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EDITORIAL

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Decline in respiratory and cardiac admissions during the COVID-19 pandemic: What is the role of common respiratory virus infections?

Numerous countries across the globe have introduced a variety of public health measures, non-pharmaceutical interventions (NPIs), to reduce the transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and accordingly reduce coronavirus disease 2019 (COVID-19) hospitalizations and mortality. Effective NPIs have at the same time caused considerable changes in healthcare demand for non-COVID-19 conditions. In New Zealand, during the first wave of the pandemic in early 2020, their government instigated a stringent programme of restrictions, with a four-level alert system, including border closure, quarantine for returning travellers, social distancing measures and personal hygiene promotion. High public compliance with NPIs prevented COVID-19 community transmission for 102 consecutive days. In fact, they were so effective that the usual winter influenza surge was also disrupted, with an extraordinary 99.9% reduction in influenza virus detections as compared to previous years and a substantial reduction in all other respiratory viruses, including a 98% reduction in respiratory syncytial virus detections.[1] Due to the key role viruses are known to play in many respiratory conditions and are postulated to play in myocardial infarctions and heart failure, it may be hypothesized that the stringent reductions implemented in New Zealand may also have mitigated the incidence of these conditions during that time.

In a recent publication in *Respirology*, Fairweather et al. have used weekly national hospital admission data, from January 2015 to September 2020, to map the effects of New Zealand's programme of NPIs on acute (non-COVID-19) infectious respiratory admissions, non-infectious respiratory admissions and cardiac admissions.[2] As might be expected, the authors found an absence of the usual winter peak of acute respiratory infectious admissions, including pneumonias, influenzas, acute bronchitis, acute bronchiolitis and unspecified acute upper and lower tract respiratory infections. Admissions were low even during the lowest level of pandemic restrictions (level 1), paralleling the lack of community COVID-19 transmission during that phase. They also found a reduction, albeit a less dramatic reduction, in chronic obstructive pulmonary disease admissions. These findings provide further evidence that the normal seasonal trends in infectious respiratory admissions are driven by common circulating respiratory viruses. In contrast, there was little or no reduction in non-infectious respiratory admissions, including lung cancer, pulmonary embolism and pneumothorax.

Interestingly, asthma admissions also initially fell during level 4 to level 2 restrictions, but then and distinct to all other respiratory admissions, displayed a sharp, transient, rise immediately on dropping restrictions from level 2 to level 1. Asthma admissions have been found to have a sustained decline in other countries, including Singapore, South Korea and Scotland and Wales.[3–5] The authors showed that the temporary rise was closely aligned to a similarly sharp increase in rhinovirus detections during the same period. Rhinoviruses were detected through samples provided by a select group of patients admitted to a single hospital; however, it is notable that their reported trend in rhinovirus detections agreed with national surveillance data.[1] Rhinovirus infections are known to be the major cause of asthma exacerbations[6] and the strong relationship between peak rhinovirus detections and asthma admissions in June, and subsequent simultaneous decline in July, is strongly suggestive of a causal link. However, causation may have been confounded by a change in the threshold to attend healthcare facilities or other environmental exposures.

Alongside respiratory admissions, Fairweather et al. documented the longitudinal changes in acute coronary syndrome (ACS) and heart failure.[2] The authors noted a clear fall in ACS admissions during the 5 weeks of level 4 restrictions but reported little change in heart failure admissions relative to previous years. However, looking closely at their data for 2020, there is a distinct drop in heart failure admissions during the period of level 4 restrictions as compared to the previous and subsequent months, and compared to the trends in the previous years. Due to the nature of observational data, it is not possible to pinpoint the exact causes of the reduction in cardiac admissions, but two likely candidates are a change in the threshold to present to healthcare facilities and lack of exposure to common viruses. The pattern of abrupt and temporary decline in cardiac admissions, related only to implementation of the most severe NPIs, was also seen in South Korea, Singapore and the U.K.[4,7,8] The authors of a large U.K. study argued towards fear of hospital attendance as the biggest driver,[7] whereas a study from Singapore was able to clearly demonstrate a significant relative reduction in admissions due to a decline in heart failure with concomitant reductions in respiratory viral infections.[8] The influence of respiratory virus infections on the aetiology of acute episodes of cardiovascular disease is yet to be fully clarified. While there is good evidence reporting that they

are associated with 2.8- to 10.1-fold increased risk of myocardial infarctions in the 7-day period following virus infection,[9] the effect of mitigation through influenza vaccination in heart failure patients is less certain. A meta-analysis reported a 17% lower risk of all-cause mortality but there was no significant effect on cardiovascular mortality.[10] Further larger studies will be needed to provide more certainty in this regard.

One hypothesis to explain a link between respiratory virus infections and acute episodes of cardiovascular disease is that acute respiratory virus infections induce a state of hypercoagulability, as a direct consequence of the virus infection or through virus induction of an inflammatory-mediated mechanism. Experimental and observational studies have shown evidence of a hypercoagulable state, an increase in local and systemic procoagulant activity and activation of haemostasis during respiratory virus infections.[11,12] Indeed, hypercoagulability has been postulated as one mechanism to explain the association between severe COVID-19 and the elevated risk of acute episodes of cardiovascular disease.[13]

The authors conclude that their study suggests the winter peak in heart failure admissions is probably not driven by respiratory viral infections. However, we would propose that their data does show a relative fall in heart failure admissions, alongside the fall in ACS admissions, and lack of respiratory viral infection is one highly plausible mechanism for these reductions in acute cardiovascular phenomena.

KEYWORDS

asthma, cardiovascular disease, coronavirus disease, COVID-19, respiratory infections (non-tuberculous), SARS-CoV-2, viral infection

CONFLICT OF INTEREST

Sebastian L. Johnston reports personal fees from Virtus Respiratory Research, Myelo TherapeuticsÐmbH, Bayer, Novartis, Boehringer Ingelheim, Gerson Lehrman Group, resTORbio, Bioforce, Lallemand Pharma and Enanta, outside the submitted work. Sebastian L. Johnston is the Asthma UK Clinical Chair (grant CH11SJ) and a National Institute of Health Research Emeritus Senior Investigator and is funded in part by European Research Council Advanced Grant 788575. Chloe I. Bloom reports no competing interests.

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REFERENCES

1. Huang QS, Wood T, Jelley L, Jennings T, Jefferies S, Daniells K, et al. Impact of the COVID-19 nonpharmaceutical interventions on influenza and other respiratory viral infections in New Zealand. Nat Commun. 2021;12:1001.
2. Fairweather SM, Chang CL, Mansell CJ, Shafuddin E, Hancox RJ. Impact of COVID-19 pandemic restrictions on the cardio-respiratory health of New Zealanders. Respirology. 2021;26:1041–8.
3. Davies GA, Alsallakh MA, Sivakumaran S, Vasileiou E, Lyons RA, Robertson C, et al. Impact of COVID-19 lockdown on emergency asthma admissions and deaths: national interrupted time series analyses for Scotland and Wales. Thorax. 2021 Mar 29;76:867–73.
4. Huh K, Kim YE, Ji W, Kim DW, Lee EJ, Kim JH, et al. Decrease in hospital admissions for respiratory diseases during the COVID-19 pandemic: a nationwide claims study. Thorax. 2021 Mar 29;76:939–41.
5. Wee LE, Conceicao EP, Tan JY, Sim JXY, Venkatachalam I. Reduction in asthma admissions during the COVID-19 pandemic: consequence of public health measures in Singapore. Eur Respir J. 2021;57:2004493.
6. Johnston SL, Pattemore PK, Sanderson G, Smith S, Lampe F, Josephs L, et al. Community study of role of viral infections in exacerbations of asthma in 9-11 year old children. BMJ. 1995;310:1225–9.
7. Mafham MM, Spata E, Goldacre R, Gair D, Curnow P, Bray M, et al. COVID-19 pandemic and admission rates for and management of acute coronary syndromes in England. Lancet. 2020;396:381–9.
8. Wee LE, Conceicao EP, Tan JY, Chan LL, Phoon PC, Sim XYJ, et al. Reduction in heart failure admissions with concomitant respiratory viral infections during the novel coronavirus disease-2019 pandemic: unintended consequence of public health measures in Singapore. J Card Fail. 2021;27:117–9.
9. Kwong JC, Schwartz KL, Campitelli MA, Chung H, Crowcroft NS, Karnauchow T, et al. Acute myocardial infarction after laboratory-confirmed influenza infection. N Engl J Med. 2018;378:345–53.
10. Rodrigues BS, David C, Costa J, Ferreira JJ, Pinto FJ, Caldeira D. Influenza vaccination in patients with heart failure: a systematic review and meta-analysis of observational studies. Heart. 2020;106:350–7.
11. Seemungal T, Harper-Owen R, Bhowmik A, Moric I, Sanderson G, Message S, et al. Respiratory viruses, symptoms, and inflammatory markers in acute exacerbations and stable chronic obstructive pulmonary disease. Am J Respir Crit Care Med. 2001;164:1618–23.
12. Majoor CJ, van de Pol MA, Kamphuisen PW, Meijers JC, Molenkamp R, Wolthers KC, et al. Evaluation of coagulation activation after rhinovirus infection in patients with asthma and healthy control subjects: an observational study. Respir Res. 2014;15:14.
13. Sandor-Keri J, Benedek I, Polexa S, Benedek I. The link between SARS-CoV-2 infection, inflammation and hypercoagulability-impact of hemorheologic alterations on cardiovascular mortality. J Clin Med. 2021;10:3015.

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