all prequalified vaccines are non-inferior in both younger children and older adults is needed before a stronger recommendation can be made for the use of fractional yellow fever vaccine in people aged 9 months or older.

Secondly, Juan-Giner and colleagues[1] did not assess for cross-reactivity flavivirus antibodies in participants' pre-vaccination samples. Whether pre-existing immunity to related flaviviruses can affect the response to smaller amounts of antigen in fractional doses of yellow fever vaccine remains an important knowledge gap, and might limit the global applicability of these findings.

Finally, the authors reported seroconversion and antibody titres at 10 days postvaccination for both full and fractional doses of all four vaccines. Unfortunately, they lacked adequate power to examine differences at this timepoint. However, the trends observed for three of the four vaccines indicated that seroconversion and titres were lower for fractional doses than full dose at 10 days after vaccination. Given the current indication of fractional doses for use when doses of vaccine are insufficient in the face of an outbreak,[5] delayed antibody formation with lower doses of the vaccine is concerning. More data are needed on the kinetics of antibody response for fractional vaccine doses to know if lower doses of antigen can be administered and result in the same rapid and sustained protection seen with full doses.[11] Until these data exist, the norm and struggle will probably remain ensuring that adequate amounts of full dose yellow fever vaccine are available for international travel, childhood vaccination programmes, and during campaigns. However, this study,[1] which is part of an accelerated global research agenda on the use of fractional yellow fever vaccines doses,[5] will allow public health to respond quickly to outbreaks of yellow fever where vaccine availability is limited, with the knowledge that all pre-qualified vaccines can be administered as a fractional dose with good safety and immunogenicity.

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# Increasing the visibility of LGBTQ+ researchers in STEM

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Visibility creates a crucial sense of individual belonging and security for LGBTQ+ people, and those who are able to be open about their sexuality and gender can serve as role models for the wider community.[1] Visible or not, LGBTQ+ people frequently encounter societal or legal discrimination, particularly in countries that retain colonial-era legislation.[2] One of the aims of The STEM Village Virtual Symposium, which took place in August, 2020, was to increase visibility of LGBTQ+ individuals in the science, technology, engineering, and mathematics (STEM) community. More than 700 attendees participated, including from countries where it is dangerous or illegal to be openly LGBTQ+.[3] We received feedback from people in these regions that events such as the symposium helped them to feel hopeful and part of a wider community.

The problem of invisibility is exacerbated in STEM fields due to heteronormative stereotypes, which can lead to challenges for LGBTQ+ individuals in the workplace.[4] Reticence to be out at work can be rooted in notions of

**Panel: Interventions to increase LGBTQ+ visibility in STEM**

**Micro-interventions (individual and group levels)**

- Normalise sharing pronouns—include them in emails and introductions during meetings or classes.
- Demonstrate allyship with flags and symbols of solidarity and understand and know what they mean.
- Don't assume someone's gender or sexual identity and be mindful of phrasing if asking questions. Ask yourself, "Would I ask or say this if I thought the person was heterosexual?"

**Macro-interventions (institutional level)**

- Data monitoring—ensure inclusive gender and sexuality options as part of human resources monitoring in the workplace. Analysis of data around marginalised identities must be examined through an intersectional lens: discrete categorisation, while necessary to capture multiple elements of an individual's identity, must not lead to discrete analyses.[13,14]
- Required training—regular training, delivered by LGBTQ+ individuals, that focuses on the understanding of intersectional LGBTQ+ identities.
- Support and safety—institutions should ensure the safety of their LGBTQ+ staff and students in the workplace and when organising overseas work in countries that openly discriminate against the community.[15]
- Resources—provide funding to support network building activities and create mechanisms to integrate them into the STEM environment.
- Accountability and transparency—experiences of workplace bullying and harassment are a reality for many LGBTQ+ people. Accountability and safeguarding are often inadequate and all stakeholders have a responsibility to create academic environments where LGBTQ+ people are fully protected against discrimination, harassment, and microaggressions.

STEM=science, technology, engineering, and mathematics.

wanting to appear professional and rigorous, something also often conflated with heteronormativity.[5,6] Therefore, it is perhaps not surprising that there is both a visibility and under-representation problem for LGBTQ+ professionals and students in STEM. A survey of LGBTQ+ physical scientists in the UK showed that they commonly feel isolated and that almost 50% of transgender researchers have considered leaving or have left their jobs in STEM.[7] A Wellcome Trust study of 4000 biomedical research scientists in the UK found that 24% of LGBTQ+ respondents felt uncomfortable being open with colleagues about their sexuality.[8] Another study surveying more than 270 000 people employed in US federal agencies highlighted the lack of LGBTQ+ representation in STEM-related compared to non-STEM federal agencies.[9] Thus, even in countries where LGBTQ+ identities are more widely accepted, there are barriers that require resolution within STEM workplaces. In the USA, under-representation and lack of visibility also have an impact on LGBTQ+ students in STEM who are less likely to be retained than their heterosexual, cis-gendered peers.[10] Despite these disparities, many government institutions, funding agencies, and educational organisations do not collect data on sexuality and gender identity. For instance, the National Science Foundation in the USA does not include the LGBTQ+ demographic in their national STEM census.[11] Scarce data on LGBTQ+ individuals in the STEM workplace make it difficult to fully understand and subsequently address the educational and career barriers that our community faces.

Changes cannot be initiated only by the LGBTQ+ community and must be embedded in institution-wide policies and procedures and part of wider diversity efforts to improve race, gender, and disability equality.[12] We propose micro-interventions and macro-interventions that can help to increase LGBTQ+ visibility and inclusion in STEM (panel). Macro-interventions require institutional leadership and system-wide institutional changes, while micro-interventions are steps that individuals and groups can take to create inclusive STEM environments.

Ultimately, we want LGBTQ+ people to be visible and included as part of the STEM community. We would like the future of STEM to be one that challenges gender stereotypes and notions of heteronormativity. We represent a number of different identities within the LGBTQ+ community as well as different nationalities, ethnicities, disabilities, and neurodiversities, but recognise that we do not and cannot fully represent the experience of all LGBTQ+ people. Multiple intersecting forms of oppression and privilege exist that some of us are disadvantaged by and some of us benefit from. Our proposals are intended to stimulate the important conversations that are needed so that we can continue working towards an inclusive STEM environment for everyone.

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# Pay gaps in medicine and the impact of COVID-19 on doctors' careers

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Gender equality and the gender pay gap in medicine have been long-standing problems globally.[1] Concerns about a large gender pay gap in medicine prompted the Department of Health and Social Care in England to commission an independent review, *Mend the Gap: the Independent Review into Gender Pay Gaps in Medicine in England*,[2] that has now been published and which we led. This review shows that the total medical gender pay gap in England is 24·4% for hospital doctors, 33·5% for general practitioners, and 21·4% for clinical academics.[2] The pay structure in UK medicine was designed for the health system of 1948, when the UK's National Health Service (NHS) was established, and has not kept up with the changes in women's position in society. These new data on the gender pay gap in UK medicine are likely to be mirrored internationally;[3] the gap is fairly easy to measure in England because the NHS is a single employer.

The gender pay gap in medicine review gathered evidence from the NHS Electronic Staff Record, linked to workforce and tax records, and triangulated with survey data from a randomised selection of doctors on the General Medical Council register, and in-depth qualitative interviews. Results confirm a large overall pay gap with several underlying causes. Some of the causes, such as men having, on average, been in the workforce for longer, or the fact that women are more likely to have children and to work part-time, are not a surprise. However, a less well recognised factor is the way that pay progression is structured. NHS medical pay increases in an automatic and incremental way over several years. This structure means the easiest way to accrue a large salary is to be in the system for a long time, with no breaks, resulting in widening pay gaps for those who take time off, most of whom are women. This pay gap grows with increasing age and does not narrow until age 65 years.

This review was undertaken before the COVID-19 pandemic and the impacts of the pandemic on doctors' pay gaps are not yet fully understood. However, the COVID-19 pandemic is likely to have sharpened the disadvantageous effects of work circumstances, especially for female and Black, Asian, and minority ethnic (BAME) doctors.

The necessity to adjust working hours to manage serious overwork and the worsening imbalance of work and life during the pandemic typically results in missed experience and leadership opportunities for women[4] and pay penalties over and above missed hours.[2] Similarly, the severe reduction in child-care provision will have disproportionately stalled the careers of