

Progress of women in neurosurgery

Robert F. Spetzler

Division of Neurological Surgery, Barrow Neurological Institute, St. Joseph's Hospital and Medical Center, Phoenix, Arizona, and Department of Surgery, Section of Neurosurgery, University of Arizona College of Medicine, Tucson, Arizona, USA

ABSTRACT

Despite advances in issues related to gender equity, barriers to recruiting and retaining women in neurosurgery continue to exist. At the same time, the overall projected shortage of neurosurgeons suggests that women will be vital to the long-term success of the field. Attracting women to neurosurgery can capitalize on strategies, such as mentoring, teaching leadership and negotiating skills, and job sharing or dual training tracks to name a few, that would benefit both men and women passionate about pursuing neurosurgery. Ultimately, personal and institutional accountability must be evaluated to ensure that the best and brightest candidates, regardless of gender, are recruited to neurosurgical programs to promote the health of our challenging but most satisfying profession.

Key words: History, neurosurgery, recruitment, women

In late December 2010, Dr. Kato graciously extended me the opportunity to share my thoughts about females in neurosurgery in the *Asian Journal of Neurosurgery*. It would be one of my fondest hopes that such a discussion would no longer be necessary a decade into the no-longer quite-so-new millennium. Sadly, that is not the case despite the progress women have made in medicine overall. And, because the New Year is always a good time to take stock of areas still in need of improvement, I am happy to contribute my voice to this important issue – one that will greatly affect how the field of neurosurgery evolves. Virginia Woolf once wrote: “. . . when a subject is highly controversial – and any question about sex is that – one cannot hope to tell the truth. One can only hope to show how one came to hold whatever opinion one does hold.”^[1] What follows, then, is my opinion. Some data exist to support my contentions; common sense informs the remainder. Unavoidably, my perspective primarily reflects the status of women in neurosurgery in the United States.

Who are the Founding Mothers?

All neurosurgeons are aware that Dr. Harvey Cushing is considered the father of neurosurgery, but how many of us know the names of the females who paved the way for women in neurosurgery? Among the earliest representations of females performing surgery are found in a Turkish book by Serefeddin Sabuncuoglu from the 15th century. In this work, Sabuncuoglu, a surgeon from a small town in Anatolia, illustrates female surgeons, known as Tabibes, using a scalpel to extract a fetus dead from hydrocephalus. Sabuncuoglu recommended crushing the skull if a fetal head was large from a cause other than hydrocephalus. Bademci proposed that the miniatures representing these procedures indicated that Turkish women practiced a form of pediatric neurosurgery.^[2]

Before females could think about pursuing a medical specialty, they first had to gain entry to medical training, a battle begun in earnest in the 19th century. The barriers were not only real but entrenched in the very fabric of the academy. In the United States, for example, Walter Channing, MD, a Harvard professor of obstetrics, proclaimed in 1822 that “one of the first and happiest fruits of medical education in America” was the exclusion of women from practice.^[3,4] As Dr. Kato has reported,^[5] Ine Kusumoto was the first Japanese woman to graduate from medical school in 1852, and Ginko Ogino was the first woman to pass the Japanese medical practitioner examinations in 1885.

Finally, in the 20th century, women began to specialize in neurosurgery. In the United Kingdom, Diana Beck, MD, became perhaps the first female neurosurgeon in the world.^[6] This claim has also been made of Sofia Ionescu, the first female neurosurgeon in Romania,^[7] but she did not qualify from medical school until 1945.^[6] In 1939, Dr. Beck apprenticed

Access this article online	
Quick Response Code:	Website: www.asianjns.org
	DOI: 10.4103/1793-5482.85627

Address for correspondence:

Dr. Robert F. Spetzler, c/o Neuroscience Publications; Barrow Neurological Institute, St. Joseph's Hospital and Medical Center, 350 W Thomas Rd, Phoenix, Arizona 85013, USA
E-mail: neuropub@chw.edu

with Hugh Cairns who had trained with Harvey Cushing and William Halstead. Cairns' influence as a mentor likely played a major role in Dr. Beck's achievements.^[6]

While training at Oxford, Beck participated in a productive collaboration with pathologist Dorothy Russell. As a result of World War II, she was appointed consulting neurosurgeon at the Royal Free Hospital in 1943 and served as an advisor for the Emergency Medical Services. After the war, she became a consultant at Middlesex Hospital where students are said to have given up their weekend activities to attend her Saturday rounds – a claim few of us could make today.^[6] Ironically, Dr. Beck who suffered from myasthenia gravis was initially diagnosed with that catch-all 19th century malady ascribed to women – “hysteria.” Dr. Beck died in 1959.

That same year, Dr. Ayisima Altinok completed her neurosurgical training in Turkey where she was not only the first female neurosurgeon, but an important clinical and academic leader as well. She served as the chief of neurosurgery in a hospital in Istanbul for 24 years and helped found the Turkish Neurosurgical Society.^[8] Two years after Dr. Altinok broke the neurosurgical gender barrier in Turkey, Dr. Ruth Kerr Jakoby became the first woman Diplomate of the American Board of Neurological Surgery (ABNS) in 1961. Other women pioneers in neurosurgery include Dr. Merylee Werthan, Dr. Carole Ann Miller, Dr. Joan Venes, and Dr. Frances Conley.^[9]

In Asia, T. S. Kanaka became perhaps the first female neurosurgeon. Two more decades elapsed before Alexa Canady, MD, became the first African-American neurosurgeon. At Case Western Reserve University School of Medicine, I had the privilege of being involved in the training of Dr. M. Deborah Hyde, the second African-American woman to become a board-certified neurosurgeon.^[10] Dr. Kato, of course, was the first woman to become a full professor of neurological surgery in Japan. In Iran, the first female neurosurgeon graduated in 1984. As of 2004, Iran had 17 female neurosurgeons, four of whom are board certified and two of whom hold academic positions.^[11]

A comprehensive history of women in neurosurgery is beyond the scope of this article. However, the scant historical literature devoted to women in the field of neurosurgery suggests not that their contributions are less worthy than those of their male counterparts as much as that their contributions have yet to be fully recounted. Fascinating biographies could be written about any of the trailblazing women mentioned above. The research, careers, interests, accomplishments, and life choices of these women – and of many more pursuing neurosurgery – have been as varied and as fascinating as those of any male neurosurgeon. Dr. Jakoby, for example, later became the first woman neurosurgeon also to become a lawyer. Dr. Kanaka established a hospital for the needy endowed by her own earnings. With a few notable recent exceptions such as Dr. Frances Conley's *Walking Out on the Boys*^[12] and the commemorative anthology celebrating

the 20th anniversary of the founding of Women in Neurosurgery (WIN), *Heart of a Lion, Hands of a Woman*, edited by Dr. Deborah Benzil and Dr. Karin Muraszko, many of these stories await to be written. In late 2004, Dr. Muraszko, a pediatric neurosurgeon at the University of Michigan, was the first woman to be appointed chair of a residency training program approved by the Residency Review Committee (RRC). Dr. Benzil was a driving force behind the founding of WIN in 1989.

Neurosurgery Needs Women

A few years ago, the Board of the Directors of the American Association of Neurological Surgeons (AANS), under the leadership of President James Bean, MD, requested the leadership of WIN to write a white paper on the recruitment and retention of women in neurosurgery.^[13,14] As a member, I am proud of the statement from the AANS that the organization believes that “fairness and equality are fundamentally right and vital to the future success of our evolving specialty.”^[14] Nor is it an overstatement that women will be vital to the success of neurosurgery as well as to academic medicine in general. The numbers tell the story.

The number of women enrolling and graduating from college in the United States now exceeds the number of men. Furthermore, as has been the case since 1995, more than half of the students accepted into and attending medical school in the United States today are women.^[13] As of the spring of 2010, 49% of the graduates from medical school were female.^[15] This percentage, however, in no way implies that gender equity has been achieved. For many years in neurosurgery, for example, women have occupied only about 10% of the residency positions,^[16] too few to be considered a “minority” (defined as 15%) within the field, too few to create a so-called critical mass large enough to independently attract other females.^[17] To date, Case Western Reserve University, Mount Sinai School of Medicine, and the University of Utah have accepted the largest numbers of female neurosurgical residents.^[13]

After training, of course, the situation does not improve in academic medicine in general or in neurosurgery specifically. Despite the limitations associated with a cross-sectional study conducted by survey, Ash *et al.* found that women do not advance in academic rank as quickly as men and are compensated less well than their male counterparts.^[18] Furthermore, the discrepancies were greater than could be accounted for by the relatively late entry of sufficient women into medicine: The representation of women among full professors was only slightly higher in 1998 than it had been 20 years earlier.^[18] Not surprisingly, the number of women in leadership positions in medical schools is similar. In 2007, of the 124 medical deans in the United States, only 14 (11%) were women.^[19] Furthermore, only 9% of all clinical department chairs were women.^[19]

In terms of the number of women in neurosurgery, is the glass half full or half empty? Their numbers have increased. In 1961, Dr. Jakoby was the only board-certified female neurosurgeon; 50 years later, about 200 women now claim that distinction.^[20] However, women account for about 12% of neurosurgical residents – less than the percentage in general surgery, otolaryngology, thoracic surgery, and orthopedics – and the number projected through 2017 remains relatively flat.^[15] The year 2010 witnessed 49 new female neurosurgical residents compared with 28 in 2008 and 16 in 2006. Although the number of residents may be increasing, only about 5% of board-certified, practicing neurosurgeons are women.^[15]

Regardless of gender, the number of neurosurgeons relative to the population is decreasing. In 1990, the ratio was 1: 80 000; a decade later, it was 1: 91 500.^[16] By 2030, the overall shortfall of neurosurgeons in the United States alone is estimated to be about 6%.^[21] Although the preceding discussion primarily applies to the United States, the status of women in neurosurgery does not greatly differ elsewhere. In 2004, Kato *et al.* reported that women comprised 3.4% of the neurosurgeons in Japan. Nonetheless, only 1.8% of the certified neurosurgeons in Japan are women, despite projections that the total number of female physicians will reach 30% by 2015.^[5] In developing countries, the current status and outlook are far worse, with some countries having only a few neurosurgeons to service millions in population.

Although the gender studies can be criticized for their limitations,^[18] the workforce shortage compels the following conclusions: Neurosurgery needs women among their ranks of practitioners, and most are pursuing other medical specialties.

WINning Strategies

The WIN white paper recommended the following four strategies to help address the lack of women in neurosurgery: (1) characterize barriers; (2) identify and eliminate discriminatory practices when recruiting medical students, training residents, and hiring and promoting of neurosurgeons; (3) promote women into leadership positions within organized neurosurgery; and (4) foster the development of female neurosurgeon role models by training and promoting competent female trainees and surgeons.^[13]

Barriers

In broad terms, the road to becoming a successful neurosurgeon is long with many barriers for any candidate to overcome. The years of training are daunting – and necessarily uncompromising. Passion for the field is required to stay the course. Furthermore, practitioners must be devoted to lifelong learning. Regulatory concerns are increasingly onerous, and residents receive scant training to deal with the intricacies of business demands that they encounter in their own or group practice or in terms of their financial importance to hospital systems. Neurosurgeons are at

a particularly high risk for malpractice suits, and premiums for malpractice insurance can be burdensome, especially for young neurosurgeons already responsible for hefty student loans for medical school. Increasingly, young trainees also want to pursue a “balanced” life – always a challenge for a neurosurgeon. For women, potential discriminatory practices (overt and subtle), lack of mentors, and childbearing (and quite likely the primary responsibility for childrearing) must be added to this list of obstacles.

Although women are more likely to encounter discriminatory practices and behavior than men, males from minorities can also face this problem. Male candidates can also suffer from a lack of mentoring, although, again, this issue is likely to be a bigger concern for women than men. Consequently, when this list is dissected, only one issue falls entirely within the domain of the female: childbearing. I will return to this topic later. However, as Dr. Bean noted in his editorial accompanying the WINS white paper, “The barriers (for women) may neither be obvious nor even acknowledged, but they exist.”^[14]

Gender inequities

Although it is easy to identify the barriers in general terms, doing so specifically in terms of barriers for women requires more studies and more subtle analyses than have yet been conducted. As the WINS white paper points out,^[13] there are no studies on the obstacles to retention and advancement of women. Is the rate of attrition of female neurosurgical residents actually higher than that of males? No studies exist. Solutions cannot be proposed for a problem not yet demonstrated. How many chairs or program directors and their colleagues specifically “groom” female residents to assume leadership positions in organized or academic neurosurgery? If not, why not? Do the women intend to pursue private practice, or does the male majority hinder such interactions? Given the need for women in the workforce, should chairs and program directors be assessed for developing competent female residents?

High-profile cases like that of Dr. Frances Conley at Stanford make it clear that outright sexism remains an issue of concern,^[22-24] and men need to be aware of how they may contribute to creating an atmosphere hostile to women. Furthermore, slights can be unintentional based on our unexamined assumptions. For example, Nancy Andrews, MD, PhD, the first woman appointed dean of the Duke University School of Medicine, has recounted that when she and her husband were introduced to the principal of a school, the man shook her husband’s hand and said, “You must be the man of the moment.”^[19] Such cases, regardless of one’s interpretation of the facts, raise further questions. What are the institutional policies on sexual harassment and discrimination? Has a zero tolerance policy toward discriminatory behavior been implemented? Such policies are unlikely to be uniform across programs, so how do we compare apples to oranges? Is gender an issue that the RRC should tackle?

Nor are hard data available on gender equity in recruitment, compensation, or promotion. Are there differences in interview techniques or questions asked of women (e.g., related to spousal relocation, children, or lifestyle; such questions also may be asked of female residency candidates).^[25] Once women are hired, are efforts made to insure that appointments to committees promote diversity and faculty development? Do women neurosurgeons receive similar rewards for achievements similar to those of their male colleagues?

Without answers to such questions, the real obstacles to recruiting and retaining women cannot be identified and solutions cannot be implemented.

Promoting women in academic and organized neurosurgery

Women are underrepresented in leadership positions both in organized and in academic neurosurgery. Dr. Muraszko remains the first and only female chair of a neurosurgical department. In 2007, she became the first woman to be voted into the American Academy of Neurological Surgeons. She is now also the Director of the ABNS. Dr. Carol Miller from Ohio has served as Chairman of the Joint Section of Spine and as President of the Neurosurgical Society of America. Dr. Gail Rosseau and Dr. Diane Abson-Kraemer have cochaired the AANS membership committee.^[26] Dr. Rosseau is the second woman to serve on the AANS Board of Directors. Still, the list is not long.

What is needed to advance competent women in neurosurgery? Leadership training and negotiating skills have been identified as two of the most crucial needs.^[13] Interestingly, such training is not necessarily gender-specific. They are skills needed by all neurosurgeons who aspire to be leaders. Consequently, such training could easily be incorporated within general faculty development.^[3] In fact, as Venes and Parent have pointed out, most of the training needs identified to address the issue of how to develop women leaders in neurosurgery would benefit men as well.^[3]

Existing neurosurgical leaders need to reflect on their accountability, and departments and institutions also need to hold themselves accountable. In what way is gender likely to raise issues? Should women explicitly be identified for leadership positions (in both academic programs and professional organizations)? Do we create an environment that respects the opinion of women as well as of men, especially in public settings? Do we need to develop goals (not quotas!) related to gender and rewards for achieving them? Should department heads be evaluated on their faculty development skills? Should the faculty be surveyed periodically to determine not only their general level of satisfaction but also their satisfaction with career development experiences? Are interventions working? What is the return on investment for such faculty development programs? What are the costs

of faculty turnover compared with the costs of development or mentoring programs?

Such questions and many more have been asked in terms of increasing women's leadership in academic medicine in general.^[25,27] Has neurosurgery given these same issues adequate consideration?

Mentoring

Despite the independence and strong egos for which neurosurgeons are known, what successful neurosurgeons could honestly claim to have it made it "on their own?" The world of neurosurgery is too complex for one individual to master all aspects of the discipline; relying on the expertise of others is unavoidable. Even when exercising our individual skill to its utmost, for example, during the dissection of a particularly complicated aneurysm, neurosurgeons function as a member of a team. If we are lucky, that team will include a neuroanesthesiologist, circulating and scrub nurses, residents, fellows, and an entire back office of support needed to get the patient to the operating room – to name just a few. In my experience, the most effective team is the one whose members are mentored and who mentor in return. Few would probably argue this point.

Therefore, it is not surprising that female neurosurgeons, whether in training or already in practice, also need mentoring. We all do. None of us profit by anything less than honest and constructive criticism. What, if anything, could we have done differently when resecting that arteriovenous malformation that might have avoided a complication? How might we have better resolved that policy disagreement with a colleague? Why does one surgeon succeed in obtaining research funding and another does not? We all face such issues, and we may well find the answers ourselves. However, we are likely to get there sooner and to respond more appropriately in a similar situation in the future when mentors graciously inform us about institutional politics and culture, share their own surgical experiences, and gently guide us to find our own answers – which is what mentoring is about anyway.

The lack of a critical mass of females in neurosurgery can translate to greater difficulties in establishing a supportive network and a greater likelihood of feeling isolated as a result.^[13] Mentoring therefore may become a particularly important factor in developing successful women neurosurgeons who, in turn, can serve as role models for other women. Although it may be desirable for women to mentor other women, it is not strictly necessary. In a survey of junior faculty, 80% of the female responders and 86% of the minority group responders reported that a mentor did not have to be of the same sex or minority group to be effective.^[28] Men can, should, and must serve as mentors to women in neurosurgery – another goal for faculty development perhaps.

Not surprisingly, women neurosurgeons proactively began to create their own solution to the need for mentoring, among the most notable of which is WIN itself. WIN was founded in 1989 by a handful of women. In 2001, the number had increased to 98.^[29] Two years later, the number of members was 215.^[30] By 2008, WIN had 176 physician members, 15 lifetime members, and 181 total members including medical students, registered nurses, and physician assistants [Table 1].^[31] Membership, however, is not restricted to women alone. The mission of this dynamic international organization, which now has members from Asia, Europe, and Africa, is “to educate, inspire, and encourage women neurosurgeons to realize their professional and personal goals, and to serve neurosurgery in addressing the issues inherent to training and maintaining a diverse and balanced workforce.”^[32]

To fulfill its mission, WIN has launched several independent initiatives.^[13] They offer biannual meetings to provide education and opportunities to network. They developed the brochure, *So, You Want to be a Neurosurgeon?* to help with resident recruitment. In this endeavor, they follow in the footsteps of Dr. Ruth Jakoby who published an article on careers in neurosurgery in 1964.^[33] For more than 15 years, they have offered resident travel scholarships. They also support named lectureships as well as a speaker’s bureau to interest medical students in careers in neurosurgery. Finally, they have established a mentoring program designed to match students and residents with practicing female neurosurgeons.

Such efforts have taken root on a global scale as well. In 1990, Dr. Kato founded the Women’s Neurosurgical Association of Japan to provide a forum for women neurosurgeons to exchange ideas, particularly about clinical and research issues. In 1996, she then founded the Asian Women’s Neurosurgical Association. This organization specifically focuses on promoting excellence in female neurosurgeons across Asia and in advancing the neurosurgical profession in general.

Attracting Women to Neurosurgery

Lifestyle considerations are a major concern to both genders when choosing a career. Increasingly, men and women of the younger generations want a balanced life with time for their family and friends.^[27] To “old school” neurosurgeons, such concepts may seem incompatible with a career in neurosurgery. Nonetheless, as societal norms change in terms of lifestyle choices, we must adjust our expectations, like it or not. We gain nothing as a discipline if we fail to make reasonable accommodations that will attract and nurture the best and brightest, including women, to our field. As senior neurosurgeons retire, such changes will happen anyway as the younger generation redefine the discipline for themselves.

The changes may not necessarily all be detrimental. Careers may be less likely to follow a linear trajectory, but longer life

Table 1: Presidents of WIN^[36]

Year	President
1990	Deborah Benzil, MD
1991	Kym Chandler, MD
1992	Karin Muraszko, MD
1993	Isabelle Germano, MD
1994	Gail Rosseau, MD
1995	Diana L. Kraemer, MD
1996	Lucy Love, MD
1997	Anne Marie Flannery, MD
1998	Emily Friedman, MD
1999	Daria Schooler, RPh, MD
2000	Edie E. Zusman, MD
2001	Sherry Apple, MD
2001-2002	Roxanne Todore, MD
2003	Denise Crute, MD
2004	Holly S. Gilmer-Hill, MD
2005	Kimberly A. Page, MD
2006	Jamie S. Ullman, MD
2007	Susan C. Pannullo, MD
2008	Lauren Schwartz, MD
2009	Aviva Abosch, MD, PhD
2010	Shelly D. Timmons, MD, PhD

Women in Neurosurgery

spans may compensate and make plateaus in advancement less of a concern. Indeed, Bickel and Brown^[27] have suggested that by making healthier lifestyle choices, members of the younger generation may actually be extending their productive professional lives.

Restrictions in the work hours of residents were met with resistance in many quarters, but our programs continue to produce competent neurosurgeons. As educational technology evolves, the time spent learning neurosurgery may be facilitated by the availability of teaching aides such as computer simulations of neurosurgical procedures on which residents can practice before actual clinical encounters. Departments and programs need to be actively exploring how to increase the flexibility of options for new recruits. Job sharing may be one such tactic, and other innovations should be explored. Dual training tracks are another possibility. Instead of spending a year in the laboratory, Venes and Parent^[3] have suggested that trainees who intend to enter private practice instead learn the business skills needed to establish and run a practice. The WINS white paper outlines more than two dozen recommendations to help maintain the viability of neurosurgery.^[13] Solutions implemented in the business domain represent another option for identifying creative methods that could be adapted for recruitment and retention.

Although neurosurgeons will always be a strongly self-selected population with high drive and energy, there are misconceptions about the sacrifices that must be made to pursue this career, perhaps especially among women.^[34] Mentoring initiatives, such as those sponsored by WINS, will help address such misconceptions. However, frank dialogue is needed about that issue uniquely related to

women and that confronts them with unique challenges: pregnancy.

Dr. Susan Pannullo has noted that the employment laws implemented to prevent gender discrimination may inadvertently encourage it because a woman's thoughts concerning childbearing cannot be discussed during recruitment.^[35] Departmental members may then wonder silently to themselves if pregnancy will cause a resident to drop out of a program or a faculty member to be unable to shoulder her share of the responsibilities or fail to be worthy of advancement. Not every woman, of course, wants to have children. But, as exemplified by Dr. Pannullo herself, who was pregnant with her fourth child while serving as the President of WINS, childbearing is not incompatible with a successful career in neurosurgery. In my experience, our female residents have been sensitive to plan their pregnancies during rotations to avoid affecting their fellow residents. One female resident has even had two children during the course of her residency and still discharges her duties successfully.

Not all pregnancies may be trouble free and not all may occur at the most convenient time, but competent women with a passion for neurosurgery will find a way to manage both children and career just as men do and should be assumed to be able to negotiate this issue in the privacy of their lives just as men do. I must note, however, that my good friend and colleague, Volker Sonntag, MD, recently retired chair of our residency program and chair of our spine section, was a devoted soccer Dad, coaching his son's soccer team throughout his entire childhood. And, no one questioned Dr. Sonntag's commitment to his profession or his ability to achieve neurosurgical excellence.

A Challenge to Neurosurgeons

Let me clarify a couple of points. First, neurosurgery is an inherently demanding field. This aspect of the discipline cannot be changed to attract or accommodate any underrepresented group unwilling to do the work to master and advance the field. The overriding concern must remain the integrity of the specialty. The primary goal should be, as it always has been, to attract the best and brightest candidates and leaders who are passionate about neurosurgery, regardless of their gender or any other minority status. Personally, I do not know one female neurosurgeon who would argue differently – and doubt there are any.

The senior female neurosurgeons whom I know, as well as the residents in training at my institution, are as passionate and enthusiastic about neurosurgery as their male counterparts. They have either attained or are working assiduously to attain and maintain the highest technical standards – and then to push the boundaries for those standards of excellence even further. I consider the female residents who have graduated

from my department or who are currently training to be among the best and the brightest; otherwise, they would never have been accepted into one of the largest neurosurgical residencies in North America in a department with one of the heaviest and highest acuity caseloads. They are strong individuals with the same abilities and facing the same challenges as their male colleagues. Personally, I wholeheartedly welcome women as equal partners in what I consider to be the greatest profession.

Second, most male neurosurgeons whom I know treat all of their colleagues, male or female, professionally and respectfully. At least in my experience, outright discriminatory behavior is not the norm. But, as the saying goes, one bad apple spoils the bunch. Furthermore, female neurosurgeons are not entirely exempt from this criticism. Women who have made it as “one of the boys” are encountered in all fields of endeavor, and they may not readily extend their hand to help those who follow after. However, I was asked to write on women's issues and therefore will couch my challenge in those terms.

Many innovative and creative approaches to attain gender equity have been proposed. But solutions start within individuals as much, if not more, than they do within institutions. Before we can change our larger world, we must change ourselves. Furthermore, the path to true diversity in the workforce is more likely to be achieved by teaching, modeling, and mentoring than by mandate.^[6] All of us no doubt operate under mental models that can cloud our perceptions of what motivates our behavior. However, a few simple thought experiments may well serve as a litmus test of suitable professional conduct of male neurosurgeons toward their female colleagues.

What on a daily basis do you do, unthinkingly, to help or hinder the advancement of women? What acts of commission, what acts of omission? What behavior would you want your wife, your daughter, your granddaughter exposed to, and which behaviors, from yourself or your male colleagues, would you find objectionable? Would you want the female members of your family denied opportunities based on their gender, based on their ability to bear children?

Take the thought experiment one step further. Imagine a distant future when women, composing more than half of the population, have gained not only equality but superiority in policy-making positions. How, as a male, would you hope to be treated? Individuals endowed with the intelligence to pursue one of the most demanding medical careers that exists, who daily make decisions that affect not only the well-being of their patients but often whether they will live or die, such individuals know the honest answers to these questions within themselves and should always act accordingly. Ultimately, our goal should be that gender is less important than the overarching fact that we are all just neurosurgeons.

References

1. Woolf V. *A Room of One's Own*. New York: A Harvest/HBJ Book; 1929.
2. Bademci G. First illustrations of female "Neurosurgeons" in the fifteenth century by Serefeddin Sabuncuoglu. *Neurocirugia (Astur)* 2006;17(2):162-5.
3. Venes JL, Parent AD. Women in neurological surgery. Matson Memorial Lecture. *J Neurosurg* 2006;104(4 Suppl):227-32.
4. Channing W. *Remarks on the Employment of Females as Practitioners in Midwifery*. By a Physician. Boston: Cummings and Hilliard; 1820.
5. Kato Y, Mihara C, Matsuyama J, Ochi S, Ono H, Yamaguchi S, *et al*. Role of women in medicine: A look at the history, the present condition and the future status of women in the surgical field, especially neurosurgery. *Minim Invasive Neurosurg* 2004;47(2):65-71.
6. Gilkes CE. An account of the life and achievements of Miss Diana Beck, neurosurgeon (1902-1956). *Neurosurgery* 2008;62(3):738-42.
7. Duncan N. *Caring Physicians of the World*. New York: Pfizer Medical Human Initiatives; 2005.
8. Balak N, Elmaci I. A pioneering female neurosurgeon: Dr. Aysima Altinok. *Acta Neurochir (Wien)* 2007;149(9):943-8.
9. Rosseau GL. Examining the Role of the Female Neurosurgeon in the 21st Century. *Women in Neurosurgery February 2000 Newsletter* 2000; Available from: http://www.neurosurgerywins.org/news/newsletter/wins_0200.pdf. [Last cited on 2011 Apr 25].
10. McClelland S 3rd. M. Deborrah Hyde, MD, MS: the second African-American female neurosurgeon. *J Natl Med Assoc* 2007;99(10):1193-5.
11. Zabihiyan S. Iranian Women in Neurosurgery. *Women in Neurosurgery Spring 2004 Newsletter* 2004; Available from: http://www.neurosurgerywins.org/news/newsletter/wins_spring2004.pdf. [Last cited on 2011 Apr 25].
12. Benzil DL, Muraszko KM. *Heart of Lion, Hands of a Woman: What Women Neurosurgeons Do*. Virginia Beach, VA: Donning Company Publishers; 2009.
13. Benzil DL, Abosch A, Germano I, Gilmer H, Maraire JN, Muraszko K, *et al*. The future of neurosurgery: A white paper on the recruitment and retention of women in neurosurgery. *J Neurosurg* 2008;109(3):378-86.
14. Bean J. Women in neurosurgery. *J Neurosurg* 2008;109(3):377.
15. Abosch A. President's Message 2010: An Incredible Year for WINS. But Much Left to Do. *Women in Neurosurgery Spring 2010 Newsletter* 2010;1-2. Available from: <http://www.neurosurgerywins.org/news/newsletter/currentnewsletter.pdf>. [Last cited on 2011 Apr 25].
16. Benzil DL, Von Der Schmidt E 3rd. Toward Harnessing Forces of Change: Assessing the Neurosurgical Workforce. *AANS Bulletin* 2006;15:7-11.
17. Etzkowitz H, Kemelgor C, Neuschatz M, Uzzi B, Alonzo J. The paradox of critical mass for women in science. *Science* 1994;266(5182):51-4.
18. Ash AS, Carr PL, Goldstein R, Friedman RH. Compensation and advancement of women in academic medicine: is there equity? *Ann Intern Med* 2004;141(3):205-12.
19. Andrews NC. Climbing through medicine's glass ceiling. *N Engl J Med* 2007;357(19):1887-9.
20. Certified US Women Neurosurgeons. *Women in Neurosurgery Web site* 2009; Available from: <http://www.neurosurgerywins.org/whoware/certified.html>. [Last cited on 2011 Apr 25].
21. Williams TE Jr, Satiani B, Thomas A, Ellison EC. The Impending Shortage and the Estimated Cost of Training the Future Surgical Workforce. *Ann Surg* 2009;250(4):590-7.
22. Conley FK. And, ladies of the club. *JAMA* 1992;267(5):740-1.
23. Conley F. Walking out on the boys. Interview by Elizabeth L'Hommiedieu. *Time* 1991;138(1):52-3.
24. Barinaga M. Sexism charged by Stanford physician. *Science* 1991;252(5012):1484.
25. Bickel J, Wara D, Atkinson BF, Cohen LS, Dunn M, Hostler S, *et al*. Increasing women's leadership in academic medicine: Report of the AAMC Project Implementation Committee. *Acad Med* 2002;77(10):1043-61.
26. Women in Neurosurgery. AANS Demonstrates its Commitment to Female Neurosurgeons. *Women in Neurosurgery February 2000 Newsletter* 2000; Available from: http://www.neurosurgerywins.org/news/newsletter/wins_0200.pdf. [Last cited on 2011 Apr 25].
27. Bickel J, Brown AJ. Generation X. Implications for faculty recruitment and development in academic health centers. *Acad Med* 2005;80(3):205-10.
28. Palepu A, Friedman RH, Barnett RC, Carr PL, Ash AS, Szalacha L, *et al*. Junior faculty members' mentoring relationships and their professional development in U.S. medical schools. *Acad Med* 1998;73(3):318-23.
29. Zusman EE. A Hearty Congratulations. *Women in Neurosurgery Spring 2001 Newsletter* 2001; Available from: http://www.neurosurgerywins.org/news/newsletter/wins_spring2001.pdf. [Last cited on 2011 Apr 25].
30. Gilmer-Hill HS. Secretary-Treasurer's Report. *Women in Neurosurgery Fall 2003 Newsletter* 2003; Available from: http://www.neurosurgerywins.org/news/newsletter/wins_fall2003.pdf. [Last cited on 2011 Apr 25].
31. Schwartz LF. President's Message: Why WINS?: A President's Message. *Women in Neurosurgery Fall 2008 Newsletter* 2008; Available from: http://www.neurosurgerywins.org/news/newsletter/wins_fall2008.pdf. [Last cited on 2011 Apr 25].
32. When Women are in Neurosurgery, Neurosurgery WINS! *Women in Neurosurgery Web site* 2010; Available from: <http://www.neurosurgerywins.org/index.html>. [Last cited on 2011 Apr 25].
33. Jakoby RK. Careers in neurosurgery. *J Am Med Womens Assoc* 1964;19:783-5.
34. Ullman J. President's Message: A Balanced Workforce, a Balanced Life. *Women in Neurosurgery Spring 2007 Newsletter* 2007; Available from: http://www.neurosurgerywins.org/news/newsletter/wins_spring2007.pdf. [Last cited on 2011 Apr 25].
35. Pannullo S. The Pregnant Neurosurgeon: Not an Oxymoron. *Women in Neurosurgery Spring 2008 Newsletter* 2008; Available from: http://www.neurosurgerywins.org/news/newsletter/wins_spring2008.pdf. [Last cited on 2011 Apr 25].
36. Women in Neurosurgery. *Who We Are*. *Women in Neurosurgery Web site* 2009; Available from: <http://www.neurosurgerywins.org/whoware/index.html>. [Last cited on 2011 Apr 25].

How to cite this article: Spetzler RF. Progress of women in neurosurgery. *Asian J Neurosurg* 2011;6:6-12.

Source of Support: Nil, **Conflict of Interest:** None declared.