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# Effect of Athena SWAN funding incentives on women's research leadership

Analysis shows that funding incentives can work and more funders should trial them, say **Pavel V Ovseiko and colleagues**

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"Is it difficult being a woman scientist?" the biochemist Dorothy Crowfoot Hodgkin was asked at high table dinner in an Oxford college by the man sitting next to her. "Not since I won the Nobel Prize," she replied.<sup>1</sup> In 1964, the British press had reacted to her award with the headlines: "Oxford housewife wins Nobel" and "British woman wins Nobel Prize—£18 750 prize to mother of three."<sup>2</sup> While such overtly sexist treatment of female scientists by the media is now rare, progress towards gender equality in universities has been astonishingly slow.

A UK parliamentary inquiry into women in scientific careers found that with only 17% of professors in science, technology, engineering, and mathematics (STEM) in 2011-12 women were still under-represented at senior levels across all STEM disciplines.<sup>3</sup> Concerned with the sustainability of increasing the scientific workforce, the inquiry concluded that efforts to inspire more women into science were wasted if they were subsequently disadvantaged compared with men and recommended that universities should do more to support and retain women in scientific careers.<sup>3</sup>

To accelerate women's advancement and leadership, the UK's National Institute for Health Research (NIHR) introduced an innovative policy intervention in 2011 linking its research funding to the implementation by universities of gender equality action plans through the Athena SWAN (Scientific Women's Academic Network) charter (**box 1**). We examine the effect of this policy on women's research leadership in NIHR funded research and theorise how such incentives may work.

## Box 1: Athena SWAN charter

The Athena SWAN charter provides a peer review framework for developing action plans and gaining recognition for the advancement of gender equality in higher education and research. The charter was established in 2005 under the ownership of the non-profit organisation Equality Challenge Unit (now Advance HE), evolving from the work of the Athena Project, set up to promote diversity in UK science, and the Scientific Women's Academic Network (SWAN).

Institutions that commit to the charter establish self-assessment teams to collect and analyse evidence, identify priorities, and develop action plans using a comprehensive framework for supporting and advancing women's careers<sup>4</sup>:

- *Key career transition points*—Recruitment, induction, promotion, research excellence

- *Career development*—Training, appraisal and development review, support for career progression, support for research grant applications
- *Flexible working and managing career breaks*—Cover and support for maternity and adoption leave; maternity return rate; uptake of paternity, shared parental, adoption, and parental leave; flexible working; transition from part-time back to full-time work after career breaks
- *Organisation and culture*—Culture; human resources policies; proportion of heads of school, faculty, or department by gender; representation of men and women on committees; participation on influential external committees; committee workload; policies, practices, and procedures; workload model; timing of meetings and social gatherings; visibility of role models; outreach activities.

The framework is applied to both institutions and departments. Institutions focus on the institutional structures and policies to enable change, whereas subject departments act as the agents of change by improving hiring, retention, and promotion decisions, workplace practices, and organisational culture at discipline level.

Institutions and departments apply to have their applications and action plans peer reviewed by subject specific panels of academics, experts, and Athena SWAN professionals from other participating institutions against the self-assessments presented and good practice in the field. Applicants receive constructive feedback and awards commensurate with the committed effort and outcomes<sup>4</sup>:

- *Bronze award* requires an assessment of gender equality and the issues facing the institution or department plus a four year action plan to deal with these
- *Silver award* recognises the successful implementation of the action plan and its demonstrable impact
- *Gold award* recognises beacons of achievement in gender equality and champions in promoting good practice in the wider community

## National translational research infrastructure

With the aim of creating a national infrastructure for translating scientific breakthroughs into new treatments for patients, NIHR has awarded £2.2bn (£2.5bn; \$2.9bn) of UK taxpayers' funding for translational research to biomedical research centres and units—partnerships between NHS organisations and universities. The strategic objectives, scope, and magnitude of funding of these centres have parallels

with the Clinical and Translational Science Awards Program of the US National Institutes of Health.<sup>5</sup>

Biomedical research centres cover several disease, organ system, technology, and activity based research themes (eg, cancer, cardiovascular disease, genomics, and patient and public involvement) with multiple investigators in each theme. Centres are led by a director (senior leader) responsible for the strategy and coordination of research across themes and by theme leads (mid-level leaders), who have similar responsibilities across research topics within their theme.

Funding awards are based on peer review by an international selection panel of senior researchers and informed by bibliometrics.<sup>6</sup> The panel considers applicants' research strategy, research facilities, budget, narrative track record of success in translational research, publications, grants, and the career history of the proposed director and theme leads, including a narrative description of why they are at the forefront of their field internationally and a list of publications over the past five years.

### Funding incentives for women in science

During the 2011 competition for research centre funding, Sally Davies, then director general of research and development and chief scientific adviser at the Department of Health, sought to encourage universities to accelerate women's advancement and leadership in science. She stated that in the 2016 round of the competition the NIHR did not expect to shortlist any research centre where the academic partners had not achieved at least the Athena SWAN silver award.

NIHR's policy intervention provided sufficient incentives for universities to develop and implement gender equality action plans. This coincided with a 10-fold increase in the number of medicine related Athena SWAN silver or gold awards in 2016 (one gold and 69 silver awards) compared with 2011 (seven silver awards). Moreover, several major funders and science organisations in Ireland, Australia, the United States, and Canada subsequently adopted modified versions of the Athena SWAN framework contexts (see supplementary data on [bmj.com](http://bmj.com) for further details).

NIHR removed the requirement for applicants to hold Athena SWAN awards in 2020, partly to reduce administrative burden during the covid-19 pandemic. It stated: "we believe that use of the [Athena SWAN] charter has led to the greater embedding of gender equality practice" and that the future focus for NIHR would be on the broader commitment to all dimensions of equality, diversity and inclusion.<sup>7</sup> Although Athena SWAN awards are no longer required, applicants can still choose to evidence the relevant elements of this new broader commitment through the awards.

### Effect of funding incentives

After the introduction of the Athena SWAN incentives, the proportion of female theme leads increased to 24% (43/177) in 2016 from 8% in both 2006 (8/105) and 2011 (15/200). The proportion of women in senior director positions also increased from 11% (3/28) and 10% (3/31) in 2006 and 2011 to 15% (3/20) in 2016 (fig 1 and supplementary data on [bmj.com](http://bmj.com)). The incentives seem to have increased the number of female theme leads but not the number of female directors.

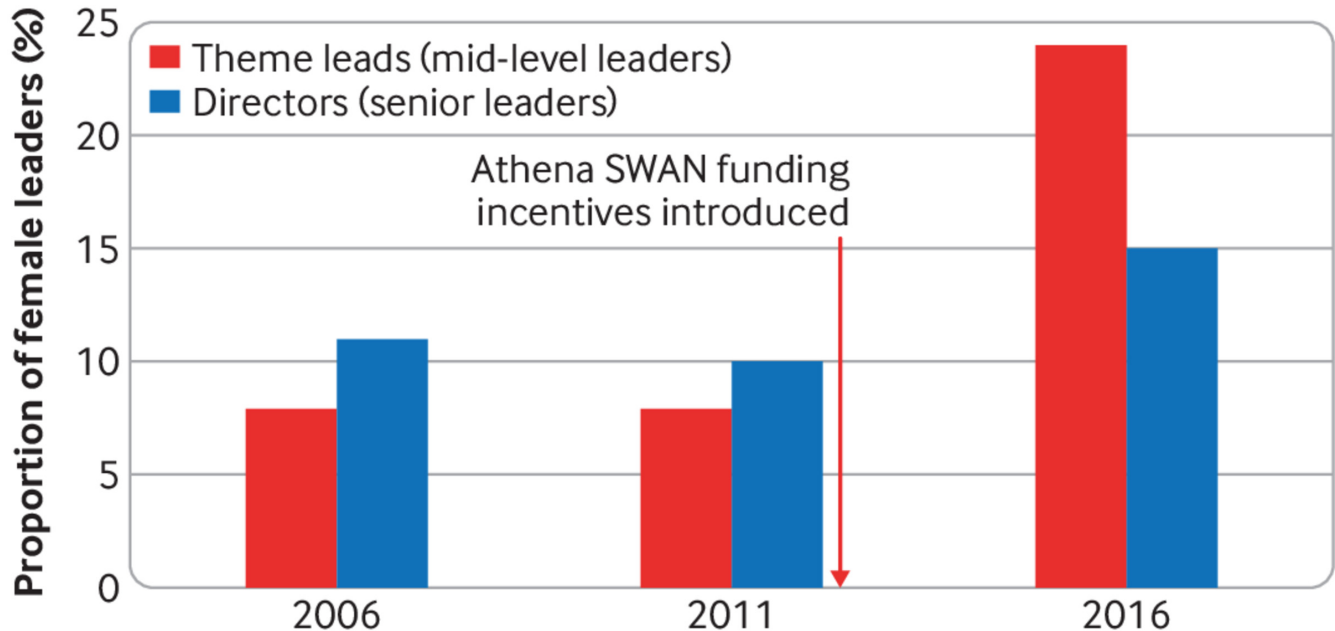


Fig 1 | Percentages of female research leaders

Before the introduction of the Athena SWAN funding incentives the proportion of funding obtained by female theme leads was 5% in 2006 and 4% in 2011. This increased to 21% in 2016. The proportion

of funding obtained by female directors increased from 2% in both 2006 and 2011 to 4% in 2016 (fig 2) but remained much lower than for male directors (see supplementary data for more detail).

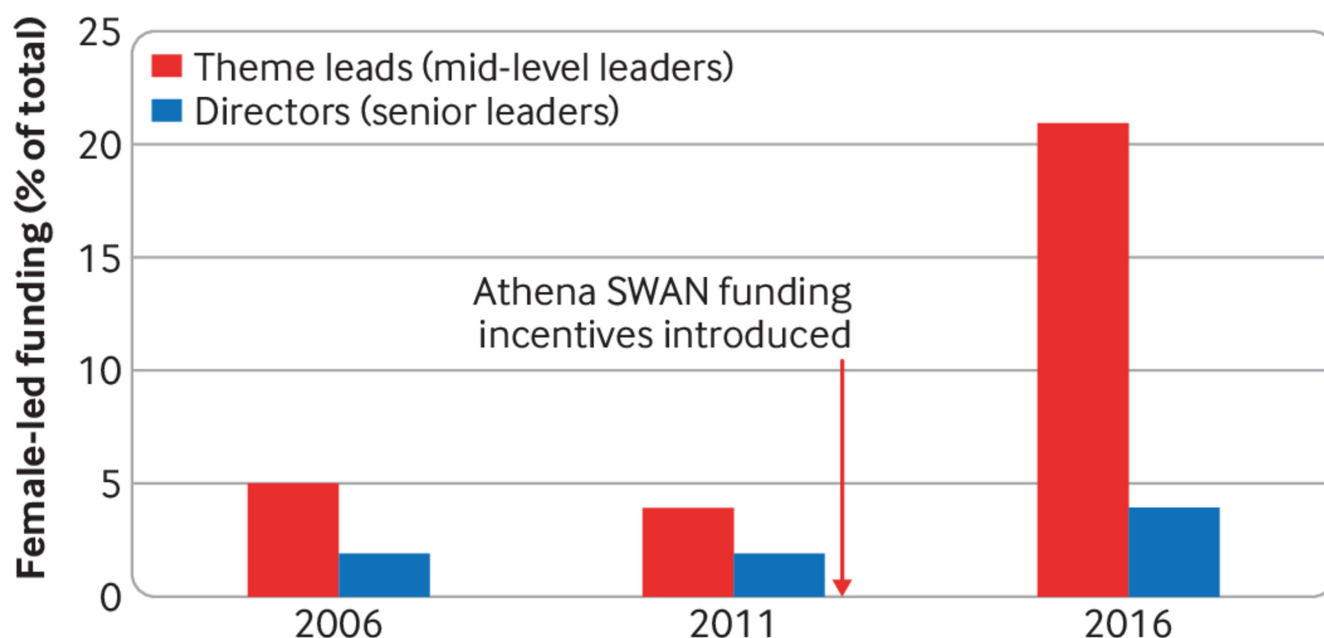


Fig 2 | Percentages of funding obtained by female research leaders

## Leaky pipelines

One possible confounder for gender disparity in leadership positions is the pipeline effect. It is often suggested that once there are sufficient numbers of women entering universities and they are not discriminated against for admission into the pipeline, the under-representation of women at all levels in academic medicine will gradually disappear. To test this theory we estimated admission into the academic medicine pipeline using scientific age—that is, the number of years after the first publication. The scientific age of female and male theme leads (27 and 28, respectively) and directors (27 and 30, respectively) was similar in 2016 (see supplementary data for more detail). Assuming the leads' first publication occurred in the first year after graduation, they entered medical school around 1980 when female admissions to UK medical schools were already 40%.<sup>8</sup> Given that the proportions of female theme leads and directors are much lower than 40%, the pipeline appears to be leaking.

When we examined a leadership pipeline within research centres, we found that in 2016 65% (13/20) of directors and 40% (71/177) of theme leads had held these roles in previous rounds and that more men than women had repeated leadership terms (see supplementary data for more detail). A disproportionately large pool of incumbent male leaders who seek repeated leadership terms more often than female leaders may partially explain the dearth of female directors.

We also examined gender balance on the international selection panel for research centre awards. In 2006 and 2011, the panels were all male but in 2016, 20% (2/10) of panel members were women. However, we could not investigate the possible effects of this change empirically or draw conclusive inferences from previous studies. Whereas some studies reported gender bias in peer review,<sup>9</sup> others found no association between the applicant's gender and the reviewers' gender.<sup>10</sup> One natural experiment suggested that gender equity in funding could be increased by focusing peer review on science rather than scientists.<sup>11</sup>

Although there could still be other unmeasured confounders such as structural changes in the number of centres and their research themes, our analysis suggests that the introduction of the Athena SWAN incentives contributed to the accelerated advancement of women to theme lead positions and gender equity gains in funding. Data from the 2021 funding round will help establish whether there is a causal link.

## Critical actors

Our analysis shows the salience of "critical actor" leaders over "critical mass" for initiating change towards more gender equitable research leadership. Critical mass theory predicted that once the proportion of female academics reached 30–35%, changes in the sociocultural environment would trigger an increase in women's leadership. However, recent research suggests that the promise of critical mass should be abandoned in favour of critical actors—"women and men, who individually and collectively have the commitment and power to create gender equitable cultures."<sup>12</sup>

Sally Davies and NIHR were collective critical actors in introducing the Athena SWAN funding incentives, which were associated with important changes in NIHR funded research. Likewise, many committed leaders and the major national funders and science organisations acted collectively to lead the adoption of Athena SWAN principles globally.

Athena SWAN requires time to affect the numbers of female scientists because it seeks structural and cultural changes for all faculty and staff.<sup>13</sup> Although Athena SWAN has been shown to be effective in challenging discrimination and bias, improving women's visibility and leadership skills, and initiating structural and cultural changes,<sup>14–17</sup> it has limitations in tackling longstanding tenure, power, and pay imbalances in the short term.<sup>18–19</sup> Unintended consequences have also been reported with the project, such as perceptions of administrative burden,<sup>20</sup> women undertaking a disproportionate amount of work,<sup>21</sup> and gender taking priority over race and class.<sup>22</sup>

Effective implementation of Athena SWAN seems to require sufficient commitment, time, resources, and professional expertise. The rise in women's research leadership in NIHR funded centres contrasts with previous research in 35 medical schools that showed no changes in gender balance among faculty two years after the introduction of the funding incentives.<sup>18</sup> NIHR funded centres had more favourable conditions and sufficient time to implement four year action plans. The linkage of Athena SWAN to the £816m funding scheme incentivised universities to commit time of leaders, faculty, and staff, invest internal resources, and employ equality and diversity professionals to implement action plans in friendly competition with their peers.<sup>13 15</sup>

## Realising the benefits of gender equity

The case for advancing gender equity in research is compelling. Equitable participation of all genders in research is imperative to social progress and legitimisation of public support for science.<sup>23</sup> Drawing on the talents of all genders is also necessary for increasing the sustainability of the scientific workforce.<sup>3</sup> Evidence suggests that gender diversity in groups is associated with greater problem solving<sup>24</sup> and higher quality research.<sup>25</sup> A gender equitable scientific workforce can therefore enhance the quality of science. As women pursue collaboration and interdisciplinary research more often than men,<sup>26 27</sup> gender equity can also improve team science. Moreover, health research led by women more often investigates sex and gender related variables than does research led by men.<sup>28 29</sup> Gender equity in research leadership can therefore increase the scientific rigour and relevance of health research to women's health.

Funders can advance gender equity in research through policy interventions and funding incentives. For example, the US National Institutes of Health championed inclusion of women and minority groups in clinical trials as research beneficiaries.<sup>30</sup> The Canadian Institutes of Health Research led the world in integrating sex and gender in research as variables to reduce sex and gender bias among research beneficiaries.<sup>30</sup> From 2021, the European Commission will require all public bodies applying to Horizon Europe—the European flagship €81bn research and innovation funding programme—to have gender equality action plans.<sup>31</sup> More funders should assume the role of critical actor in trialling policy interventions and funding incentives for gender equity.

## Evaluating interventions and incentives

Given the compelling case for gender equity and a lack of conclusive evidence on what works, for whom, and in what circumstances, we recommend evaluating the effect of Athena SWAN longitudinally using quasi-experimental designs, investigating any rare or unintended consequences, and testing its efficacy for other dimensions of diversity and inclusion. NIHR should consider the pros and cons of term limits for research leaders: refreshing leadership, encouraging innovation, and increasing diversity versus introducing disruption and inhibiting the development of expertise.<sup>32</sup> Finally, NIHR can experiment with the gender composition of interview panels for research centre funding and facilitate evaluation by including in non-blind applications leaders' gender and previous leadership terms.

### Key messages

- Gender equity in research can contribute to social progress, scientific workforce sustainability, and the quality of science
- Research funders can be critical actors in advancing gender equity through policy interventions and funding incentives

- Linking NIHR funding to Athena SWAN gender equality action plans has been associated with a rise in the number of women in mid-level leadership positions and the proportion of funding going to women
- More research funders should trial policy interventions and funding incentives for women in science and evaluate their effect

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- 1 Spokes Symonds A. *Also-rans: the injustice of history*. Robert Boyd Publications, 2014.
- 2 Dorothy Hodgkin: The only British woman to win a Nobel science prize gets a doodle. *Guardian* 2014 May 12. <https://www.theguardian.com/technology/2014/may/12/google-doodle-honours-biochemist-dorothy-hodgkin>.
- 3 House of Commons Science and Technology Committee. Women in scientific careers. Sixth report of session 2013-14. 2014. <https://publications.parliament.uk/pa/cm201314/cmselect/cm-scitech/701/701.pdf>.
- 4 Equality Challenge Unit. Athena SWAN charter awards handbook. 2015. <https://www.ecu.ac.uk/wp-content/uploads/2015/05/ECU-Handbook-26.05.15-FINAL.pdf>.
- 5 Soderquest K, Lord GM. Strategies for translational research in the United Kingdom. *Sci Transl Med* 2010;2:53cm28. doi: 10.1126/scitranslmed.3001129 pmid: 20944087
- 6 Gunashekar S, Wooding S, Guthrie S. How do NIHR peer review panels use bibliometric information to support their decisions? *Scientometrics* 2017;112:1813-35. doi: 10.1007/s11192-017-2417-8 pmid: 28804180
- 7 National Institute for Health Research. NIHR responds to the Government's call for further reduction in bureaucracy with new measures. 2020. <https://www.nihr.ac.uk/news/nihr-responds-to-the-governments-call-for-further-reduction-in-bureaucracy-with-new-measures/25633>.
- 8 Edmunds LD, Ovseiko PV, Shepperd S, et al. Why do women choose or reject careers in academic medicine? A narrative review of empirical evidence. *Lancet* 2016;388:2948-58. doi: 10.1016/S0140-6736(15)01091-0 pmid: 27105721
- 9 Wennerås C, Wold A. Nepotism and sexism in peer-review. *Nature* 1997;387:341-3. doi: 10.1038/387341a0 pmid: 9163412
- 10 Mutz R, Bornmann L, Daniel HD. Does gender matter in grant peer review?: an empirical investigation using the example of the Austrian Science Fund. *Z Psychol* 2012;220:121-9. doi: 10.1027/2151-2604/a000103 pmid: 23480982
- 11 Witterman HO, Hendricks M, Straus S, Tannenbaum C. Are gender gaps due to evaluations of the applicant or the science? A natural experiment at a national funding agency. *Lancet* 2019;393:531-40. doi: 10.1016/S0140-6736(18)32611-4 pmid: 30739688
- 12 Helitzer DL, Newbill SL, Cardinali G, Morahan PS, Chang S, Magrane D. Changing the culture of academic medicine: critical mass or critical actors? *Women's Health (Larchmt)* 2017;26:540-8. doi: 10.1089/jwh.2016.6019 pmid: 28092473
- 13 Kalpazidou Schmidt E, Ovseiko PV, Henderson LR, Kiparoglou V. Understanding the Athena SWAN award scheme for gender equality as a complex social intervention in a complex system: analysis of Silver award action plans in a comparative European perspective. *Health Res Policy Syst* 2020;18:19. doi: 10.1186/s12961-020-0527-x pmid: 32059678
- 14 Ovseiko PV, Chapple A, Edmunds LD, Ziebland S. Advancing gender equality through the Athena SWAN charter for women in science: an exploratory study of women's and men's perceptions. *Health Res Policy Syst* 2017;15:12. doi: 10.1186/s12961-017-0177-9 pmid: 28222735
- 15 Ovseiko PV, Pololi LH, Edmunds LD, et al. Creating a more supportive and inclusive university culture: a mixed-methods interdisciplinary comparative analysis of medical and social sciences at the University of Oxford. *Interdiscip Sci Rev* 2019;44:166-91doi: 10.1080/03080188.2019.1603880 .
- 16 Graves A, Rowell A, Hunsicker E. An Impact Evaluation of the Athena SWAN Charter. 2019. <https://www.ecu.ac.uk/wp-content/uploads/2019/08/Athena-SWAN-Impact-Evaluation-2019.pdf>.
- 17 Xiao Y, Pinkney E, Au TKF, Yip PSF. Athena SWAN and gender diversity: a UK-based retrospective cohort study. *BMJ Open* 2020;10:e032915. doi: 10.1136/bmjopen-2019-032915 pmid: 32051310
- 18 Gregory-Smith I. Positive action towards gender equality: evidence from the Athena SWAN charter in UK medical schools. *Br J Ind Relat* 2018;56:463-83doi: 10.1111/bjir.12252

- 19 Rosser SV, Barnard S, Carnes M, Munir F. Athena SWAN and ADVANCE: effectiveness and lessons learned. *Lancet* 2019;393:604-8. doi: 10.1016/S0140-6736(18)33213-6 pmid: 30739697
- 20 Tzanakou C. Unintended consequences of gender-equality plans. *Nature* 2019;570:277. doi: 10.1038/d41586-019-01904-1 pmid: 31213693
- 21 Caffrey L, Wyatt D, Fudge N, Mattingley H, Williamson C, McKeivitt C. Gender equity programmes in academic medicine: a realist evaluation approach to Athena SWAN processes. *BMJ Open* 2016;6:e012090. doi: 10.1136/bmjopen-2016-012090 pmid: 27609850
- 22 Bhopal K, Henderson H. Competing inequalities: gender versus race in higher education institutions in the UK. *Educ Rev* 2019;1-17. doi: 10.1080/00131911.2019.1642305
- 23 Fine C, Sojo V. Women's value: beyond the business case for diversity and inclusion. *Lancet* 2019;393:515-6. doi: 10.1016/S0140-6736(19)30165-5 pmid: 30739677
- 24 Hong L, Page SE. Groups of diverse problem solvers can outperform groups of high-ability problem solvers. *Proc Natl Acad Sci U S A* 2004;101:16385-9. doi: 10.1073/pnas.0403723101 pmid: 15534225
- 25 Campbell LG, Mehtani S, Dozier ME, Rinehart J. Gender-heterogeneous working groups produce higher quality science. *PLoS One* 2013;8:e79147. doi: 10.1371/journal.pone.0079147 pmid: 24205372
- 26 Smith-Doerr L. *Women's work: gender equality vs. hierarchy in the life sciences*. Lynne Rienner, 2004.
- 27 van Rijnsoever FJ, Hessels LK. Factors associated with disciplinary and interdisciplinary research collaboration. *Res Policy* 2011;40:463-72. doi: 10.1016/j.respol.2010.11.001
- 28 Nielsen MW, Andersen JP, Schiebinger L, Schneider JW. One and a half million medical papers reveal a link between author gender and attention to gender and sex analysis. *Nat Hum Behav* 2017;1:791-6. doi: 10.1038/s41562-017-0235-x pmid: 31024130
- 29 Sugimoto CR, Ahn Y-Y, Smith E, Macaluso B, Larivière V. Factors affecting sex-related reporting in medical research: a cross-disciplinary bibliometric analysis. *Lancet* 2019;393:550-9. doi: 10.1016/S0140-6736(18)32995-7 pmid: 30739690
- 30 Heidari S, Babor TF, De Castro P, Tort S, Curno M. Sex and gender equity in research: rationale for the SAGER guidelines and recommended use. *Res Integr Peer Rev* 2016;1:2. doi: 10.1186/s41073-016-0007-6 pmid: 29451543
- 31 Kalpazidou Schmidt E, Ovseiko PV. Link Horizon Europe funding to real steps to gender equality. *Nature* 2020;584:525. doi: 10.1038/d41586-020-02430-1 pmid: 32814915
- 32 Austin JP. Is academic medicine ready for term limits? *Acad Med* 2020;95:180-3. doi: 10.1097/ACM.0000000000003020 pmid: 31577584