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Selection, Training and Mentoring of Cardiac Surgeons

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Abstract

This chapter explores the unique challenges of selecting, training and mentoring those who will become the next generation of pediatric cardiac care professionals. In addition to the published literature on selection, training and mentoring, we provide new data from the Congenital Heart Surgeons Society and the European Association for Congenital Heart Surgery elucidating the elements deemed most important to the training and professional development of healthcare providers devoted to pediatric cardiac care.

Keywords

Training • Mentoring • Education

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Introduction

There once was a very wise, old woman who lived in a small town. The people in the town would visit her when they needed advice and her influence reached far and wide. Her reputation was irksome for a group of young boys in the town, who felt that she received far more attention and acclaim than warranted and they wanted to show how she was not nearly as smart as was claimed.

The oldest of the boys developed a plan. He would capture a small bird—one that was tiny and fragile enough that it would fit into his cupped hands. He would then approach the old woman, with the bird cupped in his hands, and he would ask the woman: "This bird in my hands… is it alive or is it dead?" The plan was diabolical and certain to succeed. If the old woman said the bird was alive, he would squeeze his hands,

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extinguishing the life from the bird, before opening his hands to show it was actually dead. If she claimed that the bird was dead, he would simply open his hands and let the bird fly away. Either way, they would show that she was not nearly as wise as was claimed. The plan could not fail.

On the selected day, with their appointment to see the old woman secured, and widely advertised to the townspeople, the boys approached the old woman. The leader of the boys had the tiny bird in his hands and he asked the woman: "This bird in my hands…is it alive or is it dead?"

The old woman gazed at them and at the hands that held the bird for a long time. The boys didn't move and the leader of the boys, the one with the bird enclosed in his fateful hands, began to become a bit anxious. Perhaps there was some truth to what was said about this woman. Perhaps she was indeed wise and knew what they were up to. No, that couldn't be. Their plot was perfect.

Finally the woman spoke. She looked at the lead boy and she said:

> About that bird. You ask me if it is alive or if it is dead. It is in your hands.

We are like those boys. We want to know what will become of our profession [1]. It is a profession that is at its greatest. The information in this textbook will illustrate how well we do and how far we have come. We hold the future in our hands.

If we are to see quality and outcomes continue to improve, then our responsibility is to attract those who are most promising. If quality and outcomes are going to improve, we have to find ways to train our successors to be better than we were, despite the challenges that we continuously encounter that alter the training environment—less exposure to cardiac surgery during early years of surgical training, work hour limitations and restrictions for all accredited residency and fellowship training programs, and with diminishing center volumes and emphasis for more "high level" involvement, fewer opportunities for patient management or interventional procedures of any type. If quality and outcomes are going to improve, we need to provide the positive connection to mentors.

Background

This chapter will address each of these challenges: Selection of those who will "follow", training to create a future of excellence, and mentoring to keep providers connected and meaningful to those who will define that future. Our comments will be founded in literature from education, business, psychology, medicine and interpersonal neurobiology and will also be connected to new data acquired for this chapter from two important pediatric cardiac surgical organizations. We will attempt to generalize our information to the challenges encountered across the spectrum of specialties that comprise the profession of pediatric cardiac care, and we will anchor many of our remarks in data obtained from experts in the field of pediatric cardiac surgery.

We've chosen surgery as an anchor for two reasons: first, we have data from this group (and we believe the data can be extrapolated to help us understand challenges that confront each of the other subspecialties) and secondly, we believe that some of the issues facing surgery are unique and require particular attention (although as such, they do appear to some degree in other specialties)—and these will be emphasized where appropriate.

Data Acquisition

In order to better understand what has worked in the past, we surveyed the members of the Congenital Heart Surgeons Society (CHSS) as well as the members of the European Congenital Heart Surgeons Association (ECHSA). Both of these organizations elect members based on merit and are therefore comprised of dedicated congenital heart surgeons who are considered, by their peers, to be successful contributors to our field. We surveyed the members of these two organizations as *surrogates* for the type of individual who has proven success in our field. We could not identify, at this time, a comparable, well-defined group of experts in pediatric cardiology or pediatric cardiac anesthesiology/intensive care; but we believe much of the information provided by our surgical experts is applicable

across specialties. In total, 189 surveys were distributed (152 to current active or past CHSS members and 37 to ECHSA members). We received 71 responses (compliance of 38 %; which provides data reliability at a level of 95 % ± 10 %) [2]. However, we believe the response rate is actually higher since many emails were likely sent to retired or inactive members who no longer participate as active members. Of those receiving surveys, 104 were actually "opened" and this yields a response rate of 68 % (reliability of 95 % ± 5 %) for those who actually "received" the survey. Regardless, research on surveys [3–5] suggests that the response rate to surveys from a fairly homogeneous group of respondents who all perform the same activity provides accurate information at response rates greater that 20 %. Our response rate was 2–3 times higher than this and the engagement of the participants (as reflected by numerous "free field" comments) is also a published indicator of survey validity.

The survey questions were created to help us better understand our educational challenges for the future. We are grateful to the members of these two elite organizations who took the time to respond candidly and thoughtfully to this survey.

Selection

Selection begins with rapture.

> When I (RMU) was 8 years old (Mid-late 1950's), I visited a museum in Chicago, Illinois (The Roosevelt Museum of Science and Industry) and there was an exhibit about the "emerging" field of heart surgery. The heart lung machine was becoming an established (although new) technology, and surgeons were beginning to imagine ways to enter the heart of children born with congenital heart lesions and repair these defects. There was a large model of a heart that museum visitors could walk through (in an anatomically correct path from right atrium, to right ventricle, to pulmonary arteries/veins, to left atrium and finally left ventricle). All of this was done to a background of sound. As the lub-dub of the heartbeat influenced the cadence of my steps, I became entranced. There were exhibits of what surgeons might be able to do in order to repair a variety of congenital heart defects. Heart surgery as an extension of thoracic surgery was a new and exciting field (Denton Cooley called the heart lung machine the "can opener for the largest picnic thoracic surgeons will ever know") [6] and I was enraptured.

Of course, it is a natural for us to think of selection from our perspective in the field, but it is not just we who select those whom we choose to train—it is also we (as a field and as individuals) being selected by those who wish to follow our career path as one worth pursuing. (Ironically, training and mentoring reflects this same duality—how many of us have learned from those we train, and how often do we find that friendships extend over decades as our students become our teachers?!). In this chapter, we explore each element: selection, training and mentoring from two perspectives—*ours* as selectors, trainers and mentors; and *the professional literature* on this topic, as it relates to what future trainees are looking for when they select training programs; what they need in order to "train to competence" in their respective fields; and how we can best fulfill our roles as mentors for their future.

First, whom do we choose? How do we excite the imagination and begin to fan the flames of passion for those who want to share with us in our extraordinary field? And how do we ensure that those whom we select will help take our field to new heights?

Current methods of selection (both for medical school and for residency training) seem to be driven most by objective indices of performance—primarily grades and performance on standardized tests (such as MCATs, USMLE, and In-Training Exams). Many medical schools and residency programs are concerned that the students they select perform well on standardized exams. Ultimately, this will be important so that the trainee can pass the exams required to become board certified in their specialty. There are data that link ability to perform well on board certifying exams (or other standardized exams) to past performance on standardized exams, such that students with high scores on MCATs, USMLE, or In-Training Exams (ITE) are most likely to perform well on subsequent qualifying exams [7–11]. No wonder these candidates seem to be

most attractive to medical schools or training programs. However, there is growing concern that while they may perform well on standardized exams, they may not have the qualities required to succeed in some specialized fields of healthcare [12–14]—that is, a good test taker might not become a great surgeon, anesthesiologist or cardiologist. Furthermore, test taking ability does not measure ability to communicate effectively in complex teams, nor does it reflect on decision making or physical performance under stressful situations. A good test taker will, however, most likely be a good test taker and continue to pass qualifying exams. A poor test taker of the USMLE exams may simply be someone who would benefit from special supervision or assistance [15].

There is increasing understanding that the skill sets necessary for success are variable and that good test taking only reflects one skill set—although an important one, since good performance on USMLE Step 1 and Step 2 is undeniably related to mastery of applied basic and clinical science knowledge. If program directors consider a solid foundation in these domains to be important measures of readiness for growth and development during graduate medical education, then it is reasonable for them to use USMLE scores as a key factor in their consideration of applicants [7, 16]. This emphasis on USMLE scores for selection into residency programs, however, neglects the numerous other talents and skills required for expertise as a physician. Some correlation studies have suggested that performance on USMLE Step 2 (clinical science) is a better predictor of success in residency than USMLE Step 1 (basic science) [13], whereas other studies have shown that Step 1 scores are only useful in students who had prior clinical experience before taking Step 1 [14]. Other studies have suggested that the abilities that are not measured by USMLE exams (such as self awareness, stress management, leadership, humility, teamwork and other "soft skills" are most predictive of how a resident will perform, particularly in interventional team endeavors such as surgery [17]. Furthermore, although gross motor skills do seem to correlate with academic performance such as class rank and USMLE scores, fine motor dexterity—such as that necessary for certain interventional pediatric cardiac subspecialties—does not correlate with academic performance or class rank [18]. The use of standardized scores as a predictor of ultimate clinical performance for a physician and as a professional has come under increasing scrutiny [19, 20]. Longitudinal studies document better correlation between clinical performance and non-standardized measures such as academic performance on clinical clerkships [21], faculty recommendations [19], election to AOA [21], and numerous other factors related to performance not currently measured by standardized exams [8, 10, 11, 13, 14, 17–19, 22].

The selection of a candidate who will be successful and who will both contribute to the profession, as well as receive a lifetime of joy and stimulation from the profession is the goal of every training program. Our expert survey provides significant insight into the factors that might best predict success for those we choose.

Results

By the nature of the membership process, members of the CHSS and ECHSA have achieved excellence as both clinicians and scientists. For this group, prior academic achievement seems to be a hallmark—2/3 (66.2 %) responded that they were in the top 10 % of their college (undergraduate) class and 87.3 % were in the top 20 % of their undergraduate class (Fig. 2.1).

This ability to perform well academically followed them through medical school where 33.8 % were in the top 5 % of their medical school class, over half (51.2 %) were in the top 10 % of their medical school class and ¾ (76 %) were in the top 25 % of their class (Fig. 2.2).

In fact, when ranking overall medical school performance (grades, recommendations, test scores), 87.3 % were considered to be excellent students (top 25 % of their medical school class) (Fig. 2.3).

For the most part, our responders were highly regarded and successful students through college and medical school. We suspect the same is true for those who have become experts in cardiology,

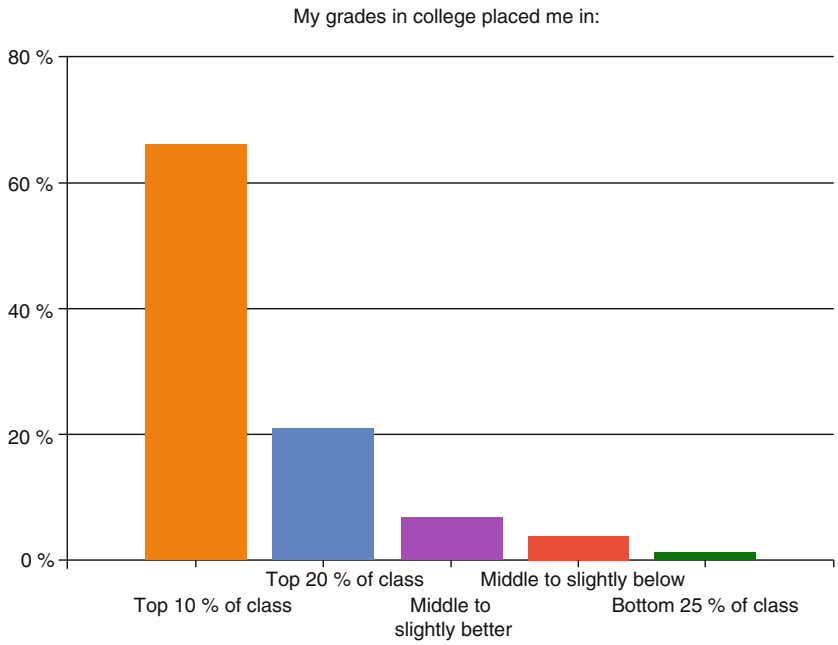

Fig. 2.1 College grades for congenital heart surgeons who are now members of the CHSS (Congenital Heart Surgeons Society) or EACHS (European Association of Congenital Heart Surgeons)

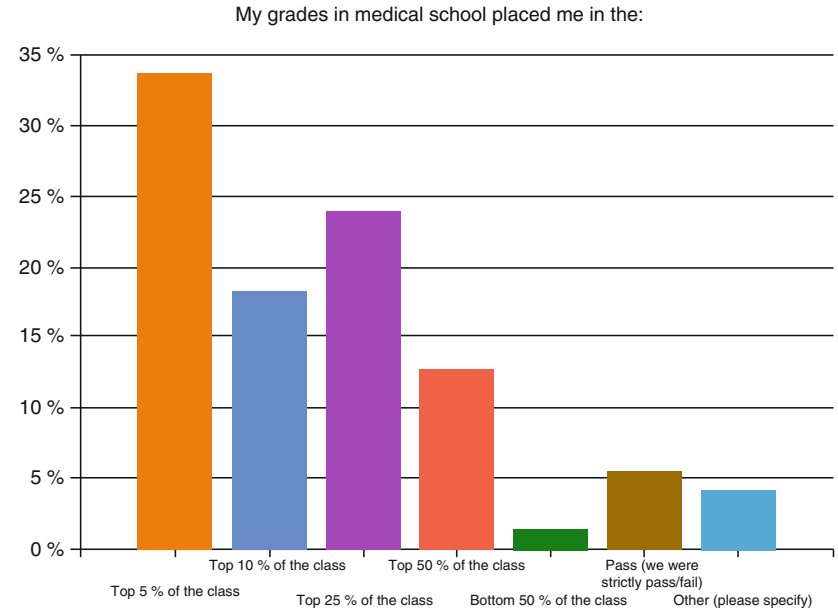

Fig. 2.2 Medical School grades and class rank for congenital heart surgeons who are now members of the CHSS or EACHS

anesthesiology and critical care medicine. For students trained in US medical schools, almost half of our "experts" (45.3 %) were elected to the Alpha Omega Alpha society.

Most of the respondents to this survey had been in practice for over 11 years (84.5 %; and in fact, 40.8 % had been in practice for over 20 years). Over half of today's pediatric cardiac surgeons (53.5 %) decided to pursue congenital heart surgery as a career while they were in their surgical residency (Fig. 2.4). With diminished exposure to cardiac surgery in today's residency programs (Wake Forest University, for example, as is true for numerous other excellent general surgery training programs, does not have general surgery residents rotate onto cardiac surgery services) it may become less likely that surgical residents will become interested in (much less "enraptured by")

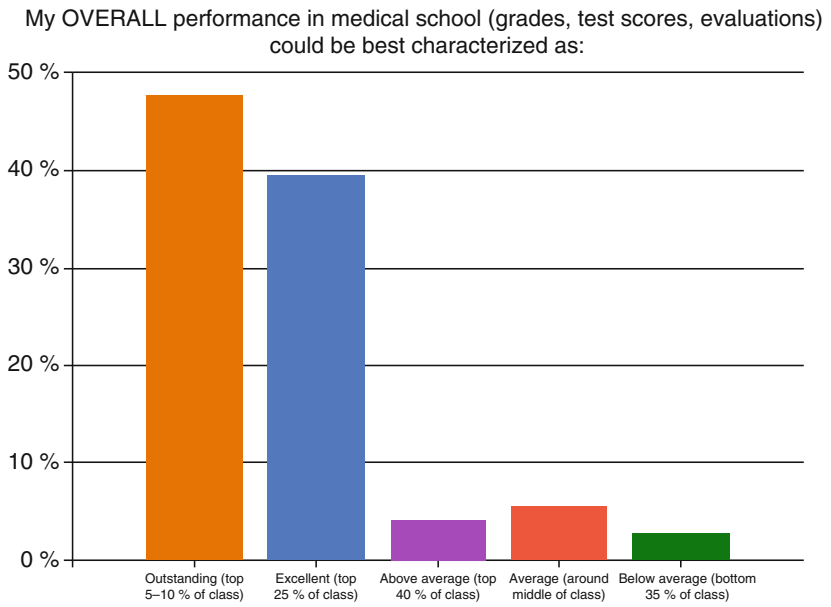

Fig. 2.3 Overall performance rank in medical school for congenital heart surgeons who are now members of the CHSS or EACHS

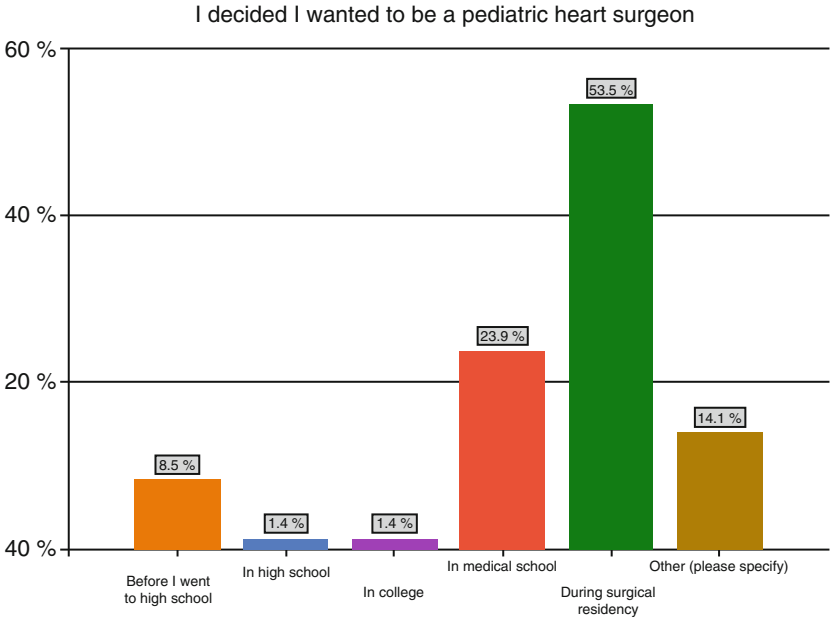

Fig. 2.4 Time period when congenital heart surgeons who are now members of the CHSS or EACHS decided they wanted a career in congenital heart surgery

cardiac surgery. Limited exposure to cardiac surgery during residency, less contact with cardiac surgical faculty mentors who can share their excitement in cardiac surgery and a commitment to mentoring interested residents, and emphasis on the different skill sets of general versus cardiac surgery will likely diminish this previously important pool of residents who will choose to pursue careers in cardiac surgery. Only one fourth (23.9 %) of our respondents decided they wanted to be pediatric heart surgeons in medical school, with another 10 % deciding prior to attending medical school (before high school—8.5 %; in high school—1.4 %; in college—1.4 %).

As the exposure to cardiac surgery becomes less available (at least in surgical residency), and exposure to pediatric cardiac surgery becomes less available during CT residency (most of those in the 14.1 % "other" category decided on pediatric cardiac surgery during their CT residency) our field may not be able to cultivate the kind of excitement and allure—rapture—that

was possible in the past; unless we change our expectations of how and when we will attract (and expose) our future colleagues.

With the emergence of a variety of challenges–economic limitations for personal reimbursement; competition amongst centers which diminish individual case volumes; decreasing jobs (at this time) for some specialties like pediatric interventional cardiology and congenital heart surgery; perceived competition between pediatric and adult cardiologists as well as between cardiologists and surgeons for certain procedures; less (sometimes no) exposure to cardiac surgery in many general surgery training programs as well as limited exposure to cardiology and cardiac critical care in even some of the largest pediatric training programs; reluctance of some general surgery program directors to train individuals interested in cardiac surgery; and the lifestyle attractions of alternative career choices–it might be presumed that students in the top 20 % of their classes would not be attracted to a career in pediatric cardiac specialties, and requirements for additional training. But this doesn't take into account the power of rapture.

Educational programs have been changing. In the US, integrated 6 year training programs (I-6) for cardiac surgeons, which not only save time over the traditional programs of general surgery followed by cardiac surgery, but also offer more exposure to cardiac and thoracic surgery to the interested residents throughout the training years [23, 24], have become extremely popular and are attracting highly successful and talented students [25]. It appears (based on our own experience) that extremely talented and exceptional students are interested in and attracted to a career in pediatric cardiac surgery, cardiology and anesthesiology/critical care medicine, despite the perceived challenges mentioned above. There are still several who select this career path later in training, so it will be valuable to maintain some traditional pathways [26].

Selection in a past era revolved around grades, academic performance and an abundance of qualified applicants. The applicant pools to the current I-6 training programs demonstrate that there are still numerous qualified applicants—in fact more than there are current spots to accommodate them [27]. The increased interest of outstanding and qualified medical students to apply for integrated training that can increase their exposure to cardiac surgery is clear [25, 27]. If these opportunities are not available to the medical school applicants, then they might be forced to enter the alternative track of general surgery training programs, which have changed considerably in their content and exposure to cardiac surgery, as well as in their attitudes towards training prospective cardiac surgeons. Although the data from our survey suggest many trainees selected cardiac surgery through their experiences while undertaking general surgery residency, the enormous changes to general surgery training, along with the lifestyle and demands of additional training may make pursuing a cardiac surgery career seem unattractive and undesirable once general surgery training begins. The integrated 6-year training programs provide a "preemptive" invitation to enter training in our field. Our options to deal with this challenge might include a more active involvement in medical school curricula, and encouragement of more programs to develop an integrated 6 year training model (as well as support from the Residency Review Committee (RRC) of the ACGME to approve and encourage development of more of these programs) [23], so that we can nurture the interest of those who choose our field by being involved with their training from the time they choose it. It is not as likely that we will be part of the types of surgical training curricula that will be inviting and enticing to residents in general surgery programs—they simply are not having the opportunities in the current programs to be exposed to, much less encouraged to consider a career in, cardiac surgery. Therefore, the previous conventional pathway through general surgery may become less optimal and conventional tracks to cardiac surgery training may disappear, particularly as avenues for the best, brightest and most highly motivated.

Given the multiple competing demands for resident's time in pediatric training programs, even some of the most competitive programs have limited exposure to subspecialties like cardiology (to as little as a 1 month rotation over the 3 years of the training program). A choice by a student to pursue a career in pediatric cardiology or in cardiac anesthesiology/critical care requires selection to a pediatric or anesthesiology training program, followed by

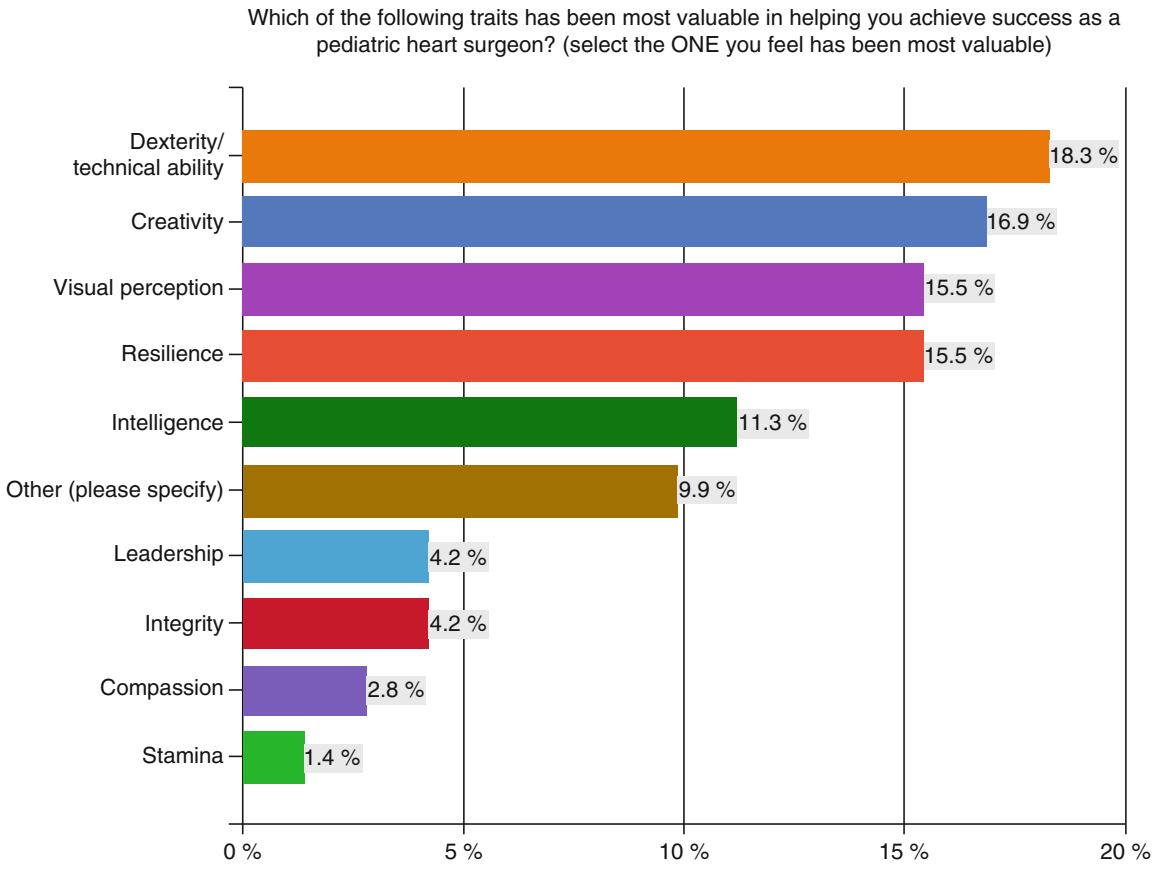

Fig. 2.5 Importance of certain traits deemed by congenital heart surgeons who are now members of the CHSS or EACHS to be valuable to success. The scale demonstrates a degree of importance with the longer bars being considered more valuable

selection into one or more specialty training fellowships.. Recently, a combined pediatric and anesthesiology residency has been developed leading to certification in both specialties. Entry into this type of program involves early selection and may result in development of novel skill sets and permit greater exposure to pediatric cardiac and critical care [28]. Despite this novel integration of training, there are currently no integrated training programs that can "fast-track" the experience and provide increased exposure to congenital heart care to the interested trainee in these specialties. Some have argued that pediatric cardiologists may not require three full years of general pediatrics training to be an academic subspecialist cardiologist [29].

Another consideration in the selection process is the identification of the qualities that are consistent with success in the field of cardiac surgery (and these can certainly be extrapolated to all disciplines). When asked to choose from an extensive list of traits that they felt were most correlated with helping them become successful congenital heart surgeons, the following traits were chosen by more than 10 % of respondents—Dexterity/technical ability (18.3 %); Creativity (16.9 %); Resilience (15.5 %); Visual Perception (15.5 %) and Intelligence (11.3 %) (Fig. 2.5). Many in the "other" group mentioned persistence and commitment—tenacity. As we talk to program directors, many are focused on how to identify and cultivate technical ability and dexterity. We find it fascinating that, on reflection, many of today's most successful surgeons feel that (while technical ability, dexterity and visual perception are certainly important) other traits such as resilience, creativity and tenacity are also extremely valuable. How we identify and select for these traits may be important in how we select those who will follow.

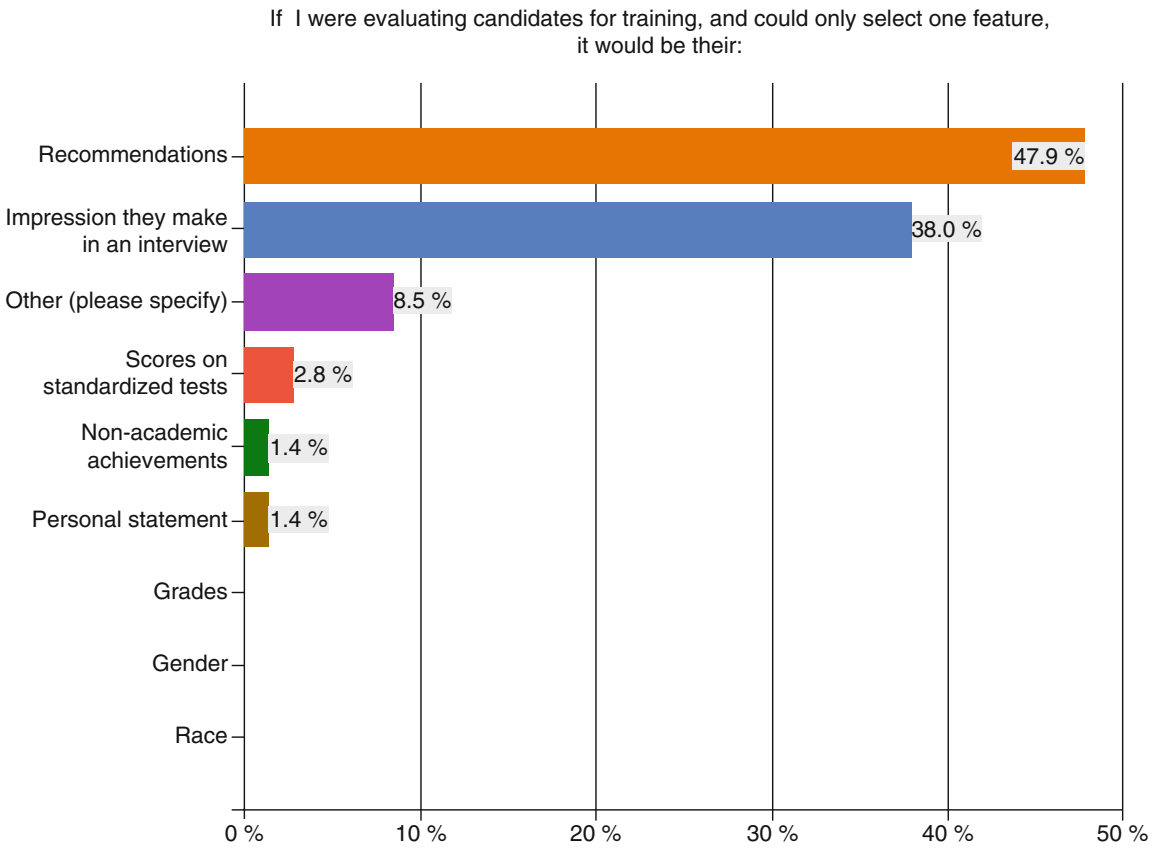

Fig. 2.6 Factors considered to be most valuable when evaluating future congenital heart surgeons, as indicated by surgeons who are now members of the CHSS or EACHS

When asked what factors were most useful in evaluating applicants for training, responses were fairly emphatic—evaluators were looking for passion (rapture), and this was often expressed (as they indicated in separate comments) by "work ethic", resilience, perseverance, determination and motivation to be a successful contributor to the field.

Evaluators were also looking beyond grades and standardized test scores and numerous responders indicated that they were looking for a past history of success (31 %) and outstanding personal values (29.6 %) demonstrated as: emotional intelligence, humility, honesty and ability to listen (also expressed directly as commentary). The importance of this will be discussed in the section under training, but it is clear that in choosing those we wish to train, grades and test scores are no longer adequate as a barometer. More and more experts desire that the applicant possess some cultivation of their personal growth. This is consistent with the research of Goleman [30–32], and others [17, 33–42], who have demonstrated that emotional intelligence (driven by self-awareness and self-management) correlates more with long term success than intellectual intelligence; and both are likely important and necessary to be successful in the practice of high quality pediatric cardiac surgery. Of the experts surveyed, 0 % used grades to evaluate applicants and only 2.8 % used standardized test scores to guide their selection process. Many evaluators believe that they can best assess for these additional qualities through recommendations (47.9 % of responders—and even more so if the recommendations were from people they knew and trusted—stated most frequently in the "other" responses) or by the impression that the candidate makes in an interview (38 %) (Fig. 2.6).

Of particular interest was that when asked which quality (from a long list) (Fig. 2.7) was the

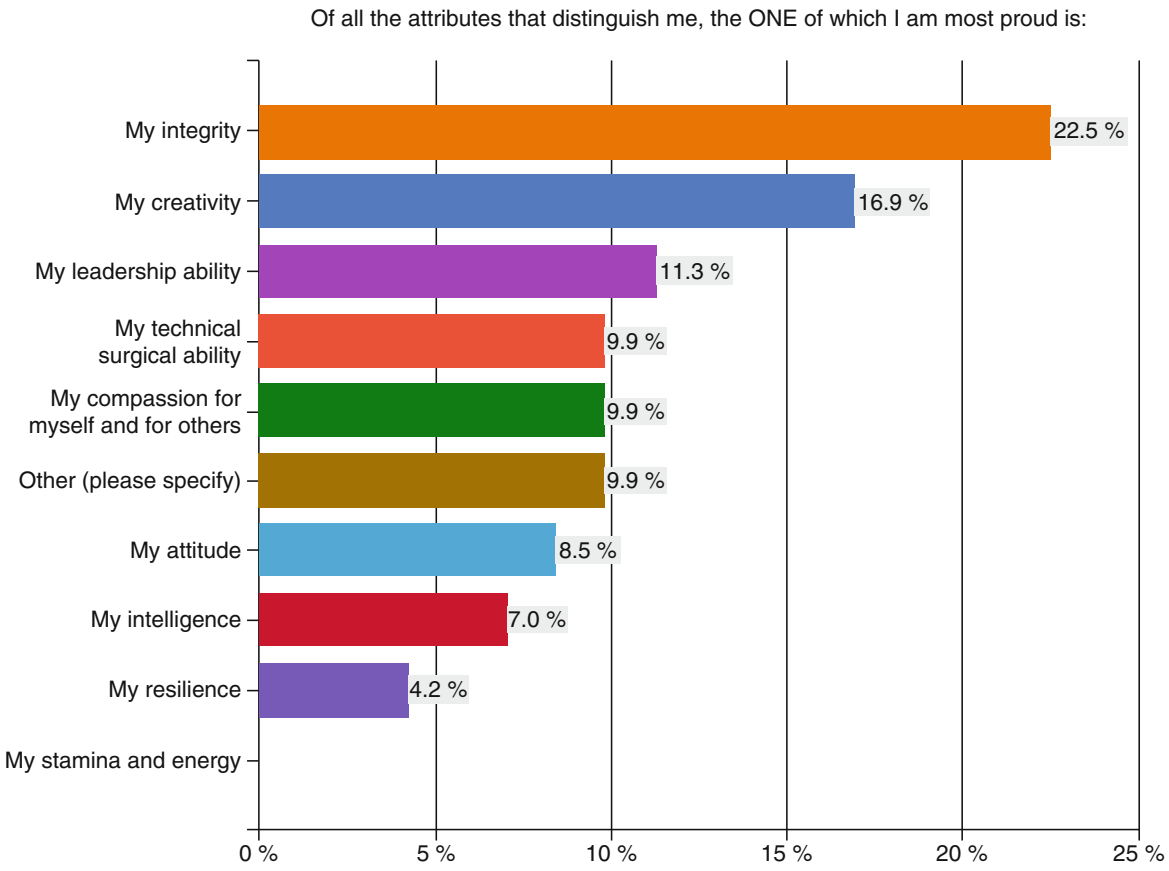

Fig. 2.7 Attributes considered most distinguishing of them as surgeons by members of the CHSS or EACHS. The bars demonstrate a scale of frequency, with the longer bars indicating a trait valued by the highest number of surgeons

ONE that they felt most distinguished them and of which they were most proud, over half indicated their integrity (22.5 %), their creativity (16.9 %) or their leadership ability (11.3 %). No other attributes (including technical abilities or intelligence) were selected by more than 10 % of responders (although compassion for families and others was highly rated). Since these are qualities that are difficult to measure outside of an interview or a recommendation, it is not surprising that these two factors (recommendations and interviews) were rated so highly.

At this time, the majority of applicants for residency training in cardiac surgery in the US are coming through the traditional track of general surgery, as opposed to an integrated 6-year (I-6) training program. Therefore the applicant pool for CT surgery is largely comprised of those who enter general surgery training as a gateway to CT training. An unintentional consequence of this is that we are left to ultimately choose from applicants who meet the criteria set forth by the general surgery programs, which often rely heavily on grades and standardized test scores. By virtue of emphasizing different selection criteria, these general surgery programs may be denying access to the types of applicants who we might find most attractive to select for training in cardiac surgery, particularly pediatric cardiac surgery. This same problem exists in many specialties. In anesthesiology, residency selection has been highly correlated with scores and grades [43]. Unfortunately, academic endeavors such as research and publication history, which may be indicative of "work ethic", seem to have no significant influence. Thus, exceptional candidates who could possibly be outstanding contributors to our field might never have an opportunity to be selected,

and they end up pursuing other career options. At least one residency program has addressed this by essentially making the interview process 24 h including meals to permit further interrogation of the "softer" qualities that may be valuable to the success of our professions.

There is another side of selection, which revolves around how we, as a profession, are "chosen." Excellent students are still attracted to cardiac surgery (as well as to related fields in cardiac care) and want us, as educational leaders, to provide them with the kind of training programs that will help them achieve their dreams of contributing to and making our field better. With the significant changes that are occurring in general surgery residency training programs (less exposure to cardiac and thoracic surgery, diminished expressed enthusiasm for cardiac and thoracic surgery as a career option—some general surgery training programs are actually disinclined to take residents with that potential interest, and transition of training to skills that are less comparable to the ones needed for pediatric cardiac surgery in particular), we can imagine that there will be declining interest from general surgery residents to enter the field of cardiac and thoracic surgery, much less pediatric cardiac surgery. The same may likely be happening in pediatrics and in anesthesiology, where training in the field of eventual interest is not available during the initial years of internship and residency. This in part is attributable to the knowledge base and experience required to achieve proficiency in the general principles of each specialty and then the complexity of each subspecialty area further limiting exposure. Prospective candidates may simply become discouraged by the layers that precede the exposure to the training they really want, and in some cases, may choose other fields entirely.

This will be a challenge that we will confront in the future—how do we respond to a pool of potential applicants to our profession that is created by our lack of ability to provide them with exposure to the fields they are most interested in? Once an applicant chooses us, and we choose them, our attention turns to how we can best train them to become successful.

Training

Our ability to train our future has been significantly influenced by changes imposed over the past decade by the ACGME. Accredited training in all specialties is now regulated by rigid duty hour restrictions, which not only limit the number of hours that trainees can work per week, but also regulate how much time they can spend in the hospital on call and how much time they are required to be off (and out of the hospital) between shifts. Although the intent of this work hour limitation is to create a more balanced, healthy and productive health care worker; and to limit errors related to fatigue and stress, the ramifications on training have been enormous, particularly in certain fields (such as surgery or interventional cardiology) where hands-on experience is a vital component of excellence.

There are conflicting reports regarding the affect of duty hour restriction on operative volume in surgical training programs, although for the most part, surgical volumes have decreased in subspecialty training programs [44–49]. Where operative surgical volumes have been maintained, there is legitimate concern that this has been at the expense of residents sacrificing other important experiences, such as outpatient clinic evaluation [49] for preoperative evaluation or postoperative follow up of surgical patients, as well as in-hospital care of convalescing patients [50]. Nevertheless, surgical trainees report spending less time in the operating room [44], and it is not evident that there is less likelihood for medical errors since the result of the duty-hour limitation is increased transitions of care (or cross covering of care), as well as a reduced sense of "ownership" by trainees of the patients they are caring for [44]. In some settings, such as the ICU, there is a national perception of decreased patient safety [51].

Hospital systems have adapted by having much of the work that used to be time consuming delegated to other health care providers, and the multidisciplinary approach has now encouraged a more collaborative team approach for sharing in the work, with intensive care being provided by board certified intensivists (instead of by surgeons), and daily rounds being performed by cardiologists, hospitalists or care extenders (such as nurse

practitioners or physician assistants). Despite the attempt to relieve the residents in training of this "extra" work, many residents feel that their training experience is reduced and negatively affected by the duty hour limitations. In national surveys of both medical and surgical residents, the vast majority report either no change or a decreased quality of education after the most recent work hour restrictions (centered on reducing duty hours for interns) were released [52]. Although designed to improve patient safety and decrease burnout, this outcome has not been a clearly demonstrated result from duty-hour limitation [44]. This in part may be related to the multiple factors, besides fatigue, that contribute to burnout such as emotional well-being, job satisfaction and a sense that the work is worthwhile, and a sense of being needed—all of which might be negatively influenced by duty hour limitations [44, 53–55].

All of this has resulted in a dilemma where some residents feel compelled to "under report" their actual hours (which results in a sacrifice of personal integrity). Alternatively, the trainee can attempt to strictly adhere to the rigid duty-hour limitations; thereby missing what might be perceived as potentially valuable experiences and occasionally upsetting faculty who they believe expect them to ignore the rules (thus creating the message that "the rules don't apply to us"—which is a dangerous message). Faculty are not entirely without accountability and there are instances where the faculty has explicitly sent this message to the trainee, giving them little choice but to comply.

Concern over the consequences of duty hour restriction was expressed in the open-ended responses by some of our experts, such as this very pointed statement:

> While it goes against current residencies, I think the "maximum exposure" by ridiculous overwork for 2 or 3 years gave me the ability, experience, and knowledge to have less bad patient outcomes in my first 5 to 7 years of practice. To become an expert, exposure is the most important thing, the less exposure the more "on the job learning" which translates to poorer patient outcomes.

Striking the ideal balance between enhancing resident education and improving patient safety will require continued efforts and creative monitoring of outcomes. Perhaps the balance will be different among various sub-specialties that require diverse skills and training. Regardless, there is extensive literature on work hours and their relationship to human performance in health care and other safety-sensitive industries and further discussion is necessary on how exactly to best apply this information to physician training programs [56–63]. Ignoring the evidence about the potentially deleterious effects of sleep deprivation, fatigue and stress on patient safety and individual well-being is not prudent, and it may simply be that we need to modify our training programs in order to pack them with more of the relevant work (which is being done in some cases through the use of physician extenders), or even to extend the duration of the programs, if necessary, so that the trainee can complete their training with a minimal level of competence (which is discussed more completely later in this chapter).

Another major element introduced by the ACGME as a part of the *Outcomes* project was the introduction of six *Core Competencies* (medical knowledge, patient care, systems-based practice, practice based learning and improvement, professionalism, and interpersonal and communication skills). These were introduced on the basis of the reports of the Institute of Medicine [64–67] which emphasized the need to create quality in six domains which included healthcare that is: *patient-centered, efficient, effective, safe, timely and equitable* [65]. In order to achieve this, the core competencies enveloped a variety of skills that training programs became accountable for teaching and evaluating. The implementation of competency awareness has been perceived, in general to have improved care and to have elevated training programs from "apprenticeships" to more formal and structured educational programs designed to teach life skills.

The introduction of formal quality improvement education into residency and fellowship training (as a result of emphasizing systems-based practice, professionalism, and practice-based learning) has the potential to improve outcomes for patients. Improving quality and outcomes requires excellent technical results from a surgery, accurate diagnosis, meticulous pre and post-operative care to avoid iatrogenic injury (such as central line infections or ventilator-associated pneumonias), and careful outpatient follow-up, particularly for the most vulnerable

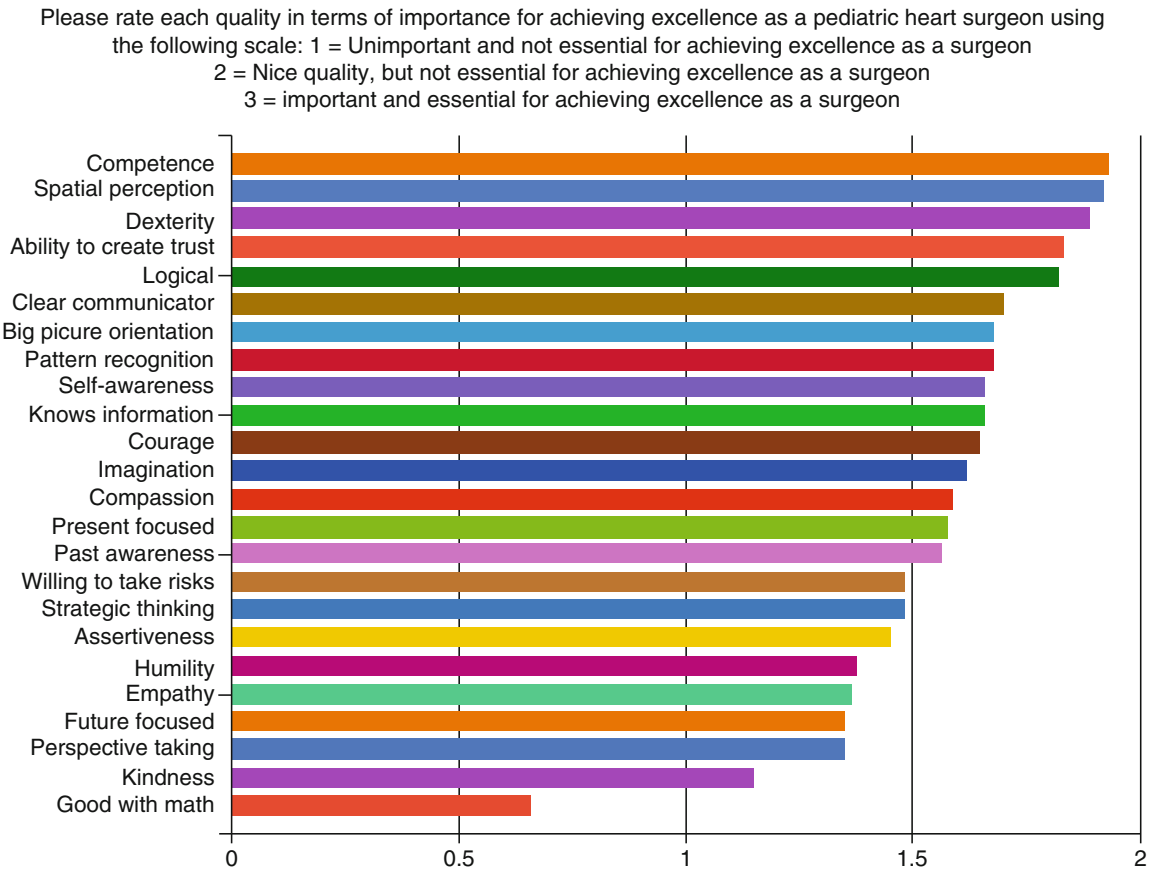

Fig. 2.8 Factors considered important in achieving excellence as a congenital heart surgeon, ranked by members of the CHSS or EACHS. The longer the bar, the more important the trait

patient populations such as the interstage single ventricle cohort. In other words, our outcomes are the result of our entire system, not just a single component. Training the next generation of surgeons, anesthesiologists, intensivists and cardiologists to examine care delivery systems and processes and to participate in rapid cycle improvement activities (related to systems-based, not just individual case-based examples) will be essential to improving the quality and outcomes for patients with congenital heart disease.

The changes to duty hours and the incorporation of more broad-based training (through the competencies) were created in an effort to not only improve quality and outcomes for our patients, but to also reduce stress, create more balance and reduce burnout for healthcare providers. Burnout is becoming recognized as an increasingly important factor in medicine that can contribute to errors [68–71]. Most disturbingly, from our own research (unpublished), burnout seems to be prevalent in medical students before they begin medical school, and increases throughout the educational journey. Awareness and recognition of burnout, and attempts to ameliorate it with programs designed to promote wellness, may have an important place in our future training programs.

In order to understand better how these changes in our educational structure fit against the backdrop of what our respondents felt was most valuable in their training, we asked pediatric cardiac surgeons about a number of qualities and had them evaluate whether or not they felt that these qualities were important to their achieving success. We believe that these data reflect the prevalent mindsets across our profession. The results are shown in Fig. 2.8 ranked in descending levels of importance.

We also inquired about whether or not they received formal education in the qualities they highlighted as important during their training.

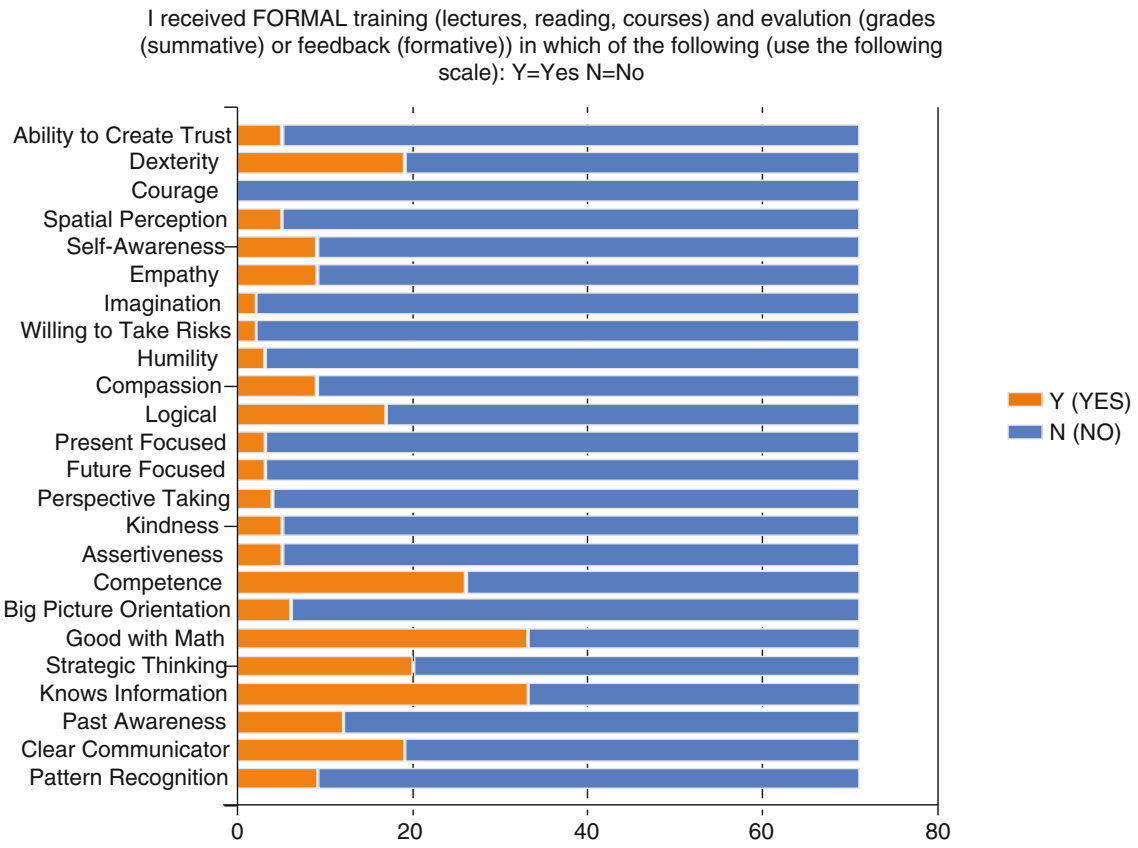

Fig. 2.9 Colored bars indicate whether or not members of the CHSS or EACHS received formal training in various areas. The longer the blue bar, the fewer number of surgeons who felt they were trained in the respective area. The data suggest that most formal training was provided with math and knowledge-based information. There was little training in courage, imagination, risk-taking, humility and kindness

The results are shown in Fig. 2.9, as stacked bars, indicating the number who felt they had received (orange) versus those who felt they did not receive (blue) formal training in these qualities.

Qualities that were deemed essential by over 75 % of the responders included: competence (meaning ability to perform a procedure without supervision) (93.0 %); spatial perception (91.5 %); dexterity (88.7 %); ability to create trust (83.1 %); and ability to be logical (81.7 %).

Other qualities that were also deemed important by over half the respondents were: clear communication (70.4 %); big picture orientation (67.6 %); pattern recognition (67.6 %); courage (66.2 %); self-awareness (66.2 %); knowledge (66.2 %); imagination (63.4 %); present focus (63.4 %); compassion (59.2 %); willingness to take risks (57.7 %); and past awareness (meaning ability to recall past events in order to incorporate them into making decisions for current events) (57.7 %).

Qualities that were felt to be "nice" but unnecessary to be successful as a pediatric cardiac surgeon (receiving votes from less than half the respondents) included: strategic thinking (47.9 %); assertiveness (46.5 %); future focus (42.3 %); humility (40.8 %); perspective taking (39.4 %); empathy (36.6 %); kindness (21.1 %); and being good with math (5.6 %).

Even though considered important to success, most surgeons did not receive formal training in ability to create trust, spatial perception, or ability to be logical. None received training in courage and very few in self-awareness, empathy, imagination, risk taking, humility, compassion, or other areas which we know to be related to developing emotional intelligence [30, 38, 72].

Most acknowledged some training (as would be expected) in math (although this was felt for the most part to be unimportant and not essential to their success), competence (ability to be self sufficient) and knowledge of medical information, as well as some training in communication and strategic thinking.

The information from this survey indicates a lack of alignment and connectedness between our training programs and the skills/attributes that will be most needed for ultimate success in our field. Self-awareness and ability to create trust are essential components for leadership and felt by many [30, 31, 38, 40, 73–79] to be the most critical foundations for successful leaders to develop. Our current training programs seem to emphasize technical skills (dexterity, medical information and "competence"—meaning the ability to do a task without help). Although not part of a "classic" surgical training curriculum, each of the other qualities listed have been associated with leadership and success, and each can be taught (and learned) [30, 33, 35, 36, 38–40, 75, 76, 79–86].

It is also notable that current training programs have no formal training or education in courage [87], imagination [83, 88–90], risk-taking [76, 78, 91], compassion [79, 84, 92, 93], perspective-taking [1, 41, 86, 94–96], pattern recognition, and many other qualities that can be taught, learned and that are associated with leadership and success [38, 40, 78, 82, 97, 98]. In fact, when choosing what they believed was most important for them to share with their colleagues, the past presidents of our national cardiac surgery organizations (American Association of Thoracic Surgery, Society of Thoracic Surgeons, Southern Thoracic Surgical Association, Western Thoracic Surgical Association) have consistently selected topics related to leadership, personal development, courage, compassion and education [1, 87, 99–101]. At this sentinel moment in their careers, these successful surgical leaders have determined that emphasizing "non-technical skills" is the message they wish to share with others.

Current training in pediatric cardiac surgery has changed in the U.S. in the past several years. As general surgery training programs have created fewer opportunities for surgical residents to work on cardiac services, and as the technical components of general surgery have transitioned more to video-assisted, robotic and other non-invasive techniques versus open, hands-on procedures that emphasize cutting and sewing, the residents entering cardiothoracic fellowship programs are less prepared for the technical challenges of cardiac and especially, pediatric cardiac surgery. Yet, these technical skills can certainly be learned and mastered in time—as long as our training programs change and adapt to the current challenges.

The aspiring pediatric cardiac surgeon must now complete an additional year of training following successful completion of cardiothoracic surgery training. This additional year of training must be completed at an ACGME accredited program for pediatric cardiac surgery training and these programs are subject to the same duty-hour restrictions that govern all ACGME accredited programs. In addition, the aspiring trainee is required to perform a specific number and diversity of procedures, show evidence of having received both summative and formative education that is structured and specific to learning congenital heart surgery, and eventually (in order to become board certified) pass a written and then an oral exam.

Many aspiring pediatric cardiologists are also encouraged to complete additional training in the current era. Advanced fellowships with specific national recommendations for the training experiences are available in a variety of subspecialties within pediatric cardiology, such as interventional cardiac catheterization, electrophysiology, echocardiography and MRI, cardiac critical care, and adult congenital heart disease. Unlike surgery, however, at this time, there is no formal exam or board certification (beyond general board certification in cardiology) for any of these subspecialties, although that may be looming on the horizon. Likewise, there is additional training available to those interested in pediatric cardiac anesthesiology. Sub-specialty certification in pediatric anesthesiology is beginning in 2013 and requires 1 year training in an ACGME accredited fellowship and then passing the subspecialty board exam. The training in pediatric anesthesiology does include training in management of

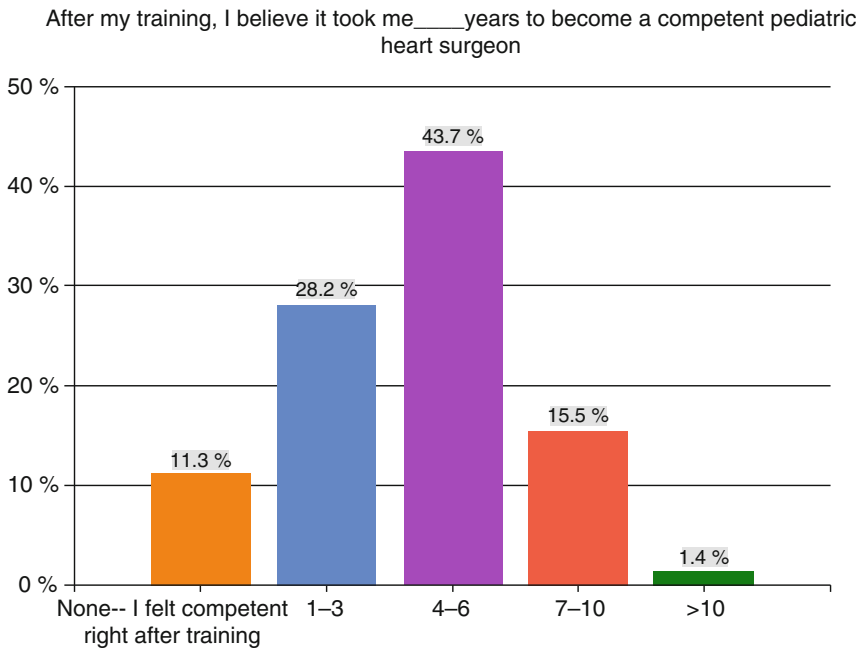

Fig. 2.10 Length of time after formal training that it took for members of the CHSS and EACHS to feel "competent"

children with complex heart disease for cardiac and non-cardiac procedures. However, at the present there is no sub-specialty certification in cardiac anesthesiology although fellowship training is recognized. Further training in pediatric cardiac anesthesiology is available, although no certification or accreditation process is in place.

Most pediatric cardiac surgeons consider themselves to either be visual learners (39.4 %–meaning they learn best by seeing or watching someone do something) or experiential learners (43.7 %–meaning they learn best by doing or having an experience of what they are trying to master). An important minority consider themselves to be perceptual learners (16.9 %–meaning they learn best by reading, reflecting and then using those processed thoughts to guide their actions). There were no surgeons surveyed who felt that they were auditory learners (learning best by listening to a talk or hearing someone describe how they do something). (A personal survey of other specialties has revealed a higher percentage of auditory learners, particularly in more medically related fields). While a minority of respondents felt that they were competent pediatric heart surgeons immediately after their training (11.3 %), the largest number felt that the journey to competence after training takes an additional 4–6 years (43.7 %) and some felt that it can take up to 10 years (15.5 %) (Fig. 2.10). For the most part, congenital heart surgeons felt that they continued to learn and develop after their formal fellowship training was completed (and many of these individuals trained in the era before duty hour limitations). The same is true for other congenital cardiac specialists such as anesthesiology, and is likely also the case for interventional cardiology, critical care, or imaging disciplines.

While competence (ability to perform routine tasks without supervision) is a likely end product of formal training, extended time to achieve expertise is more consistent with the information on development of expertise requiring focused or "deep" practice for a considerable number (10,000 or more) of hours [37, 94, 102, 103]. It may be that our experts, when responding to this question, had differing perspectives on how they valued their abilities and what, for each of them, constituted competence; with competence for some equating with expertise. Regardless, it is clear that the length of time spent in training is not sufficient to enable attainment of expertise—that takes sustained practice.

Defining stages or levels of competency may be helpful. Competency is the ability to perform

a certain task for a work situation without supervision, and to know when to ask for help. It is the intent of most training programs that this is achieved by the end of training. In anesthesia training five stages of adult skill acquisition have been applied: novice, entering training; advanced beginner, at the end of first year of training; competent, at the conclusion of training; proficient, after being in practice 5 years; and expert, after practice for 10–15 years [104]. Regardless, this makes it clear that education and learning continue beyond training and are critically important to attaining the highest degree of proficiency and expertise in all possible scenarios regardless of the discipline.

Lifelong learning itself is a topic that merits discussion, since it is at the foundation of training. The environments that we create for training will ultimately shape those who will become our future educators and mentors.

It is ironic that most health care professionals learned at *Teaching Hospitals*. Teaching evolves from knowing and a desire to share with others what you know. In 1998, Parker Palmer published "*The Courage to Teach*" [105] and each year, the ACGME (Accreditation Council for Graduate Medical Education) bestows a *Courage to Teach* award on some of the nation's great teachers. All of us recall our most influential and inspiring teachers with fondness, admiration and gratitude. We can also recall some of those teachers who made our ignorance feel painful, shameful and frightening. A "teacher" who contemptuously reprimands a student for "not knowing" or worse, for being "stupid, lazy and insulting their time" does more damage than they likely can imagine. In her work on learning, Carol Dweck [76] describes the kind of attitudes that best correlate with performance excellence, and not surprisingly, they are not related to knowing the answers, but rather to asking the questions, even when the answers seem most elusive. This is why we believe it takes more courage to learn than it does to teach [1]. Learning requires that we accept the vulnerability [80, 106] that accompanies "not knowing" and then embrace a willingness to struggle—and possibly fail—while we try to challenge ourselves (and others who work with us, or who we train) to think differently or to do things we (they) have never done. We all walk because our parents likely created for us an environment that *invited learning*. You likely don't remember for yourself, but think of how babies learn to walk. When they fall, we don't criticize them for being a failure, or tell them that they will never be successful at walking. It is not likely that we compare them to a sibling who was walking sooner and admonish them that they should try to be more like that person. No. We applaud, and smile and encourage them to try again. Until they learn. And we share their joy in accomplishment. What happens that we forget how to do that in our teaching institutions? We have created a culture that rewards "knowing" (expertise) and we worry about what would happen to our patients if we weren't experts. An inviting reframe of that last statement is "What 'could' happen for our patients if we could let go of knowing and instead, keep wondering?"

It is unfortunate that we have created a culture that demands perfection, because, in the words of noted historian, Arthur Toynbee, "nothing fails like success." It is regrettable that we have been taught that "if you want a job done right, do it yourself" (ascribed to by 54.9 % of our surveyed surgeons, in lieu of "if you want a job done right, listen to ideas from others"), because this form of contempt for how other's might complete a task is a powerful way to diminish innovation and progress. (The statement instead should be "if you want a job done your way, do it yourself"). One of the babies learning how to walk today will likely set the future record for the 100-yard dash. One of our struggling young students of today may be a future leader in his or her field. But, only if we find a way to invite them to learn. Which means we have to find a way to be tolerant of their struggles, encourage them to continue to think differently, and carefully craft an environment that is safe and free from premature judgment.

In our recent survey of pediatric cardiac surgeons, 90 % of responders stated that they viewed mistakes as inevitable and therefore accepted them as opportunities to learn. (The small minority stated that mistakes are simply not acceptable in cardiac surgery and therefore cannot be tolerated). What was particularly striking, however,

was their response to the next question, which was how they dealt with mistakes. Even though most responders recognized mistakes as inevitable, almost 2/3 (63.4 %) acknowledged that they were "hard on themselves" because mistakes are not tolerable. Only 36.6 % were able to view themselves with compassion as learners. And if the majority of our experts are hard on themselves when they make a mistake, how do we imagine they would treat a trainee?

What makes this even more remarkable is that when asked which teachers (mentors) left them with the most valuable lessons, the majority (76.1 %) remembered them as the ones who were supportive and nurturing—not critical and hard (see comments in section on mentoring). These numbers are compelling, and not surprising. We know we might make mistakes, and we appreciate it when someone supports and nurtures us as we learn, but we have created a cultural belief that we have to be hard on ourselves. This response from our group of professionals is not unusual and, in fact, has been recently validated as a common norm in many professions by research published from the Harvard Business School [107]. It seems that professional cultural norms in our society are to be hard on (critical of) one's-self, while simultaneously appreciating and desiring to be surrounded by those who are tolerant and nurturing of us when we err [108].

Why would we treat ourselves differently than how we wish to be treated by others? Our role as teachers (and potential mentors—addressed in the next section) makes it imperative that we recognize the incongruence behind how we want to have compassion for (and from) others, but not from within and for ourselves.

Our demand for perfection stems from the high stakes of what we do—taking care of patients with life threatening illnesses—and from our hope that all patients will survive to have a normal life [72]. Unfortunately, this demand for perfection—at all costs—is perpetuated by our cultural belief that errors are not tolerable—that they make us imperfect and unacceptable. Although it would seem nice to be perfect, perfection is an unachievable goal (since perfection is a moving target in complex adaptive systems) and it is unlikely to be achieved in our profession—particularly for those who cannot admit to, much less forgive themselves for error (as the work of Carol Dweck, cited below, emphasizes). For some, this intent to be "perfect" gets entangled with their own sense of worth and esteem—more important than the patient doing well is how they are thought of by their peers and therefore they can only be valued if all their patients survive and their peers (many of whom barely know them and have likely never worked with them) believe they are exceptional. This phenomenon in the marketing world is termed "perception management" and it revolves around creating an illusion that becomes the accepted reality. The belief that there is a "solution set" that will always create a successful outcome is not realistic in complex biological systems, in which no two patients or defects are exactly alike. Although mechanical systems are expected to perform in a consistently reliable and predictable fashion [65, 72], biologic systems do not behave this way. That is why there is an occasional mortality after ASD closure or why some patients develop early pulmonary hypertension from lesions that should be safe to follow. Unfortunately, when perfection is not possible, the delusion that it is achievable can lead to dashed expectations, disappointment and a "culture of blame." [74, 109] As trainers (and potential mentors), we have the power to transform our culture to one of curiosity (rather than blame), by modeling how we can explore (with compassion, openness and non-judgment) the creative potential that errors and failure (even when not associated with an error) have for helping us learn; and in the process of learning, truly enjoy our lifelong growth as students, as healers and as professionals.

Another unintended consequence of the striving for perfection is the lack of forgiveness for oneself and for others when the results aren't perfect. The research on self-compassion [84, 85, 92, 93] has been impressive. The ability to have compassion for oneself is directly and positively linked to the ability to learn and to the ability to be resilient and cope with difficulties [42]. (No wonder many of our surgical experts indicated resilience as the quality that was most important

to their success). When contrasting high self-esteem with or without self-compassion, there is a distinct difference. Self esteem without self-awareness and self-compassion (recognition and acceptance that we all have experiences of disappointment and failure–that the self is imperfect and still deserves kindness) is often associated with grandiosity and failure to acknowledge what is "real"—a potentially dangerous trait in a cardiac surgeon, cardiologist or anesthesiologist. [84] When self-esteem is tempered by awareness of limitations, and associated with the ability to be compassionate towards oneself, this can lead to more genuine (less grandiose) self esteem that is more appropriate because it is related to the ability to hear feedback (without defensiveness), while still maintaining kindness towards oneself as a *learner* [84]. This is the challenge for us as lifelong learners—to accept that we are learners, meaning there will be times we "don't know" and have to "struggle" as we try to do new things or think in new ways [1]. A system that insists on perfection makes it very dangerous to be a learner, and ultimately, limits our ability to provide best practice.

Carol Dweck a psychologist from Stanford who has spent decades studying the learning process, has arrived at the conclusion that one of the crucial ingredients of success is the ability to learn from mistakes. Her work is thoughtfully cited by Jonah Lehrer in his book "*How we Decide*" [110] in explaining the neurobiology of learning.

Lehrer writes about Dweck's most famous, and for many, most poignant study. It was conducted in twelve different New York City schools and involved more than four hundred fifth graders. One at a time, the kids were removed from class and given a relatively easy test consisting of non-verbal puzzles. After the child finished the test, Dr. Dweck and her researchers told the student his or her score and provided a single sentence of praise. Half the kids were praised for their *intelligence*. "You must be smart at this." The other students were praised for their *effort*: "you must have worked really hard."

The students were then allowed to choose between two different subsequent tests. The first choice was described as a more difficult set of puzzles, but the kids were told that they'd learn a lot from attempting it. The other option was an easy test; similar to the test they'd just taken.

When Dweck was designing this experiment, she'd expected the different forms of praise to have a rather modest effect. After all, it was just one sentence. The results of her intervention are described below. Imagine, if a single sentence has the power to create these outcomes, what might result from a pervasive attitude in a system where the sentence is expressed as a cultural value?

Of the group of kids that had been praised for their efforts, 90 % chose the harder set of puzzles. However, of the kids that were praised for their intelligence, most went for the easier test. If we do what works because we think it makes us look good—if we aren't willing to risk failure or struggle as the condition of learning, then we are doomed to stop learning, growing and improving. We get stuck. There are surgeons who tout themselves as experts, yet they are reluctant to offer new procedures to their patients and simply state: "I don't do that operation."

> I myself (RMU) used to criticize the Ross procedure in the 1980's. I rationalized that it was a bad operation ("risk for two valve disease, etc.") and encouraged patients to avoid it. What I really meant was that "I didn't know how to do the operation and it scared me to try it", so I had to find a way to rationalize why I didn't offer it. Fortunately, at the time I was also learning about fixed vs. growth mindsets [76] and beginning to understand how to find the courage to try and master new things, even when that contributed to some outcomes that were initially "less than perfect."

This is similar to the transition that occurred in pediatric cardiac surgery when transitioning from the atrial switch to the arterial switch procedures. Surgeons had to be courageous enough to learn a new technique, even though the previous one seemed to work well, because there was likelihood that the new technique might be better. Learners recognize that they need to continue to invite the "discomfort" of not knowing and of having to adopt something new if they are to keep current. The arterial switch is now a standard procedure for infants with transposition of the great arteries and

the Ross operation seems to have considerable benefits compared to other valve replacement procedures for children [111–113]. Without "inviting learning" we won't have progress, whether it is new technology or new solutions (such as new operations or strategies). We are unlikely to develop the skills and experience necessary to deal with challenging new problems if we continually choose the "solutions" that are comfortable in order to feel better about ourselves.

When we are taught to fear failure, we suppress learning. The question for our training programs—each of them—is how do they handle failure? What happens to people who fail? Are they applauded for their efforts and encouraged to learn what they need to succeed, or are they admonished, punished, dismissed or ridiculed? Which kind of training program do you think would bring out the best in you?

Dweck went on to study this further. She gave the same fifth graders yet another test. This test was designed to be extremely difficult—it was originally written for eighth graders—but Dweck wanted to see how the kids would respond to the challenge. The students who had been praised for their efforts in the initial test worked hard at figuring out the puzzles. "They got very involved," Dweck says. "Many of them remarked, unprovoked, 'this is my favorite test.'" Kids that had initially been praised for their smarts, on the other hand, were easily discouraged. They viewed their inevitable mistakes as signs of failure: perhaps they really weren't smart after all. After taking this difficult test, the two groups of students were asked to choose between looking at the exams of kids who did worse than them or looking at the exams of those who did better. Students praised for their intelligence almost invariably chose to bolster their self-esteem by comparing themselves with students who had performed worse on the test. In contrast, kids praised for their hard work were more interested in the higher-scoring exams. They wanted to understand their mistakes, to learn from their errors, to figure out how to do better.

The final round of tests was the same difficulty level as the initial test. Nevertheless, students who had been praised for their efforts exhibited significant improvement, raising their average score by 30 %. Because these kids were willing to challenge themselves, even if it meant failing at first, they ended up performing at a much higher level. This result was even more impressive when compared with students who'd been randomly assigned to the "smart" group; they saw their scores drop by an average of nearly 20 %. The experience of failure had been so discouraging for the "smart" kids that they actually regressed.

The problem with emphasizing "smart" (or natural, gifted talent) is that it misrepresents the neural reality of education, learning and development of expert skills [37, 102, 103, 110]. When neurons in a circuit become repeatedly activated, the oligodendrocytes and astrocytes (the supportive glial cells) sense that firing and wrap myelin around the interconnected neuronal circuit [41]. Myelin can increase conduction speed by 100 times. And while all neurons need to rest after firing, myelin can reduce that refractory period (resting time) by 30 times. The end result is that if we train well (and repeatedly) our learned (myelinated) circuits will function 3,000 times faster than untrained (unmyelinated) circuits [41]. "Skill is myelin insulation that wraps neural circuits and that grows according to certain signals" [37]. "Things that appear to be obstacles turn out to be desirable in the long haul."

Spending hours training and learning is not sufficient. Research is clear that the training needs to be specific, focused and "deep." "Deep practice feels a bit like exploring a dark and unfamiliar room. You start slowly, you bump into furniture, stop, think, and start again. Slowly, and a little painfully, you explore the space over and over, attending to errors, extending your reach into the room a bit farther each time, building a mental map until you can move through it quickly and intuitively" [37]. The essence of deep practice is to immerse yourself in an experience. In skill development, "by trying hard to do things you can barely do, in deep practice—then your skill circuits will respond by getting faster and more accurate" [37]. This process can be enhanced by a guide (mentor), but can only be learned by actual, repeated "doing."

Struggle is not optional—it is biologically required. In order to get your skill circuit to fire

optimally, you must by definition fire the circuit suboptimally; you must make mistakes and pay attention to those mistakes; you must teach your circuit. You must also keep firing that circuit—practicing, in order to keep myelin functioning properly. After all, myelin is living tissue. "Deep practice is built on a paradox: struggling in certain targeted ways—allowing yourself to make mistakes, (and having compassion for yourself—and others—as learners) to seem stupid—makes you smarter.

Emphasizing smart over continual training and learning encourages avoidance of the most useful learning activities, which is learning from mistakes. In medicine, this may be avoidance of doing the procedure we are uncertain of—staying safe doing what we know—even when the more risky procedure may be better for the long term benefit of the patient. It may manifest, as it did in the group of "smart" kids by choosing to compare our programs to those that are worse, perhaps using a non-valid criteria that favors us, in order to make us feel better. Perhaps this is accomplished by avoiding difficult cases (complex puzzles) or by doing less risky, although possibly less optimal procedures. Anything to convince ourselves and those who might judge us that we are "smart."

Leaders for creating the training programs for the future MUST create environments where it is safe for learners to struggle as they try new things, even if there is the price of occasional failure. This invites the use of more simulation, but also more tolerance, patience and presence [41, 114] by the trainers during actual cases in order to help keep the learner (and the patient) safe. In systems where leaders respond like the fifth graders who wanted to be validated, failure is feared and the eventual outcome is regression. There is no shortcut for this painstaking process.

Our data suggest four important recommendations for training.

The first is that surgical (and possibly interventional or anesthesia) training programs will do better by emphasizing time in the Operating Room for both visual and experiential learning, and that time for reading should be valued and supported. Lectures and didactic sessions, while a mainstay in our current training programs, may have less value, unless they are integrated into some form of other learning style (for example, case-based or systems-based learning through presentation by a trainee based on their reading—for perceptual learning; or based on their experience watching or doing a procedure—for visual or experiential learners). The act of the trainee personally presenting information may help them to myelinate learning circuits more effectively than simply listening to information presented by another.

Secondly, our surgical experts valued experiences where they felt nurtured and supported, despite a cultural tendency for self-criticism and intolerance of errors. Data on learning and ultimate success validates the importance of creating a model for self-compassion, acceptance of struggle and willingness to try and conquer new things (even when these new things might be difficult and challenging). In order to provide this type of training environment, faculty need permission to spend time in the OR helping guide the young learner, and it is incumbent on all of us to design ways to do this in our current organizational climates that emphasize operational efficiency, maximizing RVUs and intolerance of struggle (when struggling creates delays and potential for error). Additionally, use of simulation through case-based scenarios may play a role in accelerating experiential learning and proficiency by permitting discussion, evaluation, and debriefing in a trusting, non-threatening environment with no patient at risk.

In light of this altered concept of learning (as a process that requires courage and willingness to struggle), it would be helpful to create formal training in many of the qualities that our surgical experts felt were important or essential (qualities which are also supported as such by extensive literature) and which are currently not taught in our training programs. These qualities, can be taught and learned and might be best done through a series of reflective exercises, through carefully assigned reading related to personal development and through formative coaching that emphasizes the development of these attributes as a part of experiential learning.

Finally, our data demonstrate that "training to competence" extends beyond the formal residency-training period, and therefore, the period following formal fellowship training is critical for success. This also implies that certification of competence in pediatric cardiac specialties might be best "postponed" for a variable period of time following formal training until certain criteria are met that are more indicative that competence has been achieved, with competence including development of the attributes and qualities noted by our experts as important—qualities like resilience, self-awareness, integrity (self honesty), humility, courage and self compassion, recognizing that at this time there are no metrics to measure achievement of these qualities. The duration of the "time until competent" might actually increase in the era of duty hour restrictions, simply because of the reduced experience that our trainees will acquire before taking their first faculty/attending position. Therefore, mentoring (as discussed in the next section of this chapter) may play an even larger and more critical role in the future as training extends beyond the accredited training period.

Mentoring

The increasing complexity of congenital heart disease, the high stakes involved with decisions and performance, combined with the external demands on us as professionals (financial, social, relational) can lead to higher levels of stress—which can be experienced as both job and life related stress. All forms of stress, including the stress that is "job-related," have been linked to failing individual health and illness [115], decreased individual performance [116, 117], There is a growing body of evidence that when a young learner develops a relationship with a mentor, they experience decreased stress, improved performance and ultimately better personal and professional relationships.

Mentor was an Ithacan noble in Homer's *Odyssey*. He was a wise counselor for his friend Ulysses and was entrusted with the care, education and protection of Ulysses' son, Telemachus. Today, the term mentor generally indicates teacher, adviser, sponsor, counselor and role model. It likely is much more than that, with the whole becoming more than the sum of the parts. Mentoring creates a "powerful emotional interaction between (generally) an older and a younger person, in a relationship in which the older mentor is trusted, loving, and experienced in the guidance of the younger" [118]. Performed in accordance with this ideal, mentoring can create a resonant bond between the mentor and the mentee that reflects extraordinary and *primal* leadership [97]. Although there are certainly important similarities between leadership and mentoring (and some individuals in our field perform dual functions in this regard), there is an important distinction between leadership and mentorship. Whereas leaders are "creators and manipulators of culture," [119] mentors are "transfer agents of culture" [120]. Leadership involves a performance-oriented influence process, whereas mentoring involves a long-term role-model relationship that is primarily career and development-oriented [121, 122]. Leadership is typically a single leader influencing one or more followers, whereas mentoring usually involves one mentor and one protégé[1] (or mentee). Leadership may utilize a more formal, overt, and direct influence process, while mentoring may create a more informal, subtle, and indirect process of influence [123]. Not all effective and experienced leaders become effective mentors [122]. Some leader behaviors are primarily task-oriented (such as planning and organizing, problem solving, clarifying roles and objectives, monitoring), whereas others are more relationship oriented (such as supporting, developing, networking and recognizing). Some leaders perform task functions better than they do relationship functions, but *good mentors must perform relationship functions*. Only those leaders who

[1] The term protégé appears in the literature on mentoring, but seems to indicate an apprenticeship model where succession is handed to those who follow. We prefer the term mentee, since it more accurately implies the extended connection between an academic medical mentor and the younger students whose careers they influence, regardless of where those career paths lead.

excel at both task and relationship functions turn out to become great mentors.

Mentors perform both career and psychosocial functions. Career functions include sponsorship, exposure and visibility, coaching, protection, provision of challenging assignments (cases), and transmission of applied professional ethics. Psychosocial functions serve to enhance the mentee's sense of competence, identity and work-role effectiveness—essentially self-esteem or self-efficacy. In order to provide these psychosocial benefits, successful mentors provide role modeling, acceptance and confirmation, counseling and friendship (mutuality). Skillful mentors seamlessly blend these functions in their work with their protégés [124, 125].

Informal mentorships (those that develop spontaneously, without formal assignment by a third party) are considered by both mentors and mentees as being more effective and meaningful than formal (assigned) mentorships [126]. Most agree that mentorships in professional training should be facilitated rather than assigned.

Ideal mentors seem to exhibit specific personality characteristics and interpersonal traits that enhance their effectiveness. In terms of personality, desirable mentors are intelligent, caring, and appropriately humorous. The are flexible, empathic and patient. In addition, they are interpersonally supportive, encouraging and poised. They appear to exude "emotional intelligence." This is not at all surprising considering the fragile nature of learning (described in the previous section) and how it can be best nurtured and supported. Highly rated mentors also seem to be ethical, psychologically well-adjusted, and well-known as scholars and professionals. In essence, excellent mentors are kind, healthy and competent [118].

In a training environment, the "benefits to the mentee can be so valuable that identification with a mentor should be considered a major developmental task of the early career" [127]. These benefits include development of professional skills, enhancement of confidence and professional identity, scholarly productivity, enhanced networking, successful accomplishment of training goals, and overall satisfaction of the training program. Harder to measure, but perhaps most significant for the mentee who has had an effective mentor is their perceived "support, encouragement and blessing for their journey that leads to the 'realization of their dream" [128]. Mentors also benefit from the relationship with enhanced career satisfaction, rejuvenation of creative energy, and a sense of generativity [128].

As we look towards the future of our profession, the role of mentoring is critical. This is well recognized by our experts. Along with getting a good education and having natural ability for their profession, almost half of today's successful pediatric cardiac surgeons (42.3 %) felt that most contributory to their success was the involvement of a good mentor.

This is not surprising and is a theme that dates back to a time when stories were passed down as narratives. Each of us is on our own "hero's journey" [1, 78, 114, 129–132] which traces our path through the chapters of our lives. For each of us, the journey requires a period of searching and training (which includes connecting to our own best pieces), followed by a period of accomplishing and succeeding (as we become comfortable and confident with the competent best parts of who we are and what we can offer) and finally ends with enlightenment, transformation and satisfaction that we have achieved our goals (although these goals may be different than the ones we often set out to attain!) [1]. Along this journey, we find many who choose to help us on our quest, and we accept their help because they have something important to share with us. Some of those who choose to help us become valued guides whose wisdom and advice we gladly seek and whose influence on us becomes indelible. These mentors can take on many forms. When asked about the importance of various people as mentors in their lives, our experts told us that they included parents, family, spouses and colleagues as well as those assigned to formally train us (Fig. 2.11). Others included non-surgical colleagues (such as cardiologists) and even friends and roommates from college. There are so many opportunities to find influence in our lives when we are open to accepting it.

Ultimately, the bond between a mentor and a mentee is mutual and profound. It most often

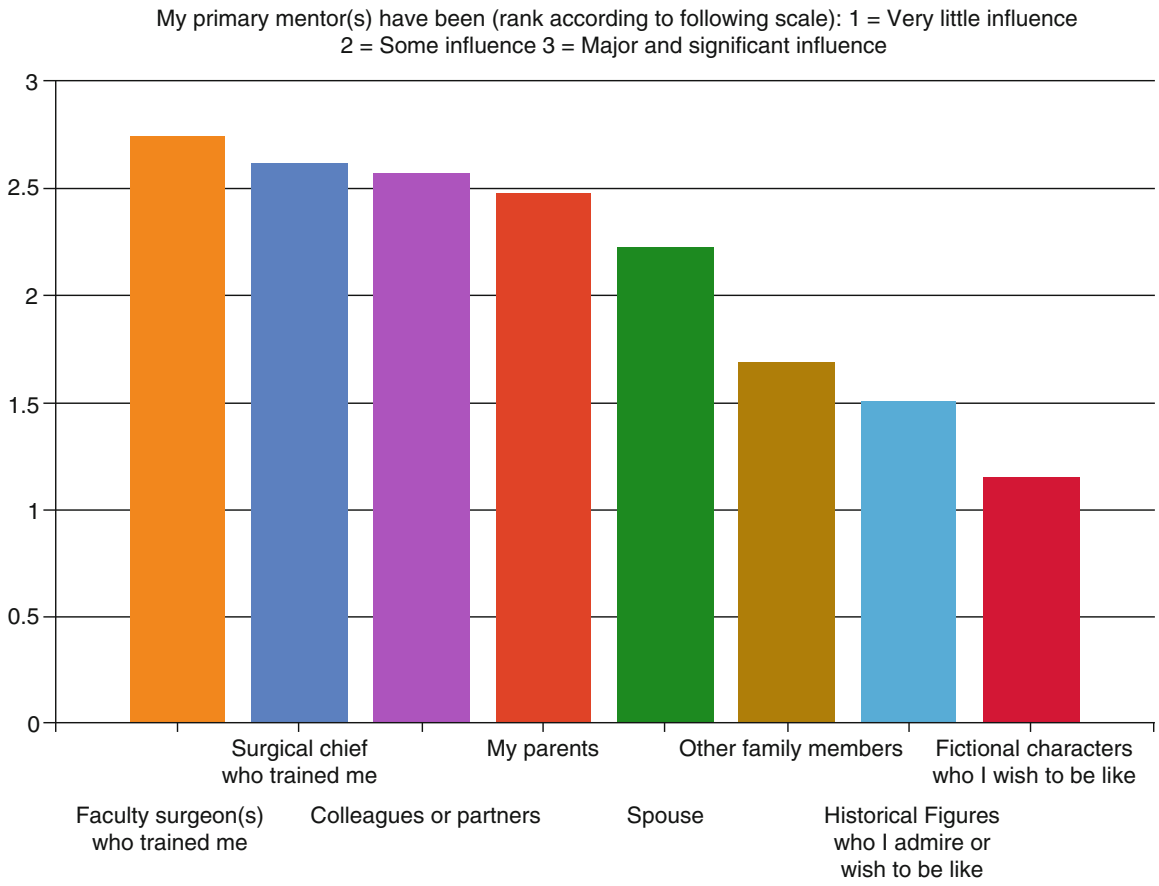

Fig. 2.11 Figure demonstrates that mentoring can come from many sources. Height of bars shows frequency that members of the CHSS or EACHS found mentors from the listed sources

develops over time and is based on shared investment in what each has to offer to the other. For the mentor, it usually includes genuine caring and concern for the mentee, but it requires much more than that to be significant. In the best circumstances, the mentor is attuned to and resonates with the mentee—and the mentee can sense this. They feel "gotten." Most importantly, the mentor accepts the learner where they are, without judgment or contempt, and the mentee can sense this [133]. As stated by one of our experts, when describing how a successful mentor should engage a learner:

> I do believe that the student should be encouraged to surpass the teacher.

Mentors attune, genuinely care, join the learner where they are and teach them how to be better. They do this by setting an example, and also by nurturing, praising and constantly allowing the learner to "work very hard at this" [76]. Mentors are patient with the process of myelination.

The importance of the mentor in creating (and transferring) a culture that nurtures a learner was expressed by one respondent to the survey (crucial identifying information deleted with editing to create anonymity):

> The attitudes of *surgeon X* as a teacher and *surgeon Y* respectively created an entirely different experience for me: 1) If, during an operation, *surgeon X* was irritated by an assistant doctor he did not like or esteem, he would not react as many of us and shout at him but rather very kindly address the person saying "why don't you go to the other side of the table, you will see much better"… 2) If, when *surgeon X* was on call, I needed to phone him at home at three o'clock in the morning, he (regardless of his age of 65) would come into the hospital to give advice or help. If an operation had to be done, *surgeon X* would assist the resident irrespective of him missing sleep. 3) *Surgeon Y* was much

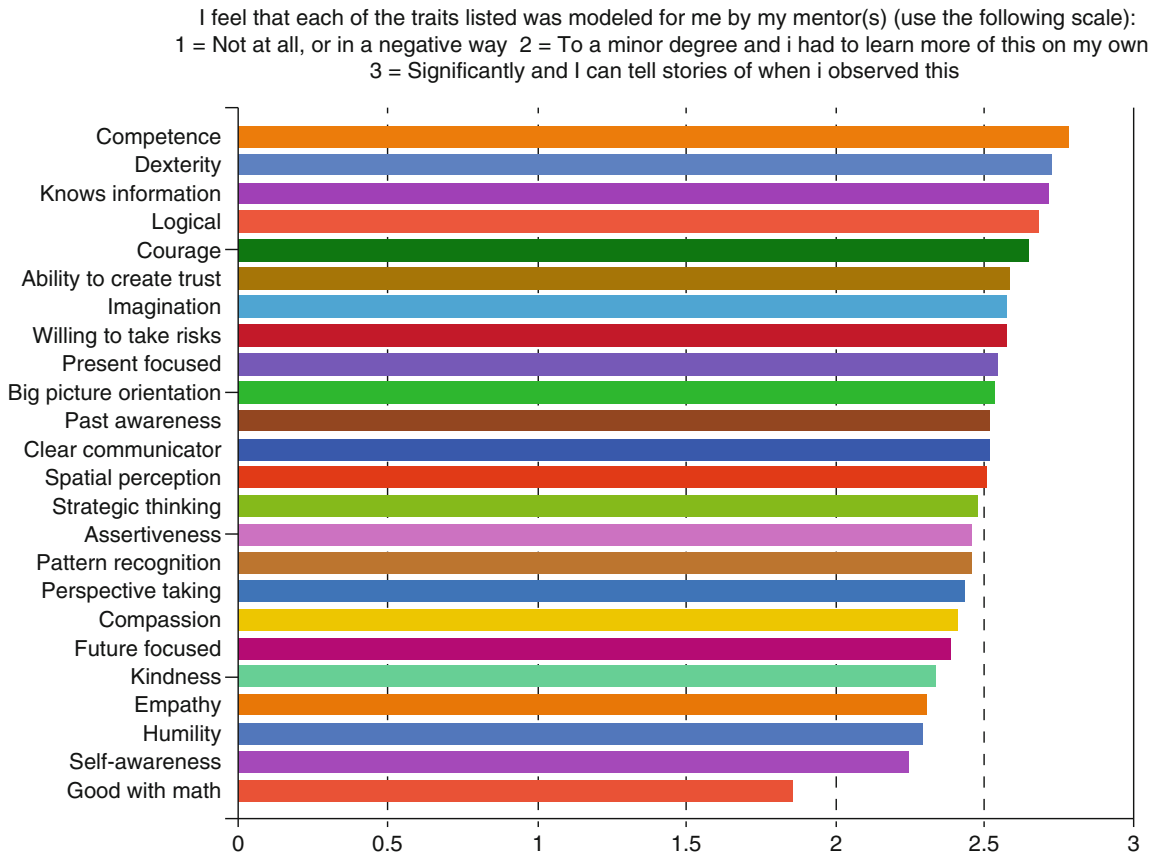

Fig. 2.12 Bar graph shows the likelihood of receiving training in a variety of areas from mentors, as perceived by members of the CHSS or EACHS. The length of the bar correlates with the likelihood that mentors provided this training. As opposed to formal training, it is more likely to receive training in courage, imagination and risk-taking from mentors. Humility and kindness still rank low on this scale

> less valuable in my training: He was known for his "let me have it!!!"… "suck!!!"… "don't!!!"… "gently, gently!!!"…"careful!!!" uttered in a rather unpleasant manner to the poor guy who had the pleasure to assist him.

In order to mentor well, a mentor needs to have achieved growth in many of the areas described as important to success as a pediatric heart surgeon, but which are ironically currently not formally taught in training programs [133]. This was indicated by our experts who responded to our survey (Fig. 2.12).

When these responses are compared to the information in Fig. 2.9, it is reassuring that qualities deemed essential for success in pediatric cardiac surgery and related specialties, but for which there is no formal educational process, are modeled by mentors; particularly qualities such as courage, ability to create trust, imagination and willingness to take risks (willingness to learn). In this sense, our education to competence (and beyond) requires mentoring to fill in the gaps that left by our current educational programs [133].

This was particularly emphasized by one respondent, who replied, in ALL CAPS:

> HAVING A MENTOR OR MENTORS IS ESSENTIAL TO BE A SUCCESSFUL PEDS HEART SURGEON. I DON'T THINK YOU CAN DO IT WELL WITHOUT ONE.

For a mentee to become receptive to a mentor, the most critical underlying condition is trust [77]. The mentee needs to feel safe—that they can expose themselves authentically and openly in the presence of their mentor, without fear for ridicule, dismissal or criticism—including all their inadequacies and imperfections [80]. It is no

surprise that mentors generally scored high (Fig. 2.12) in demonstrating the quality of trust. Trust in a training environment is a very fragile and critical component to make it safe to be a learner [134]. For the mentor/mentee relationship to thrive necessitates that the mentee has achieved enough personal growth to be able to distinguish between shame and regret [106]. If the learner has a tendency towards shame (for example, they view their struggles as evidence that they are a "bad surgeon, cardiologist, intensivist," etc.) then they may try to withhold evidence of these inabilities, or feel embarrassed by them, and resist coaching and guidance from a would be mentor. If instead, the learner is able to understand their limitations with regret (for example, even though they are struggling, they accept that they are a good surgeon, cardiologist, intensivist, etc. who is simply learning and the more they learn the better they will become) then they will be more likely to accept influence from a mentor.

In the most successful mentor/mentee relationships, the mentee ultimately becomes a teacher and the mentor a grateful recipient of what can be learned from their new colleague. The relationship is never unequal—it is always shared. There are times that the learner and teacher roles reverse, but there are never times of diminished mutual caring, concern and love.

One of our experts noted that there are also negative mentors:

> I had both positive and negative mentors. A particularly bothersome realization that I have had is that I have developed some of the traits that were negatively modeled for me, even though I recognized at the time that I was observing them that they were negative behaviors.

We are not sure we would call these negative role models "mentors", since they likely lacked genuine caring or the ability to create a safe environment for learning, but they are teachers and as such, we do learn from them. It is important to recognize that we can learn a lot about what is important to us from negative experiences, just as we can from positive experiences, and when we can internalize the difference in our own behaviors or how we wish to be from how we are in the moment—when we can begin to get in touch with our own internal gyroscope or "true North", then we may be on the threshold of identifying those mentors who can help take us to "the next level." One respondent stated:

> A transformational moment for me was when I walked out of my operating room one day after a "successful" case, but one in which I felt scared, and during which I was pretty tough on my team members. I remember feeling "icky." I might have been successful as a surgeon, but I was becoming unsuccessful as a person, and if this was the only way to be a pediatric heart surgeon, then I wasn't sure I had the stomach for it. I knew then that I had a lot to learn besides technical surgery. Thank goodness I was then able to find some extraordinary mentors who I still think about to this day. They taught me how to be *as* a surgeon, not just how to be a surgeon.

Mentoring completes the training process, and it is a never-ending process. Our journey begins with selection, proceeds through training, and includes (fortunately), some very important mentors. Ultimately, if we are fortunate, we become mentors for those who follow. It is appropriate, natural and transformative.

Conclusions

We are like the boys in the parable at the beginning of this chapter. We cradle our fragile profession in our hands and in this textbook, we present it as a vibrant, living entity that is ready to take flight. Our outcomes are the best they have ever been, thanks to multidisciplinary team collaboration, incredible advances in technology, and the extraordinary people who comprise our teams—each bringing expertise, commitment and passion for excellence.

Poised and ready to join us, is our future.

Can we create and nurture the passion and commitment of those who will follow? Can we teach them how to have the courage and the compassion to learn? And can we model for them the traits that ultimately characterize what we now know are important in order for them to lead and succeed?

Will our field continue to thrive, or will it languish? It is, after all, in our hands.

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