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Opinion Survey

Training and Credentialing Standards for Minimally Invasive Spinal Surgery Techniques: Results of a Survey

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Background: The controversy continues on how to best become proficient in contemporary minimally invasive spinal surgery techniques (MISST). Postgraduate training programs typically lag behind the innovation. Other subspecialty spine care providers often compete with spine surgeons particularly when they do not offer the treatments needed by their patients. The public debate centers around who should be taught and credentialed in providing surgical spine care.

Objectives: The purpose of this study was to conduct an opinion survey amongst spine care providers regarding the learning curve of MISST and which credentialing standards should be established.

Setting: Surgeon online opinion survey sent by email, and chat groups in social media networks, including WeChat, WhatsApp, and LinkedIn.

Methods: Surgeons were asked the following questions: 1) Do you think MISS is harder to learn compared to open surgery? 2) Do you perform MISS? 3) What type of MISS do you perform? 4) If you perform endoscopic surgery, which approach(es)/technique(s) do you employ? 5) In your opinion, where does the innovation take place? 6) Where should MISST be taught? 7) Do you think mastering the MISST learning curve and surgeon skill level affect patient outcomes? 8) Which credentialing criteria do you recommend? Demographic data of responding surgeons, including age, postgraduate training and years from graduation, and practice setting, were also obtained. Descriptive statistics were employed to count the responses and compared to the surgeon's training using statistical package SPSS Version 27.0 (IBM Corporation, Armonk, NY).

Results: The online survey was viewed by 806 surgeons, started by 487, and completed by 272, yielding a completion rate of 55.9%. Orthopedic surgeons comprised 52.6% (143/272) of respondents, followed by 46.7% (127/272) neurosurgeons, and 0.7% pain management physicians (2/272). On average, respondents had graduated from a postgraduate training program 15.43 ± 10.13 years. Nearly all respondents employed MISST (252/272; 92.8%) and thought that proficiency in MISST affects patients' outcomes (270/272; 98.2%). Some 54.1% (146/270) opined that MISS is more challenging to learn than traditional open spine surgery. Preferred credentialing criteria were 1) number of MISST cases (87.5%; 238/272), b) skill level (69.9%; 190/272), and c) proficiency assessment (59.9%; 163/272). A case log review (42.3%; 116/272) or an oral examination (26.1%; 71/272) was not favored by surgeons. Surgeons reported academia (43.4%; 116/267) and private practice (41.2%; 110/267) as the centers of innovation. Only 15.4% (41/267) of respondents opined that industry was the main driver over innovation.

Limitations: Geographical and cultural biases may impact the opinions of responding surgeons.

Conclusions: Respondents preferred case volume, skill level, and proficiency assessment as credentialing criteria. Surgeons expect academic university programs and specialty societies to provide the necessary training in novel MISST while working with governing boards to update the certification programs.

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As the demand for spine care rises (1-3), the competition between spine surgeons, which include nonsurgeons, such as anesthesiologists, physical therapists, physiatrists, Interventional radiologists, and new competing specialties, who provide interventional and procedural pain management treatments, intensifies (4-7). By default, these treatments, some of them consisting of innovative minimally invasive spinal surgery techniques (MISST), are often left to nonsurgeons, as traditionally trained spine surgeons usually do not offer alternatives to extensive and aggressive operations to patients (8-10). The debate on who should be providing what type of spine care typically heats up when surgeons are asked to take care of a complication or inferior clinical outcome that a nonsurgeon could not revise (11). Training standards and credentialing requirements are vehemently debated when other subspecialties invade the "surgical turf" of spine surgeons and when referrers send their patients to alternate providers. Examples of such trends include the rapid growth of spinal cord stimulators and pain pumps (12). Many patients who ordinarily would have been referred for surgical decompression, some of which would face the additional prospect of a more complex fusion, are often referred for such procedures. Nowadays, some of them are done performed by accomplished MI surgeons, but all new competitors for patients with or without formal training are now in the mix. Sacroiliac joint fusions are also increasingly performed by surgeons, as well as pain management physicians, who now use surgical codes to be reimbursed for the procedure (13-18).Another example is spinal endoscopy (19,20). The percutaneous nature of the surgical approach through a < 1-centimeter incision may be tempting to some interventionalists to expand their procedural portfolio (21). Some vendors have a product kit lineup ranging from nonvisualized combination decompression radiofrequency procedure done under fluoroscopic control to visualized videoendoscopic decompression, which by most would be considered surgery and not an interventional procedure. In some instances, the product components are even identical between these applications (22,23). In other words, the line between interventional spine care and spinal surgery is becoming increasingly fuzzy, creating the need to redefine training and credentialing standards to catch up with this fast-moving field. Most of the time, local medical staff offices are left to define their own standards when credentialing a provider for innovative procedures or surgeries with which they have no experience or prior track record.

The overlap in treating the same painful degenerative spine conditions between subspecialties creates controversy and the need to better understand the issues at stake that drive the innovation dynamic. Traditionally, governing boards and scientific surgeon organizations have defined the curriculum requirements before an applicant is even admitted to board certification examination (24). After completing the required postgraduate training, becoming board certified in a surgical subspecialty is no small undertaking and requires ongoing life-long learning via minimum continued medical education requirements. The latter is typically a process of several consecutive steps that have to be taken between oral and written tests. Over the professional lifetime, surgeons might recertify several times to remain in good standing with the governing board that certifies to their ability to treat members of the public effectively and safely while adhering to the highest professional standards. It is, therefore, easy to understand that any disregard of such hard-earned certification requirements by others may be looked upon critically and potentially considered inappropriate. In some cases, nonsurgeons were sued by their patients and have lost their medical licenses for practicing outside the purview of their training and board certification. The purpose of this opinion survey study relevant to implementation and quality control with modern MISST was to get an up-to-date snapshot in time on the opinions of those who are at the center of credentialing and learning debate-spine surgeons.

Methods

The authors solicited responses to an online survey via email and chat groups in social networks, including Facebook, WeChat, WhatsApp, and LinkedIn. The survey was available online and distributed via a link distributed through these social network media. Upon

clicking on the link, the prospective respondent was taken to the typeform Web site at www.typeform.com. The typeform service works on any computer, laptop, and any handheld devices, such as an iPad, or a cellular smartphone with multiple Web browser user-interface platforms. The questions were aimed at soliciting information deemed important to the understanding of current practice patterns and opinions regarding innovative MISST, training, and credentialing; whereas, another question requested demographic information of the respondent regarding postgraduate residency and fellowship training, and their practice setting. The survey was constructed of either simple "YES" or "NO" questions or simple multiple-choice questions, some of which with multiple possible answers. Surgeons were asked the following questions:

1. Do you think MISS is harder to learn compared to open surgery?
   YES/NO

2. Do you perform MISS?
   YES/NO

3. What type of MISS do you perform?
   i. Tubular retractor system
   ii. Mini-open surgery
   iii. Endoscopic surgery
   iv. Industry
   v. Other

4. If you perform endoscopic surgery, which approach(es)/technique(s) do you employ?
   i. Transforaminal
   ii. Interlaminar
   iii. Full endoscopic
   iv. Over the top
   v. Unilateral biportal
   vi. Other

5. In your opinion, where does the innovation take place?
   i. Academia
   ii. Private practice
   iii. Other

6. Where should MISST be taught?
   i. University program
   ii. Private practice
   iii. Specialty society
   iv. Industry
   v. Other

7. Do you think mastering the MISST learning curve and surgeon skill level affect patient outcomes?
   YES/NO

8. Which credentialing criteria do you recommend?
   i. Number of cases
   ii. Proficiency assessment
   iii. Oral examination
   iv. Case log review
   v. Skill assessment
   vi. Other

9. What is your training?
   i. Orthopedic spine surgeon
   ii. Neurosurgeon
   iii. Other

10. What is your age?

11. How many years ago did you graduate from a postgraduate training program (residency/fellowship)?

12. Tell us about your practice setting:
   i. Hospital employed
   ii. University employed
   iii. Private practice
   iv. Private practice with academic appointment
   v. Other

13. What's your country of residence?

The double-blinded survey ran from October 8 to December 2, 2021. Upon completion of the survey, the responses were downloaded in an Excel file format and imported into SPSS Version 27.0 (IBM Corporation, Armonk, NY) statistical software package for further data analysis. Descriptive statistics included counts, means, range, and standard deviation as well as percentages. Missing answers were not included in the analysis. Wherever applicable, a *P* value of 0.05 or less was considered statistically significant, and a confidence interval of 95% was considered for all statistical tests.

Results

The online survey was viewed by 806 respondents, started by 487, and completed by 272. The completion rate was 55.9% and the average time to complete the survey was 04 minutes and 57 seconds. Just over

half of surgeons (143/272; 52.6%) who participating in this survey were orthopedic surgeons, followed by neurosurgeons (127/272; 46.7%). Two respondents were pain management physicians (2/272; 0.7%). These respondents were between the ages of 35-44 years; 41.5%, and between the ages of 45-55 years; 33.1%, at the time. The remaining age groups were represented as follows: 55-64 years; 14%, 25-34 years; 4.4%, 65-74 years; 4.4%, and 18-24 years; 0.7%. On average, respondents had graduated from a postgraduate training program 15.43 ± 10.13 ranging from 1-49 years. In decreasing order of relevance, surgeons reported from Brazil (71/272; 26.7%), China (58/272; 21.8%), Mexico (33/272; 12.4%), South Korea (20/272; 7.5%), Chile (11/272; 4.1%), Paraguay (10/272; 3.8%), India (9/272; 3.4%), United States (8/272; 3%), Argentina (7/272; 2.6%), Colombia (7/272; 2.6%), Bolivia (6/272; 2.3%), El Salvador (3/272; 1.1%), Spain (3/272; 1.1%), Bangladesh (2/272; 0.8%), Malaysia (2/272; 0.8%), Netherlands (2/272; 0.8%), Portugal (2/272; 0.8%), Thailand (2/272; 0.8%), Algeria (1/272; 0.4%), Costa Rica (1/272; 0.4%), Dominican Republic (1/272; 0.4%), Indonesia (1/272; 0.4%), Nepal (1/272; 0.4%), Philippines (1/272; 0.4%), Singapore (1/272; 0.4%), Syria (1/272; 0.4%), United Kingdom (1/272; 0.4%), and Vietnam (1/272; 0.4%). The majority (108/272; 39.7%) of these responding surgeons were self-employed and worked in a private practice setting. The second largest group (69/272; 25.4%) was comprised of hospital employed surgeons. Fourty- Forty-five (16.2%) were private practice surgeons with an academic appointment, and another 44 surgeons were university employed. Only 6 surgeons (2.2%) were employed by a large physician-owned group (Fig. 1).

The majority of respondents performed MISS (252/272; 92.8%), and nearly all respondents (270/272; 98.2%) opined that proficiency in MISST affects patients' outcomes. However, only 54.1% (146/270) opined that MISS is more challenging to learn than traditional open spine surgery (124/270; 45.9%). Considering that multiple answers were allowed, 73.5% (200/272) of respondents performed endoscopic spine surgery, 57.7% (157/263) performed mini-open surgery, and 53.3% (145/263) employed a tubular retractor system during their spine surgeries. A breakdown of the practiced endoscopic spine surgeries revealed that 56.1% (145/263) of responding physicians performed interlaminar endoscopy, 53.2% (140/263) transforaminal endoscopy, 45.2% (119/263) full endoscopy, 23.6% (62/263) over the top, and 18.6% (49/263) unilateral biportal endoscopy. Only 15.2% (40/263) did not perform endoscopic spine surgery (Fig. 2).

When asked where innovation took place, 43.4% (116/267) thought that new inventions and clinical protocols emerged primarily in academia; whereas, 41.2% (110/267) considered private practice the primary place where clinical innovation in spine surgery played out. Only 15.4% (41/267) respondents opined that industry

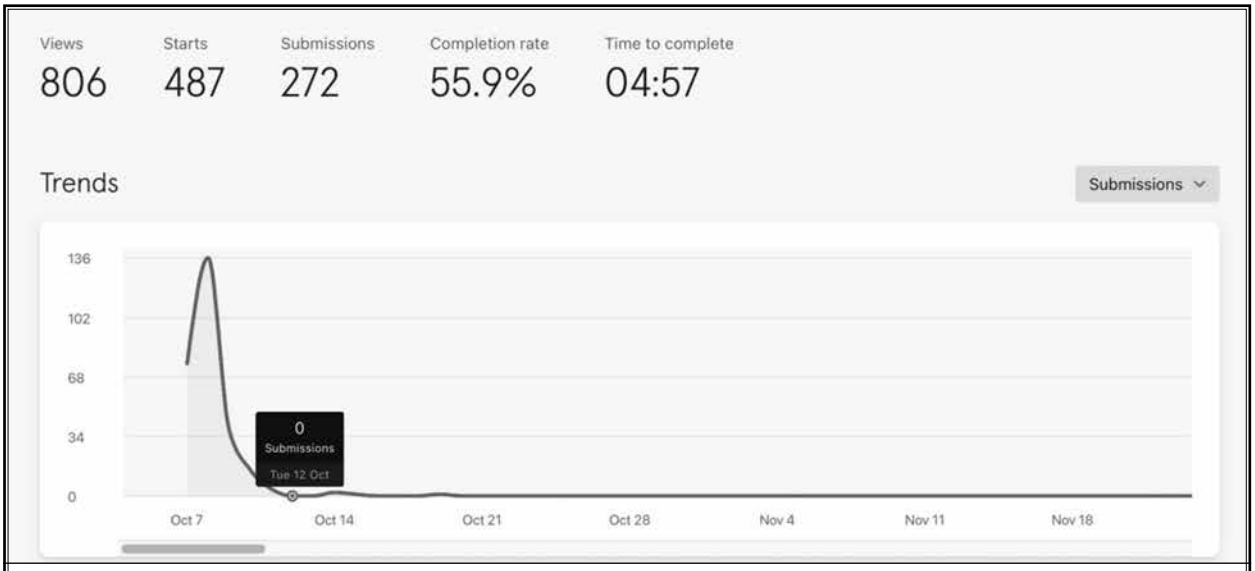

Fig. 1. *Graphic illustration of the survey response dynamic after launch demonstrating how effectively physicians interested in the clinical management of spine pain can be reached via modern social media platforms.*

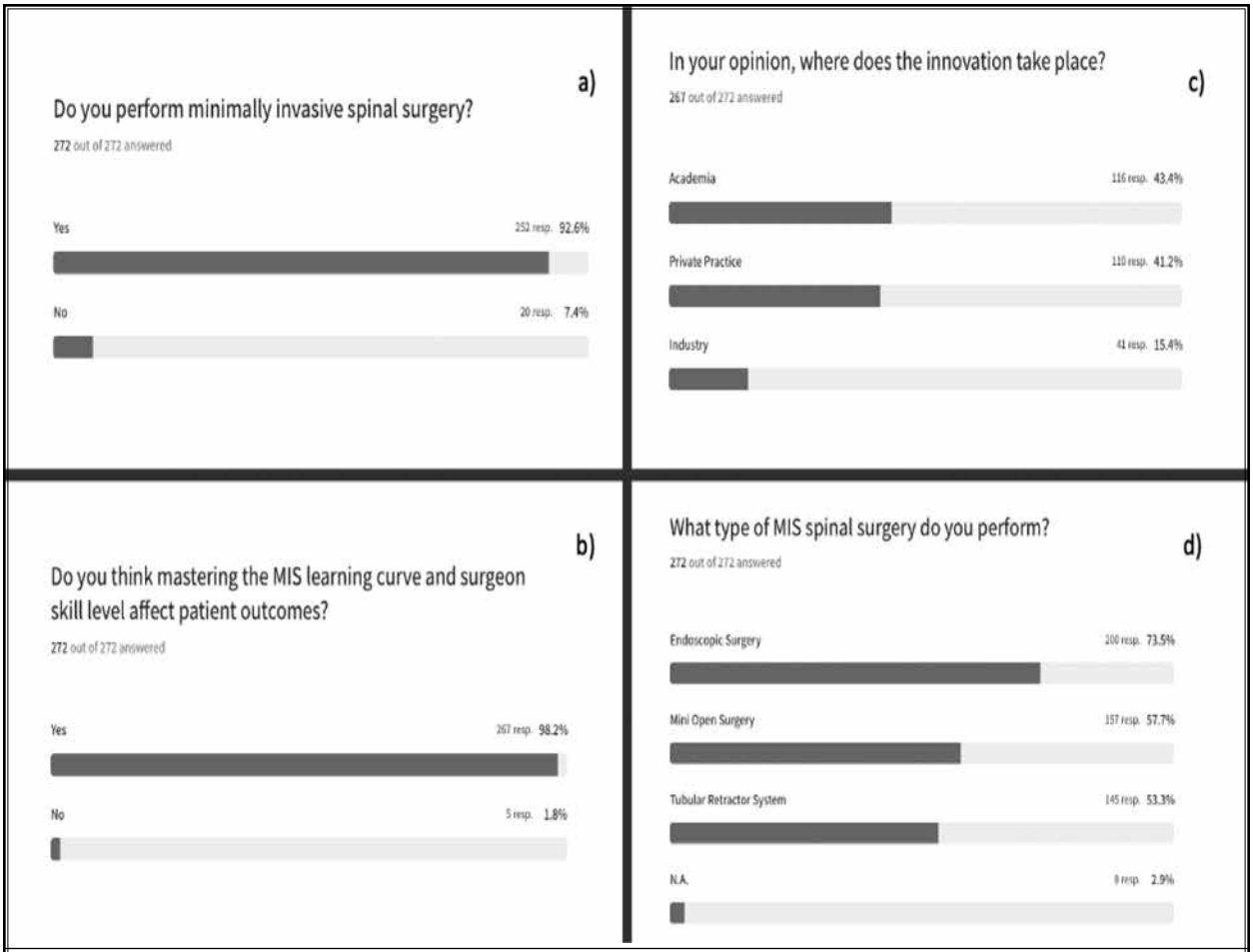

Fig. 2. *The percentage breakdown of responses to survey questions on MISS practice patterns and relevance of credentialing and training standards with multiple possible answers given by the 272 participating spine surgeons is shown. The majority of responding surgeons were employing MISS techniques (92.8%; 252/272). a) Nearly all responding spine surgeons (98.2%; 270/272) b) thought mastering the MISS learning curve affects patient outcomes. c) Some 43.4% of spine surgeons thought that the innovation in spine surgery came from academic centers vs 41.2% and 15.4% of surgeons thought innovation was driven by private practice surgeons and industry, respectively. d) Most surgeons preferred endoscopic surgery (71.5%) over mini-open (57.7%) and tubular retractor (51.3%) techniques. MISS, minimally invasive spinal surgery.*

was the main driver over innovation. When it came to who should orchestrate the teaching of modern MISST, private practice was even less relevant to survey respondents. Only 23.9% of respondents (65/272) felt that private practice was the most appropriate setting for innovation. The 2 settings for teaching novel MISST desired by survey respondents the most were a specialty society (35.7%; 97/272) and a university program (35.7%; 97/272). Only 4.8% (13/272) of them preferred that the industry orchestrate the training. The credentialing criteria were at the heart of this survey. The majority (87.5%; 238/272) of surgeons thought that the most critical credentialing criterion was the number of cases performed by a surgeon. Skill (69.9%; 190/272) and proficiency assessment (59.9%; 163/272) were other preferred credentialing criteria. A case log review (42.3%; 116/272) or an oral examination (26.1%; 71/272) did not find majority support by surgeons (Fig. 2).

Discussion

Findings of this opinion survey of 272 responding surgeons who returned completed an online questionnaire indicate that spine surgeons did find MISST

somewhat more challenging to learn and that skill level impacts clinical outcomes, thereby substantiating the authors' call for credentialing standards. Surgeons overwhelmingly voted for using the number of MISST cases (87.5%; 238/272) as the primary criterion for credentialing spine surgeons in novel MISST. The respondents also supported skill level (69.9%; 190/272) and proficiency assessment (59.9%; 163/272). A case log review (42.3%; 116/272) or an oral examination (26.1%; 71/272) did not find majority support by surgeons. The significance of these findings is that postgraduate and society specialty training programs should structure their curriculum to respond to surgeons' demand of high caseload and skill-building activities to improve proficiency. Coincidentally, spine surgeons also identified academia and a specialty society as the preferred venues where the training should occur, and the credentialing be administered. Spine surgeons did not accept MISST training by industry (Fig. 3).

The online survey proved an effective means of collecting tangible clinical information by reaching 806 surgeons, of which 487 started and 272 completed the survey (Fig. 1). This methodology has been employed by the authors in several studies (25-30) that have been published in peer-reviewed journals. It was instrumental in gathering large amounts of data quickly across

Fig. 3. *The percentage breakdown of responses to survey questions on MISS practice patterns and relevance of credentialing and training standards with multiple possible answers given by the 272 participating spine surgeons is shown. a) The majority of responding surgeons preferred case volume (87.5%; 238/272), skill level (69.9%; 190/272), and proficiency assessment (59.9%; 163/272) as credentialing criteria. b) Most surgeons worked in private practice (108/272; 39.7%), followed by hospital employment (69/272; 25.4%), and private practice with an academic appointment (45/272; 16.2%). A sizeable physician-owned group employed only 6 surgeons (2.2%). c) Respondents were made up of orthopedic surgeons (52.6%; 143/272), followed by neurosurgeons (46.7%; 127/272). Two respondents were pain management physicians (0.7%; 2/272). MISS, minimally invasive spinal surgery.*

many cultural and geographical barriers, particularly when assessing the most appropriate management of rare complications (31) or understanding surgeons' and health care facility needs when establishing an endoscopic spinal surgery program (29). One of the authors' study assessed the incidence of durotomies based on a total of 64, 470 lumbar endoscopies (25). This type of "big data" analysis is typically impossible at a single center site and may even prove difficult in multicenter trails. The present survey reached physicians working in hundreds of health care facilities worldwide.

The high completion rate of 55.9% is much higher than response rates reported with traditional in-mail surveys–5% or less (32). The literature shows that response rates may vary. The average response rate for an in-person survey is 57%, a mail survey at 50%, an email survey at 30%, an online survey at 29%, a telephone survey at 18%, and an in-app survey at 13%, with an overall average survey response rate of 33% (32-35). A survey mailed to 2,048 patients had a response rate of 46% (36). Web-based surveys have achieved a response rate of 60% (32). Paper surveys have a response rate of 49.5% (37). An online patient satisfaction survey of 9,975 Medicare beneficiaries with 434 unduplicated survey submissions had a response rate of 4.3% (36). Clinical opinion survey research amongst spine surgeons showed response rates ranging from 49% (n = 51) obtained in a study on surgical management of spinal stenosis amongst Norwegian spine surgeons (38) to 61.3% (n = 357) amongst members of the Scoliosis Research Society surveyed on use of MISST in the treatment of adult spinal deformity (39). In comparison, another sizeable online survey study (40) sent to trauma, spine, and craniomaxillofacial surgeon members of the Association of Osteosynthesis Foundation, yielded 1,212 valid and completed submissions at an overall response rate of 4.1%. These examples illustrate that there can be a wide range of survey response rates and that 55.9% obtained in this study is higher than the average reported for clinical online survey research. Research also shows that higher response rates do not necessarily translate into higher survey accuracy since missing answers do not occur randomly (35,41).

This study likely suffered from some bias. The authors did their best to minimize it. Intuition and hindsight bias is common amongst the respondents and investigators with this type of data acquisition (42,43). The authors captured opinions almost exclusively from orthopedic spine surgeons (52.6%) and neurosurgeons (46.7%). Only 2 pain management physicians (0.7%) entered data into the survey. Several explanations for the low percentage of pain physicians responding to this survey seem plausible: 1) There are likely fewer pain physicians performing endoscopic surgery than orthopedic and neurosurgeons. 2) The authors are all surgeons, and their selection bias could have preferentially distributed the survey to other surgeons. Ultimately, another survey directly addressed to pain management physicians could provide more conclusive insights into whether there is any difference regarding endoscopic spine surgery credentialing criteria between spine care providers with different postgraduate training backgrounds. Responses were blinded, and the investigators of this study had no way of anticipating any causes for regional variations in physician preferences regarding endoscopic spinal surgery credentialing criteria. Understanding the incoming data in real-time was essential to the authors since surgeons from some countries (Brazil; 26.7%, China; 21.8%, Mexico; 12.4%, South Korea; 7.5%, Chile; 4.1%, Paraguay; 3.8%, India; 3.4%, United States; 3%), were somewhat overrepresented in the survey making up 82.7% of all respondents. As recently shown, these nations are also the countries where spinal endoscopy is most accepted and considered mainstream (27). Besides, the effect size of agreements or disagreements was unknown when launching the survey. The rapid response dynamic observed by the authors (Fig. 1) suggests the study findings are, in fact, representative of current opinions regarding endoscopic spinal surgery criteria amongst physicians involved in the management of spine pain the world over.

Conclusions

This online survey reached 272 spine care providers in just 2 months, proving that surgeon opinions can be readily solicited on hand-held devices. Surgeons preferred case volume, skill level, and proficiency assessment as credentialing criteria. These criteria would virtually guarantee that surgical procedures are done by well-trained surgeons who know how to handle perioperative problems, complications, and perform revision surgeries if and when needed. Surgeons also indicated that they expect academic university programs and specialty societies to provide the necessary training and work hand-in-hand with local, state, and federal governing boards to update the certification programs to keep up with the fast-moving innovative field of MISS.

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