active certainly illustrates a perception of inappropriate adjustments of elective case volume by many local situations. The need for more local adjustments is further illustrated by the homogeneous timing of changes in surgical volumes across the country whereas the COVID-19 case surges were more temporally dispersed across the country.

Further analysis will be necessary to understand the specific factors that influenced the local and regional heterogeneity and the potential impact on patient outcomes to further inform public health response to future waves. We suggest a more locally and temporally adjusted response from US hospitals depending on COVID-19 hospitalisation trends to prevent avoidable cancellation of surgical cases, which might unnecessarily impact patient prognosis and hospital financial security.

Declarations of interest

The authors declare that they have no conflicts of interest.

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Respiratory personal protective equipment for healthcare workers: impact of sex differences on respirator fit test results

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Editor—Adequate personal protective equipment (PPE), in particular respiratory protective equipment, is a core requirement for healthcare workers during infectious disease pandemics. Global shortages of PPE during the coronavirus disease 2019 (COVID-19) pandemic have put healthcare workers at risk and likely led to preventable infection and deaths.[1] In many countries, respirators have been rationed to high-risk areas and aerosol-generating procedures because of cost and shortages.[2] In the UK, filtering face piece class 3 (FFP3) respirators are the respiratory PPE of choice and provide protection from aerosolised viruses, such as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), but only when they are properly fitted to the wearer. Thus, staff must pass a fit test to safely use respirators.[3]

The media has highlighted anecdotal evidence about the inadequacies of PPE for females.[4] The majority of healthcare staff are female[1,4]; however, respirators are modelled on white males, which means they are less likely to fit and, therefore, less likely to protect female staff, who tend to have smaller faces.[4,5] To our knowledge, there has been no published evidence that women are less likely to pass fit testing.

After approval from our Trust Information Governance Department and a waiver of individual participant consent, we analysed 1049 fit tests conducted at our institution during the COVID-19 pandemic; 813 (77%) in females and 236 (23%) in males. Staff underwent qualitative fit testing with either sweet or bitter spray.[3] Sex and gender data were not recorded during fit testing; therefore, gender was inferred from the names of staff members, and sex inferred from the gender. Females were less likely to fit FFP3 respirators with an 18.2% fail rate *vs* 9.7% for males ($P<0.01$, χ^2 test; Table 1).

Table 1 Filtering face piece class 3 (FFP3) respirator fit test results.

			Sex		
			Female	Male	Total
Test result	Pass	Count (%)	665 (81.8)	213 (90.3)	878 (83.7)
	Fail	Count (%)	148 (18.2)	23 (9.7)	171 (16.3)
Total		Count	813	236	1049

Although the majority of healthcare staff in the UK are female,[1] they work within structurally biased healthcare systems and are provided with respiratory PPE designed for males.[4,5] Although males are generally at higher risk of death from COVID-19 than females,[1] it is concerning that young female healthcare staff are reported to have double the COVID-19-related mortality rate compared with age-matched females in the general population.[1] It is possible that staff from minority ethnic groups, with higher mortality and morbidity risks from COVID-19,[6] are also at higher risk of failing fit tests because of different facial geometry.[1,7]

Our study was limited by a lack of routinely recorded data on the sex of those undergoing fit testing. Inferring sex may introduce information bias, in particular for transgender healthcare staff. This highlights the urgent need for healthcare institutions to record sex and ethnicity disaggregated demographic data during fit testing to minimise discrimination against women and minority groups. Based on our findings, our institution has improved its data collection and now routinely records gender, sex assigned at birth (if different from gender), and ethnicity data for all respirator fit tests so that we can study the impact of these demographics on respirator fit.

The lessons to be learned from the COVID-19 pandemic are not simply about maintaining adequate stocks of PPE, but also about tackling systemic discrimination in order to protect staff, who may feel pressured to work with poorly fitting, inadequate, PPE.[6] This responsibility lies with healthcare institutions and public bodies who can exert their purchasing power to influence the manufacturers of PPE. All people working in healthcare have the right to adequate PPE, and to work in an environment free from systemic discrimination.

Authors' contributions

Conception of the article: AC, AA
Data collection: AA, PC, AC
Statistical analysis: EdS, AA
Drafting of manuscript: AA, PC, EdS, MK, AC
All authors reviewed and revised drafts of the manuscript and approved the final version

Declarations of interest

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Influence of room ventilation settings on aerosol clearance and distribution

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