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RESEARCH BRIEF #77

October 4, 2022

Does COVID-19 Infection Increase Blood Pressure?

Kevin Heffernan and Andrew Heckel

KEY FINDINGS

- Adults with a history of mild-to-moderate COVID-19 have similar 24-hour blood pressure patterns as those without a history of COVID-19 infection.
- Poor sleep quality and poor mental health were associated with less desirable blood pressure patterns, regardless of history of COVID-19 infection.
- Healthcare providers may want to consider sleep quality and mental health when assessing CVD risk in their patients.

Hypertension, or high blood pressure, is a modifiable risk factor for cardiovascular disease (CVD) that affects more than half of the U.S. adult population.[1] Hypertension is known as the "silent killer" and in 2020 was responsible for over 670,000 deaths. Although hypertension is an established risk factor for severe COVID-19 illness, little is known about the effect of COVID-19 on blood pressure. At the start of the pandemic, reports emerged suggesting that severe cases of COVID-19 might damage the heart and blood vessels,[2] possibly increasing risk for developing hypertension.[3,5]

This brief summarizes the results of our recent study that examined both daytime and nighttime blood pressure (systolic and diastolic) collected in Fall 2020 and Spring 2021 from in U.S. adults with and without a history of COVID-19 infection.[5]

There is No Difference in Blood Pressure between Adults With Versus Without a History of COVID-19 Infection

Adults with a history of mild-to-moderate COVID-19 infection had similar 24-hour blood pressure patterns as those without a history of past COVID-19 infection. Moreover, the drop in blood pressure that occurs during nighttime ("dipping") did not differ between groups. Mean values of daytime and nighttime brachial systolic and diastolic blood pressure measured in the arm are shown in Figure 1.

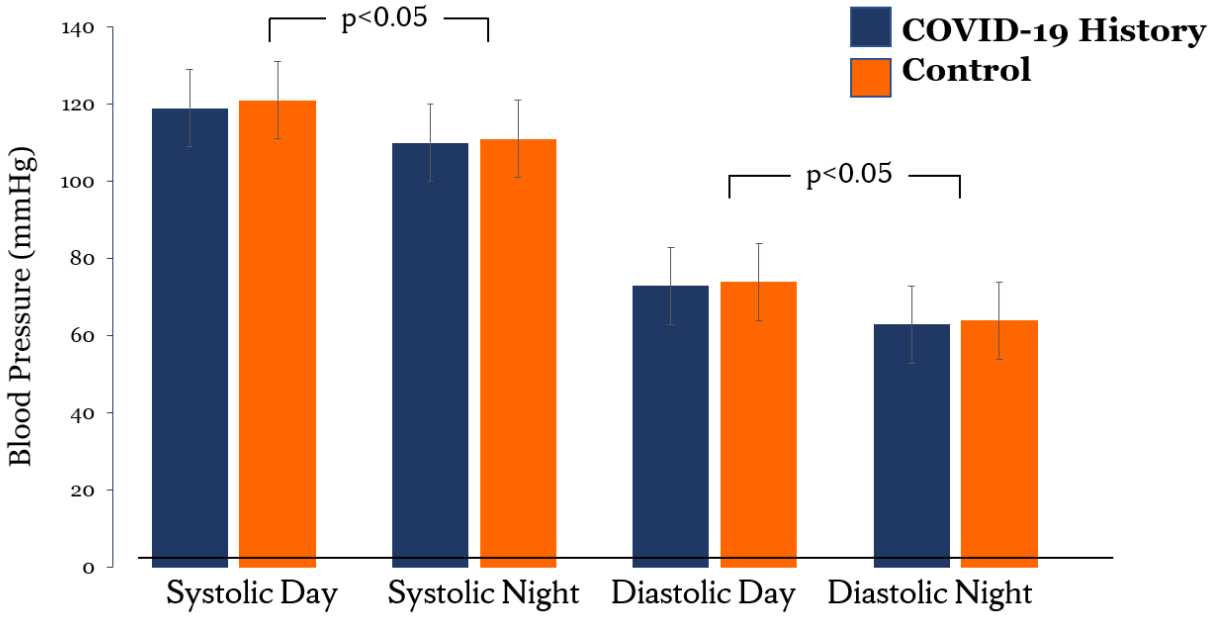

Figure 1. Daytime and Nighttime Systolic and Diastolic Blood Pressure in Adults with and without a History of COVID-19 Infection

Notes: Data were collected from Fall 2020 to Spring 2021. There were no group differences in either systolic or diastolic blood pressure measured in the arm (p>0.05).

The COVID-19 Pandemic Itself May Have Impacted Blood Pressure Regardless of COVID-19 History

Blood pressure increased among U.S. adults during the COVID-19 pandemic.[6] Increases in blood pressure and new cases of hypertension following COVID-19 infection mirrors trends in rising blood pressure and increased rates of hypertension observed during the COVID-19 pandemic.[7] Thus, it is possible that changes in lifestyle behaviors (e.g., reduced physical activity, disturbed sleep) and poor mental health (increased anxiety, depressive symptoms, and stress) stemming from the pandemic could impact blood pressure separate from the direct effect of COVID-19 infection. Therefore, we also examined potential lifestyle behaviors and mental health outcomes that could influence blood pressure, including physical activity, sleep quality, anxiety, depressive symptoms, stress, and post-traumatic stress disorder symptoms.

Adults with and without a history of COVID-19 did not differ in their lifestyle behaviors and mental health. We interpret this to suggest that a past case of mild-to-moderate COVID-19 may not alter lifestyle behaviors and mental health. However, it was striking to note that in the group overall, 35% had poor sleep quality, 20% had moderate to severe anxiety and depression symptoms, 53% had moderate to high perceived stress, and 13% had high symptomology for post-traumatic stress disorder (PTSD). Moreover, 37% had low physical activity levels. In addition, higher depressive and PTSD symptoms and lower sleep quality were associated with a small reduction in nighttime blood pressure dips in the group overall. Taken together, these findings suggest that poor sleep quality and poor mental health may have a detrimental effect on blood pressure patterns, regardless of whether someone has a history of COVID-19 infection.

Sleep and Mental Health Should be Considered "Vital" Outcomes during Medical Visits

Our findings suggest that COVID-19 infection may not influence blood pressure (at least in the period after infection has passed). However, the broader effects of the COVID-19 pandemic on cardiovascular health should not be dismissed. Many adults in our sample reported poor sleep, stress and PTSD symptoms, and low physical activity, all of which increase the risk of increasing blood pressure.

Now more than ever, primary healthcare providers should ask their patients about their sleep quality and mental health and treat those results like other vital signs (i.e., body temperature, pulse rate, breathing rate etc.)[8,9] There is a strong relationship between sleep health and mental health such that poor sleep quality negatively impacts mental health and poor mental health begets lower sleep quality. Both poor sleep quality[10] and poor mental health[11] are risk factors for hypertension and CVD. Overall, our findings underscore the importance of maintaining optimal sleep quality and mental health for maintaining cardiovascular health in adults, regardless of COVID-19 history.

Data and Methods

32 adults who had previously tested positive for COVID-19 (29±13 years of age, 22 women) and 43 adults without a history of COVID-19 (28±12 years of age, 26 women) volunteered to participate in this study. Participants were recruited from Syracuse University and the broader Syracuse community. We collected data from Fall 2020 to Spring 2021. Our study was designed to be completed remotely given the changing research landscape for in-person laboratory-based research. Oral consent and data collection were conducted virtually via Zoom. A container with research study equipment (i.e., blood pressure cuff, digital scale, finger pulse oximeter, heart rate monitor, devices to assess lung function and lung inflammation) along with nitrile gloves and disinfecting materials was dropped off at each participant's residence prior to the Zoom meeting. Also included in the container was an information sheet with pictures and written explanations for how to properly use all equipment. During the Zoom meeting, participants were carefully guided through the information sheet and given verbal instructions along with visual demonstrations for how to complete study procedures. Participants with a history of COVID-19 were tested, on average, 122 days (+/- 123 days) after their positive COVID-19 test date, experienced 6 +/- 4 COVID-19 symptoms, and had mild-to-moderate COVID-19 disease severity. We performed detailed measurement of blood pressure over 24-hours using an ambulatory monitor designed to be worn with movement such as walking.[6] Following measurement of blood pressure and other health measures, participants completed a battery of online questionnaires using RedCap. Sleep quality was determined using the Pittsburgh Sleep Quality Index (PSQI). Anxiety and depressive symptoms were appraised using the Generalized Anxiety Disorder 7-item scale (GAD-7) and Center for Epidemiological Studies Depression scale (CES-D), respectively. Perception of stress was assessed using the 10-item Perceived Stress scale (PSS-10). Post-traumatic stress disorder symptoms since the beginning of the COVID-19 pandemic were assessed using the PTSD Checklist for the DSM-5 (PCL-5). Physical activity levels were appraised using the International Physical Activity Questionnaire (IPAQ).

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