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Non-technical skills for neurosurgeons: An international survey

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ABSTRACT

Introduction: Neurosurgery is considered a technically demanding specialty; nonetheless, it also requires non-technical skills (NTSs) to reach mastery.
Research question: This study seeks to understand how important NTSs are perceived by neurosurgeons across diverse roles and socio-economic backgrounds. The objective is to identify key NTSs and explore their role in surgical precision, teamwork, and collaboration.
Material and method: An international survey involving 372 neurosurgeons from various socio-economic and cultural contexts was conducted. The extensive sample and inclusive methodology provide a comprehensive perspective on the perceived importance of NTSs in neurosurgery.
Results: The survey results highlight the universal significance of NTSs among neurosurgeons. Attention to detail, humility, and self-awareness are considered essential for surgical precision, effective teamwork, and collaboration. The findings underscore the necessity for integrated training programs that combine NTSs with technical skills.
Discussion and conclusion: The study emphasizes the importance of effective training methods such as simulations, mentorship, and role-playing in equipping neurosurgeons to navigate the complexities of their profession. Future research should focus on optimizing teaching methods for NTSs, comparing traditional courses, online modules, and hybrid training programs. Addressing the global disparity in neurosurgical care, particularly in low- and middle-income countries, is crucial for improving patient outcomes worldwide.

1. Introduction

Neurosurgery is renowned for its demand for exceptional technical proficiency, yet beyond the surgical act lies a profound and often overlooked truth: the most distinguished neurosurgeons excel not just in technique, but also in critical non-technical skills (NTSs) that redefine surgical success and optimal patient care. Consider a neurosurgeon during a complex operation; the ability to communicate clearly with the surgical team, make strategic decisions under pressure, lead with confidence, and manage stress, all skills that extend beyond the gesture, are

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crucial. Furthermore, the importance of posing sensible clinical/surgical indications, having good manners, and communicating well with patients are often overlooked skills that are now recognized as game-changers in the high-stakes environment of neurosurgery (Cobianchi et al., 2022; Hénaux et al., 2019; Hull et al., 2013; Wood et al., 2017).

Recent research has ignited a revolution in neurosurgical training, highlighting the indispensable role of NTSs. Publications on this subject have surged, from a mere 55 articles in 2005 to an astounding 225 in 2022, reflecting a shift in medical education priorities. This surge underscores a growing acknowledgment that excelling in neurosurgery demands more than just technical expertise—it requires a holistic approach to training that includes the development of these critical -so called-soft skills.

This shift has been championed by the World Health Organization (WHO) and other leading medical institutions, who are now fervently advocating for the integration of NTSs training into medical curricula. The call is clear: modern medical practice must evolve to incorporate these skills as fundamental components of neurosurgical training. However, there remains a significant challenge: identifying which NTSs are most crucial and determining the best methods for their assessment and integration into neurosurgical practice.

Despite this growing consensus, the current frameworks remain inadequate. A review by Shlobin et al. (2021) highlighted essential soft skills/NTSs for neurosurgeons, but lacked practical implementation strategies. The European Association of Neurosurgical Societies (EANS) curriculum does not provide a structured approach to these skills, revealing a critical gap between the recognized importance of NTSs and their practical application in neurosurgery (Whitfield et al., 2023).

In this paper, we dive deep into the opinions of neurosurgeons across various stages of their careers, exploring their thoughts and beliefs on the impact of NTSs on surgical performance, both inside and outside the operating room (OR). Our survey aims to determine whether these skills are perceived as innate or teachable, evaluate their importance in the field, and identify which NTSs are deemed essential in contemporary neurosurgery. Moreover, we investigate effective strategies for teaching and acquiring these skills, aiming to propose actionable solutions to bridge the current educational gap.

We collected and analyzed responses from 372 participants (including neurosurgery residents, attending neurosurgeons, and department heads) across thirty countries. Our goal was to assess the implications for training and neurosurgical practice, exploring how tailored selection and training programs could foster a new generation of neurosurgeons who are adept in both technical and social skills.

2. Methodology

2.1. The questionnaire: creation and distribution

The questionnaire was formulated based on established standards and benchmarks from the ACGME, CanMEDS, EUMS, and GMC, as well as the World Federation of Neurosurgical Societies' Statement of Ethics in Neurosurgery, NOTSS, NOTECHS, OTAS evaluation scales, and relevant literature predominantly sourced from PubMed. Keywords used in the literature search included: "*non-technical skills, technical skills, surgeon, surgery, neurosurgery, communication, teamwork, cognitive skills, interpersonal skills, behavior, training, trainees, operating theatre*, and *teaching*". From the identified non-technical skills and behaviors in surgery and other medical disciplines, the most frequently cited and those deemed essential to surgical practice were selected.

The questionnaire was collaboratively developed with psychologists and designed to be completed in approximately 15 min. It comprised of 34 items - 26 with closed-ended questions and 8 open-ended questions to minimize response bias. The open-ended questions provided space for feedback on the closed questions and the survey. The closed-ended questions employed a modified four-point Likert scale, multiple-choice answers, or checkboxes for responses (see Supplementary Materials).

Prior to dissemination, the questionnaire underwent evaluation for content validity by neurosurgeons working at the Fondazione IRCCS Istituto Neurologico C. Besta (FINCB) and the past president of the EANS, Andreas Demetriades.

The survey was created using Google Forms and distributed to each head of department around the world. The initial invitation was sent in May 2021, and data collection concluded in June 2021. A total of 291 department heads were invited, asking them to involve at least one attending neurosurgeon and one resident from their department (meaning that we may have obtained at least three filled questionnaires from every participating center). The response rate was above 40%.

2.2. Participants and procedure

We collected data from 372 participants across 30 countries, including Albania, Algeria, Saudi Arabia, Argentina, Bangladesh, Belgium, Brazil (41 participants, 11%), Bulgaria, Canada, China, Denmark, Egypt, Finland, Germany, India (94 participants, 25.3%), Italy (84 participants, 22.6%), Korea, Morocco, Nepal, Pakistan (24 participants, 6.5%), Portugal, Republic of Kazakhstan, Romania, Russia, Serbia, Spain (64 participants, 17.2%), Switzerland, South Africa, the UK, and the USA (46 participants, 12.4%). Respondents included 105 residents (28.2%), 164 neurosurgeons (44.1%) and 103 heads of departments (27.7%).

The countries have been divided by economic wealth. According to The World Bank's 2021 financial data, low/low-middle-income countries are Albania, Algeria, Bangladesh, Egypt, India, Morocco, Nepal, Pakistan, Serbia. Upper-middle-income countries are Argentina, Brazil, China, Croatia, Kazakhstan, Mexico, Romania, Russia, South Africa. Finally, high-income countries are Austria, Belgium, Canada, Denmark, Finland, Germany, Italy, Japan, Norway, Spain, Switzerland, Portugal, UK, USA, Saudi Arabia, South Korea.

2.3. Data analysis

The questionnaire responses were analyzed both in aggregate and by subdividing the sample, as previously described. Data analysis was performed using R (version 4.3.2, 2023-12-1, R foundation for Statistical Computing) with the *dplyr*, the *dunn.test*, the *pheatmap* and the *ggplot2* packages.

Responses to the Likert scale questions regarding the importance of various qualities needed by a neurosurgeon were converted to numerical scores to facilitate analysis. Specifically, the Likert scale responses were assigned numerical values as follows:

- Not at all: 1
- A bit: 2
- A lot: 3
- Absolutely: 4

These numerical scores allowed us to create an ordinal scale for each response, with the highest value (4) representing the highest importance. Rankings were then determined based on the highest scores. This conversion enabled us to quantitatively analyze the data and rank the various qualities effectively.

We employed non-parametric tests such as the Kruskal-Wallis test to examine differences in responses across groups based on role (department head, neurosurgeon, neurosurgery resident) and the average income of the country of origin (low, medium, high). Post-hoc analysis was conducted using the Dunn test with Bonferroni correction to identify specific differences between groups. We also calculated the Spearman's rank correlation coefficient to analyze the relationships between personality traits, followed by hierarchical clustering using the average linkage method based on the Spearman correlation distance matrix. Results were considered significant at $p < 0.05$.

3. Results

According to our data, most participants recognize the critical role of NTSs in neurosurgery. However, a significant portion does not see a direct link between NTSs and excellence (see Table 1). The majority believes that NTSSs are crucial for predicting excellence and should be used as selection criteria for candidates, emphasizing their importance alongside technical skills. Most participants support including NTSs in the training curriculum (see Table 2), with varying preferences as to when and how this training should occur (see Graph 1 and Graph 2). Mentorship is seen as the most effective training method. Interestingly, among those who believe one can excel without NTSs, only a small minority (7.35%) oppose including NTSs in the curriculum, and just 0.8% believe NTSs are unimportant overall.

3.1. Which NTSs matter most?

3.1.1. Personality traits

Personality skills are ranked in order of importance based on their average scores (Graph 3 A) as follow: *Attention to Detail and Concentration* (M = 2.64; SD = 0.54), *Awareness of Own Limits and Strengths* (M = 2.61; SD = 0.53), *Commitment* (M = 2.61; SD = 0.58), *Resilience* (M = 2.54; SD = 0.65), *Intellectual Curiosity* (M = 2.47; SD = 0.64), *Self-Criticism* (M = 2.44; SD = 0.65), *Stress Management* (M = 2.43; SD = 0.68), *Emotional Intelligence and Empathy* (M = 2.36; SD = 0.64), *Proactivity and Initiative* (M = 2.34; SD = 0.68), *Being a Mentor* (M = 2.08; SD = 0.74), *Administrative Task Management* (M = 1.75; SD = 0.73).

To analyze the relationships between personality traits, we computed the correlation matrix using Spearman's rank correlation coefficient. This allowed us to understand the relationships between different traits. We then performed hierarchical clustering using the average linkage method based on the Spearman correlation distance matrix. The traits were grouped into clusters, illustrating the similarity between them (Graph 3 B).

By segmenting the results based on the role of the respondent, a significant difference between groups was found for responses regarding *administrative task management* and *stress management* (respectively, H = 5.98, df = 2, p-value = 0.05 and H = 13.30, df = 2, p-value = 0.001). In the post-hoc analysis, we applied the Dunn test with Bonferroni correction to examine specific differences between groups. According to results, residents consider *stress management* to be more important than both staff neurosurgeons and heads of department do (respectively, p-value = 0.0095 and p-value = 0.0006). Moreover, department heads assign greater importance to *managerial skills* than staff neurosurgeons (p-value = 0.002).

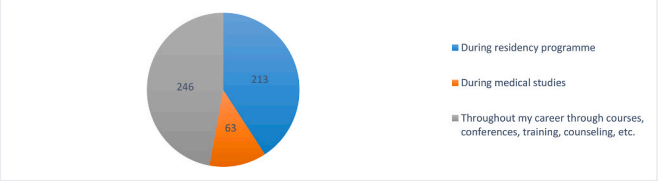
Based on analyses of data categorized according to the economic wealth of countries, it was found that, in general, low-income countries tend to regard all these personality traits as less important than middle- and high-income countries. Specifically, high-income countries place significantly greater value on skills such as *attention to detail and concentration* (H = 10.232, df = 2, p-value <0.05), *awareness of one's own limits and strengths* (H = 14.24, df = 2, p-value <0.05), *emotional intelligence* (H = 6.703, df = 2, p-value <0.05), *intellectual curiosity* (H = 11.09, df = 2, p-value <0.05), *proactivity* (H = 10.583, df = 2, p-value <0.05), *resilience* (H = 30.684, df = 2, p-value <0.05), *self-criticism* (H = 32.916, df = 2, p-value <0.05), and *stress management* (H = 18.436, df = 2, p-value <0.05).

Table 1
Can you become a great neurosurgeon without NTSs?

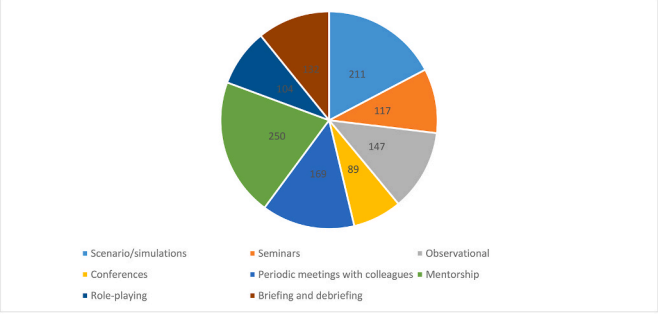
Yes	**68** – **36 staff neurosurgeons, 20 residents, 12 head of department** – **13 respondents from Italy, 11 from India and USA, 4 from Spain, Brazil, 3 from Russian Federation and Denmark, 2 from Romania, Republic of Serbia, Republic of Kazakhstan, Argentina, and 1 from Belgium, Nepal, Austria, Japan, Germany, Finland, China, Canada, Bulgaria, Albania**	**18.28 %**
No	304	81.72 %

Table 2
General questions regarding NTSs.

	Strongly Agree	Agree	Disagree	Strongly Disagree
Being an ideal neurosurgeon is more innate.	11.6% (43)	42.5% (158)	38.4% (143)	7.5% (28)
Strong non-technical skills are a predictor of neurosurgical excellence.	56.5% (210)	21.5% (80)	20.2% (75)	1.9% (7)
These qualities and behaviors (i.e., NTSs) can act as selection criteria for getting the right people into the field.	33.1% (123)	48.9% (182)	16.7% (62)	1.3% (5)
The qualities and behaviors listed above (i.e., NTSs) should be included in the neurosurgical training curriculum.	50.5% (188)	45.7% (170)	3.5% (13)	0.3% (1)



Graph 1. At what point would you prefer training.?.



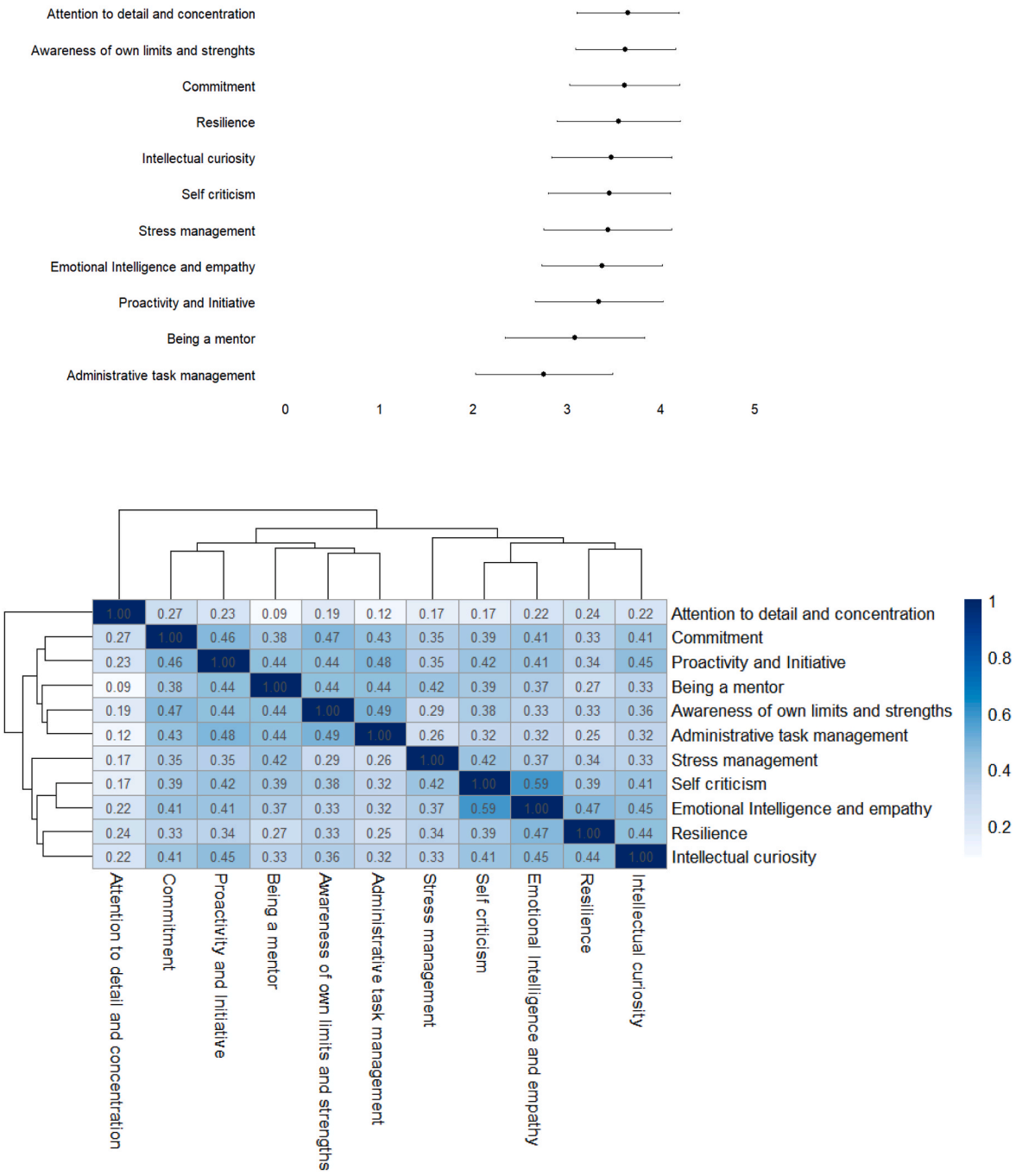
Graph 2. Which is the most effective teaching method.?.

3.1.2. Cognitive abilities

Cognitive abilities are ranked in order of importance based on their average scores (Graph 4 A) as follow: *Situation Awareness and Risk Assessment* (M = 2.48; SD = 0.64), *Analytical and Problem-Solving* (M = 2.40; SD = 0.66), *Foresight/Anticipation* (M = 2.40; SD = 0.7), *Cognitive Flexibility* (M = 2.38; SD = 0.69), *Mental Agility* (M = 2.38; SD = 0.68). Correlation matrix and hierarchical clustering are represented in Graph 4 B.

Based on analyses of data categorized according to the economic wealth of countries, it was found that, in general, countries with lower income pay less attention to cognitive abilities. However, among these, only certain differences have been found to be significantly distinct. Specifically, in comparison to low-income countries, high-income countries consider the following aspects more important: *analytical and problem-solving skills* (H = 6.49, df = 2, p-value <0.05), *cognitive flexibility* (H = 12.23, df = 2, p-value <0.05), and *mental agility* (H =

A: Ranking
B: Correlation matrix and cluster dendrogram



Graph 3. _ Personality Traits
A: Ranking
B: Correlation matrix and cluster dendrogram.

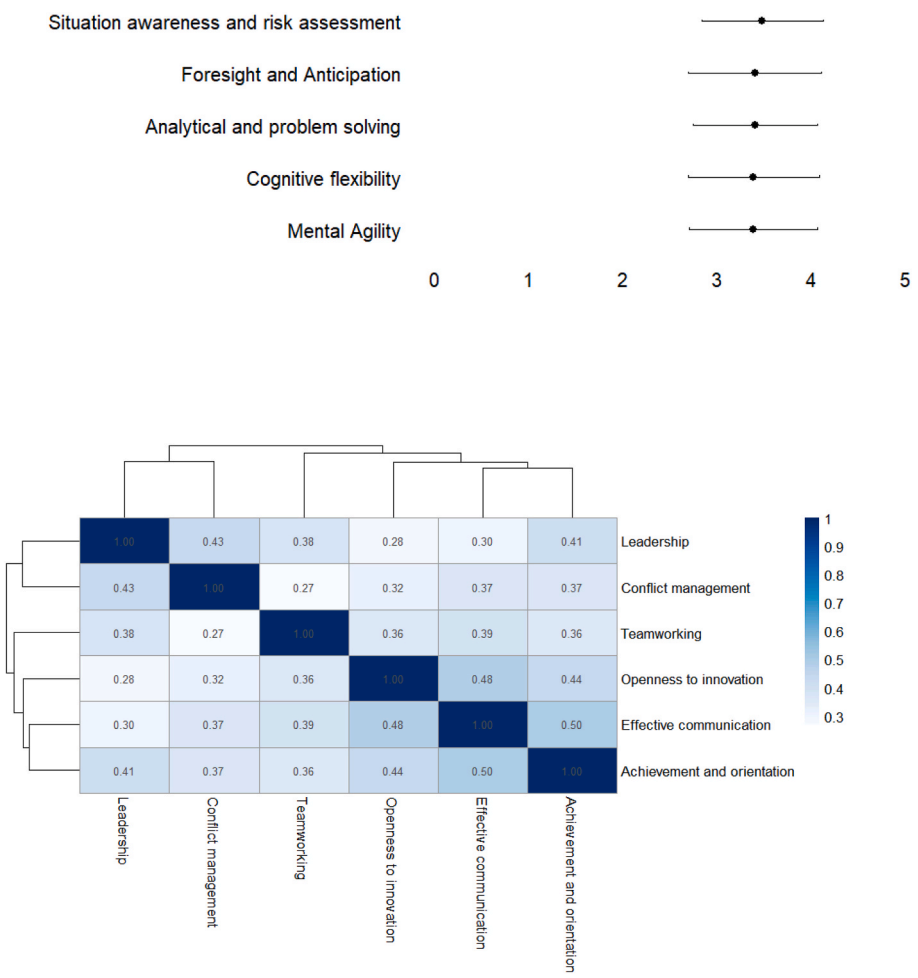
7.68, df = 2, p-value <0.05).

3.1.3. *Interpersonal skills*

Interpersonal abilities are ranked in order of importance based on their average scores (Graph 3 A) as follow: *Team-working* (M = 2.52; SD = 0.64), *Openness to Innovation* (M = 2.39; SD = 0.65), *Effective Communication* (M = 2.33; SD = 0.64), *Achievement Orientation* (M = 2.28; SD = 0.66), Leadership (M = 2.16; SD = 0.73), *Conflict Management* (M = 2.07; SD = 0.68). Correlation matrix and hierarchical clustering are represented in Graph 5 B.

In examining interpersonal skills, no differences were observed based on the role of individuals. In line with previous results, low-income nations generally allocate less emphasis to interpersonal skills. In particular, high-income countries, in contrast to their lower-income

A: Ranking
B: Correlation matrix and cluster dendrogram



Graph 4. _ Cognitive Skills
A: Ranking
B: Correlation matrix and cluster dendrogram.

counterparts, place a higher importance on abilities such as *achievement orientation* ($H = 5.884$, $df = 2$, p-value <0.05) and *openness to innovation* ($H = 6.2741$, $df = 2$, p-value <0.05).

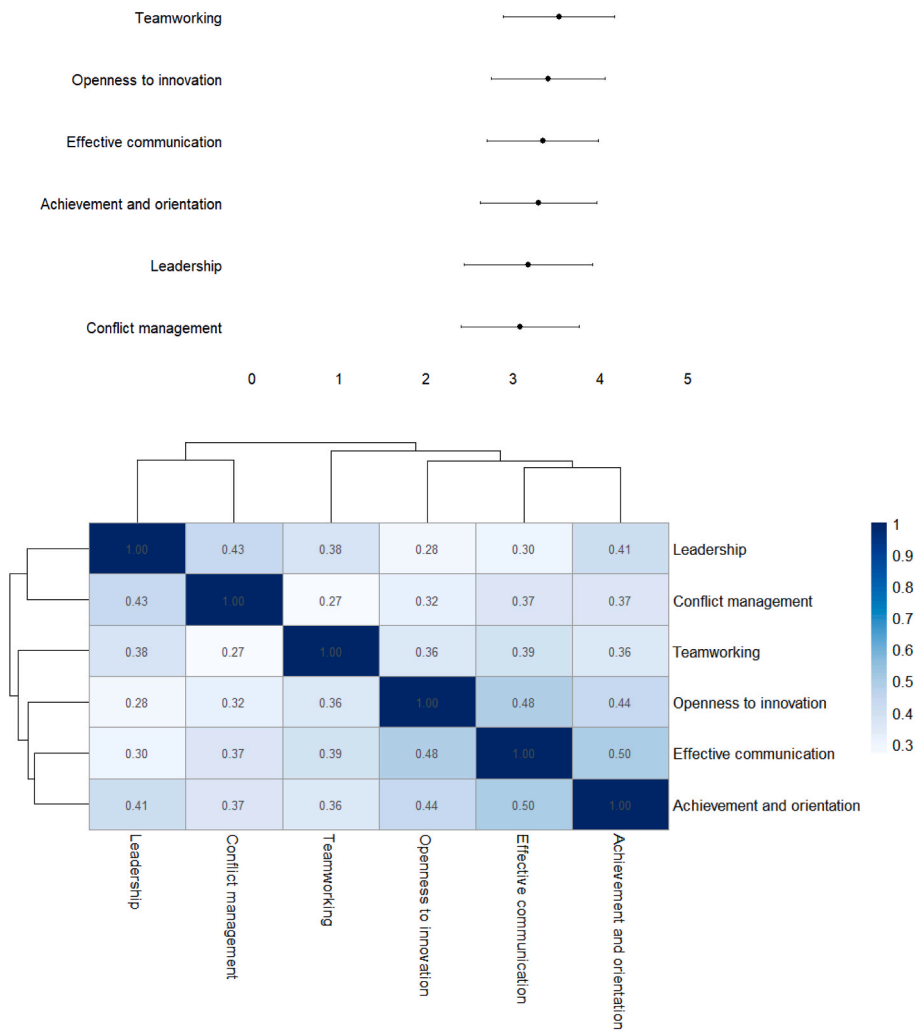
4. Discussion

Our global survey of neurosurgeons indicates that true mastery in neurosurgery transcends technical skill. The data reveal a near-universal consensus on the critical importance of NTSs, highlighting that personality traits, cognitive abilities, and interpersonal skills are perceived as crucial for a successful carrier in neurosurgery. Among these, attention to detail and self-awareness emerge as paramount. Humility, often described as "the most difficult virtue to understand and practice" (Coulehan J, 2010; Jeffrey DI, 2020), involves an accurate assessment of one's abilities and limitations without arrogance. Humble individuals recognize their imperfections while maintaining self-worth and respect for others, fostering teamwork and collaboration (Coulehan J, 2010; Jeffrey DI, 2020). Integrating self-awareness into the broader framework of NTSs would foster better collaboration and communication, enhancing overall performance in complex surgical environment. However, an apparent contradiction exists: approximately 18% of surgeons still view technical execution as the sole indicator of professional excellence. This perspective reinforces outdated stereotypes that associate surgery with decisiveness, physical strength, and emotional detachment, while undervaluing empathy and humility.

The increasing promotion of NTSs education programs signifies a shift towards dismantling these outdated views. Interestingly, even among those who consider NTSs irrelevant for neurosurgery, there is a belief that these skills should be taught or included as selection criteria. This discrepancy may stem from differing views on whether NTSs are innate or can be developed, suggesting the potential for training programs that integrate NTSs with technical skills, harnessing both intrinsic potential and teachable aspects of the profession. Such programs, utilizing diverse teaching methods like simulations, mentorship, and role-playing, aim to equip future neurosurgeons with the comprehensive skill set necessary for exceptional performance. Moreover, this apparent discrepancy may also reflect the acknowledgment of NTSs as skills that foster the acquisition and improvement of surgical skill and clinical judgement, even among those colleagues who see technical execution as the main predictor of professional excellence.

Our results also indicate that beliefs about NTSs are influenced by the specific working contexts of neurosurgeons. For instance, department

A: Ranking
B: Correlation matrix and cluster dendrogram



Graph 5. _ Interpersonal skills
A: Ranking
B: Correlation matrix and cluster dendrogram.

heads prioritize managerial skills, while residents emphasize stress management, reflecting how different levels of responsibility and experience shape perceptions of NTSs relevance.

Another aspect worth considering is that competencies essential for making a good doctor may not be always necessary during surgery. For example, dealing with a terminally ill patient requires empathy, emotional connection, communication skills and time, whereas performing a difficult surgical procedure demands emotional detachment and intense focus. These findings call for a flexible and adaptive training approach, tailored to the varied needs and perspectives within the field.

Additionally, our analysis highlights how cultural and economic contexts significantly affect the emphasis on NTSs. Across all countries, cognitive traits such as attention to detail, self-awareness, dedication, and resilience are deemed crucial for neurosurgery. However, wealthier nations place greater emphasis on qualities like self-awareness, mentoring, intellectual curiosity, and resilience, supported by robust health and education systems. Low and middle income nations may probably face different challenges, such as high patient volumes, limited resources (especially manpower), and overburdened infrastructures. In this setting, it is highly possible that higher-level competencies take a back seat, as other more basic skills may be needed, for example, doing more with less, working in adverse conditions and resourcefulness.

The challenge now is how to effectively teach these skills. Recent studies, such as Mann et al. (2015), highlight the success of structured leadership training programs like the Future Surgical Leaders curriculum, which significantly improved residents' leadership skills and knowledge. Additionally, Alayande et al. (2024) highlight the importance of hybrid training courses combining in-person and online components to maximize accessibility and effectiveness. Future research must focus on identifying the best methods to teach NTSs, including experimental studies comparing various approaches to ensure neurosurgeons are well-equipped with the holistic skills necessary for exceptional performance.

While these findings provide valuable insights, the inherent limitation of survey-based research has to be recognized; these data reflect perceptions and opinions that may not translate into empirical evidence as they do not provide a measure of the influence of different skills on neurosurgical performance. It remains very difficult to scientifically

measure the true relationship between NTSs and neurosurgical outcome.

5. Conclusion

In conclusion, our study highlights the widespread acknowledgment of the importance of NTSs to achieve professional excellence in neurosurgery. Notably, humility emerged as one of the most valued skills among neurosurgeons, highlighting the importance of self-awareness and continuous improvement in this complex field. In this view, humility may be seen a synonym for maturity. However, our survey also reveals a small but notable tendency to overlook some human aspects of the profession.

The adoption of an integrated approach may improve neurosurgical outcomes by ensuring that technically skilled neurosurgeons are also equipped with empathy and resilience to better deal with the complexities of their profession.

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.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bas.2024.102923.

References

Alayande, B.T., Forbes, Cl, Kingpriest, P., Adejumo, A., Williams, W., Wina, F., Agbo, C. A., 2024. Non-technical skills training for Nigerian interprofessional surgical teams: a cross-selection survey. BMC Med. Educ. 24 (547), 1–9.

Cobianchi, L., Dal Mas, F., Verde, J.M., Garcia-Vazquez, A., Martellucci, J., Swanstrom, L., Ansaloni, L., 2022. Why non-technical skills matter in surgery. New paradigms for surgical leaders. Discover Health Systems 1 (1), 2. https://doi.org/10.1007/s44250-022-00002-w.

Coulehan, J., 2010. On humility. Ann. Intern. Med. 153 (3), 200–202.

Hénaux, P.-L., Jannin, P., Riffaud, L., 2019. Nontechnical skills in neurosurgery: a systematic review of the literature. World Neurosurgery 130, e726–e736. https://doi.org/10.1016/j.wneu.2019.06.204.

Hull, L., Arora, S., Symons, N.R.A., Jalil, R., Darzi, A., Vincent, C., Sevdalis, N., 2013. Training faculty in nontechnical skill assessment: national guidelines on program requirements. Ann. Surg. 258 (2), 370–375. https://doi.org/10.1097/SLA.0b013e318279560b.

Jeffrey, D.I., 2020. Humility: the primary virtue of a good doctor. J. R. Soc. Med. 113 (12), 479–481. https://doi.org/10.1177/0141076820923609.

Mann, D.R., Thomas, C.S., Parrado, R.H., Rives, G.T., Talley, C.L., 2015. Future surgical leaders: resident perception of longitudinal leadership and non-technical skills curriculum. J. Surg. Educ. 81 (5), 696–701.

Shlobin, N.A., Kanmounye, U.S., Ozair, A., De Koning, R., Zolo, Y., Zivkovic, I., Niquen-Jimenez, M., Affana, C.K., Jogo, L., Abongha, G.B., Garba, D.L., Rosseau, G., 2021. Educating the next generation of global neurosurgeons: competencies, skills, and resources for medical students interested in global neurosurgery. World Neurosurgery 155, 150–159. https://doi.org/10.1016/j.wneu.2021.08.091.

Whitfield, P.C., Van Loon, J., Peul, W., Executive Board of the European Association of Neurosurgical Societies, 2023. European training requirements in neurological surgery: a new outcome-based 3 stage UEMS curriculum. Brain Spine 25 (3), 101744. https://doi.org/10.1016/j.bas.2023.101744.

Wood, T.C., Raison, N., Haldar, S., Brunckhorst, O., McIlhenny, C., Dasgupta, P., Ahmed, K., 2017. Training tools for nontechnical skills for surgeons—a systematic review. J. Surg. Educ. 74 (4), 548–578. https://doi.org/10.1016/j.jsurg.2016.11.017.