Initial distribution of COVID-19 vaccines to front-line hospital workers and community first responders—A prospective descriptive study

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Abstract
As one of the initial ten sites in Ohio designated to receive and distribute the first COVID-19 vaccines in December 2020, we initiated a self-reported IRB-approved research survey to describe the demographics, side-effects, and missed work time experienced by front-line health care workers in an urban tertiary care center and a rural regional hospital. First responders from both the urban and rural surrounding communities were also included in the initial Tier 1A vaccine distribution. The primary outcome measure was to identify the most frequently experienced side effects from the Pfizer and Moderna vaccines, based on type of vaccine, first or second dose, age, gender, race and occupation. The secondary outcome measure was to document the total number of work shifts missed after receiving the vaccine. Of interest to health care risk managers, the survey identified the most common side effects and resulting missed time from work broken down by type of vaccine and first or second dose. This information will be helpful for those institutions who have not yet vaccinated a majority of their work force, employees who still need their second dose, and for strategic scheduling of employees when booster doses become available later in the year.

KEYWORDS
health care risk management, occupational and environmental health, organizational staffing

INTRODUCTION

This study provides a prospective descriptive analysis of COVID-19 vaccine adverse effects and the demographics of health care providers and first responders meeting the initial Tier 1 guidelines for vaccine distribution. It allowed comparisons between demographics such as age, gender, race, occupation, and type of vaccine received depending upon availability/distribution.

Of interest to health care risk managers, the survey identified the most common side effects and any resulting missed time from work. While the vaccine became available to individuals age 12 years and older in May 2021, the rate of adult vaccinations began to decline in April 2021. The American Rescue Plan signed into law by President Biden provides a paid leave tax credit to offset costs to employers with fewer than 500 employees to provide full pay for any time needed to receive or recover from COVID vaccinations. This could have a huge impact on smaller long-term care facilities, assisted living, and group homes who may not have encouraged employee vaccinations. With indications that the vaccines will also require a booster dose, this information may be key to decreasing lost work time by strategic scheduling of booster immunizations for institutions with a larger work force and multiple departments dependent on essential staff.
Figure 1  Comparison of COVID-19 vaccines currently approved for United States

| COVID-19 Vaccines          | Pfizer-BioNTech | Moderna | Janssen     |
|----------------------------|-----------------|---------|-------------|
| Manufacturer               | messenger RNA   | messenger RNA | Viral vector |
| Mechanism                  | 30 mcg/0.3 mL   | 100 mcg/0.5 mL | 5x10^{10} viral particles/0.5 mL |
| Dose                       | 2 doses, 21 days apart | 2 doses, 28 days apart | 1 dose |
| Storage Temperature        | -80° to -60°C   | -25° to -15°C | 2° to 8°C   |

Figure 2  Point of dispensing model. Permission to use this figure from the POD Squad Manual was obtained from Daniel Baker and the Toledo Lucas County Health Department POD Squad Manual.

Initial planning

Prior to Emergency Use Authorization (EUA) of any of the vaccines, the Ohio Department of Health informed our hospital administration that we were one of 10 Ohio sites selected as an initial vaccine distribution center based upon geographic location and having an existing on-site, ultra-cold freezer for storage of the Pfizer vaccine. Hospitals did not have the ability to choose the vaccines received. Distribution was coordinated by the United States Military and the pharmaceutical companies, with each potential vaccine having different requirements for shipping and storage. Each state was responsible for developing their own distribution plan.

A multidisciplinary steering committee, led by our Director of Pharmacy Services and our Administrative Director/Nursing Administration, was formed to facilitate communication and best practice sharing. We began planning for COVID-19 vaccine distribution on October 26, 2020. Each of the vaccines would have different mechanisms of action, storage/thawing/administrative techniques, dosing schedules, documentation forms and time frames specific to thawing and expiration for use. This complicated the task of rapid and equitable distribution without having any wasted doses (Figure 1). Many of the principles used for planning the actual logistics of getting vaccine doses into arms came from the existing Hospital Incident Command System and annual influenza systems of care.

The Centers for Disease Control and Prevention (CDC) utilizes a Points of Dispensing Model (POD) which are “community locations in which state and local agencies dispense medical countermeasures, such as vaccines, to the public during a public health emergency.”

We implemented the POD model using the “POD Squad” Manual developed by the Toledo-Lucas County Health Department (Figure 2). The POD approach utilizes five main stations: registration, screening, treatment, support services, and exit. Each station had its own set of logistics, protocols and paperwork which are beyond the scope of this paper. The primary function of each station included:

Registration

The registration process involved verifying the appointment and obtaining required health and contact information.

Screening

During screening, the subject’s eligibility for vaccine was verified, contraindications including allergy history were identified, and signed consent for vaccine administration was obtained.

Treatment

Pharmacists provided verbal and written information to the subject on vaccine EUA status, anticipated side effects, risk of anaphylactic reactions and information on V-Safe (a smart phone...
Support services

After receiving the vaccine, subjects went to an observation area for 15–30 min. While waiting, they were scheduled for second dose if applicable, and received written and verbal information for this study. A full resuscitation cart was in the area with standing orders for immediate administration of oral diphenhydramine and/or injectable epinephrine if the subject experienced suspected anaphylactic reaction.

Exit

Subjects were provided with an updated vaccination card, verified no adverse reactions and were discharged from area.

Initial vaccine distribution

The first vaccine approved by the Food and Drug Administration (FDA) for EUA on December 11, 2020, was from the Pfizer pharmaceutical company. State distribution began shipping out immediately after the announcement. At Mercy Health St. Vincent Medical Center, front-line workers began receiving their first vaccine doses on December 15, 2020. Moderna received EUA on December 18, 2020, with the first Moderna vaccines distributed at both Mercy Health St. Vincent and Mercy Health St. Rita’s beginning December 22, 2020. Not included in this study, but later approved for EUA, was the Johnson & Johnson/Janssen COVID-19 vaccine on February 27, 2021.

At the onset of vaccine distribution, what was known about the potential side effects of the vaccines as reported by Pfizer and Moderna was

- Pain at injection site that was more severe and long lasting than a typical flu shot
- Majority of individuals had no symptoms, but 10%–15% reported symptoms that made them feel ill for 1–3 days. Most commonly this included fatigue, headaches, muscle pain, body aches, and fever. This seemed to occur more frequently with the second dose.
- The potential for individuals to experience missed work shifts due to side effects. This could result in significant disruption of care if all employees in a department were vaccinated at the same time and call off on the same day. It was recommended to managers that a “rolling” approach be used within departments, so all employees were not vaccinated on the same day. Managers suggested staff try to get scheduled for the vaccine when they had the next day off if possible.

Due to the emergent need for vaccines during a global pandemic, normal FDA testing for vaccines that normally takes years of development was accomplished within 8 months. Like other drugs that are approved after Phase 3 testing, “real life” side effects for individuals with existing co-morbidities of different ages, genders, races and ethnicity are largely unknown until distributed to larger population groups. This study started on the first day of vaccine distribution in the United States with the purpose of contributing to that body of knowledge.

The CDC also developed a COVID-vaccine specific smartphone tool “V-Safe” for individuals to voluntarily notify the CDC of any side effects, as well as receiving updates and information about COVID. The V-Safe application intends to follow subjects at 3, 6, and 12 months after their final vaccine dose. V-Safe is unrelated to our study and we were unaware of it until the first day of the vaccine distribution.

Purpose of the study

The purpose of this study was to contribute to the existing knowledge gap for non-clinical trial, real world individual experiences with the first global use of these vaccines. This study also tracked lost work time as a direct result of receiving the COVID-19 vaccine and a sliding scale of self-perceived ability to function for normal daily activities after receiving the vaccine.

Measurable objectives

1. Describe demographics, COVID-19 vaccination side effects, and any lost work time of Tier 1A hospital employees and community first responders, who received the Pfizer or Moderna COVID-19 vaccines from a study site between December 15, 2020, and February 19, 2021, and were reported prior to March 1, 2021.
2. Compare variables, including but not limited to, age, gender, race, occupation, post vaccine symptoms, and missed work time based on type of vaccine received.
3. Compare any similarities or differences with adverse events between first and second doses of vaccines for each vaccine type.
4. Establish self-perceived rating for how COVID-19 vaccine side effects affected normal daily functional ability using a Likert Scale.

METHODS

Institutional Review Board expedited approval with waiver of written consent was received on December 11, 2020 (#2020-69). This was a prospective, exploratory, observational study. Included were Tier 1A hospital employees, hospital volunteers, and community first responders who received at least one dose of the COVID-19 vaccine (Moderna or Pfizer) from a study hospital (8 facilities in the northwest Ohio area covered by the
after receiving the vaccine. COVID-19 vaccines and total number of days missed from work due to adverse events experienced by subjects receiving any of the included in the overall study results.

B. Subjects were instructed to complete the survey one week following their first vaccine dose and again one week following their second dose. Surveys needed to be received via the online website by March 1, 2021 to be included in the study results.

Due to staffing issues, only two of the 8 facilities, Mercy Health St. Vincent’s and Mercy Health St. Rita’s were able to reliably supply co-investigators to staff a research table for all distribution dates. However, all surveys that were returned were included in the overall study results.

The primary outcome measures were the most common adverse events experienced by subjects receiving any of the COVID-19 vaccines and total number of days missed from work after receiving the vaccine.

STATISTICAL METHODS

A power analysis for justification of subject number was not done as this was a self-selected convenience sample for descriptive analysis only.

Subject characteristics, missed work time, and side effect data are presented as frequency counts and percentages by vaccine dose (first, second) and by vaccine type within dose (Moderna, Pfizer).

There were some discrepant responses with regard to the missed work questions and several write-in comments indicated that subjects missed partial shifts or purposefully scheduled their vaccine around days off; however, information about purposeful scheduling was not a survey question. Data were analyzed according to the original intended design for the 3 work-related questions. That is, the analyses assume the respondent correctly answered the question, “Within 7 days of receiving the vaccine did you miss any work time as a result of vaccine side effects?” Subjects who selected ‘Yes’ were included in the analysis of the question, “How many shifts of work did your miss”. Subjects who selected ‘No’ were included in the analysis of the question, “Did you consider calling in based on symptoms but came to work anyways?” These discrepancies may have resulted in an under-reporting of missed work time.

RESULTS

Total returned surveys

Surveys were completed by 1656 subjects. Of these, 1391 completed a survey after their first vaccine dose and 850 after their second dose for a total n of 2241. Both the first and second dose surveys were completed by 585 subjects; 860 completed only the first survey; 265 completed only the second survey. The majority of surveys were completed at Mercy Health St. Vincent’s or Mercy Health St. Rita’s. A response rate of 20.3% was calculated based only on the combined total of surveys returned from these two hospitals (2105) and combined total number of vaccine doses given (10,329).

Demographics

Overall, subjects had a mean age of 49.3 years, 72.5% were female (1201), 92.4% were White (1522). Characteristics of subjects were similar between those who completed the first survey and those who completed the second. Moderna COVID-19 vaccination was administered to 81.9% of subjects (1356) and 18.1% (300) received Pfizer’s vaccine (Table 1).

Missed work shifts

After the first dose of vaccine, 9.6% (134 of 1391) of the subjects missed work or considered calling off for a work shift (Table 2). After the second dose, 39.1% (332 of 850) of the subjects missed work or considered calling off. Of the subjects who did miss work, the majority reported missing 1 work shift.

Adverse side effects and most common symptoms

Subjects were asked to give a rating of the worst they felt in the week after the vaccine. Overall, among the 1391 subjects with dose 1, 5.5% (n = 77) had major or worst symptoms; and overall 29.8% (253 of 850) had major or worse symptoms with dose 2 (Table 3). The most common side effects after the second dose were: pain at the injection site (92.1% >2 hours, 78.9% >24 hours), fatigue (66.4%), body or muscle aches (64.6%), headache (60.8%), chills (58.5%), joint or bone pain (53.9%), fever 100°F or higher (29.9%), swelling at the injection site (26.5%), redness or rash at the injection site (17.3%), and drowsiness (16.5%). Side effect rates were substantially higher at the second dose than the first dose. Notably, the rate of chills increased by 43.0% (from 15.5% after the first dose to 58.5% after the second), body aches increased by 42.1%, fatigue 40.5% and headache by 31.8% (Figure 3).
A key concern addressed in this study was worry about potential side effects that would be serious enough to require an employee to call in sick, resulting in lost pay and/or being forced to use vacation days to cover a call-off day. The CDC developed a Workplace Vaccination Program with recommended best practices that included non-punitive paid sick leave options for employees with signs and symptoms after vaccination. Employers were urged to not schedule entire departments for the vaccine on the same day to avoid mass call-offs on the same day, and to schedule employee vaccines at the end of their shifts prior to a scheduled day off. Almost 40% of subjects missed work or considered calling in sick after the second vaccine dose compared to approximately 10% with the first dose. Of the subjects who did miss work, the majority reported missing 1 shift. We also asked subjects to rate how severe the symptoms were overall using a Likert scale of 1–4 with 4 being the worst possible symptoms that prevented them from engaging in normal daily activity as a second measure of ability to work. Almost 30% reported having worst possible symptoms after the second dose compared to only 5.6% for the first dose (Table 3).

This study included several open-ended questions which have not been qualitatively analyzed yet, but numerous comments anecdotally stated many individuals received the vaccine the day before a scheduled day off or traded days to avoid calling off work. Subjects stated if they had been scheduled to work, they would not have been able to work due to side effects and would have missed work for one or more shifts. Others stated they wanted to call off but felt guilty about leaving peers short-staffed and came into work despite feeling ill. This leaves open the possibility that missed work status after vaccine immunization is underreported in this study. The data supports the recommendation that a rolling approach continues to be used within departments, so all employees are not vaccinated on the same day to avoid disruption of workflow due to multiple call-offs.

The most common side effects (Figure 3) were similar to the side effects identified in the clinical trials. Pain at the injections site that was more severe and long lasting than a typical flu shot was the most commonly reported symptom, with pain lasting over 24 hours. The majority of individuals had no symptoms, in either study, but similar to the clinical trials about 10%–15% reported symptoms that made them feel ill for 1–3 days. Most commonly this included fatigue, muscle pain, body aches, headache, chills, joint or bone pain, and fever. Similar to the clinical trials, severity of all symptoms increased with the second dose.

Another concern for vaccine administration was the potential for both Pfizer and Moderna vaccines to trigger anaphylactic reactions. Multiple subjects reported a history of reactions and several brought their own Epi-pens with them. Forty-three individuals reported systemic reactions with the first dose (hives, itching, swelling to lips, tongue, face or throat, or difficulty swallowing or breathing) and 57 reported systemic reactions with the second dose. This study did not track the number of individuals who reacted on first dose and returned for a second dose, so we are unable to report if any of the second doses were a unique or repeat reaction.

**DISCUSSION**

The majority of subjects received the Moderna COVID-19 vaccination (81.9%) compared to Pfizer (18.1%). This was strictly due to the number of allocated doses and the type of vaccine available for distribution each week.

### Table 1 Characteristics of respondents—n (%)

|                  | Dose 1 N = 1391 | Dose 2 N = 850 |
|------------------|-----------------|----------------|
| **Age**—mean years (SD) | 49.1 (14.4) | 50.5 (14.4) |
| **Age group**< = 55 years | 869 (62.5) | 493 (58.0) |
| > 55 years | 522 (37.5) | 357 (42.0) |
| **Gender** Female | 1021 (73.4) | 642 (75.5) |
| Male | 369 (26.5) | 208 (24.5) |
| identify as other | 1 (0.1) | 0 (0) |
| **Race** Asian, India, Asian American | 36 (2.6) | 22 (2.6) |
| Black or African American | 31 (2.2) | 18 (2.1) |
| Hispanic or Latino | 11 (0.8) | 9 (1.1) |
| Middle Eastern or North African | 13 (0.9) | 4 (0.5) |
| Other | 11 (0.8) | 7 (0.8) |
| White or Caucasian | 1282 (92.6) | 784 (92.9) |
| no response | 7 | 6 |
| **Occupation—Community** EMT, firefighter | 64 (4.6) | 25 (2.9) |
| Paramedic | 25 (1.8) | 13 (1.5) |
| Police, sheriff | 3 (0.2) | 1 (0.1) |
| Community—other | 85 (6.1) | 41 (4.8) |
| **Occupation—Mercy** Advance practice nurse or physician assistant, other mid-level provider | 63 (4.5) | 47 (5.5) |
| Environmental, housekeeping | 9 (0.7) | 7 (0.8) |
| Lab technician | 38 (2.7) | 24 (2.8) |
| Nurse—RN, LPN | 288 (20.7) | 161 (18.9) |
| Nurse extern, medical assistant | 44 (3.2) | 17 (2.0) |
| Other | 563 (40.5) | 370 (43.5) |
| Physician, resident, fellow | 136 (9.8) | 97 (11.4) |
| Radiology, other imaging technician | 46 (3.3) | 29 (3.4) |
| Respiratory therapy | 21 (1.5) | 12 (1.4) |
| Security | 1 (0.7) | 0 (0) |
| Transportation | 5 (0.4) | 6 (0.7) |
| **History of allergic reaction** | | |
| Moderna | 1134 (81.5) | 697 (82.0) |
| Pfizer | 257 (18.5) | 153 (18.0) |
### Table 2  Missed work time, by vaccine type and dose—n (%)

|                  | Dose 1 |                  | Dose 2 |                  |
|------------------|--------|------------------|--------|------------------|
|                  | Moderna | Pfizer | Moderna | Pfizer |
|                  | N = 1134 | N = 257 | N = 697 | N = 153 |

Within 7 days of receiving the vaccine, did you miss any work time as a result of vaccine side effects?

|                  | Yes   | No     | Yes   | No     |
|------------------|-------|--------|-------|--------|
| Moderna          | 40 (3.5) | 1094 (96.5) | 168 (24.1) | 529 (75.9) |
| Pfizer           | 2 (0.8) | 255 (99.2) | 14 (9.2) | 139 (90.9) |

If yes, how many shifts of work did you miss?

|                  | 0 | 1 | 2 | More than 2 shifts | No response |
|------------------|---|---|---|-------------------|-------------|
| Moderna          | 0 (0) | 28 (71.8) | 8 (20.5) | 3 (7.7) | 1 (7.1) |
| Pfizer           | 1 (50) | 1 (50) | 0 (0) | 0 (0) | 1 (7.1) |

If no, did you consider calling in based on symptoms but came to work anyways?

|                  | Yes  | No  | No response |
|------------------|------|-----|-------------|
| Moderna          | 81 (7.6) | 985 (92.4) | 28 |
| Pfizer           | 11 (4.6) | 231 (95.5) | 13 |

**Overall, total number of subjects who missed work or considered calling in**

|                  | 121 (10.7) | 300 (43.0) |

*aShift length of time was not defined in the study. For hospital employees it may have consisted of 4, 8, 10, or 12 h. For community first responders such as firefighters and paramedics it may have been up to 24 h.*

Pharmacists completed Vaccine Adverse Event Reporting System (VAERS) reports for all reactions that occurred at the Supportive Services station. Two individuals required treatment with epinephrine and diphenhydramine and were transferred to the Emergency Department. A third individual’s symptoms resolved without treatment.16

The data from this study suggests side effects were more severe on a second dose, and effects from a third booster dose are unknown at this time. Based on our study results, managers could anticipate 40% or more employees might miss work if a third dose of the vaccines have similar rates of side effects. Other unknowns include how long immunity will last, if those who are immunized can still spread the virus, and what effect variants will have on immunity.22 Of concern are the long-term consequences of vaccine distrust and failure to obtain initial doses, second doses and booster shots on herd immunity and future surges.17–22 The current Delta variant may be 40%–60% more transmissible, making it the most contagious form of the virus to date. Data suggests individuals who have not received both doses of the COVID vaccines have significantly less efficacy against hospitalization and death from the Delta variant than those who are fully immunized.23

**Limitations**

The V-Safe application from the CDC was a primary limitation to our study. Many individuals were suspicious of the CDC smartphone program, expressed privacy concerns due to needing to register a private device, and thought our study was another attempt to get them to sign up for the CDC program. It was essential that potential subjects were told our study was not related to the CDC program. Once reassured our study was specific to the institution and limited to a single optional survey after each of the two doses, they were more receptive to receiving the information for our study.

A second limitation was related to discrepancies that may have resulted in an under-reporting of missed work time. As more staff became vaccinated, peers began hearing from those who experienced symptoms and purposefully scheduled vaccines when they would be off the next day. We did not include questions about deliberate scheduling of vaccinations prior to a day off to avoid any missed work time, and we have not yet completed a qualitative analysis of the comments specific to missed work shifts. We also did not define what constituted a work shift—4, 8, 12, or 24 h which are common for community first responders such as firefighters and paramedics.

A third limitation was the amount of time between receiving the vaccine and allowing enough time for any symptoms to appear. We recommended waiting approximately 7 days to complete the survey and provided study cover letters to all potential subjects at both the first and second dose distributions. The surveys were individually coded each day for the date and type of vaccine received, and a recommended 7-day return survey date. During the second dose distribution, many individuals stated...
Table 3  Local and systemic side effects by vaccine type and dose—n (%)  

| Rating of worst you felt in the week after the vaccine | Dose 1 | | Dose 2 | |
|---|---|---|---|---|
| 0—no symptoms, no change in daily activity level | 325 (28.7) | 96 (37.4) | 47 (6.7) | 34 (22.2) |
| 1—minor symptoms, able to complete routine tasks without difficulty | 534 (47.1) | 131 (51.0) | 192 (27.6) | 49 (32.0) |
| 2—moderate symptoms, constantly aware of discomfort/symptom | 201 (17.7) | 27 (10.5) | 235 (33.7) | 40 (26.1) |
| 3—major symptoms, difficulty completing routine tasks | 49 (4.3) | 2 (0.8) | 143 (20.5) | 18 (11.8) |
| 4—worst possible symptoms, unable to engage in daily activities, may be sleeping more than normal | 25 (2.2) | 1 (0.4) | 80 (11.5) | 12 (7.8) |

Localized side effects

| Localized side effects | Dose 1 | | Dose 2 | |
|---|---|---|---|---|
| Arm pain at injection site lasting longer than 2 hours | 985 (86.7) | 204 (79.4) | 656 (94.1) | 127 (83.0) |
| Arm pain at injection site lasting longer than 24 hours | 842 (74.3) | 140 (54.5) | 580 (867) | 91 (59.5) |
| Arm swelling at injection site or surrounding area | 237 (20.9) | 21 (8.2) | 213 (30.6) | 12 (7.8) |
| Arm redness or rash (not hives) at injection site or surrounding area | 124 (10.9) | 9 (3.5) | 138 (19.8) | 9 (5.9) |

Systemic side effects

| Systemic side effects | Dose 1 | | Dose 2 | |
|---|---|---|---|---|
| Hives or itching anywhere on your body | 31 (2.7) | 6 (2.3) | 47 (6.7) | 3 (2.0) |
| Swelling to your lips, tongue, face or throat | 4 (0.4) | 0 (0) | 3 (0.4) | 3 (2.0) |
| Difficulty swallowing or breathing related to swelling of lips, tongue, face or throat | 2 (0.2) | 0 (0) | 0 (0) | 1 (0.7) |
| Chills | 198 (17.5) | 17 (6.6) | 431 (61.8) | 66 (43.1) |
| Confusion | 12 (1.1) | 1 (0.4) | 52 (7.5) | 1 (0.7) |
| Cough | 43 (3.8) | 6 (2.3) | 54 (7.8) | 10 (6.5) |
| Diarrhea | 75 (6.6) | 17 (6.6) | 64 (9.2) | 18 (11.8) |
| Difficulty breathing, shortness of breath not related to an allergic reaction | 16 (1.4) | 2 (0.8) | 19 (2.7) | 4 (2.6) |
| Blueish face or lips | 0 (0) | 0 (0) | 1 (0.1) | 0 (0) |
| Fatigue | 312 (27.5) | 48 (18.7) | 490 (70.3) | 74 (48.4) |
| Fever 100F or higher | 80 (7.1) | 4 (1.6) | 227 (32.6) | 27 (17.7) |
| Headache | 340 (30.0) | 63 (24.5) | 438 (62.8) | 79 (51.6) |
| Body or muscle aches (different than usual) | 284 (25.0) | 29 (11.3) | 470 (67.4) | 79 (51.6) |
| Joint or bone pain | 150 (13.2) | 16 (6.2) | 263 (37.7) | 42 (27.5) |
| New loss of taste | 4 (0.4) | 0 (0) | 5 (0.7) | 0 (0) |
| New loss of smell | 4 (0.4) | 0 (0) | 3 (0.4) | 0 (0) |
| Pain or pressure in chest that won’t go away | 14 (1.2) | 1 (0.4) | 17 (2.4) | 6 (3.9) |
| Pink eye | 1 (0.1) | 0 (0) | 6 (0.9) | 0 (0) |
| Slurred speech | 0 (0) | 0 (0) | 1 (0.1) | 0 (0) |
| Sore throat | 38 (3.4) | 9 (3.5) | 33 (4.7) | 5 (3.3) |
| Trouble waking up, very drowsy | 73 (6.4) | 7 (2.7) | 121 (17.4) | 19 (12.4) |
| Vomiting | 9 (0.8) | 4 (1.6) | 25 (3.6) | 5 (3.3) |

Finally, this study utilized a convenience sample of vaccine subjects who voluntarily agreed to complete the survey. There is a potential that subjects with a side effect were more likely to answer the survey than those who had no problems; however, the extent of selection bias is unknown.
CONCLUSION

This study provides a real-world analysis of initial COVID-19 vaccine distribution to front-line hospital workers and community first responders. With a goal of 70% of the United States to be vaccinated by July 4, 2021, at this time more than 64.6% of the total United States population has received at least one dose of a vaccine, with children and younger adults representing the largest unprotected population groups.24 Historically, December 15, 2020, was the first date of vaccine administration for this study and for many other health care providers and first responders. It represented a concept this study was not designed to measure—a sense of relief and hope for the future and an eventual return to everything normal we had previously taken for granted (supplemental video courtesy of Kelly Parker DO available at https://vimeo.com/497984435).

As the push to vaccinate employees continues, this study provides data for managers to strategically plan for continued first and second vaccine dose distribution plans, as well as considerations for possible booster doses in the future. Due to the number of individuals who have not returned for their second scheduled vaccine dose, there is the possibility employers will need to plan for additional second doses, or may need to repeat the series if immunity from the first dose only has become ineffective. For fully vaccinated individuals who may eventually need a booster dose, any possible adverse events for a third dose are unknown at this time. Health care risk managers should proactively plan for the potential of up to 40% of employees needing to miss at least one work shift for second or third doses of the vaccine. For non-immunized staff, there is the possibility of preparing for emergent mandatory vaccinations for health care employees following a recent district court decision to dismiss a lawsuit against employer mandated vaccination in Houston Texas. The judge stated the hospital’s decision to mandate inoculations for its employees was consistent with public policy.25 In the event of another COVID surge with the Delta variant, other employers may begin to mandate vaccines for employees.

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SUPPORTING INFORMATION
Additional supporting information may be found online in the Supporting Information section at the end of the article.

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