likely to report burnout (52.7% vs. 42.5%, \( p < .0001 \)). Among those who completed the daily impact questionnaire, the high-risk group reported slightly more daily impact indicators (mean 2.7 vs. 2.5, \( p = .0015 \)). Nurses in low-risk settings, by contrast, were more likely to report presence of infection (regardless of testing methods or physician diagnosis of COVID-19) (Table 2).

**Race/Ethnicity**

Overall, only 15.4% of nurse respondents identified as belonging to a racial or ethnic group other than White. Respondents in this group (Table 4) were likelier than White respondents to report any form of viral exposure. Of all ethnic groups, nurses who identified as Asian were most likely to report exposure (62.7%), followed by those identifying as Hispanic (60.6%), other (59.3%), Black (58.2%), and White (53.3%). Fifty-nine percent of Asian nurses who reported exposure to the virus indicated the workplace was an exposure source, compared with Hispanic (57.1%), other (53.9%), Black (53.4%), and White (49.1%; \( p < .0001 \)). Those identified as Black had the highest test positivity or COVID-19 diagnosis rate among the racial-ethnic groups (11.4% of Black nurse respondents, compared with 6.2% of Whites, 9.8% of Hispanics, 6.2% of Asians, and 10% of those identifying as other, \( p = .0001 \)). Among nurses who received a test for antibodies, 22.7% of those who identified as Hispanic reported a positive antibody test, compared to 15% among Black, 10.8% among White, 9.1% among other, and 8.6% among Asian nurses (\( p = .0253 \)).

**DISCUSSION**

In this analysis of the HERO Registry, a large national convenience sample of HCWs in the United States, we compared the self-reported experiences of nurses with those of nonnurse HCWs during the first 13 months of the pandemic. Similar to a previous study conducted early in the pandemic (Forrest et al., 2021), no differences between nurses and nonnurses were found in viral exposure or infection test positivity. However, in models controlling for participant, work, and geographical characteristics, differences were observed between nurses and nonnurses in outcomes of viral exposure as well as in likelihood of infection. We also found differences in patterns of access to PPE and measures of physical and mental well-being. Among nurse respondents, reports of testing and infection rates differed by race, ethnicity, and type of work setting. No standardized global system exists for reporting HCW infection and testing.

Moreover, research on nursing during the pandemic has been heterogeneous, based on localized data sources, or focused primarily on qualitative reports of mental health symptoms. Consequently, limited comparative data are available within or across nations on the relative effects of the pandemic on different healthcare disciplines. Our study attempted to address this gap using a U.S. national registry.

Over the first year of the pandemic, patterns of exposure and infection risk among HCWs were highly complex and linked to a variety of interacting factors, including worker occupational category (N. Goldman et al., 2021), type of healthcare facility (Akinbami et al., 2021), PPE use and access (Kim et al., 2021), unionization rates at facility of employment (Dean et al., 2020), frequency and quality of direct contact with COVID-19-positive patients (Shah et al., 2020), presence of seropositivity in the household of residence (Piccoli et al., 2021), presence of infected coworkers (Ibiebele et al., 2021), comorbidities such as obesity and diabetes (Stefan et al., 2021), no differences between nurses and nonnurses were found in outcomes of viral exposure as well as in likelihood of infection. However, in models controlling for participant, work, and geographical characteristics, differences were observed between nurses and nonnurses in outcomes of viral exposure as well as in likelihood of infection. We also found differences in patterns of access to PPE and measures of physical and mental well-being. Among nurse respondents, reports of testing and infection rates differed by race, ethnicity, and type of work setting. No standardized global system exists for reporting HCW infection and testing.

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**TABLE 4. COVID-19 Status Data by Race/Ethnicity in Nurse Participants**

| Variable | Overall (n = 8,606) | White (n = 7,282) | Black (n = 255) | Hispanic (n = 480) | Asian (n = 338) | Other (n = 251) | p |
|----------|-------------------|------------------|----------------|------------------|----------------|--------------|---|
| Exposure to SARS-CoV-2 virus, n (%) | | | | | | | |
| Any exposure | 4,563 (54.4) | 3,798 (53.3) | 135 (58.2) | 281 (60.6) | 205 (62.7) | 144 (59.3) | .0001 |
| Exposed at work place | 4,207 (50.2) | 3,494 (49.1) | 124 (53.4) | 265 (57.1) | 193 (59.0) | 131 (53.9) | <.0001 |
| Exposed in community | 790 (9.4) | 674 (9.5) | 19 (8.2) | 42 (9.1) | 25 (7.6) | 30 (12.3) | .3864 |
| Exposed at work place among those reported any exposure | 4,207 (92.2) | 3,494 (92.0) | 124 (91.9) | 265 (94.3) | 193 (94.1) | 131 (91.0) | .5001 |
| SARS-CoV-2 viral test, n (%) | | | | | | | |
| Ever tested (among overall) | 3,493 (40.6) | 2,918 (40.1) | 123 (48.2) | 211 (44.0) | 128 (37.9) | 113 (45.0) | .0151 |
| Tested positive (among ever tested) | 356 (10.2) | 289 (9.9) | 19 (15.4) | 22 (10.4) | 12 (9.4) | 14 (12.4) | .3222 |
| SARS-CoV-2 antibody test, n (%) | | | | | | | |
| Ever tested (among overall) | 1,523 (17.7) | 1,306 (17.9) | 40 (15.7) | 75 (15.6) | 58 (17.2) | 44 (17.5) | .6488 |
| Tested positive (among ever tested) | 173 (11.4) | 141 (10.8) | 6 (15.0) | 17 (22.7) | 5 (8.6) | 4 (9.1) | .0253 |
| SARS-CoV-2 viral or antibody test positive or physician diagnosis of COVID-19 | 577 (6.7) | 455 (6.2) | 29 (11.4) | 47 (9.8) | 21 (6.2) | 25 (10.0) | .0001 |
demic status of HCWs—especially females and nurses (Cabarkapa et al., 2020). Worldwide reports of increased stress and anxiety in HCWs during the pandemic have emerged (Czeisler et al., 2020; Shaukat, 2020). We found that nurses reported significantly more concerns about well-being than other HCWs and a higher frequency of depressive symptoms. Even before the start of the pandemic, high levels of burnout were reported in nursing (Lasater et al., 2020), and nursing organizations had already expressed concern regarding their members’ mental health and wellness. In 2019, ANA launched a Suicide Prevention Committee, which pivoted with the COVID-19 epidemic to focus on nurses’ mental health. In multiple rounds of surveys conducted in 2020, the American Nurse Foundation Study Team found that nurses’ feelings of being exhausted, overwhelmed, anxious, and irritable all intensified, signaling growing needs in an already vulnerable profession. Evidence from the HERO Study adds to these findings and further illustrates a need for intervention in conditions that affect nursing safety and mental health.

Much research on nurses during the pandemic has focused on those who work in acute care or other settings classified as high risk. Comparatively, fewer quantitative studies have been published on nurses’ experiences in nursing homes and skilled nursing facilities, even though alarming reports have emerged of catastrophic outcomes involving patients and staff in these so-called “low-risk” settings (Hughes et al., 2020). Despite overall lower rates of workplace-related exposure, nurses in settings classified by the registry as “low risk” were more likely than nurses in high-risk settings in our sample to report testing positive for infection.

Implications

Castro-Sánchez et al. (2021) have observed that nurse-led research was likely hampered during the pandemic by workforce gaps, limited integration of nursing into research infrastructures, and massive clinical redeployments. Our findings suggest that nurse-led inquiry into nurse-specific exposure risks and psychological burdens is warranted, as is further investigation of safe nursing staffing and care delivery models. It has been widely documented during the pandemic that nurses worked well beyond the usual range of their duties, often with little previous specialized experience in caring for this type of critically ill patient. Shifts like nursing work have left nurses exhausted and in moral distress (Rushton et al., 2021). Our research adds to emerging literature demonstrating the need for healthcare system reforms that directly affect nurses.

J. Goldman and Xyrichis (2020) have suggested that the pandemic has affected a host of interprofessional dynamics in healthcare workplaces, changing how teams interact, how information is shared across disciplines, and how roles and
professional role status are defined and demarcated. Little is known about how nurses in different settings and experience levels may have confronted these challenges and opportunities. Long-range effects on the nature of nursing status and the nursing role have yet to be identified and explored, as do effects on the processes of nursing identity development and team integration.

Limitations
Certain limitations were identified during this study. One limitation was that “HCW” was broadly defined in the HERO Registry and could include nonclinical staff who do not experience the same level of exposure and do not require the same access to PPE as frontline clinicians. Also, participation in the HERO Registry varied across HCW roles and geographic regions as well as across sections of the survey. An overall response rate for different HCW groups could not be calculated (Forrest et al., 2021). Although nurses across the nation were represented in the data set, the total number of nurse participants represented an unknown fraction of the nursing workforce.

Moreover, all data were self-reported and subject to potential recall bias. Changes in viral epidemiology, PPE supply, public awareness, and vaccination access, among other factors, are likely to have affected responses to HERO survey questions over time. Certain conceptualizations have changed since the start of the pandemic, such as the definition of low-risk versus high-risk settings. Additional limitations include a low response rate to well-being questions and a high prevalence of women in the nursing sample; this raises the potential that gender differences biased some responses. Limitations of this type have characterized much pandemic research and highlight the need for greater standardization and precise operational definitions in monitoring and reporting clinical- and systems-level effects.

Conclusion
This analysis of the HERO Registry, a large national convenience sample of HCWs in the United States, compared the self-reported experiences of nurses with those of nonnurse HCWs during the first 13 months of the pandemic. We found differences between nurses and nonnurses in patterns of access to PPE and measures of physical and mental well-being. Adjusted regression models also showed differences in the likelihood of testing positive for COVID-19 infection. Among nurse respondents, there was evidence that testing and infection rates differed based on race, ethnicity, and type of work setting. Nurses who worked in settings defined as high risk were more likely than nurses in low-risk settings to report workplace exposure and burnout. Nurses in low-risk settings were more likely to report positive COVID-19 infection. Nurses identifying as Asian were most likely to report exposure, but nurses identifying as Black or Hispanic were more likely than all other nurses to report COVID-19 infection. Our findings point to areas for further research on racial and ethnic disparities in nurses’ experiences of the pandemic and differences in occupational exposure across different settings. It also highlights the need for targeted policy responses that will equip our profession and the healthcare system to confront the workforce-related challenges of future pandemics ethically.

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