



# Asymptomatic SARS-CoV-2, Polymerase Chain Reaction Positive Preoperative Patients: Female Predominance

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## Abstract

**Background:** Throughout the SARS-CoV-2 (COVID-19) pandemic, multiple screening and testing tools are important to prevent disease spread and provide safety for surgical patients. These screening tests fail to identify asymptomatic carriers. To date, we are unaware of a particular infected population that is more prone to screening test failure.

**Questions/Purposes:** COVID-19 screening questionnaires and temperature checks are being utilized daily. The purpose of this study was to determine whether gender affects screening test reliability when confirmed with immediate COVID-19 Polymerase Chain Reaction (PCR) testing. In other words, is a particular gender more likely to be an asymptomatic carrier of COVID-19?

**Methods:** Two unique screening questionnaires, multiple temperature checks, and a PCR test were collected for all 1,638 patients preoperatively. Nasopharyngeal PCR tests from 1638 patients undergoing elective orthopedic surgery to check for COVID-19 infection were collected. Of the 1,638 patients that qualified through screening to be tested, 781 were female and 857 were male. The age range among the subjects was 13 to 86 years, and the average age among the patients was 52.61 years.

**Results:** Of the 1638 PCR tested for COVID-19, 21 tested positive and the other 1,617 tested negative. Overall, there were 781 females and 857 males. From the subgroup that tested positive, there were 14 females and 7 males. Approximately 1.28% of the subjects tested PCR positive for COVID-19 within 48 hours of elective orthopedic surgery. The positivity rate of females (1.79%) was more than double that of males (0.82%) which was statistically significant ( $p=0.0398$ ).

**Conclusion:** To our knowledge, there is no data demonstrating a gender difference in asymptomatic COVID-19 carriers. Our data demonstrates greater than twice the proportion of female asymptomatic COVID-19 carriers compared to their male counterparts. Based on our evidence, we conclude that females are more likely to be asymptomatic COVID-19 carriers when compared to males in this preoperative population.

## Introduction

As elective orthopedic surgeries resumed during the SARS-CoV-2 (COVID-19) pandemic, multiple screening and testing tools are important to prevent disease spread and provide safety for surgical patients. Patients who undergo surgery and are positive for COVID-19, could experience respiratory or multi-organ complications, and experience a greater morbidity and mortality rate [1,2]. Screening protocols such as questionnaires documenting exposure and symptom history and temperature are effective in identifying symptomatic individuals and reducing disease spread [3]. Although, these methods alone fail to identify infected asymptomatic patients [4]. As noted in previous literature, the prevalence of asymptomatic carriers in health care workers has been reported to be between 0.76% and 3% [5,6]. Performing a Polymerase Chain Reaction (PCR) test in the asymptomatic population can identify these potential silent carriers [4]. PCR tests for COVID-19 look for genetic material from the virus and are considered the most accurate for identifying active infection due to their high sensitivity [4]. Asymptomatic carriers can transmit the virus effectively within the general population [7].

We evaluated 1,638 asymptomatic individuals who had orthopedic presurgical negative screening tests and were afebrile. They underwent COVID-19 PCR testing. We attempted to answer

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the question, what are the statistically significant characteristics of the asymptomatic PCR positive individuals; in particular what gender is more likely to be an asymptomatic carrier of COVID-19?

## Materials and Methods

Two unique screening questionnaires, multiple temperature checks, and a PCR test were collected for all 1,638 patients preoperatively from June 2020 to December 2020.

Prior to being seen at each orthopedic appointment and the pre-operative appointment (within 30 days of surgery) a COVID-19 screening questionnaire was completed. The specific questions were as follows:

- Do you currently have a fever or upper respiratory symptoms such as a cough or shortness of breath?
- Do you have loss of sense of smell and/or taste?
- Have you or people you have been in close contact with traveled outside of California in the last month? If so, where and when?
- Have you or people you are in close contact with been around a person known to have COVID-19?
- Have you been diagnosed with COVID 19? If so, when?
- Have you traveled by airplane in the last two weeks?

For all 1,638 patients, questionnaires were answered negatively, and all temperature checks were found to be afebrile at every preoperative orthopedic clinic appointment.

Nasopharyngeal COVID-19 PCR tests from 1,638 patients undergoing elective orthopedic surgery to check for COVID-19 infection were collected. COVID-19 PCR tests were used from two different manufacturers, (Cepheid - Sunnyvale, CA) and (Luminex-Austin, TX). All tests were carried out in asymptomatic preoperative patients who were afebrile. Tests were performed within 48 hours of elective surgery and immediately after a negative COVID-19 screening questionnaire and negative temperature check.

Before patients arrived at the PCR testing center, they were screened over the phone, and were asked if they had any symptoms:

- Fever  $>100.4^{\circ}\text{F}$  ( $38^{\circ}\text{C}$ ), subjective fever (feel feverish), chills, runny nose, muscle aches, sore throat, cough (new onset or worsening of chronic cough), shortness of breath, nausea or vomiting, headache, abdominal pain, diarrhea, rigors, new olfactory and taste disorder(s), fatigue, wheezing, difficulty breathing, chest pain, and other symptom (if other symptom, please describe), and date of symptom onset.

If the patient answered negative to all questions on the phone interview, they proceeded to the COVID-19 PCR test. Immediately upon patient arrival to the testing center, patients were screened again with the same questions listed above and their temperature was taken. The patient was PCR tested if that had confirmed negative answers to all the above questions and they were afebrile.

Of the 1,638 patients that qualified to be tested, 781 were female and 857 were male. The age range among the subjects was 13 to 86 years, and the average age among the patients was 52.61 years (Figure 1).

If patients tested PCR positive preoperatively, they were rescheduled to a new surgery date after the 14-day infectious period

[8].

## Results

Of the 1638 PCR tested for COVID-19, all of whom had consecutive negative screening criteria of questionnaires and temperature, 21 tested positive and the other 1,617 tested negative. Overall, there were 781 females (age range of 13 years to 86 years) and 857 males (age range of 14 to 81 years). From the subgroup that tested positive, there were 14 females (age range of 16 to 66 years) and 7 males (age range of 39 to 67 years) (Figure 2A).

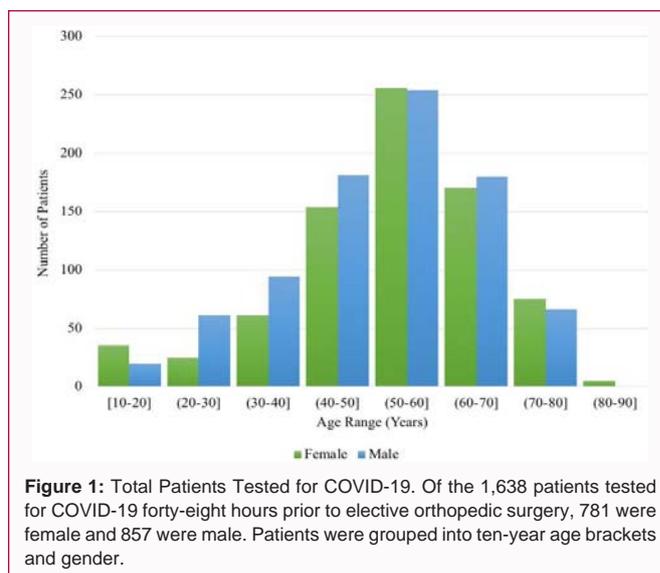
Approximately 1.28% of the subjects tested PCR positive for COVID-19 within 48 hours of elective orthopedic surgery. All of these patients that had consecutive negative screening criteria, through questionnaires and temperature checks, historically and immediately prior to PCR testing. The positivity rate of females (1.79%) was more than double that of males (0.82%) which was statistically significant ( $p=0.0398$ ). A one-tailed two-sample z-test was performed to determine a significant difference in the percent of positive patients by gender (Figure 2B).

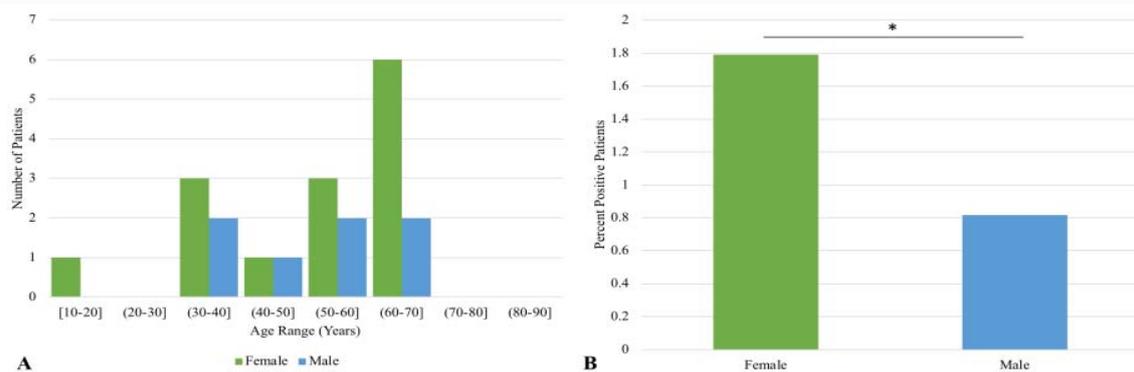
There did not appear to be any correlation of age and positive COVID-19 PCR test in this population.

## Discussion

Asymptomatic carriers are a significant source of COVID-19 spread within the population [7]. The prevalence of asymptomatic carriers in health care workers has been reported to be between 0.76% and 3% [5,6]. To our knowledge, no specific gender difference has been identified as being more prevalent asymptomatic carriers.

Methods like effective screening and testing can be implemented to identify asymptomatic carriers and reduce disease transmission [3,4]. However, screening questionnaires and temperature checks do not always identify asymptomatic infected individuals [4]. Within this study, a group of 1,638 patients underwent preoperative screening, including two distinct screening questionnaires and multiple temperature checks. These patients had negative temperature checks and no symptoms based on multiple screening criteria. After screening, a COVID-19 nasopharyngeal swab PCR test was conducted for these patients 48 hours prior to surgery. This presents a unique population, as they underwent COVID-19 testing as a result





**Figure 2:** Positive Asymptomatic Covid-19 Tests. A) Positive COVID-19 tests are grouped by ten-year age brackets and gender. Of the 1638 patients tested using the COVID-19 Virus PCR Test, 21 patients tested positive within forty-eight hours of elective orthopedic surgery. B) The percent of positive tests are grouped by gender. A one-tailed two-sample z-test was performed to determine a significant difference in the percent of positive patients by gender ( $p=0.0398$ ).

of routine presurgical screening, not due to potential exposure. If patients tested PCR positive preoperatively, they were rescheduled to a date after the 14-day infectious period [8].

Zhou et al. [6] did not identify a difference in the age or gender of infected asymptomatic individuals [6]. In contrast, we identified a difference in the rate of asymptomatic positive PCR tests between genders. In the present study, females have a statistically significant increase in the proportion of positive tests compared to males. There was a difference in the populations studied; Zhou et al. [6] studied a population of healthcare workers [6] compared to our elective presurgical population.

Previous literature demonstrates that in symptomatic individuals, infected males suffer from more severe symptoms and have a greater mortality rate as a result of COVID-19, while infected females are less symptomatic [9,10]. One might extrapolate from these studies that because COVID-19 infected females have less severe symptoms when compared to males, infected females might also predominate as asymptomatic carriers when compared to males.

The size of the population tested may have limited any further statistically significant correlations with patient age and COVID-19 positive PCR test results. However, using the same reasoning, that younger infected patients with COVID-19 have fewer symptoms than older populations, one might expect that younger individuals might also predominate as asymptomatic carriers. A larger study would be required to confirm or disprove this hypothesis.

To our knowledge, there is no data demonstrating a gender difference in asymptomatic carriers. Our data demonstrates greater than twice the proportion of female asymptomatic carriers compared to their male counterparts, which was statistically significant. Based on our evidence, we conclude that females are more likely to be asymptomatic carriers when compared to males in this preoperative population. Conversely, negative screening tests, including questionnaires and temperature assessments, appear to be more effective in correctly identifying non-infected males compared to females. In an effort to minimize the spread of infection through asymptomatic carriers, further studies might look towards more rigorous screening methods in asymptomatic patients with a focus on the female patient.

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