



Gender disparity in neurosurgery: A multinational survey on gender-related career satisfaction



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ARTICLE INFO

Keywords:

Neurosurgery

Women

Female

Gender

Career satisfaction

ABSTRACT

Introduction: Women continue to be underrepresented in the majority of surgical specialties, including neurosurgery.

Research question: In this multinational survey, we aimed to assess current gender disparities in neurosurgery focusing on job satisfaction and inequity/discrimination at work.

Material and methods: Female and male members of the European Association of Neurosurgical Societies were asked to complete an electronic survey (Google Forms, Mountain View) containing demographic baseline data and questions on attitudes regarding gender disparity, personal experience with gender inequity and career satisfaction/work-life balance. Quantitative analyses were performed to analyse the responses, including summary and comparative statistics.

Results: We received 168 responses from 40 different countries. Survey responders had a mean age of 40.8 ± 11.5 years; 29.8% were female. There were significant more male than female residents and attending surgeons per department. Eighty-eight percent of female and 38.1% of male responders experienced gender inequity or discrimination at work (adjusted OR 10.8, 95%CI 4.2–27.8, $p < 0.001$). Female neurosurgeons were more likely to be discriminated by colleagues (aOR 4.32, 95%CI 2.1–9.1, $p < 0.001$) and by patients/relatives (aOR 3.65, 95%CI 1.77–7.54, $p < 0.001$). There was a trend towards lower job satisfaction ($p = 0.012$), less satisfaction with career goals ($p = 0.035$) and worse work-life balance ($p = 0.0021$) in female surgeons.

Discussion and conclusion: This survey underlines that a significant proportion of neurosurgeons – in particular females – continue to experience gender inequity & discrimination at work, which may translate into lower work-related satisfaction. A better understanding of the gender-related aspects of job satisfaction is an important step to improving gender equity in our profession.

1. Introduction

Despite a marked increase in female medical students worldwide, neurosurgery remains one of the specialties with the lowest proportions of female faculty along with urology and orthopaedic surgery (Bennett et al., 2020; Odell et al., 2010; Balasubramanian et al., 2020; Junior et al., 2021). A recent study from the US predicted that a gender parity in surgical specialties is still decades away if it continues to evolve at the current pace (Bennett et al., 2020). Multiple barriers have been described for females entering the neurosurgical field, particularly academic

neurosurgery (Spetzler, 2011; Odell et al., 2010; Balasubramanian et al., 2020). These include the lack of successful female role models as well as a fear of gender discrimination and problems in balancing their personal and professional life (Lulla et al., 2021). In the US and Canada, the proportion of female neurosurgeons was reported steady from residency to academic staff positions, however, there was a significant decrease in the number of women holding full professorships when compared with their male colleagues (Odell et al., 2010). Similar findings were reported from Germany, where only 6.3% of chairman positions and 2.4% of vice-chairman positions are currently appointed to women (Forster et al.,

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<https://doi.org/10.1016/j.bas.2022.100890>

Received 7 February 2022; Received in revised form 2 April 2022; Accepted 20 April 2022

Available online 6 May 2022

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2021). These findings are in line with a recently published paper on the number of women on editorial boards of neurosurgery journals, where – similarly – women were significantly less represented (Bauman et al., 2021).

Although there is a growing body of literature analysing the proportion of women in different fields and positions in neurosurgery, to date there is a paucity of studies involving both men and women investigating aspects of gender inequality at the workplace and career satisfaction in neurosurgery. A better understanding of the environment both women and men face, as well as of any potential career barriers preventing gender parity in neurosurgeons is needed to recruit and promote individuals of both sexes equally in our profession.

In this multinational study, we aimed to assess current gender disparities in neurosurgery, focusing on job satisfaction and work environment. Both female and male neurosurgeons were included to draw a holistic picture of gender-related aspects in neurosurgery to date.

2. Methods

Members of the European Association of Neurosurgical Societies (EANS) across all age groups were invited by the EANS office to complete the survey via email invitation, which was sent out on 27 November 2018. A web-based survey platform was utilized to collect responses (Google Forms, Google, Mountain View, CA (USA)). Participants were asked to complete a 31-question survey on demographics, surgical education, career goals and satisfaction as well as gender disparities. The questionnaire can be found as Appendix to this article (**Supplemental material**).

We employed binomial and multiple-choice questions as well as five-point scale questions (e.g. rate your career satisfaction on a scale from 1 to 5, higher numbers indicating greater satisfaction). Participation in the survey was voluntary, anonymous, and no compensation was provided. No further participant data was collected. Formal approval by an institutional review board and patient consent was not required for this type of study.

Quantitative analyses were performed to analyse the responses from the study questionnaires after exporting the data from Google Forms to Microsoft Excel 2016 (Microsoft Corporation, Redmond, WA, USA) and importing the data into the statistics software. Stata (v14.2; StataCorp, College Station, TX) for Mac was used for the statistical analysis. Data are presented as mean and standard deviation, as median and interquartile range (IQR), as well as absolute frequencies and percentages. Variables were analysed using student's t-tests, Fisher's exact test or analysis of variance (ANOVA), as appropriate. Logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs). Female survey responders were about nine years younger (43.6 vs. 34.4 years, $p < 0.001$), which is why logistic regression analyses (and adjusted odds ratios (aORs) were expressed) and multivariate analyses of variance (MANOVA) were adjusted for the age variable. With Bonferroni adjustment for multiple testing (11 statistical tests) p-values of ≤ 0.0045 were considered to be statistically significant (0.05 (two-tailed)/11).

3. Results

3.1. Survey responders

Out of 1642 EANS members asked to participate in our study, 168 returned the complete anonymous questionnaire (response rate 10.23%) and were considered for the analysis.

Demographic characteristics of the study cohort are summarized in Table 1. Survey participants worked in 40 different countries and on five different continents. They had a mean age of 40.8 ± 11.5 years (range 25–75 years), 50 (29.8%) were female and about two thirds were board-certified in neurosurgery. The majority of participants worked in Europe (82.1%), mostly in Germany (24%), Switzerland (21%) and Italy (12%) (Supplemental Fig. 1).

Table 1

Demographic characteristics of the study cohort are summarized. Results are expressed as mean (SD) or count (percent).

Age in years	40.8 (11.6)
Sex	
Male	50 (29.8%)
Female	118 (70.2%)
Civil status	
Single	32 (19.0%)
Married	103 (61.3%)
Other relationship	31 (18.5%)
Divorced	2 (1.2%)
Raising children	
No	79 (47.0%)
Yes	89 (53.0%)
Continent of residence	
Europe	138 (82.1%)
Australasia	13 (7.7%)
Africa	8 (4.8%)
North America	4 (2.4%)
South America	5 (3.0%)
Board-certified in neurosurgery	
No	50 (29.8%)
Yes	118 (70.2%)
Career level	
Attending neurosurgeon	115 (68.5%)
Resident in neurosurgery	53 (31.5%)
Postgraduate year (of residents)	
PGY 1–2	16 (30.2%)
PGY 3–4	15 (28.3%)
PGY 5–6	18 (34.0%)
> PGY 6	4 (7.5%)
	n = 168 (100%)

Overall, participants indicated a greater number of male residents (4.89 ± 3.17 vs. 2.38 ± 2.31 ; Fig. 1) and male attending surgeons (7.24 ± 2.55 vs. 1.83 ± 1.90 ; Fig. 2) in their neurosurgical departments.

3.2. Attitudes with regard to gender disparity

3.2.1. Question 1: all people are equal, and gender does not matter

75% of responders (58% of females and 82.2% of males, $p < 0.001$) believed that the gender of a neurosurgeon did not matter.

3.2.2. Question 2: who makes better leaders?

74% of female and 72% of male responders considered men and women equally good as leaders. 16% of female and 24.6% of men responders suggested that men were better leaders, and 10% of female and 3.4% of male responders suggested that women were better leaders ($p = 0.132$).

3.2.3. Question 3: who makes better surgeons?

90% of female and 72.9% of male responders stated that men and women are equally skilled surgeons. 2% of female and 27.1% of male responders stated that men make better surgeons, and 8% of female and none of the male responders stated that women make better surgeons ($p < 0.001$).

3.2.4. Question 4: who makes better teachers?

78% of female and 82.2% of male responders considered men and women equally good as teachers. 8% of female and 13.6% of male responders stated that men make better teachers, and 14% of female and 4.2% of male responders stated that women make better teachers ($p = 0.059$).

3.2.5. Question 5: who has better bedside manners and empathy

58% of female and 69.5% of male responders considered men and women to have equally good bedside manners and empathy. None of the female and 5.9% of the male responders stated men were superior, and

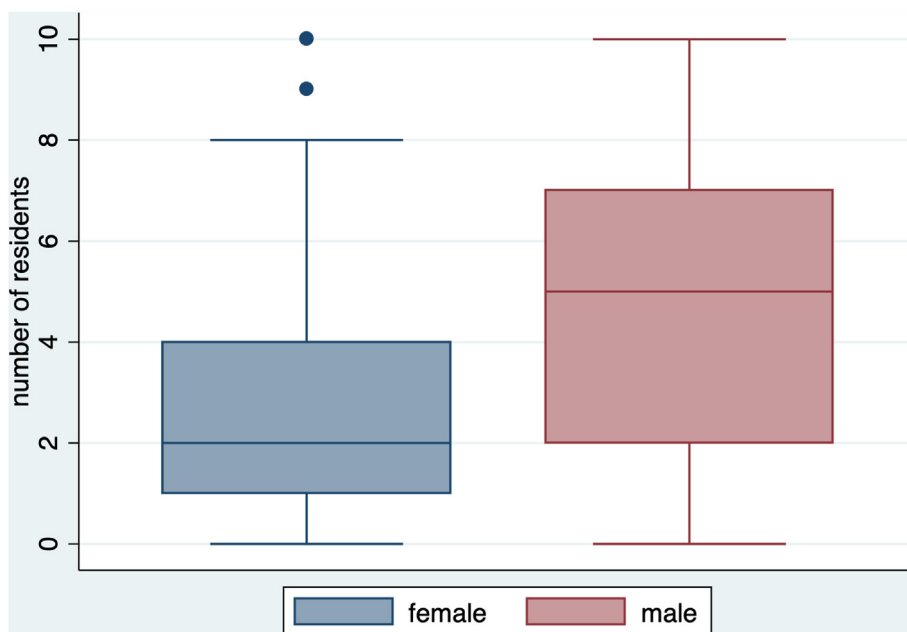


Fig. 1. Number of female (blue) and male (red) residents per neurosurgical department. The box plots display the median with the 25th–75th percentile (box), the upper and lower adjacent values (whiskers) and outliers (dots). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

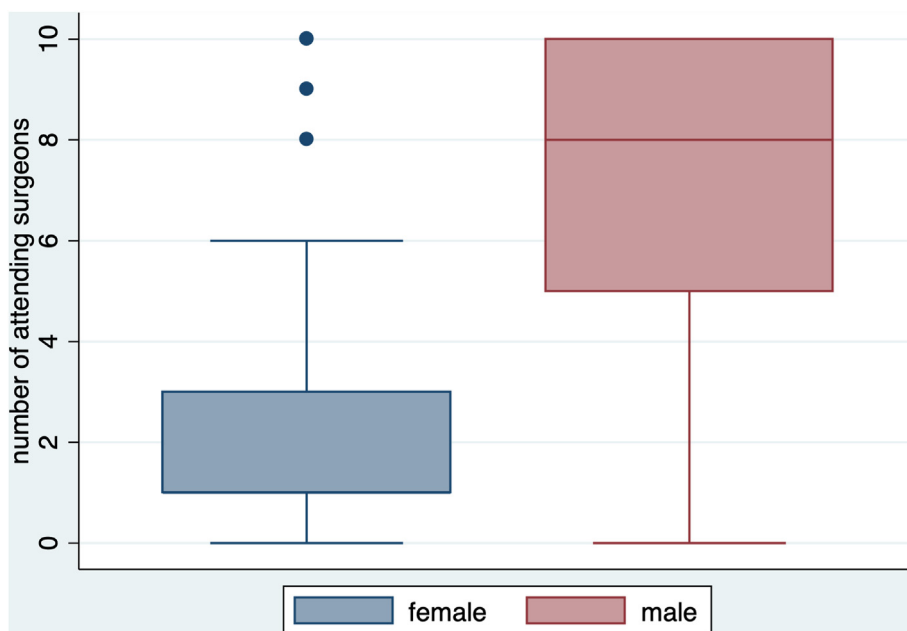


Fig. 2. Number of female (blue) and male (red) attendings per neurosurgical department. The box plots display the median with the 25th–75th percentile (box), the upper and lower adjacent values (whiskers) and outliers (dots). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

42% of females and 24.6% of male responders stated women were superior in this regard ($p=0.027$).

3.3. Personal experience with gender inequity/discrimination

3.3.1. Question 6: have you ever experienced gender inequity/gender discrimination?

88% of female and 38.1% of male responders reported to have experienced gender inequity and/or gender discrimination at some point at their workplace (OR 11.9, 95% CI 4.70–30.16, $p<0.001$). The result

remained stable after adjustment for the age of the survey participants (aOR 10.8, 95% CI 4.2–27.8, $p<0.001$). Sources of discrimination were cited as “patients and relatives” (35.1%), followed by “other physicians” (32.7%), “boss/superior” (27.4%), “operating room (OR) personnel” (21.4%) and “nursing staff” (19.6%) by both gender (Fig. 3). Female neurosurgeons were 4.3 times as likely to be discriminated by colleagues (aOR 4.32, 95% CI 2.1–9.1, $p<0.001$), 3.6 times as likely to be discriminated by patients/relatives (aOR 3.65, 95% CI 1.77–7.54, $p<0.001$) or the OR personnel (aOR 3.62, 95% CI 1.61–8.16, $p=0.002$), 2.8 times as likely to be discriminated by the boss/superior (aOR 2.82,

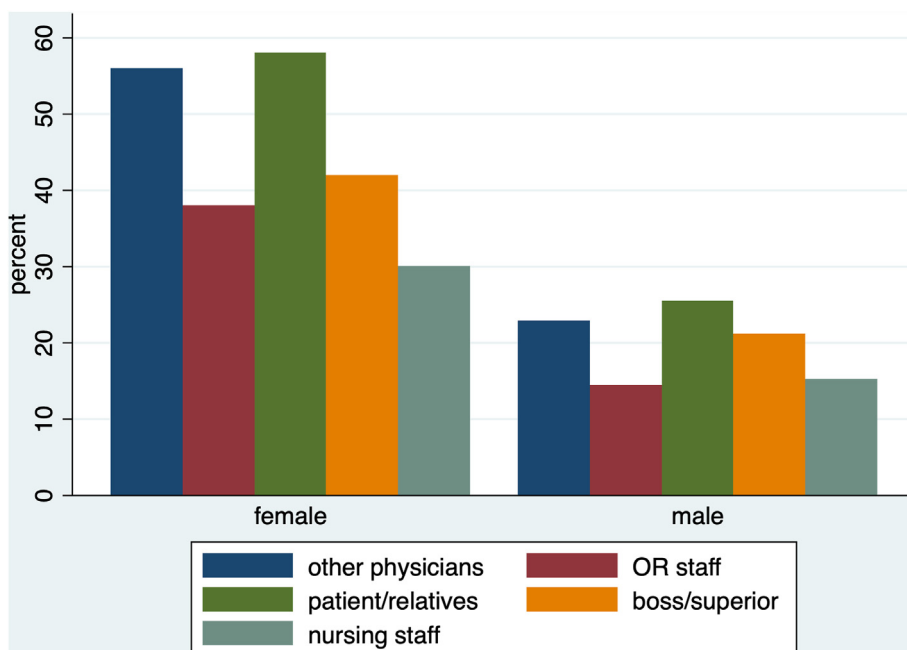


Fig. 3. The sources of discrimination and their frequency in percent are illustrated for neurosurgeons of both sexes separately.

95% CI 1.32–6.00, $p=0.007$) and about twice as likely to be discriminated by the nursing staff (aOR 2.29, 95% CI 1.00–5.24, $p=0.049$).

3.3.2. Question 7: do you think you need to work harder than a male/female colleague to achieve the same goal?

78% of female and 20.3% of male responders reported that they feel like they have to work harder than their male/female colleagues to achieve the same recognition at their work (aOR 12.4, 95% CI 5.4–28.2, $p<0.001$).

3.3.3. Question 8: do you think that you have to be less friendly and more serious than male/female colleagues to appear more professional?

44% of female and 8.5% of male responders stated that they believe they have to be less friendly in order to be taken seriously (aOR 6.2, 95% CI 2.5–15.0, $p<0.001$).

3.4. Career satisfaction and work-life balance

3.4.1. Question 9: on a scale of 1–5, how happy are you at work? (1: low score. 5: best score)

Female neurosurgeons indicated a lower job satisfaction than male

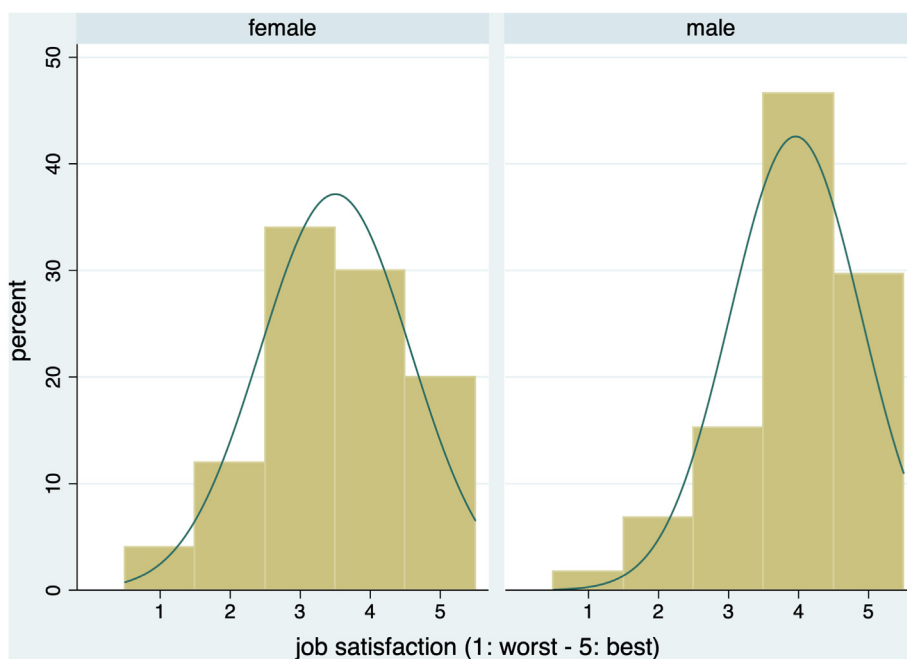


Fig. 4. Job satisfaction – as ranked on a scale from 1 to 5 – of female and male neurosurgeons is graphically illustrated, with higher numbers indicating greater satisfaction. The categories are expressed in frequency (percent) and normal curves are drawn. Female neurosurgeons indicated lower job satisfaction than male surgeons (median, IQR 3.5 (1) vs. 4.0 (1), $p=0.003$).

surgeons (median, IQR 3.5 (1) vs. 4.0 (1), $p=0.003$), which fell short on significance after adjustment for participant age (MANOVA $p=0.012$; Fig. 4) and considering the level of significance, corrected after Bonferroni.

3.4.2. Question 10: on a scale of 1–5, how satisfied are you with your professional goals? (1: low score. 5: best score)

Female neurosurgeons indicated a trend towards less satisfaction with their career goals than male neurosurgeons (median, IQR 4.0 (2) vs. 4.0 (1), $p=0.033$), which remained insignificant after adjustment for participant age (MANOVA $p=0.035$).

3.4.3. Question 11: on a scale of 1–5, how would you rate your work-life balance? (1: low score. 5: best score)

Female neurosurgeons indicated a trend towards worse work-life balance than male neurosurgeons (median, IQR 3.0 (2) vs. 3.0 (1), $p=0.031$), which remained insignificant after adjustment for participant age (MANOVA $p=0.021$).

4. Discussion

In this survey-based study, we set out to assess the status quo of gender-related aspects of neurosurgery from the viewpoint of both male and female EANS members. Receiving 168 responses, including 50 (29.8%) from females, we were able to describe the current attitudes regarding gender disparity, provide quantitative data on personal experience with gender inequity/discrimination and describe career satisfaction and work-life balance in this sample of neurosurgeons and trainees. Several striking results emerged, which are discussed in the respective paragraphs below.

4.1. Attitudes regarding gender disparity

The first five questions addressed attitudes of neurosurgeons regarding equity in general, leadership, qualities as surgeon or teacher, as well as bedside manners. The results indicate that about 25% more female than male respondents consider sex differences as relevant ($p<0.001$). The opinions about leadership ($p=0.132$) and teaching skills ($p=0.059$) were balanced between both sex; about 3–4 out of five surveyed neurosurgeons indicated equipoise. The opinions about skills as surgeons differed between both sex ($p<0.001$). While the vast majority of females (90%) stated both sexes were similarly skilled as surgeons, the remainder was convinced that females are better surgeons. This confidence in the same sex is even more pronounced in surveyed male neurosurgeons, with approximately a quarter of respondents. Only a negligibly small percentage considers the opposite sex as better surgeon. The quality of bedside manners and empathy was considered similar by 60–70%; most of the remaining neurosurgeons agreed that women were superior in this regard ($p=0.027$). While these questions only surveyed attitudes and do not necessarily have to represent the truth, the results are interesting and shed light on opinions present in male and female neurosurgeons today. The attitudes regarding gender disparity in neurosurgeons have not been assessed in a representative sample, prior to this study.

4.2. Personal experience with gender inequity/discrimination

The (neuro)surgical profession has traditionally been a male-dominated field and its longstanding gender disparity has resulted in deeply rooted structural barriers that seem to continue to prevent equal opportunities for female and male surgeons and may foster discrimination (De Simone and Scano, 2018). In fact, we noted an extremely high proportion of females (88%) that experience gender-based discrimination at work. Albeit being too high as well, the rate in males was comparably lower (38%). Interestingly, results from a recently published survey investigating career satisfaction in female general surgeons from

Germany reported a lower rate (52.8%) of perceived gender discrimination (Radunz et al., 2020), suggesting that this topic remains a relevant problem in various surgical fields, including prominently neurosurgery. In line with these results, a systematic review on female neurosurgeons worldwide identified discrimination as the 4th most common aspect contributing to gender differences, after the lack of mentoring, lifestyle issues and the glass ceiling effect, referring to unequal opportunities for women in the workplace with inhibition of their professional advancement (Lulla et al., 2021). The main source of discrimination according to our survey were “patients and relatives”, suggesting that there is still a systemic bias towards female surgeons in this historically male-dominated profession. Moreover, a frequently encountered stereotype in surgery asserts that female surgeons are less suited for the demanding and technical manual workload (Lim et al., 2021). In our study, almost half of the female (44%) and only 8.5% of male neurosurgeons stated that they felt like they had to be less friendly than their opposite sex colleagues in order to be taken seriously. Female neurosurgery residents in particular, but also young attendings are not uncommonly addressed as nurses and tend to be trusted less than their male colleagues. In our study, colleagues were identified as the second most common source of discrimination. Although this was not further specified in our survey, prior studies have agreeingly reported on several aspects that female surgeons frequently face at work, including harassment and lower levels of respect (Lulla et al., 2021). As a consequence, it is unsurprising that female neurosurgeons were about 12 times as likely as male neurosurgeons to feel like they have to work harder than their opposite sex colleagues to achieve the same recognition at work (aOR 12.4, 95% CI 5.4–28.2, $p<0.001$).

4.3. Career satisfaction and work-life balance

It goes without saying that discrimination, lack of recognition and inequity in personal and career development have negative consequences that may include depression burnout and, by itself or by the consequences, lead to lower job performance. Our survey found that female neurosurgeons indicated lower satisfaction with their job ($p=0.003$), with their career goals ($p=0.033$), and with their work-life balance compared to male neurosurgeons ($p=0.031$), and these findings remained stable after adjustment for the participant's age. Prior EANS surveys on 532 neurosurgical residents found that female trainees tended to feel less well trained and confident to work independently (OR 0.66, 95% CI 0.42–1.03; $p=0.070$), while having significant higher odds for future career anxieties (OR 2.01, 95% CI 1.23–3.28; $p=0.005$) (Stienen et al., 2016). Even though these are subjective impressions, recent objective data underscores a tendency for European female residents to perform less cases during training (Stienen et al., 2020). These inequities may result in asymmetric career development, with less females intending to pursue an academic career at university centers (OR 0.61, 95% CI 0.40–0.92; $p=0.019$) and favouring certain subspecialties (e.g. paediatric neurosurgery) while avoiding others (e.g. spine) as evident in previous surveys (Stienen et al., 2016). The proportion of neurosurgical trainees in neurosurgery has increased in both Europe and the US (Stienen et al., 2020; Renfrow et al., 2016), while the attrition rate of female residents of 17% remains significantly higher than the one of male residents (5.3%) in the US. (Renfrow et al., 2016) To date, there is no data available to estimate the attrition rate of female residents and the proportion of practicing female neurosurgeons in Europe, but it can be assumed that similar to the US, women are still underrepresented in neurosurgery, especially in (higher) academic positions.

4.4. Perceived vs. actual quality of care of female neurosurgeons

In contrast to the stereotype and outdated perception of some patients and even employees in the health care field, studies for general surgery found that female surgeons have complication rates and outcomes that similar or even slightly superior compared to those of their male

colleagues (Wallis et al., 2017; Sharoky et al., 2018). A systematic review by Shi et al. regarding women in neurosurgery around the world was in line with these findings. The authors proposed solutions that are essential for successful career development in particular to advance women in neurosurgery, including but not limited to professional advancement, maternity leave and policies promoting work-life balance, increasing visibility of women in neurosurgery and increasing mentorship accessibility (Shi et al., 2021). Moreover, with the increasing recognition of the unique professional traits of female surgeons, there is progress towards the recognition of valuable attributes women provide to this profession (Zanon et al., 2021; Habibi et al., 2021; Drummond et al., 2021). As a prominent and outstanding example, Women In NeuroSurgery (WINS) was created in 1989 with the intention to educate, inspire and encourage female neurosurgeons globally and support this transition. There is a growing body of literature about the history and achievements of female leaders in neurosurgery, which is encouraging and shows increasing interest in the matter. The “Progress in neurosurgery: Contributions of women in neurosurgery” series and the “European women in neurosurgery” series by Gail Rousseau are to be mentioned in this regard (Hernández-Durán et al., 2021; Murphy et al., 2021). Hopefully in the future, these perceptions will be shared by both the public and other healthcare professionals, recognizing that the diverse field of neurosurgery requires a diverse set of team players to continue to strive towards professional perfection. The recruitment and retention of women in neurosurgery should be regularly assessed, as female surgeons offer valuable attributes, including the physician-patient communication and intellectual expertise.

4.5. The situation of male neurosurgeons

Altogether, the situation of male neurosurgeons appeared more favourable than the situation of female surgeons, based on our survey results. However, still a third of the male responders also stated to have experienced gender disparity. There may be numerous reasons for such a result, but it might even be indicative of recent developments where females are actively promoted. There are, e.g., growing numbers of job advertisements stating that “in case of equal qualifications, women are preferentially employed”, as well as grants or sponsorships that are specifically addressed to women in the field. The currently ongoing transition process leading to more equity in training and work must continue to be monitored closely to ensure favourable conditions for both sexes alike.

4.6. Strengths, limitations and future directions

We consider the survey representative for European neurosurgery, as we obtained complete responses from both male and female neurosurgeons of different age, working in 40 countries and hence representing many attitudes and levels of surgical expertise. Most prior studies focusing on gender-issues in the surgical field questioned exclusively women, hereby ignoring the fact that these can affect individuals of both sexes and preventing from comparative analyses. Moreover, we applied a conservative statistical approach, adjusting for multiple testing with the Bonferroni method to avoid type-1 errors.

The most important weakness of this study is the relatively low overall response rate of only 10.23% of the invited EANS members. Moreover, more than half of the questionnaires were completed by neurosurgeons from Germany (24%), Switzerland (21%) and Italy (12%), thus may not reflect conditions equally well in other European countries. More responses from neurosurgeons across Europe would have allowed for country-specific analyses, which we desisted from performing due to the limited response rate. Additionally, inherently to the design of voluntary survey studies, individuals directly affected by the topic are more likely to participate. There were also few responses from non-European countries, which was inevitable considering that only registered EANS members were addressed via email.

Accordingly, although many issues raised by this paper have been described by groups from other regions alike, it is unclear, whether the results from this survey can be generalized to regions outside of Europe. Importantly, although our results may suggest an association between gender-based discrimination at the work-place with overall job satisfaction, further data would be necessary to evaluate a causal relationship between these parameters.

We believe that within the described limitations, this survey can serve as a basis for future research on this topic with the ultimate goal of providing an evidence-based, data-driven foundation that is needed to address remaining areas of inequity. This survey was sent out in 2018, thus some aspects may have changed in the past four years. For this purpose, we plan to conduct a follow-up survey using an updated version of the well-designed questionnaire on gender-based discrimination first described by Bruce et al. (2015) (Bruce et al., 2015). This survey will additionally include questions related to the specific type of discrimination experienced, including hiring, promotions, salary and work assignments. These aspects were not addressed in the current survey and would allow for a better understanding of our work environment and point our areas for improvements.

5. Conclusion

This survey underlines that a significant proportion of neurosurgeons – and in particular females – continue to experience gender inequity and discrimination at work, which may translate into lower work-related satisfaction. A better understanding of the gender-related aspects of job satisfaction is an important step to improving gender equity in our profession.

Competing interests

The authors have no relevant financial or non-financial interests to disclose.

Authors contributions

All authors contributed to the study conception, data collection and design. Material preparation and analysis were performed by Lima Sprenger, Karima Tizi, and Martin Stienen. The first draft of the manuscript was written by Anna Zeitlberger and Nalla Silva Baticam. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding

The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

Availability of data and material

The data is available upon reasonable request by the corresponding author.

Ethics approval

No institutional review board approval is required for this survey-based study.

Consent to participate

Not applicable.

Declaration of competing interest

The authors declare that they have no known competing financial

interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.bas.2022.100890>.

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