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Resident Autonomy

Amanda Cooper and Steven Allen

Abstract

Autonomy in medical training is required to develop independent and competent physicians. The way in which this incremental level of independence is granted to a trainee must be thoughtful and deliberate to ensure appropriate supervision and patient safety. Theories that support the role of autonomy will be introduced and discussed in this chapter. Ethical considerations that describe the implications of balancing the necessary independence for trainees and an attending physician's responsibility to the patient and the patient's safety will also be considered. The level of autonomy that is granted is the responsibility of both the attending physician and trainee so that it is not only appropriate but also well-earned. There are multiple tools that may be used to objectively measure one's competence and necessary level of autonomy based on performance that will be discussed within this chapter. Finally we will demonstrate that encouraging and striking the balance of supervision and autonomy may be done safely with appropriate patient outcomes and trainee development into independent physicians. These outcomes will help to encourage autonomy amongst medical trainees, no matter one's specialty, to train and develop competent, independent physicians of the future.

Keywords: autonomy, self-determination theory, entrustment, entrustable professional activities, graduate medical education, Zwisch scale, graduated responsibility

1. Introduction

Successfully training residents to become competent, independent physicians requires balancing supervision and autonomy. Autonomy in residency has been previously defined as the ability of a resident “to manage patients on his or her own” [1]. Residents, teaching faculty, hospital administrators, and members of the general public all understand the importance of autonomy in training for developing the skills necessary for independent practice [1, 2]. The Accreditation Council for Graduate Medical Education (ACGME), the organization that oversees residency programs in the United States, specifies that “the privilege of progressive authority and responsibility, conditional independence, and a supervisory role in patient care delegated to each resident must be assigned by the program director and faculty members” [3]. Benefits of autonomy include increased resident self-confidence, engagement in learning, sense of ownership of patients, and self-directed learning [1, 2]. The benefits of autonomy, however, must be balanced (**Figure 1**) against the potential risk to patient safety. In the years since the 1999 publication of *To Err is Human*, the Institute of Medicine's report on patient safety [4], the focus of the healthcare field on safety has increased, resulting in more

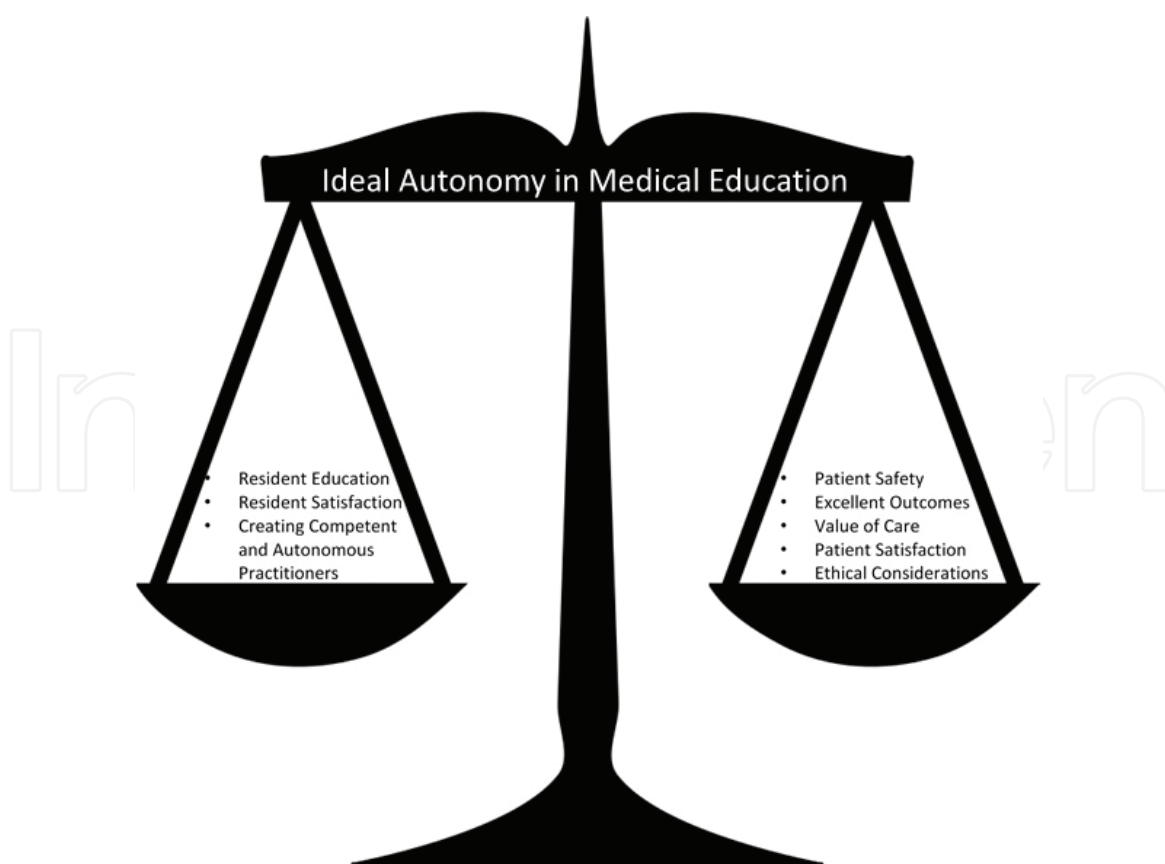


Figure 1.
Balance of resident autonomy and patient outcomes.

stringent requirements for supervision of residents [3], which has contributed to a trend in decreased autonomy for residents and may be resulting in recently graduated trainees who are entering the workforce less prepared than their predecessors were. Concerns about these trends have led to a recent focus on resident autonomy within the medical education community.

In this chapter we will discuss the theories that support the incredibly important subject of autonomy in medical education. Furthermore, we will review the ethical issues surrounding autonomy amongst trainees and the attending physicians' obligation to providing quality and safe medical care to their patients. Additionally, we will describe methods of granting autonomy and objective measures to determine how much autonomy should be granted. Finally we will discuss the outcomes associated with increased autonomy amongst trainees in medicine and finally describe methods that help to promote autonomy all while keeping patients safe.

2. Theories supporting autonomy

2.1 Self-determination theory

Self-determination theory is a validated motivational theory that has been often applied to education. Self-determination theory states that autonomy, competence, and relatedness are powerful motivators of intrinsic motivation and are important factors in well-being [5]. Intrinsic motivation is critical for learning. Self-determination theory provides a powerful argument in favor of not only maintaining, but working to increase autonomy in medical trainees. As Ten Cate, Kursurkar, and Williams have argued, "High IM [intrinsic motivation], e.g., learning out of interest, curiosity or enjoyment, and autonomous forms of self-regulation

are associated with better learning, better conceptual understanding, better academic performance and achievement and higher levels of well-being than high extrinsic motivation” [6]. These outcomes are ones that all medical educators aspire for their learners to achieve.

An important caveat about autonomy, however, is that “autonomy does not mean acting without help from others, it means having feelings of volition and free will in whatever actions are carried out” [6]. This underscores the role the educator can play in supporting autonomous decision making in trainees. In particular, for those learners who may be more novice or struggling with obtaining competence, the supervising physician can provide scaffolding [7] (discussed further below) and other types of autonomy support, which includes asking the learner for personal goals, encouraging questions, answering questions in a thoughtful way, and avoiding judgment about prior behavior [6].

2.2 Expectancy theory

Work-motivation theories try to account for individuals’ choice of tasks to pursue and their performance on and persistence in those tasks [8]. Expectancy theory is one such theory, which postulates that expectancy, one’s belief about how well one will do on future tasks (vs. ability, which is one’s belief about one’s current competence) [9], is one of the main factors explaining the amount of time and effort one is willing to put into an activity. Expectancy theory also states “that a person’s choice in certain action reflects a belief that such action will result in a desired outcome” and that those who believe that greater effort is associated with success and lower effort is associated with higher likelihood of failure are more likely to exert greater effort to master a task [8]. Shweiki et al. argue that if expectancy theory is applied to residency training then more frequent formative assessments will be given, which in turn will foster constant progress toward autonomy and competence and that if improvement in competence is rewarded with autonomy, then resident motivation will increase [8]. This provides another powerful argument for increasing resident autonomy.

2.3 Cognitive apprenticeship framework

Wakatsuki et al. interviewed anesthesia residents to find out what their most effective attending teachers in the operating room were doing that others were not and found that fostering autonomy was one of the nine key behaviors these faculty exhibited [10]. This behavior and the other effective teaching behaviors identified in this study fit within the cognitive apprenticeship framework of learning, which includes teaching methods such as scaffolding, modeling, articulation, reflection, and exploration [11]. As Stalmeijer explains, “In cognitive apprenticeship, the cognitive and meta-cognitive (thinking about thinking) processes and skills that experts use when performing a task are emphasized and are the focus of teaching activities” [12]. Cognitive apprenticeship particularly emphasizes using scaffolding to support novice learners as they develop skills that allow autonomous practice of medicine. The steps an educator can take to lead learners through the progression from novice to expert include modeling, coaching, articulation, reflection, and exploration [11]. When modeling for learners, educators should explicitly state what they are demonstrating so that learners do not reach mistaken conclusions about what is being taught. Clinical preceptors should act as a coach by providing real-time feedback and when needed, motivation and mentoring. Clinical educators should articulate their clinical reasoning to help learners develop expert reasoning. Experts should also encourage their trainees to reflect on what they have learned

from a clinical encounter, how to apply this knowledge to new problems, and how future patients might require a modification in approach. Medical educators also need to allow their learners to explore the limits of their comfort zone so that they can maximize their learning [11].

3. Ethical considerations

Training residents involves a delicate balance between appropriate supervision and progressive autonomy to develop the skills and confidence necessary for independent practice. With this in mind, teaching attendings must balance ethical obligations to both their patients and their trainees (and by extension the future patients of their trainees). Other authors have argued that “patient safety goals must account for both short-term outcomes associated with trainees and future outcomes attributable to early career surgeons” [13, 14]. Much like the ethical conflicts that arise between respect for a patient’s autonomy and beneficence toward that patient, and what offers the best learning opportunity for the resident caring for that patient is sometimes at odds. In situations where patient autonomy and beneficence are in conflict, patient autonomy is felt to take priority over beneficence; however, in the case of patient autonomy and resident education, the decision is not so clear-cut [15].

The first question to consider when weighing the potential ethical dilemma regarding patient safety and resident autonomy is whether increasing resident autonomy impacts patient safety negatively, positively, or indifferently. The published data on this topic is inconclusive. A study analyzing malpractice claims to determine factors that contribute to surgical errors found that interns, residents or fellows contributed to 46% of surgical errors (attending surgeons contributed to 92% of surgical errors) and 40% of cases involved lack of competence in a surgical trainee (whereas 58% of cases involved lack of knowledge or technical competence by the attending surgeon) [16]. This study also found that 47% of errors involved inappropriate supervision and in 53% of cases resulting in patient harm a surgical trainee had the highest or equally highest rate of contribution to the error [16]. A follow up analysis limited to technical errors identified in malpractice claims reported that only 4% of technical errors were the sole responsibility of a surgical resident or fellow with another 27% of errors attributable to both an attending surgeon and a trainee; only 9% of technical errors occurred because of inadequate supervision of trainees [17].

Some studies have suggested that teaching hospitals have higher rates of adverse events than nonteaching hospitals [18] and that surgical complication rates (but not mortality rates) are higher at teaching than nonteaching hospitals [19]. A randomized controlled trial comparing outcomes in a single medical intensive care unit (ICU) for patients treated with nocturnal intensivist staffing to those treated with the daytime intensivist available by phone at night found no significant difference in length of hospital or ICU stay, ICU or in-hospital mortality, rates of ICU readmission, or discharge disposition between the two groups [20]. A systematic review and meta-analysis by Snowdon et al. analyzed studies of clinical supervision of health care professionals and found low quality evidence that clinical supervision of medical professionals (the vast majority were residents) decreased the risk of mortality and complications [21]. This study also found moderate quality evidence that direct supervision of invasive procedures (central venous catheter placement and emergent intubation) resulted in lower rates of complications [21].

Studies examining surgical outcomes with and without residents also have mixed results. Celentano et al. compared outcomes in laparoscopic surgery for

inflammatory bowel disease for operations which were trainee performed (with either the attending assisting or supervising while unscrubbed in the operating room) or trainer performed (i.e., the attending performed two or more of the critical steps of the operation) and found no significant difference in overall 30-day mortality rate, intraoperative blood loss, reoperation rates, readmission rates, or rates of conversion to an open operation between the two groups [22]. In fact, the only significant difference was an increase in operative time in the trainee group (166.6 vs. 130.4 minutes). In another study post hoc analysis of prospective study data on outcomes of inguinal hernia repairs compared results for hernia repairs performed by junior surgical residents as opposed to those performed by senior surgical residents and found that those performed by junior residents had similar overall complication rates, but increased operative times and higher recurrence rates at 2 years for open, but not laparoscopic repairs [23]. The protocol of this study required the attending surgeon to be scrubbed in from the initial skin incision to the beginning of skin closure, but the degree of involvement of the attending surgeon in performing the critical steps of the operation was not measured. The systematic review and meta-analysis by Snowden et al. found moderate quality evidence that direct supervision of surgery results in a significant decrease in mortality rates, but low quality evidence that direct supervision did not significantly impact surgical complication rates [21]. This study also found moderate quality evidence that direct supervision decreased the rates of conversion of laparoscopic operations to open operations and evidence that direct supervision did not significantly impact reoperation rates. The meta-analysis, however, does not provide sufficient detail to determine what degree of autonomy the supervised surgical residents in the included studies were granted. A recent report on a resident-run surgical service designed to increase autonomy for senior residents found that patients undergoing cholecystectomy or appendectomy on this service had similar rates of 30-day postoperative complications, readmissions, and major operative adverse events as patients undergoing these operations on other surgical services at the same hospital [23]. The structure of the service was designed so that the supervising attending surgeon scrubbed in for the critical portions of the procedure, but there was no report on how often, if ever, the attending actually performed the critical steps of the operation.

The ACGME, American Colleges of Surgeons (ACS), and the American Medical Association (AMA) all have guidelines specifying that patients must be notified of the roles and level of training of both attending physicians and medical trainees [3, 24, 25]. Despite these guidelines, previous studies have shown that attendings and resident physicians rarely make their roles, level of training, and expected level of participation in procedures or that of their trainees explicitly known to patients [26, 27]. Multiple other studies have shown, however, that patients want to know if residents are going to be involved in their care, particularly if they are going to be involved in an operation they are having [28–30]. Several studies have also found that although the general public is overwhelmingly supportive of physicians-in-training learning through hands on practice, even among patients being treated in teaching hospitals, a significant number of them report they do not want residents involved in their care [31, 32], particularly if that care involves an operation and the resident involved is an intern [2, 29, 33]. Many of these studies have found that the general public has a limited level of understanding of the level of training of residents [28, 31, 32], but if education is provided about the role of residents and their extent of training, comfort levels with resident participation in their care greatly increases [28, 30].

4. Traditional methods of granting autonomy

Traditionally the highest levels of autonomy have been experienced by residents during overnight shifts when there were typically few, if any, attending physicians in the hospital [14, 34, 35]. With the increasing expectations for resident supervision and the decrease in resident work hours, over the last 15 years, the implementation of 24-hour coverage by hospitalists has become more common, resulting in a decrease in resident experience managing patients without direct supervision immediately available; however, this is not uniformly rated by residents as being detrimental to their education [35, 36]. Another time-honored practice for promoting resident autonomy is the continuity clinic, which has been (and in many cases continues to be) a common part of training for pediatric [37], internal medicine [38], neurology [39], obstetrics and gynecology [40], and even ophthalmology [41] residencies. Although the level of supervision in continuity clinics varies by institution [41], continuity clinics provide the opportunity for residents to be involved in longitudinal care, develop a strong sense of ownership for their patients, and practice some degree of independent decision making.

In years past, senior surgical residents were often allowed to operate with junior residents without attending surgeons physically present in the operating room [27]. This has become a much less frequent occurrence as more stringent requirements for supervision of operations have been adopted and as a result, chief surgical residents have been graduating with significantly fewer teaching assistant cases (cases where the senior resident leads a junior resident through an operation), a trend which began even before the implementation of a universal 80-hour work week for residents in the United States in 2003 [42, 43]. It should be noted, however, that although it is more challenging to have two residents participating in the same operation without risking work hours violations, it is still possible to allow senior residents to operate with junior resident assistants while the attending surgeon is directly supervising (either scrubbed in or present, but not scrubbed). This just requires more restraint on the part of the supervising surgeon. Another, more structured approach to providing surgical residents autonomy is the resident-run surgical service [44]. On such services, the pre- and post-operative care, decisions about when and on whom to operate, and the pre-operative work up are typically managed by senior surgical residents with limited attending involvement. The degree of attending oversight in the operating room may vary, but is typically less hands-on than in most other surgical cases.

5. Attending responsibilities when granting autonomy

Supervising attendings have a responsibility to utilize their best judgment about when a trainee has demonstrated the appropriate trustworthiness, level of awareness of his or her limitations, and adequate competence to be given the autonomy to perform a particular patient care task [45, 46]. Attendings should clearly specify their expectations for residents so that they are aware of the goal they are trying to reach [7]. It is also imperative that supervising physicians provide constructive feedback that is specific enough to allow residents to understand how to improve their performance [46]. The provision of specific and timely feedback may be the most important factor in improving resident performance and is a key component of deliberate practice [47, 48]. Supervising physicians also have a responsibility to provide appropriate assistance when their trainees reach their limits of ability and/or comfort [46]. Attendings who want to promote resident autonomy should

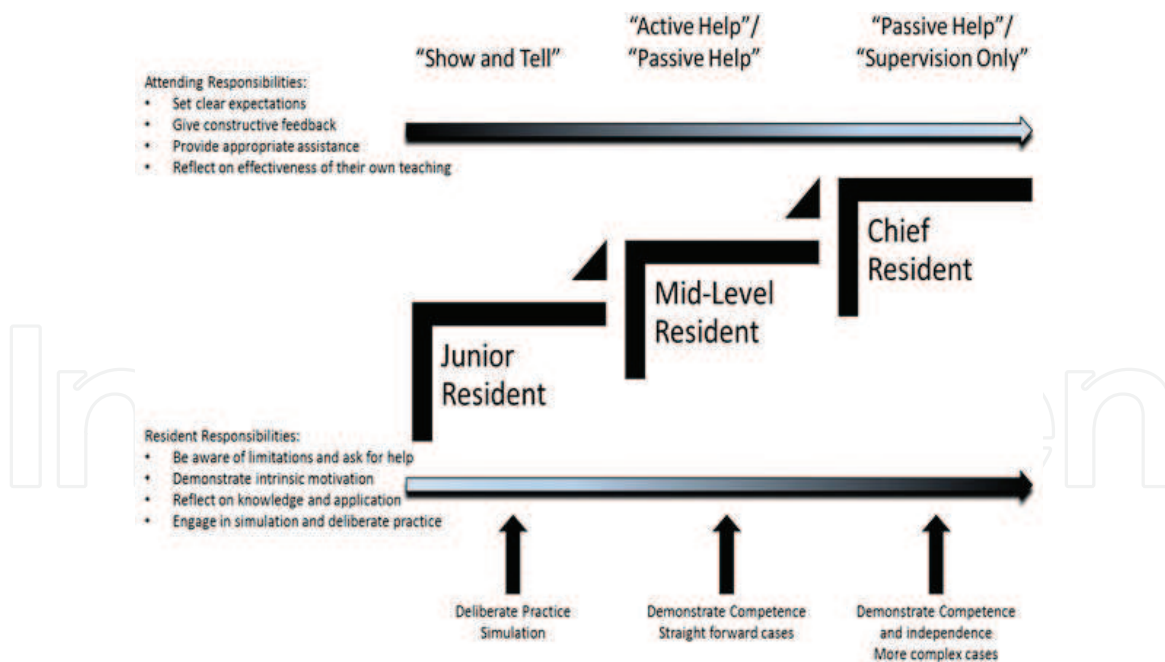


Figure 2.
Schema of graduated autonomy in medical training.

work to provide appropriate scaffolding for novice trainees and to gradually withdraw that scaffolding as the resident develops competence and gains confidence [7, 11]. Teaching attendings also have a responsibility to their learners to continually reflect on their teaching and its effectiveness and to adopt new techniques that may improve their trainees learning and retention of knowledge and skills (**Figure 2**).

6. Trainee responsibilities when being granted autonomy

Trainees who wish to gain autonomy in patient care have several responsibilities. Perhaps the most essential of these is to develop an awareness of their limitations and a willingness to ask for help when they have reached the limit of their abilities or comfort level [49]. Attendings also want to see trainees demonstrate that they have intrinsic motivation to learn and improve their performance before granting them significant autonomy [7]. Residents should also engage in reflection on both their personal knowledge [50] and how it can be applied to other patients and their performance and how it can be improved. Liability, as determined by courts of law, provides information about the responsibility to which the public and the legal system hold physicians. A study that analyzed court cases where resident physicians were found to have liability found that “the law expects first-year residents to exercise at least that level of knowledge and care expected of other practitioners at a similar state of training or that standard of care applicable to licensed non-specialists, i.e., general practice doctors” [51]. This study also found that unless residents specifically inform patients of their status as trainees, most courts have ruled that the resident’s liability is equivalent to that of licensed physician in their specialty.

Some surgical educators have urged that “the earlier stages of teaching technical skills should take place outside the operating room to permit deliberate practice” [48]. This suggests that residents have a responsibility to ensure that they engage in simulation of basic technical skills with the intent to deliberately practice them until they have achieved proficiency prior to expecting to perform these skills on

patients. Studies of virtual reality simulation for laparoscopic operations have found that such training decreases error rates and improves efficiency during actual operations [47, 52]. In fact, some surgical residencies require their residents to demonstrate proficiency of basic technical skills in the simulation lab prior to performing those skills in the operating room [48]. A study that evaluated resident autonomy in over 7000 operations found that the resident's performance in a particular case was the single biggest predictor of how much autonomy the attending granted during that operation [53], which suggests engaging in deliberate practice to improve technical skills is one of the most effective strategies residents can employ to increase their level of operative autonomy. Residents hoping to be granted autonomy during an operation should "hold themselves accountable for entering the operating room as prepared as possible; this should intuitively include review of the patient history" [54]. Preparation for the operating room should also include appropriate knowledge of the relevant anatomy for the case and familiarity with the steps of the operation to be performed. Discussing the surgical plan with the attending prior to surgery is also a valuable step in preparation [54] (**Figure 2**).

7. Tools to measure autonomy and competence

The competence of surgical trainees has historically been assessed in a very subjective manner. The actual performance and competence has been at the discretion of the training program. Traditional methods to assess trainees' competence lie primarily in their fund of knowledge and the ability to pass both qualifying (written) and certifying (oral) board exams. Very little attention has been spent on adequately assessing a trainee's ability to safely and effectively perform various surgical procedures. With the inception of the core competencies set forth by the ACGME there has been an increasing effort to more effectively and objectively assess procedural as well as clinical competence among trainees [55].

The goal of any training program is to graduate competent surgeons who may safely operate independently. However, a prior survey of fellowship directors reported that nearly two-thirds of residents are not able to operate independently for 30 minutes of a major procedure [56]. This issue raises the issue of progressive autonomy in preparation for independent practice. This autonomy must be given in a safe and thoughtful manner to residents that have demonstrated procedural competence. This competence and objective evaluation of performance must be appropriately documented [56]. With that in mind, multiple instruments have been designed to assess competency in the clinical and procedural realms.

Previous utilized approaches to assess operative exposure to various cases have included procedure or case logs. This strategy is highly dependent on timely and accurate recording by the resident. Furthermore, these are often recorded in a retrospective manner and do not allow for fruitful or timely evaluation and more importantly-feedback. Additionally, simply capturing which cases a resident is performing does not adequately capture one's ability or competence in performing a given procedure. Furthermore, previously described and validated tools such as the Objective Structured Assessment of Technical Skills (OSATS) [57] and Multiple Objective Measures of Skill (MOMS) [58] are useful for assessing one's technical skills in a general way but do not adequately assess a trainee's ability to competently complete a specific surgical procedure. This chapter will review several of the most commonly utilized tools to assess competence among surgical trainees.

7.1 Entrustable professional activities

Entrustable professional activities (EPA) are a concept in medical education that allows faculty to make competency-based decisions on the level of supervision for a trainee. EPA’s are individual tasks within professional practice that trainees have demonstrated sufficient competence to perform in an unsupervised manner. EPA’s are tasks or skills that are able to be executed independently, observable and objectively measurable in process and outcome. These may be introduced in training based on difficulty, degree of risk or complexity in a sequential fashion and may serve as a backbone for graduate medical training. EPA’s differ from competencies as EPA’s are descriptors of work performed by physicians while competencies are descriptors of the physicians themselves.

Entrustment decisions require more than competence of a particular clinical skill. Trainees must understand their own limitations and know when to ask for help. Entrustment decisions are based on four factors: (1) attributes of the trainee (level of training, confidence, exhausted or not); (2) attributes of the trainers (strict or lenient); (3) context (time of day, resources and facilities available); (4) nature of the EPA (complex vs. straightforward, rare vs. common) [59]. By allowing trainees to perform various clinical tasks or skills, one acknowledges that the trainee has passed a certain threshold allowing for decreased supervision for that particular task or skill. It is recommended that these accomplishments should be documented. One method of documentation is a certificate awarded called a statement of awarded responsibility (STAR) [60].

With EPA’s one must ask, “Can we trust this trainee to execute this EPA?” The answer should be translated into five levels of supervision for that EPA (Table 1). The EPA’s are translatable for all specialties within medicine and may be tailored to individual specialty needs for trainees. The EPA’s are currently in development for multiple medical specialties but the formula for their development is generalizable and should be based on the specialty’s requirements and milestones. Faculty development in providing EPA-based assessments is paramount. The decisions based on these EPA’s may serve as a “license” for trainees to perform a specific EPA with the appropriate level of supervision [59].

7.2 The superb/safety model

In an effort to optimize resident supervision in non-procedural situations (established within general internal medicine) a bidirectional model SUPERB/SAFETY was developed by Farnan et al. [61]. The components of the acronym are as follows: Set expectations for when to be notified; Uncertainty is a time to contact; Planned communication; Easily available; Reassure fears; and Balance supervision and autonomy. Those for SAFETY include: Seek attending physician input early; Active clinical decisions; Feeling uncertain about clinical decisions; End-of-life care or family/legal issues; Transitions of care; and You need help with the system/hierarchy [61].

5 Levels of Supervision for EPA's
1. Observation but no execution, even with direct supervision
2. Execution with direct, proactive supervision
3. Execution with reactive supervision, on request and quickly available
4. Supervision at a distance and/or post hoc
5. Supervision provided by the trainee to more junior colleagues

Table 1.
Entrustable professional activities.

The SUPERB/SAFETY model is developed off of qualitative data and demonstrates the specific actions necessary for optimizing clinical care in parallel with ensuring effective education and development of residents. This is referred to as a bidirectional model in that both the resident and faculty members must take an active role in the supervisory relationship. This model helps to establish that expectations are clear, communication is available and timely and that autonomy is appropriate with providing adequate resident supervision [61].

7.3 Resident supervision index

A group of scholars from Graduate Medical Education (GME) and the Institute of Medicine have come together to identify “optimal” level of supervision of trainees. This definition of what optimal means in graduate medical education and supervision is paramount to not only optimize trainee development but also to ensure patient safety. In order to accomplish this, the Resident Supervision Index (RSI) was developed to measure the intensity of resident supervision during outpatient clinical encounters. The RSI is comprised of (1) the RSI inventory—a validated and reliable instrument [62, 63] to be completed by faculty and residents to assess supervision data on outpatient care encounters [62, 64]; and (2) RSI scores are calculated from the RSI inventory to quantify the intensity of supervision of residents [65].

The RSI theory rests on several theoretical assumptions regarding patient-centric optimal resident supervision. This model is based on supervision as “resource allocation of scarce clinic resources, including residents, so as to maximize the collective health outcomes of all clinic patients seen in the teaching clinic” [65]. The explicit theoretical assumptions include: optimal supervision, informed decision, patient assignment, professional time, patient outcomes and resident learning (**Table 2**).

Theoretical results derived mathematically include: optimal supervision identified-when the attending physician supervises residents in a way that allows those that supervise to allocate time among patients and between patient care and supervision to achieve the greatest effect on patient outcome. This theory is centered on resource allocation to achieve a single goal of optimal patient outcomes. There must be a balance between being under-supervised and over-supervised, where residents miss appropriate clinical activities that would not have resulted in adverse patient outcomes. Optimal patient outcomes and progressive autonomy for residents are theoretically compatible. The RSI establishes a framework for scientific research to more accurately measure the connection between resident supervision and patient outcomes and may be very useful in informing GME policies related to appropriate resident autonomy [65].

7.4 Ottawa surgical competency operating room evaluation (O-SCORE)

The O-SCORE (**Table 3**) is a tool that was designed as a succinct instrument to assess competence on any surgical procedure. In the development of the O-SCORE, four surgeons, two evaluation experts and one psychometric researcher considered all of those features of any surgical procedure that are necessary to assess competence. They defined surgical competence as “readiness for independent performance of the procedure.” The key to the O-SCORE’s assessment method is to evaluate a trainee’s readiness for independent performance for a given procedure rather than comparing that trainee to a peer group. The goal of this design was to force raters away from a central scoring tendency. The evaluation was based on a trainee’s degree of “active participation” in each key aspect of a given procedure [55].

Theoretical Assumptions of Resident Supervision Index	
1. Optimal Supervision	Attending physicians will supervise residents and engage in direct patient care to maximize the health outcome for all patients
2. Informed Decision	Attending physician makes decisions concerning direct supervision of patient care after learning about the patient's case and resident's performance. This assumption follows after the attending has engaged in oversight of the resident collected information to make an informed decision
3. Patient Assignment	Patients who present to the clinic are assigned to a resident for resident-provided care or retained by the attending staff for staff-provided care 3(a). The number of patients assigned to a resident is predetermined based on patient complexity as well as clinic protocols, GME program requirements and government regulations
4. Professional Time	4(a). Attending physicians will provide care to patients or supervise residents engaged in patient care 4(b). The efficacy of residents to provide professional services and improve patient outcomes will depend on: <ul style="list-style-type: none">- The resident's clinical experience (competencies, judgment, prior training, etc.)- The clinical competencies of the assigned patients 4(c). Attending physicians supervise none, some or all of the time that residents are engaged in patient care
5. Patient Outcomes	Attending physicians and residents prioritize their time to make the most significant improvement in patient outcomes with each additional minute 5(a). Staff professional time 5(b). Resident professional time 5(c). Quality. Professional contributions to outcome will depend on the quality of patient care and effectiveness of resident supervision
6. Resident Learning	Residents learn clinical competencies by engaging in optimally supervised care.

Table 2.
Resident supervision index: Adapted from Kashner et al. Journal of Graduate Medical Education [65].

The first version of the O-SCORE consisted of a 14-item instrument that consisted of 10 items rated on a 5-point scale, 2 yes/no questions and 2 open-ended questions (one specific aspect of the case performed well and one that requires improvement). This was later refined to 11 items (8 items rated on the 5-point competency scale, 1 yes/no question about the competency to perform the procedure independently and the same 2 open-ended questions). While initially piloted amongst orthopedic surgery trainees, this was expanded across specialties to include general surgery. The O-SCORE was used to evaluate residents' performance with five common general surgery procedures: open hernia repair, laparoscopic appendectomy, laparoscopic cholecystectomy, emergency laparotomy and axillary node dissection [55].

The O-SCORE was able to accurately differentiate amongst senior, midlevel and junior trainees. There was a trend towards improvement in performance with several procedures with increasing PGY-levels. While this evaluation instrument was only assessed in two surgical specialties, the O-SCORE is felt to provide an objective and reliable assessment of competence for perioperative decision-making and procedural competency [55].

Scale					
1-	"I had to do"- requires complete hands on guidance, did not do, or was not given the opportunity to do				
2-	"I had to talk them through"- Able to perform tasks but requires constant direction				
3-	"I had to prompt them from time to time"- Demonstrates some independence but requires intermittent direction				
4-	"I needed to be in the room just in case"- Independence but unaware of risks and still requires supervision for safe practice				
5-	"I did not need to be there"- Complete independence, understands the risks and performs safely, practice ready				
1. Pre-procedure plan: Gathers/assesses required information to reach diagnosis and determine correct procedure required	1	2	3	4	5
2. Case Presentation: Patient correctly prepared and positioned, understands approach and required instruments, prepared to deal with probable complications	1	2	3	4	5
3. Knowledge of specific procedural steps: Understands the steps of procedure, potential risks and means to avoid/overcome them	1	2	3	4	5
4. Technical performance: Efficiently performs steps, avoiding pitfalls and respecting soft tissues	1	2	3	4	5
5. Visuospatial Skills: 3D spatial orientation and able to position instruments/hardware where intended	1	2	3	4	5
6. Post-procedure Plan: Appropriate complete post procedure plan	1	2	3	4	5
7. Efficiency and flow: Obvious planned course of procedure with economy of movement and flow	1	2	3	4	5
8. Communication: Professional and effective communication/utilization of staff	1	2	3	4	5
9. Resident is able to safely perform this procedure independently	Yes		No		
10. Give at least 1 specific aspect of procedure done well					
11. Give at least 1 specific suggestion for improvement					

Table 3.
Ottawa surgical competency operating room evaluation (O-SCORE): Adapted from Gofton et al. Academic Medicine, 2012 [55].

7.5 Zwisch scale

The Zwisch scale was initially described by DaRosa et al. in 2013 [56, 66] in which the authors describe a 1-dimensional behaviorally anchored ordinal scale used to assess the amount of guidance provided by an attending surgeon provides to the trainee during the “critical portion” of a procedure (Table 4). This 4-level scale describes the spectrum of assistance required by the attending surgeon ranging from “show and tell” in which the attending surgeon performs the critical portions of a case and explains each step of the procedure to the resident to “supervision only”—the most advanced level—where the attending surgeon is present only to guarantee patient safety. The middle levels consist of “active help” and “passive help.” These levels are coded as 1 through 4, with supervision only receiving a level of 4 [56].

The Zwisch scale was compared to modified versions of the OPRS and O-SCORE instruments. The study by George et al. looked at 1490 operative performance assessments for 31 residents across several surgical procedures, with laparoscopic cholecystectomy and laparoscopic appendectomy being the most common. The authors demonstrated a significant increase in Zwisch scores across increasing PGY-levels. Interestingly, among PGY-5 residents, only 23.2% of the observed operations were scored at level 4 (supervision only). Additionally, the Zwisch scale correlated closely with the operative volume of a given procedure for each resident. If a

Stage of Supervision	Attending Behaviors	Resident Behaviors with Level of Supervision
Show and Tell	<ul style="list-style-type: none">-Does majority of key portions of the case-Narrates steps of the case-Demonstrates key concepts and skills	<ul style="list-style-type: none">-Opens and closes-First assists and observes
Active Help	<ul style="list-style-type: none">-Shifts between and surgeon and first assist roles-As first assist, actively assists resident in surgeon role-Coaches for specific technical skills-Identifies anatomical landmarks for the resident	<ul style="list-style-type: none">-Shifts between surgeon and first assist roles-Knows all the needed technical skills-Demonstrates increased ability to perform different key parts of an operation with assistance
Passive Help	<ul style="list-style-type: none">-Assists and follows the lead of the resident-Coaching regarding refinement of skills and techniques	<ul style="list-style-type: none">-Able to "set up" and accomplish next step for the entire case with increasing efficiency-Recognizes critical transition points
Supervision only	<ul style="list-style-type: none">-Provides no unsolicited advice-Assisted by a junior resident or attending who acts like a junior resident-Monitors progress and ensures patient safety	<ul style="list-style-type: none">-Able to work with inexperienced first assistant-Can safely complete a case without faculty assistance-Able to recover from most errors-Recognizes when to seek advice/help

Table 4.
Zwisch scale: Adapted from DaRosa et al. Journal of Surgical Education, 2013 [66].

resident performed 5 or fewer procedures of a given type, the median Zwisch scale was “active help” while if more than 5 had been performed prior to evaluation with the Zwisch scale the median score was “Passive Help” [56].

The Zwisch scale was highly correlated with other assessment tools such as the O-SCORE and OPRS as assessed by video rating by blinded reviewers. These results come to mean that the Zwisch scale can be used to accurately assess intraoperative performance. Additionally there was noted to be high inter-rater reliability. Interestingly, there was significant reliability amongst “types” of reviewers (attending physicians, in-room observer, and video raters) giving the Zwisch scale the flexibility of not needing to be used physically in the operating room as long as the audio-visual recording of the faculty-resident interaction is able to be reviewed [56].

The simplicity of the Zwisch scale with its 4-point scale and its accessibility on a smart-phone app allow for real-time accessibility and promotes a significantly higher response rate [67]. Limitations of the Zwisch scale include it being limited to a summative assessment tool. It does not provide the more granular information that is provided by other evaluation tools such as the OPRS. Despite these limitations, the Zwisch scale allows for an accurate and reliable measure of resident operative performance and the amount of faculty guidance for a given procedure and allows for a longitudinal resident operative performance evaluation method.

7.6 Procedural autonomy and supervision system (PASS)

PASS is a smartphone-based app that utilizes the Zwisch scale and a scale of procedural difficulty. With this instrument, the faculty member receives an

evaluation prompt through the smartphone. The faculty member must then enter the procedure that was performed, the date and time and resident name. Then the faculty member scores the resident performance using the Zwisch scale and then scores the difficulty of that particular procedure as easiest 1/3, middle 1/3 or most difficult 1/3 for a particular procedure [68].

The PASS app was designed to encourage the completion of operative performance assessments in a timely and efficient manner that minimizes disruptions in a busy surgical practice. In fact, a recent study by Fryer et al. demonstrated no increase in mean OR times while using PASS. Additionally, there was no significant difference in OR satisfaction amongst residents. However, depending on statistical methods used, the authors did identify a slight decrease in positive responses in the OR Educational Environment Measure (OREEM) scale. In their assessment, faculty reported a lesser degree of agreement with four specific items on the OREEM scale: (1) my resident(s) and I got along well; (2) the atmosphere in the OR was pleasant; (3) the staff in the OR was friendly to my resident(s); and (4) my resident(s) felt like part of a team in the OR; following implementation of PASS. While one may ponder reasons for this difference, including greater anxiety amongst faculty members as they work with residents who wish for more participation during a given procedure; a less relaxed environment knowing that an imminent evaluation was looming; or there may have been a sense of a more formal mentor-trainee relationship that may have led to this perceived decrease in faculty satisfaction [68].

Three additional OREEM items that prompted more negative responses by faculty after PASS implementation were related to residents' skills. This difference may be related to a greater awareness of a given resident's operative performance that led to a more critical evaluation of performance. Thus, using this PASS and the built-in Zwisch scale, there may have been an inherent change in the way a faculty member perceived a resident's operative performance [68].

7.7 Global operative assessment of laparoscopic skills (GOALS)

GOALS is an assessment instrument that evaluates performance during laparoscopic procedures over five domains. It was initially validated using common laparoscopic procedures—laparoscopic appendectomy and cholecystectomy. Others have worked to validate this instrument in other procedures including both groin and incisional hernias. GOALS assesses performance over five domains (depth perception, bimanual dexterity, efficiency, tissue handling, and autonomy). For each of these five domains, there is a rating from 1 to 5 with a descriptive anchor for scores 1, 3 and 5. A total score for each operation is calculated by adding the scores from all five domains and is used as an overall assessment of a trainee's performance [69].

While GOALS provides formative feedback across multiple domains, the domain of autonomy assesses the degree to which the trainee completed a given procedure with varying amounts of supervision. A score of 1 means that the trainee was "unable to complete the entire procedure, even in a straightforward case and with extensive verbal guidance." A score of 3 states that the trainee is "able to complete operation safely with moderate prompting" while a score of 5 is "able to complete operation independently without prompting" [69]. The combination of domains that evaluate a trainee's operative skills (depth perception, bimanual dexterity and tissue handling) along with the degree to which a trainee required supervision and intervention by an attending surgeon is critical for a more complete assessment of one's ability to perform a given procedure. Thus GOALS may be useful in assessing a trainee's progress across their time in training as well as identify specific areas of improvement required to attain adequate technical proficiency.

8. Outcomes associated with autonomy

Across disciplines, patient safety and providing high quality care are the priorities within any health system. This is balanced with providing appropriate trainee supervision to allow for adequate education and resident development. Concerns that center on increasing regulations of resident education including limited work hours may hinder residents' training experience and an appropriate level of autonomy [70–73]. Studies across many disciplines of medical training have studied the effects of autonomy among trainees on patient outcomes from in-patient pediatrics, anesthesia as well as surgery. While there are studies that demonstrate less than ideal outcomes related to longer operative times [74], or overall worse outcomes, many studies have demonstrated significant improvement in resident satisfaction and confidence without any detrimental effects on patient outcomes.

Biondi et al. hypothesized that modifying the extent of attending input during the pediatric admissions process would improve efficiency in the admission process, increase perceptions of patient ownership without compromising the quality of patient care. In this study, a new process was implemented regarding pediatric admissions in which the ED physician called the pediatric admitting resident (PGY-3 or 4 pediatrics resident) directly. In this new process the admitting resident was empowered to accept the patient and perform necessary admission duties. The patient was evaluated by the attending on the day of admission during daytime hours (7 am–5 pm). However, during evening hours (5 pm–10 pm), the resident was expected to evaluate the patient and staff the patient with the attending after developing a plan. During overnight hours (10 pm–7 am), the resident contacted the attending at the resident's discretion and the patient was seen and evaluated by the attending in the morning. The residents were encouraged to contact the overnight attending on call if they had questions or felt the admission was inappropriate [70].

This new process resulted in a reduction in the time from the initial request by the ED for admission to the time the admission order was placed by over an hour. While there was improved efficiency in the admission process there were several cases noted where the resident's plan did not meet the standard of care. However, due to the relative low frequency of these events there was not identifiable impact on major patient outcomes [70]. This study was likely underpowered to truly detect a difference in the infrequent quality of care and patient harm events. Despite the limitations outlined by the authors, they concluded increased resident autonomy by limiting mandatory attending input at the time of admission improves efficiency and does not adversely affect major patient outcomes.

Several published studies have studied outcomes associated with appendectomies performed by general surgery residents compared to those performed by senior surgeons (attendings). One such study by Siam et al. [75] demonstrated no difference in outcomes for those appendectomies performed by senior general surgeons and general surgery residents. In this large retrospective study from Israel, over 1600 appendectomies were evaluated with over 500 of those performed alone by a general surgery resident. As mentioned in an earlier section, Siam et al. did demonstrate a longer length of procedure time in procedures performed by residents as well as a higher rate of open appendectomies compared to those performed by attending surgeons. However, there was no difference in post-operative complications or hospital length of stay between the two groups. Thus, the authors concluded that it is safe to allow surgical residents to perform appendectomies done under standard conditions to be safe. This is balanced with the residents' ability to recognize and engage an attending should such a clinical situation arise [75]. Other studies have similarly demonstrated safety in resident performed appendectomies with minimal attending supervision [76–79].

This idea of safe and effective resident autonomy amongst surgical subspecialties may translate to safe and quality patient care in the clinic setting as well. A study by Day et al. demonstrated progressive surgical autonomy amongst plastic surgery residents in a plastic surgery resident clinic (PSRC). The PSRC was staffed by attending plastic surgeons, but all aspects of patient care history and physical exams and interpretation of radiology studies were performed by residents and a supervising chief resident. In this study, over 3300 clinic appointments and 653 operations were performed and there was a statistically significant increase in resident autonomy as one progressed through post-graduate years. Not only did this study confirm improved autonomy with the PSRC model, but it also demonstrated improved continuity of patient care amongst residents, one facet of training threatened by the duty hour regulations. Furthermore, graduated chief residents were surveyed and reported significant value in the surgical experience, operative autonomy, medical knowledge and ACGME core competencies afforded by supporting a resident run clinic. These findings have been echoed in other studies as well in the settings of a resident-run aesthetic clinic [80] which demonstrated a structured, autonomous experience in rhinoplasty with acceptable complication rates as well as good satisfaction as rated by both patients and residents [81].

Additional studies have been performed in the realm of plastic surgery, specifically cosmetic surgery. A retrospective chart review by Walker et al. [82] of 326 patients with 714 aesthetic procedures demonstrated that a chief resident run clinic allowed the chief residents to feel “very comfortable” based on survey results performing facelifts, body contouring and aesthetic breast surgery. None of the residents who responded completed a cosmetic fellowship with 60% of the residents surveyed stating that the experience from the chief led clinic contributed to their decision to not pursue further cosmetic training. The authors demonstrated that a chief-run clinic with the appropriate supervision and autonomy allows chief residents to feel comfortable performing common cosmetic procedures. They conclude that chief resident clinics may provide good results with no increase in complications rates or need for revisions. Additionally, it significantly improved resident comfort levels with common procedures and may even mitigate the need for graduating chief residents to pursue further training in aesthetic fellowships.

Despite the challenges (legal, regulatory, staffing) of establishing a chief resident run service or clinic in any specialty, recent studies by Jarman et al. [44, 83, 84] demonstrated that this can be done safely and effectively in the realm of general surgery. Chief resident run services afford chief residents the opportunity to provide and hone perioperative decision making and hone operative skills on common general surgical procedures with appropriate supervision-most often in the “passive help” or “supervision” roles only as determined by the Zwisch scale. Jarman et al. demonstrated a strong correlation between procedures performed on the chief resident service and during their first year of clinical practice. While this study did not measure the quality or rates of complications associated with a chief-run service, there was significant increase in positive survey results by the graduated chief residents who participated in the chief resident service and the autonomy that the service afforded them [85]. Wojcik et al. [84] demonstrated that implementation of a resident-run minor surgery clinic safe in regards to 30-day post-procedure complications which persisted on multivariate analysis. Addition to demonstrating patient safety, residents evaluated the clinic experience in a very positive manner, increased operative autonomy being the biggest strength cited.

Another measure to assess for autonomy in the operating room is based on the volume of teaching assistant (TA) cases. As eluded earlier, it has been demonstrated that TA cases have declined by 79% between the years of 1999 and 2012. A study by Kantor et al. [42, 83, 86] sought to implement a resident acute care surgery

consult service (RACS) and to assess the impact of resident autonomy as demonstrated by TA cases by chief residents. Over a 12-month period, over 1100 consults were seen with nearly one third of those being operative. For appropriate operative cases, 82% of the cases were done entirely by residents. Using graduating chief residents prior to implementation of RACS as controls, the number of TA cases after RACS more than doubled (mean 13.4–32.2) per chief resident over the period of 1 month. Along with increased TA cases, the authors demonstrated an increase in resident satisfaction with case complexity and variety. Furthermore, there was improved efficiency with operative consultation times [83].

Autonomy both in and out of the operating room is necessary to allow surgical trainees in all surgical specialties to become confident in their operative skills and decision-making. While there are studies that demonstrate less than ideal outcomes related to longer operative times, many studies have demonstrated significant improvement in resident satisfaction and confidence without any detrimental effects on patient outcomes. Trainees must be afforded the right balance of autonomy and supervision to ensure appropriate growth of technical and non-technical skills for their given field of specialization but also to ensure appropriate decision making and patient safety.

9. Encouraging autonomy

In the face of increased scrutiny of decreased resident work hours and an increasing amount of administrative responsibilities placed on residents in this day and age, residents and their supervising faculty must strike a balance between maximizing education in a limited timeframe, a gradual and appropriate increase in autonomy across the spectrum of patient care and quality of care and patient safety. There are some attributes that are harder to objectively measure that may indicate a resident's investment or "ownership" for a patient. Ownership, as defined by McLaren et al. [87] is a broad term that includes professionalism, patient care and patient safety. It is this ownership and its perceived implications upon which many faculty members may grant increased autonomy. A recent qualitative study by Chen et al. demonstrated that willingness to grant a resident autonomy may hinge on various resident characteristics, medical knowledge and factors that go beyond the current OR case [87].

Resident characteristics that may allow an attending to offer more autonomy include the resident's level of training, the amount of personal effort the resident placed into preparing for a given case, the resident's attitude and motivation as well as the perceived level confidence by the resident. Medical knowledge is based on several different aspects that may be assessed even before the safety time-out is performed for a particular case. First is the resident's basic knowledge of anatomy, pathology and the steps of the procedure. A resident is more likely to gain autonomy if he/she is able to understand the attending surgeon's guidance and directions. Taking this assessment of knowledge one step further is whether the resident is able to develop an appropriate operative plan, demonstrate adequate judgment and know what instruments are needed for the next step in an operation. This is further supported by the resident's ability to actively teach medical students and other residents these steps while performing the procedure. Autonomy is also guided by experience with that resident that goes beyond that of the current surgical case. These experiences may be the result of prior experiences that the attending surgeon has had with a particular resident, the reputation of a resident from co-residents, chief residents and other faculty members who have worked with that resident. Furthermore, objective evaluations and milestone documentation also often play a

role in one’s ability to gain autonomy in the operating room. An attending surgeon’s teaching philosophy and the contextual issues about the case (case complexity) also will determine the amount of autonomy a resident may be allowed to have during a case [88].

Faculty development efforts are paramount to optimizing the assessment and appropriate granting of autonomy for residents among attending surgeons. Faculty development would allow for expert surgical teachers to educate other faculty members as to their best practices. One example of a best practice as outlined by Chen et al. is the set of questions (**Table 5**) “Performance-Impression-Characteristics-Knowledge-Situation” (PICKS) that will allow an attending to quickly and easily assess a resident’s readiness for autonomy in the operating room, even prior to the safety timeout [88].

Optimizing resident autonomy is dependent on development of both the trainer (attending surgeon) and trainee (resident). Faculty development efforts that teach attending surgeons to assess and guide the appropriate level of autonomy based on the three groups of evidence (resident characteristics, medical knowledge and factors beyond the current OR case) as outlined by Chen et al. as well as the context variable of a specific surgical case can assure more appropriate levels of autonomy for trainees. Similarly, teaching residents to demonstrate increased medical knowledge and preparation for the surgical operation to the attending surgeon will also help to optimize the autonomy they are granted in the operating room [88].

Other strategies to promote autonomy as described by Beck et al. [89] on Family-Centered Rounds (FCR) may be broken down to various phases of the FCR activity. Prior to the beginning of FCR, framing expectations and agreeing upon nonverbal signals were found to be helpful. Setting expectations allows for defining roles of team members and allows the attending to be viewed primarily as a consultant who may be allowed to step in based on the predetermined nonverbal

Questions to Assess Residents' Readiness of Autonomy	
P - Performance	Do I feel comfortable with this resident's technical performance and skills?
I - Impression	What is my perception of this resident? <ul style="list-style-type: none">- Did the resident meet my expectation in recent cases?- Does the resident have a good reputation among faculty, residents and patients?- Does the resident do well in floor management?
C - Characteristics	What is the resident's training level (PG Y-year)? Has this resident done this procedure before? Has the resident prepared for this case? <ul style="list-style-type: none">- Does the resident know my patient (history, imaging, and previous surgeries)?- Does the resident know this procedure (indications and complications)?- Does the resident know his or her learning goals in this case?
K - Knowledge	Does this resident's knowledge and operative plan fit my case? <ul style="list-style-type: none">- Does the resident understand my instructions?- Does the resident have a reasonable operative plan
S - Situation	Do I need to speed up this case? <ul style="list-style-type: none">- Is this case too complicated for this resident?- Do I have a tight schedule today?

Table 5.
Performance-impression-characteristics-knowledge-situation (PICKS): Adapted from Chen et al. Journal of Surgical Education. 2017 [88].

signals. A pre-rounds huddle allows the resident to address any major clarifying questions and allows the resident to develop the logistical and educational aspects of the FCR. During the FCR, deliberate positioning of the senior resident and establishing them as the primary physician so that questions and issues are directed primarily to them. Allowing for flexibility and allowing for the resident to develop their own plan so long as to prevent patient harm and avoiding micro-management of those decisions will also be paramount to promoting autonomy in these situations. If a resident does not initially come up with a plan, the attending should probe and encourage the resident to develop a plan. Additionally, maintaining silence and allowing the resident to control rounds will encourage autonomy for the resident. After the FCR, promoting reflection and allowing the resident to reflect on how the rounds went is critical to improvement. Also allowing the resident to offer feedback to junior residents and medical students will promote the educational value of the FCR [89]. These steps outlined by Beck may be widely translatable to other activities within graduate medical education across specialties.

10. Conclusion

Training the next generation of physicians to be competent and independent physicians is paramount to ensure adequate experience and patient safety as they prepare to enter independent practice. This has become more difficult in the face of increasing regulatory guidelines and restricted work hours. The traditional models of promoting resident autonomy in training have been challenged over the past several years and require innovative solutions as outlined in this chapter. The responsibility for promoting and earning autonomy rests equally with attendings and trainees. These theories and methods of promoting and granting autonomy continue to evolve and must be objectively studied to ensure effectiveness and safety that we owe our patients. Efforts to optimize autonomy must continue to be a focus of graduate medical education.

Conflict of interest


The authors declare that they do not have any conflicts of interest to declare in the authorship of this book chapter.

Author details

Amanda Cooper and Steven Allen*
Penn State Milton S. Hershey Medical Center, Hershey, PA, United States

*Address all correspondence to: sallen4@pennstatehealth.psu.edu

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