COVID-19 Vaccination Effects on Viral Load and Symptomology

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BACKGROUND

- The COVID-19 pandemic has lasted over 2 years with just over 65% of the population having been fully vaccinated.
- Breakthrough infections for COVID-19 post-vaccination are common.
- COVID-19 vaccination is associated with less severe disease, death, and lower hospitalization rates.
- Data conflict on whether vaccination decreases severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) viral load.

OBJECTIVES

- DetermineSARS-CoV-2 viral load differences between vaccinated and unvaccinated individuals at baseline.
- Determine the association between the severity of symptoms and viral load at baseline.

SAMPLE

- COVID-OUT trial is a phase 3, double-blind, factorial design, placebo-controlled trial
- Participants were eligible if:
  - aged 30-85 adults with BMI of >= 25kg/m^2
  - within 3 days of a positive COVID-19 test;
  - symptoms not required but must be <7 days if present.
- Sites: University of Minnesota, University of Colorado, Northwestern University, UCLA/LA county
- Study population was the first 433 sequentially enrolled participants prior to 9/12/21
- 272 of these had both a known vaccination status and had provided their optional nasal swabs
- Median age was 46 years
- Median BMI was 31.2 kg/m^2
- 159 (58%) were women, 217 (80%) were white

FUNDING

METHODS

- Participants opted in to self-collect anterior mid-turbinate nasal samples with a nasal swab and standardized instructions. These were then shipped to the study site.
- Symptom severity was rated on a self-reported form that participants filled out. It was then dichotomized to moderate/severe vs absent/mild. Presence of any reduction in smell or taste was considered loss of smell/taste and pres. Vomiting was positive if they had one instance in the last 24 hours and diarrhea was considered present if they had at least three bouts in the last 24 hours.
- Log10 PCR viral loads were normalized to human RNase P by time from vaccination, vaccine status and symptoms.
- Participants were divided into viral load tertiles to analyze differences in proportion of participants reporting moderate or severe symptoms at baseline.
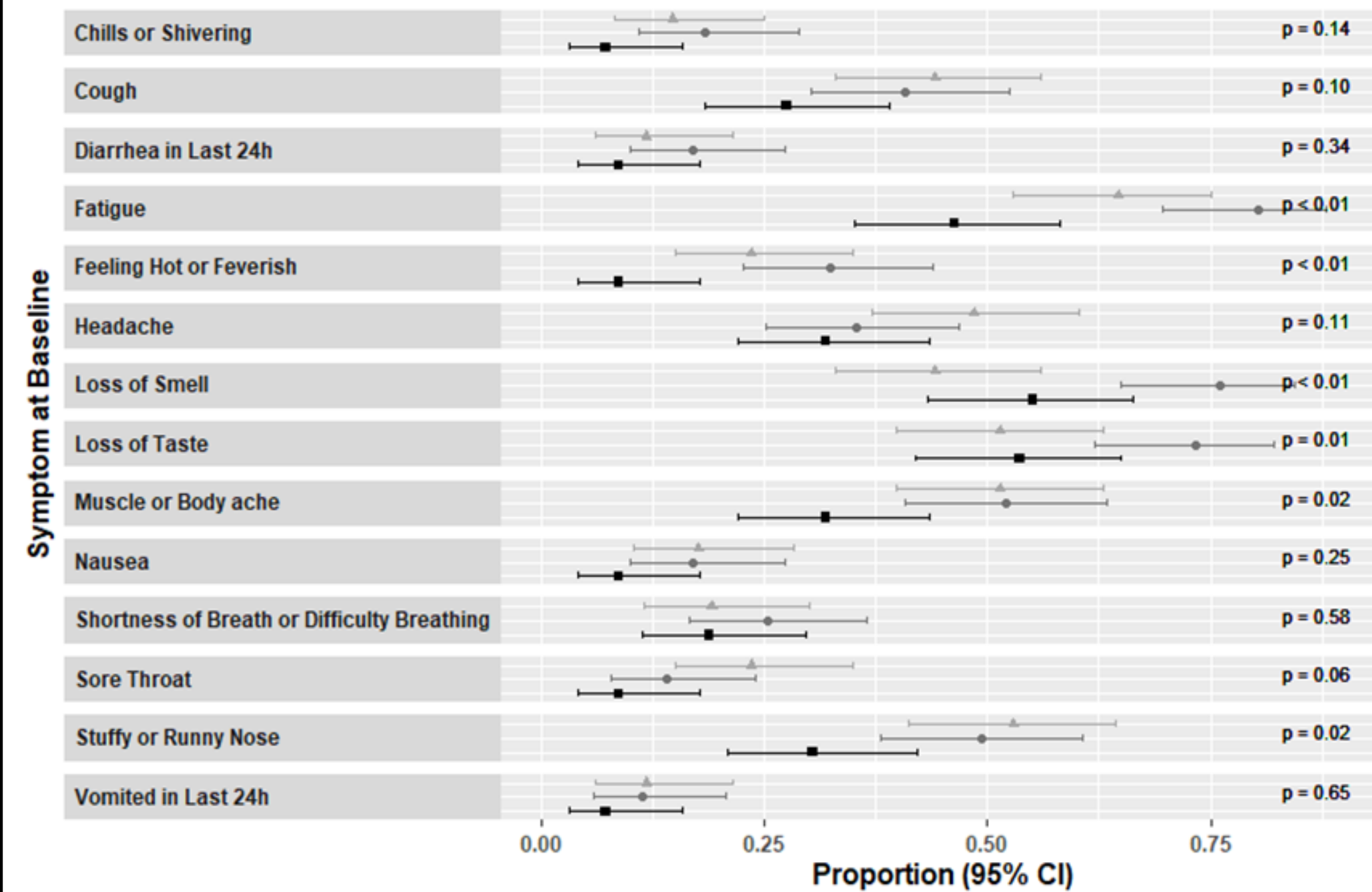
RESULTS

Figure 1. (left) Proportion of participants with moderate or severe COVID-19 symptoms at baseline and associated 95% Wilson-score CIs for participants based on viral load tertile.
Figure 2. (right) SARS-CoV-2 log10 viral load values by COVID-19 vaccination status and duration of antecedent vaccination. The beige dots reflect each observation in the study sample whereas error bars reflect average log10 viral load values and associated 95% confidence intervals. Random jittering was applied along the horizontal axis for visual clarity.
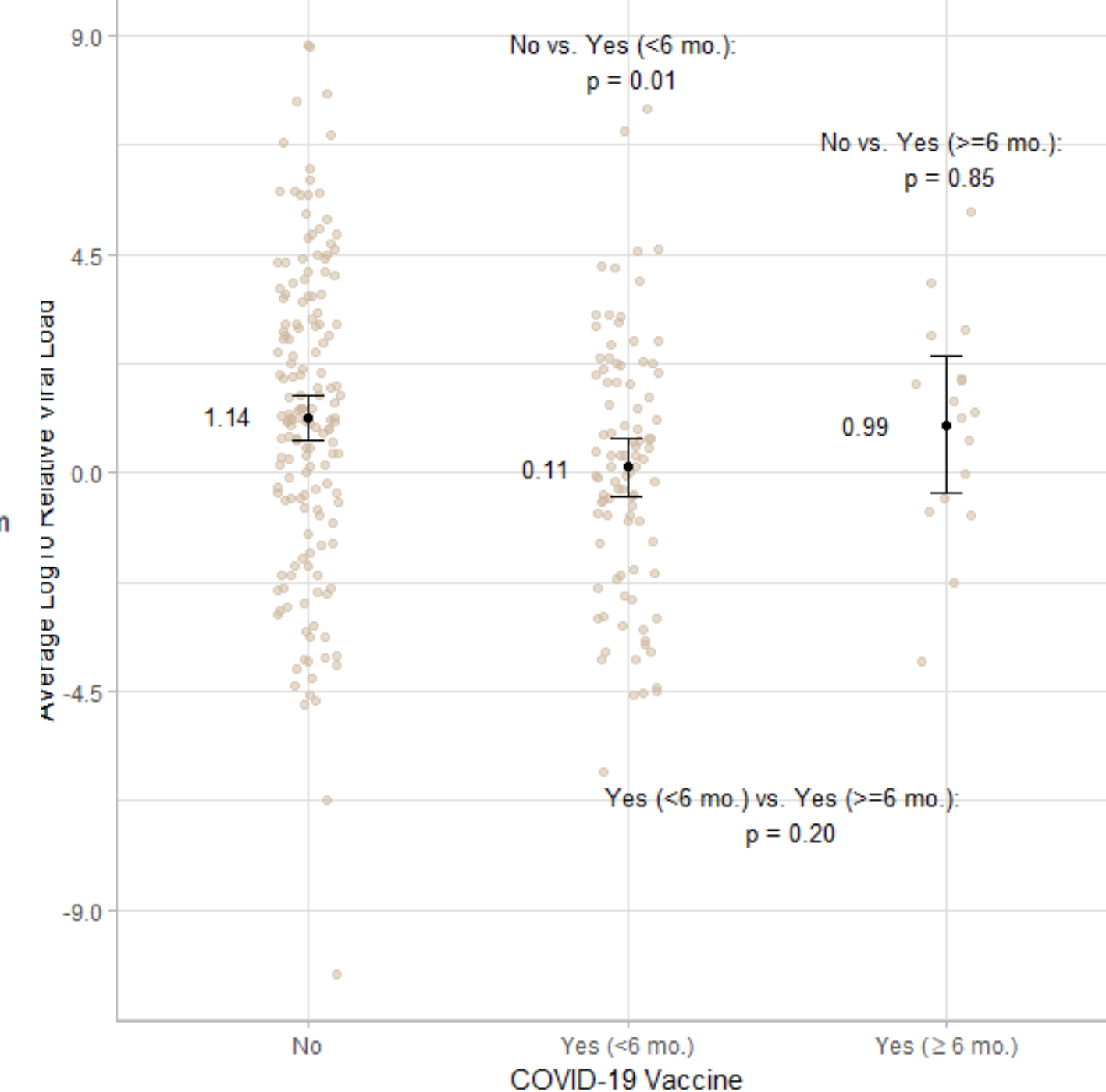
- The mean relative log10 viral load for those vaccinated <6 months from infection was 0.11 (95% CI, -0.48, 0.71), significantly lower than the unvaccinated (n=160, p=0.01).
- Those vaccinated >= 6 months did not differ from the unvaccinated in viral load (mean 0.99, 95% CI, -0.41 to 2.40; p=0.85).

- The proportion of participants significantly varied by viral load tertiles for subjective fever, loss of smell, loss of taste, fatigue, myalgia, and stuffy/runny nose (all p<=0.02).
- The middle tertile contained the largest proportion of participants for each of these symptoms besides stuffy/runny nose.
- There was no significant difference between viral load tertile groups at baseline for chills, cough, diarrhea, headache, nausea, dyspnea, sore throat, and vomiting.

CONCLUSIONS

- These data suggest vaccination within 6 months of infection is associated with a lower viral load.
- Viral loads returned to pre-vaccination levels after 6 months.
- Increased viral load was associated with worse fever, loss of smell/taste, fatigue, myalgia, and stuffy/runny nose.
- Many symptoms (including respiratory symptoms) are unaffected by viral loads.

LIMITATIONS

- Individuals experiencing increased severity and frequency of symptoms may be more likely to enroll in this trial, leading to selection bias with those who were vaccinated likely having a suboptimal response.
- Participants who were enrolled at the time of this study who were vaccinated >6 months had received their vaccines prior to them becoming widely available. This could indicate that this population has a disproportionately larger amount of comorbidities and exposure risk to contract COVID compared to the non-vaccinated.
- Nasal swabs were collected by the participants in their own homes and were transported to the research facility. While efforts to standardize this process were made, it could have introduced additional error.

FUTURE DIRECTIONS

- Now that roughly 2/3 of the population in the United States are vaccinated fully, it will be important to continue to examine these relationships on a broader scale.
- It will be important to explore full vaccination (with and without boosters) as it relates to viral load and symptomology.

FUNDING