

ABSTRACT

The COVID-19 pandemic had significant impacts on first responders (i.e., police, firefighters, emergency services), in part due to these personnel continuing to work to serve the public. First responders had increased COVID-19 exposure rates during the pandemic when responding to emergencies and public interactions, and are still at greater risk due to a high volume of continued population contacts. Contracting the virus could result in long-term negative health outcomes. Increased stress, lockdowns, and potential COVID-19 infection could have impacted the physical activity levels of first responders further compromising their health and occupational fitness. Given the myriad of health effects associated with COVID-19, information about long-term fitness impacts could be extrapolated from body composition and aerobic fitness measurements. **PURPOSE:** To extrapolate potential impacts of COVID-19 in a sample of first responders through analyzing differences in body composition and aerobic fitness across 5 years (2019-2023). **METHODS:** A retrospective cross-sectional analysis was conducted on data collected from 73 firefighters from 2019-2023 as part of a wellness program. Body mass index (BMI), body fat percentage (BF%), pulmonary function (forced expiratory volume and forced vital capacity ratio; FEV/FVC), and estimated maximal aerobic capacity ($\dot{V}O_{2max}$) were measured each year following the National Fire Protection Association guidelines. The pandemic changed how the data were measured (FEV/FVC was not recorded in 2020), in addition to how many firefighters were tested per year. Accordingly, this study analyzed the data as a group per year, rather than tracking individuals from year-to-year. A series of univariate ANOVAs, with birth year as a covariate, compared the years in BMI, BF%, FEV/FVC, and $\dot{V}O_{2max}$ ($p < 0.05$). Post hoc analyses were conducted with a Bonferroni adjustment for multiple comparisons. **RESULTS:** There were no significant differences in BMI across the 5 years ($p = 0.936$). The 2022 group had a significantly lower BF% compared to the 2021 group ($p = 0.025$). The 2019, 2022, and 2023 groups had a significantly ($p \leq 0.002$) lower FEV/FVC ratio compared to the 2021 group. Both the 2022 and 2023 groups had a significantly lower $\dot{V}O_{2max}$ ($p \leq 0.009$) compared to the 2019-2021 groups. **CONCLUSIONS:** BMI was not significantly different across the 5 years and there were limited differences in BF%. As body composition can be influenced by physical activity, it is possible that the firefighters in this sample may have been able to maintain some form of exercise over the years. However, in this sample FEV/FVC peaked in 2021 before declining. Notably, the lowest $\dot{V}O_{2max}$ recordings occurred in 2022-2023, where the aftereffects of COVID-19 may have influenced the aerobic fitness of firefighters in this sample. Overall, the groups were generally below the recommended $\dot{V}O_{2max}$ standard of 45 ml/kg/min for firefighters. **PRACTICAL APPLICATIONS:** Although there are multiple factors that contribute to the body composition and fitness of first responders, this data does provide information regarding potential impacts of COVID-19. The lower $\dot{V}O_{2max}$ recorded in 2022-2023 is concerning. First responder organizations should provide aerobic re/conditioning programs for personnel, especially for those returning from COVID-19 infection. Wellness programs could also be used to record baseline aerobic capacity data for use in return-to-work protocols for first responders.

INTRODUCTION

- SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2), is the virus associated with causing the coronavirus disease in 2019 (COVID-19) which rapidly spread around the world (10). On March 11, 2020, the World Health Organization declared COVID-19 to be a worldwide pandemic (2).
- The COVID-19 pandemic had significant impacts on first responders (i.e., police, firefighters, emergency services), in part due to these personnel continuing to work to serve the public. First responders had increased COVID-19 exposure rates during the pandemic when responding to emergencies and public interactions. Baker et al. (1) found that 52% of protective service personnel (police and correctional officers, firefighters) were exposed more than once per month, and 29% more than once per week. McGuire et al. (7) documented a three-fold higher prevalence in municipal first responders of past COVID-19 infection compared to general population. First responders are still at greater risk due to a high volume of continued population contacts. Contracting the virus could result in long-term negative health outcomes for the individual (4,11).
- Increased stress, lockdowns, and potential COVID-19 infection could have impacted the physical activity levels of first responders (6), further compromising their health and occupational fitness. Given the myriad of health effects associated with COVID-19, information about long-term fitness impacts could be extrapolated from body composition and aerobic fitness measurements.
- The purpose of this study was to extrapolate potential impacts of the COVID-19 pandemic in a sample of first responders through analyzing differences in body composition and aerobic fitness across 5 years.

METHODS

- A retrospective cross-sectional analysis was conducted on data collected from 73 male firefighters from 2019-2023 as part of one health and wellness program.
- As part of the health and wellness program, body mass index (BMI), body fat percentage (BF%), pulmonary function (forced expiratory volume and forced vital capacity ratio; FEV/FVC), and estimated maximal aerobic capacity ($\dot{V}O_{2max}$) were measured each year following the National Fire Protection Association guidelines (9).
- The pandemic changed how the data were measured (FEV/FVC was not recorded in 2020), in addition to how many firefighters were tested per year. Accordingly, this study analyzed the data as a group per year, rather than tracking individuals from year-to-year.
- A series of univariate ANOVAs, with birth year as a covariate, compared the years in BMI, BF%, FEV/FVC, and $\dot{V}O_{2max}$ ($p < 0.05$). Post hoc analyses were conducted with a Bonferroni adjustment for multiple comparisons.

RESULTS

- There were no significant ($p = 0.936$) differences in BMI across the 5 years (Table 1). The 2022 group had a significantly ($p = 0.025$) lower BF% compared to the 2021 group.
- The 2019 ($p < 0.001$), 2022 ($p < 0.001$), and 2023 ($p = 0.002$) groups had a significantly lower FEV/FVC ratio compared to the 2021 group. Both the 2022 ($p \leq 0.009$) and 2023 ($p \leq 0.003$) groups had a significantly lower $\dot{V}O_{2max}$ compared to the 2019-2021 groups.

Table 1. Descriptive (mean \pm SD) data for body mass index (BMI), body fat percentage (BF%), ratio between forced expiratory volume and forced vital capacity (FEV/FVC), and estimated maximal aerobic capacity ($\dot{V}O_{2max}$) in firefighters. The number of firefighters tested per year for each variable is indicated in the table. FEV/FVC was not collected in 2020.

Year	BMI (kg/m ²) (n = 48, 43, 43, 45, 47)	BF% (n = 48, 45, 43, 45, 55)	FEV/FVC (n = 45, 43, 45, 47)	$\dot{V}O_{2max}$ (ml/kg/min) (n = 45, 44, 45, 43, 44)
2019	29.39 \pm 4.47	27.21 \pm 8.24	83.37 \pm 6.35*	41.96 \pm 4.57
2020	28.95 \pm 4.60	27.60 \pm 7.65	-	44.57 \pm 7.86
2021	29.25 \pm 4.97	28.42 \pm 6.80	91.93 \pm 5.02	42.87 \pm 6.54
2022	28.22 \pm 5.18	25.05 \pm 8.03	84.24 \pm 7.40*	37.13 \pm 8.99§
2023	28.66 \pm 5.33	22.69 \pm 8.60*	87.29 \pm 7.20*	37.06 \pm 9.22§

* Significantly ($p < 0.05$) different from 2021.
§ Significantly ($p < 0.05$) different from 2019, 2020, and 2021.

CONCLUSIONS

- BMI was not significantly different across the 5 years and there were limited differences in BF%. As body composition can be influenced by physical activity, it is possible that the firefighters in this sample may have been able to maintain some form of exercise over the years.

- Health and wellness programs often encourage greater physical activity and can also provide specific exercise programming (5). The current data provides some evidence for the potential effectiveness of strategies used by the health and wellness program staff.
- Nonetheless, in this sample of firefighters FEV/FVC peaked in 2021 before declining. What was also notable was that the lowest $\dot{V}O_{2max}$ recordings occurred in 2022-2023, where the aftereffects of the COVID-19 pandemic may have influenced the aerobic fitness of firefighters in this study. COVID-19 infection rates were not collected from the firefighters so it cannot be confirmed that the disease was responsible for the changes in aerobic fitness, and other factors (e.g., physical activity, diet, etc.) may have influenced these results. Nevertheless, the data suggests that the firefighters do require specific aerobic exercise interventions. Health and wellness program and training staff should use some type of return-to-work protocol for first responders returning following contraction of the COVID-19 infection. Numerous organizations have provided guidelines for return-to-play protocols following COVID-19 infection; and example is provided from Gluckman et al. (3) (Figure 1).
- Aerobic fitness interventions are even more pertinent when considering the 2022 and 2023 year groups were below the recommended $\dot{V}O_{2max}$ standard of 42 ml/kg/min for firefighters (8).

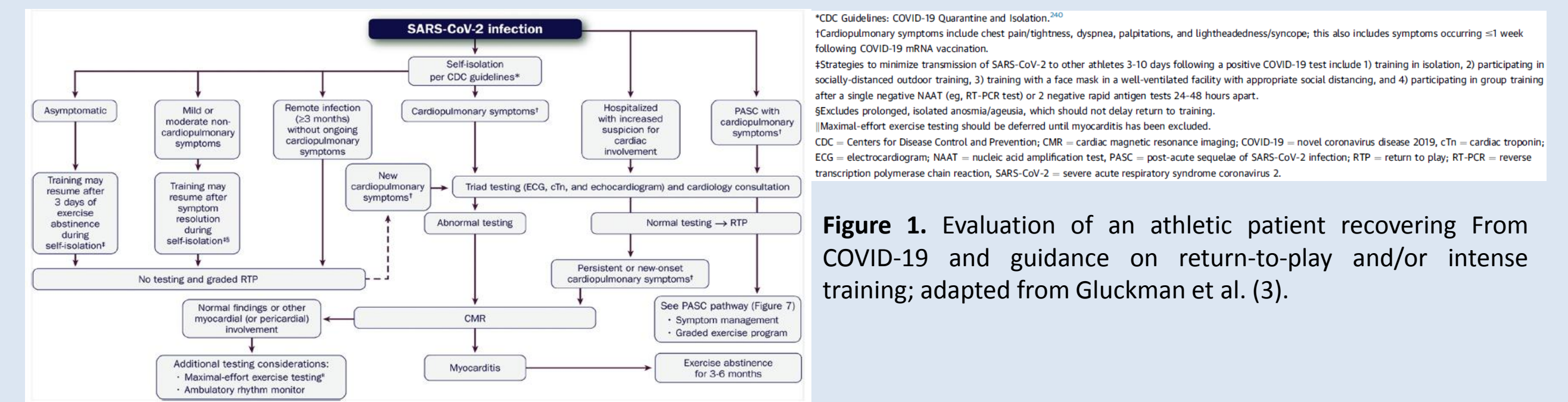


Figure 1. Evaluation of an athletic patient recovering from COVID-19 and guidance on return-to-play and/or intense training; adapted from Gluckman et al. (3).

PRACTICAL APPLICATIONS

- Although there are multiple factors that contribute to the body composition and fitness of first responders, this data does provide information regarding potential impacts of COVID-19. The lower $\dot{V}O_{2max}$ recorded in 2022-2023 is concerning. First responder organizations should provide aerobic re/conditioning programs for personnel, especially for those returning from COVID-19 infection. Health and wellness programs could also be used to record baseline aerobic capacity data, in addition to other measures of health and fitness, for use in return-to-work protocols for first responders.

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