**Cardiovascular hospitalizations, influenza activity and COVID-19 measures**

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During the COVID-19 pandemic there have been reports suggesting a decrease in hospitalizations for cardiovascular disease (CVD), including acute myocardial infarction (MI) 1 and heart failure (HF) 2. This reduction does not only relate to temporarily postponed elective procedures, but also acute and life-threatening conditions. The explanation for this phenomenon is not clear, but there have been concerns that fear of contracting COVID-19 may contribute 3.

There is an established temporal association between influenza activity in the community and CVD hospitalizations, associating a 5% monthly increase in influenza activity with a 24% increase in HF 4. The pandemic has caused enforcement of hygiene and social distancing measures that influence the activity of influenza and other respiratory viruses. Accordingly, in this study we describe the association between CVD hospitalizations, influenza activity and COVID-19 burden before, during and after restrictions from Norwegian authorities.

We used anonymized, aggregated data from publically available databases ([www.fhi.no/en](http://www.fhi.no/en)) to investigate trends in hospitalizations for CVD at Akershus University Hospital (AUH), a tertiary care hospital covering a catchment area of ~560,000 individuals, during the first wave of the COVID-19 pandemic. All hospitalizations during weeks 6 (three weeks before first COVID-19 case in Norway) to 21 of 2020 and 2019 with primary ICD-10 code I20-22; I25; I34-37; I44-49; I50 or I42; R07; R55 and Z034-035 were included. We also recorded the number of patients hospitalized with laboratory confirmed COVID-19 at AUH the corresponding week, as defined by SARS-CoV-2 in combined nasopharyngeal and oropharyngeal swabs determined by real-time polymerase chain reaction test (RT-PCR) with cycle threshold as described by Corman (2020), using the ABI7500 Systems (Thermo Fisher Scientific). Influenza activity during the same period of 2019 and 2020 was obtained from the Norwegian Institute of Public Health as proportion of specimens positive for influenza virus A/B by RT-PCR among all people tested for influenza in Norway. Norwegian authorities introduced strict restrictions for travel, school closure, social distancing, hygiene and rules for quarantine and isolation on March 12th 2020 and these restrictions were gradually eased from April 20th 2020. Incidence rates were calculated as number of hospitalizations divided by the population of the hospital catchment area during the defined period and the 95% CIs were calculated using the z-values for standard normal distribution.

Weekly hospitalizations for CVD, the total number of patients hospitalized with COVID-19 and the proportion positive RT-PCR for influenza virus in 2019 and 2020 are presented in the **Figure**. The first case of COVID-19 in Norway was in week 9 and the first patient hospitalized at AUH with COVID-19 was admitted in week 10. There was a rapid increase in COVID-19 hospitalizations with a peak in week 13, and a similar decrease the following weeks. The proportion positive RT-PCR for influenza virus decreased from week 7 in both years. The decrease was steeper in 2020 with a positive rate under 5% in week 12, versus week 18 in 2019. The hospitalization rate for CVD ranged from 142-185 per week during the period in 2019. In 2020, there was a >50% reduction from week 9 to 13 (from 167 to 82 hospitalizations per week), with a following increase to week 17. After week 17 of 2020, the weekly amount of hospitalizations for CVD remained lower than for 2019.

We observed that hospitalizations for CVD in Norway decreased during the first wave of the pandemic and remained lower than normal the first weeks after easing the restrictions. In parallel with the rise in COVID-19 hospitalizations and the introduction of drastic restrictions, there was a parallel rapid reduction in CVD hospitalizations and influenza activity. With a very low incidence of SARS-CoV-2 in the community and ease of restrictions by the authorities, the rate of CVD hospitalizations increased, but only to a lower level than before the pandemic.

Whether the decrease in CVD hospitalizations relates to patients concerns for contracting COVID-19 in hospital or reflects a true reduction in the incidence of CVD is unclear. In Norway, far-reaching restrictions were implemented early, resulting in a rapid reduction in the incidence of hospitalizations and deaths from COVID-19. Norway was one of the first countries to gradually lift restrictions, providing a unique opportunity to assess the trends in CVD hospitalizations in the next phase of the pandemic. A delay in time from symptom onset to hospitalization would have been expected if patients with CVD emergencies delayed health care contact, but the Norwegian MI Registry report no such delay in 2020 compared to 2019 5. Given the known association between influenza activity and CVD, it is likely that the rapid and steep decrease in influenza associated with social distancing and hygiene measures during the pandemics’ first wave might have contributed to the decrease in CVD hospitalizations. This in turn would contribute to comparable mortality rates in Norway during the first wave of the pandemic in 2020 and previous years (Statistics Norway).

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**FIGURE LEGEND**

**Figure.** Weekly cardiovascular disease (CVD) hospitalization rates with 95% confidence intervals in 2019 and 2020 at a tertiary care hospital in Norway and the total hospitalization rate for corona virus disease 2019 (COVID-19) the same week. Also presented is the proportion of polymerase chain reaction (PCR) positive tests for influenza virus in Norwegian laboratories in 2019 and 2020.