US COVID-19 clinical trial leadership gender disparities

The COVID-19 pandemic has disproportionately affected the careers of women, including those in academia and research. In June, 2020, only 430 (27·8%) of 1548 COVID-19 clinical trials were led by female principal investigators and in August, 2020, only 28·0% of first authors in COVID-19 manuscripts were women.[1,2] We sought to analyse disparities in gender, which was assumed from author's first name, in COVID-19 trial leadership throughout the pandemic. Only names with a probability of more than 0·8 of being either male or female were included. Furthermore, we investigated how the gender of trial leaders is associated with the gender of trial participants and trial intervention type.

On Aug 1, 2022, we identified 11 281 unique US trials for COVID-19 since Jan 1, 2020, and for four comparison diseases since Jan 1, 2015, on ClinicalTrials.gov. Similar to Cevik and colleagues,[1] we included two non-communicable diseases: breast cancer and type 2 diabetes. We also included one communicable respiratory disease category (eg, non-COVID respiratory diseases) and one non-respiratory communicable disease (ie, HIV). Between Jan 1, 2020, and Aug 1, 2022, 8058 COVID-19-related study records were published to ClinicalTrials.gov; 2443 trials had sites in multiple countries, such as Brazil or Afghanistan. We restricted our analysis to US trials to clearly describe trends in one region.

A validated machine learning tool was used to probabilistically infer gender from the first names of investigators.[1–4] We excluded 3131 trials with no human investigator listed and 650 trials for which gender could not be confidently ascertained (confidence score <0·8).[2] For the remaining 7500 trials, we analysed the genders of 7490 principal investigators, 528 study chairs, and 842 study directors (appendix p 12). 119 trials corresponded to multiple diseases so leaders from these trials were counted multiple times; there were 10 COVID-19 trials associated with the non-respiratory disease comparators. We used Yates' χ^2 test to compare two groups and the Kruskal–Wallis rank sum test to compare more than two groups. We used linear regression to assess the association between female leadership, the gender of trial participants, and trial intervention type.

As the COVID-19 pandemic progressed, the proportion of women leading COVID-19 trials increased (figure). For example, in the first 6 months of 2020, 145 (32·2%) of 451 leadership positions in US COVID-19 clinical trials were held by women. This number increased significantly to 65 (49·2%) of 132 in the first 6 months of 2022 (p<0·001).

Between January, 2020, and August, 2022, 545 (37·4%) of 1457 of US COVID-19 clinical trial leadership positions were held by women, significantly less than for diabetes (128 [47·6%] of 269), breast cancer (359 [59·9%] of 599), and HIV (165 [54·1%] of 305) trials (appendix p 8; p<0·01 for all comparisons). By contrast, there was a similar rate of female leadership among non-COVID respiratory disease trials during this period. The low rate of female leadership in non-COVID respiratory disease trials might occur owing to the under-representation of female doctors in pulmonary and critical care medicine compared with medicine in general.[5]

Among COVID-19-related trials, unclassified interventions (425 [29·2%] of 1457) and drug-based interventions (396 [27·1%] of 1457) were most common, followed by behavioural (206 [14·1%] of 1457) and biological interventions (179 [12·3%] of 1457; appendix p 9). Among COVID-19 trial leadership, women were under-represented in biological (50 [27·9%] of 179) and drug (102 [25·8%] of 396) trials but were well represented in behavioural (117 [56·8%] of 206)

For the **machine learning tool** see https://genderize.io/

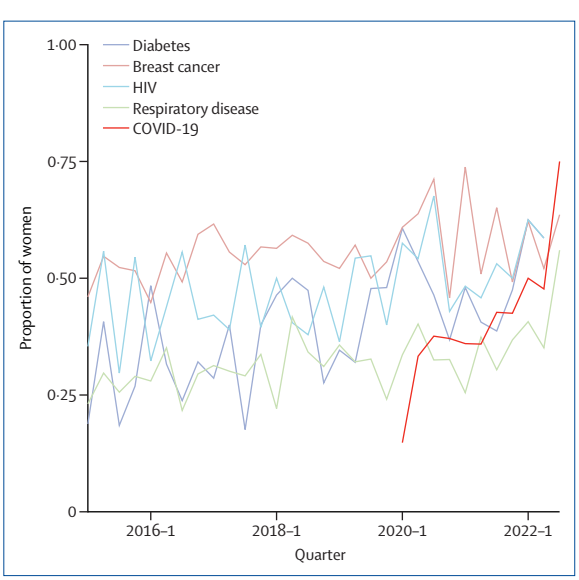

Figure: **Proportion of women in clinical trial leadership positions**

See **Online** for appendix

trials. This pattern generally occurred throughout the comparison diseases, although women were well represented in breast cancer (322 [49·3%] of 653) and HIV (136 [46·6%] of 292) drug trials. The rate of new drug and biological COVID-19 trials decreased significantly throughout the pandemic, with a less precipitous decrease in behavioural trials (appendix p 13).

Of all 11 281 originally identified trials, 1814 (16·1%) listed results on ClinicalTrials.gov; 1787 (15·8%) listed information on baseline participants' sexes and eight (0·1%) were related to multiple diseases of interest (appendix p 14). Among the 1787 trials with information about participant sex, 47·3% of participants in COVID-19 trials were women (appendix p 10). We fit a linear regression to assess the association between women in COVID-19 trial leadership positions and participant population gender. In a bivariate model, having a woman among trial leaders was associated with a 13·1% (p<0·001) more women in the participant population (appendix p 11). There was an attenuated relationship (7·3%, p=0·036) when controlling for intervention type, which might influence trial cohort. The association also occurred among breast cancer, HIV, and diabetes trials, although controlling for intervention type in diabetes trials leads to no significant association. Past research observed similar occurrences for other diseases, such as in oncology and historical HIV trials.[4,6]

There are several limitations of our analysis. We excluded 3781 (33·5%) of 11 281 trials because they did not identify a human study investigator or the investigator's name could not be algorithmically assigned to a gender. Moreover, the machine learning tool labels individuals as men or women and is exclusionary to gender non-conforming individuals. Furthermore, we analysed trials from ClinicalTrials.gov so our results might not apply to trials registered elsewhere or unregistered trials. Future research should investigate gender-leadership trends across countries by examining other relevant clinical trial repositories.

Overall, the stark gender disparities documented in the early stages of the COVID-19 pandemic have reduced in the past 2 years, coinciding with a reduction in the number of clinical trials being done. Previous research hypothesised that the urgency of public health emergencies leads to fewer checks and balances of equity, allowing women to be excluded from leadership roles.[1] Moreover, caregiving demands are often made of women, with female scientists reporting substantial declines in time for research at the onset of the pandemic.[7] Research groups with the resources to rapidly shift focus to COVID-19 in the beginning of the pandemic and subsequently shift focus away when interest declines might be dominated by men. Along with decreases in urgency of research of COVID-19, decreases in the number of biological and drug trials might also explain increases in female leadership in the later stages of the pandemic. For example, women are under-represented in academic medicine and biomedical faculty, with better representation in behavioural fields, such as psychology.[8,9]

As indicated in previous studies for other diseases, increased gender diversity in trial leadership is associated with increased gender equity in participant enrolment.[4,6] This association is not clearly causal, and past work is unclear on the explicit or implicit role of study leadership in cohort recruitment.[6] The attenuation by intervention type for COVID-19 could be explained by specific interventions being targeted at critically ill patients who are predominantly male, although this would not explain the positive association in other diseases.

Gender diversity in research is crucial. Across medicine, gender-diverse teams produce more effective research.[10] During future public health emergencies, lessons from the COVID-19 pandemic should be heeded, including ensuring the participation of women as both leaders and participants in clinical trials.

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*Neil K R Sehgal, John S Brownstein, Maimuna S Majumder, *Gaurav Tuli*

gaurav.tuli@childrens.harvard.edu

Computational Epidemiology Lab (NKRS, JSB, GT), Computational Health Informatics Program (MSM), Boston Children's Hospital, Boston, MA, USA; Institute for Applied Computational Science (NKRS), Department of Pediatrics, Harvard Medical School (JSB, MSM), Harvard University, Cambridge, MA, USA

1 Cevik M, Haque SA, Manne-Goehler J, et al. Gender disparities in coronavirus disease 2019 clinical trial leadership. *Clin Microbiol Infect* 2021; **27:** 1007–10.

2 Muric G, Lerman K, Ferrara E. Gender disparity in the authorship of biomedical research publications during the COVID-19 pandemic: retrospective observational study. *J Med Internet Res* 2021; **23:** e25379.

3 Santamaría L, Mihaljević H. Comparison and benchmark of name-to-gender inference services. *PeerJ Comput Sci* 2018; **4:** e156.

4 Waldhorn I, Dekel A, Morozov A, et al. Trends in women's leadership of oncology clinical trials. *Front Oncol* 2022; **12:** 885275.

5 Olson EM, Kennedy CC, Kelm DJ. Assessment of gender parity: leadership representation in pulmonary and critical care medicine. *J Womens Health (Larchmt)* 2022; **31:** 439–46.

6 Cotton DJ, Finkelstein DM, He W, Feinberg J. Determinants of accrual of women to a large, multicenter clinical trials program of human immunodeficiency virus infection. The AIDS Clinical Trials Group. *J Acquir Immune Defic Syndr (1988)* 1993; **6:** 1322–28.

7 Myers KR, Tham WY, Yin Y, et al. Unequal effects of the COVID-19 pandemic on scientists. *Nat Hum Behav* 2020; **4:** 880–83.

8 Jena AB, Khullar D, Ho O, Olenski AR, Blumenthal DM. Sex differences in academic rank in US medical schools in 2014. *JAMA* 2015; **314:** 1149–58.

9 Casad BJ, Garasky CE, Jancetic TR, Brown AK, Franks JE, Bach CRUS. US women faculty in the social sciences also face gender inequalities. *Front Psychol* 2022; **13:** 792756.

10 Yang Y, Tian TY, Woodruff TK, Jones BF, Uzzi B. Gender-diverse teams produce more novel and higher-impact scientific ideas. *Proc Natl Acad Sci USA* 2022; **119:** e2200841119.